This is a scanned version of the text of the original Soil Survey report of Gem County Area, Idaho issued September 1965. Original tables and maps were deleted. There may be references in the text that refer to a table that is not in this document.

Updated tables were generated from the NRCS National Soil Information System (NASIS). The soil map data has been digitized and may include some updated information. These are available from http://soildatamart.nrcs.usda.gov.

Please contact the State Soil Scientist, Natural Resources Conservation Service (formerly Soil Conservation Service) for additional information.

SOIL SURVEY OF GEM COUNTY AREA, IDAHO

BY F. R. TROEH, J. C. CHUGG, G. H. LOGAN, C. W. CASE, AND VIRGIL COULSON, SOIL CONSERVATION SERVICE'

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH UNIVERSITY OF IDAHO COLLEGE OF AGRICULTURE AND IDAHO AGRICULTURAL EXPERIMENT STATION

THE GEM COUNTY AREA consists of all of Gem County, Idaho, except about 60,480 acres that forms part of the Boise National Forest, in the extreme northern part.

The Area covers 294,720 acres, or about 460 square miles (fig. 1). About 40,000 acres is irrigated, 11,500 acres is dry farmed, 2,284 acres is in private woodland, and the rest is in pasture and range.

The Area is in the Payette section of the Columbia Plateau physiographic province *(3)*. The topography ranges from nearly level bottom lands to dissected plains and mountains. The Payette River crosses the southern part of the Area. from east to west and has cut valleys known locally as the Emmett Valley and the Montour Valley. The Emmett Valley, in the western part, was cut in the sandy, unconsolidated Idaho formation (7). It is much larger than the Montour Valley and contains most of the orchards and farms. Squaw Creek, a tributary of the Payette River, has cut a narrow valley from north to south in the eastern part of the Area. Squaw Butte, which lies to the west of Squaw Creek, has an elevation of 5,906 feet and is the highest point in the Area. Crown Point, in the southeastern part, has an elevation of 5,163 feet. At the west county line, the Payette River has an elevation of 2,250 feet.

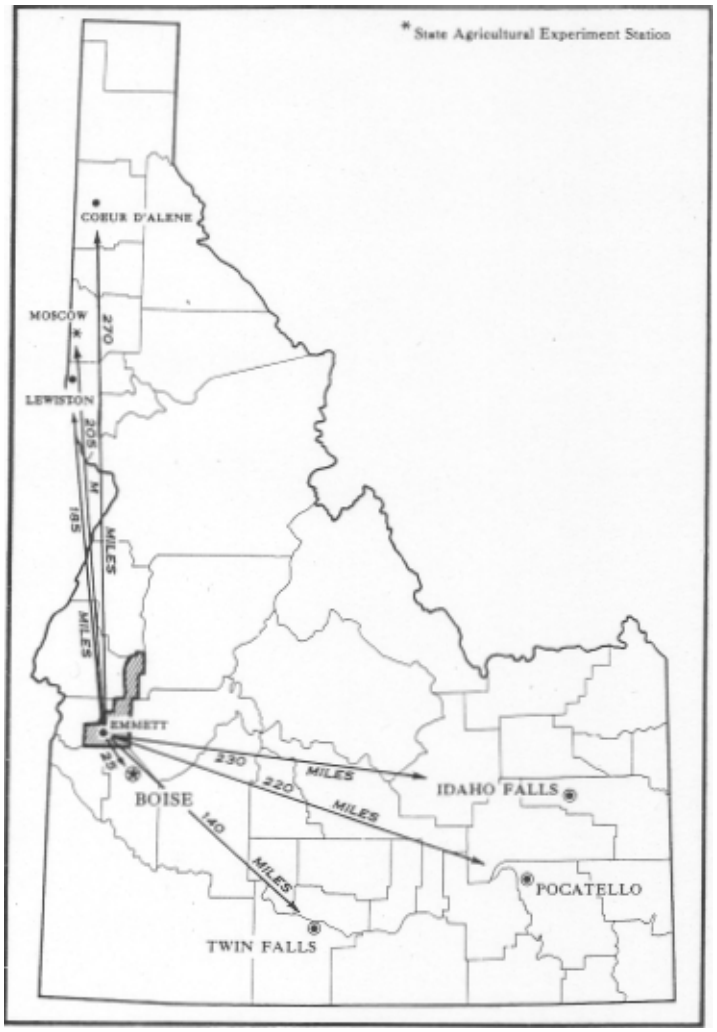

Figure 1.-Location of the Gem County Area in Idaho.

How Soils Are Mapped and Classified

Soil scientists made this survey to learn what kinds of soils are in the Gem. County Area, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, the major horizons of all the soils of one series are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Jacknife and Payette, for example, are the names of two soil series in the Gem

DR. J. F. DOUGLASS, W. J. LEIGHTY, and R. A. SALZMAN , Soil Conservation Service, assisted by reviewing the manuscript and suggesting revisions.

County Area. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Jacknife clay loam and Jacknife loam are two soil types in the Jacknife series. The difference in texture of their surface layers is apparent from their naives.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Jacknife loam, 1 to 3 percent slopes, is one of several phases of Jacknife loam, a soil type that ranges from nearly level to steep.

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

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

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed and occur in individual areas of such small size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Sweet-Kepler complex, 1 to 3 percent slopes. Also, on most soil maps, areas are shown that are so rocky, so shallow, or so frequently worked by wind and water that they scarcely can be called soils. These areas are shown on a soil snap like other mapping units, but they are given descriptive names, such as Riverwash or Wet alluvial land, and are called land types rather than soils.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way that it is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. Based on the yield and practice tables and other data, the soil scientists set up trial groups, and they test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations. Such a map is the colored general soil map in the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ from each other in some or in many properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map shows, not the kind of soil at any particular place, but patterns of soils, in each of which there are several different kinds of soils.

Each soil association is named for the major soil series in it, but, as already noted, soils of other series may also be present. The major soils of one soil association may also be present in other associations, but in a different pattern.

The general map showing patterns of soils is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

Level to Gently Sloping Irrigated Soils

1. Emerson-Wardwell-Quenzer soil association

This association is made up of light-colored soils on low terraces that are at the upper end of the Emmett Valley, northeast and south of Emmett. These terraces cover an area of about 6 square miles south of the Payette River. They are only slightly higher than the adjoining saline terraces in the Letha-Baldock-Lahontan soil association. The soils are level to gently sloping and are well drained to imperfectly drained. They are either nonsaline and nonalkali or only slightly saline and alkali.

The well-drained Emerson soils occupy the higher parts of the terraces. They are underlain by loose sand and gravel and are moderately coarse textured and noncalcareous. The moderately well drained Wardwell soils occur in swales and depressed areas and are interspersed with Emerson soils. They have some accumulation of clay in the subsoil. The imperfectly drained, clayey Quenzer

soils occur in the lowest part of the area. The Bissell soils are minor soils in the association. They occur along the toe of adjoining alluvial fans, are well drained, and have a moderately line textured subsoil.

The crops commonly grown are irrigated row crops, forage crops, pasture crops, and grain. The Emerson soils are more droughty than the other soils in this association and are less productive. Orchards are poorly suited because of the limited depth of the root zone and the hazard of frost. The problems of management are primarily those of drainage of the wet soils and maintenance of the fertility and the organic-matter content of the more sandy soils.

2. Harpt-Cashmere soil association

The soils in this association are on sloping alluvial fans formed by the many small streams that flow from the Idaho and Payette geologic formations. These fans occur where the streams enter the valleys. Along the eastern and southern boundaries of the Emmett Valley, the fans join to form a continuous band that separates the hilly uplands from the terraces and bottom lands (figs. 2 and 3). The total acreage in this association is about 20 square miles.

The soils are mostly grayish brown when dry and very dark grayish brown when moist. They are deep, well drained, and leached of lime. The content of organic matter is low or moderate.

The Harpt soils occur on the middle and lower parts of fans. Their surface layer ranges from coarse sandy loam to loam, and their subsoil is loam. The Cashmere soils generally are on the steeper, upper part of the fans. They are moderately coarse textured throughout, but some organic material has accumulated in the surface layer. The Wasatch and Bissell soils are minor soils in the association. The Wasatch soils are similar to the Cashmere, except that they are coarser textured. The Bissell soils occupy the gently sloping lower part of fans. Their surface layer ranges from loam to clay loam, and their subsoil is clay loam.

The soils in this association occur mainly on slopes where there is a limited hazard of damage by frost. They are used principally for cherry, prune, and apple orchards, but they are also well suited to alfalfa, pasture, and grain. The Bissell soils are well suited to row crops. Problems of management are primarily those of controlling erosion on the steeper soils and maintaining the fertility of the ore sandy soils.

Figure 2.-View from near Freeze Out Hill, looking northward across the Emmett Valley: (1) immediate foreground, Payette coarse sandy loam, in the Haw-Payette-Van Dusen association; (2) in foreground, orchards in the Harpt-Cashmere association; (3) to the left of orchards, low terrace in the Emerson-Wardwell-Quenzer association; (4) right background, top and upper part of the east slope of Squaw Butte, in the Gwin-Mehlhorn-Jacknife association; (5) upper part of the west slope of the butte and lower part of the east slope, in the Gem-Newell association; (6) lower part of the south slope of the butte, toward the southeast, in the Lickskillet Bakeoven association; (7) left of the butte, dissected uplands in the Haw-Payette-Van Dusen association.

Figure 3.-View from near Freeze Out Hill, looking westward along south side of Emmett Valley. Soils in foreground and on steep northerly slopes at south edge of valley are in the Haw-Payette-Van Dusen association; orchards on the "slope" are in the Harpt Cashmere association; low terrace or valley floor in right background is in the Letha-Baldock-Lahontan association.

3. Moulton-Falk soil association

This association occurs on bottom lands, mainly along the Payette River. A lame area is in the Emmett Valley below the Black Canyon Dam; a smaller area is in the vicinity of Montour. The soils are level to gently sloping and in most places are traversed by old stream channels. Formerly, much of this association was periodically overflowed, but storage reservoirs on the river now prevent floods. Natural drainage is restricted in most places, and some areas are drained by open ditches or tile drains. The development of a good drainage system throughout most of the association is hampered by the lack of sufficient grade to the Payette River.

The soils in this association formed in alluvium. They are mostly sandy loams and are underlain by gravel. The surface layer commonly is light brownish gray when dry and dark grayish brown when moist. Except for some spots of Moulton soils, the soils are not saline or alkali.

The Falk and Moulton soils are dominant in the association, and the Chance and Notus soils are of minor extent. The Falk soils are noncalcareous, moderately well drained, and moderately deep to deep. Their surface layer is light brownish-gray fine sandy loam or loamy sand. and their subsoil is sandy loam. The Moulton soils occur at slightly lower elevations than the Falls soils and also in areas where drainage is more restricted. They are slightly darker colored than the Falk soils, are mottled in the uppermost 20 inches, and are somewhat poorly drained. The Chance soils are poorly drained and very poorly drained. They generally occur in long narrow strips along old drainageways and in depressed areas where the native vegetation consisted mainly of rushes, sedges, and cattails. The Notus soils are moderately coarse textured and shallow. Riverwash occurs along the Payette River and along some of the older stream and river channels.

If adequately drained, these soils are suited to pasture crops, grain, forage crops, and row crops. Yields of field corn, sweet corn, clover, and grasses for pasture generally are good on the Moulton and Falk soils. Because of the difficulty of maintaining adequate drainage, most of the Chance soils are used for pasture. Such deep-rooted plants as alfalfa or fruit trees normally are not well suited, because the root zone is restricted either by drainage or, on the Notus soils, by shallowness to gravel. The very wet soils and Riverwash are not suitable for crops but are useful as wildlife habitats. Land smoothing and the construction of drainage systems to control water are needed, for the best yields.

4. Power-Purdam soil association

This association is made up of light-colored soils on high river terraces along the Payette River. It covers about 27 square miles in the driest part of the county.

The larger part. the Emrnett Bench, is north of the river; a small area is south of the river, southwest of Emmett. The soils are mostly level to gently sloping and well drained. They are dissected in a few places by snail streams. Along some of the streams, there are narrow bottom lands that in places have restricted drainage. The native vegetation was primarily bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush.

The Power and Purdam soils have a surface layer of silt loam or loam and a slightly finer textured subsoil. They are underlain at a depth of 3 to 6 feet by water-laid sandy, loamy, or gravelly material. The Purdam soils have a hardpan beneath the subsoil. The Draper soils occur along drainageways and are of minor extent in the association. They are deep, loamy, and moderately well drained. A water table occurs in the lower part of these soils.

The soils in thus association are well suited to a wide range of crops. The most common crops are field corn, sweet corn, alfalfa, small grain, and pasture crops, but many other crops could be intensively grown. Deep-rooted, long-lived crops grow well, except on the Purdam soils, which have a hardpan near the surface, and on some areas of Draper soils, where the lack of adequate drains or the application of excessive amounts of irrigation water causes a perched water table.

The problems of management are mainly those of controlling irrigation water on uneven land surfaces and of removing excess water from soils that have a hardpan or that are in low areas.

Nearly Level Saline and Alkali Soils

5. Letha-Baldock-Lahontan soil association

This association consists mainly of saline and alkali soils on low terraces and in basins. It covers about 22 square miles in the Emmett Valley, west of Emmett. The soils commonly are nearly level (see fig. 3), but much of the acreage is traversed by old drainage channels. A water table is present in all of the soils, but the depth to the water table varies. Considerable work has been done to drain, irrigate, and reclaim these soils, but much remains to be done. The native vegetation in the saline-alkali areas consisted mainly of alkali bluegrass, foxtail barley, greasewood, and saltgrass; in the wetter saline-alkali areas, some wiregrass, redtop, and sedges; in the better drained, less alkaline areas, giant wildrye, rabbitbrush, big sagebrush, and other bunchgrasses; and in the swales and basins, where the water table was higher, mostly rushes, sedges, and cattails.

The Letha, Baldock, and Lahontan soils are dominant in the association. The Bramwell, Black Canyon, and Bowman soils and Mountainview muck are of minor extent.

In this association there are large areas of soils that are strongly saline and alkali. These soils are difficult to reclaim. The saline-alkali Letha soils are the most extensive. They are somewhat poorly drained to moderately well drained. Their surface layer is fine sandy loam or loam, and their subsoil is sandy loam. Coarse sand and gravel occur at a depth of more than 20 inches. The somewhat poorly drained Baldock soils are loams or silt loams and are underlain by gravelly material. The Lahontan soils occupy broad basins on low terraces and are somewhat poorly drained. Their surface layer is mostly silty clay loam or silty clay. and their subsoil is silty clay. In most places the substratum consists of loose sand or gravel. The somewhat poorly drained Bra swell soils occupy about 5 square miles in the southwestern part of the Emmett Valley. Their surface layer and subsoil are silt loam, and the substratum is silty, laminated lacustrine or alluvial deposits. The Black Canyon soils are dark colored, high in organic matter, and poorly drained. They have a thick surface layer of silty clay loam. The Bowman soils are deep to moderately deep, loamy, and somewhat poorly drained. Mountainview muck is poorly drained.

The soils in this association are best suited to shallow-rooted, short-lived forage crops, pasture crops, row crops, and grain. Alta. fescue, clover, corn, barley, and wheat are commonly grown. Tall wheatgrass is saline-alkali tolerant and will provide vegetation in the early stages of reclamation. provide deep-rooted, long-lived crops as alfalfa and orchard crops do not grow well. Management practices to drain excess water and to remove excess salts and alkali are important.

Level to Gently Sloping Soils With Hardpan

6. Sweet-Kepler soil association

This association is made up of level to gently sloping soils that have a hardpan. It covers about 7 square miles on both sides of the Payette River, in the vicinity of Sweet and Montour. It consists mainly of high stream terraces that are only slightly dissected by stream cutting. Some lower terraces and narrow bottom lands occur along streams, and, south of Sweet, there are some low, rounded hills that are underlain by the Payette formation. In places the high terraces have a microrelief of small mounds and swales. Drainage is good to moderately good. The native vegetation consisted mostly of bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush.

The Sweet and Kepler soils dominate in the association, but the Newell, Goose Creek, Montour, and Haw soils are also important. The Sweet soils are deep or moderately deep and well drained. They have a moderately fine textured or fine textured subsoil and a weakly cemented to moderately cemented hardpan at a depth of 24 to 42 inches. The Kepler soils have a fine-textured subsoil and are moderately well drained or well drained. They also have a hardpan in the substratum. The Kepler soils differ from the Sweet soils in having a light brownish-gray leached horizon above the clay subsoil. Where these soils occur together in a complex, the Sweet soils occupy the mounds and the Kepler soils occupy the areas surrounding the mounds. The Haw soils lack a hardpan. The Montour soils are well drained, deep, and fine textured. The Newell soils are on low terraces or alluvial fans, and the Goose Creek soils are on bottom lands.

Most of the soils in this association are used for dry-farmed small grain or alfalfa. If dry-farmed grain is gown, the soils are summer-fallowed in alternate years between grain crops. Yields are fairly low. Some areas of the Sweet soils and most areas of the Newell and Goose Creek soils are irrigated and are used for grain, forage crops, pasture crops, and row crops. Yields of irrigated

crops are good. Areas that are not cultivated are used for range.

Management practices to prevent or to slow surface runoff are important, especially if the soils have a hardpan or a claypan.

Deep and Shallow Soils in Hilly and Mountainous Areas (Moderate Precipitation)

7. Brownlee-Rainey-Ola soil association

This association covers about 30 square miles in the eastern part of the county and consists of dark-colored, granitic soils that receive a moderate amount of precipitation. Important areas are near Crown Point and northeast of Ola. Most of the association is hilly to mountainous, but some ridgetops are undulating to rolling. The native vegetation consisted mostly of bluebunch wheatgrass, Idaho fescue, bitterbrush, big sagebrush, and associated herbs. Big sagebrush, cheatgrass, and weeds are now dominant on the range, but some native plants remain. Grass and browse plants grow on the steep northerly slopes.

The soils of this association developed mainly in residuum weathered from granite, quartz monzonite, quartz diorite, or other coarse-grained bedrock. The deep Brownlee soils have a dark-colored surface layer and a clay loam subsoil. They occur on hilltops and in the less steeply sloping areas. The Rainey soils have a less clayey subsoil and occur on ridgetops and on steep south-facing slopes. Outcrops of rock are common. The Ola soils are on north-facing slopes. They have a thick, dark-colored surface layer and a loamy subsoil.

Some of the less steep, less rocky areas of these soils are used for dry-farmed grain and hay. Yields are moderate to low. The rest are used for range. The potential production of the range is much higher than the present production.

Raising beef cattle and sheep and growing cash wheat crops are the major farm enterprises. Farms and ranches are moderate to large in size.

8. Gem-Newell soil association

This association of dark-colored soils covers a very large area that is west and south of Squaw Butte, in Squaw Creek Valley, and on the adjoining hills and the lower part of mountain slopes (see fig. 2). A smaller area occurs on the uplands, south of Montour. Except for the Squaw Creek Valley, this association is mainly hilly to mountainous. In Squaw Creek Valley and on the lower part of other areas, there are many alluvial and colluvial fans and a few terraces and bottom lands that are suitable for crops. The native vegetation consisted mostly of bluebunch wheatgrass, Idaho fescue, bitterbrush, big sagebrush, and associated forbs.

The soils in this association are typically dark grayish brown when dry and very dark brown when moist. Their organic-matter content is moderate. A layer of calcium carbonate accumulation commonly occurs just above bedrock in the moderately deep soils and below a depth of 30 inches in the deeper soils.

The Gem and Newell soils are dominant in this association, and the Bakeoven, Squaw, Salisbury, Gross, Goose Creek, Catherine, Van Dusen, and Elmore soils are of minor extent. The Gem soils occur on the hilltops and on the less steep south-facing slopes. They have a loamy surface layer and a clayey subsoil and they are underlain by basalt bedrock at a depth of about 1.5 to 3.5 feet. They generally are slightly to extremely stony, and only. small areas are suitable for farming. The very shallow, rocky Bakeoven soils are scattered among areas of Gem soils. The Newell and Squaw soils occur on the alluvial and colluvial fans. The Newell soils are deeper than the Gem soils and are less stony in the upper part of the profile; the Squaw soils have a. less clayey subsoil. The Salisbury soils also occur on alluvial and colluvial fans and in most places are extremely stony. They have a clay subsoil that is underlain by a hardpan. The Gross soils, which generally occur on steep north-facing slopes, have a thick surface layer of dark-colored stony loam. The Goose Creek and Catherine soils occupy bottom lands. The Van Dusen soils have a very dark colored surface layer and a clay loam subsoil. They occur on steep north-facing slopes. The Elmore soils have a lighter colored surface layer and a clay loam subsoil. They occur on south-facing slopes and on ridgetops.

Most of this association is used for range. The soils are fertile and are capable of producing large amounts of high-quality herbage. Nonstony or only slightly stony soils that are not too steep are used for dry-farmed grain, alfalfa, and seeded pasture. Yields are fair. Relatively small areas of the Newell, Squaw, Goose Creek, and Catherine soils are used for irrigated grain, forage crops, row crops, and pasture crops. Yields commonly are high. An important management problem on the range is the encroachment of big sagebrush, rabbitbrush, annual grasses, and weeds.

9. Gwin-Mehlhorn-Jacknife soil association

This association of dark-colored soils covers a large area in the northern part of the surveyed area and on Squaw Butte. Most of the association is mountainous or hilly (see fig. 2), but alluvial and colluvial fans that occur mainly as small scattered areas make up a considerable acreage. The native vegetation consisted mostly of bluebunch wheatgrass, Idaho fescue, lupine, arrowleaf balsamroot, wild carrot, larkspur, bitterbrush, and big sagebrush. Now, big sagebrush, cheatgrass, and weeds dominate in many areas of range, but some native plants still remain. Grass and such browse plants as snowberry, snowbrush, and ninebark grow well on all of the steep northerly slopes, except those in the extreme northern part of the association. Ponderosa pine and Douglas-fir grow well in these areas.

The soils in this association are typically dark grayish brown when dry and very dark brown when moist. They have a moderately high content of organic matter. They have been leached of virtually all of the free calcium carbonate, and most of them are slightly acid.

The Gwin, Mehlhorn, and Jacknife soils are dominant. The Mehlhorn soils occur mainly on hilltops and on steep south-facing slopes. They have a loamy surface layer and a clay loam subsoil, and they are underlain by basalt bedrock. Most areas are very stony ; only small areas are free enough of stones to be tilled for crops or to pre-

pare seedbeds for reseeding the range. Shallow, extremely rocky Gwin soils are interspersed with Mehlhorn soils. The deeper Jacknife soils occur in the small valleys and on alluvial and colluvial fans. The De Masters soils, which occupy steep north-facing slopes, are minor soils in the association. They have a thick surface layer of dark-colored stony loam. Small areas of Catherine and Goose Creek soils are on bottom lands.

This association is used mostly for range. Yields of herbage are higher than on the soils in the Gem-Newell soil association because the annual precipitation is greater. Problems of management, however, are about the same. Encroachment of brush is an important management problem, especially on the more shallow and more rocky soils. Some small areas are used for dry-farmed grain and hay crops.

Deep and Shallow Soils in Hilly Areas (Low Precipitation)

10. Chilcott-Lanktree-Lolalita soil association

The light-colored soils in this association occur in the driest part of the county. The association is fairly extensive and covers most of the dissected uplands north and south of the Emmett Valley. Much of the acreage is hilly, but there are some nearly level to undulating broad ridgetops that are remnants of the former plain. The native vegetation consisted mostly of bluebunch wheatgrass, Sandberg bluegrass, and bio sagebrush. Big sagebrush, cheatgrass, and Medusahead wildrye are now dominant on most of the range.

The soils typically are light brownish gray when dry and dark grayish brown when moist. They are low in organic matter. Most of the soils formed partly or wholly from material weathered from the sandy Idaho formation, but some were influenced by a thin covering of loess.

The Chilcott and Lanktree soils are dominant on the uplands south of the Emmett Valley. Their subsoil is clay to clay loam. The Chilcott soils have a hardpan, whereas the Lanktree soils do not. A layer of limy material is common at a depth of 12 to 20 inches. The Chilcott soils make up the larger part. of the dissected uplands north of the Emmett Valley. The Vickery soils, which occur as small mounds 10 to 30 feet across, are intermixed with the Chilcott soils. The Vickery soils have a loamy subsoil that is underlain by a hardpan. The Sebree soils, which are high in exchangeable. sodium, occur as small barren spots. They occur within larger areas of Chilcott soils. The Jenness soils are along small drainageways and on narrow bottom lands and alluvial fans. They are well drained, deep, and medium textured. The Lolalita soils occur on steep south-facing slopes, and the Payette soils occur on steep north-facing slopes. The Lolalita soils are moderately sandy throughout, and droughty. The Payette soils are darker colored than the Lolalita soils and have a surface layer of sandy loam or loam. They are underlain by loose sandy material at a depth of 2 to 3 feet.

This association is used almost exclusively for range. The soils generally are fertile, but yields are limited because of the low precipitation. Seedbed preparation for the reseeding of range grasses is possible in most areas. The Lolalita soils are more droughty and less productive than the other major soils of the association. Small areas in the valleys and a few hundred acres in the southwestern part of the county are irrigated. The crops commonly irrigated are grain, alfalfa, pasture crops, and corn. Most of the soils are suited to irrigation, but at this time water for irrigation is not available.

11. Haw-Payette-Van Dusen soil association

This association consists of soils that are underlain by sand or rhyolite and occur on the semiarid hilly uplands. It covers about 70 square miles north and east of Emmett. Much of the upland plain is strongly dissected, and steep slopes and very- narrow valleys are common (see figs. 2 and 3). The native vegetation consisted largely of bluebunch wheatgrass, Sandberg bluegrass, and some big sagebrush. Most of the range is now dominated by big sagebrush, cheatgrass, and Medusahead wildrye.

The Haw, Payette, and Van Dusen soils are dominant. The Payette soils occur at high elevations on steep south-facing slopes of the Idaho and Payette formations and at low elevations on steep north-facing slopes. They are loamy and are underlain by loose sandy material at a depth of 2 to 3 feet. The Haw soils are on ridgetops and old plains. Their surface layer is loam, and their subsoil is clay loam. An accumulation of calcium carbonate is common at a depth of 18 to 24 inches. The Van Dusen soils are on north-facing slopes. They are dark-colored and have a loam surface layer and a clay loam subsoil. The Dishner soils formed in residuum weathered from sandstone strata of the Idaho formation. They are light colored, shallow, and stony. The Cashmere and Harpt soils occur on alluvial fans. The Perla soils have a stony and extremely stony loam surface layer and a clay subsoil. They are underlain by rhyolitic bedrock at a depth of 2 to 3 feet. The Aikman soils probably formed in residuum weathered from rhyolitic tuff. They are either stony or nonstony and are reddish and clayey throughout. Cracks 1 to 2 inches wide form in the surface layer during the dry summer. The Roystone soils are deep and occur on valley bottoms. They have a dark-colored surface layer and a clay loam subsoil.

Because of the many steep slopes and the limited amount of rainfall, this association is used largely for range. Some areas that are less steep are dry farmed in a wheat-fallow rotation or in continuous alfalfa. A few small areas are irrigated and are suitable for diversified farming. Raising beef cattle and raising sheep are the principal enterprises. Problems of management include increasing the native vegetation on the more steep and rocky soils, and reseeding or improving the range on the other soils.

12. Lickskillet-Bakeoven soil association

This association consists of shallow soils that are underlain by basalt. It covers a small area on both sides of the Black Canyon Reservoir (see fig. 2). Most of the association is hilly, but the lower part of slopes and some alluvial fans are less steep.

The Lickskillet and Bakeoven soils formed in residuum weathered from basalt. They differ from each other

chiefly in the texture of the subsoil and in depth to bedrock. The Lickskillet soils have a subsoil of clay loam and are as much as 22 inches in depth to basalt bedrock. The Bakeoven soils are loam or gravelly loam and are less than 12 inches in depth to basalt bedrock. Stones and outcrops of bedrock are common throughout the association.

Because of the shallow stony soils, outcrops of rock, and low precipitation, this association is used almost entirely for range. Seedbed preparation for the reseeding of the range is possible in some places. Control of big sagebrush, cheatgrass, and Medusahead wildrye is important in range management.

Descriptions of the Soils

In this section, the soils of the Gem County Area are listed in alphabetical order and described. Following the general description of each series, there is a profile description of a typical soil in that series. Each of the other soils in the series is described by comparing it to the typical soil. Additional facts about each soil are also given.

Unless otherwise stated, the colors shown in this section are for moist soils. Color designations are according to the Munsell system. The terms used to express the pH are defined in the Glossary. The approximate acreage and proportionate extent of the soils are given in table 1.

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All tables have been updated and are available as a separate document.

Aikman Series

This series is made up of well-drained, reddish soils that have a clayey surface layer and a clayey subsoil. The parent material consisted mainly of residuum weathered from rhyolite or from rhyolitic tuff. It contained rhyolite stones and cobblestones and was mixed with material weathered from the sandy sedimentary Idaho formation. The depth to rhyolite or rhyolitic tuff ranges from 25 to 50 inches but generally is about 40 inches. During the dry summer, cracks that are from 1 to 1 1/2 inches wide and from 10 to 20 inches deep form in the upper part of these soils, and some of the granular surface soil falls into these cracks.

The Aikman soils occur mostly in the Haw-Payette-Van Dusen soil association. They occur on undulating to hilly uplands southwest of Pearl, at elevations of 3,000 to 4,000 feet. The slope ranges from 3 to 30 percent. The annual precipitation ranges from 11 to 14 inches. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, and lupine. This has been replaced in most places by Medusahead wildrye, cheatgrass, and wild onions.

These soils are slightly or moderately eroded. Permeability is rapid when the soils are cracked and dry, and slow to very slow when they are wet. The available water holding capacity is moderate, and fertility is moderate.

All of the acreage is used for pasture and range.

Representative profile of Aikman stony clay, 3 to 12 percent slopes, 740 feet north and 200 feet east of the southwest corner of the SE1/4 sec. 20, T. 6 N., R. 1 E., in an area used as range.

A11-0 to 1 inch, dark reddish-brown (5YR 3/2) clay; dark reddish gray (5YR 4/2) when dry; moderate, fine, granular structure ; very firm when moist, very hard when dry; slightly acid to neutral (pH 6.3 to 6.7).

A12-1 to 16 inches, dark reddish-brown (5YR 3/3) clay; reddish brown (5YR 4/3) when dry; moderate, coarse and very coarse, prismatic structure and moderate, medium, angular blocky structure ; slickensides ; very firm when moist, very hard when dry ; slightly acid to neutral (pH 6.5 to 7.0).

A13-16 to 21 inches, dark reddish-brown (5YR 3/4) or reddish-brown (5YR 4/4) clay; dark reddish gray (5YR 4/2) or reddish brown (5YR 4/3) when dry; moderate, medium, angular blocky structure ; very firm when moist, very hard when dry; neutral (pH 6.6 to 7.1).

AC-21 to 24 inches, red (2.5YR 4/5) clay; red (2.5YR 5/5) when dry ; weak, medium, angular blocky structure ; very firm when moist, very hard when dry; neutral (pH 6.6 to 7.1).

Cca-24 to 36 inches, reddish, partly decomposed rhyolite or rhyolitic tuff with splotches and veins of calcium carbonate; mildly alkaline.

R-36 inches +, rhyolite or rhyolitic tuff bedrock.

The thickness of the granular A11 horizon ranges from 1 to 3 inches, depending on the time of year. The color of the moist surface layer ranges from dark reddish brown to reddish brown, reddish gray, dark reddish gray, or dusky red. Grains of quartz sand and very fine fragments of rhyolite are common. There are a few outcrops of sandstone, rhyolite, calcic silica, and white tuff. At. the western edge of their range, the Aikman soils are underlain by the Idaho and Payette formations. Spots of

Aikman soils too small to delineate occur in areas of the Lickskillet and Gem soils and are mapped with those soils.

Aikman stony clay, 3 to 12 percent slopes (AcC). - A profile of this soil is the one described as typical of the series. Stones and cobblestones of rhyolite are scattered on the surface and throughout the profile, but they do not prevent tillage. In some places there are outcrops of rock. Some areas have been farmed, then were abandoned, and are now used for range. These areas are slightly to moderately eroded, and scattered gullies have formed. Included in the areas mapped are small spots of Dishner, Perla, and Haw soils.

This soil is used for pasture or range, but most of the plant cover is in poor condition as a result of overgrazing or of trampling when the soil was wet. The principal plants are Medusahead wildrye, cheatgrass, wild onions, and other annual grasses and forbs. Extensive reseeding with suitable grasses and legumes is needed for maximum yields. A mixture of Ladak alfalfa and Whitmar beardless wheatgrass or of Ladak alfalfa and pubescent wheatgrass is suitable. Summer fallowing and proper seedbed preparation will help to establish good stands. This soil dries slowly and should not be used for grazing until late in spring. Trampling when the soil is wet and overgrazing can destroy even a good stand of grass.

This soil could be used for dryland crops. It is difficult to till because of the clayey surface layer. Suitable crops include alfalfa and grass for hay, small grain, brass for seed, and alfalfa for seed. Yields probably would be fair to low because of the lack of available moisture in summer. Crop rotations and the use of manure, green manure, and crop residues would help to maintain or increase fertility, to supply organic matter, and to preserve soil structure. *Capability unit IVe-6, dryland. Clay-Brown range site.*

Aikman stony clay, 12 to 30 percent slopes (AcE).- This is the most extensive soil in the Aikman series. Except for slope, it is similar to Aikman stony clay, 3 to 12 percent slopes. Stones or cobblestones of rhyolite are scattered on the surface and throughout the profile but do not Prevent tillage. There are a few outcrops of rock. Erosion is slight to moderate, and shallow gullies have formed in the drainageways.

This soil is poorly suited to crops. It is used for pasture and range, and it needs the same management as Aikman stony clay, 3 to 12 percent slopes. In most places the native vegetation has been replaced by Medusahead wildrye. cheatgrass, wild onions, and other annual grasses and forbs. Some areas have been farmed, then were abandoned, and are now in poor condition. *Capability unit IVe-6, dryland. Clay-Brown range site.*

Aikman extremely stony clay, 0 to 30 percent slopes (AkE).-This soil is similar to Aikman stony clay, 3 to 12 percent slopes, except that it contains stones of sandstone and rhyolite that prevent tillage. The stones generally are from 1 to 2 feet in size and make up about 5 to 10 percent of the soil material. Erosion is slight to moderate, and shallow gullies have formed in some drainageways.

This soil is used for pasture and range, but the plant cover is now in poor condition. The principal plants are Medusahead wildrye, cheatgrass, and annual weeds. Yields of forage are low but can be increased by broad cast seeding and by management practices that favor the growth of the perennial grasses. *Capability unit VIIs-1, dryland. Clay-Brown range site.*

Bakeoven Series

The Bakeoven series consists of dark-colored, medium-textured, very shallow soils that formed in residuum weathered from basalt. The surface layer is loam, and it is moderately low in organic-matter content. The subsoil is also loam, but it has slightly more clay than the surface layer and contains angular gravel and cobblestones. Lime accumulation is not common, but possibly there is a little lime beneath some of the basalt fragments or in cracks in the bedrock. Stones and outcrops of rock occur in most places. The depth to bedrock ranges from about 4 to 12 inches.

These soils are mostly in the Gem-Newell soil association and in the Lickskillet-Bakeoven soil association. They occur at elevations of 2,700 to 5,200 feet on hills and mountains north and east of Emmett. The slope ranges from 3 to 90 percent but is mostly between 15 and 45 percent. The annual precipitation ranges from about 11 to 16 inches. The native vegetation consisted of big sagebrush, bitterbrush, bluebunch wheatgrass, and Sandberg bluegrass.

Erosion is slight to severe, permeability is moderate, and the available water holding capacity is very low.

These soils are used principally for pasture and range.

Representative profile of Bakeoven extremely rocky loam, 900 feet east and 500 feet south of the northwest corner of the SW1/4 sec. 26, T. 7 N., R. 1 W., in a non-cultivated area.

A1-0 to 3 inches, very dark grayish-brown (10YR 3/2) loam that contains stones and angular gravel; grayish brown (10YR 5/2) when dry; weak, thin, platy structure and moderate, fine, granular structure; very friable when moist, slightly hard when dry ; abundant roots ; neutral to mildly alkaline.

Blt-3 to 6 inches, dark-brown (10YR 3/3) loam that contains stones and angular gravel ; brown (10YR 5/3) when dry ; weak, fine, subangular blocky structure ; friable when moist, slightly hard when dry; roots plentiful; many fine pores; neutral to mildly alkaline.

B2t-G to 11 inches, dark-brown (10YR 3/3) very gravelly loam; brown (10YR 5/3) when dry; weak, medium, prismatic structure and weak, fine, angular blocky structure ; slightly darker, thin, patchy clay films on the ped surfaces ; friable when moist, hard when dry ; fine roots plentiful; few fine pores; mildly alkaline.

R-11 inches +, basalt bedrock ; slightly weathered in upper part.

In most places from 50 to 7 5 percent of the soil, by volume, is basalt gravel, cobblestones, or stones. The surface layer ranges from very dark grayish brown (10YR 3/2) to dark brown (10YR 3/3) when moist, and from grayish brown (10YR 5/2) to brown (10YR 5/3) when dry. In places the B2t horizon grades toward clay loam. The color of the B horizon is dominantly in the 10YR hue, but in places it is in the 7.5YR hue or grades toward the 2.5Y hue. The reaction is neutral or mildly alkaline.

In Gem County Area the Bakeoven soils are mapped only as a complex or undifferentiated unit with the Lickskillet, Gem, or Gross soils.

Bakeoven and Lickskillet extremely rocky soils, 0 to 30 percent slopes (BaE).-These soils are extremely

rocky loams. The Bakeoven soil ranges from 2 to 12 inches in depth to basalt bedrock, and the Lickskillet soil ranges from 1.2 to 20 inches. The Bakeoven soil occupies from 25 to 45 percent of most areas, and the, Lickskillet soil, from 20 to 40 percent.. Outcrops of basalt and areas of soils that are less than 4 inches in depth occupy from 15 to 50 percent and are from 10 to 30 feet apart. In a few places the soils are more than 20 inches in depth to bedrock. The Bakeoven and Lickskillet soils are described more fully in the description of their respective series.

These soils have a shallow or very shallow root zone, are very low in available water holding capacity,' and have rapid surface runoff. In places fragments of rock make up as much as 20 percent of the surface layer. Cultivation is not feasible, because of the numerous outcrops of rock, the rock fragments, and extreme shallowness. . These soils are used for pasture and range. The plant, cover commonly is in poor condition and in most places has been invaded by Medusahead wildrye. Yields of forage are low but can be increased somewhat by proper management practices. *Capability unit VIIs-1, dryland.*
Shallow stony-Brown range site.

Bakeoven and Lickskillet extremely rocky soils, 30 to 60 percent slopes (BaF).-These soils are extremely rocky loams. The Bakeoven soil makes up from 30 to 50 percent of most areas; the Lickskillet soil, from 15 to 30 percent ; and outcrops of rock and soils that are less than 4 inches in depth, from 20 to 50 percent. Most of the soils have southerly exposures and, consequently, higher temperatures and greater evaporation of moisture.. The soils that have northerly exposures have a slightly darker colored surface layer and contain a little more organic matter. The percentage of Lickskillet soil generally is slightly higher on north-facing slopes. Some small areas of Gross soils on north-facing slopes were included in the areas mapped.

These soils have rapid surface runoff. They can be used in the same way as the less strongly sloping Bakeoven and Lickskillet extremely rocky soils, but more vegetation should be left on then to control erosion. Forage yields are low but are slightly higher on the north-facing slopes where evaporation is less. *Capability unit VIIs-2, dryland. Shallow south slope-Brown range site.*

Bakeoven and Lickskillet extremely rocky soils, 60 to 80 percent slopes (BaG).-These soils are extremely rocky foams. The very shallow Bakeoven soil and the outcrops of rock are more extensive than the deeper Lickskillet soil. The slopes are very steep, and surface runoff is very rapid. Most slopes have a southerly exposure.

Because of steepness and shallowness, these soils are best suited to watersheds and wildlife habitats. Most of the plant cover is in good condition because it is seldom grazed. The principal plants are big sagebrush, bitterbrush, Sandberg bluegrass, and bluebunch wheatgrass.

Capability unit VIIIs-1, dryland.

Baldock Series

These soils formed from alluvium in imperfectly drained basins on the low terrace west of Emmett. The surface layer is medium textured to moderately fine textured, calcareous, and mildly to strongly alkaline. The subsoil is similar in texture to the surface layer. It is underlain by coarser material that overlies gravelly alluvium at a, depth of 30 to 7 0 inches. The parent material is mostly acid igneous material deposited by the Payette River, but it includes some material from silty wind-laid deposits. Except for small areas, the surface layer and subsoil are free of gravel and stones. Spots of salts or alkali occur in most areas. In places there are mounds that are about 15 feet across and 1 foot high. These mounds are mildly alkaline, but the soils surrounding the mounds are moderately to strongly alkaline.

These soils are extensive in the Letha-Baldock-Lahontan soil association. They are mainly in level to nearly level basins, but in a few places they occur on the edge of small terraces that have a slope of as much as 5 percent. They range from 2,250 to 2,300 feet in elevation. The annual precipitation ranges from 9 to 11 inches. The vegetation consists principally of saltgrass; greasewood, and some bunchgrasses.

Little or no erosion has occurred on these soils. The available water holding capacity is moderate to high, and permeability is moderate to moderately slow. The water table is at a depth of 1 to 6 feet and is highest in fall.

These soils are used principally for pasture.

Representative profile of Baldock silt loam, moderately alkali, 1,200 feet south and 100 feet west of the northeast corner of see, 33, T. 7 1., R. 3 W., in a level alfalfa-grass meadow.

Ap-0 to 10 inches, dark grayish-brown (2.5Y 4/2) silt loam; light gray (2.5Y 7/1) or light brownish gray (10YR 6/2) when dry; weak, thin, platy structure or weak, very fine, granular structure ; friable when moist, hard when dry; moderately calcareous; mildly alkaline (pH 7.7).

C1ca-10 to 19 inches, grayish-brown (2.5Y 5/2) loam: light gray (2.5Y 7/1) or light brownish gray (10YR 6/2) when dry ; very weak, medium, platy structure or weak, fine, granular structure ; friable when moist, hard when dry ; moderately calcareous ; few fine veins of calcium carbonate; mildly alkaline (pH 7.8).

C2ca-19 to 27 inches, (lark grayish-brown (2.5Y 4/2) loam; light brownish gray (2.5Y 6/2) with few, fine, distinct, brown mottles when dry ; weak, fine, granular structure ; friable when moist, hard when dry ; moderately calcareous ; mildly alkaline (pH 7.8).

C3-27 to 43 inches, olive-brown (2.r5Y 4/3) loam; light yellowish brown (2.5Y 6/3) when dry; few, fine, distinct, dark-brown (10YR 3/3) mottles that are dark grayish brown when moist; very weak, fine, sub angular blocky structure ; friable when moist, hard when dry ; noncalcareous or very slightly calcareous ; mildly alkaline (pH 7.4).

IIC4-43 to 49 inches, olive-brown (2.5Y 4/3) fine sandy loam; light yellowish brown (2.5Y 6/3) when dry ; common, fine, distinct, light yellowish-brown (10YR 6/4) mottles when dry; common, medium, black (N 2/0) mottles when moist; many faint, olive-brown (2.5Y 4/4) and dark yellowish-brown (10YR 4/4) mottles in lower part of horizon ; massive ; firm when moist, hard when dry; noncalcareous; mildly alkaline (pH 7.5).

IIIC5-49 to 67 inches, light olive-brown (2.5Y 5/3) coarse sand; light gray (2.5Y 7/2) and pale yellow (2.5Y 7/3) when dry; common, medium, faint or distinct, light yellowish-brown (2.5Y 6/4), yellowish-brown (10YR 5/4), and dark-gray mottles when dry; single grained ; loose; noncalcareous ; moderately alkaline (pH 7.9).

IVC6-67 inches +, loose gravel.

The surface layer is light gray to light brownish gray when dry and dark grayish brown to very dark gray when moist. The reaction of the surface layer ranges from pH 7.7 to pH 9.0. The subsoil is dominantly loam or silt loam,

but in places it ranges to light silty clay loam. Strata of fine sandy loam or clay loam occur in places. In the wetter areas the lower layers are bluish gray. In places a thin white salty crust forms on the dry surface soil.

Baldock silt loam, moderately alkali (Bc)- This is the most extensive soil in the Baldock series. A profile of this soil is the one described as typical of the series. The surface layer is dominantly silt loam, but in many places it is loam, and in a few places, light silty clay loam. In most places the slope is less than 1 percent. The depth to the water table generally is between 30 and 50 inches. The water level is highest in summer and in fall. Alkali spots occupy less than 15 percent of the acreage. Generally these spots are strongly alkaline in the surface layer.

Included in the areas mapped are a few soils that have slopes of more than 1 percent. These soils occur as narrow strips along drainageways or along the edges of low terraces. Small spots of Letha and Bowman soils were also included in the areas mapped.

In a few spots, runoff caused by excessive irrigation causes the water table to rise to within 15 to 30 inches of the surface during the summer and fall. In a few places, the water table has been lowered to a depth of more than 5 feet by means of deep, open drainage ditches. The available water holding capacity is moderately high.

This soil is used for irrigated crops and improved pasture. Such crops as small grain, corn, and hay crops grow well under good management. A rotation that includes a grass-legume crop is beneficial. Saltgrass and greasewood provide little usable forage, but yields of pasture mixtures are good. Pastures need nitrogen and phosphate fertilizers and manure. Intervals between grazing periods should be adequate to allow the regrowth of desirable grasses. Alkali spots are likely to produce mostly saltgrass if used for hay or pasture crops and little or nothing if used for cultivated crops. Manure and soil amendments help to get crops established on alkali spots, and green manure is beneficial. Border or basin irrigation is best for reclaiming these spots. Overirrigation can cause waterlogging and crop damage. *Capability unit IIIw-6, irrigated.*

Baldock silt loam, moderately saline-alkali (Bd).- Between 30 and 60 percent of this soil consists of moderately to strongly saline-alkali spots. In most of these spots, the surface layer is strongly alkaline or very strongly alkaline, but in some it is moderately alkaline. The soil between the spots is similar to the soil described as typical of the series. The surface layer is dominantly silt loam, but in places it is loam. The depth to the water table generally is between 30 and 50 inches. The available water holding capacity is moderately high. Included in the areas mapped was about 10 acres of gravelly loam. This acreage is near the southeast corner of section 24, T. 6 N., R. 2 W.

This soil is used for irrigated crops and pasture. The most productive crops are tall wheatgrass and alta fescue grown either for hay or for pasture. Large applications of manure and of gypsum or other amendments are needed to reclaim this soil. Green manure also helps. Border or basin irrigation is best during the reclamation process. Some spots have been leached and are nonsaline-alkali. *Capability unit IVw-2, irrigated.*

Bissell Series

In this series are well drained or moderately well drained soils that occur mainly on terraces and on the toe of alluvial fans south and east of Emmett. These soils contain no gravel or stones and are nonalkali. Their surface lager is loam or clay loam, and their subsoil is clay loam. They are underlain by sandy alluvium at a depth of 50 inches or more. The parent material consists of acid igneous material that was deposited by the river and by the many small streams that drain the hills. The native vegetation consisted of bunchgrasses and some sagebrush and herbaceous plants. Because of the additional moisture from the streams, the vegetation was more abundant than it otherwise would have been, and, consequently, the surface layer is darker colored.

These soils are mainly in the Harpt-Cashmere soil association, the Emerson-Wardwell-Quenzer soil association, and the Power-Purdam soil association. They occur at an elevation of about 2,400 feet and have slopes of less than 7 percent. The annual precipitation ranges from 10 to 12 inches.

Fertility is high, and the available moisture holding capacity is high. Permeability is moderately slow in the subsoil.

These soils are used for orchards, row crops, and irrigated pasture.

Representative profile of Bissell loam, 1 to 3 percent slopes, 150 feet west and 500 feet north of the southeast corner of the N E1/4 sec. 17, T. 6 N., R. 1 W., in an orchard.

Ap-0 to 8 inches, very dark grayish-brown (10YR 3/2) loam; grayish brown (10YR 5/2) when dry ; moderate, fine, granular structure ; friable when moist, slightly hard when dry ; abundant roots ; neutral (pH 6.6).

B21t-8 to 14 inches, very dark grayish-brown (10YR 3/2) clay loam ; grayish brown (10YR 5/2) when dry ; weak, medium, prismatic structure and moderate, medium, angular blocky structure ; firm when moist, hard when dry ; thin, continuous clay films on vertical and horizontal surfaces; roots plentiful; common fine pores ; neutral (pH 7.1).

B22t-14 to 20 inches, light olive-brown (2.5Y 5/3) clay loam ; light brownish gray (2.5Y 6/2) when dry ; weak, fine, subangular blocky structure ; firm when moist, hard when dry ; thin, continuous clay films on vertical and horizontal surfaces ; fine roots plentiful ; common fine pores ; mildly alkaline (pH 7.8).

B3t-20 to 25 inches. grayish-brown (2.5Y 5/2) clay loam: light brownish gray (2.5Y 6/2) when dry; weak, medium, subangular blocky structure; friable when moist, slightly hard when dry ; thin, patchy clay films ; few fine roots ; many fine pores ; moderately alkaline (pH 8.0).

Clca-25 to 58 inches, light olive-brown (2.5Y 5/3) loam; light brownish gray (2.5Y 6/2) when dry; massive; friable when moist, slightly hard when dry ; common, small, calcium carbonate veins and spots in the lower 4 inches ; slightly calcareous ; moderately alkaline (pH 8.1).

IIC2ca-58 to 60 inches, light olive-brown (2.5Y 5/3) loamy sand ; pale yellow (2.5Y 7/3) when dry ; single grained ; loose; calcareous; moderately alkaline (pH 8.4).

The texture of the surface layer is loam, clay loam, or sandy clay loam. The subsoil is clay loam or sandy clay loam. The parent material was stratified, and in places strata of sandy loam, loam, or clay loam occur in the profile. The depth to calcareous material ranges from 20 to 45 inches. In some, places the material below a depth of about 50 inches is mottled, stained, or variegated. Small areas of Harpt loam were included in the areas mapped,

and these make up as much as 10 percent of a mapping unit.

Bissell clay loam, 0 to 1 percent slopes (BfA).-A profile of this soil is similar to the one described as typical of the series, but the surface layer is clay loam, and, consequently, this soil tends to clod more when dry, is stickier when wet, and is somewhat more difficult to work than the typical soil. The hazard of erosion is negligible.

This soil is used for irrigated hay, corn, small grain, and pasture. Yields can be kept high by using a good crop rotation, utilizing crop residues, and applying nitrogen and phosphate fertilizers and manure. Because of the frost hazard, only a small acreage is used for orchards. Irrigation can be by the border, corrugation, furrow, or sprinkler method. *Capability unit I-1, irrigated.*

Bissell clay loam, 1 to 3 percent slopes (BfB).-A profile of this soil is similar to the one described as typical of the series, except that the surface layer is clay loam. Because of the finer texture, this soil is stickier when wet, harder when dry, and somewhat more difficult to work than the typical soil. The hazard of erosion is slight.

This soil is used for irrigated orchards, crops, and pasture. The acreage that is used for crops and pasture can be managed in about the same way as Bissell clay loam, 0 to 1 percent slopes, but more care is needed to control erosion. Orchards need to be kept in a permanent grasslegume cover, and they need applications of nitrogen and phosphate. Sprinkler irrigation is preferable in orchards. *Capability unit IIe-2, irrigated.*

Bissell loam, 0 to 1 percent slopes (BgA).-A profile of this soil is similar to the one described as typical of the series. The hazard of erosion is negligible.

This soil can be used and managed in the same way as Bissell clay loam, 0 to 1 percent slopes, but it is more easily worked. *Capability unit I-1, irrigated.*

Bissell loam, 1 to 3 percent slopes (BgB).-This is the most extensive soil in this series. A profile of this soil is the one described as typical of the series.

Most of the acreage is used for orchards. Orchards need a permanent grass-legume cover crop to control erosion. They respond to applications of nitrogen and phosphate. The acreage that is used for irrigated crops and pasture can be managed in about the same way as Bissell clay loam, 0 to 1 percent slopes, but more care is needed to control erosion. *Capability unit IIe-2, irrigated.*

Bissell loam, 3 to 7 percent slopes (BgC).-Except for slope, this soil is similar to Bissell loam, 1 to 3 percent slopes. The hazard of erosion is slight.

Most of the acreage is used for orchards. Orchards need to be kept in a permanent grass-legume cover, and they need applications of nitrogen and phosphate. The acreage that is used for irrigated crops needs applications of nitrogen and phosphate fertilizers and manure to maintain yields. A suitable rotation is a grass. legume mixture or winter cover crop for 3 years and then a role crop or small grain for 2 years. *Capability unit IIIe-2, irrigated.*

Black Canyon Series

In this series are very dark colored, fine textured to moderately fine textured soils that occur in basins in the Emmett Valley and on bottom lands alone Squaw Creek. The surface layer has a high content of organic matter. The subsoil is fine textured. The underlying material, which occurs at a depth of 21 feet to 6 feet or more, is stratified alluvium that is either sandy or gravelly. This alluvial material washed from uplands of quartzic or acid igneous rocks. Commonly, the soils are noncalcareous throughout, and they range from mildly alkaline to slightly acid. There are no stones or gravel in the uppermost 3 feet.

These soils occur on slopes of less than 1 percent, at elevations of 2,300 to 3,000 feet. The annual precipitation ranges from 9 to 16 inches. The vegetation consists of rushes, sedges, cattails, and other water-tolerant plants.

Erosion is negligible, fertility is high, and the available water holding capacity is high to very high. The subsoil is slowly permeable. Natural drainage is poor or very poor, but deep drainage ditches have lowered the water table to a depth of 3 feet or more on much of the acreage.

Drained areas are irrigated or subirrigated and are used for hay, pasture, and corn.

Representative profile of Black Canyon silty clay loam, 250 feet south and 450 feet west of the center of sec. 23, T. 6 N. R. 2 W., in an alfalfa field that has a slope of 0.5 percent.

Ap--0 to 9 inches, black (2.5Y 2/1) silty clay loam; dark gray (2.5Y 4/1) when dry; strong, very fine, granular structure ; firm when moist, very hard when dry ; roots plentiful; noncalcareous; mildly alkaline (pH 7.4).

A1-9 to 20 inches, black (2.5Y 2/1) silty clay; very dark gray (2.5Y 3/1) when dry ; weak, coarse, prismatic structure and moderate, fine, angular blocky structure; very firm when moist, very hard when dry; roots plentiful ; few fine pores ; noncalcareous ; neutral (pH 7.0).

C1g-20 to 45 inches, dark-gray (2.5Y 4/1)) silty clay; common, dark reddish-brown (5YR 3/3) mottles about 1/4 inch across; light gray (2.5Y 6/1) when dry; massive ; very firm when moist, very hard when dry ; few roots ; few fine pores ; noncalcareous ; neutral.

IIC2g-45 to 55 inches, dark-gray (2.5Y 4/1)) silty clay loam ; yellowish-brown mottles; light gray (2.5Y 6/1) when dry ; massive ; noncalcareous.

IIIC3-55 to 70 inches, loose gravelly sand; noncalcareous.

The color of the moist surface layer ranges from 2.5Y 2/2 to N 2/0 or 10YR 2/1. The thickness of the A horizon ranges from 12 to 23 inches. The color of the moist C1g horizon ranges from olive gray to dark gray. The texture of the C1g horizon is silty clay or clay. In places layers of peat occur in the profile.

Small areas of Mountainview muck were included in the areas mapped, and these make up as much as 5 percent of the mapping unit. A few small saline and alkali spots were also included.

Black Canyon silty clay loam (Bh).-A profile of this soil is the one described as typical of the series. This soil is poorly drained or very poorly drained, and the water table is at or near the surface much of the year. Most areas are along Squaw Creek.

This soil is too wet for cultivation and is used for pasture. Legumes are occasionally seeded. Irrigation is not needed. *Capability unit Vw-1, dryland.*

Black Canyon silty clay loam, drained (Bk).-This soil occurs in the Emmett Valley and along Squaw Creek. In a few places in the Emmett Valley, the surface layer is silty clay or clay. This soil differs from Black Canyon silty clay loam in having been artificially drained, mainly by deep open ditches. Some tile drains have also been installed. The water table has been lowered considerably

and generally is at a depth of 30 to 50 inches, but it fluctuates somewhat.

The principal crops are irrigated hay, small grain, corn and pasture. The soil. especially the silty clay and clay surface layer, is somewhat difficult to work, and tillage needs to be carefully timed. If the soil is too wet, it is easily puddled; if too dry, it will form clods. Phosphate benefits hay crops and corn. Irrigation can be. by the border, corrugation, or furrow method. The amount of irrigation water needs to be adjusted to avoid waterlogging. *Capability unit IIIw-4, irrigated.*

Bowman Series

The Bowman series consists of dark colored or very dark colored, calcareous soils on bottom lands and low terraces west of Emmett. These soils formed under naturally poor drainage (fig. 4), in alluvium that washed mainly from areas of acid igneous rocks. Some of the alluvial material washed from areas of the Idaho and Payette formations, and a lesser amount from areas of basalt and rhyolite.

The surface layer is dominantly silt loam or loam, but in places it is light clay loam or light silty clay loam.

Figure 4.-Profile of Bowman silt loam, 0 to 1 percent slopes, showing the thick, dark-colored surface horizon and the lighter colored, gleyed subsoil.

It has a high content of organic matter. Between the plow layer and a depth of as much as 30 inches, the subsoil is dominantly loam or silt loam but ranges to clay loam or silty clay loam. Stratified layers generally occur below the subsoil, and sandy or gravelly layers are common. There are no stones or gravel in the uppermost part of the profile. The soils are grayish and commonly mottled in the lower part of the profile.

These soils occupy a small total acreage in the Letha-Baldock-Lahontan soil association. They occur at elevations of 2,250 to 2,500 feet. The slope ranges from 0 to 3 percent but is mostly less than 1 percent. The annual precipitation is 9 to 11 inches. The vegetation consisted mainly of water-tolerant grasses. sedges, and rushes.

In most places the surface layer is mildly alkaline, but there are some small saline-alkali spots. The available water holding capacity is moderate to high, and permeability is moderate in the subsoil. There is little or no erosion.

Most of the acreage is used for irrigated crops and pasture.

Representative profile of Bowman silt loam, 0 to 1 percent slopes, 1,100 feet west and 1,000 feet south of the northeast corner of sec. 23, T. 6 N., R. 2W., in a hayfield.

Ap-0 to 10 inches, very dark gray (10YR 3/1) or black (10YR 2/1) silt loam; gray (10YR 5/1) or dark gray (10YR 4/1) when dry ; moderate, medium, granular structure ; friable when moist, slightly hard when dry ; moderately calcareous ; moderately alkaline(pH 8.0).

ACca-10 to 18 inches, very dark gray (10YR 3/1) silt loam; gray (10YR 5/1) when dry ; few, medium, distinct, brown mottles ; weak, fine, subangular blocky structure; friable when moist, hard when dry; slightly calcareous; mildly alkaline (pH 7.0).

C1cag 18 to 32 inches, grayish-brown (2.5Y 5/2) or gray (2.5Y 5/1) loam; light brownish gray (2.5Y 6/2) or light gray (2.5Y 6/1) when dry; common, medium, distinct, brown mottles ; massive ; friable when moist, hard when dry ; slightly calcareous ; neutral (pH 7.2).

C2a 32 to 38 inches, light brownish-gray (2.5Y 6/2) or light gray (2.5Y 6/1) loam; light gray (2.5Y 7/2) when dry; many, medium, prominent, strong-brown (7.5YR 5/8) mottles ; massive; friable when moist, hard when dry; noncalcareous; neutral (pH 7.2).

IIC35 38 to 42 inches, gray (N 5/0) loamy fine sand; light gray (N 7/0) when dry ; massive ; very friable when moist, soft when dry ; noncalcareous ; moderately alkaline (pH 8.2).

IIIC4g--42 to 48 inches, gray (N 5/0) sand; light gray (N 7/0) when dry ; single grained ; loose ; noncalcareous ; mildly alkaline (pH 7.6).

IVC5-48 inches +, gravelly alluvium, mostly of acid igneous origin.

The color of the moist surface layer ranges from black (2.5Y 2/1) to very dark gray (10YR 3/1). The subsoil includes strata with textures ranging from sandy loam to silty clay loam. There are no evident clay films on peds. Mottles are common below a depth of 10 to 20 inches. Peat layers occur in the substratum in places. Depth to gravel ranges from 20 to 70 inches or more.

Inclusions of Baldock soils make up about 3 or 4 percent of the areas mapped, and Black Canyon, Mountainview, Letha, and Lahontan soils make up as much as 3 or 4 percent of some mapping units.

Bowman silt loam, **0 to 1 percent slopes** (BmA).-This soil is the most extensive in the Bowman series. It occurs in swales, depressions, and basins and on the level parts of low terraces and bottom lands, mainly west of Emmett.

A profile of this soil is the one described as typical of the series. The surface layer is principally silt loam, but in many places it is loam. The depth to loose gravel, coarse sand, or gravelly sand is more than 3 feet. In most of the areas mapped, there are a few small alkali or saline-alkali spots.

Most of the acreage has been partially drained by deep open ditches or tile. In these areas the depth to the water table is between 30 and 50 inches during most of the grow ing season. The available water holding capacity is high.

This soil is irrigated and used for pasture, hay, corn, and small grain. A rotation that includes a mixture of grasses and legumes is desirable. Phosphate is needed on legumes and corn. Nitrogen helps to decompose crop resi dues that are plowed under. The organic-matter content and soil structure are benefited if green-manure crops are plowed under or manure is applied. Soil amendments are needed on the more saline-alkali spots. Yields of improved pasture are highest if grazing is rotated. Border irrigation is preferable on these soils, but sprinkler, corrugation, and furrow irrigation methods can be used. Deep-rooted crops normally obtain enough moisture from the water table. *Capability unit IIIw-2. irrigated.*

Bowman silt loam, 1 to 3 percent slopes (BmB).-A profile of this soil is similar to the one described as typical of the series. This soil occurs along drainageways and edges of terraces. There are a few alkali or saline-alkali spots. The depth to the water table is between 30 and 60 inches during most of the growing• season.

Most of this soil is used for irrigated crops and pasture, but some is still under a cover of native grasses and sedges. Management needs are similar to those of Bowman silt loam, 0 to 1 percent slopes, but more care is needed in irrigating, to avoid causing erosion. Yields of native grasses are fair, but they can be increased by seeding improved pasture mixtures and by rotation grazing. *Capability unit IIIw-2. irrigated.*

Bowman silt loam, moderately deep, 0 to 1 percent slopes (BnA).-This soil is more shallow than the typical Bowman soil. It ranges from 20 to 36 inches in depth to the underlying gravel or sand. Most of it is level, but some small inclusions have very gentle slopes. There are a few small alkali or saline-alkali spots. The depth to the water table is between 20 and 60 inches. The available water holding capacity is moderate.

This soil is used and managed in the same way as Bowman silt loam, 0 to 1 percent slopes, but yields may be slightly lower, especially yields of deep-rooted crops. Cuts made in land leveling should be more shallow than those on the typical Bowman soil. *Capability unit IIIw2, irrigated.*

Bramwell Series

The Bramwell series consists of light colored or very light colored, alkali and saline-alkali soils that formed from more or less laminated, very deep silty sediments. The surface layer is principally silt loam, but it is loam in some areas that have received wash from higher lying slopes. The subsoil ranges from silt loam to light silty clay loam. It is underlain by silty lake-laid sediments that have one or more dense, very slowly permeable, laminated layers. In places the lacustrine sediments are mixed with or include strata of alluvium, and in many places gravel occurs below a depth of 10 feet or more. The entire profile is calcareous, and the lower part of the subsoil has a light to moderate accumulation of calcium carbonate. The surface layer and subsoil commonly are strongly or very strongly alkaline, and a salt crust occurs in places. The parent material is dominantly laminated, silty lacustrine deposits, but some layers may have been laid down by streams. Possibly the upper part received some wind-laid silt.

These soils occupy an extensive area on a low terrace along the south side of the western part of the Emmett Valley. The elevation is 2,250 to 2,300 feet. The annual precipitation is 9 to 11 inches. The slopes are less than 3 percent, except at the edge of the terrace, where they are as much as 7 percent. There are no stones or gravel in the soil material. The vegetation consists of greasewood, saltgrass, giant wildrye, bunchgrasses, and forbs.

Erosion is slight on these soils, the organic-matter con tent is low, the available moisture holding capacity is high, and permeability is slow in the subsoil. Subterranean water and irrigation water applied to pervious soils on the slopes above the terrace have caused these soils to be imperfectly drained. The saline-alkali condition is strongest in a strip that extends through the middle of the terrace.

The less alkaline soils produce moderate yields of alfalfa, corn, small grain, and pasture. The more alkaline soils are mainly under a cover of greasewood and saltgrass pasture.

Representative profile of Bramwell silt loam, strongly saline-alkali, 0 to 1 percent slopes, 500 feet east and 100 feet south of the northwest corner of the NE1/4SW1/4sec. 2, T. 6 N., R. 3 W., in a greasewood-saltgrass pasture.

Ap-o to 10 inches, dark-gray (10YR 4/1) silt loam: light gray (10YR 6/1) when dry; moderate, thin, platy structure; friable when moist, slightly hard when dry; many very fine and fine pores; slightly to moderately calcareous; strongly to very strongly alkaline (pH 8.8 to 9.3).

C1ca-10 to 19 inches, dark grayish-brown (10YR 4/2) silt loam or light silty clay loam ; light brownish gray (10YR 6/2) -when dry; very weak, coarse, prismatic structure and weak or moderate, fine, angular blocky structure ; firm when moist, bard when dry ; few roots ; common very fine pores ; some darker colored, thin organic coatings on peds; moderately calcareous; very strongly alkaline (pH 9.3).

C2ca-19 to 29 inches, dark grayish-brown (10YR 4/2) silt loam or light silty clay loam; light gray (2.5Y 7/2) when dry; common dark-brown staining on peds when moist, pale brown when dry ; weak, medium, laminated structure or weak, fine, subangular blocky structure; firm when moist, very hard when dry; few roots; common very fine pores ; moderately calcareous with common splotches of calcium carbonate ; very strongly alkaline (pH 9.1).

C3ca-29 to 39 inches, light olive-brown (2.5Y 5/3) silt loam or light silty clay loam: common brown staining when moist, light gray (2.5Y 7/2) when dry; weak, medium. platy structure breaking into moderate. very fine. angular blocky fragments : firm when moist, very hard when dry ; very few roots ; few very fine pores strongly calcareous; strongly alkaline (pH 8.7).

C4-39 to 49 inches, grayish-brown (2.5Y 5/2) silt loam; light gray (2.5Y 7/2) when dry; moderate, thin. platy structure breaking into moderate. very fine. angular blocky fragments ; firm when moist, hard when dry ; very few roots; few very fine pores; few 1/8-inch brown mottles: moderately calcareous ; moderately alkaline (pH 8.4).

C5-49 to 60 inches, grayish-brown (2.5Y 5/2) silt loam; light gray (2.5Y 7/2) when dry; strong, medium, platy structure ; very firm when moist, very hard when dry ; very few roots; few very fine pores ; few 1/8-inch brown mottles ; moderately calcareous ; moderately alkaline (pH 8.4).

C6-60 inches +; grayish-brown (2.5Y 5/2) silt loam; light gray (2.5Y 7/2) when dry; massive; firm when moist, hard when dry ; very few roots ; few very fine pores ; few 1/8-inch brown mottles ; moderately calcareous ; moderately alkaline (pH 8.4).

The color of the moist surface layer ranges from dark grayish brown (10YR 4/2 or 2.5Y 4/2) to dark gray (2.5Y 4/1) or grayish brown (10YR 5/2). The subsoil ranges from silt loam to silty clay loam in texture and from weak to moderate blocky in structure. The depth to the first platy layer ranges from 25 to 40 inches.

Bramwell silt loam, 0 to 1 percent slopes (BoA).This soil generally is less strongly saline-alkali than the typical soil. Salute-alkali spots, On which plant growth is poor, make up about 5 to 15 percent of the areas mapped. The water table commonly is at a depth of 3 to 5 feet and generally does not seriously affect the growth of any except deep-rooted crops.

Near the southern edge of its range. this soil has received some overwash from adjoining slopes. In these areas there are fewer alkali spots, and in places the surface layer is loam. In some places the depth to the water table is more than 5 feet. Included in the areas mapped were a few small areas of soils that have a higher water table. In these areas the depth to the water table is less than 3 feet for considerable periods because of runoff from excessive irrigation of higher lying soils.

Pasture, hay, small grain, and corn grow fairly well, except on the alkali spots. These spats can be improved by adding manure, crop residues, and soil amendments. Grasses and legumes should be grown at least 60 percent of the time in the crop rotation to build up and maintain the organic-matter content and to preserve soil structure. Crops respond to nitrogen and phosphate. Irrigation can be by the border, corrugation, or furrow method. The amount of water and the rate of application should be regulated to prevent waterlogging. Areas that have a high water table need to be drained. Runoff caused by excessive use of irrigation water should be eliminated. *Capability unit IIIw-6, irrigated.*

Bramwell silt loam, 1 to 3 percent slopes (BoB). This soil is not so severely affected by salinity and alkalinity as the typical soil. Alkali spots, on which plant growth is poor, occupy about 5 to 15 percent of the areas mapped. The water table normally is at a depth of 3 to 6 feet and generally does not seriously affect the growth of any except deep-rooted crops.

Near the southern edge of its range, some of this soil has received overwash from adjoining slopes and in places has a surface layer of loam.

This soil is used and managed in much the same way as Bramwell silt loam, 0 to 1 percent slopes, but sonic adjustments are needed in irrigating to avoid causing erosion. *Capability unit IIIw-6, irrigated.*

Bramwell silt loam, strongly saline-alkali, 0 to 1 percent slopes (BpA).-A profile of this soil is the one described as typical of the series. About 30 to 50 percent of this soil is so severely affected by salt and alkali that it produces few or no crops. The depth to the water table generally is between 3 and 5 feet.

Alkali-tolerant crops, such as tall wheatgrass and alta fescue, can be grown. Alfalfa can also be grown but commonly produces only fair to poor yields. The primary management problems are to increase the water intake rate and to remove excess salts and exchangeable sodium. Crop residues, green manure, manure, and soil amendments, such as gypsum or sulfur, are helpful. Because of the slowly permeable subsoil, irrigation water must be carefully applied, or the uppermost part of the soil will become waterlogged. This soil puddles if it is tilled when too wet. *Capability unit IVw-3, irrigated.*

Bramwell silt loam, strongly saline-alkali, 1 to 3 percent slopes (BpB).-Except for slope, this soil is similar to the one described as typical of thee series. About 30 to 50 percent is so severely affected by salts and alkali that it produces few or no crops. The depth to the water table commonly is between 3 and 6 feet.

This soil is used and managed in much the same way as Bramwell silt loam, strongly saline-alkali, 0 to 1 percent slopes, but some adjustments are needed in irrigating to avoid causing erosion. *Capability unit IVw-3, irrigated.*

Brownlee Series

The Brownlee series consists of dark colored to very dark colored, well-drained soils that formed in residuum weathered from granite, quartz monzonite, or other coarse-grained acid igneous rocks. The surface layer is loam or coarse sandy loams that is high in quartz sand, contains some mica, and is moderately high in content of organic matter. The subsoil is clay foam or sandy clay loam that is also high in quartz sand and contains some mica. Decomposing granite or similar rock occurs at a depth of 30 to 55 inches. The entire profile is slightly acid or medium acid.

These soils are extensive in the granitic area north of Sweet near the east county line, and on north-facing slopes in the vicinity of Crown Point. South of Montour. They are in the Brownlee-Rainey-Ola soil association. Near Kennedy and Timber Flat Creeks, the surface layer and subsoil are brighter colored and redder than in the Brownlee soils near the east county line.

These soils are undulating to steep. They have slopes of 3 to 45 percent and occur at elevations of 3,000 to 5,000 feet. The annual precipitation ranges from 15 to 23 inches. The areas of lower precipitation are on northerly slopes. The native vegetation consisted of bluebunch wheatgrass, Idaho fescue, and herbaceous plants.

Some fine gravel occurs in the soil material, but there are few cobblestones or loose stones, except on the northerly slopes near Crown Point. Outcrops of rock occur where the soils are associated with the Rainey soils. Erosion is moderate to slight; the available moisture holding capacity is moderate; permeability is moderately slow or moderate in the subsoil.

Some of the acreage is used for dry-farmed crops, and the rest is used for pasture and range.

Representative profile of Brownlee coarse sandy loam, 900 feet north and 945 feet east of the southwest corner of the NW1/4 SW1/4 sec. 12, T. 8 N., R. 1 E.

A1-0 to 9 inches, very dark brown (10YR 2/2) coarse sandy loam; dark grayish brown (10YR 4/2) when dry; very weak, very thin. platy structure or weak or moderate, fine and very fine, granular structure friable when moist, hard when dry; slightly acid (pH 6.2).

A3-9 to 12 inches, coarse sandy loam, slightly lighter colored than Al horizon ; weak, fine, granular structure ; friable when moist, hard when dry; medium acid (pH 6.0).

B1t-12 to 20 inches, *very* dark grayish-brown (10YR 3/2) coarse sandy loam; dark grayish brown (10YR 4/2) when dry; weak, coarse, prismatic structure and weak, medium, subangular blocky structure; thin, patchy, slightly darker colored clay films on ped surfaces ; firm when moist, very hard when dry ; medium acid (pH 6.0) ; lower part contains a very thin horizontal band of redder and more clayey material.

B2t-20 to 42 inches, dark-brown (7.5YR 3/2) coarse sandy clay loam; dark brown (7.5YR 4/2) when dry; weak, coarse, prismatic structure and weak or moderate, medium, suhangular blocky structure ; thick, continuous clay films on ped surfaces; firm when moist; very hard when dry; medium acid (pH 5.9) ; two very thin horizontal bands of reddish-brown and more clayey material.

B3t-42 to 45 inches, dark-brown (10YR 3/3) fine gravely coarse sandy loam ; dark brown (10Y R 4/3) when dry ; very weak, coarse, prismatic structure ; firm when moist, very hard when dry ; slightly acid (pH 6.1).

C/R-45 inches +, decomposed granitic material, grading into granite bedrock.

In places the surface layer is loam, sandy loam, or gravelly loam. Some areas are stony. In some places outcrops of rock are common: in other places there are none. The surface layer ranges from 10YR to 7.5YR in hue; from 2 to 3 in chroma; and from 2 to 3 in value, when moist, and from 4 to 5 in value, when dry. The B2t horizon ranges from clay loam to sandy clay loam or loam that is nearly clay loam. It has hues of 10YR to 7.5YR and chromas of 3 to 4. Very thin, continuous, horizontal bands of redder and finer textured material are common. The combined thickness of the surface layer and subsoil commonly is 30 to 50 inches. Bedrock is more or less weathered and disintegrated to a depth of several feet.

Brownlee coarse sandy loam, 12 to 30 percent slopes (BrE).-A profile of this soil is similar to the one described as typical of the series. This soil is mostly in the vicinity of Crown Point and south of Pearl, where the precipitation generally is slightly less than normal for the Brownlee soils. Surface runoff is medium. In many places erosion is moderate ; in other places it is slight.

A small acreage is used for dry-farmed crops; the rest is used for pasture and range. The plant cover generally is in poor to fair condition. It can be improved by reseeding with suitable grasses. A suitable mixture is Ladak alfalfa seeded with Siberian wheatgrass, crested wheatgrass, or pubescent wheatgrass. Once established, a good stand can be maintained by careful management. Enough growth needs to be left after grazing to control erosion and to ensure regrowth. Grasses should be allowed to reseed periodically. This soil is easily tilled for reseeding.

Capability unit IVe-4, dryland. Granitic-Prairie range site.

Brownlee loam, 3 to 7 percent slopes (BsC).-This soil is slightly browner or redder than the typical Brownlee soil, and it has a more loamy surface layer and subsoil. The surface layer ranges from very dark brown to very dark grayish brown when moist and from dark grayish brown to brown when dry. The subsoil is reddish brown in places. The surface layer is mostly loam, but in places it is a fine gravelly loam. The subsoil is sandy clay loam or clay loam.

This soil occurs mainly on undulating or gently sloping ridgetops near the headwaters of Kennedy and Timber Flat Creeks, northeast of Ola. It is near the lower, drier edge of the ponderosa pine forest, and the annual precipitation ranges from 20 to 23 inches. Surface runoff is slow. In most places erosion is slight, but there are some scattered gullies.

This soil is used for dry-farmed crops, pasture, and range. The principal crops are small grain, alfalfa for hay, alfalfa for seed, grass for seed, and pasture. A rotation in which. a grass-legume mixture is grown at least 60 percent of the time is needed to maintain or improve the organic-matter content and to preserve soil structure. The rotation can be extended by adding a green-manure crop of Austrian peas and another grain crop. Plowing under the last hay crop for green manure enriches the soil and helps to maintain soil structure and to control erosion. The utilization of manure and stubble with applications of nitrogen helps to maintain productivity. Phosphate is needed if legumes are grown.

The pasture and range are in poor to fair condition. Annual weeds make up a large percentage of the plant cover. Yields of usable forage are low but can be increased by summer fallowing, preparing good seedbeds, and reseeding with suitable forage plants. Ladak alfalfa seeded with Siberian wheatgrass, intermediate wheatgrass, or beardless wheatgrass is suitable. Once established, a good stand can be maintained by good management practices. *Capability units IIIe-1, irrigated; IIe-4, dryland. Granitic-Prairie range site.*

Brownlee loam, 7 to 12 percent slopes (BsD).-A profile of this soil is like the one described as typical of the series, except that in most places the surface layer is loam, and in some places it is fine gravelly loam. The subsoil is sandy clay loam or clay loam. Surface runoff is slow to medium. Erosion generally is slight, but in some spots it is moderate. There are some scattered shallow gullies, and in places there are some stones and cobblestones.

Much of this soil, especially that near the headwaters of Kennedy and Timber Flat Creeks, is associated with Brownlee loam, 3 to 7 percent slopes. This soil is slightly browner or redder than the typical Brownlee soil.

This soil is used for dry-farmed crops, pasture, and range. The principal crops are alfalfa, small grain, grass for seed, alfalfa for seed, and pasture. A rotation that consists of a grass-legume mixture at least 75 percent of the time and not more than 2 successive years in grain helps to maintain the organic-matter content and to preserve soil structure. Plowing under the last hay crop as green manure enriches the soil and helps to control erosion. Cross-slope tillage and the use of manure, been-manure crops, and crop residues help to maintain long-time productivity. -Nitrogen helps to decompose crop residues and may also be needed on the second crop of small grain. Phosphate benefits legumes.

The pasture and range generally are in poor to fair condition. Management needs are similar to those of Brownlee loam, 12 to 30 percent slopes. *Capability unit IIIe-5, dryland. Granitic-Prairie range site.*

Brownlee loam, 12 to 30 percent slopes (BsE).-A profile of this soil is similar to the one described as typical of the series, except that the surface layer is dominantly loam and the subsoil is clay loam or sandy clay loam. In places the surface layer is fine gravelly loam. A few stones or

cobblestones are scattered on the surface, and in places there are outcrops of rock. Much of this soil occurs near the headwaters of Kennedy and Timber Flat Creeks. Here, the soil is slightly browner than the typical soil.

About half of the acreage is moderately eroded. In these areas from 2 to 5 inches of the original surface layer has been removed, mainly by sheet erosion. The rest of the acreage is slightly eroded. Scattered gullies occur in places. In a. few areas there are enough stones to prevent tillage. These areas are indicated on the soil map by stone symbols.

This soil is used for dry-fanned crops, pasture, and range. Annual weeds have invaded much of the pasture and range, and forage yields are low. If these areas are reseeded with desirable grasses, moderate yields can be expected. A suitable mixture consists of Ladak alfalfa seeded with a grass, such as intermediate wheatgrass, Whitmar beardless wheatgrass, thickspike wheatgrass, smooth broomgrass, pubescent wheatgrass, or slender wheatgrass. Once a good stand is established, it can be maintained by management of grazing. The grasses should be allowed to reseed periodically, and enough growth needs to be left after grazing to control erosion and to ensure regrowth. *Capability unit IVe-4, dryland. Granitic-Prairie range site.*

Brownlee and Ola rocky soils, 30 to 60 percent slopes (BtF).-Brownlee rocky coarse sandy loam makes up from 45 to 65 percent of the delineated areas ; Ola rocky loam makes up from 20 to 40 percent; and outcrops of rock or very shallow soils make up from 2 to 10 percent. Rainey soils and other soils are included in the areas mapped, and these make up as much as 15 percent of the acreage.

The Brownlee soil is similar to the soil described as typical of the Brownlee series, except that in places the surface layer is loam or fine gravelly loam, and in many places the subsoil has slightly less clay. The Ola soil is similar to the soil described as typical of the Ola series, except that in places the surface layer is sandy loam or coarse sandy loans. Outcrops of rock are from 100 to 400 feet apart and generally occupy only a. fraction of an acre. In some places, there are many stones and cobblestones on the surface and throughout the profile, and in other places there are only a. few.

These soils occur mainly on steep northerly slopes in the vicinity of Crown Point, south of Montour. They generally receive less moisture than is normal for the series. Surface runoff is rapid. Most of the acreage is slightly eroded, but a few spots are moderately eroded, and there are some scattered, shallow gullies.

All of the acreage is used for pasture and range. In most places the plant cover is in fair to good condition. A considerable amount of plant growth should be left after grazing to protect the soils from erosion. Deferred gazing allows perennial grasses to reseed and helps to maintain or improve yields. Reseeding is difficult. *Capability unit VIe-2, dryland. Granitic north, slope-Prairie range site.*

Brownlee and Rainey soils, 7 to 12 percent slopes (BuD).-These soils occupy only a small total acreage. From 50 to 70 percent of the delineated areas is Brownlee coarse sandy loam, and from 25 to 45 percent is Rainey coarse sandy loam. Small areas of Brownlee loam and some Brownlee soils that have a slope of as little as 5 percent were included in the areas mapped. Some Ola soils and other soils were also included, and these make up as much as 15 percent of the mapping units.

In most places erosion is slight. A few spots are moderately eroded, and there are some scattered shallow gullies. A few stones occur on the surface and throughout the profile.

These soils are used for pasture and range, but they are also suitable for dry-farmed small grain and hay crops. Because of the hazard of erosion, however, small grain should be grown for only 1 year in a rotation. Manure, green-manure crops, crop residues, and commercial fertilizers are needed to maintain productivity.

The plant cover generally is in poor condition and needs to be reseeded. Management needs are about the same as those of Brownlee coarse sandy loam, 12 to 20 percent slopes. *Capability unit IVe-4, dryland. The Brownlee soil is in the Granitic-Prairie range site; the Rainey soil is in the Granitic,-Chestnut range site.*

Brownlee and Rainey soils, 12 to 30 percent slopes (BuE).-Brownlee loam and Brownlee coarse sandy loam make up from 50 to 70 percent of the delineated areas, and Rainey coarse sandy loam makes up from 25 to 45 percent. Small areas of Ola soils and other soils make up as much as 15 percent of the areas mapped.

Near the headwaters of Kennedy and Timber Flat Creeks, the Brownlee soil is slightly browner or redder than the typical soil. In places a few stones are scattered on the surface and throughout the profile, and there are some scattered outcrops of rock.

Surface runoff is medium on these soils. Slightly more than half of the acreage is moderately eroded. In these areas from 2 to 5 inches of the original surface layer has been removed, mainly by sheet erosion. The rest of the acreage is slightly eroded. Shallow gullies occur in places. The Brownlee soil is moderate in available water holding capacity, and the Rainey soil is very low.

These soils can be used and managed in the same way as Brownlee loam, 12 to 30 percent slopes, but yields will be somewhat less because of the Rainey soil. The Rainey soil should be seeded with drought-resistant grasses, such as Siberian wheatgrass, crested wheatgrass, or pubescent wheatgrass. *Capability unit IVe-4, dryland. The Brownlee soil is in the Granitic-Prairie range site; the Rainey soil is in the Granitic-Chestnut range site.*

Brownlee and Rainey rocky soils, 12 to 30 percent slopes (BvE). This mapping unit consists of Brownlee and Rainey coarse sandy foams and unnamed very shallow soils, which are only about 5 inches thick. The Brownlee soil makes up about 30 to 55 percent of the delineated areas the Rainey soil, about 25 to 45 percent; and the unnamed soils and outcrops of rock, about 5 to 30 percent. Many of the rock outcrops are large. They generally are surrounded by the very shallow soils and by the Rainey soil. In some places there are many loose stones on the surface and throughout the profile; in other places there are few. Some Brownlee soils northeast of Ola are browner or redder than the typical soil. Small spots of Ola soils were included in the areas mapped.

These soils have medium to rapid surface runoff. Slightly more than half of the acreage is moderately eroded. In these areas, from 2 to 5 inches of the original surface layer has been removed, mainly by sheet erosion.

The rest of the acreage is slightly eroded. Gullies occur in places.

The available water holding capacity is moderate in the Brownlee soil and very low in the Rainey soil. The outcrops of rock, the loose stones, and the moderately steep slopes make the use of heavy machinery difficult but not impossible.

These soils can be used and managed in the same way as Brownlee loam, 12 to 30 percent slopes, but yields are somewhat less because of the Rainey soil and the outcrops of rock. The Rainey soil is better, suited to the more drought-resistant grasses, such as Siberian wheatgrass, crested wheatgrass, or pubescent wheatgrass. *The Brownlee soil is in capability unit IVe-4, dryland; Granitic-Prairie range site. The Rainey soil is in capability unit VIe-2, dryland; Granitic-Chestnut range site.*

Cashmere Series

In this series are well-drained, very deep soils on alluvial fans. The surface laves is dark colored. The underlying layers are slightly lighter colored and browner than the surface layer. The parent material is stratified local alluvium and colluvium that washed from areas of Idaho and Payette formations. These formations consist of sediments derived mostly front coarse-grained acid igneous rocks. In a few places the soils are gravelly.

These soils are in the Harpt-Cashmere, soil association. They occupy the upper part of sloping alluvial and colluvial fans that were formed by the many small streams flowing from the adjacent sandy, hilly uplands (see figs. 2 and 3). They have slopes of 1 to 30 percent and are mostly planes that have a gradient in only one direction. They are extensive along the eastern and southern parts of the Emmett Valley, but smaller areas also occur in the Montour Valley. The elevation ranges from 2,300 to 2,800 feet. The annual precipitation ranges from 9 to 13 inches and is supplemented by runoff water. Erosion is negligible to moderate, but in some places streams have cut gullies that are several feet deep. The native vegetation consisted of needlegrass, Indian ricegrass, and other bunchgrasses, and some big sagebrush, bitterbrush, and forbs.

The available water holding capacity is moderate, permeability is moderately rapid, and fertility is moderate.

These soils are used mostly for orchards, but some strawberries, pasture crops, and small grain are grown. Areas that do not have irrigation water are used for grazing.

Representative profile of Cashmere coarse sandy loam, 12 to 30 percent slopes, 400 feet west and 1,250 feet north of the center of sec. 10, T. 6 N., R. 1 W., in a sagebrush area.

A11-0 to 3 inches. very dark grayish-brown (10 YR 3/2) coarse sandy loam; grayish brown (10YR 5/2) when dry ; weak, medium, platy structure or weak, fine, granular structure ; very friable when moist, slightly hard when dry ; neutral (pH 6.7).

A12-3 to 10 inches, very dark grayish-brown (10YR 3/2) coarse sandy loam; grayish brown (10YR 5/2) when dry; weak, fine, granular structure; very friable when moist, slightly hard when dry; neutral (pH 6.7).

C1-10 to 25 inches, very dark grayish-brown (10YR 3/2) coarse sandy loam; grayish brown (10YR 5/2) when dry ; very weak, fine, subangular blocky structure or massive ; very friable when moist, slightly hard when dry; neutral (pH 6.7).

C2-25 to 49 inches, very dark grayish-brown (10YR 3/2) coarse sandy loam; grayish brown (10YR 5/2) when dry; very weak, very fine, subangular blocky structure or massive ; very friable when moist, slightly hard when dry ; neutral (pH 6.7).

C3-49 to 60 inches, grayish-brown (10YR 4/2) coarse sandy loam; light brownish gray (10YR 6/2) when dry; massive; very friable when moist, slightly hard when dry; neutral (pH 6.9).

The surface layer ranges from very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) in color, when moist, and from neutral to medium acid in reaction. Strata of coarse sand to coarse sandy clay loam occur in the profile. In places the subsoil or lower lying strata are gravelly or cobbly. The subsoil has weak structure, or it is massive. Inclusions of Harpt soils make up as much as 5 percent of the areas mapped, and Wasatch soils make up as much a s 2 percent.

Cashmere coarse sandy loam, 1 to 3 percent slopes (CaB).-This soil is similar to the soil described as typical of the series, except that it is only slightly susceptible to erosion.

Most of this soil is used for irrigated orchard crops. Nitrogen and phosphate are needed for the best yields. Some of this soil is used for hay, pasture, small grain, and row crops. A crop rotation that consists of a grass-legume crop at least 50 percent of the time and a row crop not more than 2 years in succession is desirable to preserve soil structure and to maintain organic-matter content. The sprinkler method of irrigation is best for orchards. The border method is preferable for other crops and pastures, but corrugations and furrows can also be used. Overirrigation results in deep percolation and removal of plant nutrients. *Capability units IIe-3, irrigated; VIs-2, dryland. Granitic-Brown range site.*

Cashmere coarse sandy loam, 3 to 7 percent slopes (CaC).-This soil is similar to Cashmere coarse sandy loam, 12 to 30 percent slopes. The hazard of erosion is slight.

This soil can be used and managed in nearly the same way as Cashmere coarse sandy loam, 1 to 3 percent slopes. Because of the steeper slopes, however, it needs to be kept in a grass-legume crop at least 60 percent of the time, to maintain the content of organic matter and to control erosion. The sprinkler method of irrigation is preferable. Corrugations or furrows can be used if the. length of the run and the size of the irrigation stream are limited.

In some areas, irrigation water is not available. These areas are used for pasture and range. On most of these sites, the vegetation consists mainly of cheatgrass and annual weeds. If these sites are reseeded and well managed, they will produce good forage yields. A suitable mixture is crested wheatgrass and Ladak alfalfa. *Capability units IIIe-3. irrigated; VIs-2, dryland. Granitic-Brown range site.*

Cashmere coarse sandy loam, 7 to 12 percent slopes (CaD).-A profile of this soil is similar to the one described as typical of the series. This soil is moderately susceptible to erosion. In most places, it has lost from 10 to 50 percent of its original surface layer through erosion.

Most of this soil is used for orchards. A permanent grass-legume cover is needed in orchards to maintain the content of organic matter and to control erosion. Phosphate and nitrogen are needed for good yields. If rotation crops are grown, a grass-legume mixture should be grown at least 75 percent of the time. More than one annual crop in the rotation will cause the soil to deteriorate

and erode. Sprinkler irrigation is best, but corrugations can be used if the irrigation runs are short and the streams are small. Overirrigation is likely to cause erosion, leaching of plant nutrients; and waterlogging of lower lying soils.

Where irrigation water is not available, this soil is used for pasture and range. The plant cover is in poor condition. Management needs are similar to those of Cashmere coarse sandy loam, 3 to 7 percent slopes. *Capability units IVe-2, irrigated; VIs-2, dryland. Granitic-Brown range site.*

Cashmere coarse sandy loam, 12 to 30 percent slopes (CaE).-A profile of this soil is the one described as typical of the series. This soil has lost from 10 to 75 percent of its original surface layer through erosion, and gullies occur in places.

This soil needs a permanent cover to control erosion. If irrigated, it can be used for orchards, cover crops, hay, or pasture. Nitrogen and phosphate are needed for good yields. Sprinkler irrigation is best. Overirrigation causes erosion, leaching of plant nutrients, and waterlogging of lower lying soils.

In some areas irrigation water is not available, and the soils are used for pasture or range. Management needs are similar to those of Cashmere coarse sandy loam, 3 to 7 percent slopes. *Capability units VIe-1, irrigated; VIe-2, dryland. Granitic-Brown range site.*

Catherine Series

In this series are very dark colored, noncalcareous, poorly drained soils on bottom lands in Squaw Creek Valley. These soils are deep or moderately deep to loose gravel or sand. The surface layer is high in content of organic matter. The subsoil is stratified and ranges from loam to light silty clay loam. The underlying material is sandy or gravelly alluvium washed from soils that developed in material weathered from basaltic and acid igneous rocks.

These soils have slopes of less than 1 percent. They occur at elevations of 2,500 to 3.500 feet. The annual precipitation ranges from 13 to 20 inches. The vegetation consists of grasses, sedges, and reeds.

The available water holding capacity is low to high, and permeability is moderate in the subsoil. Some of the acreage is used for pasture, but many areas have been drained and are used for irrigated crops and improved pasture.

Representative profile of Catherine loam, 200 feet north and 20 feet east of the southeast corner of the NE1/4NW1/4 of sec. 35, T. 10 N., R.1 E., in an improved pasture.

Ap-0 to 9 inches, black (10YR 2/1) or very dark brown (10YR 2/2) loam; dark grayish brown (10YR 4/2) when dry: few, faint. dark-brown (7.5YR 3/2) mottles: yellowish brown (10YR 5/5) when dry; weak, medium and fine, granular structure ; friable when moist, slightly hard when dry ; roots plentiful ; neutral (pH 6.9).

A11-9 to 16 inches, very dark grayish-brown (10YR 3/2) loam ; dark grayish brown (10YR 4/2) when dry; common, fine, faint, dark-brown (7.5YR 3/3) mottles; weak, medium and fine, granular structure ; friable when moist, slightly bard when dry ; roots plentiful ; neutral (pH 7.0)

A12g-16 to 22 inches, very dark gray (10YR 3/1) silt loam: dark gray (10YR 4/1) when dry; few, fine, distinct, dark-brown (7.5YR 3/3) mottles; moderate, coarse, granular structure; friable when moist, slightly hard when dry; many worm casts ; roots plentiful ; neutral (pH7.0).

A13g-22 to 28 inches, very dark brown (10YR 2/2) silt loam ; _gray (10YR 5/1_ when dry; few, medium, faint, very dark brown (10YR 2/3) mottles ; weak, fine, granular structure ; friable when moist, slightly hard when dry ; few roots ; neutral (pH 7.0).

IIC1g-28 to 39 inches. very dark grayish-brown (2.5Y 3/) sandy loam; gray (10YR 5/1) when dry; few, medium, faint, dark-brown (7.5YR 3/3) and dark-gray (2.5YR 4/1) mottles; massive; very friable when moist, soft when dry ; few roots ; neutral (pH 7.0).

IIIC2g- 39 to 56 inches, very dark gray (2.5YR 3/1) loamy sand ; gray (2.5Y 5/1) when dry ; many, medium, distinct, dark reddish-brown (5YR 3/4), black (N 2/0), and dark-brown (7.5YR 3/3) mottles ; massive ; very friable when moist, soft when dry; neutral (pH 7.2).

IVC3-56 to 65 inches, dark-gray (2.5YR 4/1) gravelly sand containing much quartz; light gray (2.5Y 6/1) when dry; single grained; mildly alkaline (pH 7.4).

The surface layer is loam or silt loam in texture. and, when moist, ranges from black (2.5Y 2/1) to very dark brown (10YR 2/2) in color. Strata of loam, silt. loam, and light silty clay loam are in the subsoil. Distinct dark-brown or reddish-brown mottles are below a depth of 12 to 24 inches. In places some faint mottles are near the surface. Hues of 2.5Y are most common in the subsoil, but hues of 5Y and 10YR also occur. The water table fluctuates; most of the year it is at a depth between 18 and 48 inches, and it is highest in spring. Inclusions of Goose Creek, Black Canyon, and Moulton soils make up as much as 5 percent of the areas mapped.

Catherine loam (Ch).-A profile of this soil is the one described as typical of the series. This soil occurs in swales and depressions and on the more poorly drained parts of level bottom lands along Squaw Creek. host areas have been partially drained shallow ditches and by the deepening of stream channels. The water table is at a depth of 2.5 to 4 feet for several months during the latter half of the year, but it rises to within 1.5 feet of the surface for appreciable periods. Most areas are overflowed in spring. Some areas are eroded during these floods, and other areas receive deposits of new material. The depth to loose gravel, gravel and sand, or sand is more than 3 feet.

This soil is used for pasture crops, small grain, grasses and legumes for hay, and some row crops. A deep-rooted crop, such as alfalfa, dies out sooner on this soil than on a well-drained soil because of the high water table. Much of this soil is subirrigated. In places corrugation irrigation is used to supplement the subwater. This soil needs a good plant cover in spring when overflows may occur. A rotation that includes a grass-legume mixture helps to maintain the organic-matter content, to preserve soil structure, and to control erosion during floods. Nitrogen and phosphate are needed for best crop yields. Utilization of manure and of crop residues helps to supply organic matter and to maintain productivity.

In places streambanks need to be stabilized with vegetative growth or bank revetments to prevent bank damage. Dikes are needed in some areas to prevent flooding and cutting of adjacent soils.

Irrigation may be by the border, corrugation, furrow, or sprinkler method. The length of the run and size of the irrigation stream need to be adjusted so that irrigation will not cause erosion or waterlogging. Deep-rooted

crops do not require much irrigation after they are well established, but some drainage may be necessary. *Capability units IIIw-2, irrigated; IVw-4, dryland.*

Catherine loam, moderately deep (Cm).-This soil is like Catherine loam, except that the depth to stratified loose sand and gravel is between 20 and 36 inches and the depth to the water table is mostly between 20 and 50 inches during a large part of the year. In some areas, the water table is within 20 inches of the surface for considerable periods. Most areas are subject to overflow during runoff in spring.

Much of the acreage is too wet. for cultivated crops and is used for pasture and hay crops. Forage yields generally are fair, but many areas are too wet for the `best forage yields. More crops could be grown if the soil were drained, but drainage is difficult because of the lack of suitable outlets. Diversions to keep out excess runoff water are helpful. Reed canarygrass, alsike clover, and meadow foxtail are suitable pasture and hay crops.

Capability units IIIw-2, irrigated; IVw-4, dryland.

Chance Series

This series consists of noncalcareous, poorly drained and very poorly drained soils that occupy swales and low places on flood plains along and in the vicinity of the Payette River. The surface layer is mostly fine sandy loam, but it ranges from loam to loamy coarse sand, and in places it is gravelly. The subsoil is dominantly moderately coarse textured. The surface layer and subsoil are grayish and mottled. The subsoil is underlain by gravel or sand at a depth of 20 to 55 inches. The parent material is alluvium that washed from areas of acid igneous rocks or from areas of the Idaho and Payette formations.

Under natural conditions, the water table is within 10 inches of the surface, but in some areas drainage ditches have lowered the water table to as much as 30 inches below the surface. The annual precipitation ranges from 9 to 13 inches. The elevation is between 2,200 and 2,500 feet. The slopes are less than 2 percent. The vegetation consists of cattails, rushes, sedges, and giant wildrye.

These soils are used for pasture and range and for wildlife food and cover. Drainage is the only reclamation needed. However, these soils are on nearly the same level as the river, and, consequently, drainage is difficult because of the lack of suitable outlets.

Representative profile of Chance fine sandy loam, taken at a point 250 feet south and 150 feet east of the northwest corner of the SW1/4 sec. 5, T. 6 N., R.. 1 W., in a noncultivated area.

A1g-0 to 6 inches. very dark gray (2.5Y 3/1) fine sandy loam; gray (2.5Y 5/1) when dry; many, fine and medium, distinct, dark-olive (5Y 3/3) mottles; olive (5Y 5/3) when dry; weak. fine, granular structure: friable when moist, slightly hard when dry ; abundant roots ; neutral (pH 6.8).

C1g-6 to 26 inches, dark-gray (2.5Y 4/1) fine sandy loam: gray (2.5Y 5/1) when dry: common, fine and medium, prominent, dark-brown (7.5YR, 3/3) mottles: brown (7.5YR 5/3) when dry; massive; friable when moist and slightly hard when dry; plentiful fine roots ; many very fine pores; neutral reaction (pH 6.9).

IIC2g-26 to 35 inches, dark-gray (N 4/0) loamy fine sand; light gray (N 6/0) when dry: common, fine. distinct, dark-brown (10YR 4/3) mottles; single grained; loose when dry or when moist ; neutral reaction (pH 6.7).

IIIC-35 to 60 inches, stratified sand and gravel ; single grained; loose when dry or moist; neutral reaction.

The color of the moist surface layer ranges from very dark gray (2.5Y 3/1) to dark gray (10YR 4/1) ; the 2.5Y hue is dominant. The degree of mottling and staining varies considerably. The alluvial parent material is stratified. In places the profile contains layers that range from sand to loam in texture. In a few places an inch or more of peaty material is on the surface.

Chance fine sandy loam (Cn).-This soil occurs mostly in swales or depressions on flood plains, and it generally has slopes of less than 1 percent. In a few places it occupies oxbows and intermittent drainage channels, where the slope ranges from 1 to 2 percent. In most places, the surface layer is fine sandy loam or sandy loam, but in other places it is loam, loamy sand, gravelly sandy loam, or gravelly loam. Some of the higher spots are slightly saline. Small gravel bars, riverwash, or the imperfectly drained Moulton soils make up as much as 5 percent of the delineated areas.

This soil is too wet for cultivation. Without artificial drainage, it is suited only to permanent pasture. The principal plants are rushes, sedges, and orchardgrass. Yields can be increased by applying manure and nitrogen and by using good management practices. Reed canarygrass is well suited and can be established even if the soil is too wet for tillage. *Capability unit Vw-1, dryland.*

Chilcott Series

The Chilcott series consists of well-drained, fine textured and moderately fine textured soils that have an indurated or strongly cemented silica-calcium carbonate hardpan at a depth of 18 to 40 inches. The surface layer is mostly silt loam, but in places it is loam or sandy loam. The subsoil is clayey. These soils formed in a thin or very thin layer of wind-laid silt over unconsolidated or very poorly consolidated sediments of the Idaho, Payette, or upper Mesa formations. These underlying sediments are very coarse, coarse, or medium sands or loamy sands that are feldspathic, micaceous, high in quartz, and mainly noncalcareous.

These soils are extensive in the uplands in the vicinity of the Emmett Valley. They are in the Chilcott-Lanktree-Lolalita soil association. They occur at elevations of 2,800 to 3,200 feet and have from 9 to 11 inches of precipitation annually. The slope ranges from 0 to 15 percent but is generally between 2 and 1.0 percent. There are no large stones, but in places there are a few cobblestones or some gravel. Erosion has been slight to moderate. The native vegetation consisted mostly of bunchgrasses, big sagebrush, and herbaceous plants.

These soils have low to moderate available water holding capacity and a slowly permeable subsoil. They are well drained and free or nearly free of salts and alkali. The hardpan is impermeable except for cracks or other openings.

Most of the acreage is used for pasture and range. Medusahead wildrye, cheatgrass, and other annual weeds are the dominant vegetation. Some Chilcott soils are included in the Black Canyon irrigation project.

Representative profile of Chilcott silt loam, 300 feet east and 60 feet north of the center of the east half of sec. 7, T. 7 N., R. 2 W., on a range site.

A1-0 to 0.3 inch, very dark grayish-brown (10YR 3/2) silt loam: grayish brown (10YR 5/2) when dry; weak, very fine, granular structure ; friable ; slightly hard; slightly acid (pH 6.1).

A2-0.3 inch to 8 inches, dark grayish-brown (10YR 4/2) silt loam; light brownish gray (10YR 6/2) when dry; weak, very thin or thin, platy structure: friable; slightly hard ; many fine vesicular pores in upper part ; neutral (pH 6.9) ; abrupt, wavy boundary.

B21t-8 to 17 inches, dark-brown (10YR 4/3) heavy silty clay loam or silty clay; brown (10YR 5/3) when dry; moderate, medium, prismatic structure and strong, medium, angular blocky structure ; medium, continuous, slightly darker colored clay films on ped surfaces ; firm when moist, very hard when dry ; mildly alkaline (pH 7.6).

B22tca-17 to 24 inches, dark-brown (10YR 4/3) clay brown (10YR 5/3) when dry; weak, medium, prismatic structure and moderate, medium, angular blocky structure; few large calcium carbonate splotches on ped surfaces ; firm when moist, very hard when dry ; mildly alkaline (pH 7.8).

B3tca-24 to 28 inches, brown (10YR 5/3) heavy silt loam; pale brown (10YR 6/3) when dry ; weak, medium, subangular blocky structure; thin, patchy clay films in pores ; friable; slightly hard ; strongly calcareous with many splotches of calcium carbonate ; mildly alkaline (pH 7.5).

IIC1ca--28 to 30 inches, brown (10YR 5/3) light loam; pale brown (10YR 6/3) when dry ; moderate, fine, subangular blocky structure ; firm ; hard; much calcium carbonate ; mildly alkaline (pH 7.7).

IIC2cam-30 to 47 inches, yellowish-brown (10YR 5/4) hardpan strongly cemented with silica and calcium carbonate ; very pale brown (10YR 7/3) when dry ; indurated plates and less cemented material between them ; moderately alkaline (pH 8.1) ; top of hardpan glazed and pinkish.

IIIC3cam--47 to 53 inches, pale-brown (10YR 6/3), weakly cemented sand and gravel ; light gray when dry ; strongly calcareous; moderately alkaline (pH 8.0).

IIIC4-53 to 75 inches, sand and gravel ; coated with iron oxides; loose; slightly calcareous with lower side of pebbles coated with calcium carbonate.

In bare spots and between the sagebrush, the A1 horizon is commonly lacking; in cultivated areas, it is mixed with the A2 horizon. The color of the moist A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). Where eroded, the plow layer is slightly browner and has more clay than typical. In some places the B2t horizon is silty clay, clay, or sandy clay; in other places it is silty clay loam or clay loam that is nearly clay. The B2t horizon commonly is prismatic or columnar but in places ranges from moderately or strongly angular to subangular blocky. The depth to calcareous material ranges from about 15 to 25 inches, and the content of calcium carbonate above the hardpan varies. The hardpan may have cracks or spots of weaker cementation, which allow some movement of water through it. In a few areas the hardpan overlies medium-textured sediments, which may be loess.

Chilcott-Vickery complex, 0 to 12 percent slopes (CrC).-Chilcott silt loam occupies about 65 to 85 percent of most delineated areas. The Vickery silt loam occupies about 10 to 15 percent and occurs mostly as small round spots or low mounds. Very small, nearly barren "slick spots" of Sebree soils that have an alkali subsoil are included, and these make up about 1 percent or less of the delineated areas. Lanktree soils and other soils are also included, and these make up about 5 to 20 percent of most areas. The Lank-tree soils resemble the Chilcott silt loam but have no hardpan. Some included soils have a subsoil of clay loam or silty clay loam over a hardpan.

These soils are used for pasture and range. On most of these sites, the plant cover is in poor condition and is dominated by Medusahead wildrye and cheatgrass. Reseeding and good management are needed to increase forage yields. Suitable plants for reseeding are crested wheatgrass. Siberian wheatgrass, Whitmar beardless wheatgrass, and Ladak alfalfa. Summer fallow and good seedbed preparation generally are needed to obtain a good stand. These soils are suitable for irrigation, but water is not available. *Capability unit VIs-2, dryland. Loamy-Sierozem range site.*

De Masters Series

The De Masters series consists of noncalcareous, well-drained soils that occur mostly on northerly slopes from Squaw Butte northward to the forested areas. These soils are deep to moderately deep to basalt bedrock. They have a very dark brown loam surface layer and a loam subsoil. The parent material is mainly residuum that weathered from basalt but in places includes some colluvium.

These soils are extensive in the Gwin-Mehlhorn-Jackknife soil association. They occur at elevations of 3,500 to 5,900 feet. The slope ranges from 30 to 75 percent but is dominantly between 45 and 70 percent. The native vegetation consisted of grasses and such browse plants as ninebark, cherry, aspen, pinegrass, elk sedge, lupine, and Idaho fescue.

The available water holding capacity is moderate, and permeability is moderate in the subsoil.

These soils are used for pasture and range.

Representative profile of De Masters loam, 60 to 75 percent slopes, 20 feet east and 540 feet south of the northeast corner of the SW1/4, sec. 34, T. 12 N., R. 1 E., on a range site.

O1-2 inches to 0, black (10YR 2/1), partly decomposed leaves and twigs; very dark grayish brown (10YR 3/2) when dry ; neutral (pH 7.0).

A11-0 to 14 inches, very dark brown (10YR 1/2) stony loam; a little fine basaltic gravel; very dark brown (10YR 2/2) when dry; moderate or strong, very fine, granular structure; very friable; soft; abundant roots; neutral (pH (3.8).

A12-14 to 21 inches, very dark brown (10YR 2/2) stony loam a little fine gravel ; very dark grayish brown (10YR 3/2) when dry ; moderate or strong, *very* fine, granular structure ; very friable ; soft ; abundant roots; many very fine and fine pores; neutral (pH 6.7).

B21t-21 to 28 inches, very dark brown (10YR 2/2) stony loam ; slightly more clay than in the A1 horizon ; a little fine gravel; dark brown (10YR 3/3) when dry; weak, coarse and medium, subangular blocky structure and moderate, very fine, granular structure: friable; slightly hard ; abundant roots; many very fine and fine pores; thin patchy clay films on peds; neutral (pH 6.6).

B22t-28 to 35 inches, dark-brown (10YR 3/3) stony loam: dark brown (10YR 4/3) when dry ; much fine angular gravel ; weak, coarse and medium. subangular blocky structure and moderate, very fine, granular structure; friable ; slightly hard ; abundant roots ; many fine and very fine pores ; thin, patchy clay films on peds ; neutral (pH 6.8).

C1-35 to 43 inches, dark-brown (7.5YR 3/3). cobbly and gravelly loam ; brown (10YR 5/3) when dry: massive or weak, very fine, granular structure ; very friable ; slightly hard; roots plentiful ; common, very fine, tubular pores; neutral (pH 7.0).

C3-43 to 52 inches, when dry, mottled brown (7.5YR 5/4) and dark-brown (7.5YR 4/2), gray (7.5YR 5/1 and N 5/0), and weak-red (2.5YR 5/2), very cobbly and gravelly loam: basalt fragments well decomposed : roots plenti ful ; common, very fine, tubular pores ; neutral (pH 7.0).

R-52 to 61 inches, moderately weathered basalt bedrock; neutral (pH 6.9).

The color of the surface layer ranges from very dark brown (10YR 1/2 to 10YR 2/2) to black (10YR 1/1) or very dark grayish brown (10YR 3/2). Bleached silt and very fine sand grains are not common. The B2t horizon may have from 3 to 6 percent more clay than the A11 horizon. In some places there are numerous stones on and in the A1 horizon, and in other places there are few.

Small areas of Mehlhorn, Gwin, and Jacknife soils make up from 1 to 15 percent of the acreage of the areas mapped.

De Masters stony loam, 30 to 60 percent slopes (DmF).-This soil is mostly in the northern part of the surveyed area. Most slopes have northerly aspects. In some places there are numerous stones and outcrops of rock, and in other places there are few. In some places from 2 to 5 inches of the original surface layer has been lost through sheet erosion, but in most places more than 20 inches of dark-colored soil remains.

All of the acreage is used for pasture and range. The plant cover is in a fair to good condition. Forage yields can be maintained or increased by good management practices. *Capability unit VIe-2, dryland. North slope-Prairie range site.*

De Masters stony loam, 60 to 75 percent slopes (DmG).-A profile of this soil is the one described as typical of the series. This soil occurs mostly on northerly slopes. It generally is somewhat more shallow to bedrock than De Masters stony loam, 30 to 60 percent slopes.

This soil is used to a limited extent for pasture and range. The hazard of erosion is very severe if the slopes are excessively disturbed or denuded of vegetation. *Capability unit VIIe-2, dryland. North slope-Prairie range site.*

Dishner Series

The Dishner series consists of shallow, well-drained, stony or rocky soils in the sandstone uplands in the vicinity of Pearl and Little Butte. These soils have a. loam surface layer and a clay subsoil. They are underlain by sandstone at a depth of 8 to 20 inches. They formed in residuum weathered from quartzose sandstone or conglomerate, which is noncalcareous, micaceous, and arkosic. In places the conglomerate contains rhyolite gravel, cobblestones, and stones. In some places the upper part of the profile is influenced by a thin covering of wind-laid silt. In the vicinity of Pearl, the soils contain numerous stones of rhyolite and sandstone, whereas near Little Butte, they contain only fragments of sandstone.

These soils occupy a moderate acreage in the Haw-Payette-Van Dusen soil association. They occur at elevations of 2,600 to 4,000 feet and receive from 11 to 14 inches of precipitation annually. The slope ranges from 0 to 12 percent but typically is less than 10 percent. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, forbs, and dwarf sagebrush.

These soils are only slightly eroded. They are low to very low in available water holding capacity and low in fertility. The subsoil is slowly to very slowly permeable.

All of the acreage is used for pasture and range.

Representative profile of Dishner extremely stony loam, 0 to 12 percent slopes, taken 190 feet south and 300 feet west of the center of the NE1/4 sec. 28, T. 6 N., R. 1 E.

A2-0 to 6 inches, dark grayish-brown (10YR 4/2) extremely stony loam; some gravel and cobblestones ; light brownish gray (10YR 6/2) when dry: moderate, thin, platy structure and moderate, fine, granular structure ; friable when moist, slightly hard when dry ; common very fine pores; slightly acid (pH 6.5).

B2t-6 to 16 inches, dark-brown (7.5YR 3/2) slightly gravelly clay : small to moderate number of angular cobblestones and stones; brown (7.5YR 5/3) when moist; moderate to strong, medium, prismatic structure and moderate, medium, angular blocky structure ; thick, darker colored clay films on ped surfaces; very firm when moist, very hard when dry ; few fine roots ; dense or few very fine pores; neutral (pH 6.9).

R-16 inches +, sandstone or conglomerate bedrock.

The uppermost 1 to 2 inches in uncultivated areas commonly is slightly darker colored and has a higher content of organic matter than that in cultivated areas. The color of the moist surface layer is dark grayish brown or grayish brown. The boundary between the A and B horizons generally is abrupt. The B2t horizon ranges from moderate or strong prismatic structure to weak or moderate angular blocky structure. In hue it is dominantly 7.5YR, and in chroma, 3 to 4, but the hue ranges to a 10YR or 5YR. The A and B horizons generally are slightly acid or neutral in reaction, but the lower part of the subsoil and the bedrock commonly are neutral or mildly alkaline. Generally, the soil is noncalcareous, but slight amounts of calcium carbonate may be in cracks in the rock or on the lower side of detached rock fragments. Outcrops of rock occur in places. depending on whether the surface is parallel to the sandstone strata or across them. A thin hardpan covers the sandstone in some places. The sandstone ranges from 1 foot to 30 feet or more in thickness.

Dishner extremely rocky loam, 0 to 12 percent slopes (DnC).-This soil has numerous sandstone ledges. These ledges commonly extend 2 or 3 feet above the ground and are spaced from 5 to 30 feet. apart. Between the ledges, the soil is very stony. The stones are mostly sandstone, and they range from 6 inches to 3 feet in size. Some nearly vertical sandstone escarpments, 10 to 30 feet high, were included in the areas mapped. These are shown on the soil map by escarpment symbols.

The plant cover commonly is in poor condition and is dominated by cheatgrass, Medusahead wildrye, and other annuals. Cultivation and seedbed preparation are impossible because of the sandstone ledges and stones. Improvement of the plant cover by control of grazing is slow because of the scarcity of native bunchgrasses. Broadcast seedings of bulbous bluegrass help speed recovery. *Capability unit VIIs-1, dryland. Shallow stony-Brown range site.*

Dishner extremely stony loam, 0 to 12 percent slopes (DoC).-A profile of this soil is the one described as typical of the series. This soil is on gently sloping to moderately sloping ridgetops or benchlike areas in the uplands. In some places it is in shallow swales or along narrow

drainageways. In others it is interspersed with the deeper Haw soils. Loose cobblestones and stones, from 6 to 20 inches in size, are on and in the surface layer. They range from somewhat numerous to very numerous. In most places the stones are sandstone or conglomerate, but there are some rhyolite stones near Pearl. In most areas there are a few small outcrops of rock.

Included in the areas mapped are some Haw soils that occur as small, nonstony mounds and make up as much as 10 percent of some areas. Also included were some soils that have slopes of more than 12 percent. Other inclusions consist of a few soils in the vicinity of Pearl and Prospect Peak. These soils apparently formed in material weathered from rhyolite, rhyolitic tuff, or similar volcanic bedrock, and they contain stones and other rock fragments of rhyolite or rhyolitic tuft. Otherwise, they are similar to the Dishner soils. In some of the more nearly level areas, small mounds that consist of deeper Perla soils are surrounded by the shallow Dishnerlike soils. Some of these mounds are surrounded by rings or lines of closely packed stones and cobblestones that tend to have their longer axis oriented parallel to the intermound swales. Such stone patterns also occur in other places.

This soil is used for pasture and range. The plant cover generally is in poor to fair condition and is dominated by cheatgrass, Medusahead wildrye, Sandberg bluegrass, and dwarf sagebrush. Yields of usable forage are very low but would be increased somewhat if the plant cover contained more bunchgrasses. Cobblestones and stones, commonly between 4 and 12 inches in size, are much too numerous to allow seedbed preparation. However, grasses can be established either by managing grazing so as to allow the bunchgrasses to reseed naturally or by broadcast seedings, especially of bulbous bluegrass. *Capability unit VIIs-1, dryland. Shallow stony-Brown range site.*

Draper Series

In this series are dark-colored alluvial soils that are moderately well drained. The subsoil is dominantly loam but ranges to light clay loam. Some brown or yellowish-brown mottling occurs below a depth of 18 to 36 inches. Loose sand or gravel occurs at a depth of 35 to 60 inches or more. The parent material consists of alluvium washed mostly from soils that developed in acid igneous material.

These soils are in the Power-Purdam soil association. They occupy alluvial fans and bottoms along small streams that cross the bench north of Emmett. They slope less than 3 percent, mostly in one direction, and have a plane surface. They receive about 9 to 11 inches of precipitation annually but receive some extra moisture from runoff and seepage. The elevation ranges from 2,300 to 2,500 feet. In many places coarse and very coarse sand and fine gravel occur throughout the profile, but there are no stones. The native vegetation consisted of bunchgrasses, some sagebrush, and herbaceous plants.

These soils are uneroded or only slightly eroded. They are moderately fertile and have moderate organic-matter content. In most places they are nonsaline and nonalkali, but there are some alkali spots. The available water holding capacity is moderate, and permeability is moderate to moderately slow in the subsoil.

The Draper soils are now irrigated and used for crops and pasture.

Representative profile of Draper loam, 0 to 1 percent slopes, 100 feet north and 450 feet west of the center of sec. 31, T. 7 N., R. 2 W., in an alfalfa field.

Ap--0 to 10 inches, very dark grayish-brown (10YR 3/2) loam; grayish brown (10YR 5/2) when dry; weak, fine, granular structure ; slightly hard; friable ; neutral (pH 6.8) ; micaceous throughout.

A11-10 to 16 inches, loam, slightly lighter colored than Ap horizon ; weak, fine, granular structure ; slightly hard; friable; common fine roots; neutral (pH 7.4).

A12-16 to 24 inches, very dark gray (2.5Y 3/1) or very dark grayish-brown (10YR 3/2) loam; gray (10YR 5/1) or grayish brown (2.5Y .5/2) when dry; weak, medium and fine, subangular blocky structure; few, fine. distinct, brown (10YR 4/3, moist) mottles; friable ; slightly hard; plentiful fine roots ; neutral (pH 7.2).

C1-24 to 38 inches, very dark gray (2.5Y 3/1) or very dark grayish-brown (10YR 3/2) loam; gray (10YR 5/1) or grayish brown (2.5Y 5/2) when dry; few, fine, distinct, brown (10YR 4/3, moist) mottles; massive: very friable ; slightly hard ; few fine roots ; moderate amount of fine, granitic gravel; neutral (pH 7.2).

IIC2-38 to 42 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam; light gray (10YR 6/1) when dry ; massive ; very friable ; black staining common on gravel; few fine roots; mildly alkaline (pH 7.8).

IIIC3-42 inches +, loose sand and gravel.

The color of the moist surface layer ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). The texture may be sandy loam, loam, or clay loam. In places thin strata of loamy sand to clay loam occur in the subsoil. In some areas there are calcium carbonate spots and veins below a depth of 20 inches. Small spots of nonmottled soils are included in the areas mapped. In a few small areas, the depth to loose gravel is only 2.5 to 3.5 inches.

Draper clay loam, 0 to 1 percent slopes (DpA).-A profile of this soil is similar to the one described as typical of the series, except that the surface layer is clay loam and in most places the subsoil is also clay loam. Permeability is moderately slaw in the subsoil. The depth to the water table commonly is between 2 and 4 feet. Some saline-alkali spots occur in an area near the mouth of Bissell Creek.

This soil is used for small grain, hay, row crops, and pasture. A rotation in which a grass-legume crop is grown about half of the time is needed to maintain tilth, improve organic-mater content, and preserve soil structure. Nitrogen and phosphate are needed for maximum yields. The. use of manure. green-manure crops, and crop residues helps to maintain good tilth. The saline-alkali spots need manure and soil amendments to improve the water intake rate and the soil structure. Irrigation can be by the border, corrugation, or furrow method. However, the rate of application must be controlled to prevent excessive runoff, and the amount of water applied should be limited to avoid raising the water table. Interceptor drainage ditches are needed to lower the water table. *Capability unit I-1, irrigated.*

Draper loam, 0 to 1 percent slopes (DrA).-A profile of this soil is the one described as typical of the series. The subsoil is moderately permeable. The depth to the water table fluctuates, but it generally is between 2 and

5 feet. Included in the areas mapped are several acres in which the surface layer is a sandy loam or coarse sandy loam, and the subsoil is slightly more sandy than typical. Consequently, this included soil is more permeable than the typical soil, and it is easier to work.

This soil is used for small grain, row crops, hay, and pasture. Corn and legumes need phosphate for maximum yields, and grain and grass crops need nitrogen. A rotation in which a grass-legume crop is grown about half of the time is needed to maintain good tilth and organicmatter content. Manure, green-manure crops, and crop residues help to maintain fertility. Irrigation may be by the border, corrugation, furrow., or sprinkler method. The amount of water applied needs to be limited to prevent waterlogging. In some places the water table could be lowered by using interceptor drainage ditches. *Capability unit I-1. irrigated.*

Draper loam, 1 to 3 percent slopes (DrB).-This soil is similar to the soil described as typical of the series, except that the depth to the water table is a little greater. In most places the water table is at a depth between 3 and 6 feet, but in a few places it is slightly higher.

This soil is used and managed in nearly the same way as Draper loam, 0 to 1 percent slopes. Some precautions are needed during irrigation, to avoid causing erosion. *Capability unit IIe-2, irrigated.*

Elmore Series

The Elmore series consists of well-drained soils that formed in residuum weathered from rhyolite bedrock. The surface layer is dark colored and has a moderate content of organic matter. The subsoil is dominantly clay loam, but it ranges to light clay or heavy clay loam. The soil is noncalcareous throughout, partly because of the low content of calcium in the parent material. Rhyolite bedrock occurs at a depth of 20 to 45 inches.

These soils are in the Gem-Newell soil association. They occur in the vicinity of Sugar Loaf Butte, at elevations of 3,900 to 4,600 feet. The annual precipitation is about 13 to 16 inches. The slope ranges from 12 to 60 percent but is dominantly about 15 percent. The native vegetation consisted of bunchgrasses, some big sagebrush, bitterbrush, and associated forbs.

Erosion is slight to moderate. The available water holding capacity is low to moderate, fertility is high to moderate, and permeability is moderately slow in the subsoil.

The Elmore soils are used for dry-farmed alfalfa, small grain, pasture, and range.

Representative profile of Elmore loam, 12 to 30 percent slopes, 420 feet south and 180 feet west of the northeast corner of the NW1/4SW1/4 sec. 1, T. 8 N., R. 1 E., in a noncultivated area.

A11-0 to 5 inches, very dark brown (10YR 2/2) loam; dark grayish brown (10YR 4/2) when dry; upper 2 inches has moderate, thin, platy structure breaking to moder ate, fine, granular structure; lower part has weak, platy structure ; friable when moist, slightly hard when dry; abundant roots; medium acid (pH 6.0).

A12-5 to 11 inches, very dark brown (10YR 2/2) loam; dark grayish brown (10YR 4/2) when dry; weak, medium, prismatic structure and moderate, fine. granular structure; few bleached silty coatings on ped surfaces friable when moist. slightly hard when dry; plentiful roots; slightly acid (pH 6.4).

Blt-11 to 15 inches, very dark brown (7.5YR 2/2) light clay loam ; dark brown (7.5YR 4/2) when dry ; moderate, medium and fine, angular blocky structure ; faint bleached silty coatings and moderately thick clay films on ped surfaces ; firm when moist, hard when dry ; roots plentiful ; many fine and very fine pores; slightly acid (pH 6.4).

B2t-15 to 38 inches, dark-brown (7.5YR 3/3) clay loam: dark brown (7.5YR 4/3) when dry; moderate, very coarse, prismatic structure and weak, medium, angular blocky structure; slightly darker colored thick clay films on ped surfaces ; very firm when moist, very hard when dry : few fine roots ; common to few, very fine pores; neutral (pH 6.6).

C-38 to 42 inches. dark-brown (7-5YR 4/4) sandy loam: brown (7.5YR 5/3) when dry; partially decomposed rhyolite ; massive; thick clay films in cracks ; neutral (pH 6.7).

R-42 inches +, rhyolite bedrock.

The color of the moist surface layer is very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2). Bleached silt coatings are always present in the lower part of the A horizons or upper part of the B horizons. The B horizons typically have a, 7.5YR hue. The structure of the B2t horizon ranges from moderate to strong. Some soils have a C horizon above the rhyolite bedrock and others do not. In many places there are few to many angular fragments of rhyolite throughout the profile. Very shallow soils and small outcrops of rhyolite make up as much as 5 percent of the areas mapped.

Elmore loam, 12 to 30 percent slopes (EaE).-A profile of this soil is the one described as typical of the series. This soil is slightly to moderately eroded, and there are deep gullies in some drainageways. Stones and outcrops of rock occur but do not prevent tillage. The available water holding capacity is moderate..

This soil is used for dry-farmed small grain and alfalfa and for pasture and range. It is limited in use, however, because of the slope and the lack of available moisture during the growing season. A rotation in which a grasslegume mixture is grown at least 75 percent of the time is needed to maintain the content of organic matter, to preserve soil structure, and to control erosion. Plowing under the last hay crop for green manure enriches the soil and helps to preserve soil structure. Cross-slope tillage helps to control erosion. The utilization of manure and stubble, with careful use of nitrogen, helps to maintain productivity. Phosphate is needed for maximum. yields of legumes.

Much of the native vegetation has been replaced by big sagebrush and cheatgrass, and the plant cover is in poor condition. This soil can be tilled and reseeded to increase forage yields. *Capability unit IVe-4, dryland.*

Loamy-Chestnut range site.

Elmore rocky loam, 30 to 60 percent slopes (EeF).This soil is like the. soil described as typical of the series, except that the subsoil has less clay and the depth to bedrock is only 20 to 30 inches. It occurs on steep southerly slopes. It is slightly to moderately eroded. and there are deep gullies in some drainageways. Stones and outcrops of rock are numerous. The available water holding capacity is low.

This soil is used for pasture and range. The dominant plants are bitterbrush, big sagebrush, and cheatgrass, but there is a limited amount of native grasses. Yields could be increased by improved management. *Capability unit VIe-2, dryland. South slope-Chestnut range site.*

Emerson Series

The Emerson series consists of light-colored, welldrained soils on the low terrace of the Payette River. These soils formed in river alluvium that contained some basaltic and rhyolitic material but was principally acid igneous material. Some of the alluvial material may have been washed from areas of the Idaho and Payette formations. The soil material is moderately micaceous, quartzic, feldspathic, and noncalcareous. The subsoil, Between a depth of about 6 inches and at least 20 inches, is moderately coarse textured. The subsoil, particularly the- lower part, is stratified. A layer of loamy sand or other coarsetextured material is common just above loose gravel or gravelly sand that occurs at a depth of 20 to 50 inches (fig. 5).

These soils are moderately extensive in the Emerson.-Wardwell-Quenzer soil association. They occur east of Emmett, at elevations of 2,300 to 2,550 feet. The slopes are less than 3 percent, except along terrace edges. The annual precipitation is 10 or 11 inches. The native vegetation consisted of needlegrasses, other bunchgrasses, big sagebrush, and herbaceous plants.

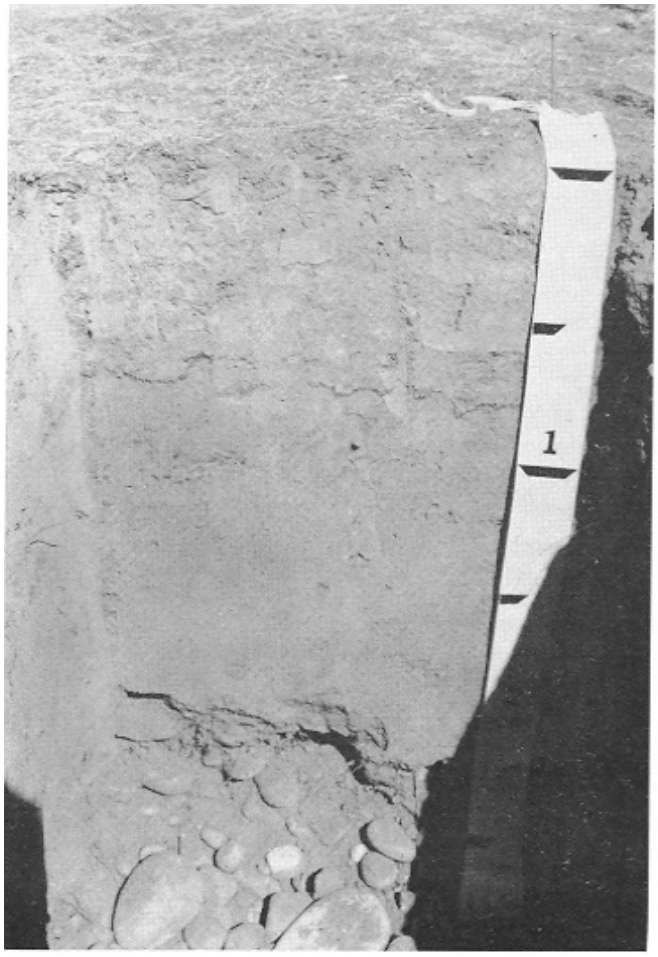

Figure 5. Profile of Emerson fine sandy loam showing a uniform profile and underlying loose gravel and sand.

Erosion is negligible in most places. Permeability is moderately rapid to very rapid in the subsoil. The organic-matter content is low.

These soils are used for irrigated pasture crops, alfalfa, clover for hay, corn, and small grain. Some orchard crops are grown, especially in the more gravelly areas.

Representative profile of Emerson fine sandy loam, 0 to 1 percent slopes, at a site 70 feet east and 730 feet south of the northwest corner of the SW1/4 sec. 34, T. 7 N., R. 1 W., in an orchard.

Ap-O to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; pale brown (10YR 6/3) when dry; weak, very tine, granular structure; very friable when moist, slightly hard when dry; slightly acid (pH 6.5).

Cl-8 to 12 inches, dark-brown (10YR 4/3) fine sandy loam; pale brown (10YR 6/3) when dry; very weak, coarse, subangular blocky structure ; friable when moist, hard when dry; roots plentiful ; many very fine pores; neutral (pH 6.7).

C2-12 to25 inches, dark-brown (10YR 4/3) fine sandy loam; light olive brown (2.5Y 5/3) when dry; massive; friable when moist, except for few, firm, rounded nodules of soil material, 3/4 to 1 inch in diameter ; slightly hard when dry ; few roots ; many very fine pores: neutral (pH 7.0).

IIC3-25 to 32 inches, dark-brown (10YR 4/3) gravely sandy loam; massive; very friable; few roots; mildly alkaline (pH 7.7).

IIIC4-32 to60 inches, loose gravelly sand, mostly alluvium derived from acid igneous rocks; mildly alkaline.

In virgin soils, particularly near or under big sagebrush plants, the uppermost half inch or more is slightly darker colored and higher in content of organic matter. The next lower horizon is low in content of organic matter. Tillage mixes these layers. The plow layer ranges from dark grayish brown (10YR 4/2) to dark brown (10YR 4/3) when moist and from light brownish gray (10YR 6/2) to pale brown (10YR 6/3) when dry. gray uncultivated areas, the uppermost 2 or 3 inches is platy. The reaction ranges from pH 6.2 to pH 7.3. The subsoil, to a depth of 20 or 30 inches, is fine sandy loam, sandy loam, coarse sandy loam, or gravelly sandy loam or is marginal to loam or loamy sand. There is no B2t horizon, but in places a few thin clay coatings occur in pores or in very thin, continuous, wavy, horizontal bands. The subsoil has a chroma of about 3 in the 10YR or 2.5Y hues, and it is not mottled. It generally is massive, but in places it has weak, sub angular blocky structure. In places the uppermost few inches of the underlying gravelly layer has some calcium carbonate on the lower side of the pebbles.

Soils that have a surface layer of loam make up as much as 1 or 2 percent of the areas mapped; soils that have dark yellowish-brown mottles in the lower part of the subsoil and that are more like the Falk soils make up as much as 5 percent ; and small areas of Wardwell soils make up as much as 3 percent.

Emerson fine sandy loam, 0 to 1 percent slopes (EmA).-A profile of this soil is the one described as typical of the series. The depth to loose sand and gravel ranges from 20 to 36 inches. Permeability is moderately rapid in the subsoil. The available water holding capacity is low.

This soil is used for irrigated crops. Excellent yields can be expected if fertilization is adequate and crops are rotated. Nitrogen and phosphate are needed for the best yields. A suitable rotation consists of a mixture of grasses

and legumes at least 60 percent of the time and a row crop not more than 2 nears in succession. The utilization of crop residues and manure helps to maintain fertility. Irrigation can be by the border, sprinkler, corrugation, or furrow method. Light and frequent irrigation is necessary because of the low available water holding capacity. *Capability unit IIIs-1. irrigated.*

Emerson fine sandy loam, 1 to 3 percent slopes (EmB).-Except for slope, this soil is similar to the soil described as typical of the series. In most places the depth to loose gravel and sand is between 20 and 40 inches. In some areas there is a considerable amount of gravel in the surface layer and subsoil, and in places there are some cobblestones. These areas are indicated on the soil map by gravel symbols. The gravel and cobblestones do not prevent tillage, but the soil is slightly lower in waterholding capacity than the nongravelly soil and slightly less productive.

About 20 acres along the line between sections 27 and 34, T. 7 N., R. 1 W. were included in the areas mapped. In this area the soil has a surface layer of loam and is slightly higher in available water holding capacity than typical. In a few spots the soil is between 40 and 50 inches in depth to loose sand and gravel and, consequently, is slightly more productive.

This soil is used and managed in the same way as Emerson fine sandy loam. 0 to 1 percent slopes, but more care is needed in irrigating, to avoid causing erosion. *Capability unit IIIs-1, irrigated.*

Emerson fine sandy loam, deep, 0 to 1 percent slopes (ErA).-This soil is similar to the one described as typical of the series, except that the depth to loose gravel and sand is 36 to 50 inches. The available water holding capacity is moderate.

This soil is used and managed in much the same way as Emerson fine sandy loam, 0 to 1 percent slopes, but it produces slightly better yields. The period between irrigations can be longer than on the more shallow soil. A rotation in which a grass-legume mixture is grown at least 50 percent of the time and a row crop not more than 2 years in succession is suitable. *Capability unit IIs-2, irrigated.*

Emerson loamy sand, 0 to 1 percent slopes (EsA).--This soil differs from the typical soil in that the surface. layer and subsoil are loamy sand or loamy fine sand. The depth to loose gravel and sand ranges from 20 to 45 inches. Permeability is very rapid in the subsoil. The available water holding capacity is very low.

This soil is used for orchard crops, hay, pasture, and small grain. Small grain can be grown for 1 year if it is necessary to reestablish hay or pasture stands. Otherwise, the soil is best suited to grasses and legumes. These can be grown for pasture, hay, or orchard cover crops. Good response can be expected from nitrogen and phosphate. The utilization of manure, green-manure crops, and crop residues helps to build up the organic-matter content. Irrigation should be very light and frequent because of the very low water-holding capacity. Sprinkler irrigation is preferable, but border and corrugation irrigation can be used. *Capability unit IVs-1, irrigated.*

Emerson loamy sand, 1 to 3 percent slopes (EsB).-This soil differs from the typical soil in that the surface layer and subsoil are loamy sand or loamy fine sand. The depth to loose gravel and sand ranges from 20 to 45 inches. Small areas of soils that occur on the edge of terraces and that have slopes of as much as 5 percent were included in the areas mapped.

This soil is used and managed in the same way as Emerson loamy sand, 0 to 1 percent slopes. If surface irrigation is used, however, the system needs to be adjusted somewhat because of the very gentle slopes. *Capability unit IVe-3, irrigated.*

Falk Series

The Falk series consists of light-colored, moderately well drained soils on bottom lands. These soils are forming in recent alluvium that washed mostly from areas of granitic rocks or other somewhat similar acid igneous rocks or from areas of the Idaho and Payette formations. The alluvium may contain small a mounts of basaltic and rhyolitic materials. It is feldspathic, moderately micaceous, high in quartz, and noncalcareous. The surface layer is moderately coarse textured or coarse textured, and in some places it is gravelly. It is low or moderately low in content of organic matter. The subsoil, between a depth of about 6 inches and 20 or 30 niches, is dominantly moderately coarse textured. In places the subsoil, particularly the lower part, is stratified. Brown mottles occur in the subsoil below a depth of 20 to 50 inches. A layer of loamy sand or other coarse-textured material is common just above the loose gravel or gravelly sand that occurs below a depth of 20 to 55 inches. The water table fluctuates. Most of the tune it is in the gravelly substratum, but some of the time it has been high enough to have caused mottling in the lower part of the subsoil.

These soils are extensive in the Moulton-Falk soil association. They occur on the higher parts of the river flood plains and on the very low terraces nearby. The elevation ranges from 2,250 to 3,700 feet but is mostly less than 2,400 feet. The annual precipitation ranges from 9 to 12 inches. The slopes are less than 3 percent, except along the edge of some channels. Old stream channels meander through these soils, but erosion has been negligible. Gravelly and cobbly areas, from a few feet in circumference to an acre or more in size, occur in places. The native vegetation consisted mainly of needlegrass and other bunchgrasses and some big sagebrush.

These soils are used for native pasture, improved pasture, corn, small grain, and alfalfa and clover for hay.

Representative profile of Falk fine sandy loam, 0 to 1 percent slopes, 380 feet north and 120 feet west of the center of sec. 4, T. 6 N., R. 1 W., in a cultivated area.

Ap-0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loans; light brownish gray (10YR 6/2) when dry; very weak, very fine, granular structure ; very friable when moist, soft when dry: slightly acid(pH (3.4).

C1-8 to 14 inches, dark-brown (10YR 4/3) fine sandy loam; light brownish gray (10YR 6/2) when dry; very weak, medium and coarse. subangular blocky structure ; very friable when moist, slightly hard when dry; many fine roots ; many fine and very fine pores; slightly acid (pH 6.4).

C2-14 to 25 inches. dark-brown (10YR 4/3) fine sandy loam light olive brown (2.5Y 5/3) when dry; very weak, coarse, subangular blocky structure; very friable when moist, slightly hard when dry; many fine roots: many fine and very fine pores; neutral (pH 6.S).

C3g-25 to 35 inches, olive-brown (2.5Y 4/3) fine sandy loam with many, medium, distinct, dark-gray (5Y 4/1)

and dark-brown (10YR 3/3) mottles when moist; light yellowish brown (2.5Y 6/3) with light-gray (2.5Y 7/1) and brown (10YR 5/3) mottles when dry; massive ; very friable when moist. slightly hard when dry; very few roots; few pores; neutral (pH 6.9).

IIC4g 35 to 60 inches, mottled sand and gravel ; single grained; loose.

The color of the moist surface layer ranges from dark grayish brown (10YR 4/2) to very dark grayish brown (2.5Y 3/2) or dark brown (10YR 4/3). In places the subsoil has a hue of 10YR or 2.5Y and a chroma of 2 or 3. Inclusions of Notus, Moulton, Emerson, and Lathe soils make up about 5 percent of the areas mapped.

Falk fine sandy loam, 0 to 1 percent slopes (FaA).- This is the most extensive soil in the Falk series. A profile of this soil is the one described as typical of the series. The depth to loose gravel and sand ranges from 20 to 36 inches, and the water table is in the gravel. Permeability is moderately rapid in the subsoil. The available water holding capacity is low.

In some areas as much as 20 to 50 percent of this soil, by volume, is gravel. These areas are indicated on the soil map by gravel symbols. In places, cobblestones are mixed with the gravel. The gravel causes this soil to be slightly lower in water-holding capacity than the nongravelly soil, and it interferes to some extent with, but does not prevent, tillage.

Most of the acreage is irrigated and used for pasture, hay, corn, and small grain. A small acreage, consisting mostly of the gravelly areas, is pasture. In these areas the plant cover is dominated by cheatgrass and annual weeds. Good crop yields can be obtained by using a suitable crop rotation, adequate nitrogen and phosphate, proper tillage, and irrigation. A suitable crop rotation consists of a grass-legume crop about 60 percent of the time and not more than 2 successive years of a row crop. Irrigation may be by the border, sprinkler, corrugation, or furrow method. Only as much water as the soil will hold should be applied. Excess water can raise the water table and thus injure such deep-rooted crops as alfalfa and cause waterlogging of adjoining soils. *Capability unit IIIs-1, irrigated.*

Falk fine sandy loam, 1 to 3 percent slopes (FaB).- This soil ranges from 20 to 40 inches in depth to loose gravel and sand, and in a few spots it is slightly more than 40 inches deep. The water table is in the gravel. Included in the areas mapped were some small strips of steeper soils and some soils along old stream channels.

In some areas as much as 20 to 50 percent of this soil, by volume, is gravel. These areas are indicated on the soil map by gravel symbols. In places. cobblestones are mixed in the gravel. The gravelly soil is slightly more permeable than the nongravelly soil, but it is slightly lower in water-holding capacity. The gravel and cobblestones interfere to some extent with tillage but do not prevent tillage.

This soil is used and managed in the same way as Falk fine sandy loam, 0 to 1 percent slopes, but it requires more careful irrigation to avoid causing erosion. It is likely to need more leveling for irrigation than the more nearly level Falk soil. *Capability unit IIIs-1, irrigated.*

Falk fine sandy loam, deep, 0 to 1 percent slopes (FfA).-This soil ranges from 36 to 55 inches in depth to the loose gravel and sand. The available water holding capacity is moderate.

This soil is used and managed in nearly the same way as Falk fine sandy loam, 0 to 1 percent slopes, but it can be used slightly more intensively. A suitable crop rotation consists of a soil-building crop at least 50 percent of the time and a row crop not more than 2 years in succession. *Capability unit IIs-3, irrigated.*

Falk loamy sand, 0 to 1 percent slopes (FkA).- This soil differs from the soil described as typical of the series in having a surface soil and subsoil of loamy sand. The depth to the underlying loose gravel is 20 to 50 inches. Permeability is very rapid in the subsoil. The available water holding capacity is very low.

Much of the acreage is used for pasture. The plant cover is dominated by cheatgrass and other forbs and grasses. Forage yields are low. If irrigated, this soil is best suited to hay and pasture crops. Small grain can be grown occasionally, but yields are likely to bee low. Manure helps to improve soil structure and to increase fertility. Green-manure crops and crop residues also help. - Nitrogen and phosphate are needed. Applications of irrigation water need to be light and frequent. Sprinkler irrigation is best suited, but the border or corrugation method can be used if the runs are short. *Capability unit IVs-1, irrigated.*

Falk loamy sand, 1 to 3 percent slopes (FkB).-This soil has a surface layer and subsoil of loamy sand. The depth to the underlying loose gravel ranges from 20 to 50 inches. Some small strips of steeper soils and some soils along old stream channels were included in the areas mapped.

This soil is used and managed in the same way as Falk loamy sand, 0 to 1 percent slopes, but it is more likely to erode if irrigated by surface methods. Sprinkler irrigation is preferable. *Capability unit IVe-3, irrigated.*

Gem Series

The Gem series consists of well-drained soils that formed in residuum weathered from basalt bedrock. The surface layer is dark colored, granular, and medium textured or moderately fine textured. It has a moderate content of organic matter. The subsoil is clayey. A weak or moderate accumulation of calcium carbonate is common in the lower part of the subsoil, at a depth of 15 to 30 inches, or in cracks in the bedrock. In some places there are a few angular pebbles. cobblestones, and stones on the surface and throughout the profile, and in other places there are many. The depth to bedrock ranges from 18 to 42 inches.

Soils of the Gem series occupy the largest acreage of any of the soils in the surveyed area. Most of the acreage is in the Gem-Newell soil association. These soils occur at elevations of 2,500 to 4, 200 feet, on hills and mountainous slopes around Squaw Butte and northeast and east of Emmett. The annual precipitation ranges from 13 to 16 inches. The slope ranges from 0 to 60 percent but is mostly between 5 and 25 percent. The native vegetation consisted of bluebunch wheatgrass and other bunchgrasses, forbs, and some bitterbrush and big sagebrush.

These soils are slightly to moderately eroded. Permeability is slow in the subsoil; the available water holding capacity is moderate; and surface runoff is medium to rapid. Small springs or seeps commonly occur at the bottom of slopes where these soils border the Newell soils.

The Gem soils are used principally for pasture and range, but some small areas are used for dry-farmed and irrigated crops.

Representative profile of Gem clay loam,, 12. to 30 percent slopes, 400 feet east and 700 feet south of the center of the NE1/4 sec. 10, T. 7 N., R. 1 W., in a noncultivated area.

A11-0 to 3 inches, very dark brown (10YR 2/2) loam to silt loam ; few basaltic angular pebbles ; dark grayish brown (10YR 4/2) when dry ; vertical cracks form very thick 4- to 6-sided blocky plates, 4 to 7 inches across; breaks to moderate. thin platy structure, then to moderate, tine, granular structure ; friable when moist. very hard when dry ; roots plentiful ; neutral (pH 6.6).

A12-3 to 6 inches, very dark brown (10YR 2/3) silty clay loam to clay loam; few angular basalt pebbles; dark brown (10YR 3/3) when dry; main vertical cracks form very thick 4- to 6-sided blocky plates, 4 to 7 inches across; some secondary cracks, 2 inches apart; weak, medium, platy structure breaking to moderate, fine, subangular blocky ; firm when moist, very hard when dry; roots plentiful; slightly acid (pH 6.4).

Blt-6 to 9 inches. dark-brown (Z5YR 3/2) silty clay loam: few angular basalt pebbles; dark brown (7.5YR 4/2) when dry; moderate, coarse, prismatic structure and weak, fine and very fine, angular blocky structure; thin. nearly continuous, slightly darker colored clay films on ped surfaces ; very firm when moist, very bard when dry: very fine roots plentiful; few very fine pores; slightly acid (pH 6.3).

B2t-9 to 20 inches, dark-brown (7.5YR 3/3) silty clay or heavy silty clay loam ; moderate amount of basaltic, angular fine pebbles and very coarse sand particles; dark brown (7.5YR 4/2) when dry ; moderate, coarse, prismatic structure in upper part and weak, medium, prismatic structure in lower part ; breaks to moderate, fine and very fine. angular blocky structure : moderate. continuous, slightly darker colored clay films on ped surfaces; very firm when moist, very hard when dry; few very fine roots ; dense ; few *very* fine pores ; neutral (pH 6.6).

B31t-20 to 23 inches, dark-brown (7.5YR 4/3) light clay loam few basaltic, angular fine pebbles and very coarse sand particles ; brown (10YR 5/3) when dry ; weak, medium, prismatic structure that breaks to moderate. fine, angular blocky structure; thin, continuous darker colored clay films on ped surfaces ; firm when moist, very hard when dry ; few very fine roots ; common fine pores ; neutral (pH 6.9).

B32tca- 23 to 29 inches, dark-brown (7.5YR 3/3) loam ; moderate amount of basalt fragments; brown (10YR 5/3) when dry ; weak, medium, angular blocky structure ; thin patchy clay films ; firm when moist, hard when dry ; few very fine roots ; many very fine pores ; noncalcareous except common calcium carbonate veins; mildly alkaline (pH 7.4).

Rica-29 to 34 inches, slightly decomposed basalt rock ; calcium carbonate coatings in cracks.

R2-34 inches +, basalt bedrock.

The color of the moist surface layer is very dark brown (10YR 2/2 to 7.5YR 2/2 or 2/3). The subsoil ranges from 10YR to 7.5YR in hue and from 3 to 2 in chroma. The texture ranges from silty clay or clay to heavy silty clay loan or heavy clay loam. The blocky structure in the B2t horizon is strong in places. Spots that have a surface layer of silt loam, loam. or clay were included in the areas mapped.

Small areas of Bakeoven, Lickskillet, Newell, Squaw, Mehlhorn, and Gross soils make up as much as 5 percent of the mapping units, and in some areas the percentage is as much as 10 or 15 percent. A few small spots of a clayey, reddish soil similar to that of the Aikman soils were also included. Streaks of various colors caused by minerals and by tuffaceous materials occur in the soil and in the underlying rock.

Gem clay loam, 3 to 7 percent slopes (GcC).-Except for slope, this soil is similar to the soil described as typical of the series. In some small areas the surface layer is silt loam, silty clay loam, or clay. Commonly, there are a few loose stones on the surface but not enough to interfere with tillage.

In some included areas there are sufficient stones and cobblestones, from 6 to 20 inches in size, to interfere with tillage but not enough to, prevent tillage. These areas are indicated on the soil snap by stone symbols.

This soil is used for irrigated pasture, hay, and small grain; for dry-farmed crops; and for range. A grass-legume mixture is needed in the rotation to maintain the organic-matter content and to preserve soil structure. The utilization of manure, green-manure crops, and crop residues helps to preserve soil structure and to maintain productivity. Good response can be expected from nitrogen and phosphate. Irrigation is mostly by corrugations. The length of the run and the size of the irrigation stream should be limited, to control erosion. Sprinkler irrigation can be used on close-growing crops.

Yields of dry-farmed pasture crops, hay crops, and small grain are poor to fair because of the lack of available moisture during the growing season. A grass-legume mixture in the rotation helps to maintain or to increase the organicmatter content and to preserve soil structure. Plowing under the last hay crop for green manure and utilizing manure and crop residues also help to supply organic matter, to maintain productivity, and to preserve soil structure. Careful use of nitrogen benefits pasture crops and grain.

The pasture and range are mostly in poor condition. The vegetation is composed largely of Medusahead wildrye, cheatgrass, and big sagebrush. Forage yields are low but can be increased by summer fallowing, preparing good seedbeds, and reseeding Ladak alfalfa with suitable dry-farmed grasses. Suitable grasses include intermediate wheatgrass, crested wheatgrass, pubescent wheatgrass and Sherman big bluegrass. Good management practices are needed to maintain a good stand and ensure long-time production. *Capability units IIIe-1, irrigated; IIIe-4, dryland. Loamy-Chestnut range site.*

Gem clay loam, 7 to 12 percent slopes (GcD).-Except for slope, this soil is like the soil described as typical of the series. In some small areas the surface layer is clay, probably because of the influence of tuffaceous material. Commonly, there are a few stones on the surface but not enough stones to interfere with tillage.

In some included soils loose stones and cobblestones, from 6 to 20 inches in size, are numerous enough to interfere with tillage but not numerous enough to prevent tillage. These areas are indicated on the soil map by stone symbols.

This soil is used for irrigated and dry-farmed crops and for pasture and range. The irrigated soil is suited to alfalfa for hay, small grain, and pasture crops. Fair to good yields can be expected. A grass-legume crop should be kept on this soil most of the time. More than one successive year in grain tends to increase erosion and to cause the soil to deteriorate. Irrigation can be by the sprinkler or corrugation method but must be carefully done to avoid causing erosion.

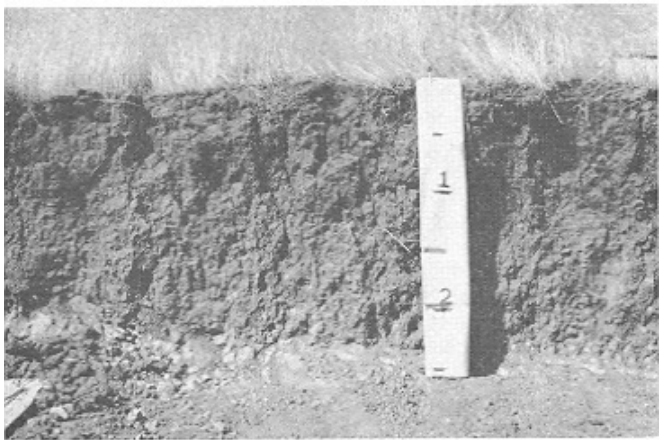

Figure 6.-Profile of Gem clay loam, 12 to 30 percent slopes, showing the darker colored surface layer, the somewhat prismatic and blocky, clayey subsoil, and the underlying basalt bedrock.

If this soil is dry farmed, management for crops, pasture, and range is the same as for dry-farmed Gem clay loam, 3 to 7 percent slopes. *Capability units IVe-1. irrigated; IIIe-4, dryland. Loamy-Chestnut range site.*

Gem clay loam, 12 to 30 percent slopes (GcE).-A profile of this soil is the one described as typical of the series (fig. 6). Some small areas that were included in mapping have a surface layer of silt loam, loam, or clay. In places there are some stones on the surface but not enough to interfere with tillage. Erosion has been moderate on most of this soil, and deep gullies occur in some drainageways.

This soil is used for grazing and needs the same management as Gem clay loam, 3 to 7 percent slopes. *Capability unit IVe-4, dryland. Loamy-Chestnut range site.*

Gem stony clay loam, 12 to 30 percent slopes (GhE).A profile of this soil is similar to the one described as typical of the series, except that it is stony. Most of the stones are between 6 and 20 inches in size. There are enough to interfere with tillage but not enough to prevent tillage. Some areas that were included in mapping have a surface layer of stony loam or stony clay.

This soil is used for grazing. It needs the same management as Gem clay loam, 3 to 7 percent slopes. *Capability unit IVe-4, dryland. Loamy-Chestnut range site.*

Gem stony clay loam, 30 to 60 percent slopes (GhF).-This soil is similar to the soil described as typical of the series, except that it is stony and there are some scattered outcrops of rock. In places the subsoil has somewhat less clay than typical. Erosion is slight to moderate, and deep gullies have formed in some drainageways. Most of this soil is on southerly slopes on steep uplands and mountains. About a fourth of the acreage is on northerly slopes, where the precipitation generally is lower than is typical for the Gem soils. Some adjacent ridgetops and southerly slopes are occupied by Lickskillet and Bakeoven soils, and small spots of these soils were included in the areas mapped. These soils are more shallow to bedrock than the Gem soil, and they have less clay in the subsoil. This soil is used for grazing. The plant cover is dominated by Medusahead wildrye, cheatgrass, and big sagebrush. This soil is too steep and in many places too stony to be tilled for seedbeds, but the plant cover can be improved by broadcast seedings, revegetation of adjoining areas, and careful control of grazing. *Capability unit VIe-2, dryland. South slope-Chestnut range site.*

Gem extremely stony clay loam, 0 to 30 percent slopes (GmE).-This soil is similar to the soil described as typical of the series, except that it is extremely stony and has a wider range of slope. In places there are outcrops of rock. The stones are mostly between 6 and 20 inches in size. They are so numerous that tillage is not practical. Included in the areas mapped were some small areas of soils that have a surface layer of extremely stony clay or extremely stony loam, and some Bakeoven and Lickskillet soils.

This soil is used for grazing. On much of the range the native vegetation has been replaced by Medusahead wildrye, cheatgrass, and other annuals. In other places, big sagebrush is dominant. These plants produce only small amounts of usable forage. However, if the range is well managed, moderate yields of usable forage can be expected. The soil is too stony to be tilled for seedbeds, but broadcast seedings of bulbous bluegrass will improve the vegetation. Areas that have some remnants of native grasses can be improved by careful control or deferment of grazing. Once established, a good vegetative cover can be maintained by good grazing management. *Capability unit VIIs-1, dryland. Stony-Chestnut range site.*

Gem and Bakeoven extremely stony soils, 0 to 30 percent slopes (GnE).-Gem extremely stony clay loam makes up from 50 to 80 percent of the areas mapped, and Bakeoven extremely rocky loam makes up from 20 to 40 percent. These soils are so mixed that it is not practical to use or map them separately. Except for extreme stoniness, they are similar to the soils described as typical of their respective series. They are covered by many basaltic stones and angular cobblestones that range from 6 to 18 inches in size. Outcrops of rock are common. Small spots of Lickskillet soils were included in some of the areas mapped.

These soils are used and managed in the same way as Gem extremely stony clay loam, 0 to 30 percent slopes, but forage yields are lower, particularly on the very shallow Bakeoven soil. *Capability unit VIIs-1, dryland. The Gem soil is in the Stony-Chestnut range site; the Bakeoven soil is in Shallow stony-Brown range site.*

Gem and Bakeoven extremely stony soils, 30 to 60 percent slopes (GnF).-Gem extremely stony clay loam makes up from 40 to 65 percent of the areas mapped, and Bakeoven extremely rocky loam makes up from 25 to 45 percent. These soils are similar to the soils described as typical of their respective series, except that in places the Gem soil has slightly less clay in the subsoil. They occur mainly on southerly slopes on uplands and mountains. About 5 percent, of the acreage is on northerly slopes. On northerly slopes the effective annual precipitation is lower than is typical for the Gem soils. Many basaltic stones and angular cobblestones that range from 6 to 18 inches in size are on the surface, and outcrops of basalt are common. Small spots of Lickskillet, Gross, or Squaw soils were included in some of the areas mapped.

These soils are used and managed in the same way as Gem stony clay loam, 30 to 60 percent slopes, but forage yields are lower because of the very shallow Bakeoven soil. *The Gem soil is in capability unit VIIs-1, dryland;*

South slope-Chestnut range site. The Bakeoven. soil is in capability unit VIIs-2, dryland; Shallow south slope. Brown range site.

Goose Creek Series

In this series are deep, imperfectly drained soils that are subject to overflow in spring. The surface layer is dark colored and moderately high in content of organic matter. The subsoil is dominantly medium textured and is mottled below a depth of 20 inches. Stratified sand and fine gravel occur at a depth of 30 to 80 inches. The parent material consists of relatively recent alluvium that washed from areas of acid and basic igneous rocks.

The Goose Creek soils are mostly in the Gem-Newell soil association. They occur at elevations of 2,500 to 3,500 feet, on flood plains along Squaw Creek. The annual precipitation ranges from 12 to 20 inches. The slopes generally are less than 1 percent. Erosion is slight, except where overflow has occurred in unprotected areas and cut small gullies. The native vegetation consisted mainly of Idaho fescue, willow, thornapple, and rushes.

These soils contain some gravel but no stones. The available water holding capacity is moderate to high; permeability is moderate in the subsoil; and fertility is high. The water table is below a depth of 50 inches, except in spring when the creek is high.

All of the acreage is used for subirrigated crops and pasture.

Representative profile of Goose Creek loam, at point 390 feet east and 400 feet north of the southwest corner of sec. 3, T. 7 N., R. 1 E., in an alfalfa field.

Ap-0 to 7 inches, very dark grayish-brown (10YR 3/2) loam ; dark grayish brown (10YR 4/2) when dry; weak, medium, platy structure and moderate, medium, granular structure ; friable when moist, slightly hard when dry ; mildly alkaline (pH 7.7).

AC-7 to 24 inches, very dark grayish-brown (10YR 3/2) loam; dark grayish brown (10YR 4/2) when dry; very weak, medium and coarse, subangular blocky structure ; friable when moist, slightly hard when dry ; mildly alkaline (pH 7.7).

C1g 24_ to 41 inches, very dark grayish-brown (10YR 3/2) loam; dark grayish brown (2.5Y 4/2) when dry; massive; common, faint, dark-brown (7.5YR 3/3) mottles; friable when moist, slightly hard when dry; mildly alkaline (pH 7.7).

IIC2g-41 to 54 inches, very dark gray (2.5Y 3/1) very fine sandy loam; grayish brown (2.5Y 5/2) when dry; massive; few, distinct, dark reddish-brown (5YR 3/3) mottles; friable when moist, slightly hard when dry; mildly alkaline (pH 7.6).

IIIC3g-54 to 60 inches, dark reddish-brown (5YR 3/3) loamy coarse sand; reddish brown (5YR 4/3) when dry; massive ; many, fine, faint, dark reddish-brown mottles (5YR 3/4) ; mildly alkaline (pH 7.6).

IVC4-60 inches +, stratified sand and gravel.

The surface layer is very fine sandy loam, loam, silt loam, or clan loam. The depth to the water table is governed largely by the level of the water in Squaw Creek, but the water table may be raised by the percolation of water from irrigated soils upslope. Small areas of Catherine, Black Canyon, and Moulton soils make up about 2 percent of the areas mapped.

Goose Creek loam (Go).-A profile of this soil is the one described as typical of the series.

This soil is used principally for hay and pasture, but some small grain and row crops are grown where flood control is adequate. Vegetative growth or revetments are needed to protect the streambanks. Dikes are necessary in most areas to prevent flooding and channel cutting. If dikes are not provided, a good plant cover should be kept on this soil during spring, when overflow normally occurs. Fall grain can be grown 1 or 2 years in the rotation but must be planted in time to make good fall growth. A grass-legume mixture, for either hay or pasture, gives better protection than grain and should be grown at least 75 percent of the time. Deep-rooted crops obtain some moisture from the water table, but supplemental irrigation is needed for maximum yields. Border, corrugation, or sprinkler irrigation can be used. Manure, nitrogen, and phosphate are needed. *Capability units IIIw-2, irrigated; IVw-4, dryland.*

Gross Series

The Gross series consists of very dark colored soils that formed in residuum weathered from basalt bedrock. The surface layer is loam. It is granular, stony, and high in content of organic matter. The subsoil generally is blocky clay loam or heavy loam. It is underlain by basalt bedrock, which is partially decomposed in the upper part. The surface layer and upper part of the subsoil are slightly acid to neutral in reaction. Generally, there is a weak accumulation of calcium carbonate in tile lower part of the subsoil or in the underlying rock. Stones are common, and there are some outcrops of rock.

These soils are extensive on the steep northerly slopes along both sides of Squaw Butte ridge. They also occur on the east side of Squaw Creek and in a small area south of Montour. Most of the acreage is in the Gear-Newell soil association. The elevation ranges from 2,500 to 5.500 feet, and the annual precipitation, from 13 to 17 inches. The slope ranges from 30 to 75 percent but is dominantly between 45 and 60 percent. The native vegetation consisted of Idaho fescue, bluebunch wheatgrass and other bunchgrasses, and some bitterbush and big sagebrush.

Most of these soils are slightly eroded, but a few are moderately eroded. The available water holding capacity is moderate; fertility is high; and permeability is moderately slow in the subsoil.

These soils are too steep to be farmed and are used for pasture and range.

Representative profile of Gross stony loam, 30 to 60 percent slopes, 600 feet east and 900 feet north of the center of sec. 4, T. 7 N., R. 1 W., in a sagebrush area.

A1-0 to9 inches, black (1OYR 2/1) stony loam; some very fine, angular, basaltic gravel; very dark grayish brown (10YR 3/2) when dry; weak, thin, platy structure and moderate, fine, granular structure; friable when moist, slightly hard when dry; abundant roots; neutral (pH 6.6).

Blt-9 to 19 inches, very dark brown (10YR 2/2) stony heavy loam ; some very fine, angular gravel ; very dark grayish brown (10YR 3/2) when dry ; weak or moderate, medium, subangular blocky structure; thin, patchy clay films on pods; firm when moist, hard when dry ; roots plentiful ; common very fine pores ; neutral (pH 6.6).

B21t-19 to 26 inches; dark-brown (10YR 3/3) stony clay loam; dark grayish brown (10YR 4/2) when dry; weak. medium, prismatic structure and moderate, medium, subangular blocky structure ; thin, continu ous clay films on peds ; firm when moist, hard when dry ; roots plentiful ; common very fine pores ; slightly acid (pH 6.5).

B22t-26 to 33 inches, dark-brown (10YR 3/3) stony clay loam ; moderate amount of subangular, very fine gravel; dark brown (10YR 4/3) when dry; moderate, medium to fine, subangular blocky structure ; thin, continuous clay films on peds ; firm when moist, hard when dry ; few fine roots ; common very fine pores ; neutral (pH 6.3).

B3t-33 to 36 inches, dark-brown (7.5YR 3/3) very stony loam ; much angular, fine gravel ; dark brown (7.5YR 4/3) when dry; moderate, fine, subangular blocky structure ; thin, nearly continuous clay films on peds ; firm when moist, hard when dry ; few fine roots ; many fine and very fine pores; neutral (pH 7.0).

Rca-36 inches +, partially decomposed basalt bedrock ; calcium carbonate in cracks.

Some areas have only a few scattered stones on and in the soil, and other areas are very stony. The B2t horizon is commonly clay loam, but it ranges to heavy loam on some of the steeper slopes. The weak accumulation of calcium carbonate commonly is below a depth of 3 feet and may occur in cracks in the bedrock or as coatings on the lower side of the rock fragments. The depth to bedrock ranges from 20 to 50 inches.

Inclusions of Bakeoven, Gem, De Masters, and Newell soils make up as much as 5 percent of the areas mapped.

Gross stony loam, 30 to 60 percent slopes (GrF).-A profile of this soil is the one described as typical of the series. This soil occurs on steep northerly slopes. Commonly, a few stones are scattered on and in the soil, and there are some outcrops of rock. Except for a few shallow gullies, erosion is moderate to slight.

This soil is used for grazing. The plant cover consists mainly of big sagebrush and an understory of forbs and annual weeds, but some remnants of native bunchgrasses still remain, especially in protected areas. The plant cover can be improved by managing grazing so as to allow the perennial grasses to regain vigor and to reseed. Broadcast seeding helps if the perennial grasses are gone. The seeding of adjacent areas that are less steep may benefit these soils by providing a natural source of seed.

Capability unit VIe-2, dryland. North slope-Chestnut range site.

Gross stony loam, 60 to 75 percent slopes (GrG).-Except for slope, this soil is similar to Gross stony loam, 30 to 60 percent slopes. Erosion is moderate in most places.

Some of the acreage has been used for grazing, but there is a serious hazard in such use. Depletion of the plant cover can cause serious erosion, and trampling by animals tends to loosen the soil and expose it to erosion. Consequently, this soil should be used mainly for watersheds and wildlife habitats. *Capability unit VIIe-2, dryland. North slope-Chestnut range site.*

Gross and Bakeoven very stony soils, 30 to 60 percent slopes (GsF).-Gross very stony loam makes up about 60 to 75 percent of this mapping unit, and Bakeoven very stony loam makes up about 20 to 35 percent. These soils are similar to the soils described as typical of their respective series, but they are so intricately mixed that they cannot be mapped separately. They occur on steep northerly slopes. Many basaltic stones, as much as 2 feet in diameter, occur on these soils, and outcrops of rock are common. Erosion is moderate inmost areas, and there are a few gullies.

These soils are used and managed in the same way as Gross stony loam, 30 to 60 percent slopes, but yields of usable forage are less because of the very shallow Bake oven soil. *The Gross soil is in capability unit VIs-1, dryland; North slope-Chestnut range site. The Bakeoven soil is in capability unit VIIs-2, dryland; Shallow south slope-Brown range site.*

Gross and Bakeoven very stony soils, 60 to 80 percent slopes (GsG).-Gross very stony loam makes up from 50 to 70 percent of this mapping unit, and Bakeoven very stony loam makes up from 20 to 40 percent. These soils occur on very steep northerly slopes. Many basaltic stones, as much as 2 feet in diameter, occur on these soils, and outcrops of rock are common. Erosion is moderate, and there are some gullies.

The Gross soil can be used to a limited extent for grazing. The Bakeoven soil is best suited to watersheds and to wildlife habitats. *The Gross soil is in capability unit VIIe-2, dryland; North slope-Chestnut range site. The Bakeoven soil is in capability unit VIIIs-1, dryland.*

Gwin Series

The Gwin series consists of dark-colored, shallow or very shallow soils that formed in residuum weathered from basalt bedrock. The surface layer has a moderate content of organic matter. The subsoil is dominantly clay loam, but in places it is silty clay loam or loam that grades toward clay loam. The surface layer and subsoil are neutral or slightly acid in reaction. The depth to basalt bedrock ranges from 5 to 20 inches, and the soils are slightly stony to extremely stony.

These soils are extensive in the Gwin-Mehlhorn-Jackknife soil association. They occur at elevations of 3,000 to 5,900 feet, on hills and mountains in the northeastern part of the surveyed area. The slope ranges from 0 to 80 percent but is dominantly between 12 and 60 percent. The annual precipitation ranges from 16 to 23 inches. The native vegetation consisted of bunchgrasses, bitterbrush, and forbs.

These soils are slightly to moderately eroded. Permeability is moderately slow in the subsoil, and the available water holding capacity is very low to low.

All of the acreage is used for pasture and range.

Representative profile of Gwin stony loam, 12 to 30 percent slops, 700 feet west and 100 feet south of the northeast corner of sec. 10, T. 12 1., R. 1 E., in a noncultivated area.

A1-0 to 5 inches, very dark brown (10YR 2/2) stony loam; some basaltic, angular, fine gravel ; dark grayish brown (10YR 4/2) when dry; weak, thin, platy structure and moderate, fine, granular structure; friable when moist, slightly hard when dry; slightly acid (pH 6.4).

B2t-5 to 12 inches, dark-brown (7.5YR 3/3) stony clay loam; dark brown (7.5YR 4/3) when dry; weak, coarse, prismatic structure and weak or moderate, fine, subangular blocky structure ; firm when moist, hard when dry ; thin clay films on peds ; many roots ; many very fine pores; slightly acid (pH 6.4).

B3t-12 to 16 inches, dark-brown (7.5YR 3/3) stony clay loam; interstitial material in the rocks; dark brown (7.5YR 4/3)) when dry; moderate or strong, fine, angular blocky structure; clay films on all surfaces; firm when moist, hard when dry; slightly acid (pH 6.5).

R-16 inches +, fractured, partly decomposed basalt bedrock.

The color of the. moist surface layer ranges from very dark brown (10YR 2/2) to very dark grayish brown

(10YR 3/2) or dark brown (10YR 3/3)). The Bt horizon occurs either as a continuous layer or as interstitial material in the rock fragments or in the bedrock fractures. The subsoil ranges from 7.5YR to 5YR or 10YR in hue. The rock fragments range from angular gravel to large boulders. Bedrock crops out in places.

Gwin stony loam, 12 to 30 percent slopes (GtE).-A profile of this soil is the one described as typical of the series. This soil is slightly to moderately eroded, and deep gullies have formed in some drainageways.

All of the acreage is used for pasture and range. The plant cover is in poor to fair condition. There are enough stones and outcrops of rock to interfere with tillage but not enough to prevent the preparation of seedbeds for reseeding. *Capability unit VIe-2, dryland. Shallow stony-Prairie range site.*

Gwin extremely stony loam, 0 to 30 percent slopes (GwE).-This soil is moderately eroded, and some gullies extend to bedrock. All of the acreage is used for pasture and range, but in most places the plant cover is in poor condition. There are enough stones and outcrops of rock to prevent tillage. *Capability unit VIs-1, dryland. Shallow stony-Prairie range site.*

Gwin extremely stony loam, 30 to 60 percent slopes (GwF).-This soil is on steep southerly slopes. It has a thinner surface layer and somewhat less clay in the subsoil than Gwin stony loam, 12 to 30 percent slopes, and in most places the depth to bedrock is slightly less. Erosion is slight to moderate, and several gullies extend to bedrock. Rock outcrops and stones are more numerous than on the less steeply sloping Gwin soil.

This soil is too steep for tillage. It is used for pasture and range, but in most places the plant cover is in poor condition. *Capability unit VIs-1, dryland. Shallow stony-Prairie range site.*

Gwin extremely stony loam, 60 to 80 percent slopes (GwG).-This soil is on very steep southerly slopes. It has a thinner surface layer and less clay in the subsoil than the typical soil, and it commonly is shallower to bedrock. Stones and outcrops of rock are numerous. Erosion is slight to moderate, and several gullies extend to bedrock.

This soil is used for grazing. In most places the plant cover is in either poor or fair condition, depending on past management and on the steepness of the slope. On steeper slopes, the plant cover is more dense, and, consequently, there has been less erosion. This soil should be set aside for use as watersheds or wildlife habitats. *Capability unit VIIIs-1, dryland.*

Harpt Series

In this series are well-drained soils on alluvial fans. The surface layer is dark-colored coarse sandy loam or loam that has a moderate content of organic matter. The subsoil, between 6 inches and 20 or 30 inches, is dominantly loam, but it includes strata of sandy loam. sandy clay loam, and clay loam. The underlying materials are stratified but are principally sandy alluvium. The parent materials washed mostly from soils that formed in sedi ments of the Idaho and Payette formations. These sediments are feldspathic, micaceous, high in quartz, and noncalcareous. They weathered principally from acid igneous rocks.

These soils are extensive in the Harpt-Cashmere soil association. They occur on sloping alluvial fans, mainly in the southern and eastern parts of the Emmett Valley. They also occur on alluvial fans and bottom lands in most areas of the Idaho and Payette formations. The elevation ranges from 2.300 to 4.000 feet. The annual precipitation is about 9 to 13 inches, but additional moisture is received from surface runoff. The slope ranges from 0 to 30 percent but generally is between 2 and 5 percent, and the gradient is mostly in one direction. The native vegetation consisted principally of bunchgrasses, big sagebrush, and forbs.

These soils contain much coarse quartz sand and some fine gravel. Erosion has been slight in most areas, but there are some rills and gullies along drainageways. Fertility is high. and permeability is moderate in the subsoil.

The Harpt soils are used principally for orchards. A small acreage is used for irrigated hay, corn. and small grain, and an even smaller acreage for irrigated pasture. Non irrigated soils are used for range.

Representative profile of Harpt loam, 3 to 7 percent slopes, 120 feet south and 550 feet west of the center of the SE1/4 sec. 19, T. 6 N., R. 1 W., in an orchard.

Ap-0 to 10 inches, very dark grayish-brown (10YR 3/2) loam; grayish brown (10YR 5/2) when dry; weak, medium. granular structure; friable when moist, slightly hard when dry; slightly acid (pH 6.2).

C1-10 to 31 inches, very dark grayish-brown (10YR 3/2) loam; grayish brown (10YR 5/2) when dry; very weak, medium, subangular blocky structure ; friable when moist, slightly bard when dry; plentiful fine roots ; many fine and very fine pores ; neutral (pH 6.6).

C2-31 to 46 inches, very dark grayish-brawn (2.5Y 8/2) loam; grayish brown (10YR 5/2) when dry ; massive; friable when moist, slightly hard when dry ; plentiful fine roots ; many fine and very fine pores ; neutral (pH 6.8).

IIC3--46 to 80 inches, light olive-brown (2.5Y 5/3) coarse sandy loam ; light brownish gray (10YR 6/ 2) when dry ; massive ; very friable when moist, slightly hard when dry ; few fine roots ; neutral (pH 6.9).

Buried soils are common and may occur at any depth in the profile. Strata of coarse sandy loam, sandy clay loam, or clay loam are also common. The entire profile is micaceous. Sandy loam and loamy sand are common below a depth of 50 inches.

Small areas of Cashmere and Bissell soils were included in the areas mapped, and these soils make up as much as 5 percent of the irrigated acreage and as much as 10 percent, of the nonirrigated acreage. In sections 27 and 34, T. 7 N., R. 1 W., the soils have been influenced to some extent by basaltic materials.

Harpt coarse sandy loam, 1 to 3 percent slopes (HaB).-A profile of this soil is similar to the one described as typical of the series, except that the surface layer is 6 to 18 inches of coarse sandy loam. The available water holding capacity is moderate.

This soil is used for irrigated orchard crops, small grain, row crops, and pasture. A good crop rotation and the use of manure, green-manure crops, and crop residues will maintain an adequate amount of organic matter in this soil. A suitable crop rotation consists of a grass-legume crop and not more than 2 successive years of a row crop. Orchard, pasture, and grain crops respond to nitrogen. Legumes and corn respond to phosphate. Irrigation can be by the sprinkler, border, corrugation, or

furrow method. *Capability units IIe-3, irrigated; VIs-2, dryland. Granitic-Brown range site.*

Harpt coarse sandy loam, 3 to 7 percent slopes (HaC).-This soil is similar to the soil described as typical of the series, except that the surface layer is 6 to 18 inches of coarse sandy loam. The available water holding capacity is moderate, and erosion is slight to moderate.

Most of the acreage is used for irrigated orchard crops, small grain, row crops, and pasture. The irrigated areas can be used and managed in the same way as the irrigated areas of Harpt coarse sandy loam, 1 to 3 percent slopes, except that they should be kept in grasses and legumes for longer periods because of the greater hazard of erosion. Border irrigation is not suitable, but the sprinkler, corrugation, or furrow method can be used.

The nonirrigated soil is used for pasture and range. It can be managed in the same way as Harpt loam, 3 to 7 percent slopes. *Capability units IIIe-3, irrigated; VIs-2, dryland. Granitic-Brown range site.*

Harpt coarse sandy loam, 7 to 12 percent slopes (HaD).-This soil is similar to the soil described as typical of the series, except that the surface layer is 6 to 18 inches of coarse sandy loam. The available water holding capacity is moderate. Erosion is moderate to slight, and gullies have formed in some drainageways.

Most of this soil is used for irrigated orchard crops, small grain, and pasture. Permanent cover crops are needed in the orchards to control erosion. A grass-legume crop protects and builds up the soil and should be included in the rotation. A grain crop increases the susceptibility of this soil to erosion and should be limited to 1 year in the rotation. A row crop should not be included in the rotation, because of the erosion hazard. Nitrogen and phosphate are needed. Sprinklers are preferable for irrigation, but corrugations can be used if the runs are short and the streams are controlled.

A small acreage is used for pasture and range. The pasture and range are used and managed in the same way as on Harpt loam, 3 to 7 percent slopes. *Capability units IVe-2, irrigated; VIs-2, dryland. Granitic-Brown range site.*

Harpt coarse sandy loam, 12 to 30 percent slopes (HaE).-This soil is similar to the soil described as typical of the series, except that the surface layer is 6 to 15 inches of coarse sandy loam. The available water holding capacity is moderate. Erosion is moderate to slight, and there are some gullies along the drainageways.

Most of this soil is used either for irrigated orchards or for pasture and range. Permanent cover crops are needed to control erosion. Orchards respond to nitrogen, and alfalfa responds to phosphate. Sprinkler irrigation is preferable because irrigation by other methods increases the erosion hazard.

The pasture and range are in poor condition. Management needs are similar to those of Harpt loam, 3 to 7 percent slopes. *Capability units VIe-l, irrigated; VIe-2, dry land. Granitic-Brown range site.*

Harpt loam, 0 to 1 percent slopes (HrA).-This soil is similar to the soil described as typical of the series. It occurs on the lower part of alluvial fans. The available water holding capacity and fertility are high.

This soil is used for irrigated crops and pasture and to some extent for orchards. irrigated use for orchards is limited because of the danger of frost. Management needs are the same as those for irrigated crops on Harpt loam, 1 to 3 percent slopes, but the hazard of erosion is less. *Capability units I-1, irrigated; IVe-1, dryland.*

Harpt loam, 1 to 3 **percent slopes** (HrB).-This soil is similar to the soil described as typical of the series. It has a high available water holding capacity. Included in the areas mapped are a few areas in which the surface layer and subsoil are clay loam or light clay loam. The soil in these areas commonly occurs in lower lying positions and in places is influenced to some extent by basaltic materials.

Much of this soil is used for irrigated orchard crops, small grain, row crops, and pasture; a small part is dry farmed; and the rest is used for range. Permanent cover crops are needed in orchards to maintain the content of organic matter and to increase permeability. Utilizing green-manure crops and crop residues and including a grass-legume mixture in the rotation help to keep the soil productive. Nitrogen and phosphate are needed. Irrigation can be by the sprinkler, border, corrugation, or furrow method.

If this soil is dry farmed, yields of hay crops and small grain are low because of the lack of available moisture during the growing season. A grain crop should be followed by a year of summer fallow, so that some moisture will be carried over to the next grain crop. A mixture of grasses and legumes in the rotation helps to preserve soil structure and to maintain the organic-matter content. Utilization of stubble and manure helps to maintain productivity and to control erosion. Some nitrogen is needed to speed decomposition. Phosphate may be needed on alfalfa and clover.

The pasture and range are used and managed in the same way as on Harpt loam, 3 to 7 percent slopes. *Capability units IIe-2, irrigated; IVc-1, dryland. Granitic-Brown range site.*

Harpt loam, 3 to 7 percent slopes (HrC)-A profile of this soil is the one described as typical of the series. Included in the areas mapped were a few areas in which the surface layer and subsoil are clay loam or light clay loam. This included soil occurs on the eastern edge of the Emmett Valley and has been influenced to some extent by basaltic material from the nearby hills. Because of its finer texture, it requires additional care in tillage and irrigation. Also included were some very gently sloping soils. The available water holding capacity is high.

Most of this soil is used for irrigated orchard crops, hay, pasture, small grain, and row crops. Orchards need permanent cover crops to control erosion and to maintain the content of organic matter. A grass-legume mixture in the rotation provides the same benefits on cropland. The utilization of manure, green manure, and crop residues helps to maintain productivity. Nitrogen is needed on orchard crops, pasture crops, small grain, and row crops. Phosphate benefits legumes. Sprinkler irrigation is preferable, particularly in orchards. Corrugation and furrow methods can be used, but irrigation by these methods may cause erosion unless special care is taken.

A small acreage is dry farmed. Management needs are the same as those of dry-farmed Harpt loam, 1 to 3 percent slopes.

Most of the nonirrigated acreage is used for grazing. The plant cover generally is in poor condition and is dominated by cheatgrass, big sagebrush, and annual weeds.

A good plant cover can be established by summer fallowing, preparing good seedbeds, and reseeding with desirable plants. A suitable mixture consists of Ladak alfalfa seeded with a grass, such as crested wheatgrass. Siberian wheatgrass, Whitmar beardless wheatgrass, pubescent wheatgrass, or intermediate wheatgrass. Once established, a good stand can be maintained by good grazing management. This soil is readily accessible to grazing animas and, consequently, is likely to be overgrazed. *Capability units IIIe-1, irrigated; IVe-1, dryland. Granitic-Brown range site.*

Harpt loam, 7 to 12 percent slopes (HrD).-A profile of this soil is similar to the one described as typical of the series. This soil is slightly to moderately eroded, and there are some gullies along drainageways. Included in the areas mapped were some small areas of less sloping soils. The available water holding capacity is high.

Irrigated areas are used and managed in the same way as the irrigated areas of Harpt coarse sandy loam, 7 to 12 percent slopes. However, this soil produces slightly better yields than the coarser textured soil and requires less frequent irrigation.

Some nonirrigated areas are used for dry-farmed crops. These areas need the same management as the dry-farmed areas of Harpt loam, 1 to 3 percent slopes.

Most of the dry-farmed acreage is used for pasture and range and needs the same management as dry-farmed Harpt loam, 3 to 7 percent slopes. *Capability units IVe-1, irrigated; IVe-7, dryland. Granitic-Brown range site.*

Harpt loam, 12 to 30 percent slopes (HrE).-A profile of this soil is similar to the one described as typical of the series. The available water holding capacity is high. Erosion is slight to moderate, and there are some gullies drainageways.

This soil is used mainly for irrigated orchards and for pasture and range. Orchards respond to applications of nitrogen and phosphate. Permanent cover crops are needed in orchards to minimize runoff and control erosion. Sprinkler irrigation is preferable because of the erosion hazard.

The pasture and range are used and managed in the same way as on Harpt loam, 3 to 7 percent slopes. *Capability units VIe-1, irrigated; IVe-7, dryland. Granitic-Brown range site.*

Haw Series

This series consists of well-drained soils on dissected uplands. These soils formed in coarse textured or moderately coarse textured, unconsolidated or weakly consolidated sediments of the Idaho and Payette formations. These sediments were derived from granitic rocks or related acid igneous rocks and are feldspathic, micaceous, high in quartz, and mostly noncalcareous. In many places the uppermost part of the soil material probably formed in or was influenced by silty wind-laid material deposited as a thin layer over the rock formations. The surface layer is dark colored and has a moderately low content of organic matter. The subsoil is sandy clay loam, clay loam, or gravelly clay loam that contains much more clay than the surface layer. Bleached silt and sand grains on peds are common in the lower part of the surface horizon and in the upper part of the subsoil horizon but are not numerous enough to form a distinct bleached horizon. A small amount of calcium carbonate typically occurs below a depth of 25 to 40 inches.

These soils occupy a large acreage in the Haw-Payette-Van Dusen soil association. They occur at elevations of 2,500 to 4,500 feet, on uplands that are north and east of Emmett and east of Pearl. The annual precipitation ranges from 11 to 13 inches. The slope ranges from 1 to 30 percent, except where these soils are associated with the steeper Payette soils. The native vegetation consisted of bunchgrasses, some big sagebrush, and annual forbs and grasses.

Generally, the soils are free of stones, but in some places sandstone debris has fallen from higher ledges. Erosion is slight to severe, and deep gullies have formed in drainageways. Permeability is moderately slow in the subsoil.

These soils are used principally for range. A small acreage is used for dry-farmed alfalfa and small grain. A smaller acreage is irrigated.

Representative profile of Haw loam, 7 to 12 percent slopes, 1,600 feet south and 1.320 feet east of the northwest corner of sec. 27, T. 6 N., R. 1 W., in a noncultivated area.

Al-0 to 8 inches, very dark grayish-brown (10YR 3/2) loam; grayish brown (10YR 5/2) when dry; weak, fine, platy structure and weak or moderate, very fine, granular structure; friable; slightly hard; roots plentiful; neutral (pH 6.7 to 6.9).

A3-8 to 12 inches, very dark grayish-brown (10YR 3/2) loam ; grayish brown (10YR 5/2) when dry; very weak, medium, prismatic structure and weak, medium, subangular blocky structure; many bleached silty specks on peds ; few very fine and common fine pores ; neutral (1)11 6.6).

B1-12 to 13 inches, dark-brown (10YR 3/3) loam ; grayish brown (10YR 5/2) when dry; weak or moderate, medium, prismatic structure and moderate, medium, subangular blocky structure; bleached coatings on ped surfaces : firm ; hard ; few fine roots ; many very fine pores: slightly acid (pH 6.3 to 6.6).

B21t-18 to 25 inches, dark-brown (10YR 4/3) clay loam; brown (10YR 5/3) when dry ; moderate, fine, prismatic structure and weak. coarse, subangular blocky structure ; slightly darker colored, moderate clay films on ped surfaces; very firm; very hard; few very fine pores; few fine roots; neutral (pH 6.7).

B22t-25 to 30 inches, dark-brown (10YR 4/3) heavy loam; brown (10YR 5/3) when dry; weak, coarse, prismatic structure and very weak, coarse, subangular blocky structure; darker colored, thin, continuous clay films on ped surfaces ; firm : very bard; very few fine roots ; few very fine pores; neutral (pH 6.7).

Clca-30 to 39 inches, dark-brown (10YR 4/3) coarse sandy loam; brown (10YR 5/3) when dry ; massive ; friable ; hard; very few fine roots ; few very fine pores ; slightly calcareous with common calcium carbonate veins ; mildly alkaline (pH 7.7).

C2ca-39 to 49 inches, olive-brown (2.5Y 4/3) coarse sandy loam; light yellowish brown (2.5Y 6/3) when dry; massive; friable ; slightly hard; very few fine roots ; common very fine pores ; slightly calcareous ; moderately alkaline (pH 7.9).

C3-49 to 75 inches, light yellowish-brown (2.5Y 6/3) coarse sand with very thin, wavy, horizontal, clayey bands; pale yellow (2.5Y 7/3) when dry; single grained; loose; noncalcareous; moderately alkaline (pH 8.3).

The surface layer is dominantly loam, but in places it is sandy loam, silt loam, or gravelly loam. The A horizon ranges from 6 to 12 inches in thickness. A hue of 10YR is dominant in the B horizon, but in places the hue tends toward 7.5YR. Some peds in the upper part of the subsoil are coated with a dark-colored organic stain. Loose, coarse sand commonly underlies these soils at a depth of 42 to 54 inches, but in places the C horizon is stratified

and consists of moderately coarse textured material. In places where the Haw soils are adjacent to the Dishner soils, they are underlain by sandstone at a depth of 24 to 60 inches. In these areas the subsoil is redder and the bleached coatings are more pronounced than in the typical Haw soil. The stony Haw soils are also associated with the Dishner soils. The stones are fragments from the sandstone that underlie the Dishner soils.

In some of the lowest lying areas, Haw soils have less clay in the B horizon and fewer clay films than the typical soil and few or no bleached specks. These areas of the Haw soils are transitional toward the Bissell soils. One such area occurs near the southwest corner of sec. 35, T. 7 N., R. 1 W. Adjacent to the Sweet soils, some Haw soils have hardpan lenses at a depth of 24 to 60 inches.

Inclusions of Bissell, Sweet, Dishner, Lolalita, Payette, and Van Dusen soils make up as much as 5 percent of the areas mapped. Another 3 or 4 percent is a soil that has a bleached A2 horizon and is similar to Kepler loam but lacks a hardpan.

Haw loam, 1 to 3 percent slopes (HwB).-This soil is similar to the soil described as typical of the series, except that it has slightly more clay in the subsoil and more bleached specks. The hazard of erosion is very slight.

This soil is used for irrigated and dry-farmed crops and for range. The irrigated crops include pasture, hay, small grain, row crops, and orchard crops. A rotation that includes a mixture of grasses and legumes is needed to help maintain the organic-matter content and to preserve soil structure. Utilization of crop residues, manure, and green manure helps to maintain soil tilth and productivity. Irrigation can be by the border, corrugation, or furrow method. Sprinklers can be used on such close-growing crops as hay or pasture. Irrigation water should be applied slowly because of the moderately slowly permeable subsoil and the slight hazard of erosion.

The use of this soil for dry-farmed crops is limited because of the lack of available moisture during the growing season. Suitable crops are small grain, mixtures of alfalfa and grass, grass for seed, alfalfa for seed, and pasture crops. Mixtures of grasses and legumes help to maintain or increase the organic-matter content and to preserve soil structure. Plowing under the last hay crop for green manure improves the. soil, helps to preserve structure, and helps to control erosion. Utilization of manure and stubble helps to maintain productivity and to control erosion. Nitrogen will speed decomposition. Phosphate may be needed on legumes.

The range is mostly in poor condition. The plant cover consists principally of Medusahead wildrye, cheatgrass, big sagebrush, and annual weeds. A good plant cover can be established by summer fallowing, preparing good seedbeds, and reseeding suitable plants. A suitable mixture consists of Ladak alfalfa seeded with Siberian wheatgrass, crested wheatgrass, Whitmar beardless wheatgrass, Sherman big bluegrass, pubescent wheatgrass, or intermediate wheatgrass. Once established, a good plant cover can be maintained by good management practices. *Capability wits IIe-2, irrigated; IVc-1, dryland. Loamy-Brow n range site.*

Haw loam, 3 to 7 percent slopes (HwC).-This soil is similar to the soil described as typical of the series, except that it is gently sloping or undulating. The underlying material is loose sandy or gravelly material of the Idaho formation or sandstone bedrock.

This soil is used for irrigated and dry-farmed crops and for pasture and range. The irrigated crops include pasture, hay, small grain, row crops, and orchard crops. A rotation that includes a mixture of grasses and legumes is needed to maintain the organic-matter content and to preserve soil structure. Utilizing manure and crop residues helps to maintain productivity and to preserve soil structure. Good response to nitrogen and phosphate can be expected. Irrigation can be by the corrugation or furrow method, but sprinklers can be used if closegrowing crops are grown. Because of the slope and moderately slow permeability, the length of the runs and the size of irrigation streams need to be adjusted so as to avoid erosion.

If this soil is dry farmed, management for crops, pasture, and range is the same as for dry-farmed Haw loam, 1 to 3 percent slopes. *Capability units IIIe-2, irrigated; IVe-1, dryland. Loamy-Brown range site.*

Haw loam, 7 to 12 percent slopes (HwD).-A profile of this soil is the one described as typical of the series. In places the surface layer is clay loam, and in some places the underlying material is sandstone.

This soil is used for irrigated and dry-farmed crops and for range. Irrigated pasture crops, hay crops, small grain, and an occasional row crop can be grown if the soil is well managed. A rotation that includes a grass-legume mixture is needed to maintain the organic-matter content, to preserve soil structure, and to control erosion. Nitrogen and phosphate are needed. Irrigation can be by the sprinkler. corrugation, or furrow method but needs to be carefully controlled so that it will not cause erosion.

If this soil is dry farmed, management for crops, pasture, and range is the same as for dry-farmed Haw loam, 1 to 3 percent slopes. *Capability units IVe-1, irrigated; IVe-h, dryland. Loamy-Brown range site.*

Haw loam, 12 to 30 percent slopes (HwE).-A profile of this soil is similar to the one described as typical of the series. This soil occupies a large total acreage, mostly on hilly or moderately steep uplands. It is susceptible to erosion if not protected by a vegetative cover. Most of it has been slightly eroded, and many spots have been moderately eroded by water. Deep gullies occur in some of the large drainageways and in a few of the smaller drainageways. In some places the soil is underlain by sandstone; in other places it is underlain by a weakly cemented hardpan. Included in the areas mapped are some soils that have a surface layer of clay loam or silt loam. These included soils have a slightly higher water-holding capacity than Haw loam.

In some areas, indicated on the soil map by stone symbols, there are enough stones or cobblestones on and in the surface layer to hinder tillage, but not enough to prevent tillage. In others, indicated on the soil map by gravel symbols, the surface layer is a gravelly loam or gravelly sandy loam, and in some of these the subsoil is also gravelly. These stony and gravelly areas are somewhat difficult to till.

This soil is used for irrigated and dry-farmed crops and for range. Irrigated orchards need permanent cover crops. The cover crops can be mowed or chopped prior to harvest but should be left on the soil to control damage by Trampling or by erosion. This soil is best kept in

permanent hay and pasture plants and plowed only to reestablish these plants. Legumes respond to phosphate, and grass responds to nitrogen. Irrigation by sprinklers is preferable, but controlled flooding can be used if the streams are small.

The use of this soil for dry-farmed crops is limited by the lack of available moisture during the growing season. Suitable crops are small grain, a mixture of alfalfa and grass, grass for seed, alfalfa for seed, and pasture plants. A rotation that includes a mixture of grasses and legumes much of the time is needed to maintain the organicmatter content, to preserve soil structure, and to control erosion. The utilization of manure, green manure, and stubble helps to maintain productivity and to control erosion. Nitrogen can be used to speed decomposition. Phosphate benefits legumes.

The range is used and managed in the same way as on Haw loam, 1 to 3 percent slopes. *Capability units VIe-1, irrigated; IVe-7, dry land. Loamy-Brown range site.*

Haw extremely stony loam. 12 to 30 percent slopes (HxE).-This soil is similar to the soil described as typical of the series but has many stones and cobblestones, chiefly of sandstone, on the surface and in the uppermost part of the profile. These stones and cobblestones rolled from adjacent higher lying areas or from sandstone ledges. In some places the surface layer is sandy loam, and in others it is clay loam. In some areas this soil is moderately deep to the underlying material, and the subsoil is less clayey than that in the typical soil. In places the underlying material is sandstone. The available water holding capacity is moderate.

This soil is used for pasture and range. The plant cover commonly is in fair condition. The principal plants are three-awn, Indian ricegrass, Idaho fescue, Sandberg bluegrass, some big sagebrush, bitterbrush. and annual Weeds. This soil is too stony to be tilled for seedbeds, but the plant cover generally can be gradually improved by spraying the brush and by controlling grazing to allow perennial grades to reseed. *Capability unit VIs-1, dryland. Stony-Brown range site.*

Jacknife Series

This series consists of very deep, very dark colored soils on alluvial and colluvial fans at the base of steep slopes. The surface layer is nonstony to extremely stony loam, silt loam, or clay loam. It has a high content of organic matter. The subsoil is clay or moderately fine textured material that grades toward clay. The parent material is local basaltic alluvium and colluvium- In places basaltic gravel, cobblestones, or stones are mixed in the soil material below a depth of 10 to 36 inches. The reaction is neutral or slightly acid.

These soils occupy a large acreage in the Gwin-Mehlhorn-Jacknife soil association. They occur at elevations of 3,000 to 4,000 feet and extend from the east-central part through the northern part of the surveyed area. The annual precipitation ranges from 17 to 23 inches. The slope ranges from 1 to 30 percent but is dominantly between 5 and 12 percent. The native vegetation consisted of Idaho fescue. bluebunch wheatgrass. Sandberg bluegrass, lupine,. aspen, chokecherry, and thornapple. Willows grew around springs and along creeks.

Erosion is slight to moderate. The available water holding capacity is high, permeability is moderately slow to slow, and fertility is high.

These soils are used for range, dry-farmed crops, and some irrigated crops.

Representative profile of Jacknife loam, 7 to 12 percent slopes, 2,300 feet east and 1,300 feet north of the southwest corner of sec. 27, T. 11 N., R. 1 E., in an alfalfa field.

Ap-0 to 5 inches, very dark brown (10YR 2/2) loam; very dark grayish brown (10YR 3/2) when dry; weak. medium, platy structure and moderate, medium and fine, granular structure; friable when moist, slightly hard when dry; abundant roots; neutral (pH 6.8).

A1-5 to 14 inches. very dark brown (10YR 2/2) loam; very dark grayish brown (10YR 3/2) when dry; few bleached silt grains; strong, fine, granular structure; fine roots plentiful ; many worm holes and casts ; neutral (pH 6.s).

Blt-14 to 19 inches. very dark brown (7.5YR 2/2) clay loam; dark brown (7.5YR 3/2) when dry; some basaltic gravel; strong, very fine, subangular blocky structure and strong to moderate, fine, granular structure; friable when moist, slightly hard when dry: fine roots plentiful ; many fine and very fine pores ; thin, patchy day films on peds; neutral (pH (6.8).

B21t-19 to 34 inches, dark-brown (7.5YR 3/2), cobbly clay or heavy clay loam; dark brown (7.5YR 4/3) when dry ; moderate, medium. prismatic structure and moderate, fine and very fine, angular blocky structure; firm when moist, very hard when dry ; few fine roots ; common very fine pores ; thick, continuous, dark-brown (7.5YR 3/2) clay films on peds; neutral (pH 7.0).

B22t-34 to 38 inches, dark-brown (7.5YR 3/3), cobbly and gravelly heavy clay loam ; not prismatic ; medium,continuous clay films on peds.

IIC-38 to 60 inches, subangular, basaltic cobblestones and gravel and considerable clay loam and loam interstitial material; neutral.

When dry, the surface layer ranges from 10YR 3/2 to 10YR 4/1 or 4/2 in color. The subsoil has moderate to strong structure. Its hue is dominantly 7.5YR but in places grades slightly toward 10YR or 5YR. In most areas there are small amounts of subangular gravel or cobblestones, and in some there are large enough amounts that the soils are classified as stony.

Adjacent to springs, the included soils are darker colored throughout and commonly have a clay loam to loam subsoil. These soils are similar to the De Masters soils but are underlain by loose stones rather than bedrock. Areas of the Mehlhorn and De Masters soils occur as inclusions and make up as much as 5 percent of some areas mapped.

Jacknife clay loam, 1 to 3 percent slopes (JaB).-This soil is similar to the soil described as typical of the series, except that the surface layer is clay loam. In places the subsoil contains angular, basaltic cobblestones and stones.

This soil is used for irrigated and dry-farmed crops and for range. The irrigated crops include pasture, al falfa, small grain, and row crops. A mixture of grasses and legumes in the rotation helps to maintain the organicmatter content and to preserve soil structure. Manure and green manure help to maintain good soil tilth and workability. Alfalfa and other legumes respond to phosphate, and pasture crops, small grain, and row crops respond to nitrogen. Irrigation can be by the border, corrugation, furrow, or sprinkler method.

The dry-farmed crops include small grain, alfalfa. alfalfa for seed, and pasture, but the use of this soil' for dry-farmed crops is limited by the lack of available mois-

ture during the growing season. A mixture of grasses and legumes in the rotation helps to maintain the organic-matter content and to preserve soil structure. The rotation can be extended by adding a green-manure crop of Austrian peas, then another grain crop. Plowing under the last hay crop for green manure and utilizing stubble and manure help to maintain productivity, to preserve soil structure, and to control erosion. Some nitrogen is needed to speed decomposition.

The plant cover on the range is in poor to fair condition. This soil can be tilled, however, and if reseeded will produce high yields. *Capability units IIe-1, irrigated; IIe-1, dryland. Loamy-Prairie range site.*

Jacknife clay loam, 3 to 7 percent slopes (JaC).-This soil is similar to the soil described as typical of the series, except that the surface layer is clay loam. In places the subsoil contains angular, basaltic cobblestones and stones. Erosion is slight to moderate, and deep tallies have formed in some drainageways.

In a few areas there are enough stones and cobblestones on and in the surface layer to hinder tillage but not enough to prevent tillage. These areas are indicated on the soil map by the stone symbols.

This soil is used for irrigated and dry-farmed crops and for range. The irrigated crops include pasture, hay, small grain, and row crops. A mixture of grasses and legumes in the rotation helps to maintain the organicmatter content, to preserve soil structure, and to control erosion. Manure and green manure help to maintain good tilth and workability. Alfalfa and other legumes respond well to phosphate, and pasture plants, small grain, and row crops respond to nitrogen. Irrigation can be by the sprinkler, corrugation, or furrow method, but the length of the run and the size of the irrigation stream need to be limited so that irrigation will not cause erosion.

The dry-farmed crops include small grain, alfalfa, alfalfa for seed, and pasture. Areas used for dry-farmed crops need the same management as dry-farmed Jacknife clay loam, 1 to 3 percent slopes.

The range is used and managed in the same way as on Jacknife clay loam. 1 to 3 percent slopes. *Capability units IIIe-1. irrigated; IIIe-5 dryland. Loamy-Prairie range site.*

Jacknife clay loam, 7 to 12 percent slopes (JaD).This soil is similar to the soil described as typical of the series, except that the surface layer is clay loam. In places the subsoil contains angular, basaltic cobblestones and stones. Erosion is slight to moderate, and deep gullies have formed in some drainagewavs.

This soil is used for irrigated and dry-farmed crops and for range. The irrigated crops include pasture, hay, and small grain. A mixture of grasses and legumes is desirable in the rotation to maintain the organic-matter content, to preserve soil structure, and to control erosion. More than 1 year of an annual crop, such as a row crop or a small grain, tends to increase erosion, to decrease the content of organic matter, and to impair soil structure. The utilization of manure and crop residues helps to maintain productivity. Nitrogen and phosphate are needed for maximum production. Irrigation can be by the sprinkler, corrugation, or furrow method, but the length of the run and size of the irrigation stream need to be limited so as to avoid erosion.

The dry-farmed crops include small grain, alfalfa, alfalfa for seed, and pasture. Areas used for dry-farmed crops are managed in the same way as the dry-farmed Jackknife clay loam,1 to 3 percent slopes.

The range is managed in the same way as on Jacknife clay loam, 1 to 3 percent slopes. *Capability units IVe-1, irrigated; IIIe-5, dryland. Loamy-Prairie range site.*

Jacknife loam, 1 to 3 percent slopes (JcB).-A profile of this soil is similar to the one described as typical of the series.

This soil is used and managed in the same way as Jacknife clay loam, 1 to 3 percent slopes, but it is somewhat easier to work than Jacknife clay loam. *Capability units IIe-1, irrigated; IIe-1, dryland. Loamy-Prairie range site.*

Jacknife loam, 3 to 7 percent slopes (JcC).-A profile of this soil is similar to the one described as typical of the Series.

Where irrigated, this soil is used and managed in the same way as the irrigated areas of Jacknife clay loam, 3 to 7 percent slopes. However, this soil is easier to till than Jacknife clay loam.

If this soil is dry farmed, management for crops, pasture, and range is the same as for dry-farmed Jacknife clay loam, 1 to 3 percent slopes. *Capability units IIIe-1, irrigated; IIe-4, dry land. Loamy-Prairie range site.*

Jacknife loam, 7 to 12 percent slopes (JcD). A profile of this soil is the one described as typical of the series.

Where irrigated, this soil is used and managed in the same way as the irrigated areas of Jacknife clay loam, 7 to 12 percent slopes, but this soil is somewhat easier to work than Jacknife clay loam.

If this soil is dry farmed, management for crops, pasture, and range is the same as for dry-farmed Jacknife clay loam, 1 to 3 percent slopes. *Capability units IVe-1, irrigated; IIIe-5, dryland. Loamy-Prairie range site.*

Jacknife loam, 12 to 30 percent slopes (JcE).-Except for slope, this soil is similar to the soil described as typical of the series.

Included in the areas mapped are soils that have a surface layer of clay loam or light clay loam. These included soils are slightly more difficult to till than Jacknife loam.

This soil is used for dry-farmed crops and for pasture and range, but its use for crops is limited by the moderately steep slopes and the lack of available moisture during the growing season. The principal crops are small grain, alfalfa, and pasture plants. A mixture of grasses and legumes is needed in the rotation to maintain the organic-matter content and to preserve soil structure. Plowing under the last hay crop for green manure helps to maintain productivity, to preserve soil structure, and to control erosion. The utilization of manure and stubble also helps to maintain productivity. Nitrogen is needed to speed decomposition. Legumes respond to phosphate.

The range is managed in the same way as on Jacknife clay loam, 1 to 3 percent slopes. *Capability unit IVe-4, dryland. Loamy-Prairie range site.*

Jacknife stony loam, 12 to 30 percent slopes (JfE).This soil differs from the soil described as typical of the series in that it has a stony surface layer. The stones hinder but do not prevent tillage.

Included in the areas mapped were a few soils that have a surface layer of stony clay loam or light clay loam.

These included soils are slightly more difficult to till than Jacknife loam.

This soil is used and managed in the same way as Jacknife loam, 12 to 30 percent slopes. *Capability unit IVe-4, dryland. Loamy-Prairie range site.*

Jacknife extremely stony loam, 0 to 30 percent slopes (JkE).-This soil is similar to the soil described as typical of the series, except that it has an extremely stony surface layer and a stony subsoil. Erosion is slight to moderate, and deep gullies have formed in some drainageways. In some areas the surface layer is light clay loam or clay loam that contains numerous stones.

This soil is used for pasture and range. The plant cover is mostly in poor to fair condition. Stoniness prevents tillage for the preparation of seedbeds. Management that favors the remaining perennial grasses swill help to improve the cover. *Capability unit VIs-1, dryland. Stony-Prairie range site.*

Jenness Series

In this series are very deep, well-drained soils on bottom lands and alluvial fans. These soils occur along drainageways in the uplands south of the Emmett Valley. The surface layer is light colored and low in content of organic matter. The subsoil, between plow depth and at least 20 or 30 inches, is dominantly medium textured and contains little or no accumulation of clay. Stratification is common below a depth of about 30 inches, and in places there are layers of sandy loam, loamy sand, or sand in the lower part of the profile. The parent material is alluvium that washed chiefly from the light-colored Chilcott, Lolalita. and Lanktree soils of the adjoining uplands. This alluvial material contains much gritty quartz sand and is micaceous and noncalcareous. It consists mostly of material weathered from acid igneous rocks.

These soils are mainly in the Chilcott-Lanktree-Lolalita soil association. They occur mostly along intermittent streams. The elevation ranges from 2,500 to 3,000 feet. The annual precipitation is between 9 and 11 inches. The slope ranges from 0 to 30 percent but is mostly between 0 and 7 percent. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, giant wildrye, and big sagebrush.

These soils contain no stones and little gravel. Erosion is slight in most places. The available water holding capacity is high, and permeability is moderate in the subsoil.

The Jenness soils are used mainly for pasture and range. Some areas are included in the Black Canyon irrigation project, which is in the southwestern part of the county. These areas are used for irrigated crops and pasture.

Representative profile of Jenness loam. 3 to 7 percent slopes, 200 feet north and 850 feet east of the southwest corner of sec. 15, T. 6 N., R. 3 W., on a range.

A1-0 to 1/2 inch. very dark grayish-brown (10YR 3/2) loam grayish-brown (10YR 5/2) when dry; weak, very fine, granular structure ; very friable when moist, soft when dry; fine roots abundant; neutral (pH 6.7).

AC-1/2 inch to 5 inches, dark grayish-brown (10YR 4/2) loam ;light brownish gray (10YR 6/2) when dry ; weak, very coarse, subangular blocky structure and weak, very fine, granular structure; friable when moist, slightly hard when dry: fine roots plentiful; many very fine pores; neutral (pH 6.8).

C1-5 to 25 inches, dark grayish-brown (10YR 4/2) loam light brownish gray (10YR 6/2) when dry ; very weak, medium, subangular blocky structure to massive; friable when moist, slightly hard when dry ; fine roots plentiful; common very fine pores; neutral (pH 7.0).

IIC2-25 to 40 inches, dark-brown (10YR 4/3) sandy loam; pale brown (10YR 6/3) when dry ; massive ; very friable when moist, slightly hard when dry; few fine roots and pores; neutral (pH 7.2).

IIIC3-40 to 60 inches, dark-brown (101R 4/3) stratified layers of loam and sandy loam; pale brown (10YR 6/3) when dry ; very few fine roots ; noncalcareous ;l neutral (pH 7.0).

In cultivated areas, the Al horizon is mixed with the AC horizon.

Areas of a soil that has a slight accumulation of clay in the subsoil are scattered among areas of Jenness soils. In this soil, the subsoil has weak to moderate subangular blocky structure. Inclusion of Cashmere, Harpt, and Lanktree soils make up as much as 5 percent of some areas mapped.

Jenness loam, 0 to 1 percent slopes (JnA).-This soil is similar to the soil described as typical of the series, except that it is nearly level. Some areas may be flooded for brief periods once every few years. Erosion is negligible.

This soil is used for irrigated hay, pasture, small grain, and row crops. It is managed in nearly the same way as Jenness loans, 1 to 3 percent slopes, but the hazard of erosion is less. Only minor leveling is needed in preparation for border, corrugation, or furrow irrigation. *Capability unit I-1, irrigated.*

Jenness loam, 1 to 3 percent slopes (JnB).-Except for slope, this soil is similar to the soil described as typical of the series. In some places it is flooded for brief periods once every few years. Erosion is slight, but some areas are gently undulating because of the intermittent streams that cross them.

About a third of the acreage is part of the Black Canyon irrigation project and is used for irrigated hay, pasture, small grain, row crops, and orchards. The rest is above the irrigation canals and is used for pasture and range. A mixture of grasses and legumes should be included in the crop rotation to increase the content of organic matter. Orchards need a permanent grass-legume cover crop to preserve soil structure and to maintain the organic-matter content. Nitrogen and phosphate are needed. The utilization of manure, green manure, and crop residues helps to maintain long-time productivity. Irrigation can be by the border, corrugation, furrow, or sprinkler method.

The plant cover on the pasture and range is mostly in poor condition. It is dominated mainly by cheatgrass, mustard, and annual weeds. A good stand can be established if the soil is summer fallowed and a good seedbed is prepared. Ladak alfalfa seeded with a grass, such as crested wheatgrass, Siberian wheatgrass, or Whitmar beardless wheatgrass, is suitable. Once these plants are established, good grazing management will permit them to reseed themselves and maintain the stand. *Capability units IIe-2, irrigated; VIc-l, dryland. Loamy-Sierozem range site.*

Jenness loam, 3 to 7 percent slopes (JnC).-A profile of this soil is the one described as typical of the series. This soil is undulating or gently sloping. Erosion is slight.

Most of this soil is above the irrigation canals and is used for pasture and range. The pasture and range are used and managed in the same way as on Jenness loam, 1 to 3 percent slopes.

If cultivated, this soil is used in much the same way as the less sloping soil, but it needs more protection to control erosion. A rotation that includes a grass-legume crop is desirable. Irrigation can be by the sprinkler, corrugation, or furrow method. *Capability units IIIe-2, irrigated; VIc-1, dryland. Loamy-Sierozem range site.*

Jenness sandy loam, 3 to 7 percent slopes (JsC).-A profile of this soil is similar to the one described as typical of the series, except that the surface layer ranges from 6 to 14 inches in thickness and is sandy loam or fine sandy loam. The organic-matter content of the surface layer is slightly less than in the typical soil, and the waterholding capacity is slightly less. In places there are thin layers of sandy loam in the subsoil. Erosion is slight.

This soil should be used and managed in the same way as Jenness loam, 3 to 7 percent slopes. *Capability units IIIe-2, irrigated; VIc-1, dryland. Loamy-Sierozem range site.*

Jenness sandy loam, 12 to 30 percent slopes (JsE).-A profile of this soil is similar to the one described as typical of the series, except that the surface layer ranges from 6 to 15 inches in thickness and is sandy loam or fine sandy loam. The organic-matter content of the surface layer is slightly less than in the typical soil. In places there are thin layers of sandy loam in the subsoil. Erosion is slight to moderate.

This soil is used for grazing. In most places the plant cover is in poor condition. Management requirements are similar to those of Jenness loam, 1 to 3 percent slopes. *Capability unit VIie 2. dryland. Loamy-Sierozem range site.*

Kepler Series

This series consists of well-drained soils on high river terraces. These soils formed in medium-textured or moderately coarse textured old stream alluvium. The alluvium washed principally from areas of granitic, quartz monzonitic, quartz dioritic, and basaltic rocks. It is micaceous and high in quartz. The uppermost few inches of this soil probably was influenced by a thin mantle of silty material. The surface layer is somewhat light colored and has a moderately low content of organic matter. It is underlain by a lighter colored, leached, medium-textured, bleached horizon. This horizon grades abruptly to an extremely hard clay subsoil. The lower part of the subsoil contains less clay and has a moderate accumulation of calcium carbonate. It is underlain by a weakly cemented hardpan.

These soils are moderately extensive in the SweetKepler soil association. They occur at elevations of 2,500 to 2,800 feet, in the Montour Valley and in the southern part of the Sweet Valley. The annual precipitation is 12 or 13 inches. The slope ranges from 0 to 12 percent but is mostly between 3 and 7 percent. In places there are distinct mounds. Generally, Sweet soils occupy the mounds, and Kepler soils surround the mounds. The native vegetation consisted mainly of bunchgrasses and some sagebrush.

Most areas are nonstony, but there are some stony and extremely stony areas in the southern part. of the Montour Valley. Erosion is slight to moderate, and gullies have formed in some places. Permeability is slow to very slow in the subsoil. The available water holding capacity is moderate to high.

The Kepler soils are used for irrigated and dry, farmed crops and for pasture and range. They occur in intricate patterns with the Sweet soils and are mapped as a complex with these soils.

Representative profile of Kepler loam, 900 feet east and 300 feet north of the center of the SW1/4 sec. 15, T. 7 N., R. 1 E., in a cultivated field.

Ap-0 to 7 inches, very dark grayish-brown (10YR 3/2) loam ; grayish brown (10YR 5/2) when dry; moderate, fine and very fine, granular structure ; friable when moist, slightly hard when dry ; abundant roots ; neutral (pH 6.7).

A1-7 to 9 inches, very dark grayish-brown (10YR 3/2) loam; grayish brown (10YR 5/2) when dry; weak, medium and thin, platy structure and weak, fine and very fine, granular structure; friable when moist, slightly hard when dry ; abundant roots ; neutral (pH 6.6).

A21-9 to 12 inches, dark grayish-brown (10YR 4/2) loam; light brownish-gray (10YR 6/2) when dry; weak, thick and medium, platy structure and weak, fine, granular structure; slightly lighter colored bleached specks ; friable when moist, hard when dry; roots plentiful; many very fine pores; neutral (pH 6.9).

A22-12 to 14 inches, dark grayish-brown (10YR 4/2) loam; light brownish gray (10YR 6/2) when dry; weak, medium and coarse, subangular blocky structure; friable when moist, bard when dry ; fine roots plentiful ; many very fine pores ; neutral (pH 7.0); abrupt boundary.

B2t-14 to 25 inches, very dark brown (10YR2/3) clay; dark brown (10YR 4/3) when dry ; strong, coarse, columnar structure and strong, very fine, angular blocky structure; thick, continuous, very dark brown (10YR 2/3) clay films on the vertical and horizontal ped surfaces; extremely firm when moist, extremely hard when dry; plentiful roots follow cracks; very dense ; neutral (pH 7.1) ; thick, lighter colored coatings on top of columns.

B3tca-25 to 39 inches, dark-brown (10YR 3/3) clay loam; brown (10YR 5/3) when dry; moderate, fine, angular blocky structure ; continuous calcium carbonate coatings in vertical cracks; slightly darker colored, thin, patchy clay films on the vertical and horizontal ped surfaces ; firm when moist, hard when dry ; few roots ; many very fine pores ; strongly calcareous ; moderately alkaline (pH 8.2).

C1mca-39 to 50 inches, dark-brown (7.5YR 3/3) fine sandy loam; dark brown (10YR 4/3) when dry; weakly cemented hardpan ; weak, thick, platy structure to massive ; few roots, mainly on top of plates ; moderately calcareous, with many splotches of calcium carbonate ; moderately alkaline (pH 8.1).

C2-50 to 54 inches, dark-brown (7.5YR 3/3) fine sandy loam ; dark brown (10YR 4/3) when dry; massive; friable when moist ; noncalcareous.

The surface layer is very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) when moist. The A2 horizon varies in prominence and thickness from place to place, and it has a wavy surface. The depth to the B2t horizon ranges from 8 to 19 inches within short distances. The hardpan is weakly cemented, probably by silica and calcium carbonate. The depth to the hardpan ranges from 24 to 42 inches.

Lahontan Series

This series consists of light-colored, calcareous, alkali or saline-alkali, clayey soils that occur in basins on the low Payette River terrace, south and west of Emmett. The surface layer is dominantly silty clay loam but ranges from loam to silty clay. It is low in content of organic matter.

The subsoil, to a depth of at least 20 or 30 inches, is dominantly fine textured, but in places it is heavy silty clay loam or heavy clay loam. The subsoil shows very little or no accumulation of clay ; the clay was deposited by sedimentation from fairly still floodwater. The lower part of the profile commonly is stratified and mottled or strongly reduced, and in most places the underlying strata, below a depth of 36 to 60 inches, consist of loose gravel, sand, or sandy materials.

These soils formed in young stream alluvium or in shallow lake or basin deposits. This material washed mainly from areas of granitic rocks or other intrusive acid igneous rocks. In places, some or all of the material is from areas of the Idaho and Payette formations. Some material washed from basaltic or rhyolitic rocks.

These soils occupy a moderately small acreage in the Letha-Baldock-Lahontan soil association. They occur in basins, depressions, swales, or backwater areas on a former flood plain and have slopes of less than 1 percent. The elevation is between 2,250 and 2,300 feet. The annual precipitation is about 9 to 11 inches. The vegetation consists of greasewood, saltgrass, and other salt-tolerant and alkalitolerant plants.

Apparently, these soils formed under imperfect or poor drainage and under rather strongly saline-alkali conditions. Consequently, very little organic matter accumulated. Erosion is negligible, and there are no stones and very little gravel in the soil material. The available water holding capacity is moderate to high. Permeability is very slow in the subsoil. The depth to the water table ranges from 30 to 70 inches. Strongly saline-alkali spots are scattered among less alkali soils.

These soils are used for irrigated pasture, hay, and small grain or are under a cover of greasewood and saltgrass.

Representative profile of Lahontan silty clay, strongly saline-alkali, 150 feet north and 150 feet east of the southwest corner of sec. 16. T. 6 N., R. 2 W. in a greasewood area.

A1ca-0 to 4 inches grayish-brown (2.5Y 5/2) silty clay; light gray (2.5Y 7/1) when dry; vertical cracks form coarse prisms that break to weak, thin and medium, platy structure ; firm when moist, very hard when dry ; roots plentiful; very few pores ; moderately calcareous ; strongly alkaline (pH 8.9).

C1ca-4 to 13 inches, grayish-brown (2.5Y 5/2) silty clay ; light gray (2.5Y 7/1) when dry; coarse prisms break to weak, medium, platy structure and moderate, fine and very fine, angular blocky structure ; firm when moist, very hard when dry ; roots plentiful ; very few pores ; moderately calcareous; strongly alkaline (pH 8.9).

C2ca-13 to 21 inches, grayish-brown (2.5Y 5/2) silty clay; light gray (2.5Y 7/2) when dry; weak, medium, prismatic structure breaks to weak, medium, platy structure, then to moderate, very fine and fine, angular blocky structure ; firm when moist, very hard when dry; fine roots plentiful ; few very fine pores ; strongly calcareous; very strongly alkaline (pH 9.4).

C3ca 21 to 28 inches, grayish-brown (2.5Y 5/2) silty clay; light gray (2.5Y 7/2) when dry; very weak, medium platy structure breaks to weak, very fine and fine, subangular blocky structure ; few roots; strongly calcareous; very strongly alkaline (pH 9.4).

IIC4ca-28 to 36 inches, grayish-brown (2.5Y 5/2) loam; light gray (2.5Y 7/2) when dry; weak, medium, subangular blocky structure ; firm when moist, very hard when dry ; moderately calcareous ; very few roots and pores ; very strongly alkaline (pH 9.4).

IIIC1ca-36 to 43 inches, olive-brown (2.5Y 4/3) fine sandy loam; light brownish gray (2.5Y 6/2) when dry ; weak, medium, subangular blocky structure to massive ; friable when moist, very hard when dry ; moderately calcareous ; very few roots and pores ; few dark manganese stains; very strongly alkaline (pH 9.1).

IIIC6-13 to 57 inches, olive-brown (2.5Y 4/3) fine sandy loam; light brownish gray (2.5Y 6/2) when dry; massive; common, coarse, light-gray (2.5Y 7/2 when dry) mottles; friable when moist, very hard when dry ; slightly calcareous ; very strongly alkaline (pH 9.2).

IIIC7-57 inches +, dark-gray (N 4/0) fine sandy loam; gray (N 6/0) when dry; massive; friable when moist, very hard when dry; noncalcareous to slightly calcareous ; very strongly alkaline (pH 9.1).

If moist, the surface layer ranges from grayish brown (2.5Y 5/2) to dark grayish brown (2.5Y 4/2) , light brownish gray (2.5Y 6/2), or light gray (2.5Y 6/1). If dry, it ranges from light gray to gray (2.5Y 7/1 to 6/1) to white (2.5Y 8/1 or 8/2). The hue is dominantly 2.5Y, but in places it ranges toward 10YR. The color of the subsoil resembles that of the surface layer. Mottling is variable because of the range in depth to the water table. These soils typically are moderately calcareous and very strongly or strongly alkaline, except in the waterlogged substratum. In places, particularly in those areas that are partially reclaimed, the uppermost few inches is noncalcareous or only slightly calcareous and only moderately or mildly alkaline. The salt content is highly variable; the surface layer may be slightly, moderately, or strongly saline. If the soil is dry, a white salty crust forms in some areas.

Lahontan, Bowman, Baldock, or Letha soils make up as much as 5 percent of the areas mapped.

Lahontan silty clay, strongly saline-alkali (La).-A profile of this soil is the one described as typical of the series. Most of this soil is very high in exchangeable sodium and has a pH above 8.5. In many places a white salty crust forms on the surface when the soil is dry or nearly dry. The depth to the water table generally is between 30 and 50 inches.

Much of this soil has a cover of greasewood and saltgrass. Yields of usable forage are low. Yields of irrigated crops and pasture generally are low to very low.

This soil is very difficult to reclaim because of its fine texture and very slow permeability. Very large amounts of manure, green manure, and soil amendments are needed for satisfactory yields. Tillage is likely to cause the soil to slick over and run together or to break into large clods, depending on the moisture content. The most satisfactory treatment for this soil is to keep it in alkali-tolerant grasses and legumes for hay or pasture and to plow it only to reestablish these plants. Alfalfa seeded with either tall wheat grass or alta fescue generally is most suitable. Border or basin irrigation is best, because these methods are less likely to cause salts and alkali to concentrate in the surface layer. Corrugations can also be used. *Capability unit IVw-3, irrigated.*

Lahontan silty clay loam, moderately saline-alkali (Lb).-This soil is similar to the soil described as typical of the series, except that the surface layer is silty clay loam and on 70 to 90 percent of the acreage, the pH of the surface layer is less than 8.5. The depth to the water table is between 30 and 70 inches. Small areas of soils that have a surface layer of silty clay were included in the areas mapped.

This soil produces fair to poor yields of irrigated pasture crops, hay crops, and small grain. A suitable rotation consists of hay and pasture crops most of the time and

a small grain or corn for 1 or 2 years when the legume-grass stand needs to be reestablished. Plowing under crop residues, green-manure crops, and manure helps to improve this soil. Gypsum and other soil amendments and large amounts of manure are needed on the alkali spots. Tillage should be carefully timed to prevent puddling or the formation of large clods. Irrigation can be by the border, basin, corrugation, or furrow method. *Capability unit IIIw-5, irrigated.*

Lahontan silty clay loam, strongly saline-alkali (Lc).-This soil is similar to the soil described as typical of the series, except that the surface layer is silty clay loam. Most of this soil has a pH above 8.5 and is very high in exchangeable sodium. When the soil is dry or nearly dry, a white salty crust forms on much of the surface. The depth to the water table generally is between 30 and 60 inches. Small areas of soils that have a surface layer of loam and some very gently sloping soils along drainageways were included in the areas mapped.

Much of this soil has a cover of greasewood and saltgrass, and yields of usable forage are low. Alfalfa seeded with tall wheatgrass or alta fescue is the most satisfactory crop. This mixture can be used for either hay or pasture. Small grain or corn can be grown when the grass-legume mixture needs to be reestablished, but yields commonly are low. Large amounts of gypsum or other soil amendments, manure, and green manure are needed. Crops respond to nitrogen and phosphate. Tillage should be carefully timed to prevent puddling or the formation of clods. Irrigation can be by the border, corrugation, or furrow method. *Capability unit IIIw-3, irrigated.*

Lanktree Series

This series consists of well-drained, light-colored soils that have a fine textured to moderately fine textured subsoil. The surface layer is loam, sandy loam, gravelly loam, or gravelly sandy loam. It has a low content of organic matter. The transition from the surface layer to the subsoil is abrupt. The subsoil ranges from clay to heavy clay loam. The lower part contains a moderate accumulation of calcium carbonate. The parent material consists mainly of loose to very weakly consolidated sand or gravelly material of the Idaho and related formations. Most of these materials weathered from granitic, quartz monzonitic, quartz dioritic, or similar acid igneous rocks. They contain much quartz and lesser quantities of feldspar and mica. In places the uppermost part of the soil is influenced by silty wind-laid deposits.

These soils occupy a large acreage in the Chilcott-Lanktree-Lolalita soil association. They occur on uplands north and south of the Emmett Valley. The slope ranges from 1 to 30 percent but is mostly less than 20 percent. The elevation ranges from 2,500 to 3,000 feet. The annual precipitation is 9 to 11 inches. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, Indian ricegrass, and other bunchgrasses and some big sagebrush and herbaceous plants.

Erosion is slight to moderate, the available water holding capacity is moderate, and permeability is slow in the subsoil.

Most of the acreage is used for pasture and range. A small acreage is used for irrigated pasture, hay, and grain.

Representative Profile of Lanktree loam, 7 to 12 percent slopes, 400 feet south and 400 feet west of the northeast corner of sec. 31, T. 6 N., R. 2 W., under a cheatgrass cover.

A1-0 to 0.3 inch, *very* dark gray (10YR 3/1) loam; gray (10YR 5/1) when dry; weak, thin, platy structure; friable when moist, slightly hard when dry ; abundant roots ; neutral (pH 6.6).

A2-0.3 inch to 8 inches, dark grayish-brown (10YR 4/2) loam ; light brownish gray (10YR 6/2) when dry ; weak, very thin, platy and very weak, very fine, granular structure ; friable when moist, slightly hard when dry ; fine roots plentiful ; common very fine pores ; neutral (pH 6.7).

B1t-8 to 10 inches, dark-brown (10YR 3/3) clay loam that grades toward loam : brown (10YR 5/3) when dry ; moderate, fine, angular blocky structure ; firm when moist, hard when dry; thin, nearly continuous clay films on peds ; thick, grayish-brown bleached silty specks of A2 material on peds, light gray (10YR 7/2 when dry) ; fine roots plentiful; common very fine pores; mildly alkaline (pH 7.5).

B21t-10 to 16 inches, dark-brown (10YR 4/3) heavy clay loam to clay ; pale brown (10YR 6/3) when dry ; moderate, medium, prismatic structure and moderate, fine, angular blocky structure ; moderate, dark grayish brown (10YR 4/2), continuous clay films on all ped surfaces; firm when moist, hard when dry ; few fine roots, mostly in vertical cracks ; few *very* fine pores ; moderately alkaline (pH 7.9).

B22tca-16 to 22 inches, dark grayish-brown (10YR 4/2) clay loam ; light brownish gray (10YR 6/2) when dry; moderate, fine, angular blocky structure; thin, continuous clay films on all ped surfaces ; firm when moist, hard when dry ; few fine roots ; few very fine pores ; common, medium. calcium carbonate splotches ; moderately alkaline (pH 8.2).

B3ca-22 to 37 inches, brown (10YR 5/3) loam; pale brown (10YR 6/3) when dry; weak, fine, angular blocky structure; thin, patchy clay films on peds; friable when moist, slightly hard when dry ; very few fine roots; common very fine pores; common, fine, calcium carbonate veins and splotches ; moderately alkaline (pH 8.3).

Cca-37 to 60 inches, light brownish-gray (10YR 6/2) loamy sand ; light gray (10YR 7/2) when dry ; single grained ; loose, slightly calcareous; moderately alkaline (pH 8.0).

In cultivated or disturbed areas, the very thin, darker colored A1 horizon is absent or has been mixed with the lighter colored A2 horizon. The surface layer is loam, fine sandy loam, sandy loam, gravelly or cobbly loam, or gravelly or cobbly sandy loam. It is 5 to 9 inches thick. When dry, the A2 horizon is light brownish gray (10YR 6/2) to light gray (10YR 7/2). In reaction it ranges from pH 6.0 to 7.0. The B2t horizon ranges from clay to sandy clay, heavy clay loam, or heavy sandy clay loam in texture, and from prismatic to columnar in structure. When dry, it is pale brown (10YR 6/3) to brown (10YR 5/3) and has darker colored clay films. The reaction of the B21t horizon ranges from pH 6.5 to 7.9. The Bt horizons typically contain less than 15 percent exchangeable sodium. The depth to calcareous material ranges from 15 to 22 inches. The depth to sand, loamy sand, or gravel ranges from 35 to 60 inches.

Various amounts of soil material have been added to or removed from irrigated areas to improve field layouts. Where the B21t horizon is exposed, good crop yields are difficult to obtain. Large amounts of manure, green manure, and nitrogen are needed in these areas. Where deeper cuts have removed the clayey subsoil, yields are higher.

Inclusions of Lolalita, Payette, Chilcott, and Haw soils make up as much as 5 to 10 percent of some areas mapped. Slick spots occupy as much as 5 percent of some areas and occur mainly on ridgetops.

Lanktree gravelly loam, 12 to 30 percent slopes (LdE).-This soil is similar to the soil described as typical of the series, except that the surface layer is gravelly loam and the subsoil is gravelly or cobbly sandy clay. It occurs north of the Emmett Valley. Most of the gravel and cobblestones rolled from the Upper Mesa formation, an old valley floor, and became mixed with the sandy and loamy material of the Idaho formation. Erosion is moderate in some places and slight in other places. Small areas of a soil in which the subsoil has less clay and is more permeable than the typical soil were included in some of the areas mapped.

This soil is used for grazing. The plant cover is in poor condition and is composed largely of such annuals as cheatgrass, fiddleneck, and wild mustard. Yields of the usable forage are very low but can be increased by reseeding•. The gravel and cobblestones do not prevent tillage. Summer fallowing and the preparation of good seedbeds will help to establish a good stand. A suitable seeding mixture consists of Ladak alfalfa seeded with crested wheatgrass, Siberian wheatgrass, or Whitmar beardless wheatgrass. Once established, a good stand can be maintained by good management. *Capability unit VIe-2, dryland. Loamy-Sierozem rangesite.*

Lanktree gravelly sandy loam, 12 to 30 percent slopes (LeE).-This soil is similar to the soil described as typical of the series, except that the surface layer is gravelly sandy loam and the subsoil is gravelly or cobbly sandy clay. Most of this soil is north of the Emmett Valley. The gravel and cobblestones rolled from the Upper Mesa formation. Erosion is moderate in many places but slight in some places. Small areas of a soil in which the subsoil has less clay and is more permeable than the typical soil were included in some of the areas mapped.

This soil can be used and managed in the same way as Lanktree gravelly loam, 12 to 30 percent slopes. *Capability unit VIe-2, dryland. Loamy-Sierozem range site.*

Lanktree loam, 3 to 7 percent slopes (LfC).-Except for slope, this soil is similar to the soil described as typical of the series. It occurs south of the Emmett Valley. Erosion is slight in most places. Small slick spots make up as much as 2 percent of some areas mapped. The soils in these spots resemble the Sebree soils, except that they have no hardpan. They commonly are very slowly permeable and are low in productivity. Their subsoil contains soluble salts and a considerable amount of exchangeable sodium. Also included in the areas mapped were some soils that have a surface layer of sandy loam or fine sandy loam and a subsoil of heavy sandy clay loam or sandy clay. These soils are slightly more permeable than the typical soil. Other inclusions are soils that have a loamy subsoil. These soils are more rapidly permeable than the surrounding soils and are more productive.

Some of this soil is in the Black Canyon irrigation project. It produces good yields of irrigated pasture crops, hay crops, small grain, and corn. Limiting annual crops to 2 successive years in the rotation is advisable. A rotation that includes a mixture of grasses and legumes helps to maintain or increase the organic-matter content, to preserve soil structure, and to improve workability. Manure, green manure, and crop residues can be utilized for the same purpose. Nitrogen and phosphate are needed. Irrigation can be by the corrugation or furrow method, but small streams are advisable.

If dry farmed, this soil is used for pasture and range. It needs the same management as Lanktree gravelly loam, 12 to 30 percent slopes. *Capability units IIIe-2, irrigated; VIs-2, dryland. Loamy-Sierozem range site.*

Lanktree loam, 7 to 12 percent slopes (LfD).-A profile of this soil is the one described as typical of the series. Most of this soil is south of the Emmett Valley, and some is north of the valley. Erosion is slight to moderate. Included in the areas mapped were soils that have a surface layer of sandy loam or fine sandy loam and a subsoil of heavy sandy clay loam or sandy clay. These included soils are slightly more permeable than the typical soil. Also included were soils that resemble the Power soils. These soils have a subsoil of light clay loam or light silty clay loam. In some small spots that were included in mapping, the subsoil is loam that differs only slightly from the surface layer. In noncultivated areas these spots commons are low mounds and have been burrowed by badgers and other rodents. The soils in these spots are more permeable and more productive than the Lanktree soil.

This soil is used for irrigated crops and for pasture and range. The irrigated soil is in the Black Canyon irrigation project. Although it produces fair yields of pasture, hay, small grain, and orchard crops, it is best suited to pasture and hay. Grain should be limited to 1 year in the rotation, to control erosion. Orchards need a permanent cover crop. Nitrogen and phosphate are needed. Irrigation is by the corrugation method. The length of the runs must be short and the irrigation streams small so that irrigation will not cause erosion.

The pasture and range are used and managed in the same way as on Lanktree gravelly loam, 12 to 30 percent slopes. *Capability units IVe-1, irrigated; VIs-2, dryland. Loamy-Sierozem range site.*

Lanktree loam, 12 to 30 percent slopes (LfE).-A profile of this soil is similar to the one described as typical of the series. This soil occurs on both sides of the Emmett Valley. It is moderately eroded in many places and slightly eroded in some places. Included in the areas mapped were some soils that resemble the Power soils. Their subsoil is clay loam or silty clay loam and contains less clay than that of the typical Lanktree soil.

Most of this soil is used for pasture and range. A small acreage is in the Black Canyon irrigation project. Irrigated areas are best suited to permanent pasture or to orchards that have a cover crop. Irrigation water should be applied carefully, so that it. will not cause erosion.

The range needs the same management as the range on Lanktree gravelly loam, 12 to 30 percent slopes. *Capability units VIe-1, irrigated; VIe-2, dryland. LoamySierozem range site.*

Lanktree sandy loam, 12 to 30 percent slopes (LkE).This soil is similar to the soil described as typical of the series, except that the surface layer is sandy loam and the subsoil is heavy sandy clay loam, heavy clay loam, or sandy clay. host of this soil is south of the Emmett Valley. Erosion is moderate to slight. Included in the areas mapped were some soils that resemble the Power soils.

Their subsoil is clay loam or sandy clay loam, and it contains less clay than that of the typical Lanktree soil.

This soil is used mainly for pasture and range. A small acreage is in the Black Canyon irrigation project. The irrigated soil is best suited to permanent pasture or to orchards that have a cover crop. Sprinkler irrigation is best because of the erosion hazard.

The range needs the same management as the range on Lanktree gravelly loam, 12 to 30 percent slopes. *Capability units VIe-1 irrigated; VIe-2, dryland. Loamy-Sierozem range site.*

Lanktree sandy loam, 30 to 60 percent slopes (LkF).-This soil occurs on steep southerly slopes, north of the Emmett Valley. It is similar to the soil described as typical of the series, but the surface layer is sandy loam or, in places, loam, gravelly loam, or gravelly sandy loam. The gravel and some cobblestones rolled from the Upper Mesa formation. Erosion is slight to moderate in most areas, and small gullies have formed in some drainageways. Included in the areas mapped were some soils that resemble the Power soils. Their subsoil is clay loam or sandy clay loam, and it contains less clay than that of the typical Lanktree soil. Small areas of Lolalita soils were also included.

This soil is used for pasture and range. The plant cover is mostly in poor condition and is composed largely of such annuals as cheatgrass, fiddleneck, and wild mustard. Three-awn is the most common perennial grass. Seedbed preparation is not practical on this steep soil, but the plant cover can be improved gradually by establishing a good grass stand on adjoining soils. Broadcast seedings will also help to improve the stand. Management of grazing is essential to allow perennial grasses to become established. *Capability unit VIIe-1, dryland. Granitic south slope-Sierozem and Brown range site.*

Lanktree and Chilcott loamy, 3 to 7 percent slopes (LmC).-This mapping unit is about 60 to 70 percent Lanktree loam and 30 to 40 percent Chilcott loam. These soils are similar to those described as typical of their respective series. They occur in and near the Black Canyon irrigation project, in the southwestern part of the county. In most places there is a discontinuous or sporadic hardpan, and in many places the hardpan is only weakly cemented. Erosion is slight in most areas but is moderate in spots. In grading and leveling for irrigation, part or all of the original surface layer was removed from some areas and added to other areas. In places where the clayey subsoil is within plow depth, intake of water is slower, tilth is poorer, and productivity is lower than on the typical soils.

Small slick spots make up less than 2 or 3 percent of the acreage of the areas mapped. If a hardpan is present in these spots, the soils are Sebree soils or they closely resemble the Sebree soils. They commonly are very slowly permeable and are low in productivity. Their subsoil contains salts and exchangeable sodium. Small spots in which the subsoil is loamy instead of clayey make up as much as 5 percent of the areas mapped. If a hardpan is present in these spots, the soils are Vickery soils or they resemble the Vickery soils. These spots are more productive than the surrounding soils. In areas that have not been tilled, these spots commonly occur as low mounds.

These soils are used principally for irrigated crops. The irrigated areas need the same management as on Lanktree loam, 3 to 7 percent slopes.

The nonirrigated areas are used for range. These areas need the same management as on Lanktree gravelly loam, 12 to 30 percent slopes. *Capability units IIIe-2, irrigated; VIs-2, dryland. Loamy-Sierozem range site.*

Lanktree and Chilcott loamy, 7 to 12 percent slopes (LmD).-These soils are extensive south of the Emmett Valley. They are similar to Lanktree and Chilcott loams, 3 to 7 percent slopes, except that they are more erodible. Also, the proportion of Chilcott loam is less, and there are fewer slick spots. Some small areas that are less sloping were included in the areas mapped.

Some of the acreage is in the Black Canyon irrigation project and is used for irrigated crops. These areas need the same management as irrigated areas of Lanktree loam, 7 to 12 percent slopes.

Nonirrigatecl areas are used for pasture and range. The plant cover generally is in poor condition. These areas need the same management as Lanktree gravelly loam, 12 to 30 percent slopes. *Capability units IVe-1, irrigated; VIs-1, dryland. Loamy-Sierozem range site.*

Lanktree and Chilcott loams, 12 to 30 percent slopes (LmE).-Lanktree loam makes up about 60 to 75 percent of this unit, and Chilcott loam makes up about 15 to 25 percent. These soils occur both north and south of the Emmett Valley. In most places they are slightly eroded, but some spots are moderately eroded. Commonly, the hardpan occurs only in the less steeply sloping soils. It generally is discontinuous and only weakly cemented. It is not typical of the hardpan in the Chilcott soils.

Included in some of the areas mapped are soils that resemble the Power or Purdam soils. Their subsoil is clay loam, but it contains less clay than that of the typical Lanktree or Chilcott soils. Inclusions of Sebree soils make up as much as 2 percent of the areas mapped, and inclusions of Vickery soils make up as much as 5 percent.

Mlost of the acreage is used for pasture and range. The small acreage that is cultivated is in the Black Canyon irrigation project and is best suited to permanent pasture or to orchards that have a cover crop. Irrigation water needs to be carefully applied so that it will not cause erosion.

The pasture and range are used and managed in the same way as on Lanktree gravelly loam, 12 to 30 percent slopes. *Capability units VIe-1, irrigated; VIe-2, dryland. Loamy-Sierozem range site.*

Lanktree and Chilcott sandy loamy, 12 to 30 percent slopes (LnE).-Lanktree sandy loam makes up about 65 to 75 percent of this mapping unit, and Chilcott sandy loam makes up about 15 to 20 percent. These soils occur south of the Emmett Valley. They are similar to the soils described as typical of their respective series, except that their surface layer is sandy loam or fine sandy loam. In some places the Chilcott soil has a surface layer of loam. The Chilcott soil differs from the Lanktree soil in having a weakly cemented hardpan. The hardpan occurs sporadically, at a moderate depth, mostly in the less steeply sloping areas. In most places erosion is slight, but there are a few moderately eroded spots.

Included in some of the areas mapped were small areas of soils that resemble the Power or Purdam soils. Their subsoil is clay loam or sandy clay loam, but it contains less clay than that of the typical Lanktree and Chilcott soils. Also included were small spots of Vickery soils.

These soils are used for pasture and range. The vegetative cover is mostly in poor condition. Management needs are similar to those of Lanktree gravelly loam, 12 to 30 percent slopes. *Capability unit VIe-2, dryland. LoamySierozem range site.*

Lanktree, Chilcott, and Sebree loams, 1 to 3 percent slopes (LoB).-This mapping unit is about 50 to 70 percent Lanktree loam, 30 to 40 percent Chilcott loam, and 1 to 3 percent Sebree silt loam. These soils are in the Black Canyon irrigation project, in the southwestern part of the county. They are similar to the soils described as typical of their respective series, except that in most places the surface layer is loam and the subsoil is heavy clay loam or clay. A weakly cemented hardpan occurs sporadically. Erosion is slight in most places. However, in grading and leveling for irrigation, part or all of the original surface layer has been removed from some places and added to other places. Where the clayey subsoil is within plow depth or is mixed in the plow layer, infiltration is slower, tilth is poorer, and productivity is lower. The Chilcott and Sebree soils have a hardpan. Sebee loam occurs as slick spots. It has a very slowly permeable subsoil that contains soluble salts and is high in exchangeable sodium. In the Lanktree and Chilcott soils, the subsoil is not high in soluble salts and exchangeable sodium.

Power and Purdam soils, or somewhat similar soils, make up as much as 10 to 15 percent of the areas mapped. These soils have a clay loam or silty clay loam subsoil that contains less clay than that of the typical Lanktree and Chilcott soils. They are slightly more permeable than the typical Chilcott and Lanktree soils and are more productive. As much as 5 percent of the areas mapped consists of Vickery loam, Vickery silt loam, or a somewhat similar soil that has a loam or silt loam subsoil but no hardpan. If not tilled, these included soils commonly occur as small, low mounds. They are more productive than the surrounding soils.

These soils are used principally for irrigated pasture, hay, small grain, and corn. The organic-matter content is low but can be built up or maintained by utilizing crop residues, manure, and green manure: by applying nitrogen and phosphate; and by using good crop rotations. A grasslegume crop should be included in the crop rotation. Irrigation can be by the border, corrugation, or furrow method, but the water must be applied slowly because of the slow intake rate.

The small acreage that is not irrigated is used for grazing. It needs the same management as Lanktree gravelly loam, 12 to 30 percent slopes. *The Lanktree and Chilcott soils are in capability units IIe-2, irrigated; VIs-2, dryland. The Sebree soil is in capability unit VIs-2, dry land. Loamy-Sierozem range site.*

Letha Series

In this series are imperfectly drained, calcareous soils on low terraces along the Payette River, west of Emmett and near Montour. These soils are moderate to very high in exchangeable sodium and more or less saline, or salty. The surface layer is light colored and low to very low in content of organic matter. The subsoil, to a depth of at least 20 or 30 inches is dominantly moderately coarse textured. It commonly contains a slight accumulation of calcium carbonate. Loose gravel and sand commonly occur at a depth of 20 to 50 inches. The soils formed in recent stream alluvium, washed principally from areas of granite, quartz monzonite, quartz diorite, and other acid igneous rocks. In places, the parent material includes some wash from areas of the sedimentary Idaho and Payette formations and small amounts of basaltic and rhyolitic materials.

These soils occupy a large acreage in the Letha-Baldock-Lahontan soil association. The elevation is between 2,200 and 2,600 feet. The annual precipitation is 9 to 12 inches. Slopes are mostly less than 3 percent, except for some small escarpments along drainageways and terrace edges. In many places, old river and stream channels have caused the soils to be undulating or channeled. The vegetation consists mainly of greasewood, saltgrass, bassia (an alkalitolerant annual weed), and foxtail. Big sagebrush and bunchgrasses grow in some of the better drained, less saline-alkali areas.

These soils are gravelly in places but are free of stones. Erosion has been negligible in most places. The available water holding capacity is very low to moderate. Permeability is slow to very slow in the subsoil. Drainage is mostly imperfect but ranges from good to poor.

The Letha soils are used for irrigated crops and pasture and for dryland pasture.

Representative profile of Letha fine sandy loam, deep, strongly saline-alkali, 0 to 1 percent slopes, 500 feet north and 60 feet east of the southwest corner of the NW1/4 sec. 8, T. 6 N., R. 2W., in a greasewood-saltgrass area.

A1-0 to 6 inches, light olive-brown (2.5Y 5/3) fine sandy loam; light gray (2.5Y 7/2) when dry; weak or moderate, very thin, platy structure and very weak, very fine, granular structure; friable when moist, slightly hard when dry ; slightly calcareous ; abundant roots ; very strongly alkaline (pH 9.4).

C1ca-6 to 11 inches, light olive-brown (2.5Y 5/3) fine sandy loam; light yellowish brown (2.5Y 6/3) when dry; weak, medium, subangular blocky structure ; thin, patchy films on peds ; friable when moist, hard when dry ; roots plentiful ; common very fine pores ; moderately calcareous; very strongly alkaline (pH 9.7).

C2ca-11 to 22 inches, light olive-brown (2.5Y 5/3) fine sandy loam; light yellowish brown (2.5Y 6/3) when dry; moderate or weak, medium, subangular blocky structure: firm when moist, very hard when dry; roots plentiful ; few very fine pores ; few thin, dark-brown (10YR 4/3) films on pods ; moderately calcareous ; very strongly alkaline (pH 10.4).

C3ca-22 to 27 inches, light olive-brown (2.5Y 5/3) fine sandy loam; light yellowish brown (2.5Y 6/3) when dry; slightly less clayey than the C2ca horizon ; very weak or weak, medium, subangular blocky structure: firm when moist, very hard when dry ; roots plentiful; few very fine pores; few thin, dark-brown (10YR 4/3) films on peds ; moderately calcareous; very strongly alkaline (p110.4).

C4-27 to 35 inches, light olive-brown (2.5Y 5/3) fine sandy loam; light yellowish brown (2.5Y 6/3) when dry; massive; very friable when moist, very hard when dry; roots plentiful; few very fine pores; slightly calcareous; very strongly alkaline (pH 10.2).

C5g 35 to 43 inches. dark grayish-brown (2.5Y 4/3) and grayish-brown (2.5Y 5/2) fine sandy loam; pale yellow (2.5Y 7,13) when dry ; few, medium, faint, light olive-brown (2.5Y 5/3) and dark grayish-brown (10YR 4/2) mottles ; massive ; friable when moist ; few roots ; few very fine pores ; slightly calcareous to noncalcareous ; very strongly alkaline.

IIC6--43 to 58 inches, very gravelly very coarse sand ; single grained: loose : noncalcareous or very slightly calcareous ; strongly alkaline.

These soils generally are rather low in salinity, are very strongly alkaline, and have weak structure. The surface

layer ranges from loam to fuse sandy loam or gravelly loamy sand that is light olive brown to grayish brown or olive brown when moist and pale yellow to light gray, white, or light brownish gray when dry. Under shrubs, the uppermost half inch or more is slightly darker colored and higher in content of organic matter than typical. The subsoil is dominantly moderately coarse textured but in places has a loam or light sandy clay loam texture. Its structure ranges from weak to moderate subangular blocky to weak prismatic. In places the subsoil contains brown or grayish mottles, and in some places the lower layers are bluish gray. In some areas there are veins of calcium carbonate in the subsoil. Salt forms a crust on the surface. and in places there are fluffy puffed spots. Deflocculated, or dispersed, hard spots are common.

Inclusions of Notus, Falk, Chance, and Lahontan soils make up as much as 2 or 3 percent of the acreage.

Letha fine sandy loam, 0 to 1 percent slopes (LpA).This soil is like the soil described as typical of the series, except that generally it is less affected by salts and alkali and the depth to the underlying gravel is only 20 to 36 inches. In a few small areas, the surface layer is loamy sand. The depth to the water table commonly is between 30 and 40 inches. The available water holding capacity is low. Permeability is slow except in alkali spots, where it is very slow. Alkali spots make up from 5 to 30 percent of the acreage of the areas mapped. Also included in the areas mapped are a few areas in which the surface layer and subsoil are gravelly sandy loam. The amount of gravel in these areas is sufficient to interfere to some extent with tillage and to reduce the available water holding capacity. Permeability, however, is somewhat more rapid than is typical. These areas are indicated on the soil map by gravel symbols.

In a few places the water table has been lowered to a depth of more than 40 inches by deep, open drainage ditches. Where the water table has been lowered, the further accumulation of soluble salts is less likely and conditions are more favorable for the removal of salts and alkali. In these areas the soil is somewhat more productive, especially of deep-rooted plants.

In other places runoff during irrigation or the excessive application of water has raised the water table to a depth of somewhat less than 30 inches. The higher water table is conducive to the further accumulation of soluble salts and alkali, and the soil in these places is less productive of deep-rooted plants.

Figure 7.-Cornfield on Letha soil, showing the spotting effect of alkali and salinity.

Some of the acreage is used for irrigated pasture and crops, but much of it is still in dryland pasture. The saltgrass and greasewood produce little usable forage. Irrigated pastures that have a good stand of grasses and legumes and that are adequately fertilized produce fair to good yields. Saline-alkali spots in both pasture and cropland need large applications of manure and a soil amendment, such as gypsum (fig. 7). A row crop should be limited to 2 successive years in the rotation, and a mixture of grasses and legumes should be grown at least 60 percent of the time. Nitrogen, phosphate, and manure are needed. The border and basin methods of irrigation are best for reclaiming alkali spots. but the corrugation, furrow, and sprinkler methods can be used. Irrigation water should be carefully controlled to avoid raising of the water table. A deep-rooted crop, such as alfalfa, generally needs little or no irrigation after it is well established. *Capability unit IIIw-6, irrigated.*

Letha fine sandy loam, 1 to 3 percent slopes (LpB).This soil is similar to Letha fine sandy loam, 0 to 1 percent slopes. In many places, it is adjacent to drainage channels. In a few areas where the surface layer is a loamy sand, permeability is more rapid than is typical, but the available water holding capacity is lower. Included in the areas mapped are a few areas in which the surface layer and subsoil are gravelly sandy loam. The amount of gravel is sufficient to hinder tillage slightly and to reduce the available water holding capacity. These included areas are indicated on the soil map by gravel symbols.

In a few areas the water table has been lowered to a depth of more than 40 inches by deep, open drainage ditches. Where the water table has been lowered, the further accumulation of soluble salts is less likely and conditions are more favorable for the removal of salts and alkali. In these areas the soil is somewhat more productive of deep-rooted plants.

This soil can be used and managed in the same way as Letha fine sandy loam, 0 to 1 percent slopes, but it is more difficult to irrigate evenly and more erodible than the more nearly level soil. *Capability unit IIIw-6, irrigated.*

Letha fine sandy loam, deep, 0 to 1 percent slopes (LrA).-This soil is like the soil described as typical of the series, except that the saline-alkali or alkali spots make up only about 5 to 30 percent of the acreage. The depth to the underlying gravel ranges from 36 to 60 inches. The available water holding capacity is moderate. The depth to the water table commonly is between 30 and 45 inches.

In a few areas the water table has been lowered to a depth of more than 45 inches by deep, open drainage ditches. Where the water table has been lowered, the reclamation of the alkali spots is more feasible and more lasting.. In other areas runoff from irrigation or the excessive use of water has raised the water table to a depth of less than 30 inches.

This soil can be used and managed in much the same way as Letha fine sandy loam, 0 to 1 percent slopes. *Capability unit IIIw-6, irrigated.*

Letha fine sandy loam, deep, 1 to 3 percent slopes (LrB).-Except for slope, this soil is similar to Letha fine

sandy loam. deep, 0 to 1 percent slopes. Only 5 to 30 percent of the acreage is seriously affected by alkali or saline-alkali. The depth to the underlying gravel ranges from 36 to 60 inches. The depth to the water table commonly is between 30 and 50 inches. The available water holding capacity is moderate. A few spots that have a surface layer of loamy sand were included in the areas mapped.

This soil can be used and managed in much the same way as Letha fine sandy loam, 0 to 1 percent slopes, but irrigation and the reclamation of saline-alkali spots are more difficult because of the gently undulating slopes. *Capability unit IIIw-6, irrigated.*

Letha fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes (LsA).-This soil is similar to the soil described as typical of the series, except that it is not so thick. The depth to the underlying gravel ranges from 20 to 36 inches. The available water holding capacity is low. The depth to the water table commonly is between 30 and 50 inches. A white salty crust forms on much of this soil during the drier periods, and the reaction generally is above pH 8.5 (5). A few areas in which the surface layer and subsoil are gravelly sandy loam were included in the areas mapped. The amount of gravel is sufficient to hinder tillage slightly and to reduce the available water holding capacity. These areas are indicated on the soil map by gravel symbols.

In a few places the water table has been lowered by deep, open ditches. In other places runoff or excessive irrigation has caused the water table to be higher than typical.

Some of this soil is under a cover of greasewood and saltgrass pasture. This soil is best suited to alkali-tolerant grasses and legumes. It should be plowed only to reestablish these plants. An annual crop, such as corn or small grain, can be grown for 1 year in the rotation, but yields will be low. Irrigation should be by the border or basin method, to avoid the accumulation of salts and alkali in the surface layer. Manure, green manure, and soil amendments are needed to reclaim this soil. *Capabilit unit IVw-2, irrigated.*

Letha fine sandy loam, strongly saline-alkali, 1 to 3 **percent slopes** (LsB).-Except for slope, this soil is similar to Letha fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes. The depth to the underlying gravel ranges from 20 to 36 inches. A few areas in which the surface layer and subsoil are gravelly sandy loam were included in the areas mapped. The amount of gravel is sufficient to hinder tillage slightly and to reduce the available water holding capacity. These areas are indicated on the soil map by gravel symbols. Small areas in which the surface layer is loamy sand were also included. In a few spots, the depth to the water table sometimes is less than 30 inches.

This soil can be used and managed in the same way as Letha fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes. Irrigation and reclamation are more difficult because of the gently undulating slopes. *Capability unit IVw-2, irrigated.*

Letha fine sandy loam, deep, strongly saline-alkali, 0 to 1 percent slopes (LtA)-A profile of this soil is the one described as typical of the series. The depth to the underlying gravel is 36 to 60 inches. The water table commonly is between 30 and 50 inches.

In some spots the water table is higher than typical because of runoff or excessive irrigation. In a few other places the water table has been lowered by deep, open drainage ditches. A white salty crust forms on the surface of much of the acreage during the drier periods, and the reaction generally is above pH 8.5. The available water holding capacity is low.

This soil can be used and managed in the same way as Letha fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes. *Capability unit IVw-2, irrigated.*

Letha fine sandy loam, deep, strongly saline-alkali, 1 to 3 percent slopes (LtB).-A profile of this soil is similar to the one described as typical of the series. The depth to the underlying gravel ranges from 36 to 60 inches. The depth to the water table commonly is between 30 and 50 inches. A white, salty crust forms on the surface of much of this soil during the drier periods, and the reaction generally is above pH 8.5. The available water holding capacity is low. A few small spots in which the surface layer is loamy sand were included in mapping.

This soil can be used and managed in the same way as Letha fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes, but irrigation and reclamation are more difficult because of the gently undulating slopes. *Capability unit IVw-2, irrigated.*

Letha loam, strongly saline-alkali, 0 to 1 percent slopes (LuA).-This soil is like the soil described as typical of the series, except that it is somewhat transitional toward the Baldock soils. The surface layer is loam, and the subsoil is loam or fine sandy loam. The depth to the underlying gravel or sand ranges from 36 to 60 inches. The depth to the water table commonly is between 30 and 50 inches. A white, salty crust forms on the surface of much of the acreage during the drier periods, and generally the pH is above 8.5. The available water holding capacity is moderate.

This soil can be used and managed in nearly the same way as Letha fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes, though it absorbs water more slowly and is more difficult to reclaim than the coarser textured soil. *Capability unit IVw-2, irrigated.*

Lickskillet Series

The Lickskillet series consists of well-drained, dark-colored soils on basaltic hills and mountainous slopes northeast of Emmett. These soils developed in residuum weathered from basalt or other fine-grained, basic igneous rocks. In places the uppermost few inches developed in or was influenced by a thin covering of silty wind-laid material. The surface layer is principally loam and is moderately low in content of organic matter. The subsoil is clay loam or has slightly more clay than the surface layer. It is underlain by basalt bedrock at a depth of 12 to 22 inches. A weak or moderate accumulation of calcium carbonate occurs in the lower part of the profile.

These soils occupy a moderate to moderately large acreage in the Lickskillet-Bakeoven soil association. They occur mostly on ridgetops and southerly slopes. The elevation ranges from 2,500 to 3,500 feet. The annual precipitation is 11 to 13 inches. The slope ranges from 0 to 60 percent but is mostly between 3 and 25 percent. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, and other grasses and forbs.

The Lickskillet soils are slightly to moderately eroded. The available water holding capacity is low, permeability is moderately slow in the subsoil, and fertility is low to moderate.

A small acreage is used for irrigated and dry-farmed crops and pasture, but most of the acreage is used for range.

Representative profile of Lickskillet stony loam, 12 to 30 percent slopes, 700 feet south and 200 feet east of the northwest corner of sec. 23, T. 7 N., R. 1 W., in a noncultivated area.

A1-0 to 5 inches, very dark grayish-brown (10YR 3/2) stony loam; grayish brown (10YR 5/2) when dry; weak, medium, platy structure and weak or moderate, fine, granular structure ; friable when moist, slightly hard when dry; roots plentiful: neutral (pH 6.6).

B1t-5 to 8 inches, dark-brown (10YR 3/3) stony loam or clay loam: brown (10YR 5/3) when dry; weak, fine, subangular blocky structure ; friable when moist, hard when dry; slightly darker colored, thin, patchy clay films on ped surfaces; roots plentiful; common very fine pores; neutral (pH 6.8).

B21t-8 to 13 inches, dark-brown (10YR 3/3) stony clay loam: brown (10YR 5/3) when dry weak, medium, prismatic structure and moderate, medium, subangular blocky structure; slightly darker colored, moderately thick, continuous clay films on ped surfaces ; very firm when moist, very hard when dry; few fine roots; common very fine pores; neutral (pH 6.9).

B22t-13 to 17 inches. dark-brown (10YR 3/3) stony clay loam ; brown (10YR 5/3) when dry; weak or moderate, fine, subangular blocky structure; thin clay films on ped surfaces ; very firm when moist, very hard when dry ; few fine roots ; common very fine pores; neutral (pH 6.9).

B3tca-17 to 20 inches, dark-brown (10YR4/3) stony light clay loam; weak, medium, suhangular blocky structure; friable when moist, hard when dry ; moderately calcareous with calcium carbonate veins, splotches, and coatings on basalt fragments; mildly to moderately alkaline.

R-20 inches +, somewhat weathered basalt bedrock, grading to unweathered basalt.

The color of the moist A horizon is very dark grayish brown to dark brown (10YR 3/2 to 3/3). The color hue of the B horizon is 10YR to 7.5YR. In some places, particularly in shallower areas, the layer of calcium carbonate accumulation is in the underlying rock or is lacking. In places tuffaceous materials underlie the soil. These soils range from nonstony and nonrocky to extremely stony or extremely rocky. Inclusions of Bakeoven and Gem soils make up from 5 to 15 percent of the acreage of the areas mapped.

Lickskillet stony loam, 12 to 30 percent slopes (LvE).-A profile of this soil is the one described as typical of the series. The stones are from 6 to 18 inches in size and are spaced from about 20 to 100 feet apart. They hinder but do not prevent tillage. Most of this soil is moderately eroded, and there are small shallow gullies in some drainageways.

Included in the areas mapped were some soils that range from 22 to 40 inches in depth to bedrock. Also included were some soils that have a surface layer of stony clay loam.

This soil is used for pasture and range. The plant cover generally is in poor condition, and management needs are the same as those of Lickskillet complex. 7 to 12 percent slopes. *Capability unit VIe-2, dryland. Loamy-Brown range site.*

Lickskillet stony loam, 30 to 60 percent slopes (LvF).-This soil is like the soil described as typical of the series, except that it is slightly stony to very stony. The stones consist mostly of angular cobblestones and stones between 6 and 20 inches in size. There are also some outcrops of rock. Erosion is slight to moderate, and small shallow gullies have formed in some drainageways. Included in the areas mapped were some very shallow Bakeoven soils.

This soil is used for pasture and range. The plant cover generally is in poor condition and is dominated by big sagebrush, cheatgrass, Medusahead wildrye, and other annual weeds and forbs. The slopes are too steep for the preparation of seedbeds. Consequently, any improvement in the stands must be by broadcast seedings or by livestock management. If suitable grasses are established on adjoining soils, they will gradually spread to this soil. Good management is needed, however, to allow the introduced grasses or remnants of the native grasses to make enough growth to produce seed. *Capability unit VIIe-1, dryland. Shallow south, slope-Brown range site.*

Lickskillet complex, 7 to 12 percent slopes (LwD).-This complex consists of shallow Lickskillet stony loam and an unnamed moderately deep soil. These soils are so intermingled that it was not feasible to show them separately on a soil map of the scale used. The unnamed soil has a profile somewhat like that of Lickskillet stony loam, except that the depth to basalt bedrock is from 22 to 40 inches. The Lickskillet soil makes up about 40 to 60 percent of the areas mapped, and the unnamed moderately deep soil, from 35 to 55 percent. Inclusions of very shallow Bakeoven soil make up from 1 to 15 percent of most delineated areas. Also included in mapping were small areas of a soil that has a clay subsoil. Erosion has been slight in most places but moderate in some spots.

These soils are used mainly for pasture and range, but small acreages are used for nonirrigated and irrigated crops. Hay crops and small grain are the principal crops. A grass-legume mixture helps to control erosion, to preserve soil structure, and to maintain the organic-matter content. The use of manure, green manure, crop residues, and nitrogen and phosphate helps to maintain productivity. On nonirrigated soils, the amount of nitrogen should be limited because the supply of available moisture is low. Both the corrugation and the sprinkler methods of irrigation are suitable, but the application of water must be slow to avoid excess runoff and erosion.

The pasture and range generally are in poor condition. The principal plants are Medusahead wildrye, cheatgrass, and annual weeds. Forage yields can be increased by summer fallowing, preparing good seedbeds, and reseeding Ladak alfalfa with suitable range grasses. Suitable grasses include Siberian wheatgrass, crested wheatgrass, Whitmar beardless wheatgrass, Sherman big bluegrass, pubescent wheatgrass, and intermediate wheatgrass. Once a plant cover is established, it can be maintained by good grazing management. The plants must be allowed to snake enough growth to maintain vigor and to reseed.
Capability units IVe-1, irrigated; VIs-2, dryland. Loamy-Brown range site.

Lickskillet complex, 12 to 30 percent slopes (LwE).-This complex consists of shallow Lickskillet stony loam and an unnamed moderately deep soil. These soils are so intermingled that it was not feasible to show them separately on a soil map of the scale used. The unnamed soil has a profile like that of Lickskillet stony loam, except

that the depth to basalt bedrock is 22 to 40 inches. Lickskillet stony loam makes up about 40 to 60 percent of most of the areas mapped, and the unnamed moderately deep soil makes up about 30 to 50 percent. Inclusions of very shallow Bakeoven soil make up from 1 to 15 percent of most areas. Small areas of a soil that has a clay subsoil were also included in mapping. Most of the acreage is only slightly eroded, but many spots are moderately eroded.

These soils are used mainly for pasture and range. Some small areas are used for dry-farmed or irrigated crops. Irrigated areas need a permanent cover of hay or pasture crops. Cover crops are also needed in orchards. Irrigation can be by the corrugation or the sprinkler method, but the erosion hazard is high if grain or a row crop is grown. Nonirrigated areas can be managed in the same way as nonirrigated areas of Lickskillet complex, 7 to 12 percent slopes.

The pasture and range are mostly in poor condition. Management needs are the same as those of Lickskillet complex, 7 to 12 percent slopes. *Capability units VIe-1, irrigated; VIe-2, dryland. Loamy-Brown range site.*

Lickskillet-Bakeoven extremely stony complex, 0 to 30 percent slopes (LxE).-This complex is about 50 to 80 percent Lickskillet extremely stony loam and 20 to 40 percent Bakeoven extremely stony loam. In the Lickskillet soil, basalt bedrock occurs at a depth of 12 to 22 inches; in the Bakeoven soil. basalt bedrock is within 12 inches of the surface. The Lickskillet soil is more common in concave areas, on the lower and middle parts of slopes, and on northerly slopes. The Bakeoven soil generally surrounds outcrops of rock, or it is on convex spurs and on points of ridges. The Lickskillet and Bakeoven soils are like the soils described as typical of their respective series, except that in most places the surface layer and subsoil are extremely stony or cobbly. Fragments of basalt range from a fraction of an inch to 20 inches in size and are mostly angular or subangular.

Outcrops of basalt bedrock and soils that are less than 4 inches thick occupy from about 5 to 25 percent of most delineated areas. A soil that is more than 22 inches thick was included in some of the areas mapped. Also included were some small areas of a soil that has a clay subsoil.

In most places these soils are only slightly eroded, but in many spots they are moderately eroded. The rock outcrops, stones, and cobblestones make tillage impractical in most areas.

These soils are used for pasture and range. The plant cover is in poor condition. In some areas it is dominated by Medusahead wildrye, and in others by big sagebrush and cheatgrass. These soils are too stony and too rocky to permit preparation of seedbeds for reseeding. Bulbous bluegrass can be broadcast, and other grasses can be established by reseeding adjoining soils and allowing the grasses to spread. Areas that have remnants of native grasses can be improved by controlling grazing or preventing grazing. Once a better cover is established, it can be maintained-by good grazing management. *Capability unit VIIs-1, dryland. Shallow stony-Brown range site.*

Lickskillet-Bakeoven extremely stony complex, 30 to 60 percent slopes (LxF).-This complex resembles Lickskillet-Bakeoven extremely stony complex, 0 to 30 percent slopes, except that it has steeper slopes and, consequently, more rapid runoff. The Lickskillet soil makes up from 45 to 75 percent of most delineated areas, and the Bakeoven soil makes up from 25 to 45 percent. In most places the surface layer and subsoil are extremely stony or cobbly. Fragments of basalt range from a fraction of an inch to 20 inches in diameter and are mostly angular or subangular. Basalt bedrock outcrops and soils that are less than 4 inches thick occupy about 5 to 30 percent of most delineated areas. A soil that is more than 22 inches thick makes up a small percentage of some areas. Small areas of a soil that has a clayey subsoil were included in some of the areas mapped.

Most of these soils are only slightly eroded, but many small areas are moderately eroded, and small gullies have formed in some drainageways. The slopes generally have a southerly aspect. The steep slopes, rock outcrops, and stones and cobblestones make tillage impractical in most areas.

These soils are used for pasture and range. The condition of the plant cover is fair in some places but poor in most places. Management needs are similar to those of Lickskillet stony loam. 30 to 60 percent slopes, but forage yields will be less because of the very shallow Bakeoven *soil. Capability unit VIIs-2, dryland. Shallow south slope-Brown range site.*

Lolalita Series

In this series are light-colored, well-drained or somewhat excessively drained soils that are principally on southerly slopes in the uplands. The surface layer and subsoil generally are moderately coarse textured, but in places the surface layer is loamy coarse sand or loamy sand. At a depth of 10 to 36 inches, the subsoil is underlain by stratified sandy or gravelly material of the Idaho and related formations. The coarse or moderately coarse textured parent material is high in quartz, feldspar, and mica and generally is noncalcareous. This material weathered chiefly from coarse-grained acid igneous rocks. In places the upper part of the soil may be influenced by wind-laid silt or slough from finer textured soils. The surface layer has a low or moderately low content of organic matter. The subsoil has no appreciable accumulation or only a very weak accumulation of clay, and there is either no accumulation or only a weak accumulation of calcium carbonate below a depth of 2 or 3 feet.

These soils are extensive in the Chilcott-Lanktree-Lolalita soil association. They occur at elevations of 2,300 to 4,500 feet, mainly in the southern and western parts of the county. The slope ranges from 12 to 75 percent but is dominantly between 30 and 50 percent. The annual precipitation is about 9 to 12 inches. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, Indian ricegrass, giant wildrye, and big sagebrush.

Erosion is slight to severe on these soils. In spring there is considerable runoff during some rains. Slips and landslides occur occasionally, and rills and gullies are common. In some places there are ledges of sandstone. Except for fragments from these ledges, the soils generally are free of large stones. In places, however, there are numerous cobblestones and considerable gravel, mostly from old river deposits. such as the Upper Mesa and Lower Mesa formations. The available water capacity is low, and permeability is moderately rapid.

These soils are used for pasture and range.

Representative profile of Lolalita coarse sandy loam, 30 to 60 percent slopes, 650 feet east and 800 feet north of the southwest corner of the SE1/4 sec. 25, T. 6 N., R. 2 W., in a lightly grazed area.

A1-0 to 0.5 inch, dark grayish-brown (2.5Y 4/2) coarse sandy loam; light brownish gray (2.5Y 6/2) when dry; weak, medium, platy structure; very friable when moist, soft when dry ; fine roots plentiful ; slightly acid (pH 6.5).

AC-0.5-inch to 3 inches, dark grayish-brown (2.5Y 4/2) coarse sandy loam; light brownish gray (2.5Y 6,12) when dry ; weak, very flue, granular structure ; very friable when moist, soft when dry ; abundant fine roots ; neutral (pH 6.9).

C1-3 to 36 inches, olive-brown (2.5Y 4/4) coarse sandy loam ; light yellowish brown (2.5Y 6/3 when dry ; massive; friable when moist, slightly hard when dry ; fine roots plentiful ; many fine pores ; neutral (pH 7.0).

C2ca-36 to 70 inches +, light olive-brown (2.5Y 5/3) loamy coarse sand ; pale yellow (2.5Y 7/3) when dry ; massive; very friable when moist, soft when dry; few fine roots; few faint veins of calcium carbonate; slightly calcareous; mildly alkaline (pH 7.8).

The surface layer is dominantly coarse sandy loam and loamy coarse sand, but in places it is loam, sandy loam, or loamy sand that in some places is gravelly or cobbly. The surface layer is dark grayish brown (10YR 4/2 or 2.5Y 4/2) to grayish brown (10YR 5/2 or 2.5Y 5/2) when moist, and light brownish gray (2.5Y 6/2 or 10YR 6/2) to light yellowish brown or pale brown (2.5Y 6/3 or 10YR 6/3) when dry. The subsoil is dominantly coarse sandy loam, but in places it is sandy loam or moderately coarse textured gravelly material. The surface layer is slightly acid to neutral in reaction, and the subsoil is slightly acid to mildly alkaline. In many places, the C1 horizon has a very few or patchy clay films.

Inclusions of Lanktree and Payette soils make up about 5 percent of the acreage of the areas mapped. In some places the Lolalita soils are transitional to the Lanktree soils or to the Payette soils.

Lolalita coarse sandy loam, 12 to 30 percent slopes (LyE). A profile of this soil is similar to the one described as typical of the series. The surface layer and subsoil are predominantly coarse sandy loam. In most places this soil is only slightly eroded, but in some places it is moderately eroded. Included in mapping were a few areas in which the surface layer and subsoil are gravelly coarse sandy loam. These areas are indicated on the soil map by gravel symbols. Also included wore a few acres of a soil that has a surface layer of loamy coarse sand.

This soil is used for grazing. The plant cover is in poor condition and is dominated by cheatgrass and annual weeds. Summer fallow, good seedbeds, and reseeding are necessary to establish a good stand of desirable grasses. A good seeding mixture consists of Ladak alfalfa and a grass, such as crested wheatgrass, Siberian wheatgrass, or Whitmar beardless wheatgrass. *Capability unit VIe-2, dryland. Loamy-Sierozem range site.*

Lolalita coarse sandy loam, 30 to 60 percent slopes (LyF). A profile of this soil is the one described as typical of the series. Much of this soil is only slightly eroded, but a considerable acreage is moderately eroded. Gullies occur in some areas. Most slopes have a southern aspect. Included in mapping were a few areas in which the surface layer and subsoil are gravelly coarse sandy loam. These areas are indicated on the soil map by gravel symbols. Also included are a few acres of soils that have a surface layer of loamy coarse sand or loam.

This soil is used for pasture and range. The plant cover is in poor to fair condition and is dominated by cheatgrass, fiddleneck, three-awn, and annual weeds. Remnants of big sagebrush and native grasses occur in some places. Yields of usable forage can be increased in these areas by managing grazing so as to allow the native grasses to reseed. In other Places, the plant cover can be improved only by broadcast seedings of bulbous bluegrass or by reseeding adjoining soils and allowing the grass to gradually spread to this soil. Good grazing management is essential to permit perennial gasses to become established and to maintain them after they are established. *Capability unit VIIe-1, dryland. Granitic south slope-Sierozem and Brown range site.*

Lolalita loamy coarse sand, 60 to 75 percent slopes (LzG).-A profile of this soil is similar to the one described as typical of the series, except that the surface layer is dominantly loamy coarse sand and the subsoil, to a depth of 10 to 36 inches, is mostly coarse sandy loam. In many places, however, the surface layer is coarse sandy loam, and in some places it is gravelly coarse sandy loam or gravelly loamy coarse sand. Nearly all of this soil is on very steep, southerly slopes. On much of the acreage erosion has been moderate; in many places it has been slight; and in a few places it has been severe. In some places the stratified parent material is exposed.

This soil is so steep and so erodible that it is suitable only for watersheds and wildlife habitats. A plant cover is needed to minimize runoff and to control erosion. In many places the plant cover is in nearly as good condition as the original cover, but it generally is in poor condition where it has been grazed. If this soil occurs on the edge of a terrace on which there are irrigated soils, it needs to be protected from waste water that may rum over the terrace edge and cut gullies. *Capability unit VIIIs-1, dryland.*

Mehlhorn Series

This series consists of dark-colored, well-drained soils on uplands. These soils formed in residuum weathered from basalt or other fine-grained basic igneous rocks. The surface layer is dominantly loam, but in places it is clay loam. It ranges from stone free to extremely stony. It is moderately high in content of organic matter. The subsoil typically is clay loam. Its content of rock fragments ranges from a few angular pebbles to many angular cobblestones or stones. The depth to bedrock ranges from about 20 to 45 inches. The reaction is neutral to slightly acid.

These soils are extensive in the Gwin-Mehlhorn-Jacknife soil association. They occur on ridgetops and southerly slopes from Squaw Butte northward. The slope ranges from 0 to 60 percent but generally is between 5 and 25 percent. The annual precipitation ranges from 16 to 23 inches. The native vegetation consisted of Idaho fescue, bluebunch wheatgrass, other bunchgrasses, herbaceous plants, and some forbs.

Erosion is slight to moderate on these soils. The available water capacity is low to moderate, permeability is moderately slow in the subsoil, and fertility is moderate.

The Mehlhorn soils are used for pasture and range and for dry-farmed crops.

Representative profile of Mehlhorn stony loam, 12 to 30 percent slopes. 2,120 feet north and 2,200 feet east of the southwest corner of sec. 3, T. 11 N., R. 1 E., in a nonculti vated area.

A11-0 to 3 inches, very dark grayish-brown (10YR 3/2) to very dark brown (7.5YR 2/2) stony loam; dark grayish brown (10):R 4/2) when dry; few to moderately numerous, angular, basalt pebbles and cobblestones ; weak, thin, platy structure and moderate, fine to very fine, granular structure; friable when moist, slightly hard when dry ; abundant fine roots; slightly acid (pH 6.4).

A12-3 to 7 inches. dark-brown (7.5YR 3/3) stony loam ; dark brown (7.5YR 4/2 to 10YR 4/3) when dry ; few to common, angular, basalt pebbles and cobblestones ; moderate or strong, very fine, subangular blocky structure ; friable when moist. slightly hard when dry ; few fine roots ; many very fine pores ; slightly acid (pH 6.5).

Blt-7 to 15 inches, dark-brown (7.5YR 3/13) light clay loam ; brown (7.5Y 5/3) when dry; common, angular, basalt pebbles and cobblestones ; moderate, very fine, subangular blocky structure ; friable when moist, hard when dry ; thin, continuous clay films on all surfaces ; few fine roots; common very fine pores; neutral (pH 6.6).

B2t-15 to 23 inches, dark-brown (7.5YR 3/3), angular cobbly clay loam; brown (7.5YR 5/3) when dry ; moderate, medium to fine, angular blocky structure ; firm when moist, hard when dry ; thick, continuous clay films on all surfaces ; few fine roots ; common very fine pores; neutral (pH6.6).

B3t-23 to 29 inches, dark-brown (7.5Y 4/3) clay loam; brown (7.5YR 5/3) when dry; many angular basalt pebbles, cobblestones, and stones ; weak, fine, subangular blocky structure ; firm when moist, hard when dry; moderately thick, continuous clay films on all surfaces ; few fine roots ; common very fine pores ; slightly acid (pH 6.2).

R-29 inches +, basalt bedrock.

The surface layer ranges from very dark grayish brown (10YR 3/2) to very dark brown (10YR 2/2) when moist and from dark grayish brown (10YR 4/2) to dark brown (7.5YR 4/3) when dry. The hues of the B2t horizon ranges from 7.5YR to 5YR.

Inclusions of Gwin and Jacknife soils make up from 5 to 10 percent of the acreage of the areas mapped.

Mehlhorn loam, 12 to 30 percent slopes (MaE).-This soil is like the soil described as typical of the series except that there are no stones or only a few stones on and in the surface layer. Erosion is slight to moderate in most places, and there are gullies in some drainageways.

This soil is used for pasture and range, but it is also suitable for dry-farmed alfalfa, small grain, and pasture crops. A mixture of grasses and legumes in the rotation will help to maintain the organic-matter content and to improve soil structure. The use of green manure crop residues, and fertilizers will help to enrich the soil, to maintain soil structure. and to control erosion.

The plant cover generally is in poor condition and is dominated by annual weeds. Yields of usable forage are low, but they' can be increased by summer fallowing, preparing good seedbeds, and reseeding suitable forage plants. A mixture of Ladak alfalfa and Siberian wheatgrass, intermediate wheatgrass, or beardless wheatgrass is suitable. Once established, a good stand can be maintained by good grazing management. A good stand of grass on this soil will help to revegetate adjoining soils. *Capability unit IVe-4, dryland. Loamy-Prairie range site.*

Mehlhorn stony loam, 12 to 30 percent slopes (MbE).-A profile of this soil is the one described as typical of the series. There are enough stones and cobblestones on and in the surface layer to hinder tillage but not enough to prevent tillage. Slopes face in all directions. On southerly slopes the surface layer is slightly browner than is typical, and on northerly slopes it is slightly darker colored and grayer.

This soil is used for dry-farmed crops and for pasture and range. Its management needs are the same as those of Mehlhorn loam, 12 to 30 percent slopes. *Capability unit IVe-4, dryland. Loamy-Prairie range site.*

Mehlhorn stony loam, 30 to 60 percent slopes (MbF).-This soil is similar to the soil described as typical of the series. It has steep, southerly slopes. Erosion is moderate, and gullies have formed in drainageways.

This soil is used for pasture and range. In most places the plant cover is in poor condition. The slopes are too steep for the preparation of seedbeds, but the sites can be improved by careful management and broadcast seedings. *Capability unit VIe-2, dryland. South slope-Prairie range site.*

Mehlhorn extremely stony loam, 0 to 30 percent slopes (McE).-This soil is like the soil described as typical of the series, except that it is extremely stony. Basaltic stones and cobblestones, from 6 to 20 inches in diameter, make up from 20 to 50 percent of the soil material. Erosion is slight to moderate, and deep gullies have formed in some drainageways.

This soil is used for pasture and range. In most places the plant cover is in poor condition. This soil is too stony for the preparation of seedbeds, but the sites can be improved by broadcast seedings and good management. *Capability unit VIs-1, dry and. Stony-Prairie range site 3.*

Mehlhorn-Gwin extremely stony complex, 0 to 30 percent slopes (MdE).-This mapping unit is about 50 to 70 percent Mehlhorn extremely stony loam and about 20 to 50 percent Gwin extremely stony loam. The Mehlhorn soil is similar to the soil described as typical of the Mehlhorn series, except that it is extremely or very stony. The Gwin soil is similar to the soil described as typical of the Gwin series. The Gwin soil occurs along ridges and around rock outcrops. Outcrops of basalt make up from 2 to 15 percent of the area of this complex.

These soils generally are slightly to moderately eroded, and shallow gullies have formed in some drainageways. The available water holding capacity is very low in the Gwin soil and low to moderate in the Mehlhorn soil.

These soils are used for pasture and range. The plant cover commonly is in poor condition. Stoniness prevents the preparation of seedbeds, but the sites can be improved by broadcast seedings, particularly of bulbous bluegrass, and by good management.. *Capability unit VIs-1, dryland. The Mehlhorn soil is in the Stony-Prairie range site; the Gwin soil is in the Shallow stony-Prairie range site.*

Mehlhorn-Gwin extremely stony complex, 30 to 60 percent slopes (MdF).-This mapping unit is about 40 to 65 percent Mehlhorn extremely stony loam and about 25 to 50 percent of Gwin extremely stony loam. These soils are extremely stony or very stony. Outcrops of basalt bedrock make up about 2 to 20 percent of the area. The shallow Gwin soil occurs mainly around the outcrops of rocks, on the upper part of slopes, and on spurs of ridges. The moderately deep Mehlhorn soil commonly is less stony

than the Gwin soil, and it occurs mainly in concave areas and on the lower part of long slopes. These soils are mostly slightly to moderately eroded.

These soils are used for pasture and range. Stoniness and the steep slopes prevent the preparation of seedbeds. *Capability unit VIs-1, dryland. The Mehlhorn soil is in the Stony-Prairie range site; the Gwin soil is in the Shallow stony-Prairie range site.*

Montour Series

This series consists of dark-colored, well-drained, clayey soils on rolling to steep uplands. These soils apparently formed in weakly consolidated or unconsolidated sandy sediments of the Idaho and Payette formations, which are quartzic, feldspathic, micaceous, and chiefly noncalcareous. These sediments weathered from coarse .grained intrusive acid igneous rocks. The parent material may have been more or less tuffaceous. The surface layer has a moderately high content of organic matter and is moderately fine textured. During dry or nearly dry periods, cracks that are as much as 1 inch in width and from 20 to 30 inches deep form in the upper part of this soil. Granular material from the surface layer falls into these cracks. The subsoil is fine textured and contains more clay than the surface layer. A weak to moderate accumulation of calcium carbonate occurs between the subsoil and the stratified underlying material.

The Montour soils occur southeast of Sweet and east of Pearl. The elevation ranges from 2,600 to 4,500 feet. The annual precipitation is 12 to 15 inches. The slope ranges from 7 to 60 percent but is dominantly between 10 and 30 percent. The native vegetation consisted of bluebunch wheatgrass, Idaho fescue, big sagebrush, and forbs.

Erosion is slight to moderate on these soils. In most places there are no stones, but in some places stones have rolled from adjoining basaltic hills. Permeability is slow to very slow in the subsoil, the available water holding capacity is moderate, and fertility is moderate. Tillage is difficult because of the clayey surface layer.

These soils are used mostly for pasture and range. Some alfalfa and grain are grown under both irrigated and dryland farming systems.

Representative profile of Montour clay loam, 800 feet west and 200 feet north of the southeast corner of the NE1/4 of sec. 10, T. 7 N., R. 1 E., in a noncultivated area.

A11-0 to 1 inch, very dark gray (10YR 3/1), gritty clay loam; dark gray (10YR 4/1) when dry; weak, medium, platy structure and strong, fine, granular structure ; very firm when moist, very hard when dry; slightly acid (pH 6.5).

A12-1 to 6 inches, very dark gray (10YR 3/1), gritty clay loam ; dark gray (10YR 4/1) when dry ; wide cracks contain granular material from All horizon ; very coarse prisms that break to very thick plates, then to weak, medium, plates ; very firm when moist, extremely hard when dry ; few fine roots ; dense; few very fine pores.

A3B1t-6 to 13 inches, very dark gray (10YR 3/), gritty clay ; dark gray (10YR 4/1) when dry ; strong, very coarse prisms that break to strong, medium prisms ; very dense ; glossy surfaces on peds, either slickensides or clay films; primary cracks contain granular material from All horizon; extremely firm when moist; extremely hard when dry; few fine roots, mostly in cracks ; neutral (pH 6.T).

B2t-13 to 29 inches, olive-brown (2.5Y 3/3) fine gravelly clay; olive brown (2.5Y 4/3) when dry; strong, coarse, prismatic structure breaking to moderate, medium, angular blocky structure; glossy surfaces on peds, either slickensides or thick, continuous clay films ; extremely firm when moist, extremely hard when dry ; few very fine roots in cracks ; a very few roots penetrate interior of peds; neutral (pH 7.0).

C1ca-29 to 38 inches, olive-gray (5Y 4/2) to dark grayish brown (2.5Y 4/2), stratified coarse sandy loam, loamy sand, and sand; light brownish gray (2.5Y 6/2) when dry ; massive ; common, 1/2 to 1-inch, yellowish-brown (10YR 5/4, moist) mottles; moderately calcareous, with splotches and lenses of calcium carbonate ; mildly alkaline (pH 7.5).

C2-38 inches +, stratified sand; common iron oxide mottles; noncalcareous.

All horizons contain considerable coarse and very coarse quartz sand and very fine gravel. The A12 and A3B1t horizons have large cracks that contain granular material sloughed from the A11 horizon. In the lower part, these cracks contain some sandy calcareous material similar to that of the C1ca horizon. The surface layer is dominantly clay loam, but in places it is sandy clay loam, sandy clay, or clay. The granular All horizon is about 2 inches thick in spring but may be less than 1 inch thick late in summer or in fall. The color of the moist surface layer ranges from black (10YR 2/1) to very dark gray (10YR 3/1). The soils near Sweet generally are darker colored than those near Pearl. The B2t horizon is clay, gritty clay, or sandy clay. It commonly has a hue of 10YR but the interior of the peds ranges to a hue of 2.5Y. Darker colored coatings on the vertical surfaces of prisms are common. In places the peds in the lower part of the B horizon have manganese staining. The Al horizon ranges from 6.2 to 6.6 in pH; the B2 horizon, from 6.5 to 7.0; and the C1ca. horizon, from 7.3 to 7.6.

In less than 15 percent of the areas mapped, the surface layer is slightly less clayey, less granular, and less likely to form deep, wide cracks. Inclusions of Haw and Sweet soils make up as much as 3 percent of the acreage of the areas mapped.

Montour clay loam, 7 to 12 percent slopes (MfD).-A profile of this soil is similar to the one described as typical of the series.

This soil is used to a limited extent for dry-farmed crops. Because of the clay loam surface layer, good seed-beds are difficult to prepare and crop growth is slower than on the less clayey soils. A mixture of grasses and legumes is needed in the rotation to maintain or increase the organic-matter content and to preserve soil structure. Manure, green manure, and crop residues can be used to help granulate the surface layer and to increase the organic-matter content. Nitrogen is needed to help decompose plant residues and to increase yields.

Most of this soil is used for pasture and range. The plant cover is dominated by wild carrot, cheatgrass, and other annual weeds. Extensive reseeding of suitable grasses and legumes is needed to increase yields. A good stand of desirable forage plants can be obtained by summer fallowing, preparing good seedbeds, and seeding Ladak alfalfa with Whitmar beardless wheatgrass. bluebunch wheatgrass, or pubescent wheatgrass. This soil will be damaged by trampling if it is grazed early in spring when it is wet. It is best suited to grazing late in spring or in summer. *Capability unit IVe-6. dryland. ClayBrown range site.*

Montour clay loam, 12 to 30 percent slopes (MfE).-A profile of this soil is the one described as typical of the series.

This soil is used principally for pasture and range. It needs the same management as Montour clay loam, 7 to 12 percent slopes. Some small areas are dry farmed, but in these areas the hazard of erosion is serious because of runoff. *Capability unit IVe-6, dryland. Clay-Brown range site.*

Montour clay loam, 30 to 60 percent slopes (MfF).-This soil is similar to the soil described as typical of the series. It has steep, southerly slopes. On points and narrow ridgetops, particularly where the slopes are more than 50 percent, small inclusions of Payette soils make up as much as 5 percent of the acreage of the areas mapped.

All of the acreage is used for pasture and range. The plant cover consists principally of Medusahead wildrye, cheatgrass, and annual weeds. This soil is too steep for the preparation of seedbeds. Any improvement in the plant cover must be by broadcast seedings or by reseeding nearby areas so that grasses can gradually invade these areas. Good grazing management is essential to allow perennial grasses to reseed and to maintain a good stand after the grasses are established. This soil will be damaged by trampling if it is grazed too early in spring. Rapid runoff and erosion occur if too much of the plant cover is removed by grazing or burning, *Capability unit VIe-2, dryland. Clay-Brown range site.*

Moulton Series

This series consists of noncalcareous, imperfectly drained soils that formed in recent alluvium on bottom lands. The alluvium washed from areas of granitic, quartz monzonite, quartz diorite, or related intrusive acid igneous rocks or from areas of the Idaho and Payette formations. In places it contains small amounts of basaltic and rhyolitic materials. These soils typically are stratified, micaceous, high in quartz, and noncalcareous. The surface layer is dark colored but has a moderately low or low content of organic matter. Between a depth of 6 inches and at least 20 or 30 inches, the subsoil is dominantly moderately coarse textured. Typically, the subsoil is distinctly mottled below a depth of 8 to 20 inches. The depth to loose gravel and sand ranges from 20 to 55 inches.

These soils occupy an extensive area in the MoultonFalk soil association. They occur at elevations of 2,200 to 2,550 feet along the Payette River and its tributaries. They are the dominant soils on the river flood plains. Slopes are less than 3 percent, except for short breaks along some draina-geways. The annual precipitation is 9 to 12 inches. The vegetation consists of rushes, sedges, grass, willows, big sagebrush, and herbaceous plants.

Erosion has been negligible on these soils. The available water holding capacity is low to moderate, and fertility is moderate. Some areas have been improved by artificial drainage and are moderately well drained. There are some alkali spots.

These soils are used for irrigated crops and pasture.

Representative profile of Moulton fine sandy loam, 0 to 1 percent slopes, 600 feet south and 320 feet east of the center of sec. 6, T. 6 N.; R. 2 W., in a cultivated field.

Ap-0 to 6 inches, very dark grayish-brown (2.5Y 3/2) fine sandy loam ; grayish brown (2.5Y 5/2) when dry ; weak, very fine, granular structure ; very friable when moist and slightly hard when dry ; plentiful fine roots ; neutral (pH 6.6).

A1g-6 to 12 inches, very dark grayish-brown (2.5Y 3/2) fine sandy loam having common, fine, faint, very dark grayish-brown (10YR 3/2) mottles; grayish brown (2.5Y 5/2) when dry, having grayish-brown (10YR 5/2) mottles; very weak, medium, subangular blocky structure ; very friable when moist and slightly hard when dry; plentiful fine roots ; many very fine pores ; neutral (pH 6.8).

Clg-12 to 19 inches, very dark grayish-brown (2.5Y 3/2) fine sandy loam having common, fine, distinct, dark-brown (10YR 3/3) mottles; grayish brown (2.5Y 5/2) when dry, having brown (10YR 5/3) mottles ; massive ; very friable when moist and slightly hard when dry; plentiful fine roots; many very fine pores; neutral (pI3 6.7).

C2g-19 to 26 inches, dark grayish-brown (.2.5Y 4/2 fine sandy loam having many, medium, distinct, yellowish-brown (10YR 5/4) mottles; light brownish gray (2.5Y 6/2) when dry, having very pale brown (10YR 7/4) mottles ; massive; very friable when moist and slightly hard when dry; plentiful fine roots ; many very fine pores ; neutral (pH 6.7).

IIC3g-26 inches +, faintly mottled: very gravelly loamy sand; single grained; loose; few fine roots; neutral (pH 6.8).

The surface layer is fine sandy loam, loamy sand, or loam. It is gravelly in places. The color of the moist surface layer ranges from very dark grayish brown (2.5Y 3/2 or 10YR 3/2) to dark grayish brown (2.5Y 4/2 or 10YR 4/2) when moist, and from grayish brown (2.5Y 5/2 or 10YR 5/2) to light brownish gray (2.5Y 6/2 or 10YR 6/2) when dry. Below plow depth, a hue of 2.5Y is dominant, but the hue may be 10YR. The degree of mottling in the subsoil is variable. Stratification is common in the lower part. Although the soils are typically noncalcareous and about neutral in reaction, in places the upper part is slightly saline, alkali in spots, or faintly calcareous.

Along stream channels, Chance soils make up as much as 5 percent of some of the areas mapped. Along Bissell Creek, soils that have a subsoil of clay loam and that are transitional to Draper soils make up as much as 10 percent of some delineated areas. Slightly higher soils that are better drained, less mottled, and more like the Falk soils make up as much as 5 percent of some areas. Small areas of soils that are shallow to gravel like the Notus soils commonly make up 1 or 2 percent.

Moulton fine sandy loam, 0 to 1 percent slopes (MgA).-A profile of this soil is the one described as typical of the series. The depth to loose gravel ranges from 20 to 36 inches. Permeability is moderately rapid in the subsoil. The depth to the water table is between 20 and 40 inches most of the time. Small areas of a soil that contains a moderate amount of gravel or cobblestones throughout the profile were included in mapping. These areas are indicated on the soil map by gravel symbols. The gravel and cobblestones cause tilling to be somewhat more difficult than on the typical soil but do not prevent tillage.

This soil produces fair yields of irrigated pasture, hay, small grain, and row crops. Rotations that include a mixture of grasses and legumes are helpful in maintaining the organic-matter content and in preserving soil structure. Nitrogen and phosphate are needed. The use of manure, green manure, and crop residues helps to maintain productivity. Irrigation can be by the border, sprinkler, corrugation, or furrow method. Overirrigation can cause waterlogging and will shorten the life, of deep-rooted crops, such as alfalfa. *Capability unit IIIw-1, irrigated.*

Moulton fine sandy loam, 1 to 3 percent slopes (MgB).-This soil is similar to the soil described as typical of the series. The depth to loose gravel ranges from 20 to 36 inches. The relief is very gently sloping, gently undulating, or channeled.

Small areas of a soil that contains a moderate amount of gravel or cobblestones throughout the profile were included in mapping. These areas are indicated on the soil map by gravel symbols. The gravel and cobblestones interfere somewhat with tillage but do not prevent tillage.

This soil is used and managed in nearly the same way as Moulton fine sandy loam. 0 to 1 percent slopes. However, it is likely to need more leveling than the more nearly level soil and to be more difficult to irrigate. Irrigation should be more carefully controlled. *Capability unit IIIw-1, irrigated.*

Moulton fine sandy loam, deep, 0 to 1 percent slopes (MhA).-This soil is like the soil described as typical of the series, except that the depth to loose gravel and sand ranges from 36 to 55 inches. The water table generally is at a depth of 25 to 45 inches. Some areas are flooded occasionally.

In a few areas, drainage has been improved by deep, open ditches, and the water table seldom rises above a depth of 40 inches. These areas are more favorable for deep-rooted plants.

This soil is used and managed in nearly the same way as Moulton fine sandy loam, 0 to 1 percent slopes. However, it commonly produces slightly better yields than the more shallow soil. Yields would be greater if this soil were drained. *Capability unit IIIw-1, irrigated.*

Moulton fine sandy loam, moderately alkali, 0 to 1 percent slopes (MmA).-This soil is like the soil described as typical of the series, except that there are some spots that are saline or saline-alkali. These spots make up from 5 to 30 percent of the areas mapped. In these spots, permeability is moderately slow. In most places the depth to loose gravel is 20 to 36 inches. The depth to the water table is between 20 and 40 inches most of the time.

Between the saline-alkali spots, this soil produces fair yields of irrigated pasture, hay, small grain, and row crops. On the alkali spots, plant growth generally is poor, except for such alkali-tolerant crops as tall wheatgrass. Plant growth and soil amendments help to reclaim these spots. Rotations that include a grass-legume crop are desirable to maintain soil tilth and organic-matter content and to preserve soil structure. Nitrogen and phosphate are needed for maximum yields. Utilizing manure, green manure, and crop residues is especially beneficial on the saline-alkali spots and promotes long-time productivity on all of this soil. Irrigation by the border, basin, or sprinkler method is best for reclaiming the saline-alkali spots. Excess irrigation water helps in reclamation but may cause waterlogging if applied when crops are growing. Improvement of drainage would be beneficial. *Capability unit IIIw-6, irrigated.*

Moulton fine sandy loam, moderately alkali, 1 to 3 percent slopes (MmB).-This soil is like Moulton fine sandy loam, moderately alkali, 0 to 1 percent slopes, except that it is very gently sloping, gently undulating, or channeled. In a few places, the depth to loose gravel and sand is more than 3 feet.

This soil can be used and managed in nearly the same way as Moulton fine sandy loam, moderately alkali, 0 to 1 percent slopes, but it is likely to need more leveling and to be more difficult to irrigate than the more nearly level soil. *Capability unit IIIw-6, irrigated.*

Moulton fine sandy loam, deep, moderately alkali, 0 to 1 percent slopes (MoA).-This soil is like the soil described as typical of the series, except that there are some alkali spots. These spots occupy less than 15 percent of the total acreage. The depth to loose gravel and sand ranges from 36 to 55 inches. The water table generally is at a depth of between 25 and 45 inches. Permeability is moderately rapid, except in saline-alkali spots, where it is moderately slow. About 30 acres has a surface layer of loam. These areas are just below the bench, in sec. 6, T. 6 N., R. 1 W. and in sec. 1, T. 6 N., R. 2 W.

This deep soil can be used and managed in the same way as Moulton fine sandy loam, moderately alkali, 0 to 1 percent slopes. The saline-alkali spots in this deeper soil probably will take longer to reclaim than those in the more shallow soil, but they will produce better crops when they are free of salts and alkali. *Capability unit IIIw6, irrigated.*

Moulton loam, 0 to 1 percent slopes (MpA).-This soil is like the soil described as typical of the series, except that the surface layer is loam. In many places, the subsoil is also loam. The depth to the underlying gravel ranges from 20 to 45 inches. The depth to the water table ranges from 25 to 40 inches. Permeability is moderate in the subsoil.

This soil can be used and managed in nearly the same way as Moulton fine sandy loam, 0 to 1 percent slopes. *Capability unit IIIw-1, irrigated.*

Moulton loamy sand, 0 to 1 percent slopes (MrA).This soil is like the soil described as typical of the series, except that the surface layer is loamy sand or loamy fine sand. In most places, the subsoil is also loamy sand. The depth to gravel ranges from 20 to 50 inches and varies within short distances. The water table generally is at a depth of 20 to 40 inches. Permeability is very rapid in the subsoil. Included in the areas mapped were small areas of a soil that has a moderate amount of gravel or cobblestones throughout the profile. These areas are indicated on the soil map by gravel symbols. The gravel and cobblestones interfere with but do not prevent tillage.

This soil is used for irrigated pasture, hay, and small grain. Pasture and hay crops are best suited. Nitrogen and phosphate fertilizers and manure are needed. Irrigation can be by the sprinkler, border, or corrugation method but should be light and frequent because of the low water-holding capacity. *Capability unit IVw-1, irrigated.*

Moulton loamy sand, 1 to 3 percent slopes (MrB).This soil is like Moulton loamy sand, 0 to 1 percent slopes, except that it is very gently sloping, channeled, or gently undulating. The depth to the underlying gravel ranges from 20 to 50 inches and varies within short distances. The water table commonly is at a depth of between 20 and 40 inches.

This soil can be used and managed in the same way as Moulton loamy sand, 0 to 1 percent slopes, but it is more difficult to irrigate and more likely to need leveling than the more nearly level soil. *Capability unit IVw-1, irrigated.*

Moulton loamy sand, moderately alkali, 1 to 3 percent slopes (MsA).-This soil is like Moulton loamy sand,

1 to 3 percent slopes, except that it has some saline-alkali spots. These spots make up less than 15 percent of the acreage of the areas mapped.

This soil can be used and managed in about the same way as Moulton loamy sand, 1 to 3 percent slopes. Large applications of manure and gypsum are needed to increase yields on the saline-alkali spots. *Capability unit IVw-1, irrigated.*

Mountainview Muck Series

This series consists of organic soils that formed in very poorly drained basins from stratified plant remains and alluvial material. The content of organic matter in these soils is more than 30 percent. The surface layer is predominantly muck, and the plant remains are so well decomposed that generally they cannot be identified. The original plants probably were sedges, reeds, cattails, and rushes. The subsurface organic layer is muck, but it approaches well-decomposed or disintegrated peat. The muck above the highest mineral layer has a high ash content, and it is neutral to mildly alkaline but noncalcareous. The organic layers below the highest. mineral layer may be fibrous peat or disintegrated peat. If undrained, these soils are less than 58 inches in depth to the highest layer of mineral soil ; if drained, they are less than 43 inches.

These soils occur in basins in the valley west of Emmett, mostly in what was formerly the Blockhouse Swamp. Ditches have improved drainage inmost areas. The slopes are less than 1 percent. The elevation is between 2,250 and 2,300 feet. The annual precipitation is 9 to 11 inches.

The Mountainview soils are free of gravel and stones and are not eroded. The available water holding capacity is very high; permeability is moderately rapid in the subsoil; and fertility is high, but phosphate is needed.

Drained areas are now used for irrigated crops; undrained areas remain in marsh.

Representative profile of Mountainview muck, 1,150 feet north and 200 feet west of the southwest corner of the SW1/4 of sec. 23, T. 6 1., R. 2 N.

O1-0 to 4 inches, very dark brown (10YR 2/2) mucky peat; dark grayish brown (10YR 4/2) when dry; strong, very fine, granular structure ; very friable when moist, soft when dry ; root mat; neutral (pH 6.6) .

O2-4 to 18 inches, black (10YR 1/1) muck; dark gray (N 4/0) when dry; weak, medium, subangular blocky structure and weak. fine, granular structure; firm when moist, hard when dry; roots very abundant; neutral (pH (3.6).

O3-18 to 38 inches, black (10YR 1/1) muck; dark gray (N 4/0) when dry ; weak, medium, granular structure ; friable when moist; roots very abundant; neutral pH 7.2).

IICg-38 to 41 inches, light-gray (5YR 7/1) loam ; common, fine, prominent, dark yellowish-brown (10YR 4/4) mottles and few, fine, distinct, very dark gray (2.5Y 3/1) and pale-brown (10YR 6/3) mottles; massive; firm when moist. bard when dry ; roots plentiful ; mildly alkaline (pH 7.4).

IIIO1-41 to 57 inches, black (10YR 1/1) peaty muck; very dark gray (N 4/0) when dry ; weak, very fine, granular structure ; friable when moist, very hard when dry ; abundant roots; mildly alkaline (pH 7.4) ; one or more thin layers of mineral soil.

IIIO2-57 to 72 inches, dark-brown (7.5YR 3/2), very slightly decomposed, broad-leaved, coarse, fibrous sedges and black (10YR 2/1), well-decomposed muck; noncalcareous; mildly alkaline (pH 7.8).

The uppermost 6 inches is dominantly muck, mucky peat, peaty muck, or loamy muck. In some places the muck overlies mineral soil that is not underlain by organic soil. The highest layer of mineral soil generally is medium textured or moderately coarse textured. There are no layers of impermeable material, marl, or diatomaceous earth.

Small areas of Black Canyon, Bowman, Lahontan, and Baldock soils make up as much as 10 percent of the areas mapped.

Mountainview muck (Mt).-A profile of this soil is the one described as typical of the series. This soil is principally muck, but it contains some peat and some mineral soil layers. In many places, the depth to the underlying mineral soil layer is more than 3 feet. The available water holding capacity is very high. The water table generally is at a depth of 25 to 50 inches. In most places, it has been lowered by deep, open drainage ditches. Some areas have not been drained to the extent that other areas have and are not suited to most crops. These areas are indicated on the soil map by wet spot symbols.

This soil is used for irrigated crops. Phosphate is needed, especially if legumes and corn are grown. Improved drainage allows the organic material to decompose gradually. As it decomposes, the soil shrinks unevenly, and leveling is necessary from time to time. Irrigation can be by the border, sprinkler, corrugation, or furrow method. Excess water will waterlog the soil and damage deep-rooted crops. *Capability unit IIIw-3, irrigated.*

Mountainview muck, moderately deep (Mu).-This soil is principally muck but contains some peat and some mineral soil. It is like the soil described as typical of the series, except that the muck is underlain by loose sand, gravel, or other mineral soil at a depth of 18 to 36 inches. In most places, the water table has been lowered by deep, open drainage ditches and generally is at a depth of 20 to 50 inches. The available water holding capacity is high.

Some areas have not been drained to the extent that other areas have and are not suited to most crops. These areas are indicated on the soil map by wet spot symbols. Areas in which the water table is at, near, or above the surface much of the year and on which cattails are the principal vegetation are indicated on the soil map by marsh symbols. Unless artificially drained, these areas are too wet for most crops.

This soil is used and managed in about the same way as Mountainview muck. It holds less water and, therefore, requires more frequent irrigation than the deeper soil. *Capability unit IIIw-3, irrigated.*

Newell Series

The Newell series consists of very deep, well-drained soils on terraces and alluvial fans. These soils formed in basaltic alluvium and colluvium that, in places, included some granitic, rhyolitic, or related materials. The surface layer is dark colored and moderately high to high in content of organic matter. The subsoil commonly is silty clay loam or clay loam. A weak or moderate accumulation of calcium carbonate is common below a depth of 30 to 55 inches.

The Newell soils occupy a moderate to large acreage in the Gem-Newell soil association. They occur at ele-

vations of 2,500 to 3,500 feet along Squaw Creek in the Ola and Sweet Valleys; along Willow Creek north of Emmett; and in valleys in the vicinity of Squaw Butte. The annual precipitation ranges from 12 to 18 inches. The original vegetation consisted of bluebunch wheatgrass, Idaho fescue, other perennial grasses, and some herbaceous plants.

These soils are used mainly for irrigated crops and pasture, but some areas are used for dry-farmed crops, pasture, and range. The available water holding capacity is high, permeability is moderately slow in the subsoil, and fertility is high.

Representative profile of Newell silt loam, 0 to 1 percent slopes, 0.3 mile south of Sweet School.

Ap-0 to 7 inches, very dark brown (10YR 4/2) silt loam ; dark grayish brown (10YR 4/2) when dry; moderate, fine, granular structure ; friable when moist, hard when dry; abundant roots; slightly acid (pH 6.5).

A1-7 to 12 inches, very dark brown (10YR 2/2) silt loam ; dark grayish-brown (10YR 4/2) when dry; weak, medium, prismatic structure and weak, fine, subangular blocky structure ; friable when moist, hard when dry ; abundant roots; slightly acid (pH 6.5).

Blt-12 to 19 inches, very dark grayish-brown (10YR 3/2) light silty clay loam; grayish brown (10YR 5/2) when dry; weak, medium, prismatic structure and moderate, fine, subangular blocky structure; firm when moist, hard when dry ; roots plentiful ; many very fine and fine pores; thin, patchy, darker colored clay films; neutral (pH 6.7).

B21t-19 to 30 inches, dark-brown (10YR 3/3) silty clay loam; brown (10YR 5/3) when dry; weak, coarse, prismatic structure and moderate, fine, subangular blocky structure; firm when moist, very hard when dry ; roots plentiful ; common very fine pores ; medium or thin, nearly continuous, darker colored clay films; neutral (pH 6.6).

B22t-30 to 39 inches. clay loam ; slightly higher in color value and chroma than B21t horizon ; weak, coarse, prismatic structure and moderate fine subangular blocky structure ; firm when moist, very hard when dry ; roots plentiful; common very fine pores; medium or thin, nearly continuous, darker colored clay films; neutral (pH G.6).

C1ca-39 to 60 inches, dark-brown (10YR 3/3) light clay loam or heavy loam; brown (10YR 5/3) when dry; massive ; firm when moist, hard when dry; few fine roots ; common very fine pores; slightly calcareous, and few calcium carbonate veins; mildly alkaline (pH 7.8).

C2ca-60 to 75 inches, dark-brown (10YR 4/3) light clay loam or heavy loam ; brown (10YR 5/3) when dry ; massive; friable when moist, hard when dry; few fine roots; common very fine pores ; moderately calcareous ; many fine calcium carbonate veins ; moderately alkaline (pH 8.0).

C3-75 inches +, dark-brown (10YR 4/3) light clay loam or heavy loam ; brown (10YR 5/3) when dry ; few, medium. distinct, yellowish-brown mottles ; massive ; slightly calcareous; mildly alkaline (pH 7.8).

The surface layer is dominantly silt loam, clay loam, and silty clay loam, but in places it is loam. When moist, it ranges from very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2). The B2t horizon has weak to moderate structure and has a chroma of 2 to 3 in the 10YR and 7.5YR hues. In places the subsoil is stratified with materials that range from heavy loam to light clay. In some areas there are a few stones and cobblestones or a little gravel on the surface and throughout the profile, and in other areas there are numerous stones and cobblestones or much gravel.

Small areas of Gem, Squaw, Sweet, or Jacknife soils make up from 3 to 6 percent of the acreage of the areas mapped. Springs are common where the Newell soils join the steeper slopes. Included in some areas around these springs are soils that are black, granular, and loamy throughout. These soils are somewhat similar to the De Masters soils but are underlain by loose stones and gravel instead of bedrock. In a few places, the soils have a buried profile that has a black or very dark colored A1B horizon. The soils included with the Newell soils in the Ola Valley are not representative of the Newell series, because they commonly do not have a Cca horizon.

Newell clay loam, 3 to 7 percent slopes (NcC).-Except for the texture of the surface layer, this soil is like the soil described as typical of the series. It is only slightly eroded in most areas, but it is susceptible to moderate erosion. In some places the surface layer is loam.

This soil is used for irrigated and dry-farmed crops, pasture, and range. The irrigated crops are hay, small grain, row crops, and pasture. A mixture of grasses and legumes in the rotation helps to maintain organic-matter content and to preserve soil structure. Manure and green manure help to maintain soil tilth, workability, and productivity. Alfalfa and other legumes respond well to phosphate, and pasture, small grain, and row crops respond to nitrogen. Irrigation can be by the sprinkler, corrugation, or furrow method. The length of the run and the size of the irrigation stream need to be adjusted so that irrigation will not cause erosion.

If this soil is dry farmed, management is the same as for dry-farmed Newell silt loam. 1 to 3 percent slopes.

Medusahead wildrye, cheatgrass, big sagebrush, and annual weeds dominate in the plant cover on the pasture and range. The plant cover can be improved by preparing good seedbeds and reseeding with desirable grasses. Summer fallowing helps to control weeds. Ladak alfalfa can be seeded with a suitable grass, such as intermediate wheatgrass, pubescent wheatgrass, crested wheatgrass, Siberian wheatgrass, or beardless wheatgrass. Once established, the plant cover can be maintained by good grazing management. A good stand of grass will help to reseed adjoining soils that are too stony for seedbed preparation. *Capability units IIIe-1, irrigated; IIc-2, dryland. Loamy-Chestnut range site.*

Newell clay loam, 7 to 12 percent slopes (NcD).-A profile of this soil is like the one described as typical of the series, except that the surface layer is clay loam or, in places, loam. In most areas this soil is only slightly eroded, but in some places it is moderately eroded.

This soil is used for irrigated and dry-farmed crops, pasture, and range. The irrigated crops include hay, pasture, small grain, and orchards. Limiting annual crops to 1 year in the rotation helps to control erosion. A mixture of grasses and legumes in the rotation helps to maintain the content of organic matter, to preserve soil structure, and to control erosion. In orchards, permanent cover crops serve the same purposes and also make sprinkler irrigation more practical by increasing the intake rate. Utilizing crop residues, manure, and green manure helps to maintain long-time productivity. Nitrogen and phosphate are needed. Irrigation can be by either the sprinkler or corrugation method, but the rate of applying water must be limited so that irrigation will not cause erosion.

If this soil is dry farmed, management for crops, pasture, and range is the same as for dry-farmed Newell clay

loam, 3 to 7 percent slopes. *Capability units IVe-1, irrigated; IIIe-4, dryland. Loamy-Chestnut range site.*

Newell clay loam, 12 to 30 percent slopes (NcE).-This moderately steep soil is the most extensive soil in this series. It is like the soil described as typical of the series, except that the surface layer is clay loam and the subsoil has slightly less clay. Erosion is slight to moderate.

This soil is used to some extent for irrigated and dryfarmed crops, but it is used mainly for pasture and range. If irrigated, it is suitable for orchards that have a cover crop or for permanent hay crops or pasture. Nitrogen and phosphate fertilizers and manure are needed. Irrigation by the sprinkler method is preferable, but controlled flooding can be used if the streams are small enough not to cause erosion.

The dry-farmed areas are used for hay and small grain. 4 mixture of grasses and legumes should be grown at least 75 percent of the time. Manure, crop residues, and limited amounts of nitrogen are needed.

The pasture and range are used and managed in the same way as on Newell clay loam, 3 to 7 percent slopes. *Capability units VIe-1. irrigated; IVe-4. dryland. Loamy-Chestnut range site.*

Newell silt loam, 0 to 1 percent slopes (NmA). A profile of this soil is the one described as typical of the series.

This soil is used for all irrigated crops grown in the county. Growing a mixture of gasses and legumes at least half the time helps to maintain the content of organic matter and to preserve soil structure. Manure and green manure help to maintain soil filth, workability, and productivity. Pasture crops, small grain, and row crops respond well to nitrogen. Alfalfa and other legumes need phosphate. Irrigation can be by the border, corrugation, furrow, or sprinkler method. *Capability unit I-1, irrigated.*

Newell silt loam, 1 to 3 percent slopes (NmB).-Except for slope, this soil is like the soil described as typical of the series. A small area in which the surface layer is silty clay loam was included in mapping.

This soil is used chiefly for irrigated crops. Only a small acreage is used for dry-farmed crops, pasture, and range. The irrigated soil is used and managed in nearly the same way as the irrigated areas of Newell silt loam, 0 to 1 percent slopes. The irrigation stream and the length of run need to be adjusted so that irrigation will not, cause erosion.

The dry-farmed areas are used for alfalfa, small grain, and pasture, but their use is limited by lack of available moisture during the growing season. A mixture of grasses and legumes in the rotation will help to maintain the organic-matter content and to preserve soil structure. The rotation can be extended by adding a green-manure crop, such as Austrian winter peas, then another grain crop. Plowing under the last hay crop for green manure helps to enrich the soil, to preserve soil structure, and to control erosion. Utilizing manure and stubble helps to maintain productivity. Nitrogen will speed decomposition. Legumes need phosphate.

The pasture and range have been overgrazed and are in poor to fair condition. However, this soil is easily tilled for seedbeds. *Capability units IIe-1, irrigated, IIc-2, dryland. Loamy-Chestnut range site.*

Newell silt loam, 3 to 7 percent slopes (NmC).-A profile of this soil is similar to the one described as typical of the series. Most areas of this soil are slightly eroded, and areas unprotected by vegetation are moderately eroded. In places the surface layer is loam.

Most of the acreage is used for irrigated crops, and a small acreage is used for nonirrigated crops, pasture, and range. Hay, small grain, row crops, and pasture are grown under irrigation.

This soil can be used and managed in about the same way as Newell clay loam, 3 to 7 percent slopes, but it is more easily tilled and is slightly more permeable than the clay loam. *Capability units IIIe-1, irrigated; IIc-2, dryland. Loamy-Chestnut range site.*

Newell silty clay loam, 0 to 1 percent slopes (NsA).This soil is like the soil described as typical of the series, except that its surface layer is silty clay loam or clay loam.

This soil is used and managed in nearly the same way as Newell silt loam, 0 to 1 percent slopes, but tillage is somewhat more difficult and must be more carefully timed because of the finer textured surface layer. *Capability unit I-1, irrigated.*

Newell stony clay loam, 7 to 12 percent slopes (NtD).-This soil is similar to the soil described as typical of the series, except that the surface layer is stony clay loam. The stones and angular cobblestones commonly are between 4 and 15 inches in diameter and are numerous enough to hinder but not to prevent tillage. Generally, the number of stones increases with depth, especially in the lower part of the subsoil. Most of this soil is slightly eroded.

The irrigated soil is used and managed in the same way as the irrigated areas of Newell clay loam, 7 to 12 percent slopes. The dry-farmed areas, pasture. and range are used and managed in the same way as similar areas of Newell clay loam, 3 to 7 percent slopes. *Capability units IVe-1, irrigated; IIIe-4, dryland. Loamy-Chestnut range site.*

Newell stony clay loam, 12 to 30 percent slopes (NtE).-This soil is like the soil described as typical of the series, except that the surface layer is stony clay loam. The stones or angular cobblestones commonly are between 4 and 15 inches in diameter and are numerous enough to hinder but not to prevent tillage. Generally, the number of stones increases with depth, especially in the lower part of the subsoil. Erosion is slight to moderate.

This soil is used for irrigated and nonirrigated crops and for pasture and range. The irrigated and nonirrigated cropland is managed in the same way as similar areas of Newell clay loam, 12 to 30 percent slopes. Pasture and range are used and managed in the same way as on Newell clay loam, 3 to 7 percent slopes. *Capability units VIe-1, irrigated; IVe-4, dryland. Loamy-Chestnut range site.*

Notus Series

This series consists of light-colored, moderately well drained to imperfectly drained, coarse textured and moderately coarse textured soils that are underlain by loose gravel or gravelly sand at a depth of less than 20 inches. These soils are micaceous and high in quartz. They are forming in recent alluvium that washed principally from areas of granitic rocks or similar intrusive acid igneous rocks. Some of the material may have washed from areas of the Idaho and Payette formations, and smaller amounts from basaltic and rhyolitic areas. In places there are mottles in the lower part of the profile.

The Notus soils occupy a small total acreage, mainly in the Moulton-Falk association. They occur mostly on the higher bottom lands along the Payette River. The slopes generally are convex and are less than 3 percent. The elevation ranges from 2,200 to 2,500 feet. The annual precipitation is 9 to 12 inches. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, herbaceous plants, and possibly some willows and other browse plants.

Some of these soils are slightly eroded, and some are gravelly or cobbly. The available water holding capacity and fertility are very low, and permeability is rapid to very rapid. Saline-alkali spots occur on the imperfectly drained soils.

Areas that are interspersed with Moulton and Falk soils are used to some extent for crops and pasture, but much of the acreage is in cheatgrass and other weeds.

Representative profile of Notus coarse sandy loam, 1 to 3 percent slopes, 180 feet north and 830 feet west of the center of sec. 8, T. 6 N., R. 2 W., in a bluegrass pasture.

A1-0 to 0.5 inch, very dark grayish-brown (10YR 3/2) coarse sandy loam; grayish brown (10YR 5/2) when dry; weak, very fine, granular structure ; very friable when moist, soft when dry ; abundant roots : neutral.

C1-0.5 inch to 8 inches, dark grayish-brown (10YR 4/2) coarse sandy loam : very few pebbles and cobblestones ; light brownish gray (10YR (3/2) when dry; common, fine, faint, dark-brown (10YR 4/3) mottles that are yellow ish brown when dry; many, medium, faint, dark-gray (2.5Y 4/1) mottles : very weak, very fine, granular structure; very friable when moist, slightly hard when dry ; fine roots plentiful; many very fine pores; medium acid (pH 6.0).

C2-8 to 12 inches, olive-brown (2.5Y 4/3) coarse sandy loam; very little gravel and very few cobblestones ; light brownish gray to light yellowish brown (2.5Y 6/2 to 6/4) when dry; massive; very friable when moist, slightly hard when dry; fine roots plentiful ; many very fine pores; slightly acid (pH 6.1).

IIC3-12 to 18 inches. olive-brown (2.5Y 4/3) very gravelly loamy sand; single grained; loose; fine roots plentiful; many very fine pores; slightly acid (pH 6.2).

IIIC4--18 to 60 inches, grayish-brown (2.5Y 5/2) very gravelly sand; light gray (2.5Y 7/2) when dry; single grained; loose ; few fine roots ; many very fine pores; slightly acid (pH 6.3).

The surface layer and the subsoil range from fine sandy loam to very gravelly loamy sand. The surface layer ranges from very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2) to dark brown (10YR 3/3) or olive brown (2.5Y 4/3), when moist.

Inclusions of deeper Moulton and Falk soils and of gravelly areas make up as much as 10 percent of the acreage of the areas mapped.

Notus coarse sandy loam, 0 to 1 percent slopes (NuA).-A profile of this soil is like the one described as typical of the series.

This soil is best suited to hay and pasture crops, but it commonly is intermixed with deeper soils and is used with those soils for growing other crops. Manure, green manure, and crop residues can be used to increase the organic-matter content. Because of the very low waterholding capacity, frequent light applications of irrigation water are needed. The sprinkler, border, or corrugation method can be used. *Capability unit IVs-2, irrigated.*

Notus coarse sandy loam, 1 to 3 percent slopes (NuB).-A profile of this soil is the one described as typical of the series.

This soil can be used and managed in about the same way as Notus coarse sandy loam, 0 to 1 percent slopes, but it is more difficult to irrigate because of the gently undulating slopes. *Capability unit IVs-2, irrigated.*

Notus gravelly loamy coarse sand, 0 to 1 percent slopes (NvA).-This soil is like the soil described as typical of the series, except that the surface layer is loamy coarse sand and there are enough cobblestones and gravel in both surface layer and subsoil to hinder tillage materially but not enough to prevent tillage. In some areas there are saline-alkali spots.

This soil is best suited to hay and pasture crops, but generally it is used with deep adjoining soils. Manure, green manure, and crop residues are needed to increase the organic-matter content and to improve productivity. Irrigation can be by the sprinkler, border, or corrugation method, but applications must be light and frequent. The saline-alkali spots need such soil amendments as gypsum and large applications of manure. Nonirrigated areas produce mostly cheatgrass and other weeds. Reseeding these areas with suitable perennial grasses, such as Indian ricegrass, will make them more productive of usable forage crops. *Capability unit IVs-2, irrigated.*

Notus gravelly loamy coarse sand, 1 to 3 percent slopes (NvB).-This soil is like the soil described as typical of the series, except that there are enough cobblestones and gravel in both the surface layer and subsoil to materially hinder tillage but not enough to prevent tillage. In a few areas the surface layer is loamy coarse sand or loamy sand that contains little or no gravel.

This soil is used and managed in about the same way as Notus gravelly loamy coarse sand, 0 to 1 percent slopes, but irrigation is more difficult than on the more nearly level soil. *Capability unit IVs-2, irrigated.*

Odermott Series

This series consists of dark-colored, well-drained soils that formed in sandy sediments of the Idaho and Payette formations. These sediments are feldspathic, micaceous, high in quartz, and mainly noncalcareous. They weathered from intrusive acid igneous rocks. The surface layer is principally loam or clay loam and is moderately high in content of organic matter. The subsoil is dominantly fine textured but ranges to moderately fine textured. These soils are slightly acid throughout.

These soils are moderately extensive in the Ola Valley. They range from 3,000 to 3,600 feet in elevation, and receive about 15 to 18 inches of precipitation annually. The slope ranges from about 3 to 60 percent. Some areas are very stony. The native vegetation consisted of bunchgrasses, related forbs, and some bitterbrush and sagebrush.

Erosion has been slight to moderate on these soils. The available water holding capacity is moderate, fertility is moderate, and permeability is moderately slow in the subsoil.

Representative profile of Odermott loam, 12 to 30 percent slopes, 800 feet east and 380 feet north of the southwest corner of NE1/4, sec. 2, T. 9 N., R. 1 E., 380 feet north and 420 feet east of the gate in the southwest corner of the field.

Ap-0 to 8 inches, very dark-brown (10YR 2/2) gritty loam; dark grayish brown (10YR 4/2) when dry ; moderate, fine, granular structure ; upper part may have medium

and thick, platy structure ; friable when moist, slightly hard when dry; abundant roots; slightly acid (pH 6.4).

B21t-8 to 20 inches, dark-brown (7.5YR 3/3) light sandy clay ; dark brown (7.5YR 4/3) when dry; weak to moderate, medium, prismatic structure and moderate, medium, angular and subangular blocky structure ; moderate, continuous, slightly grayer and redder clay films on peds ; firm when moist, extremely hard when dry ; few fine roots; common very fine pores; slightly acid (pH 6.4).

B22t-20 to 26 inches, dark-brown (7.5YR 3/3) light sandy clay: dark brown (7.5YR 4/3) when dry; moderate. medium, prismatic structure and moderate or strong, medium, angular blocky structure; reddish-brown 5YR 4/3), thick, continuous clay films on peds; firm when moist, extremely hard when dry ; few fine roots ; common very fine pores; slightly acid (pH 6.4).

B23t-26 to 32 inches, dark-brown (7.5YR 3/3) coarse sandy clay loam; dark brown (7.5YR 4/3) when dry; weak coarse, prismatic structure and moderate or strong, medium, angular blocky structure; reddish-brown (5YR 4/3), thick, continuous clay films on peds; firm when moist, extremely hard when dry; few fine roots; common very fine pores; slightly acid (pH 6.4).

C1l-32 inches -. brown (10YR 5/3) and yellowish-brown (10YR 5/4) stratified loamy sands and sands of the Idaho formation and related strata.

The color of the moist surface layer is very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2). Hues of 7.5YR are dominant in the subsoil, but hues of 5YR and 10YR occur. The depth to the C1 horizon ranges from 2 to 4 feet. Shallower soils occupy the narrow ridgetops.

The parent material contained some diatomaceous materials. Soils formed in this material are moderately fine textured and, except for color, resemble the Montour soils. In some areas there are basalt rocks from higher lying basaltic areas. Soils of surrounding basaltic and granitic areas make up as much as 2 percent of the areas mapped.

Odermott clay loam, 30 to 60 percent slopes (OcF).-This soil is like the soil described as typical of the series, except that the surface layer is clay loam and the subsoil is clay. It occurs on steep northerly slopes and receives slightly less precipitation than the other Odermott soils. In most areas, erosion is slight, but in places it is moderate.

On points and narrow ridges, especially where the slopes are more than 50 percent, small inclusions of Van Dusen soils make up as much as 5 percent of the areas mapped.

This soil is used and managed in about the same way as Odermott loam, 30 to 60 percent slopes, which is on southerly slopes. However, it has somewhat higher yields than the south-facing soil because of the cooler temperature and more effective use of moisture, but it should be grazed later in the season. *Capability unit VIe-2, dry land. Granitic north slope-Prairie range site.*

Odermott loam, 3 to 7 percent slopes (OdC).-A profile of this soil is similar to the one described as typical of the series. Most of this soil is only slightly eroded, but a few spots are moderately eroded.

This soil is used for irrigated and dry-farmed crops and pasture and for range. The irrigated soil is used for alfalfa hay, small grain, and pasture. Fertility can be improved by utilizing manure, green manure, and crop residues. A rotation that includes a mixture of grasses and legumes helps to maintain the organic-matter content, to preserve soil structure, and to control erosion. Irrigation may be by the sprinkler, corrugation, or furrow method, but if corrugations and furrows are used, the length of run and size of irrigation stream should be limited so that irrigation will not cause erosion.

The dry-farmed areas are used for alfalfa for hay and for seed, small grain, and pasture. A mixture of grasses and legumes in the rotation helps to maintain or increase the organic-matter content and to preserve soil structure. Plowing under the last hay crop for green manure and utilizing manure and stubble help to maintain productivity, to preserve soil structure, and to control erosion. Nitrogen will speed decomposition. Legumes respond to phosphate.

The original plant cover on the range has been nearly replaced by cheatgrass, Medusahead wildrye, and other annual forbs and grasses. *Capability units IIIe-1, irrigated; IIe-4, dryland. Loamy-Prairie range site.*

Odermott loam, 7 to 12 percent slopes (OdD).-Except for slope, this soil is like Odermott loam, 3 to 7 percent slopes. Most of this soil is only slightly eroded, but many spots are moderately eroded, and gullies have formed in a few drainageways.

This soil is used and managed in about the same way as Odermott loam, 3 to 7 percent slopes, but less of the acreage is irrigated. Irrigation is more difficult than on the less sloping soil. and the erosion hazard is greater. *Capability units IVe-1, irrigated; IIIe-5, dryland. Loamy-Prairie range site.*

Odermott loam, 12 to 30 percent slopes (OdE).-A profile of this soil is the one described as typical of the series. On the ridgetops and points, this soil is shallower and more eroded than is typical. The water-holding capacity ranges from low on the ridgetops and points to moderate on the broader slopes. Included are some clayey soils that formed in the finer textured materials of the Idaho and Payette formations. Deep gullies have formed in a few of the drainageways.

This soil is used for nonirrigated crops and for pasture and range. The nonirrigated crops are alfalfa for hay, alfalfa For seed, small grain, and pasture. Management needs are similar to those of Odermott loam, 3 to 7 percent slopes.

The pasture and range are managed in the same way as the pasture and range on Odermott loam, 3 to 7 percent slopes. *Capability unit IVe-4, dryland. Loamy-Prairie range site.*

Odermott loam, 30 to 60 percent slopes (OdF).-A profile of this soil is similar to the one described as typical of the series. This soil is on steep southerly slopes but generally receives slightly more precipitation than Odermott clay loam, 30 to 60 percent slopes. Erosion is slight to moderate in most areas, and some drainageways are Bullied. 1lloderately fine textured spots are fairly common.

This soil is used for pasture and range. The plant cover has been invaded by Medusahead wildrye, cheatgrass, and some big sagebrush and bitterbrush. It generally is in poor condition. Forage yields are low but can be increased by good management practices. *Capability unit VIe-2, dryland. South slope-Prairie range site.*

Odermott very stony loam, 0 to 30 percent slopes (OmE).-This soil is like the soil described as typical of the series, except that it is very stony. The stones rolled from surrounding higher lying basaltic soils. They are numerous enough to prevent tillage for cultivated crops,

but tillage for reseeding the pasture and range probably is feasible. From 10 to 50 percent of the original surface layer has been lost through erosion because of the lack of an adequate plant cover. Deep gullies have formed in some places.

This soil is used for pasture and range. The plant cover has been invaded by Medusahead wildrye, cheatgrass, and other annual forbs and grasses, and generally it is in poor condition. Yields of usable forage can be increased by good management practices. *Capability unit VIs-1, dryland. Stony-Prairie range site.*

Ola Series

The Ola series consists of very dark colored, well-drained, moderately deep and deep soils that formed in residuum weathered from granite, quartz monzonite, quartz diorite, and closely related intrusive acid igneous rocks. The surface layer is dominantly loam, but in places it is coarse sandy loam or sandy loam. It has a high content of organic matter. The subsoil is dominantly medium textured, but in places it is moderately coarse textured. It is slightly brighter colored than the surface layer and contains only a faint accumulation of clay. The entire profile is micaceous, noncalcareous, high in quartz, and slightly acid or nearly so.

These soils are moderately extensive in the BrownleeRainey-Ola soil association. They occur on steep to very steep northerly slopes in the uplands in the eastern part of the county. The slope ranges from about 30 to 80 percent but generally is about 45 percent. The elevation ranges from 3,400 to 5,000 feet, and the annual precipitation ranges from about 14 to 23 inches. The native vegetation consisted of ninebark, chokecherry, snowberry, bunchgrasses, associated forbs, and some ponderosa pine.

Erosion is slight to moderate on these soils, and deep gullies have formed in some drainageways. There are some outcrops of rocks. The available water holding capacity is low to moderate, and permeability is moderate in the subsoil.

These soils are used for pasture and range or for wildlife habitats and watersheds.

Representative profile of Ola rocky loam, 60 to 80 percent slopes, 660 feet north and 240 feet west of the center of the NE1/4 sec. 7, T. 10 N., R. 2 E., in a shrub area.

A11-0 to 7 inches, very dark brown (10YR or 7.5YR 2/2) loam; very dark grayish brown (10YR 3/2) when dry ; moderate, fine and very fine, granular structure ; friable when moist, slightly hard when dry ; very abundant roots; slightly acid (pH 6.4).

A12-7 to 15 inches, very dark brown (10YR or 7.5YR 2/2) loam ; very dark grayish brown (10YR 3/2) when dry ; moderate, medium and fine, granular structure; friable when moist, slightly hard when dry ; abundant fine roots ; faint bleached specks ; slightly acid (pH6.4).

AC-15 to 21 inches, loam, slightly lighter colored and browner than A12 horizon; weak, medium, subangular blocky structure and moderate, fine, granular structure; friable when moist, slightly hard when dry; fine roots plentiful ; many very fine pores ; slightly acid (pH6.4).

C1-21 to 29 inches, very dark brown (10YR 2/2) coarse sandy loam ; pieces of disintegrated granite ; dark grayish brown (10YR 4/2) when dry; weak, fine and very fine, granular structure to massive ; friable when moist, slightly hard when dry ; fine roots plentiful ; many very fine pores; thin, patchy clay films in pores; slightly acid (pH 6.4).

C2-29 to 35 inches, very dark grayish-brown (10YR 3/2) gravelly coarse sandy loam ; pieces of disintegrated granite and some moderately weathered pebbles ; dark grayish brown (10YR 4/2) when dry; massive; friable when moist, slightly hard when dry ; fine roots plentiful ; many very fine pores ; thin to medium patchy, darker colored clay films in cracks and on pebbles; slightly acid (pH 6.3).

R-35 inches +, gray (N 5/0, dry) and light-gray (2.5Y 7/2) partially decomposed granite or closely related bedrock; many, medium, distinct, olive-brown (2.5Y 4/4) and common, large, prominent, yellowish-red (5YR 4/6) stains ; moderately thick, patchy clay films in cracks ; few roots in cracks ; neutral (pH 6.6).

The A1 horizon ranges from very dark brown (10YR 2/2) to black (10Y R 2/1) when moist and from very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) when dry. In some places there are practically no clay films in the subsoil, and in other places there are medium patchy clay films, but the accumulation of clay is not distinct. Partially decomposed bedrock occurs at a depth of 24 to 40 inches.

Small areas of Brownlee soils and outcrops of rock make up as much as 3 percent of the acreage of the areas mapped.

Ola rocky loam, 30 to 60 percent slopes (OrF).-This soil is like the soil described as typical of the series. It has steep northerly slopes, and in most places it is slightly eroded. In a few places the surface layer is sandy loam or coarse sandy loam. Outcrops of rock and soils that are less than 4 inches thick make up from 2 to 20 percent of most areas. In a few areas, rock outcrops and extremely shallow soils occupy less than 2 percent of the acreage. In seine areas there are a few to a moderate number of detached stones and cobblestones.

This soil is too steep for tillage. It is used for pasture and range, which generally are in fair to good condition. Good grazing management is needed to maintain or to improve the grass cover and to control erosion. *Capability unit VIe-2, dryland. Granitic north slope-Prairie range site.*

Ola rocky loam, 60 to 80 percent slopes (OrG).-A profile of this soil is the one described as typical of the series. This soil is similar to Ola rocky loam, 30 to 60 percent slopes, except that it has very steep northerly slopes. Moderate or severe erosion has occurred in isolated areas.

Some of this soil is used for pasture and range. The plant cover commonly is in fair to good condition. *Capability unit VIIe-2, dryland. Granitic north slope-Prairie range site.*

Payette Series

This series consists of dark-colored, moderately coarse textured soils that are mostly on steep slopes. Generally, the surface layer and subsoil are both coarse sandy loam, but the subsoil shows a slight accumulation of clay. The surface layer has a moderate to moderately low content of organic matter. A weak or very weak accumulation of calcium carbonate is common in the lower part of the subsoil. These soils formed in material weathered from stratified sand or, in a few places, gravel of the Idaho and related formations (fig. 8). These formations occur at a depth of 20 to 45 inches and consist of unconsolidated water-laid sediments that weathered mostly from acid

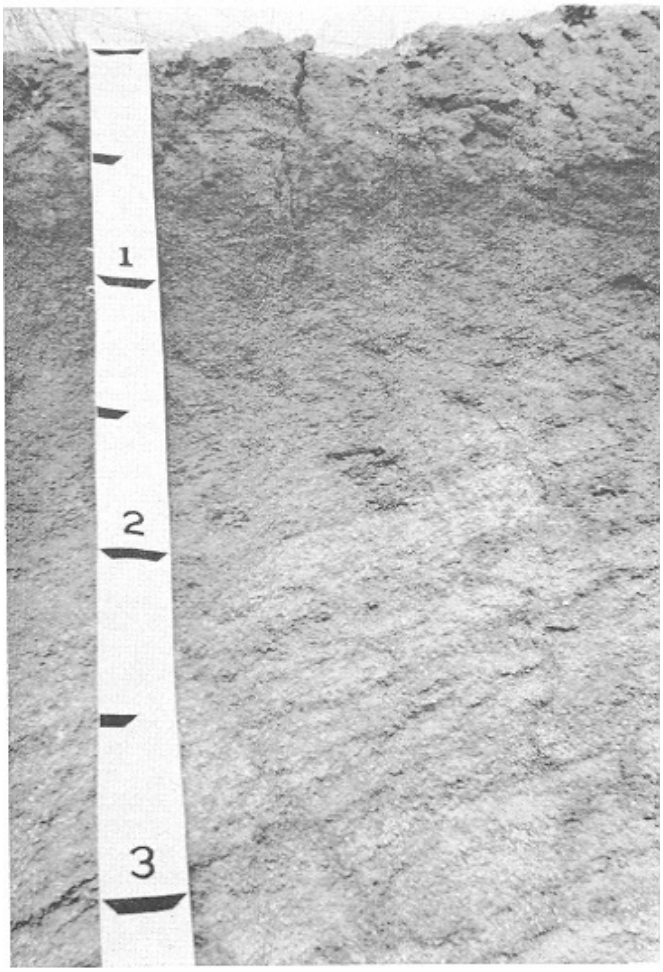

Figure 8.-Profile of Payette coarse sandy loam showing the weakly differentiated horizons and the sandy underlying material.

igneous rocks but that include small amounts of tuffaceous and diatomaceous materials. They are high in quartz, feldspar, and mica and are mostly noncalcareous.

These soils occupy a very large acreage in the Haw-Payette-Van Dusen soil association. They occur at elevations of 2,300 to 4,500 feet, mainly in the southwestern part of the county. The slope ranges from 0 to 75 percent, but is dominantly between 20 and 60 percent. The annual precipitation ranges from 9 to 11 inches on the steep northerly slopes and from 11 to 13 inches on steep southerly slopes. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, Idaho fescue, needlegrasses, and some scattered big sagebrush and bitterbrush.

Generally, these soils are free of gravel, cobblestones, and stones, but in some places they contain gravel and cobblestones from such deposits as the Upper Mesa formation. In other places, fragments have broken from sandstone ledges and sloughed onto these soils. Erosion is slight to severe, and there are some rills and gullies. Landslides and soil slips occur in places. The available water holding capacity is low, and permeability is moderately rapid in the subsoil.

These soils are used for range. However, the plant cover is now dominated by big sagebrush, cheatgrass, three-awn, and annual weeds.

Representative profile of Payette coarse sandy loam, 550 feet east and 75 feet north of the southwest corner of sec. 2, T. 6 N., R. 2 W.

A1-0 to 5 inches, very dark grayish-brown (10Y8 3/2) coarse sandy loam; grayish brown (10YR 5/2) when dry; very weak, thin, platy structure and weak, very fine, granular structure; very friable when moist, slightly hard when dry; abundant roots; neutral (pH 6.9).

B2t-5 to 16 inches, coarse sandy loam; slightly more clayey and slightly browner than Al horizon; weak, medium, subangular blocky structure ; thin, patchy clay films on ped surfaces; friable when moist, slightly hard when dry ; roots plentiful ; many very fine pores ; neutral (pH 6.9).

B3tca-16 to 31 inches, brown (10YR 5/3) coarse sandy loam; very pale brown (10YR 7/3) when dry ; weak, fine, subangular blocky structure ; very friable when moist, slightly bard when dry ; weakly calcareous, with com mon fine veins of calcium carbonate ; few fine roots ; few very fine pores; mildly alkaline (pH 7.6).

C1-31 inches +, stratified sandy layers of the Idaho formation; noncalcareous; neutral (pH 7.0).

In places, especially on the lesser slopes, the texture of the surface layer is loam. The surface layer is very dark grayish brown to dark brown (10YR 3./2 to 4/3) when moist. Some 2.5Y hues are included. In some places gravel occurs throughout the soil, and in a few areas there are stones and ledges of sandstone. The ca horizon is lacking in places because of the lack of lime in the parent material.

Inclusions of Lolalita or Van Dusen soils make up about 3 percent of the acreage of the areas mapped. An unnamed soil that has a greater accumulation of clay in the subsoil. and that is transitional to the Haw soils makes up another 5 percent.

Payette coarse sandy loam, 0 to 30 percent slopes (PaE).-This soil is similar to the one described as typical of the series. It occurs on hilltops and on moderately steep to steep slopes. In most places the surface layer is coarse sandy loam, but in many places it is loam or gritty loam. Some soils that have more clay in the subsoil than is typical were included in the areas mapped. Surface runoff is slow to medium, and erosion is slight to moderate.

This soil is used for pasture and range. The plant cover commonly is in poor condition, and cheatgrass and annual weeds are dominant. The soil is easily tilled for summer fallowing and seedbed preparation, but it generally occurs in small, relatively inaccessible areas. If a special effort is made to reseed these areas, they will be a source o f seed for adjoining areas that are too steep for tillage. A mixture of Ladak alfalfa and crested wheatgrass, Siberian wheatgrass, or Whitmar beardless wheatgrass is suitable. If this soil is used as a source of seed for adjoining areas, grazing should be managed so as to allow the grass to reseed regularly, preferably annually. *Capability unit IVe1, dryland. Granule-Brown range site.*

Payette coarse sandy loam, 30 to 60 percent slopes (PaF).-A profile of this soil is similar to the one described as typical of the series. In most areas the surface layer is coarse sandy loam, but in many places it is a loam or gritty loam, and in a few places it is gravelly coarse sandy loam or gravelly loam. This soil is very extensive. It occurs mainly on steep northerly slopes that have annual precipitation of 9 to 11 inches. About a third of the acreage is on

steep southerly slopes that have anneal precipitation of about 11 to 13 inches. Most areas are slightly to moderately eroded, and gullies have formed in some drainageways. Surface runoff is rapid. In places, particularly in concave areas, soils that have more clay in the subsoil than is typical were included in the areas mapped.

This soil is used for pasture and range. The plant cover generally is in fair condition. The vegetation consists principally of big sagebrush, Sandberg bluegrass, threeawn, squirreltail, and annual weeds. Yields can be increased by managing grazing *so* as to allow the perennial grasses to reseed regularly. This soil is too steep for tillage for seedbed preparation, but broadcast seedings of bulbous bluegrass will improve areas that are in poor condition. Gradual improvement may result if desirable grasses are established on less sloping soils nearby. *Capability unit VIIe-1, dryland. Granitic south slope-Sierorem and Brown range site.*

Payette coarse sandy loam, 60 to 75 percent slopes (PaG).-A profile of this soil is the one described as typical of the series. In most areas the surface layer is coarse sandy loam, but in some places it is loam. Most of this soil is on very steep northerly slopes that have annual precipitation of 9 to 11 inches. About a sixth of the acreage is on very steep southerly slopes that have an annual precipitation of about 11 to 13 inches. This soil generally is slightly to moderately eroded, and some drainageways are gullied.

Most of this soil is along the southern border of the Emmett Valley. Because of the steep slopes, it is subject to very severe erosion if grazed. Much of it is on slopes above orchards and is owned by orchardists. Consequently, it is not grazed. This soil is suitable for watersheds and wildlife habitats. It has been little used, and the plant cover generally is in good condition. *Capability unit VIIIe-1, dryland.*

Payette very stony soils, 30 to 60 percent slopes (PgF).-These soils occur on steep southerly slopes. Stones, cobblestones, and ledges occupy about 1.0 to 20 percent of the surface. The stones rolled from higher lying sandstone strata. They range from 6 inches to 4 feet in diameter. The annual precipitation ranges from about, 11 to 13 inches. Erosion is slight to moderate, and gullies have formed in some drainageways.

These soils are used for pasture and range. The plant cover is in poor to fair condition. Management needs are similar to those of Payette coarse sandy loam, 30 to 60 percent slopes. *Capability unit VIIs-2, dryland. Granitic south slope-Sierozem and Brown range site.*

Perla Series

The Perla series consists of dark-colored, well-drained soils that formed in residuum weathered from rhyolite bedrock or similar extrusive acid volcanic rocks. The surface layer is loam. It is nonstony to extremely stony and moderately low in organic-matter content. The compact subsoil is clay. It is underlain by rhyolitic bedrock at a depth of 22 to 35 inches.

These soils are extensive in the Haw-Payette-Van Dusen soil association. They occur at elevations of 3.500 to 4,800 feet, in the vicinity of Prospect Peak. The annual precipitation ranges from 12 to 13 inches. The slope range is 0 to 60 percent but is dominantly between 12 and 25 percent. The slope is mainly to the west and south from Prospect Peak and from lower peaks nearby. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, and herbaceous plants.

Erosion is slight to moderate on these soils. The subsoil is slowly to very slowly permeable. The available water holding capacity is moderate to low, and fertility is moderate.

The Perla soils are used for grazing.

Representative profile of Perla extremely stony loam, 12 to 30 percent: slopes, 600 feet north and 1,000 feet west of the southeast corner of the NE1/4 sec. 36, T. 6 N., R. 1 E., in a noncultivated area.

A11-0 to 4 inches, *very* dark grayish-brown (10YR 3/3) very stony loam ; grayish-brown (10YR 5/2) when dry ; weak, thin, platy structure; friable when moist, slightly hard when dry ; fine roots plentiful ; neutral (pH 6.6).

A12-4 to 9 inches, very dark grayish-brown (10YR 3/2) very stony loam; grayish-brown (10YR 5/2) when dry; moderate, fine, granular structure ; friable when moist, slightly hard when dry ; fine roots plentiful ; slightly acid (pH 6.5).

Blt-9 to 13 inches, very dark grayish-brown (10YR 3/2) very stony light clay loam; grayish-brown (10YR 5/2) when dry; weak or moderate, medium to very fine, subangular blocky structure; thin, patchy clay films in pores; friable when moist, slightly hard when dry; fine roots plentiful ; many very fine pores ; very slight bleached silty specks on peds; slightly acid (pH 6.4).

B21t-13 to 18 inches, very dark grayish-brown (10YR 3/2 stony clay; grayish-brown (10YR 5/2) when dry; strong or moderate, medium, prismatic structure ; thick, continuous clay films on all ped surfaces ; very firm when moist, very hard when dry; few fine roots along vertical cracks; dense, but few very fine pores; upper part has thin bleached silty specks on peels; slightly acid (pH 6.2).

B22t-18 to 21 inches, dark-brown (10YR 4/3) stony clay; pale brown (10YR 6/3) when dry; moderate or strong, fine and very fine, angular blocky structure; slightly darker colored, medium, continuous clay films on all ped surfaces ; very firm when moist, very hard when dry; few fine roots; dense, but few very fine pores ; slightly acid (pH 6.2).

B3t-21 to 25 inches, dark yellowish-brown (10YR 4/4) very stony clay loam; pale brown (10YR 6/3) when dry; moderate, *very* fine, subangular blocky structure ; firm when moist, hard when dry; few fine roots and very fine pores ; thick clay films around rock fragments ;medium acid (pH 6.0).

R-25 inches +, somewhat decomposed rhyolitic bedrock grading to unweathered rhyolite.

The color of the moist surface layer is very dark grayish brown to dark grayish brown (10YR 3/2 to 4/2). In some places the subsoil has 7.5YR hues. The subsoil commonly is nearer pH 7.0 than pH 6.5. Some bleached silty specks are present in the upper part of the B horizon. On some steeper slopes the subsoil is clay loam.

Inclusions of Dishner and Van Dusen soils make up from 3 to 5 percent of the acreage of the areas mapped. A darker colored soil, more like the Elmore soil, has formed in areas that receive additional moisture. This soil makes up about 1 percent of the acreage.

Perla stony loam, 12 to 30 percent slopes (PmE).-This soil is like the soil described as typical of the series, except that there are fewer stones and cobblestones. In most areas there are some scattered stones and angular cobblestones, but not enough to prevent tillage. Slopes are dominantly moderately steep to steep, but some are less than 12 percent. In most places erosion is slight to moderate.

This soil is used for pasture and range, but it is suitable for dry-farmed hay and small grain. Manure, green manure, crop residues, and commercial fertilizers should be used to maintain productivity.

The pasture and range generally are in poor condition. The plant cover is dominated by big sagebrush, cheatgrass, Medusahead wildrye, and other annual weeds, but there are few remnants of native bunchgrasses. Yields can be increased by summer fallowing, preparing good seedbeds, and reseeding with Ladak alfalfa and a suitable grass. Suitable grasses include Siberian wheatgrass, crested wheatgrass, Whitmar beardless wheatgrass, Sherman big bluegrass, pubescent wheatgrass, and intermediate wheatgrass. Once a good stand is established, it should be allowed to make enough growth to maintain vigor and to reseed periodically. If a good grass cover is maintained on this soil, it will gradually spread to surrounding stonier *soils. Capability unit IVe-7, dryland. Loamy-Brown range site.*

Perla extremely stony loam, 12 to 30 percent slopes (PnE). A profile of this soil is the one described as typical of the series. Rhyolitic stones and angular cobblestones, ranging from 6 to 18 inches in diameter, are so numerous that tillage is not practical. There are also some outcrops of rhyolite. Some Dishner soils were included in mapping.

This soil is used for grazing. The plant cover is in poor to fair condition and is dominated by cheatgrass, Medusahead wildrye, and big sagebrush. Remnants of native grasses are scarce. The plant cover can be improved to some extent by broadcast seedings, especially of bulbous bluegrass, and by permitting the remaining bunchgrasses to produce seed. This involves careful control of grazing or the removal of all grazing animals. If the original plant cover is restored, It can be maintained by good graz ing management. *Capability unit VIs-1, dryland. Stony-Brown range site.*

Perla extremely stony loam, 30 to 60 percent slopes (PnF).-This soil is like the soil described as typical of the series, except that it commonly contains more rhyolitic stones and angular cobblestones. Although it typically is 22 to 30 inches thick, it is only about 15 to 22 inches thick on about 15 percent or more of the acreage. In places there are outcrops of rhyolitic rock. The stones and cobblestones generally are between 6 and 18 inches in diameter.. In many places lines of closely packed stones extend straight down the hills. These lines are from 1 to 2 feet wide. This soil is on steep southerly slopes. Surface runoff is rapid, and most areas are slightly to moderately eroded. Included in mapping were a few areas in which there are only a few stones.

The pasture and range are in poor to fair condition. Big sagebrush, cheatgrass, and annual weeds are dominant in the vegetation. Remnants of the native grasses are scarce. The slopes are too steep and the soil is too stony for the preparation of seedbeds. Any improvement in the vegetation must be by broadcast seedings and by livestock management. The bunchgrasses need to be protected to permit them to reseed. *Capability unit VIIs-2, dryland. Granitic south slope-Sierozem and Brown range site.*

Perla and Payette extremely stony soils, 12 to 30 percent slopes (PpE).-This mapping unit is about 50 to l0 percent Perla extremely stony loam and 20 to 40 percent Payette extremely stony coarse sandy loam. In places the soils are transitional between the Perla and the Payette soils and have a clay loam subsoil. In most areas the Perla and Payette soils are extremely stony or very stony. Outcrops of rock and soils that are less than 4 inches thick make up from 5 to 30 percent of some areas. Surface runoff is medium to rapid, and in most areas erosion is slight to moderate. Tillage is not feasible because of the stones and outcrops of rock.

These soils are used for pasture and range. Management needs are similar to those of Perla extremely stony loam, 12 to 30 percent slopes. *Capability unit VIs-1, dryland. Stony-Brown range site.*

Perla and Payette extremely stony soils, 30 to 60 percent slopes (PpF).-This mapping unit consists of about 40 to 60 percent Perla extremely stony loam and 30 to 50 percent Payette extremely stony coarse sandy loam. Sonic, of the soils are somewhat transitional between the Perla and Payette soils and have a clay loam subsoil. In most areas the Perla and Payette soils are extremely stony or very stony. Outcrops of rocks or soils that are less than 4 inches thick make up from 5 to 30 percent of much of the acreage. Tillage is not feasible because of the stones, outcrops of rock, and steep slopes.

These soils are used for pasture and range. Management needs are similar to those of Perla extremely stony loam, 30 to 60 percent slopes. *Capability unit VIIs-2, dryland. Granitic south slope-Sierozem and Brown range site.*

Power Series

The Power series consists of well-drained, light-colored soils on high terraces bordering the Payette River. The surface layer is dominantly silt loam, but in places it is loam. It is low to moderately low in organic-matter content. The subsoil has well-developed structure and contains about twice as much clay as the surface layer. It commonly is heavy silt loam but in some places is heavy loam or light silty clay loam. The depth to calcareous material ranges from 15 to 24 inches. Below this material there is a moderate or strong accumulation of calcium carbonate. In many places these soils formed in wind-deposited silt or silty alluvium that is underlain at a depth of 2 to 4 feet by loam or moderately coarse textured old river alluvium. The alluvium washed chiefly from areas of granitic rocks or other intrusive acid igneous rocks, but some may have washed from areas of the Idaho and Payette formations, and smaller amounts from basaltic areas.

These soils are extensive in the Power-Purdam soil association. They occur at elevations of 2,300 to 2,500 feet, mainly on the Emmett bench. A small area is on a high terrace on the south side of the Emmett Valley. These terraces are 30 to 100 feet above the Payette River. The annual precipitation is 9 to 11 inches. The slope ranges from 0 to 30 percent but generally is less than 5 percent. In places these soils have been considerably dissected by small streams that flow from the adjoining uplands. The native vegetation consisted of bunchgrasses, big sagebrush, and forbs.

The Power soils are free of stones and are mostly nonsaline and nonalkaline. They are slightly to moderately

eroded. The available water holding capacity is high, and permeability is moderately slow.

These soils are used for irrigated crops and pasture and to some extent for orchards.

Representative profile of Power silt loam, in the NE1/4NW1/4NW1/4 of sec. 22, T. 7 N., R. 3 W., in an area of big sagebrush and cheatgrass:

A1-0 to 1/2 inch, dark grayish-brown (10YR 4/2) silt loam; light brownish gray (10Y.R 0/2) when dry ; weak, very fine, granular structure; very friable when moist, slightly hard when dry; abundant roots; slightly acid (pH 6.2).

A21-1/2 inch to 8 inches, dark grayish-brown (10YR 4/2) silt loam; light brownish gray (10YR 6/2) when dry; weak or moderate, thin, platy structure and very weak, very fine, granular structure ; top of plates lighter gray, bottom of plates slightly browner ; very friable when moist, slightly hard when dry; abundant roots in uppermost 2 inches, few below; vesicular pores in uppermost 2 inches; neutral (pH 6.8).

A22B21t-8 to 9 inches, silt loam; transitional horizon, including the light-gray caps and coatings and the upper part of the columns or prisms; few, fine, iron and manganese concretions; mildly alkaline (pH 7.6).

B21t-9 to 17 inches, dark-brown (10YR 4/3) heavy silt loam; pale brown (10YR 6/3) when dry; weak or moderate, medium, prismatic to columnar structure and strong, fine and medium, subangular blocky structure ; slightly darker colored, thick, continuous clay films on all ped surfaces;; very friable when moist, very hard when dry ; plentiful roots, mostly very fine, that penetrate peds and are between peds; peds have very dense surfaces but few fine pores ; very few, very fine, iron and manganese concretions; mildly alkaline (pH 7.8).

B22t-17 to 21 inches, dark-brown (10YR 4/8 heavy silt loam; pale brown (10YR 6/3) when dry; moderate, medium, subangular blocky structure; moderately thick clay films ; friable when moist, very hard when dry; plentiful roots, mostly very fine; few flue pores; very few, very fine, iron and manganese *concretions ;* moderately alkaline (pH 8.2).

B3tca-21 to 27 inches, brown (10YR 5/3) silt loam ; pale brown (10YR 6/3) when dry; moderate or weak, medium, subangular blocky structure; slightly darker colored, thin, patchy *clay* films on ped surfaces; friable when moist, hard when dry; few fine roots and very fine pores ; few calcium carbonate segregations ; moderately alkaline (pH 8.3).

C1ca-27 to 46 inches, pale-brown (10YR 6/3) silt loam; light gray to very pale brown (10YR 7/2 to 7/3) when dry; massive ; very friable when moist, slightly hard when dry ; very few fine roots; few very fine pores ; moderately calcareous with segregated calcium carbonate; moderately alkaline (pH 8.0 to 8.4).

IIC2ca-46 to 60 inches, pale-brown (10YR 6/3) fine sandy loam or loam; light gray to very pale brown (10YR 7/2 to 7/3) when dry ; massive ; friable when moist and slightly hard when dry ; stratified old alluvium; slightly to moderately calcareous ; strongly alkaline (pH 8.5).

The A1 horizon normally is very thin under sagebrush and generally is absent or indistinct in barren or nearly barren spots. In cultivated areas, the A1 horizon is mixed with the A2 horizon. The color of the moist A2 horizon is dark grayish brown to dark brown (10YR 4/2 to 10YR 4/3). In undisturbed areas, the A2 horizon ranges from light brownish gray (10YR 6/2) to light gray (10YR 7/2) when dry. It is 5 to 10 inches thick. In many leveled areas, the entire A2 horizon has been removed. The boundary between the A and B horizons ranges from clear or gradual to nearly abrupt. The structure of the B2t horizon ranges from very weak to moderate prismatic or weakly columnar. The boundary of the lilt horizon ranges from clear or gradual to nearly abrupt. The depth to the IIC layer ranges from 25 to 60 inches.

Slick spots that are from 5 to 15 feet across and on which crops are poor or fair are associated with the Power soils. In many of these spots, the water intake rate is very slow and the lower part of the subsoil is saline-alkali. The soil in these spots is somewhat like the Sebree soils, but the upper layers have been mixed by cultivation. Inclusions of Harpt and Draper soils make up as much as 2 or 3 percent of the acreage of the areas mapped. Because of variations in thickness of overwash material., the profile in places is somewhat like that of the Harpt soils.

In Gem County, the Power soils are mapped only as undifferentiated mapping units with the Lolalita soils and with the Purdam soils.

Power and Lolalita soils, 12 to 30 percent slopes (PrE).-This mapping unit is 40 to 70 percent Power soils and 25 to 55 percent Lolalita soils. The Power soils are dominantly silt loam, but in places they are loam. The Lolalita soils are mostly coarse sandy loam and sanely loam. In some areas these soils, particularly the Lolalita soils, are gravelly or cobbly. They are slightly to moderately eroded. Many of the areas border streams that cross the bench north of Emmett. Some occur along the upper edge of the bench, on the slope leading to the hills above. Small areas of Purdam soils make up from 2 to 5 percent of some of the areas mapped.

Most of these soils are used for pasture or range. They are too steep and too erodible to be used for crops without serious damage to the soils. Pasture yields are good if these soils are seeded with improved pasture mixtures, fertilized with nitrogen and phosphate, and carefully managed and irrigated.

Cheatgrass and other annuals make up most of the vegetation on the range. The soils can be summer fallowed and tilled for reseeding. A suitable reseeding mixture consists of alfalfa seeded with crested wheatgrass, Siberian wheatgrass, or Whitmar beardless wheatgrass. Once established, a-good stand can be maintained by controlled grazing to permit the plants to reseed. *Capability units VIe-1, irrigated; VIe-2, dryland. Loamy-Sierozem range site.*

Power and Purdam soils, 0 to 1 percent slopes (PuA).-This mapping unit is about 50 to 70 percent Power silt loam and 30 to 50 percent Purdam silt loam. These soils are somewhat similar, but a sporadic, weakly cemented hardpan occurs at a depth of 3 to 5 feet in the Purdam Soil. In a few areas the surface layer is loam.

Leveling has made the surface layer variable. The removal of soil from the high spots has brought the original subsoil to the surface or within plow depth. As a result, the surface layer has more clay and has a slower waterintake rate. Low spots that have been filled commonly have a more rapid water-intake rate.

In many of the spots that have a very slow water-intake rate and very slow permeability, the soils have a profile like that of the Power or Purdam soils but have an appreciable content of soluble salts and an exchangeable sodium content of 15 to 50 percent in at least part of the subsoil. Such spots make up less than 1 percent of the acreage, but they make up from 5 to 10 percent of a few small fields.

These soils are used mainly for irrigated pasture crops, hay, small grain, corn, and sugar beets. A small acreage

is used for orchards. Yields generally are good, but they are poor to fair in spots where irrigation water does not penetrate the soil readily. Consequently, uneven crop growth is common. Large applications of manure and gypsum will improve the spots where crop growth is not good.

The organic-matter content of these soils is low or moderately low but can be built up or maintained by using a good crop rotation, plowing under crop residues and green-manure crops, and applying manure and fertilizers. A mixture of grasses and legumes should be included in the crop rotation. Pastures have a high carrying capacity if they are planted with a suitable legume-grass mixture, fertilized, and managed so as to allow adequate regrowth between grazing periods. Orchards benefit from a permanent cover crop if they are irrigated by the sprinkler method. Other crops are irrigated by the border, corrugation, or furrow method.

In areas where the subsoil is exposed, large amounts of manure, green manure, and commercial fertilizers help to make the. soils productive. Full production is more readily obtained where the substratum is exposed than where the subsoil is exposed. *The Power soil is in capability unit I-1, irrigated. The Purdam soil is in capability unit IIs-1, irrigated.*

Power and Purdam soils, 1 to 3 percent slopes (PuB).-This mapping unit is the most extensive one consisting of these two series, and it is the largest irrigated area in the county. It consists of Power silt loam and Purdam silt loam. Except for slope, these soils are like Power and Purdam soils, 0 to 1 percent slopes.

Leveling operations have caused the surface layer to be variable. The original surface layer has been entirely or partially removed from the high spots, and the former subsoil is now exposed or the upper part is mixed with what remains of the original surface layer. The water-intake rate in these spots is slow to moderately slow, and crops grow less well than in other areas. In low spots, soil has been added to the original surface layer. The water-intake rate in these spots commonly is more rapid than is typical, and crop growth is correspondingly better.

Spots that have a very slow water-intake rate and very slow permeability make up about 1 percent of the acreage of the areas mapped. In many of these spots, the soils resemble the Power or Purdam soils but have an appreciable amount of soluble salts and an exchangeable sodium content of 15 to 50 percent in at least part of the subsoil.

These soils are used and managed in nearly the same way as Power and Purdam soils, 0 to 1. percent slopes, but the irrigation runs should be somewhat shorter because of the hazard of erosion. Crop growth is uneven partly because of the variable water-intake rate. *Capability unit IIe-2, irrigated.*

Power and Purdam soils, 3 to 7 percent slopes (PuC).-This mapping unit consists of Power silt loam and Purdam silt loam. These soils are like the Power and Purdam soils, 0 to 1 percent slopes, except that the hardpan in the Purdam soil is commonly at a depth of 2 to 4 feet. Spots that have a very slow water-intake rate make up about 1 percent of the acreage of the areas mapped. Over much of the area, a fourth to a half of the original surface layer has been lost through erosion or has been removed by leveling.

These soils can be used and managed in much the same way as Power and Purdam soils, 0 to 1 percent slopes, but they need more protection against erosion. A mixture of grasses and legumes is needed in the rotation to help control erosion. Irrigation is by the corrugation or furrow method. The length of runs and the size of streams should be adjusted to offset the erosion hazard. Crop growth commonly is variable. *Capability unit IIIe-2, irrigated.*

Power and Purdam soils, 7 to 12 percent slopes (PuD).-This mapping unit consists of Power silt loam and Purdam silt loam. These soils are like the Power and Purdam soils, 0 to 1 percent slopes, except that the hardpan in the Purdam soil is commonly at a depth of 2 or 3 feet, partly because several inches of soil have been lost; through erosion or removed by leveling. Part of the finer textured subsoil is included in the plow layer, and, consequently, the water-intake rate is slower.

These soils are used for irrigated pasture crops, hay crops, corn, and small grain. Fair to good yields generally are obtained, but crop growth is variable. The organic-matter content is low, but it can be built up or maintained by plowing under crop residues and green-manure crops and by applying manure and fertilizers.

Because of the erosion hazard, these soils are best suited to close-growing hay and. pasture crops. An annual crop, such as corn or small grain, can be grown once every 4 or 5 years. If an annual crop is grown more often, increased erosion and soil deterioration is likely. Irrigation can be by the corrugation or furrow method if the length of runs and the size of irrigation streams are limited to avoid erosion. Sprinklers can be used on close-growing crops or on orchards that have a permanent cover crop. *Capability unit IVe-1, irrigated.*

Purdam Series

The Purdam series consists of well-drained, light-colored soils that have a hardpan. The surface layer is dominantly silt loam, but in places it is loam. It is low to moderately low in organic-matter content. The subsoil has distinct structure and contains more clay than the surface layer. It commonly is heavy silt; loam butt in places is heavy loam. The depth to calcareous material ranges from 15 to 24 inches. Below this material there is a moderate or weak accumulation of calcium carbonate. A hardpan, weakly cemented by silica and calcium carbonate, occurs at a depth of 2 to 5 feet. In many places these soils formed in wind-deposited silt or silty alluvium that is underlain at a depth of 1 1/2 to 4 feet by loam or moderately coarse textured old river alluvium. The alluvium washed mainly from areas of granitic rocks or other intrusive, acid, igneous rocks, but some may have washed from areas of the Idaho and Payette formations, and smaller amounts from basaltic areas.

These soils are extensive in the Power-Purdam soil association. They occur at elevations of 2,300 to 2,500 feet, mainly on the high terrace north of Emmett. A smaller area is on a high terrace on the south side of the Emmett Valley. These terraces are 30 to 100 feet above the Payette River. The annual precipitation is 0 to 11 inches. The slope ranges from 0 to 12 percent but generally is less than 5 percent. In places the terraces have been considerably dissected by small streams that flow from

the adjoining uplands. The native vegetation consisted of bluebunch wheatgrass and other bunchgrasses and some big sagebrush and forbs.

The Purdam soils are free of stones and are mostly nonsaline and nonalkali. Erosion has been slight to moderate, except where deep cuts have been made in land leveling. The available water holding capacity is moderate in most soils but low in the shallowest soils and high in the deepest soils. The subsoil is moderately slowly to slowly permeable.

These soils are used for irrigated crops and pasture and to some extent for orchards.

Representative profile of Purdam silt: loam, 275 feet north and 140 feet west of the southeast corner of the NE1/4NE1/4 of sec. 31, T. 7 N., R. 2 W., in an irrigated pasture.

Ap-0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; light brownish gray (10YR (5/2) when dry; weak, thin, platy structure ; friable when moist, slightly hard when dry; abundant roots; medium acid (pH 6.0).

B1t-7 to 9 inches, dark-brown (10YR 4/3) silt loam; pale brown (10YR 6/3) when dry; weak, medium, prismatic structure and moderate, coarse and medium, subangular blocky structure; coatings of material similar to that of Ap horizon on upper surfaces and sides of peds ; thin, patchy clay films on some vertical ped surfaces and in pores ; firm when moist, hard when dry; roots plentiful ; common very fine pores ; common, dark-colored, soft concretions of iron and manganese.

B2t-9 to 16 inches, dark-brown (10YR 4/3) heavy silt loam; pale brown (10YR 6/3) when dry; weak, medium, prismatic structure and moderate, medium, subangular blocky structure; thin, continuous clay films on ped surfaces ; firm when moist, very hard when dry ; few fine roots; dense, but few very fine and line pores ; few, very fine, soft concretions of iron and manganese; neutral (pH 6.6).

B3tca-16 to 28 inches, dark grayish-brown (10YR 4/2) silt loam; pale brown (10YR 6/3) when dry; moderate or weak, medium, subangular blocky structure ; thin, patchy clay films ; firm when moist, hard when dry ; few fine roots; dense: common, very firm, half-inch nodules of soil material; noncalcarcous, except for common calcium carbonate veins; neutral (pH 7.3).

Clca-28 to 35 inches, dark-brown (10YR 4/3) silt loam; pale brown (10YR.6/3) when dry; weak, coarse. subangular blocky structure ; firm when moist., hard when dry; few fine roots ; many calcium carbonate veins; moderately alkaline (pH 8.0).

IIC2ca-35 to 42 inches, brown (10YR 5/3) silt loam: more quartz sand than C1ca horizon; light gray (10YR 7/2) when dry ; massive ; firm when moist, hard when dry ; moderately to strongly calcareous, many calcium carbonate veins; moderately alkaline (pH 8.0).

IIC3ca-42 to 56 inches, dark-brown (10YR 4/3) silt loam; very pale brown (10YR 7/3) when dry; massive or thin, platy structure; firm when moist; common very fine pores ; slightly to moderately calcareous ; moderately alkaline (pH 8.1).

IIC4sicam-56 to 66 inches, brown (10/YR 5/3, dry) silica-calcium carbonate hardpan: tends to have medium to coarse, platy structure and breaks to fine angular fragments; top inch weakly to strongly cemented, rest weakly cemented; moderately alkaline (pH 8.0).

IIC5-66 inches +, pale-brown (10YR 6/3, dry) gritty loam; slightly calcareous ; mildly alkaline (pH 7.7).

In undisturbed areas, a very thin, darker colored A1 horizon is common, especially near sagebrush. It is mixed with the underlying horizon by tillage.

The color of the moist Ap horizon is dark grayish brown to dark brown (10YR 4/2 to 4/3). The thickness of the A horizon ranges from 4 to 10 inches, except in leveled areas, from which the A horizon has been entirely removed. The boundary between the A and B horizons ranges from clear or gradual to nearly abrupt. The structure of the B2t horizon ranges from very weak to moderate prismatic or weakly columnar. In many areas the B3tca horizon is immediately above the hardpan. The B3tca horizon and the lower layers commonly have dark manganese stains. The lower part of the profile may be stratified with medium-textured or moderately coarse textured materials. In places an old buried soil occurs in the underlying layers.

Near the top of some of the steeper slopes, erosion and leveling have brought the hardpan within plow depth. Slick spots that are from 5 to 15 feet across are associated with the Purdam soils. Crop growth is very poor in these spots. The water-intake rate is very slow, and the subsoil is saline-alkali. The soil is somewhat like the Sebree soils, but the upper layers have been mixed by cultivation.

Inclusions of Harpt and Draper soils make up 2 or 3 percent of the acreage of the areas mapped.

All of the Purdam soils in the Gem County Area are mapped as part of undifferentiated units with the Power soils. A description of these mapping units follows the description of the Power series.

Quenzer Series

The Quenzer series consists of clayey, imperfectly drained soils in basins and swales on low terraces in the Payette River Valley. The surface layer is dark gray and fine textured or moderately fine textured. It has a moderate content of organic matter. The subsoil is grayish and is fine textured to a depth of at least 20 or 30 inches. The underlying material is sandy or gravelly alluvium or other alluvium. The parent material is fine or Moderately fine textured alluvium. It is underlain by stratified material of various textures, weathered mainly from granitic rocks and_ the Idaho and Payette formations.

These soils make up a small total acreage in the Emerson-Wardwell-Quenzer soil association. They occur on low terraces, south and east of Emmett. The elevation is between 2,300 and 2,400 feet. The annual precipitation is about II or 12 inches. Slopes are less than 1 percent. The vegetation consists of rabbitbrush, giant wildrye, iris, and phlox.

A small area is gravelly, but in most places the uppermost 3 feet is free of gravel and stones. Erosion is negligible. Fertility is moderate, the available water holding capacity is high, and permeability is slow in the subsoil. In many places a fluctuating water table has been lowered by drainage ditches.

These soils are used for irrigated crops and pasture.

Representative profile of Quenzer silty clay, 0 to 1 percent slopes, 450 feet west and 1,260 feet north of the center of. sec. 20, T. 6 N., R. 1 W., in a cornfield.

Apg-0 to 5 inches, dark-gray (2.5Y 4/1) silty clay with common, medium, faint, gray (2.5Y 5/1) mottles and few, fine, distinct, very dark brown (10YR 2/2 mottles when moist; gray (2.5Y 5/1) with light-gray (2.5Y 7/1)and dark-brown (10YR 4/3) mottles when dry; strong, fine and medium, subangular blocky structure; firm when moist, very hard when dry; few fine roots; few black manganese stains; neutral (pH 6.6)

C1g-5 to 11 inches, dark-gray (2.5Y 4/1) silty clay with few, fine, distinct, dark yellowish-brown (10YR 3/4)mottles when moist; gray to grayish brown (2.5Y

5/1.5) with yellowish-brown (10YR 5/4) mottles when dry ; moderate, fine, angular blocky structure ; very firm when moist, extremely hard when dry few fine roots and very fine pores; slightly darker colored coatings on peds, probably organic; neutral (p1I 7.1).

C2g-11 to 16 inches, (lark-gray to dark grayish-brown (2.5Y 4/1 to 4/2) silty clay; few, fine, faint, gray (2.5Y 6/1) mottles and few dark-colored manganese stains; weak, fine, angular blocky structure to massive; very firm when moist, extremely hard when dry ; few fine roots and very fine pores; slightly darker colored coatings on peels, probably organic ; mildly alkaline (7.4).

C3g 16 to 33 inches, (lark-gray to dark grayish-brown (2.5Y 4/1 to 4/2) silty clay; slightly more clayey than C2g horizon ; few, dark-colored, fine manganese stains ; weak, fine, angular blocky structure; firm when moist, extremely hard when dry ; very few fine roots and very fine pores; mildly alkaline (pH 7.6).

C4g-33 to 48 inches, dark grayish-brown (2.5Y 4/2) silty clay; few, fine, distinct, dark-brown (10YR 3/3) and very dark gray (10YR 3/1) mottles; light brownish gray (2.5Y 6/2) when dry; weak, medium and coarse, blocky structure or massive; firm when moist, hard when dry ; no roots ; few very fine pores ; mildly alkaline (pH 7.5).

C5g-48 to 74 inches, dark grayish-brown (2.5Y 4/2) clay ; few, fine, distinct, gray (2.5Y 5/1) mottles; grayish brown (2.5Y 5/2) when dry; weak, medium and fine, angular blocky structure or massive; firm when moist, very hard when dry ; no roots ; few very fine pores ; neutral (pH 7.2).

IIC6g-74 inches +, iron accumulation over gravel.

The surface layer is dominantly silty clay, but in some areas it is clay, silty clay loam, or clay loam. The color of the moist surface layer ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2). The surface layer ranges from slightly acid to mildly alkaline (pH 6.5 to 7.4), and the subsoil ranges from neutral to moderately alkaline (pH 7.0 to 8.0). The parent material is stratified, and in places layers that range from loam to clay occur in the profile. The layer between plow depth and a depth of 20 to 30 inches is dominantly silty clay or clay, but in places it is heavy silty clay loam or heavy clay loam. The. mottles vary in kind and degree, but they commonly are not, prominent. These soils commonly are nonsaline and nonalkali, but in places, particularly in the subsoil, they are slightly saline or slightly alkali.

Inclusions of Lahontan or Wardwell soils make up as much as 2 percent of the acreage of the areas mapped.

Quenzer silty clay, 0 to 1 percent slopes (QcA). A profile of this soil is described as typical of the series. The surface layer is dominantly silty clay, but in some places it is silty clay loam. There are also two small areas in which the surface layer is gravelly clay loam. These areas are in the NE1/4 of sec. 20, T. 6 N., R. 1 W. and are indicated on the soil map by gravel symbols. The water table is at a depth of 4 to 6 feet.

This soil is used for irrigated crops and pasture. It is moderately fertile but can be improved by utilizing manure, green-manure crops, and crop residues. Tillage is difficult but is less difficult if the organic-matter content is maintained. A rotation that includes grasses and legumes is desirable. Pastures that have a good stand of alfalfa and grass or of ladino clover and grass have moderate to high carrying capacities if they are well managed. Irrigation can be by the border, corrugation, or furrow method.

The rate of application and the amount of water need to be adjusted so as to avoid waterlogging. *Capability unit IIIw-5, irrigated.*

Rainey Series

In this series are well-drained to somewhat excessivelydrained soils that are from 18 to 42 inches thick over decomposing bedrock. These soils formed in residuum weathered from granite, quartz mouzonite, quartz diorite, or similar coarse-grained intrusive acid igneous rocks. The parent material is quartzic, feldspathic, micaceous, and noncalcareous. The surface layer is dark colored and has a moderate content of organic matter. It is dominantly coarse sandy loam, but in places it is sandy loam or gritty loam. The subsoil is similar to the surface layer in texture. The upper part of the profile is slightly acid. The lower part is neutral or slightly acid.

These soils are extensive in the Brownlee-Rainey-Ola soil association. They occur at elevations of 2,600 to 5,200 feet, in hilly granitic areas in the eastern part of the county. The annual precipitation ranges from 13 to 22 inches. The slope ranges from 5 to 75 percent but generally is between 30 and 50 percent. The slopes of more than 30 percent have southerly exposures. The native vegetation consisted of bluebunch wheatgrass, big sagebrush, Sandberg bluegrass, Idaho fescue, bitterbrush, and annual forbs.

Erosion is slight to moderate in most areas but may be severe on some of the steeper slopes. Rill erosion is common. Outcrops of rock are common, but there are few loose stones. The available water holding capacity is low, and permeability is moderately rapid to rapid in the subsoil.

These soils are used for range and for dry-farmed crops. The vegetation is largely cheatgrass and annual weeds.

Representative profile of Rainey rocky sandy loam, 30 to 60 percent slopes, 400 feet east and 300 feet north of the southwest corner of the NW1/4SE1/4 sec. 13, T. 8 N., R. 1 E., in a range area that has a southwesterly exposure.

A11-0 to 4 inches, very dark grayish-brown (10YR 3/2) sandy loans; grayish brown (10YR 5/2) when dry; very weak, very thin, platy structure and weak, fine, granular structure ; very friable when moist, soft when dry ; abundant fine roots; slightly acid (pH 6.5).

A12--4 to 16 inches, very (lark grayish-brown (10YR 3/2) sandy loam; grayish brown (10YR 5/2) when dry; weak, medium, subangular blocky structure and weak, fine, granular structure ; very friable when moist, soft when dry; few fine roots; many very fine pores; few continuous, wavy, darker colored 1/16-inch bands of more clayey material; slightly acid (pH 6.5).

AC-10 to 19 inches, very dark grayish-brown (10YR 3/2) coarse sandy loam; grayish brown (10YR. 5/2) when dry; weak, medium, subangular blocky structure to massive ; very friable when moist, soft when dry; very few fine roots; many very fine pores ; thin clay films in channels; moderate number of partially decomposed granite fragments; neutral (pH 6.6).

C1-19 to 24 inches, yellowish-brown (10YR 5/4) loamy coarse sand; very pale brown (10YR 7/4) when dry; massive ; very friable when moist, loose when dry; very few roots ; many fine and very fine pores; neutral (pH 6.7).

R-24 inches +, somewhat disintegrated and weathered granite or similar bedrock.

The color of the moist surface layer is very dark grayish brown (10YR 3/2). In the area near Pearl there are some loose stones, but in areas farther north there are few or no loose stones.

More than half of the acreage is Rainey rocky sandy loam, 30 to 60 percent slopes. The Rainey soils were also mapped in undifferentiated units with the Brownlee soils.

Descriptions of these units follow the description of the Brownlee series.

Small areas of Brownlee soils make up from 5 to 10 percent of the acreage of the areas mapped. Also, there are some outcrops of rock as much as 20 feet high and 15 feet wide. Smaller outcrops are common.

Rainey coarse sandy loam, 12 to 30 percent slopes (RaE).-This soil is similar to the soil described as typical of the series. It occurs mostly on moderately steep or hilly ridgetops. There are few or no outcrops of rock. Erosion is slight to moderate.

Some of the acreage is used for dry-farmed crops, but yields are very low because of the low water-holding capacity of the soil. The cultivated areas are susceptible to severe erosion and should be reseeded and used for grazing.

The plant cover is mostly in poor or fair condition. However, the soil is easily tilled, and a good stand of grass can be established. Ladak alfalfa seeded with Siberian wheatgrass, crested wheatgrass, or pubescent wheatgrass is a suitable mixture. Once a good stand is established, it can be maintained by good grazing management. Some plant growth should be left on the soil, and the grasses should be allowed to reseed regularly. *Capability unit IVe-4, dryland. Granitic-Chestnut range site.*

Rainey rocky sandy loam, 12 to 30 percent slopes (RcE).-This soil has a profile similar to the one described as typical of the series. The surface layer is dominantly sandy loam or coarse sandy loam, but in places it is loam or gritty loam. Outcrops of granitic rock are common. Most areas are on moderately steep or hilly ridgetops. Erosion is slight to moderate, and gullies have formed along some drainageways. There are loose stones in some areas in the vicinity of drown Point.

This soil is used and managed in about the same way as Rainey coarse sandy loam, 12 to 30 percent slopes. In a few small areas this soil cannot be tilled, because the outcrops of rock are too closely spaced. In most places, however, it is possible to work around the rock outcrops. *Capability unit IVe-4, dryland. GraniticChestnut range site.*

Rainey rocky sandy loam, 30 to 60 percent slopes (RcF).-A profile of this soil is the one described as typical of the series. In most places this soil is on steep southerly slopes. It is slightly to moderately eroded, and some drainageways are gulped. The surface layer is dominantly sandy loam or coarse sandy loam, but in a few places it is loam or gritty loam. Fine or very fine angular gravel is common. In a few areas, especially in the vicinity of Crown Point, there are a few to many detached stones and cobblestones on the surface and in the soil material. In some areas outcrops of granitic rock are common, but in other areas there are none.

This soil is used for pasture and range. The plant cover is mostly in poor to fair condition. The slopes are too steep for tillage, and any improvement must be by management of grazing and by broadcast seedings. Bulbous bluegrass is suitable for re seeding. Remnants of native grasses will increase if they are allowed to reseed regularly. Establishment of a good stand of grass on the higher ridges will provide a source of seed to revegetate this soil. Once established, the stand can be maintained by good grazing management. *Capability unit VIIe-1, dryland. Granitic south slope-Chestnut range site.*

Rainey rocky sandy loam, 60 to 75 percent slopes (RcG).-This soil is similar to the soil described as typical of the series. It has very steep southerly slopes. In some places there are many outcrops of rock, and in other places there are few. In the vicinity of Crown Point, there are some loose stones. Erosion is moderate to slight., and gullies have formed along some drainageways.

Some of the acreage is used as range. The plant cover is in fair to good condition and should be kept in the best possible condition because of the very severe erosion hazard. This soil is suitable for watersheds and for wildlife habitats. *Capability unit VIIe-2, dryland. Granitic south slope-Chestnut range site.*

Riverwash (Rh)

This miscellaneous land type consists of mixed, waterwashed sand and gravel. Most of it consists of sand or gravel bars. It occurs along streams or rivers and is often overflowed during spring runoff. There is very little plant growth, but the sparse growth of weeds and willows provides some protection from erosion along the streambanks. Yields of usable forage are negligible. This land is best suited to wildlife habitats and should not be used for grazing. *Capability unit VIIIs-2, dryland.*

Rock Land and Rubble Land (Rk)

This mapping unit consists of basalt rock land that commonl-7 has slopes of more than 60 percent, of sandstone ruble land, and of sandstone rock land. The basalt rock land makes up more than half of the acreage. It consists mostly of outcrops of slightly weathered basalt bedrock and some extremely shallow soils. Detached basaltic stones are common.

The sandstone rubble land and sandstone rock land make up less than half of the acreage. Most of these areas are covered with large stones and boulders. These stones and boulders broke from higher sandstone ledges when the sandy material beneath the ledges eroded. The fragments range from about 1 to 6 feet in diameter and are so closely packed that there is little soil between them. The slope is dominantly between 7 and 30 percent.

Annual weeds and such small plants as Sandberg bluegrass grow sparsely where a little soil has formed or collected. These spots are so nearly inaccessible that they provide practically no grazing. The areas are suitable principally for watersheds and wildlife habitats. *Capability unit VIIIs-2, dryland:*

Roystone Series

In this series are deep, very dark colored, level to gently sloping loamy soils. The surface layer of loam is moderately thick, and it is high in content of organic matter. It is underlain by a moderately fine textured subsoil, which is calcareous below a depth of 15 to 25 inches. In most places the underlying material is loam. The parent material is loamy alluvium and consists mainly of mixed basaltic and acid igneous material. In many areas part of the alluvium washed from areas of the Idaho and Payette formations. Apparently, these soils formed mostly under imperfect or poor drainage, probably caused by seepage from nearby hills. In recent times the stream

channels have deepened considerably, and the soils are now moderately well drained.

These soils occur on bottom lands along Bissell, Haw, and Willow Creeks. The elevation ranges from 2,500 to 2,800 feet, and the annual precipitation is 11 to 13 inches. Slopes of 1 or 2 percent predominate. Most areas slope only in one direction, roughly parallel to the stream. The native vegetation consisted of bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, giant wildrye, and some big sagebrush and herbaceous plants.

These soils contain some fuse basaltic and quartzitic gravel but no stones. Erosion is slight or negligible in most areas. The available water holding capacity is high, permeability is moderate in the subsoil, and fertility is high. Some seepage occurs during the summer.

Most of the acreage is used for crops, some of which is irrigated.

Representative profile of Roystone loam, 1 to 3 percent slopes, 1,500 feet north of the center of sec. 36, T. 6 N., R. 2 W., in a grainfield.

Ap-0 to 5 inches, black (2.5Y 2/1) loam ; dark gray (2.5Y 4/1) when dry; moderate, fine, granular structure; friable when moist, slightly hard when dry ; fine roots plentiful; neutral (pH 6.8).

A1-5 to 10 inches, black (2.5Y 2/1) loam; dark gray (2.5Y 4/1.) when dry; weak, fine, subangular blocky structure and moderate, fine, granular structure; friable when moist, slightly hard when dry; fine roots plentiful; neutral (pH 7.1).

B1t-10 to 15 inches, black (2.5Y 2/1) clay loam; dark gray (10YR 4/1) when dry ; weak, medium, prismatic structure and moderate, fine, angular blocky structure; thin, nearly continuous clay films on ped surfaces ; firm when moist, hard when dry; fine roots plentiful ; few very fine pores ; neutral (pH 7.2).

B2t-15 to 23 inches. very dark grayish-brown (2.5Y 3/2) clay loam; gray (2.5Y 5/1) when dry; weak, medium, prismatic structure and moderate, fine, angular blocky structure ; slightly darker colored, moderately thick to thin, continuous clay films on ped surfaces ; firm when moist, hard when dry; fine roots plentiful; few very fine pores; mildly alkaline (pH 7.6).

B3tca-23 to 36 inches, very dark grayish-brown (2.5Y 3/2) heavy loam; gray (2.5Y 5/1) when dry; weak, medium, prismatic structure and moderate, fine, subangular blocky structure ; thin patchy clay films ; firm when moist, hard when dry ; common 1/8-inch lime veins ; very few roots; common very fine pores ; moderately alkaline (pH 8.2).

Cca-36 to 60 inches, very dark grayish-brown (2.5Y 3/2) loam; *gray* (2.5Y 5/1) when dry; weak, fine to very fine, subangular blocky structure ; friable when moist, slightly hard when dry ; very few fine roots ; common very fine pores; slightly calcareous; moderately alkaline (pH 8.0).

The surface layer is black to very dark grayish brown (10YR 2/1 to 3/2) when moist and dark gray to gray (10YR 4/1 to 5/1) when dry. The subsoil is mainly clay' loam, but in places it is silty clay loam or heavy loam. The structure is chiefly moderate subangular or angular blocky, but it grades toward weak or strong blocky or toward weak or moderate prismatic. The accumulation of calcium carbonate in the lower part of the subsoil is weak to moderate. The pH of the surface layer ranges from about 6.6 to 7.3; the pH of the B2t horizon, from about 7.3 to 7.8; and the pH of the B3tca horizon, from 7.8 to 8.3. In places the upper part of the soil is stratified, and the lower part is commonly stratified.

Inclusions of Newell, Squaw, Harpt, and Bissell soils make up as much as 5 percent of the acreage of the areas mapped. The soils along Willow Creek, in the vicinity of the Aikman ranch, lack the ca horizon in places and are the least typical of the Roystone series.

Roystone loam, 0 to 1 percent slopes (RoA).-A profile of this soil is like the one described as typical of the series. Some small areas in which the surface layer is clay loam were included in slapping.

This soil is irrigated or subirrigated. A mixture of grasses and legumes is desirable in the rotation to maintain the organic-matter content and to preserve soil structure. Pasture crops, small grain, and row crops respond to nitrogen. Alfalfa and other legumes need phosphate. Manure and green manure help to maintain soil tilth, workability, and productivity. Irrigation can be by the border, corrugation, furrow, or sprinkler method. In places this soil is subirrigated and does not require much irrigation to produce good crops. *Capability unit I-1, irrigated.*

Roystone loam, 1 to 3 percent slopes (RoB).-A profile of this soil is the one described as typical of the series.

This soil is used for irrigated and dry-farmed crops. Pasture crops, hay, small grain, and row crops are grown. A mixture of grasses and legumes is desirable in the rotation to maintain the organic-matter content and to preserve soil structure. Manure and green manure are needed to maintain soil tilth and workability. Nitrogen and phosphate are needed. Irrigation can be by the border, corrugation, furrow, or sprinkler method. Some areas are partially subirrigated.

Dry-farmed areas are used mainly for hay crops and small grain. A mixture of grasses and legumes in the rotation helps to maintain the organic-matter content and to preserve soil structure. The utilization of manure and stubble helps to maintain productivity. Nitrogen will speed decomposition. *Capability units IIe-1, irrigated; IIc-2, dryland.*

Salisbury Series

This series consists of dark-colored, well-drained soils that formed principally in local basaltic alluvium and colluvium, on alluvial fans and colluvial foot slopes. The parent material is medium textured to moderately fine textured and in many places contains angular or sub-angular basaltic pebbles, cobblestones, or stones. The surface layer has a moderate content of organic matter and is dominantly clay loam. In some places it is stony. The subsoil is clay, cobbly clay, or stony clay. It is noncalcareous and is underlain abruptly, at a depth of about 10 to 20 inches, by an indurated or strongly cemented hardpan. The hardpan probably is cemented with silica and possibly to some extent with iron. In most places the uppermost part is noncalcareous. The surface layer and subsoil commonly are slightly acid to neutral in reaction, but in some places they are medium acid.

These soils occupy a moderate acreage, chiefly in the Gem-Newell soil association. They occur in the Sweet and Ola Valleys. The elevation is between 2,500 and 3,000 feet, and the annual precipitation is about 13 to 16 inches. The slope ranges from 1 to 30 percent but is dominantly between 10 and 20 percent. The native vegetation consisted-of bunchgrasses, big sagebrush, and forbs.

These soils are slightly to moderately eroded. Surface

runoff is slow to rapid, permeability is slow, and the available water holding capacity is low.

Some of the least stony areas are used for either irrigated or dry-farmed crops. The rest of the acreage is used for pasture and range.

Representative profile of Salisbury extremely stony clay loam, 0 to 30 percent slopes, 840 feet west and 200 feet north of the southeast corner of the SW1/4SE1/4 of sec. 33, T. 8 N., R. 1 E., in a noncultivated area.

A1-0 to 4 inches, very dark grayish-brown (10YR 3/2) extremely stony clay loam; grayish brown (10YR 5/2) when dry; very weak, thin, platy structure ; firm when moist, slightly hard when dry; fine roots plentiful; neutral (pH 6.7).

B21t-4 to 9 inches, dark-brown (7.5YR 3/2) extremely stony clay; dark brown (7.5YR 4/2) when dry; moderate or strong, medium and coarse, prismatic structure and strong, coarse, angular blocky structure; slightly darker colored, moderately thick, continuous clay films on all ped surfaces ; very firm when moist, extremely hard when dry; few fine roots; common very fine pores ; slightly acid (pH 6.5).

B22t-9 to 14 inches, dark-brown (7.5YR 3/2) extremely stony clay ; dark brown (7.5YR 4/2) when dry ; strong, medium, prismatic structure and strong, medium, angular blocky structure ; thick, continuous clay films on peds; very firm when moist, extremely hard when dry ; few fine roots ; very dense ; slightly acid (pH 6.4).

B23t-14 to 17 inches, dark-brown (7.5YR 4/3) extremely stony clay ; brown (7.5YR 5/3) when dry; moderate, medium and fine, angular blocky structure; firm when moist, very hard when dry; contains silica hardpan t/,3 inch thick; very few roots; dense; medium acid (p1I 6.0).

Csim-17 to 21 inches +, dark-brown (10YR 4/3) indurated hardpan; light brown (7.5YR 6/3) when dry; slightly acid (pH 6.1).

The A horizon ranges from 2 to 6 inches in thickness. In most places the B horizon is extremely stony clay.

Inclusions of Squaw, Gem, and Lickskillet soils make up about. 2 percent of the acreage of the areas mapped.

Salisbury clay loam, 3 to 7 percent slopes (YaC).-A profile of this soil is similar to the one described as typical of the series, except that there are few or no stones on and in the surface layer. Erosion is slight to moderate.

This soil is used mainly for dry-farmed crops. Only a small acreage is used for irrigated crops and for range. The irrigated crops include pasture, hay, small grain, and row crops. Tillage is somewhat difficult because the plow layer is moderately fine textured and tends to puddle or to form large clods. Subsoiling will help to break the subsoil and hardpan that have been exposed in leveling. This soil is best suited to pasture.

The dry-farmed crops are small grain, grass for seed, and pasture crops. Yields are limited because of the lack of available moisture during the growing season. A cloverlegume. mixture is desirable in the rotation. Phosphate is needed if legumes are grown.

The range commonly is in poor condition, but it can be tilled in preparation for reseeding. Medusahead wildrye, cheatgrass, and big sagebrush are the principal plants. *Capability unit IVs-3, dryland.*

Salisbury stony clay loam, 1 to 3 percent slopes (YcB).-This soil is like the soil described as typical of the series, except that it is less stony. There are enough stones on and in the surface layer to hinder tillage but not enough to prevent tillage. Erosion is slight.

This soil is used and managed in the same way as Salisbury clay loam, 3 to 7 percent slopes. It is slightly easier to irrigate because of the more gentle slopes, and it is less susceptible to erosion. *Capability unit IVs-3, dryland.*

Salisbury extremely stony clay loam, 0 to 30 percent slopes (YnE).-A profile of this soil is the one described as typical of the series. Surface runoff is medium to rapid, and erosion is slight to moderate. The available water holding capacity is low.

This soil is used for pasture and range. Medusahead wildrye is dominant in the plant cover. Improvement of the plant cover is difficult because the soil is too stony for the preparation of seedbeds. *Capability unit VIIs-1, dry land. Shallow stony-Chestnut range site.*

Sebree Series

The Sebree series consists of soils that occur as slick spots and are associated with the Chilcott soils on level to rolling uplands. The surface layer is thin or very thin, light colored or very light colored, and medium textured. It is very low in organic-matter content and neutral or nearly neutral in reaction. The subsoil is moderately fine textured, or it grades to a light clay. The subsoil, especially the lower part, is slightly to strongly saline and contains from 20 to 50 percent exchangeable sodium. An indurated or strongly cemented silica-calcium carbonate hardpan occurs below a depth of 20 to 40 inches. These soils formed mainly in a thin or very thin layer of windlaid silts that were underlain by unconsolidated or very poorly consolidated sediments of the Idaho, Payette, or Upper Mesa formation. These sediments are chiefly very coarse textured, coarse textured, or medium-textured sands or loamy sands that are high in quartz, feldspar, and mica and that are mainly noncalcareous.

The Sebree soils occupy a small total. acreage and occur only as very sin all spots. They are associated mainly with the Chilcott soils. The elevation ranges from 2,800 to 3,200 feet. The annual. precipitation ranges from 9 to 11 inches. The slope ranges from 1 to about 3 percent. There are no stones, but in places there are a few cobblestones or a little gravel.

These soils are slightly to severely eroded. They have low to moderate water-holding capacity and are very slowly permeable. The hardpan is not permeable, except for cracks or other openings through it. Drainage is good, but at times a perched water table may be above the hardpan. If not cultivated, these soils are mostly barren or nearly barren. Seine cheatgrass and stunted big sagebrush grow around the edges of the spots.

These soils are used in the same way as the surrounding Chilcott soils. Most areas are used for range, but some are used for irrigated pasture crops, hay crops, small grain, and other crops.

Representative profile of Sebree loam, 1,700 feet north and 1,900 feet east of the southwest corner of sec. 31, T. 6 N., R. 2 W., in an uncultivated area.

A2-0 to 0.3 inch, gray (10YR 5/1) loam; light gray (10YR 7/1) when dry; massive; friable when moist, slightly Bard when dry; no roots; many fine, vesicular pores; mildly alkaline (pH 7.6).

B21t-0.3 to 1 inch, dark grayish-brown (10YR 4/2 or darkbrown heavy loam; grayish brown (10YR 5/2) or brown when dry; moderate, fine, subangular blocky structure and moderate, very fine, granular structure ; friable when moist, slightly hard when dry; very few

fine roots ; common very fine pores ; mildly alkaline (pH 7.8).

B22t-1 inch to 2 inches, dark-brown (10YR 4/3) heavy loam; brown (10YR 5/3) when dry; strong, very fine and fine, granular structure or very fine, subangular blocky structure; friable when moist, slightly hard when dry; mildly alkaline (pH 7.8).

B23t-2 to 9 inches, dark-brown (10YR 4/3) clay loans: pale brown (10YR 6/3) when dry; moderate, fine, prismatic structure and strong. fine, angular blocky structure ; firm when moist, hard when dry; very few fine roots; few very fine pores ; medium, continuous, darker colored clay films on the ped surfaces ; few accumulations of fine, white salt in lower 4 inches ; moderately alkaline (pH 8.2).

B3tsa-9 to 15 inches, brown (10YR 5/3) light clay loam; pale brown (10YR 6/3) when dry ; moderate, fine, angular blocky structure ; friable when moist, hard when dry ; very few fine roots ; common very fine pores ; thin, continuous clay films ; slightly calcareous; common accumulations of coarse, white salt, mainly on vertical ped surfaces; strongly alkaline (pH 8.5).

Clca-15 to 24 inches, pale-brown (10YR 6/3) light loam ; white (10YR 8/2) when dry; massive; firm when moist, hard when dry ; very few fine roots and very fine pores; strongly calcareous; strongly alkaline (pH 8.5).

C2ca-24 to 35 inches, pale-brown (10YR 6/3) fine sandy loam; white (10YR 8/2) when dry; massive; friable when moist, slightly hard when dry ; very few fine roots and very fine pores ; strongly calcareous ; lower part contains weak hardpan lenses and nodules ; strongly alkaline (pH 8.8).

C3sicam-35 to 42 inches, grayish-brown (2.5Y 5/2), strongly silica-lime cemented hardpan ; light brownish-gray (2.5Y 3/2) when dry ; massive or slightly platy; upper part very dense.

C4-42 to 50 inches, pale-brown (10YR 6./3) and dark yellowish-brown (10YR 4/5) sand; light gray (10YR 7/2) and brownish yellow (10YR 6/6) when dry; single grained ; loose ; moderately alkaline (pH 8.4).

The A2 horizon ranges from light gray to light brownish gray in color and from silt loam to fine sandy loam in texture. It is gravelly in some places. Where tillage has mixed the A2 horizon with the upper part of the Bt horizon, the plow layer is silty clay loam, clay loam, sandy clay loam, or sandy clay. In places the B21t horizon has weak or very weak, very fine, prismatic structure. The depth to an appreciable amount of soluble salts ranges from 1 to 8 inches. There may be some gypsum below the upper part of the salty B3 horizon or in that, layer. The depth to calcareous material ranges from 7 to 20 inches.

The Sebree soils are not mapped separately. They are included in the undifferentiated mapping unit "Lanktree, Chilcott, and Sebree learns, 1 to 3 percent slopes." This mapping unit is described under the Lanktree series.

Squaw Series

The Squaw series consists of dark-colored, well-drained soils that formed in noncalcareous local basaltic alluvium and colluvium. The parent materials are mainly medium textured but range to moderately fine textured or moderately coarse textured. They commonly contain significant amounts of basaltic stones and angular and subangular cobblestones and gravel. The proportion of these coarse fragments to the finer textured material is high at a depth of more than 2 to 4 feet. The surface layer has a moderate content of organic matter. It is dominantly loam, but in places it is clay loam. The subsoil ranges from clay loam to heavy loam. The lower part maybe slightly calcareous or noncalcareous.

These soils are moderately extensive and are mainly in the Gem-Newell soil association. They occur on alluvial and colluvial fans at elevations of 2,500 to 3,000 feet. The annual precipitation is about 12 to 16 inches. The slope ranges from about 1 to 60 percent but is commonly between 1 and 25 percent. The native vegetation consisted of Sandberg bluegrass, bluebunch wheatgrass, bitterbrush, big sagebrush, and herbaceous plants.

The Squaw soils are slightly to moderately eroded. They are moderate in available moisture holding capacity and are moderately permeable.

Extremely stony areas are used for pasture and range. The less stony areas are used for either irrigated or dryfarmed crops.

Representative profile of Squaw extremely stony loam, 0 to 30 percent slopes, 30 feet north of the southwest corner of the NW1/4SW1/4 of sec. 4, T. 7 N., R. 1 E., in a noncultivated area.

A11-0 to 4 inches, very dark brown (10YR 2/2) extremely stony loam; dark grayish brown (10YR 4/2) when dry; weak, medium, platy structure and moderate, fine, granular structure; friable when moist, slightly hard when dry ; abundant roots ; neutral.

A12-4 to 8 inches. very dark brown (10YR 2/2) very stony loam: dark grayish brown (10YR 4/2) when dry; weak, medium, subangular blocky structure; friable when moist, slightly hard when dry; roots plentiful; many very fine pores ; neutral.

II2t-8 to 25 inches, very dark grayish-brown (10YR 3/2) very stony clay loam; dark grayish brown (10YR 4/2) when dry ; weak, medium, subangular blocky structure and weak, fine, granular structure; slightly darker colored, thin, patchy clay films on the vertical and horizontal ped surfaces; friable when moist, hard when dry ; roots plentiful to few ; many very fine and few fine pores; neutral to mildly alkaline.

B3t-25 to 41 inches, very dark grayish-brown (10YR 3/2) extremely stony heavy loam; dark grayish brown (10YR 4.5/2) when dry ; very weak, coarse, subangular blocky structure to massive; friable when moist, slightly hard when dry ; few very fine pores ; mildly alkaline ; thin coatings of calcium carbonate on lower sides of rock fragments.

C1-41 inches +. basaltic gravel, angular cobblestones, and stones, and medium-textured interstitial soil material, to a considerable depth.

The surface layer and subsoil generally contain a slight to moderate amount of basaltic, angular or subangular gravel. In some areas the surface and the tipper part of the profile are free or nearly free of gravel, stones, and angular or subangular cobblestones. In other areas the soils are extremely stony, very cobbly, or very gravelly. Some areas have been cleared of stones and cobblestones. The surface layer is very dark brown (10YR 2/2 to 2.5/1.5) to very dark grayish brown (10YR 3/2), when moist. When dry, it may range from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). The subsoil has a chroma of about 2, mainly in the IOYR hue, and in some areas it is weakly prismatic. The pH of the surface layer ranges from about 6.2 to 7.5, and the pH of the B horizon from 6.7 to 7.8.

In places the alluvial material contains some rhyolite and andesite. Small areas of Newell, Salisbury, and Roystone soils make up as much as 5 percent of the acreage of the areas mapped.

Squaw clay loam, 1 to 3 percent slopes (SaB).-This soil is like the soil described as typical of the series, except that the surface layer is nonstony clay loam. Erosion. is very slight, and the water-holding capacity is moderate.

This soil is used for irrigated and dry-farmed crops, pasture, and range. Irrigated areas are suitable for pasture crops, hay, small grain, and row crops. A mixture of grasses and legumes in the rotation helps to maintain the organic-matter content and to preserve soil structure. Manure and green manure help to maintain soil tilth and workability. Alfalfa and other legumes respond well to phosphate, and pasture crops, other grasses, and row crops respond to nitrogen. Irrigation can be by the border, corrugation, furrow, or sprinkler method. The length of runs and the size of irrigation streams need to be limited to control erosion.

Dry-farmed areas are suitable for alfalfa, small grain, and pasture, but their use is limited by the lack of available moisture during the growing season. A mixture of grasses and legumes in the rotation helps to maintain the organic-matter content and to preserve soil structure. Plowing under the last hay crop for green manure helps to improve the soil, to preserve soil structure, and to control erosion. Utilization of manure and stubble helps to maintain productivity. Nitrogen will speed decomposition. Legumes respond to phosphate.

The plant cover on the pasture and range is mostly in poor condition. It consists largely of Medusahead wildrye and cheatgrass. The soil can be tilled for reseeding. *Capability units IIe-1, irrigated; IIs-3, dryland. Loamy Chestnut range site.*

Squaw loam, 1 to 3 percent slopes (SbB).-This soil is like the soil described as typical of the series, except that there are no stones or only a few stones in the surface layer. It is used and managed in the same way as Squaw clay loam, 1 to 3 percent slopes, but it is easier to work. *Capa bility units IIe-1, irrigated; IIs-3, dryland. Chestnut range site.*

Squaw loam, 3 to 7 percent slopes (SbC).-This soil is similar to the soil described as typical of the series, except that there are no stones or only a few stones in the upper part of the profile. It is slightly eroded and has moderate water-holding capacity.

This soil is used for irrigated and dry-farmed crops, pasture, and range. Irrigated areas are suitable for hay, small grain, row crops, and pasture. A rotation that includes a mixture of grasses and legumes is desirable. Manure and green manure help to maintain good soil tilth, workability, and productivity. Alfalfa and other legumes respond to phosphate, and pasture crops, small grain, and row crops respond to nitrogen. Irrigation can be by the sprinkler, corrugation, or furrow method, but the length of runs and the size of irrigation streams need to be limited to control erosion.

If this soil is dry farmed, management .for crops, pasture, and range is the same as for dry-farmed Squaw clay loam, 1. to 3 percent slopes. *Capability units IIIe-1, irrigated; IIs-3, dryland.. Loam-Chestnut, range site.*

Squaw loam, 7 to 12 percent slopes (SbD).-This soil is like the soil described as typical of the series, except that there are no stones or only a few stones in the upper part of the profile. It, is only slightly eroded in most places but is moderately eroded in spots. Deep gullies have formed in some drainageways. The water-holding capacity is moderate.

This soil is used for irrigated and dry-farmed crops, pasture and range. Irrigated areas are suitable for hay, row crops, small grain, and pasture. A rotation that includes a mixture of grasses and legumes is desirable to maintain the organic-matter content, to preserve soil structure, and to control erosion. More than 1 year of a row crop tends to increase erosion, to deplete organic matter, and to break down soil structure. The utilization of manure and crop residues helps to maintain productivity. Nitrogen and phosphate are needed. Irrigation can be by the sprinkler, corrugation, or furrow method. The length of runs and the size of irrigation streams need to be limited to control erosion.

If this soil is dry farmed, management for crops, pasture, and range is the same as for dry-farmed Squaw clay loam, 1 to 3 percent slopes. *Capability units IVe-1, irrigated; IIIe-4, dryland. Loamy-Chestnut range site.*

Squaw loam, 12 to 30 percent slopes (SbE).-This soil is like the soil described as typical of the series, except that there are no stones or only a few stones in the upper part of the profile. The water-holding capacity is moderate. Erosion is slight to moderate, and deep gullies have formed in some drainage ways.

This soil is used for dry-farmed crops and for pasture and range. Dry-farmed crops include hay and small grain. A mixture of grasses and legumes is desirable in the rotation to maintain the organic-matter content and to improve soil structure. Plowing under the last hay crop for green manure helps to improve the soil. The utilization of manure and stubble helps to maintain productivity. Nitrogen speeds decomposition. Legumes respond to phosphate.

The pasture and range are used and managed in the same way as on Squaw clay loam, 1 to 3 percent slopes. *Capability unit IVe-4, dryland. Loamy-Chestnut range site.*

Squaw stony clay loam, 3 to 7 percent slopes (ScC).-This soil is like the soil described as typical of the series, except that it has a clay loam surface layer and is less stony. There are enough stones and cobblestones on or in the surface layer to interfere with tillage but not enough to prevent tillage. Erosion is slight, and deep gullies have formed in some drainageways. Surface runoff is low, and the water-holding capacity is moderate.

Where irrigated, this soil is used and managed in the same way as irrigated areas of Squaw loam, 3 to 7 percent slopes, but it is slightly more difficult to work.

If this soil is dry farmed, management for crops, pasture, and range is the same as for dry-farmed Squaw clay loam, 1 to 3 percent slopes. *Capability units IIIe-1, irrigated; IIIe-4, dryland. Loamy-Chestnut range site.*

Squaw stony loam, 3 to 7 percent slopes (SdC).-This soil is like the soil described as typical of the series, except that it is less stony. The water-holding capacity is moderate, surface runoff is slow, and erosion is slight. There are enough stones and cobblestones to interfere with tillage but not enough to prevent tillage.

Irrigated areas are used and managed in the same way as time irrigated areas of Squaw loam, 3 to 7 percent slopes. If this soil is dry farmed, management for crops, pasture, and range is the same as for dry-farmed Squaw clay loam, 1 to 3 percent slopes. *Capability units IIIe-1, irrigated; IIIe-4; dryland. Loamy-Chestnut range site.*

Squaw stony loam, 7 to 12 percent slopes (SdD).-This soil is like the soil described as typical of the series, except that it is less stony. There are enough stones to interfere with tillage but not enough to prevent tillage. Most areas

are slightly eroded, and deep gullies have formed in some drainageways. The water-holding capacity is moderate.

Irrigated areas are used and managed in the same way as irrigated areas of Squaw loam, 7 to 12 percent slopes. If this soil is dry farmed management for crops, pasture, and range is the same as for dry-farmed Squaw clay loam, 1 to 3 percent slopes. *Capability units IVe-1, irrigated; IIIe4, dryland. Loamy-Chestnut range site.*

Squaw stony loam, 12 to 30 percent slopes (SdE).-This soil is like the soil described as typical. of the series, except that it is less stony. There are enough stones to interfere with tillage but not enough to prevent tillage. Erosion is slight to moderate., and deep gullies have formed in some drainageways. Surface runoff is medium, and the water-holding capacity is moderate.

Dry-farmed areas are used and managed in the same way as dry-farmed Squaw loam, 12 to 30 percent slopes. Pasture and range are used and managed in the same way as on Squaw clay loam, 1 to 3 percent slopes. *Capability unit IVe-4, dryland. Loamy-Chestnut range site.*

Squaw extremely stony loam, 0 to 30 percent slopes (SeE).-A profile of this soil is the one described as typical of the series. This soil is mostly slightly to moderately eroded, and deep gullies have formed in some drainageways.

This soil is used for pasture and range. It is too stony for the preparation of seedbeds, but forage yields can be increased by broadcast seedings and careful management. *Capability unit VIs-1, dryland. Stony-Chestnut range site.*

Squaw soils, 30 to 60 percent slopes (SfF).-These soils occur on steep slopes along large drainageways. Most slopes have northerly exposures, but some have southerly exposures. The soil is dominantly stony loam, but in some areas it is loam. Surface runoff is medium, and erosion is slight to moderate. The water-holding capacity is moderate.

These soils are used for pasture and range. They are too steep for the preparation of seedbeds, but forage yields can be increased by broadcast seedings and good range management. *Capability unit VIe--2, dryland. North slope-Chestnut range site.*

Sweet Series

In this series are well-drained soils on high stream terraces. These soils formed in old stream alluvium, mainly in medium-textured or moderately coarse textured material that washed principally from areas of granitic rock or similar intrusive acid igneous and basaltic rocks. This material is high in quartz, feldspar, and mica, and is mostly noncalcareous. Possibly a thin covering of windlaid silty material has influenced the soil in places. The surface layer is dark colored and moderately low in content of organic matter. It is dominantly loam or clay loam. The subsoil is chiefly clay loans, but in places it is light clay. A weak or moderate accumulation of calcium carbonate is in the lower part of the subsoil. A weakly cemented hardpan occurs at a depth of about 24 to 50 inches. The hardpan is cemented by silica and lime.

These soils are moderately extensive in the Sweet-Kepler soil association. They occur at elevations of about 2,500 to 2,800 feet in the Sweet and Montour Valleys. The slope ranges from 0 to 30 percent, but on more than half of the acreage it is between 3 and 7 percent. The annual precipitation is 12 to 13 inches. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, and other grasses and forbs.

In most areas the soils are nonstony, but there are some stony and extremely stony soils adjacent to the basaltic hills on the south side of the Montour Valley. Erosion has been slight to moderate in most places, and there are a few gullies. Fertility is moderate, the available water holding capacity is moderate, and permeability is slow to very slow in the subsoil.

The Sweet soils are used mainly for irrigated and dry farmed crops. Some of the acreage is used for pasture and range.

Representative profile of Sweet loam, 3 to 7 percent slopes, 95 feet south and 280 feet west of the northeast corner of the SE1/4NW1/4 of sec. 10, T. 7 N., R. 1 E., in a cultivated field.

Ap-0 to 7 inches. very dark grayish-brown (10YR 3/2) loam; grayish brown (10YR 5/2) when dry; weak, thin, platy structure and weak or moderate, fine, granular structure; friable when moist, slightly hard when dry; abundant fine roots; slightly acid (pH 6.3).

Al-7 to 9 inches, very dark grayish-brown (10YR 3/2) loam ; grayish brown (10YR 5/2) when dry; weak or moderate, very fine to fine, granular structure ; moderate wormholes and casts; friable when moist, slightly hard when dry ; abundant fine roots ; slightly acid (pH 6.3).

A3-9 to 15 inches, very dark grayish-brown (10YR 3/2) loam grayish brown to brown (10YR 5/2 to 5/3) when dry; weak, coarse, subangular blocky structure and weak, fine, granular structure; thin, patchy clay films on pods: slightly lighter colored. bleached, silty specks on vertical ped surfaces; friable when moist, slightly hard when dry; roots plentiful; many very fine pores. few very coarse channels and rodent holes; neutral (pH 6.9).

B1t-15 to 21 inches, dark-brown (10YR 3/3) loam; brown (10YR 5/3) when dry; weak, medium, prismatic structure and strong or moderate, fine, subangular and angular blocky structure; slightly darker colored, moderate clay films on pods; lighter colored silty bleached specks on vertical and some horizontal ped surfaces; firm when moist, very hard when dry; roots plentiful; common very fine pores; slightly acid (pH 6.1).

B2t-21 to 33 inches, dark-brown (7.5YR 4/3) clay loam; brown (7.5YR 5/3) when dry; moderate, medium, prismatic structure and strong, coarse and medium, angular blocky structure; darker colored, thick, continuous clay films on all ped surfaces; very firm when moist, extremely hard when dry; very few very fine roots; very dense; neutral (pH 6.7).

B3tca-33 to 38 inches, brown (10YR 4/3) sandy clay loam;' brown (10YR 5/3) when dry; weak, coarse, prismatic structure and moderate, fine and medium, angular blocky structure; darker colored, thick, continuous clay films on peds; very firm when moist, extremely hard when dry; very few roots; dense to very dense; numerous to many calcium carbonate spots and veins; neutral (pH 7.2).

Clsim-38 to 46 inches, dark-brown (10YR 3/3) light sandy clay loam; brown to pale brown (10YR 5/3 to 6/3) when dry; weak, fine and medium, angular blocky structure; thin, patchy clay films on peds; very weakly to weakly cemented; upper part contains many white veins of noncalcareous material, possibly silica; noncalcareous; mildly alkaline (pH 7.8).

C2sim-46 to 58 inches, dark-brown (10YR 3/3) coarse sandy loam; brown to pale brown (10YR 5/3 to 6/3) when dry; weakly cemented hardpan: thin, patchy clay films; very few very pale brown veins of silica; noncalcareous; mildly alkaline.

The surface layer is very dark grayish brown (10YR 3/2) when moist, and it is grayish brown (10YR 5/2 when dry. The bleached silt and very fine sand specks in the A3 and B1t horizons range from very few specks to a very thin, nearly continuous coating. The B2t horizon is moderately to strongly prismatic and strongly to moderately blocky. Its hue is dominantly 7.5YR but ranges to 10YR, and its chroma is dominantly 3. The depth to the calcareous material is 2 or 3 feet. The hardpan is cemented in places by silica or by silica and calcium carbonate. In some mounds, the depth to the B horizon is as much as 20 to 24 inches, and the B horizon is less clayey and less dense than typical.

Inclusions of Salisbury, Montour, Haw, or Newell soils make up as much as 5 percent of the acreage of the areas mapped. Also included in mapping were some wet soils in swales and natural drainageways. These soils receive irrigation water from higher lying soils.

Sweet clay loam, 12 to 30 percent slopes, eroded (SgE2).-This soil is shallow, but otherwise it is like the soil described as typical of the series. It is moderately to severely eroded, and shallow gullies are common.

This soil has been used for corrals and feeding lots. It is suitable for pasture and range. The plant cover commonly is in poor condition. It consists largely of Medusahead wildrye. Management needs are the same as those of Sweet clay loam, shallow, 1 to 3 percent slopes. *Capability unit VIs-1, dryland. Loamy-Brown range site.*

Sweet clay loam, shallow, 1 to 3 percent slopes (ShB).-This soil is like the soil described as typical of the series, except that the depth to the hardpan is only 18 to 24 inches. Erosion is slight.

This soil is used for irrigated and nonirrigated crops and for pasture and range. The small acreage that is irrigated is used for pasture, hay, small grain, and row crops. The best use for this soil is pasture.

The nonirrigated crops are small grain, grass for seed, and pasture crops. The use of this soil for nonirrigated crops is limited by the lack of available moisture during the growing season. A. mixture of grasses and legumes in the rotation is desirable. The utilization of manure, green manure, and stubble helps to maintain productivity and to control erosion. Nitrogen speeds decomposition. Legumes respond to phosphate.

Most of the. range is in poor condition. The principal invaders are 1lledusahead wildrye and other annual weeds and grasses. This soil can be tilled for seedbeds, but care should be taken not to puddle the soil or to leave a rough seedbed. *Capability unit IVs-3, dryland. Loamy-Brown range site.*

Sweet clay loam, shallow, 3 to 7 percent slopes (ShC).-Except for slopes, this soil is like Sweet clay loam, shallow, 1 to 3 percent slopes. Surface runoff is slightly more rapid, and the erosion hazard is slightly greater.

This soil can be used and managed in the same way as Sweet clay loam, shallow, 1 to 3 percent slopes, but if irrigated it needs more care in the application of water, to control. erosion. *Capability unit IVs-3, dryland. Loamy-Brown range site.*

Sweet loam, 1 to 3 percent slopes (SmB).-Except for slope, this soil is like the soil described as typical of the series. The depth to the hardpan is mostly between 35 and 50 inches, but in a few areas it is between 24 and 35 inches. Erosion is slight. Some soils that have a surface layer of clay loam were included in mapping.

This soil is used mainly for irrigated crops. Only a small acreage is used for dry-farmed crops. Pasture, hay, small grain, and row crops are grown on the irrigated soil. A mixture of grasses and legumes in the rotation helps to maintain the organic-matter content and to preserve soil structure. The utilization of crop residues, manure, and green manure helps to maintain soil tilth and productivity. Irrigation can be by the border, corrugation, or furrow method, but irrigation water should be applied slowly.

Alfalfa for hay, small grain, and pasture crops are grown on the dry-farmed areas under a wheat-fallow cropping system. Yields are limited by the lack of available moisture during the growing season. A mixture of grasses and legumes m the rotation is desirable. Plowing under the last hay crop for green manure helps to improve the soil, to preserve soil structure, arid to control erosion. The utilization of manure and stubble helps to maintain productivity and to control erosion. Nitrogen can be used to speed decomposition. Alfalfa and clover may need phosphate. *Capability units IIe-2, irrigated; IVs-3, dryland. Loamy-Brown range site.*

Sweet loam, 3 to 7 percent slopes (SmC). A profile of this soil is the one described as typical of the series. The depth to the hardpan is between 35 and 50 inches in most areas, but it is between 24 and 35 inches in a few places. In most areas this soil is slightly eroded, but in some places it is moderately eroded. Some soils that have a surface layer of clay loam were included in mapping.

This soil is used for irrigated and dry-fanned crops, pasture, and range. Irrigated areas are used for pasture, hay, small grain, and row crops. A mixture of grasses and legumes in the rotation is desirable to maintain or to improve the organic-matter content and workability and to preserve soil structure. The utilization of manure and crop residues helps to maintain productivity and to preserve soil structure. Good response to nitrogen and phosphate can be expected. Irrigation can be by the corrugation or furrow method. Sprinklers can be used on close-growing crops. The length of runs and the size of irrigation streams need to be adjusted to control erosion, because of the slope and the relatively slow intake rate.

Dry-farmed areas are used and managed in the same way as on Sweet loam, 1 to 3 percent slopes.

The pasture and range commonly are in poor condition. The original vegetation has been replaced principally by cheatgrass, Medusahead wildrye, and other annual weeds. Increased production can be obtained by summer fallowing, preparing good seedbeds, and reseeding to suitable plants. A suitable mixture is Ladak alfalfa and a grass, such as Siberian wheatgrass. crested wheatgrass, Whitmar beardless wheatgrass, Sherman big bluegrass, pubescent wheatgrass, or intermediate wheatgrass. Good grazing management is needed to maintain production. *Capability units IIIe-2, irrigated; IVs-3, dryland. Loamy-Brown range site.*

Sweet loam, 7 to 12 percent slopes (SmD).-Except for slope, this soil is like the soil described as typical of the series. Erosion is slight to moderate. In a few areas the surface layer is clay loam. In most places the depth to the hardpan is between 35 and 50 inches, but in a few places it is between 24 and 35 inches. Small areas of soils that are shallow to the hardpan occur on some slope breaks. Some

wet spots occur at the base of slopes or where the hardpan is close to the surface. These spots are wet because irrigation water drains onto them from higher areas.

This soil is used for irrigated and dry-farmed crops and for pasture and range. Irrigated areas are suitable for pasture, hay, small grain, and some row crops. A mixture of grasses and legumes in the rotation helps to maintain the organic-matter content, to preserve soil structure, and to control erosion. The utilization of manure and crop residues helps to maintain productivity. Nitrogen and phosphate are needed. Irrigation can be by the sprinkler, corrugation, or furrow method. If corrugations or furrows are used, the length of runs and the size of irrigation streams need to be limited to control erosion.

Dry-farmed areas are used and managed in the same way as dry-farmed areas of Sweet loams, 1 to 3 percent slopes. The pasture and range are used and managed in the same way as on Sweet loam, 3 to 7 percent slopes. *Capability units IVe-1, irrigated; IVe-5, dryland. Loamy-Brown range site.*

Sweet-Kepler complex, **1 to 3 percent slopes** (SnB).This complex is about 60 percent Sweet loam and about 40 percent Kepler loam. These soils are like the soils described as typical of their respective series. The depth to the hardpan commonly is between 36 and 50 inches.

In most areas, Sweet loam occupies mounds that are several feet across and from 1 to 4 feet above the surrounding swales. Kepler loam occurs in the swales and slight depressions that surround the mounds. Erosion is slight.

These soils are used for irrigated and dry-farmed crops and for pasture and range. The irrigated and dry-farmed areas can be used and managed in nearly the same way as Sweet loam, 1 to 3 percent slopes. Subsoiling to break the claypan can be beneficial, but it may need to be done every 2 or 3 years.

The pasture and range are mostly in poor condition. Management needs are the same as those of Sweet loam, 3 to 7 percent slopes. *Capability units IIe-2, irrigated; and IVs-3, dryland. Loamy-Brown range site.*

Sweet-Kepler complex, 3 to 7 percent slopes (SnC).This complex is about 60 percent Sweet loam and about 40 percent Kepler loam. These soils are similar to the soils described as typical of their respective series. The depth to the hardpan generally is between 36 and 50 inches. Erosion is slight in most areas but moderate in some spots.

In most places, Sweet loam occupies mounds that are several feet across and from 1 to 4 feet above the surrounding swales. Kepler loam occurs in the swales and slight depressions that surround the mounds.

These soils are used for dry-farmed crops and for pasture and range. Dry-farmed areas are used and managed in the, same way as similar areas of Sweet loam, 1 to 3 percent slopes. Subsoiling can be beneficial, especially if deep-rooted crops are grown, but it may need to be done every 2 or 3 years.

The pasture and range are mostly in poor condition. Management needs are the same as those of Sweet loam, 3 to 7 percent slopes. *Capability unit IVs-3, dryland. Loamy-Brown range site.*

Sweet-Kepler complex, 7 to 12 percent slopes (SnD),-This complex is about 70 percent Sweet loam and 30 percent Kepler loam. These soils are similar to the soils described as typical of their respective series. The depth to the hardpan generally is between 36 and 50 inches. In most areas, Sweet loam occupies mounds that are several feet across and from 1 to 4 feet above the surrounding swales. Kepler loam occurs in the swales, slight depressions, and drainageways that surround the mounds. Most of the soil is slightly eroded. Near the top of some slopes, the hardpan is near enough to the surface to interfere with tillage.

These soils are used for dry-farmed crops and for pasture and range. Dry-farmed areas are used and managed in the same way as on Sweet loam, 1 to 3 percent slopes. Subsoiling across the slope helps to increase the rate of water intake and to promote deep root growth. It may need to be done every 2 or 3 years.

The pasture and range are used and managed in the same way as on Sweet loam, 3 to 7 percent slopes. *Capability unit IVe-5, dryland. Loamy-Brown range site.*

Sweet-Kepler stony complex, 3 to 7 percent slopes (SpC).-This complex is about 60 percent Sweet stony loam and 40 percent Kepler stony loam. These soils are like the soils described as typical of their respective series, except that there are basaltic cobblestones and stories on the surface in the soil material. These cobblestones and stones are mostly between 6 and 15 inches in diameter and are numerous enough to interfere with tillage but not to prevent tillage. The depth to the hardpan commonly is between 36 and 50 inches.

In most areas, Sweet stony loam occupies mounds that are several feet across and from 1 to 4 feet above the surrounding swales. Kepler stony loam occurs in the swales, slight depressions, and drainageways that surround the mounds.

These soils are used for dry-farmed crops and for pasture and range. Dry-farmed areas can be used and managed in the same way as dry-fanned areas of Sweet loam, 1 to 3 percent slopes, but the stones should be removed. Subsoiling would be beneficial but is difficult because of the stones.

The pasture and range are used and managed in the same way as on Sweet loam, 3 to 7 percent slopes. *Capability unit IVs-3, dryland. Loamy-Brown range site.*

Sweet-Kepler extremely stony complex, 0 to 12 percent slopes (SsC).-This complex is about 60 percent Sweet extremely stony loam and 40 percent Kepler extremely stony loam. The depth to the hardpan generally is between 36 and 60 inches. These soils are like the soils described as typical of their respective series, except that they have basaltic cobblestones and stones from 4 to 20 inches in diameter in both the surface layer and subsoil. The stones are so numerous that it is not practical to cultivate these soils for crops or to prepare seedbeds for range reseeding.

In most areas, Sweet extremely stony loam occupies mounds that are several feet across and from 1 to 4 feet above the surrounding swales. Kepler extremely stony loam is in swales, slight depressions, and drainageways that surround the mounds.

These soils are used for grazing. Cheatgrass, Medusahead wildrye, and other annual weeds make up most of the vegetation. The plant cover can be gradually improved by broadcast seedings and careful management. *Capability unit VIs-1, dryland. Stony-Brown range site.*

Van Dusen Series

This series consists of deep, dark-colored, loamy soils on steep northerly slopes. These soils formed in unconsolidated, moderately coarse textured or coarse textured sediments of the Idaho and Payette formations. These sediments weathered from granitic rocks or similar intrusive acid igneous rocks. They are high in quartz, mica, and feldspar and are mostly noncalcareous. In places the uppermost; part of the soil is influenced by wind-laid silt.

The surface layer is principally loam, but in places it is clay loam or sandy loam. It has a high or moderately high content of organic matter. The subsoil is clay loam, sandy clay loam, or heavy loam. These soils are either noncalcareous throughout, or they have a weak accumulation of calcium carbonate below a depth of about 30 inches. Below a depth of 35 to 45 inches, the substratum consists of coarse sand, loamy coarse sand, coarse sandy loam, or gritty loam.

These soils are extensive in the flaw-Payette-Van Dusen soil association. They occur on steep northerly slopes, north and east of the Emmett Valley. The slope ranges from 30 to 75 percent, and the elevation ranges from about 2,800 to 4,500 feet. The annual precipitation is between 12 and 16 inches. The native vegetation consisted of bluebunch wheatgrass, Idaho fescue, and other grasses and forbs.

The Van Dusen soils are nonstony to extremely stony and are slightly to moderately eroded. Surface runoff is rapid to very rapid. The available water holding capacity is moderate, permeability is moderate, and fertility is high.

These soils can be used to only a limited extent for grazing because of the steep slopes.

Representative profile of Van Dusen loam, 30 to 60 percent slopes, 400 feet north and 1,400 feet east of the southwest corner of sec. 5, T. 7 N., R.1 N., on a very steep northerly slope.

A11--0 to 8 inches, very dark brown (10YR 2/2) loam; dark gray (10YR 4/1) when dry; very weak, thin, platy structure and weak to moderate, fine, granular structure; very friable when moist, slightly hard when dry; abundant medium roots; neutral (pH 6.6).

A12-8 to 15 inches, very dark brown (10YR 2/2) loam; dark gray (10YR 4/1) when dry; weak, fine, subangular blocky structure and moderate, fine, granular structure ; friable when moist, slightly hard when dry ; abundant medium roots; neutral (pH 6.8).

B1-15 to 24 inches, very dark grayish-brown (10YR 3/2) loam; dark grayish brown (10YR 4/2) when dry; weak, medium and fine, subangular blocky structure: thin, patchy clay films on peel surfaces; firm when moist, slightly hard when dry ; fine roots plentiful ; many very fine pores ; neutral (pH 6.9)

B2t-24 to 29 inches, very dark grayish-brown (10YR 3/2) clay loam (nearly a loam) or sandy clay loam; grayish brown (10YR 5/2) when dry ; weak, medium and fine, subangular blocky structure; thin, continuous clay films on ped surfaces ; firm when moist, hard when dry ; fine roots plentiful; common very fine pores; neutral (pH 7.0).

B31t-29 to 34 inches, dark-brown (10YR 3/3) loam; brown (10YR 5/3) when dry; weak, medium to fine, subangular blocky structure; thin, patchy clay films on ped surfaces ; firm when moist, slightly hard when dry ; fine roots plentiful; common very fine pores; neutral (pH 6.9),

B32t--34 to 42 inches, dark-brown (10YR 3/3) loam; brown (10YR 5/3) when dry; very weak, fine, subangular blocky structure; thin, patchy clay films only in pores and root channels; firm when moist; slightly hard when dry ; few very fine roots ; common very fine pores; neutral (pH 6.9).

C1-42 to 50 inches, dark-brown (10YR 4/3) coarse sandy loam ; brown (10YR 5/3) when dry; massive ; very friable when moist, slightly hard when dry ; few fine roots ; many very fine pores ; neutral ; grades into sandy strata of the Idaho and Payette formations.

The profile is micaceous throughout and contains coarse and very coarse quartz sand grains. It generally is noncalcareous, but in places there are spots of calcium carbonate below a depth of 30 inches. The surface layer is very dark brown to black (10YR 2/2 to 2/1) when moist, and it is dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) when dry. The subsoil. generally has a hue of 10YR and a chroma of 2 or 3, but in some places it has hues of 7.5 YR and 2.5Y. The B2t horizon ranges from weak to moderate, subangular blocky. The soils are mostly nonstony and free of rock outcrops, but a few are stony, very stony, or extremely stony because of stones that have moved down from higher areas.

Small areas of Payette and Haw soils make up 3 or 4 percent of the acreage of the areas mapped. The Idaho and Payette formations include some semiconsolidated layers and some sandstone, tuffaceous, and diatomaceous materials. The soils that formed in these materials are shallower and commonly finer textured than the typical Van Dusen soils.

Van Dusen loam, 30 to 60 percent slopes (VdF).-A profile of this soil is the one described as typical of the series. This soil, is on steep northerly slopes. Surface runoff is rapid, and erosion is slight to moderate. A few areas of Van Dusen clay loam and Van Dusen sandy loam were included in mapping.

This soil is used for pasture and range. The plant cover is mostly in fair to good condition, but grasses that produce much usable forage, such as bluebunch wheatgrass and Idaho fescue, have decreased, and less productive grasses, such as three-awn and Sandberg bluegrass, have increased. Yields of usable forage can be increased by management of grazing. The grasses should be allowed to reseed periodically, and a fair amount of grass stubble should be left to protect the soil from erosion after grazing animals are removed. These practices will also help to increase forage production for the next year. *Capability unit VIe-2, dryland. Granitic north slope-Chestnut range site.*

Van Dusen loam, 60 to 75 percent slopes (VdG).-A profile of this soil is like the profile described as typical of the series, except that in most places the subsoil is loam. This soil is on very steep northerly slopes. Surface runoff is very rapid. Erosion is slight to moderate. A few acres of Van Dusen sandy loam were included in the areas mapped.

Part of the acreage is used for grazing. Because this soil is susceptible to severe erosion, such use is hazardous. An adequate plant cover should be maintained at all times to control erosion. *Capability unit VIIe-2, dryland. North slope-Prairie range site.*

Van Dusen stony loam, 30 to 60 percent slopes (VnF).-In most characteristics, this soil is like the soil described as typical. of the series. It formed in residuum weathered from rhyolite or rhyolitic tuff, and it is underlain by bedrock at a depth of 25 to 45 inches. A few to numerous rhyolitic stones and cobblestones occur on the surface and in the soil. This soil is slightly more acid than is typical, and it has a slightly darker colored surface

layer. It commonly is noncalcareous throughout. In some of the areas napped, outcrops of rhyolitic bedrock and soils that are less than 5 inches thick make up from 2 to 25 percent of the acreage. Inclusions of Perla and Elmore soils make up as much as 5 percent of the acreage.

This soil is used for pasture and range. The plant cover is mostly in fair to good condition. Enough growth should be left after grazing to protect the soil from erosion and to allow the grasses to reseed. *Capability unit VIe-2, dryland. Granitic north slope-Chestnut range site.*

Van Dusen extremely stony loam, 30 to 60 percent slopes (VsF).-This soil is like the soil described as typical of the series, except that there are numerous stones and ledges of sandstone.. The stones are fragments that have fallen from higher lying ledges. Some are as much as 4 feet in diameter. This soil is shallow where it is underlain by ledges of sandstone.

This soil can be used and managed in the same way as Van Dusen loam, 30 to 60 percent slopes. The stones do not greatly hinder the movement of grazing animals. *Capability unit VIs-1, dryland. Granitic north slope-Chestnut range site.*

Vickery Series

This series consists of light-colored, medium-textured, well-drained soils that have a hardpan. The surface layer has a low content of organic matter. In most places both the surface layer and subsoil are silt loam, but in some places they are loam. In places the subsoil contains a little more clay than the surface layer. The lower part of the subsoil. contains a weak or very weak accumulation of calcium carbonate. An indurated or strongly cemented silica-calcium carbonate hardpan occurs at a depth of 20 to 50 inches. The soils formed in a thin mantle of windlaid silt over sediments of the Idaho and Upper Mesa formations, which were derived from intrusive acid igneous rocks. The sediments are high in quartz, feldspar, and mica and are mostly noncalcareous.

These soils occupy a small total acreage in the Chilcott-Lanktree-Lolalita soil association. They occur on upland plateaus, north and south of the Emmett Valley. The elevation ranges from 2,800 to 3,200 feet. The annual precipitation is 9 to 11 inches. The slope ranges from 0 to 12 percent. The native vegetation consisted principally of bunchgrasses, big sagebrush, and herbaceous plants.

The Vickery soils occur in mounds that are 10 to 30 feet across and 1 to 3 feet higher than the surrounding Chilcott soils. The surface layer and subsoil contain little or no gravel, cobblestones, or stones. Erosion has been slight in most places. The available water holding capacity is moderate to high. Permeability is moderate, but the hardpan is impermeable or very slowly permeable.

The Vickery soils and the associated Chilcott soils are used for crops, pasture, and range.

Representative profile of Vickery silt loam, 0 to 12 percent slopes, 370 feet north and 630 feet west of the southeast corner of the NE1/4 of sec. 7, T. 7 N., R. 2 W., on noncultivated range.

A11-0 to 0.3 inch, very dark gray (10YR 3/1) silt loam; gray (10YR 5/1) when dry; weak, very fine, granular structure; very friable when moist, soft when dry; roots very abundant; neutral (pH 6.8).

A12--0.3 inch to 5 inches, dark grayish-brown (10YR 4/2) silt loam; light brownish gray (10YR 6/2) when dry; weak or moderate, thin, platy structure and very weak, very fine, granular structure; friable when moist, slightly hard when dry; fine roots abundant to plentiful; few to many very fine pores; neutral (pH 7.0).

A3-5 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; light brownish gray (10YR 6/2) when dry; weak, fine. subangular blocky structure breaking to very weak, very fine, granular structure; friable when moist, slightly hard when dry; fine roots plentiful; common very fine pores; neutral (pH 7.1).

B1-10 to 15 inches, dark grayish-brown (10YR 4/2) silt loam; light brownish gray (10YR 6/2) when dry; weak, medium, subangular blocky structure; friable when moist, slightly hard when dry ; very thin, patchy clay films ; fine roots plentiful ; many very fine pores ; neutral (pH 7.1).

B2-15 to 25 inches, dark grayish-brown (10YR 4/2) silt loam; light brownish gray (10YR 6/2) when dry; weak, medium, subangular blocky structure; friable when moist, hard when dry ; very thin, patchy clay films ; few fine roots ; common very fine pores ; mildly alkaline (pH 7.4).

B3ca--25 to 34 inches, dark grayish-brown (10YR 4/2) loam; light brownish gray (10YR 6/2) when dry; weak, medium, subangular blocky structure and common 0.5 inch nodules of soil material ; friable when moist, slightly hard when dry; few fine roots; common very fine pores; noncalcareous except for common calcium carbonate splotches and veins ; mildly alkaline (pH 7.8).

Csicam-34 inches +, light brownish-gray to pale-brown (10YR 6/2 to 6/3) and white indurated silica-calcium carbonate hardpan; light gray (10YR 7/2) and white when dry; mildly alkaline (pH 7.7).

The A11 horizon commonly is lacking in barren spots. The A12 horizon is dark grayish brown (10YR 4/2) when moist and light brownish gray (10YR 6/2) when dry. In places small fragments of the calcareous hardpan are scattered throughout the profile.

In the Gem County Area, Vickery soils are mapped in a complex with the Chilcott soils. A description of the Chilcott-Vickery complex, 0 to 12 percent slopes, follows the description of the Chilcott series.

Wardwell Series

In this series are moderately well drained soils that occur on a low terrace that borders the Payette River. The surface layer is fine sandy loam or loam and the subsoil is heavy loam. The subsoil is underlain at a depth of 25 to 50 inches by loose sand and gravel. The parent material is alluvium that washed from areas of acid igneous rocks. It contains small amounts of basaltic and rhyolitic materials. The alluvium its high in quartz, feldspar, and mica and is noncalcareous.

These soils occupy a moderate acreage in the Emerson-Wardwell-Quenzer soil association. They occur at elevations of 2,300 to 2,400 feet, mostly east of Emmett. The annual precipitation is 10 to 12 inches. The slopes are less than 1 percent. The native vegetation consisted of bunchgrasses, big sagebrush, and herbaceous plants.

The Wardwell soils have moderate available water holding capacity and a moderately slowly permeable subsoil. Surface runoff is very slow and erosion is negligible.

These soils are used for irrigated hay, pasture, corn, and small grain.

Representative profile of Wardwell loam, 50 feet north and 80 feet west of the center of the SE1/4 of sec. 5, T. 6 N., R. 1 W., in a cornfield.

Ap-0 to 7 inches, dark grayish-brown (10YR 4/2) loam ; light brownish gray (10YR 6/2) or pale brown (10YR 6/3) when dry ; weak, fine, granular structure ; very friable when moist, slightly hard when dry ; abundant roots ; medium acid (pH 6.0).

A21-7 to 10 inches, dark grayish-brown (10YR 4/2) loam; pale brown (10YR 6/3) or light brownish gray (10YR 6/2) when dry; few, fine, faint, light-gray (10YR 7/2) mottles when dry ; massive or very weak, medium, subangular blocky structure ; friable when moist, hard when dry ; fine roots plentiful ; many very fine and fine pores; slightly acid (pH 6.1).

A22-10 to 12 inches, dark grayish-brown (10YR 4/2) loam ; pale brown (10YR 6/3) or light brownish gray (10YR 3/2) when dry; few, fine, distinct, dark yellowishbrown (10YR 3/4) mottles, which are yellowish brown (10YR 5/4) when dry, and few, medium, faint, grayish-brown (10YR 5/2) mottles, which are light gray (2.5Y 7/2) when dry; massive or very weak, medium, subangular blocky structure; friable when moist, hard when dry ; fine roots plentiful ; many very fine and fine pores ; slightly acid (pH 6.1) .

B2t--12 to 17 inches, dark grayish-brown (10YR 4/2) heavy loam, containing about twice as much clay as the Ap horizon; light brownish gray (10YR 6/2) when dry; few, fine, distinct, dark-brown (10YR 4/3) mottles, which are brown (10YR 5/3) when dry; weak, fine and medium, prismatic structure and moderate and strong, subangular and angular blocky structure; firm when moist, very hard when dry ; few fine roots; few very fine pores; thin or medium, continuous, very dark grayish-brown (10YR 3/2) clay films on pods; clay films are dark grayish brown (10YR 4/2) when moist; slightly acid (pH 6.3).

B3ca-17 to 24 inches, dark grayish-brown (10YR 4/2) loam; light brownish gray (10YR 6/2) when dry; common, coarse, faint, dark-brown (10YR 4/3) mottles; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles, which are very pale brown when dry; weak, fine and medium, subangular blocky structure; friable when moist, very hard when dry; few fine roots; common very fine pores ; moderately or slightly calcareous with few lime veins and splotches; mildly alkaline (pH 7.6).

IIC1-24 to 32 inches, dark-brown (10YR 4/3) fine sandy loam; pale brown (10YR 6/3) when dry; common, medium, faint, grayish-brown (10YR 5/2) mottles, which are light gray (10YR 7/2) when dry; massive; very friable when moist, hard when dry; few fine roots ; many very fine pores; very slightly calcareous; mildly alkaline (pH 7.8).

IIIC2-32 inches +, loose gravel and sand.

The color of the moist surface layer is dark grayish brown to dark brown (10YR 4/2 to 4/3). Its texture is loam or fine sandy loam. The subsoil ranges from loam to sandy clay loam or light clay loam. The underlying material is stratified, and in some places layers of loamy sand to clay loam occur within the profile.

Spots of Emerson or Falk soils make up about 5 percent of the acreage of the areas mapped. Saline-alkali spots that are transitional to Letha soils make up about 1 percent.

Wardwell loam (Wa).-A profile of this soil is the one described as typical of the series. The surface layer is mostly loam or light loam, but in many areas it is transitional to fine sandy loam or is fine sandy loam. The depth to the water table generally is between 30 and 60 inches. A few acres in which the depth to the water table is between 20 and 30 inches for appreciable periods were included in the acreage of the areas mapped. Slopes are less than 1 percent.

Irrigated crops, such as pasture, hay, small grain, and row crops, are grown. Deep-rooted crops, such as alfalfa, die out sooner than on the better drained soils but will do fairly well for 2 or 3 years. In irrigating this soil and adjoining soils, care should be taken not to raise the water table. Otherwise, deep-rooted crops will be damaged. A mixture of grasses and legumes is desirable in the rotation to maintain the organic-matter content and to preserve soil structure. Manure, green manure, and crop residues also help to keep the soil in good condition. Nitrogen and phosphate are needed. Irrigation can be by the border, corrugation, furrow, or sprinkler method. *Capability unit IIs-2, irrigated.*

Wasatch Series

This series consists of very deep, sandy soils on alluvial fans. These soils have a dark-colored surface layer but become lighter colored with depth, except where they are changed by overwash strata. The parent material of stratified sandy local alluvium and colluvium washed mainly from darker colored soils that formed in material of the Idaho formation. This formation consists of unconsolidated sands weathered mostly from acid, igneous rocks. Between plow depth and a depth of 20 or 30 inches, the subsoil is dominantly coarse textured. It is mainly loamy coarse sand and loamy sand but contains layers of coarse sand or sand.

These soils make up a moderately small acreage in the Harpt-Cashmere soil association. They occur along the east and south sides of the Emmett Valley and occupy the upper part of the sloping alluvial fans of the many small streams that flow from adjacent uplands. The elevation ranges from 2,300 to 2,500 feet. The precipitation is 9 to 13 inches but may be supplemented by runoff water. The slope ranges from 1 to 30 percent. Drainage is good to somewhat excessive. The native vegetation consisted of needlegrass, Indian ricegrass, other bunchgrasses, and some bitterbrush and forbs.

The Wasatch soils are moderately erodible, but they are only slightly to moderately eroded. In some places they are gravelly. Permeability is very rapid, the waterholding capacity is low, and fertility is low.

These soils are moderately well suited to orchard crops and are used mostly for orchards. However, some strawberries, small grain, and pasture crops are grown.

Representative profile of Wasatch loamy coarse sand, 3 to 7 percent slopes, 1,000 feet north and 550 feet west of the center of sec. 25, T. 6 N., R. 2 W., in an orchard.

Ap-0 to 9 inches, very dark grayish-brown (10YR 3/2) loamy coarse sand; grayish brown (10YR 5/2)-when dry; very weak, medium and fine, granular structure; loose when moist, soft when dry; slightly acid (pH 6.4).

IIC1-9 to 33 inches, brown (10YR 5/3) or light olive-brown (2.5Y 5/3) coarse sand; light brownish gray (10YR 6/2) when dry; single grained; loose; neutral; (pH 6.7).

IIIC2--33 to 36 inches, brown (10YR 5/3) or light olive-brown (2.5Y 5/3) loamy coarse sand; massive; neutral (pH 6.8).

IVC3-36 to 48 inches, brown (10YR 5/3) or light olive-brown (2.5Y 5/3) coarse sand; single grained; neutral (pH 6.8).

VC4-18 to 60 inches, brown (10YR 5/3) or light olive-brown (2.5Y 5/3) loamy coarse sand; single grained; neutral (pH 6.8).

The color of the moist surface layer is very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2). The underlying material is stratified, and strata of coarse sand to coarse sandy loam may occur at any depth. The entire profile is highly micaceous. Some small areas have a loam substratum, which retards the movement of water through the profile considerably.

Inclusions of Cashmere and Lolalita soils make up about 5 percent of the acreage of the areas mapped.

Wasatch loamy coarse sand, 1 to 3 percent slopes (WsB).-Except for slope, this soil is like the soil described as typical of the series. Erosion is slight in most places.

This soil is used mainly for irrigated orchard crops, hay, pasture crops, and small grain. Irrigated areas can be managed in about the same way as irrigated areas of Wasatch loamy coarse sand, 3 to 7 percent slopes. The border method of irrigation can be used, as well as the sprinkler and corrugation methods. Cheatgrass and other annual weeds are dominant in areas that are above the irrigation canal. *Capability unit IVe-3, irrigated.*

Wasatch loamy coarse sand, 3 to 7 percent slopes (WsC).-A profile of this soil is the one described as typical of the series. Erosion is slight in most places.

Small areas of this soil are above the irrigation canal. In these areas the vegetation is principally cheatgrass and other annual weeds. Irrigated areas are used mainly for orchard crops, hay, pasture, and small grain. This soil should be kept under a plant cover most of the time. It is best suited to orchards that have a permanent cover crop or to permanent hay or pasture crops. Small grain can be grown for 1 year when the hay or pasture stands need to be reestablished. Good response to nitrogen and phosphate can be expected. The utilization of crop residues, green manure, and manure helps to build up the organic-matter content. Irrigation should be light and frequent because of the low water-holding capacity. The sprinkler method is preferable, but the corrugation method can be used if the cover crop is adequate to protect the soil from erosion. Overirrigation causes leaching of plant nutrients and waterlogging of lower lying soils. *Capability unit IVe-3, irrigated.*

Wasatch loamy coarse sand, 7 to 12 percent slopes (WsD).-Except for slope, this soil is like the soil described as typical of the series. Erosion is moderate to slight.

This soil is used and managed in the same way as Wasatch loamy coarse sand, 3 to 7 percent slopes. The sprinkler method is the only practical way to irrigate this moderately sloping sandy soil, because of the erosion hazard. *Capability unit IVe-3, irrigated.*

Wasatch loamy coarse sand, 12 to 30 percent slopes (WsE).-This soil is like the soil described as typical of the series. Erosion is moderate to slight, and gullies have formed along drainageways.

Small areas of this soil are above the canal. In these areas the plant cover is dominated principally by big sagebrush, cheatgrass, and other annual weeds. In irrigated areas a permanent cover crop is needed to control erosion. Pasture crops, hay crops, or orchards that have a cover crop are suitable. Nitrogen and phosphate are needed. The sprinkler method is the only practical method of irrigating. Irrigation by other methods may cause erosion. Irrigation should be light and frequent because of the low water-holding capacity of the soil. Overirrigation causes leaching of plant nutrients and waterlogging of lower lying soils. *Capability unit VIe-1, irrigated.*

Wet Alluvial Land (Wt)

This miscellaneous land type consists mainly of areas on flood plains and low terraces where the water table is near, at, or above the surface during much of the year. Some small areas are intermittent ponds or very shallow permanent ponds. Most areas were periodically covered by floodwater before dams were built.

The soil varies considerably in texture, depth to loose sand and gravel, and content of organic matter. In many places it resembles Chance fine sandy loam. In other places it is more sandy or it is loam. In places there is a thin layer of peat or muck on the surface.

This land type is little used, because of wetness. The principal plants are cattails, rushes, sedges, watercress, and other water-tolerant plants. Wildlife abounds in the ponds and sloughs. *Capability unit Vw-1, dryland. Wet meadow range site.*

Use, Management, and Productivity of the Soils

This section is divided into five main parts. The first discusses the general management practices that apply to all of the cultivated soils in the Gem County Area. The second explains the system of land capability classification, describes the capability units in the Area, and gives suggestions for the use and management of the soils in each unit. The third discusses estimated yields. The fourth discusses the management and productivity of soils used for range, and the fifth classifies the soils for engineering purposes.

General Management Practices

Following is a discussion of management practices that apply to all soils used for crops in the Gem County Area. The discussion covers the management of irrigated soils and the management of dry-farmed soils.

MANAGEMENT of IRRIGATED SOILS. Precise statements about the soils in the Gem County Area and predictions about their use and management can best be made according to individual mapping units. However, broad generalizations can be made by groups of soils, and certain principles of management, including those discussed in the following paragraphs, apply to ail soils that are irrigated.

Crop rotations.-Crop rotations that are suited to the soils help to sustain production over a long period of time. One crop may draw heavily on a particular nutrient and deplete the soil of that nutrient. Another crop, with different nutrient requirements and a different rooting depth, may grow well and give the soil an opportunity to restore itself.

Annual crops, especially row crops that are cultivated several times during the season, tend to deplete the content of organic matter faster than it can be replenished. Consequently, soil structure deteriorates, and the water-intake rate becomes slower. Fewer soil aggregates and fewer fine roots tend to increase the susceptibility of the soil to erosion.

Grasses and legumes improve the soil. Organic matter is supplied by their extensive root system, soil structure is improved, and the supply of nitrogen generally is increased. One of the best ways to counteract the soildepleting effects of row crops and small grain is to include 1 year of grasses and legumes in the rotation. The soil improvement brought about by the grasses and legumes results in higher yields of the row crops and grains that follow.

Generally, a farmer has a choice of several rotations that would be suitable. For a row crop, he may wish to grow corn or sugar beets, or he may prefer to substitute potatoes for one of these crops. For a grass-legume crop, he may decide to use pasture crops instead of hay crops. These substitutions could be made in any of the crop rotations suggested in the land capability section. It may be desirable to grow hay or pasture crops for more than the 3 years suggested in many rotations. A farmer may wish to harvest alfalfa or grass for seed, or he may want to use red clover in place of alfalfa. It is wise, however, to limit the percentage of time in annual crops, as well as the number of successive annual crops, to that suggested in the rotation for the particular soil. However, a farmer can extend the rotation by adding a green-manure crop. Generally, this practice benefits the soil enough to permit one more annual crop to be grown. Sweetclover and Austrian winter peas are suitable for this purpose.

Maintenance of organic-matter content.-Maintaining or increasing the content of organic matter in the soil is an important management problem in the Area. The organic-matter content of most irrigated soils is moderate. Careful management will maintain or increase this content.

Organic matter is chiefly responsible for good soil structure. It helps to keep the soil permeable and well aerated, and it also provides appreciable amounts of nitrogen and other essential plant nutrients. It is a source of energy for the micro-organisms that inhabit the soil, and it aids these organisms in making nutrients available to plants.

Organic matter can be added by plowing under plant residues or green-manure crops, by applying barnyard manure, and by growing a mixture of grasses and legumes. About 20 pounds of available nitrogen per ton of dry plant residues should be added to compensate for the nitrogen used by soil organisms in decomposing the organic residues.

Barnyard manure is especially valuable for adding organic matter to the soil. On decomposition, each ton furnishes about 10 pounds of nitrogen, 5 pounds of phosphate, 10 pounds of potash, and small amounts of other essential nutrients. Manure also improves soil structure. For maximum benefits, large quantities of bedding should be used to absorb all of the urine. The manure should be kept moist but should not be exposed to leaching. It should be plowed under as soon as possible after spreading.

The abundant fine and fibrous roots of grasses are well distributed throughout the upper part of tie soil. Consequently, grasses grown with alfalfa may supply a ton of organic matter more per acre than alfalfa grown alone. The slow decay of these roots helps to improve soil structure and to bind the soil particles against erosion.

If legumes are properly inoculated with nitrogen-fixing bacteria, considerable nitrogen from the air is added to the soil. Alfalfa and sweetclover may provide several hundred pounds of nitrogen per acre if plowed under.

Tillage.-Proper tillage is necessary to prepare good seedbeds, to destroy weeds that compete with crops for water and nutrients, to preserve soil structure, and to help control erosion. Tillage loosens the surface layer, at least temporarily. Benefits of tillage will be greater and longer lasting if the soils have a high content of organic matter. Excessive tillage may destroy favorable soil structure, deplete the supply of organic matter, and compact the soil. Some soils, especially the finer textured ones, become puddled and cloddy if worked when the moisture content is too high. Tillage that leaves the surface layer cloddy helps to control wind erosion of the coarser textured soils. Tilling in such a way as to leave crop residues on the surface also helps to control erosion.

Management of irrigation water.-To conserve both soil and water and to obtain maximum yields, the method of irrigation should be suited to the soil, the slope, the crop, and the water supply. The object of irrigation is to wet the soil to the desired depth without causing erosion damage, accumulation of salts, waterlogging, or undue water loss. Following are several methods that can be used to apply irrigation water

Border irrigation.-This is controlled flooding of the surface of the field. The object is to advance a sheet of water down a narrow strip between low ridges or borders. The strip between the ridges or borders should be leveled, and the grade down the strip should be fairly uniform. The ridges should be low and rounded so that they can be planted with the strips.

Corrugation irrigation.-In this method, the water is applied in small furrows. The water then moves laterally between the furrows and wets the entire area. This method is especially well suited to the irrigation of grain and hay crops in the Gem County Area.

Furrow irrigation.-This is the most common method of irrigating row crops. Water is applied in furrows between the plant rows. Many of the present furrows in the Area are too steep to be used without causing erosion. Erosion of the steeper slopes can be controlled by running the furrows across the slope rather than downhill. For proper irrigation, the furrows must have sufficient grade to allow the water to flow,
but not enough to cause washing. Row crops can be irrigated safely by the contour-furrow method on cross slopes of as much as 8 percent.

Sprinkler irrigation.-This method allows excellent control of water. The rate of application can be controlled so that the water will be absorbed and will not run off. Loss from ditch seepage is eliminated.

Controlled flooding.-In this method, water is flooded down slope between properly spaced field ditches that keep the water from concentrating and causing erosion. Openings in the ditches allow a uniform distribution of water over the field.

Maintenance of the plant-nutrient supply.-Irrigated soils generally are deficient in nitrogen unless a legume is grown regularly in the crop rotation or nitrogen is supplied regularly. Nitrogen deficiencies are likely to be most noticeable after a heavy growth of straw has been plowed under.

Proper timing is important if plants are to derive the greatest benefit from fertilizers. Nitrate compounds are fairly easily leached from permeable soils and should be applied near the time they are needed. Several smaller applications often give better results, particularly on sandy soils, than one large application. The supply of nitrogen is low early in spring when the soil is cold and microbial activity is slow. It generally is low again later in the season, during the period of most rapid plant growth. Phosphate fertilizers are much more difficult to leach from soil and can be applied earlier. On soils that are high in cal-

cium carbonate, the phosphate needs to be applied more frequently near the plant roots, and in larger amounts.

The actual need for fertilizers must be determined on an individual basis. The nature of the soils and their cropping history are important in deciding on the kinds and amounts of fertilizers to use. Chemical analysis of the soil and of the plant tissue helps to determine which nutrients are deficient.

Drainage.-Drainage may help to make some wet soils more productive. Before a drainage project is started, however, a careful study should be made to locate the source of the water, to determine the measures necessary to divert or drain excess water, and to decide if drainage is economically feasible.

In some places poor drainage is caused by overirrigation. Improvement of irrigation systems and methods Will do much to correct this condition. Disposal of excess water at the end of irrigation runs should be considered in planning any irrigation system. In places water may be moving in from the side of the field, and a drainage ditch or tile line can be used to intercept it. Areas where artesian water comes up from beneath the soil are difficult to drain. Such water may need to be tapped by ditches or by tile lines. Pumping the water from a drainage well sometimes alleviates this kind of drainage problem.

Irrigated pasture management.-Maximum pasture yields are obtained by the use of suitable legume-grass mixtures, by adequate fertilization, and by good pasture management. The relative proportion of grasses to legumes in the mixture can be partially controlled by the use of fertilizers. Nitrogen fertilizers favor the grasses; phosphate fertilizers favor the legumes. Adequate intervals between grazing periods for the regrowth of pasture plants increase yields by improving plant vigor. Pastures should be divided into several units and grazed in rotation. Pasture composition can also be influenced by adjusting the regrowth interval. Ladino clover does best if the interval is about 12 to 14 days. An interval of 4 to 5 weeks favors regrowth of grass and alfalfa. Fertilizing and managing so as to maintain a mixture that is 60 to 70 percent grass will minimize the bloat hazard. Allowing about 6 inches of growth before the pasture is grazed in spring and leaving 3 to 4 inches of growth for protection in-winter will promote plant vigor and high production for the next year. Clipping weeds and old grass helps to obtain the maximum use of the forage produced. Droppings can be scattered With a, harrow to obtain the greatest fertilizer benefit and to reduce clumping of grass growth. Damage by trampling is minimized if the pasture is irrigated when stock is removed. Pastures generally are adequately irrigated if the water penetrates to a depth of 2 feet.

Cover crops.-Grasses, legumes, and small grain are used as cover crops to protect soils that might otherwise be bare for a time. This protective cover helps to prevent wind and water erosion, to keep the soil surface from becoming puddled, and to keep the soil open so it will absorb water. The organic matter produced can be utilized to enrich the soil. Cover crops may prevent the leaching of readily available plant nutrients, particularly the nitrates in sandy soils.

Temporary cover crops, such as small grain and legumes, are planted late in summer or early in fall and plowed under for green manure before the next crop is planted in spring. Relatively fast growing crops, such as sweet clover. Austrian winter peas, or rye or other small grain, are used to obtain good cover during winter and spring.

Permanent cover crops are used in orchards and vineyards. In many orchards, the soils have slow infiltration rates and must have cover crops if they are irrigated by the sprinkler method. Suitable cover crops for orchards consist of alfalfa or ladino clover seeded with a grass, such as hard fescue, Chewings fescue, hardy ryegrass, or orchardgrass.

Leveling.-Proper irrigation, reclamation of saline and alkali soils, and many other farming practices are facilitated by field leveling. If plans are made for leveling, the whole farm enterprise needs to be considered. Rearrangement of adjacent fields and relocation of ditches should be planned before leveling operations begin.

Field appearance can be deceiving. Fields should be staked and surveyed so that leveling can be planned. The stakes commonly are set 100 feet apart and are lined up each way across the field. The survey shows the relative elevation of each stake. From this an engineer can plan the most satisfactory elevation at each point and can calculate the amount of cut or fill. The stakes can then be marked to guide the operator of the leveling equipment.

Uniform gradients of irrigation runs make it possible to apply irrigation water uniformly and efficiently. If one part of the run is more than twice as steep as another, it is difficult to irrigate both parts equally. Erosion will occur on the steeper part; waterlogging or silting will occur on the more nearly level part. If the field slopes as much sideways as it does in the direction of irrigation, irrigation water is likely to cross from one corrugation to another. For border irrigation, the maximum side slope is about 1 inch in each border strip.

Newly leveled soil will settle and probably will need some touching up the following year. An annual crop should be grown the first year after leveling so this can be done. Areas that have very heavy cuts may need to be ripped to loosen the soil. Heavy applications of manure, crop residues, and other organic materials benefit the soils in these areas.

Reclamation of saline and alkali soils.-The principles of reclaiming saline and alkali soils do not differ materially from those suggested by early workers in the field of soil science (5). First, provisions are made for adequate drainage, then enough water is flushed through the soil to remove excess salts. On alkali soils, the major emphasis is placed on supplying calcium for exchange with the sodium in the soil. From a practical standpoint, the rate of passage of water through the soil to facilitate the exchange is important. Reeve and Bower (12) have reported success in the use of high-salt water as a flocculent for reclaiming alkali soils under experimental conditions. Mechanical methods that shatter the hardpan layer help to increase the rate of water movement and thus to assist in the reclamation process.

Drainage, leveling, and leaching will reclaim saline soils. The soil surface must be entirely covered with water for effective leaching of excess salts. Any high points above the water level will accumulate salts from the surrounding soil and become more saline than before. Consequently, leveling is essential, and border or basin irrigation generally is most effective.

Reclamation of alkali soils is a slow process because the alkali slows permeability and makes reclamation difficult.

Soil amendments, such as gypsum or sulfur, are used to replace the sodium in alkali soils. Generally, several tons of gypsum per acre are required to keep the soil from sealing over during the leaching process. Repeated applications may be necessary to complete the reclamation process. Large applications of manure and other organic matter help.

Some crops can be grown on alkali soils. As reclamation progresses, the choice of crops increases. Plant growth on such soils provides root channels for water penetration and organic matter to improve soil structure. Even weed growth may be beneficial on very bad spots. The crops most tolerant of saline and alkali soils are tall wheatgrass, alta fescue, and the Payette strain of narrow-leaf birdsfoot trefoil. Other forage crops that are moderately salt and alkali tolerant are sweetclover, alfalfa, and strawberry clover. Field crops that are moderately salt and alkali tolerant are barley, sugar beets, rye, wheat, corn, and oats.

MANAGEMENT OF DRY-FARMED SOILS. Many practices applicable to dry-farmed soils are similar to those applicable to irrigated soils, but they differ somewhat in the time and the way they are applied. Some of the more important general practices are crop rotation, erosion control, and tillage.

Crop rotation.-A crop rotation is important on nonirrigated soils to help sustain production over a long period of time.

A common practice in the Area is to alternate grain with fallow, but this practice causes the depletion of organic matter, which is important for good soil structure and fertility. Much organic matter is lost during the fallow year because of increased aeration. The bare soil is also more susceptible to erosion by water and wind during the fallow year.

Grasses and legumes benefit the soil but in different ways. Soils that have a good cover of grass and legumes are much less susceptible to erosion. If properly inoculated, legumes obtain nitrogen from the air and help build up the supply of nitrogen in the soil. The taproots of alfalfa and clover penetrate deep into the soil and open channels into which water will percolate more rapidly. The fine and fibrous grass roots improve structure and also add to the organic-matter content of the soil and decrease susceptibility to erosion.

A cropping system that maintains or increases the amount; of organic matter in the soils is important. Alfalfa, sweetclover, and many grasses can be used in a rotation with grain and fallow to preserve or improve soil structure and to keep the soils productive.

Most cropping systems need to be individually planned to fit the needs of the soil, the nature of the farming enterprise, and the desires of the farmer.

Erosion control.-Erosion by water is a serious problem on many dry-farmed soils. The loss of any of the surface layer reduces the supply of organic matter and plant nutrients. It also makes the soil less absorbent; consequently, more water runs off, the rate of erosion increases, and the supply of available moisture decreases. Practices that help to control water erosion include

(1) Stripcropping fields that have long, uniform slopes.
(2) Establishing suitable grasses and legumes in waterways and outlets.
(3) Diverting water that runs off higher areas.
(4) Tilling and planting across slopes or on the contour.
(5) Using stubble-mulch tillage or tilling in such a way that crop residues are kept on or near the soil surface.

Tillage.-Excessive tillage of dry-farmed soils destroys soil structure and depletes organic matter. Tillage should be limited to that necessary to prepare suitable seedbeds and to control weeds.

The moisture content of the soil should be considered when tillage operations are performed. If the soil is too wet, it may be compacted by the machinery or it may become cloddy. Some soils become cloddy if tilled when too dry. Some tillage implements tend to pulverize the soil if used when the soil is too dry.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable they are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels : the capability class, the subclass, and the unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, stony, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated 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 means that water in or on the soil will interfere 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 country, indicates 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 or no limitations. Class V can contain, at the most, only subclasses w, s, and c. because the soils in it are subject to little or no erosion but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping of soils for making many statements about their management. Capability units are identified by numbers, for example IIIe-1 or IVs-2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their per

T. W. PRIEST, Soil Conservation Service, assisted in the preparation of this section.

manent limitations, but without consideration of major and generally expensive shaping that would change the slope, depth, or other characteristics of the soil ; and without consideration of possible, but unlikely, major reclamation projects.

The eight classes in the capability system, and the subclasses and units recognized in the Gem County Area, are described in the list that follows.

Class I. Soils that have few limitations that restrict their use.
- Unit I-1, irrigated. Level, very deep, moderately well drained and well drained loamy soils.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe. Soils likely to erode if they are cultivated and not protected.
  - Unit IIe-1, irrigated. Very gently sloping, very deep, well-drained loamy soils.
  - Unit IIe-2, irrigated. Very gently sloping, deep or very deep, well-drained loams, clay loams, and silt loams.
  - Unit IIe-3, irrigated. Very gently sloping, deep or very deep, well-drained sandy loams.
  - Unit IIe-4, dryland. Gently sloping, deep or very deep, well-drained loams.
- Subclass IIs. Soils that have moderate limitations because of a pan or limited available water holding capacity.
  - Unit IIs-1, irrigated. Level, deep, well-drained silt loams, underlain at a depth of more than 3 feet by a hardpan.
  - Unit IIs-2, irrigated. Level, moderately deep or deep to gravel and sand, well drained or moderately well drained fine sandy loams and loams on low terraces and bottom lands.
  - Unit IIs-3, dryland. Very gently sloping to moderately sloping, deep, well-drained, medium-textured and moderately fine textured soils on alluvial fans.
- Subclass IIc. Soils on which a slight limitation of climate is the principal problem.
  - Unit IIc-1, dryland. Very gently sloping, very deep, well-drained clay loams and loams.
  - Unit IIc-2, dryland. Very gently sloping or gently sloping, very deep, well drained or moderately well drained, medium-textured or moderately fine textured soils on low terraces and alluvial fans.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.
  - Unit IIIe-1, irrigated. Gently sloping, moderately deep to very deep, well-drained, mediumtextured or moderately fine textured soils.
  - Unit IIIe-2, irrigated. Gently sloping, very deep to moderately deep, well-drained loams, silt loams, and sandy loams.
  - Unit IIIe-3, irrigated. Gently sloping, deep or very deep, well-drained sandy loams.
  - Unit IIIe-4 dryland. Gently sloping or sloping, deep, well-drained loams and clay loams, some of which are stony .
  - Unit IIIe-5, dryland. Gently sloping or sloping, deep or very deep, well-drained loamy soils that have a dark-colored surface layer.
- Subclass IIIw. Soils that have severe limitations for cultivation because of excess water.
  - Unit IIIw-1, irrigated. Level or very gently sloping, imperfectly drained loams and fine sandy loams on flood plains; deep or moderately deep to loose gravel and sand.
  - Unit IIIw-2, irrigated. Level or very gently sloping, poorly drained or imperfectly drained silt loams and loams on flood plains and low terraces; very deep to moderately deep to loose gravel and sand.
  - Unit IIIw-3, irrigated. Level, very poorly drained organic soils in basins.
  - Unit IIIw-4, irrigated. Level silty clay loams in basins and on flood plains.
  - Unit IIIw-5, irrigated. Level, imperfectly drained silty clays and silty clay loams in basins and on low terraces.
  - Unit IIIw-6, irrigated. Level or very gently sloping, moderately alkali loamy soils on flood plains and low terraces; fluctuating water table.
- Subclass IIIs. Soils that have severe limitations for cultivation because of limited moisture capacity.
  - Unit IIIs-1, irrigated. Level or very gently sloping, moderately deep, well drained or moderately well drained sandy loams on flood plains and low terraces.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
- Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.
  - Unit IVe-1, irrigated. Sloping, deep, welldrained loamy soils.
  - Unit IVe-2, irrigated. Sloping, deep or very deep, well-drained sandy loams on alluvial fans.
  - Unit IVe-3, irrigated. Very gently sloping to sloping, deep, well drained or moderately well drained sandy soils on alluvial fans, terraces, and bottom lands.
  - Unit IVe-4, dryland. Moderately steep, moderately deep to very deep, well-drained loamy soils, some of which are stony.
  - Unit IVe-5, dryland. Sloping, moderately deep or deep, well-drained loamy soils, some of which have a hardpan.
  - Unit IVe-6, dryland. Gently sloping to moderately steep, well-drained stony clays and clay loams that crack when dry.
  - Unit IVe-7, dryland. Moderately steep, welldrained sandy loams, loams, and stony loams.
- Subclass IVw. Soils that have very severe limitations for cultivation because of excess water.
  - Unit IVw-1, irrigated. Level or very gently sloping, imperfectly drained sandy soils on flood plains.

Unit IVw-2, irrigated. Level or very gently sloping, medium-textured or moderately coarse textured, moderately or strongly saline-alkali soils.

Unit IV¯w-3, irrigated. Level or very gently sloping silt loams and silty clay loams that are strongly saline-alkali.

Unit IVw-4, dryland. Deep or moderately deep, poorly drained or imperfectly drained loams, in basins, on nearly level flood plains, or on low terraces.

Subclass IVs. Soils that have very severe limitations of stoniness, low moisture capacity, or other soil features.

Unit IVs-1, irrigated. Level, moderately well drained and well drained sandy soils that have very low available moisture capacity.

Unit IVs-2, irrigated. Level or very gently sloping, shallow sandy loams and loamy sands that have very low available water holding capacity.

Unit IVs-3, dryland. Very gently sloping or gently sloping, shallow to moderately deep clay loams, loams, and stony clay loams.

Subclass IVc. Soils on which a moderate hazard of cli mate is the major limitation.

Unit IVc-1, dryland. Level to gently sloping, very deep, well-drained loamy soils.

Class V. Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass Vw. Soils too wet for cultivation; drainage or other necessary protection not feasible.

Unit Vw-1, dryland. Level, poorly or very poorly drained silty clay loams and fine sandy loams that have a high water table; suitable for pasture and wildlife use.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIe. Soils severely limited by hazard of ero sion if protective cover is not maintained.

Unit VIe, irrigated. Moderately steep, welldrained to excessively drained, coarse-textured to moderately fine textured soils, some of which are stony; suitable for irrigated orchard, pasture, and hay crops.

Unit VIe-2, dryland. Moderately steep or steep, well-drained to excessively drained loamy soils, some of which are rocky or gravelly; suitable for range and wildlife use.

Subclass VIs. Soils severely limited, chiefly by stones, rocks, coarse texture, shallowness, or limited moisture supply.

Unit VIs-1, dryland. Moderately steep or steep, very stony and extremely stony loams; suitable for range and wildlife use.

Unit VIs-2, dryland. Nearly level to sloping, medium-textured or moderately coarse textured soils.

Subclass VIc. Soils severely limited by climate.

Unit VIc-1, dryland. Very gently sloping or gently sloping, well-drained, deep or very deep loamy soils of bottom lands and alluvial fans.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclama tion and that restrict their use largely to grazing, wood land, or wildlife.

Subclass VIIe. Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.

Unit VIIe-1, dryland. Steep sandy loams and coarse sandy loams; suitable for range and wildlife use.

Unit VIIe-2, dryland. Very steep soils that are subject to very severe erosion; suitable for range and wildlife use.

Subclass VIIs. Soils very severely limited, chiefly by stones and rocks.

Unit VIIs-1, dryland. Gently sloping to moderately steep, extremely rocky and stony soils; suitable for range and wildlife use.

Unit VIIs-2, dryland. Extremely rocky, very stony and extremely stony, steep soils; suitable for range and wildlife use.

Class VIII. Soils and landforms that have limitations that preclude their use, without major reclamation, for commercial production of plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

Subclass VIIIe. Very steep land.

Unit VIIIe-1, dryland. Very steep, coarse sandy loams.

Subclass VIIIs. Rock or soil materials that have little potential for production of vegetation.

Unit VIIIs-1, dryland. Very steep, extremely rocky and stony soils; suitable for watersheds or wildlife.

Unit VIIIs-2, dryland. Riverwash, rock land, and rubble land; suitable only for water supply, for wildlife habitats, or a source of construction materials.

In the following pages, each capability unit is described, the soils in each are listed, and some suggestions for use and management are given.

Capability unit I-1, irrigated

This unit consists of level, very deep, moderately well drained and well drained loamy soils on bottom lands and terraces. These soils are more than 5 feet in depth, have high available water holding capacity, and impose no restrictions on the growth of plant roots. Permeability is moderate or moderately slow, and the organic-matter content ranges from moderately low to high. There is little or no hazard of erosion. The soils in this unit are

Bissell clay loam, 0 to 1 percent slopes.
Bissell loam, 0 to 1 percent slopes.
Draper clay loam, 0 to 1 percent slopes.
Draper loam, 0 to 1 percent slopes.
Harpt loam, 0 to 1 percent slopes.
Jenness loam, 0 to 1 percent slopes.
Newell silt loam, 0 to 1 percent slopes.
Newell silty clay loam, 0 to 1 percent slopes.
Power silt loam, 0 to 1 percent slopes (in PuA).
Roystone loam, 0 to 1 percent slopes.

These soils generally are the most productive soils in the Area. All crops that are suited to the climate and that require good drainage do well. Row crop, forage crops,

grain, pasture, and some orchard crops are grown under irrigation. A11 crops except legumes need nitrogen, and all crops respond well to phosphate.

The supply of organic matter can be maintained or increased by returning all crop residues to the soil, growing green-manure crops, and using crop rotations that include irrigated pasture and hay crops. A suitable rotation consists of 4 to 7 years of alfalfa for hay; then 4 or 5 years of an annual crop, such as small grain or corn. Another consists of 3 to 5 years of alfalfa, clover, and grass for hay or pasture ; then 2 to 4 years of corn, silage crops, sugar beets, or small grain; then grain with a new seeding of alfalfa and grass.

Border, corrugation, or furrow irrigation can be used. Corrugations are commonly used for close-growing crops, and furrows for row crops and orchards. Overirrigation can be avoided by applying only enough water to wet the soil evenly to the rooting depth of the crop. Preparation for irrigation is no problem on these nearly level, very deep soils.

Capability unit IIe-1, irrigated

In this unit are very gently sloping, very deep welldrained loamy soils on low terraces and alluvial fans. The texture of the surface layer ranges from loam to clay loam. Permeability ranges from moderate to slow.

These soils are more than 5 feet in depth, and they have high available water holding capacity. The soils in this unit are

Jacknife clay loam, 1 to 3 percent slopes.
Jacknife loam, 1 to 3 percent slopes.
Newell silt loam, 1 to 3 percent slopes.
Roystone loam, 1 to 3 percent slopes.
Squaw clay loam,1 to 3 percent slopes.
Squaw loam, 1 to 3 percent slopes.

These soils are suitable for a wide range of irrigated crops. The practices needed to maintain productivity and to supply organic matter are the same for these soils as for the soils in unit I-1, irrigated, but more intensive management of irrigation water is required because of the slopes. If careful attention is given to the length of the run and to the size of the irrigation stream, the water will soak into the soil and will not run off and cause erosion. Deep cuts can be made to level or smooth the slopes without permanent injury to the soils.

Capability unit IIe-2, irrigated

This unit consists of very gently sloping, deep and very deep, well-drained loams, clay loams, and silt loams in bottom lands across the terraces, alluvial fans, and uplands. These soils have moderate to high available water holding capacity. Permeability ranges from moderate to slow. The soils in this unit are

Bissell clay loam, 1 to 3 percent slopes.
Bissell loam, 1 to 3 percent slopes.
Chilcott loam, 1 to 3 percent slopes (in LoB).
Draper loam, 1 to 3 percent slopes.
Harpt loam, 1 to 3 percent slopes.
Haw loam, 1 to 3 percent slopes.
Jenness loam, 1 to 3 percent slopes.
Kepler loam, 1 to 3 percent slopes (in SnB).
Lanktree loam, 1 to 3 percent slopes (in LcB).
Power silt loam, 1 to 3 percent slopes (in PuB).
Purdam silt loam, 1 to 3 percent slopes (in PuB).
Sweet loam, 1 to 3 percent slopes.
Sweet loam, 1 to 3 percent slopes (in SnS).

All crops suited to the climate are grown under irrigation. The management needed to maintain productivity and to supply organic matter is the same for these soils as for the soils in capability unit I-1, irrigated, but more intensive management of irrigation water is required because of the steeper slopes and greater hazard of erosion. In addition, some of these soils have less capacity to hold water because the depth to the hardpan or other layer that restricts water movement generally is 3 feet or less. Moderate cuts commonly can be made to level or smooth slopes without harmful effects.

Capability unit IIe-3, irrigated

In this unit are very gently sloping, deep and very deep, well-drained sandy loams on alluvial fans. These soils are more than 5 feet thick, have low to moderate available water holding capacity, and impose no restrictions on the growth of plant roots. Permeability is moderate or moderately rapid, and the hazard of erosion from irrigation water and natural precipitation is moderate. The soils in this unit are

Cashmere coarse sandy loam, 1 to 3 percent slopes.
Harps coarse sandy loam, 1 to 3 percent slopes.

Orchard crops, forage crops, grain, and row crops are grown on these soils. Deep-rooted crops, such as orchard crops and alfalfa, are especially well suited. Shallowrooted crops also do well if carefully irrigated and fertilized. Frequent, light irrigation is needed. In furrow or border irrigation, short runs help prevent the loss of water and the leaching of plant nutrients. Erosion can be kept to a minimum if irrigation water is applied carefully. Wind erosion can be controlled by using cover crops and crop mulches.

The supply of organic matter can be maintained by using green-manure crops, crop residues, and crop rotations. Nitrogen and phosphate are needed for maximum yields. If these soils are leveled, moderately deep cuts can be made without serious effects.

The soils in this unit are used principally for orchards. Alfalfa provides a good cover crop. A short rotation that consists of 3 or 4 years of alfalfa, then 2 to 4 years of small grain or corn is suitable for soils that are not used for orchards.

Capability unit IIe-4, dryland

The soils in this unit are gently sloping, deep and very deep, well-drained loams on alluvial fans and uplands. They commonly are more than 4 feet thick. The subsoil is finer textured than the surface layer. The underlying materials are deep alluvial deposits or bedrock. Perme
ability is moderately slow or slow. The soils in this unit are

Brownlee loam, 3 to 7 percent slopes.
Jacknife loam, 3 to 7 percent slopes.
Odermott loam, 3 to 7 percent slopes.

These soils are limited in use to dry-farmed crops and range because irrigation water is not available. Much of the acreage is used for wheat or barley under a summerfallow system of management. Alfalfa or a mixture of alfalfa and grass is grown for hay crops or pasture. In some areas, the soils are used to produce alfalfa or grass for seed. Many areas that are. not readily accessible for
cultivation are used for range.

Cross-slope cultivation and the use of cover crops and crop residues are needed to protect these soils from erosion. If the surface layer is loose and rough or is protected by a cover crop, water enters the soil readily and the erosion hazard is minimized.

Capability unit IIs-1, irrigated

The only soil in this unit is Purdam silt loam, 0 to 1 percent slopes (in PuA). This soil is well drained. It occurs on level old stream terraces. It is underlain by a hardpan at a depth of more than 3 feet. Permeability is moderately slow or slow. The water-holding capacity is moderate. The hazard of erosion is slight.

This soil is well suited to a wide variety of crops, and it could be used intensively for crops other than those now being grown. Row crops, grain, forage crops, pasture crops, and some orchard crops are grown under irrigation. The management needed to maintain productivity and to supply organic matter is the same for this soil as for the soils in unit I-1, irrigated. Deep-rooted crops, such as alfalfa and orchard crops, may not grow well where the hardpan is near the surface. In such areas more care is needed in the application of irrigation water to prevent the occurrence of a perched water table. Moderate cuts generally can be made to level or smooth slopes for irrigation, but the depth of the soil should be carefully checked before this work is undertaken.

Capability unit IIs-2, irrigated

The soils of this unit are well drained or moderately well drained fine sandy loams or loams on nearly level terraces and alluvial bottom lands. These soils are moderately deep and deep to gravel and sand. Permeability is moderately rapid, and the available water holding capacity is moderate. The organic-matter content is low. There is little or no hazard of erosion. The soils in this unit are

Emerson fine sandy loam, deep, 0 to 1 percent slopes.
Falk fine sandy loam, deep, 0 to 1 percent slopes.
Wardwell loam.

These soils are well suited to most irrigated crops grown in the Area. The Falk and Emerson soils are. not well suited to orchard crops, because of the high water table.

The management needed to maintain productivity and to supply organic matter is the same for these soils as for the soils in unit I-1, irrigated, but lighter and more frequent applications of irrigation water are necessary. Land smoothing in preparation for controlled irrigation is easy on these soils.

Capability unit IIs-3, dryland

In this unit are deep, well-drained, very gently sloping to moderately sloping, medium-textured and moderately fine textured soils on alluvial fans. These soils normally are about 3 1/2 feet thick over coarse material that consists of basalt fragments, cobblestones, and gravel. The surface layer is loam or clay loam that is moderate in content of organic matter. The available water holding capacity is moderate, and permeability is moderate or moderately slow. If precipitation is normal, there is little or no hazard of erosion. The soils in this unit are

Squaw clay loam, 1 to 3 percent slopes.
Squaw loam, 1 to 3 percent slopes.
Squaw loam, 3 to 7 percent slopes.

Wheat, barley, alfalfa, and grasses are suitable crops. Small grain should be alternated with summer fallow because of the limited supply of moisture. Alfalfa can be grown alone or in a mixture with suitable grasses for hay or pasture. Legumes respond to phosphate. A suitable rotation consists of wheat and fallow alternately for 5 to 7 years then alfalfa or an alfalfa-grass mixture for hay or pasture for 4 to 6 years. Plowing under the last hay crop for green manure improves the soil and helps to preserve soil structure and to control erosion. If used for pasture, these soils need the same management as the soils in capability unit VIs-2, dryland.

Capability unit IIc-1, dryland

This unit consists of very gently sloping, very deep, well-drained clay loams and loams on alluvial fans and terraces. These soils are more than 5 feet thick and impose no restrictions to the growth of plant roots. The available water holding capacity is high, permeability is moderately slow to slow, and the organic-matter content is high. There is little or no hazard of erosion. The soils in this unit are

Jacknife clay loam, 1 to 3 percent slopes.
Jacknife loam, 1 to 3 percent slopes.

The choice of crops is limited and yields are restricted because irrigation water is not available and the temperature generally is colder than in the other areas. Dryfarmed wheat, barley, alfalfa, and grasses are suitable. Small grain is grown in an alternate crop and summer fallow system. Alfalfa and grass for hay and pasture are grown either alone or in a mixture.

The use of cover crops and crop residues helps to maintain the organic-matter content. A suitable rotation consists of wheat and fallow alternately for 5 to 7 years, then alfalfa or an alfalfa-grass mixture for haw or pasture for 4 to 6 years. If used for pasture, these soils need the same management as the soils in capability unit VIc-1, dryland. Isolated areas are used for range.

Capability unit IIc-2, dryland

This unit consists of very gently sloping or gently sloping, very deep, well drained or moderately well drained, medium-textured or moderately fine textured soils on alluvial fans and low terraces. These soils are more than 5 feet thick. The surface layer is loam, silt loam, or clay loam. The available water holding capacity is high, permeability is moderate. or moderately slow, and the organicmatter content is moderately low to high. If precipita tion is normal, there is little or no hazard of erosion. The soils in this unit are

Newell clay loam, 3 to 7 percent slopes.
Newell silt loam, 1 to 3 percent slopes.
Newell silt loam, 3 to 7 percent slopes.
Roystone loam, 1 to 3 percent slopes.

These soils are not irrigated, and the choice of crops is limited. The management needed to maintain productivity and to supply organic matter is the same as for the soils in unit IIc-1, dryland, but yields commonly are slightly higher because of the warmer temperature and the slightly longer growing season. Small grain, hay crops, and forage crops are grown. If used for pasture, these soils need the same management as the soils in capability unit VIe-1, dryland.

Capability unit IIIe-1, irrigated

This unit consists of gently sloping, moderately deep to very deep, well-drained loams, silt loams, and clay loams. Some areas are stony, but the stones are not so numerous that they materially interfere with tillage. These soils are on terraces, alluvial fans, and uplands. They are moderately slowly or slowly permeable. The available water holding capacity is moderate to high, and the organic-matter content is moderate to high. The hazard of erosion is moderate. The soils in this unit are

Brownlee loam, 3 to 7 percent slopes.
Gem clay loam, 3 to 7 percent slopes.
Jacknife clay loam, 3 to 7 percent slopes.
Jacknife loam, 3 to 7 percent slopes.
Newell clay loam, 3 to 7 percent slopes.
Newell silt loam, 3 to 7 percent slopes.
Odermott loam, 3 to 7 percent slopes.
Squaw loam, 3 to 7 percent slopes.
Squaw stony clay loam, 3 to 7 percent slopes.
Squaw stony loam, 3 to 7 percent slopes.

These soils are suitable for irrigated pasture crops, hay crops, small grain, and row crops, but the climate is too severe for fruit orchards. Nitrogen and phosphate are needed for good yields. Irrigation can be by the furrow, corrugation, or sprinkler method, but short runs and small streams are necessary to control erosion. A suitable rotation consists of alfalfa-grass hay for 3 to 5 years; a row crop, such as corn, for 2 years; then small grain and a new seeding of alfalfa, and grass.

Capability unit IIIe-2, irrigated

The soils of this unit are very deep to moderately deep, well-drained loams, silt loams, and sandy loam is on gently sloping alluvial fans, terraces, and uplands. The soils in this unit are

Bissell loam, 3 to 7 percent slopes.
Chilcott loam, 3 to 7 percent slopes (in LmC).
Harpt loam, 3 to 7 percent slopes.
Haw loam, 3 to 7 percent slopes.
Jenness loam, 3 to 7 percent slopes.
Jenness sandy loams, 3 to 7 percent slopes.
Lanktree loam, 3 to 7 percent slopes.
Lanktree loam, 3 to 7 percent slopes (in LmC).
Power silt loam, 3 to 7 percent slopes (in PuC).
Purdam silt loam, 3 to 7 percent slopes (in PuC).
Sweet loam, 3 to 7 percent slopes.

These soils are suited to a wide variety of crops. Row crops, forage crops, grain, and pasture crops are grown under irrigation. Orchards are dominant on the Harpt and Bissell soils. Crops respond well to nitrogen and phosphate. These soils can be managed in about the same way as the soils in unit IIe-2, irrigated, but more care is needed in the application of irrigation water because of greater runoff and a more serious hazard of erosion.

Capability unit IIIe-3, irrigated

This unit consists of gently sloping, deep or very deep, well-drained sandy barns on alluvial fans. The soils in this unit are

Cashmere coarse sandy loam, 3 to 7 percent slopes.
Harpt coarse sandy loam, 3 to 7 percent slopes.

These soils are used principally for orchards. They can be used and managed in the same way as the soils in unit IIe-3, irrigated, but more care is needed in the application of irrigation water because of greater runoff and a more serious hazard of erosion. The corrugation, furrow, and sprinkler methods of irrigation are suitable.

Capability unit IIIe-4, dryland

This unit consists of deep, well-drained barns and clay barns on gently sloping or sloping alluvial fans, low terraces, and uplands. Some areas are stony. Permeability is moderate or moderately slow, and the available water holding capacity is moderate to high. The organic matter content is moderately low to high. The hazard of erosion is moderate. The soils in this unit are

Gem clay loam, 3 to 7 percent slopes.
Gem clay loam, 7 to 12 percent slopes.
Newell clay loam, 7 to 12 percent slopes.
Newell stony clay loam, 7 to 12 percent slopes.
Squaw loam, 7 to 12 percent slopes.
Squaw stony clay loam, 3 to 7 percent slopes.
Squaw stony loam, 3 to 7 percent slopes.
Squaw stony loam, 7 to 12 percent slopes.

Gem clay loam, 3 to 7 percent slopes; Squaw stony clay loam, 3 to 7 percent slopes; and Squaw stony loam, 3 to 7 percent slopes, were included in this grouping instead of in unit IIc-2, irrigated, because they have a small acreage and are considered more erodible than the soils in unit IIc-2.

The soils in unit IIIe-4, dryland, are well suited to small grain, hay crops, and forage crops. They are used principally for dry-farmed grain in an alternate grainsummer fallow system.

Cross-slope cultivation, cover crops, and crop residues help to supply organic matter and to protect the soils from erosion. A suitable rotation consists of wheat and fallow alternately for 5 to 7 years, then an alfalfa-grass mixture for hay or pasture for 4 to 6 years. If used for pasture, these soils need the same management as the. soils in capability unit VIs-2, dryland.

Capability unit IIIe-5, dryland

In this unit are deep or very deep, well-drained loamy soils that have a dark-colored surface layer. These soils occur on gently sloping or sloping alluvial fans and uplands. They are high in fertility. The organic-matter content is moderately high or high, and the available water holding capacity is moderate to high. Permeability is moderately slow or slow. There is a moderate hazard of erosion. The soils in this unit are

Brownlee loam, 7 to 12 percent slopes.
Jacknife clay loam, 3 to 7 percent slopes.
Jacknife clay loam, 7 to 12 percent slopes.
Jacknife loam, 7 to 12 percent slopes.
Odermott loam, 7 to 12 percent slopes.

These soils are well suited to small grain, hay crops, and forage crops. They are used principally for dryfarmed grain under a grain-summer fallow system of management. The management needed to supply organic matter, to maintain productivity, and to control erosion is the same for these soils as for the soils in unit IIIe-4, dryland, but yields are somewhat higher because of the cooler temperature and the more effective use of moisture. If used for pasture. these soils need the same management as the soils in capability unit VIs-2, dryland.

Capability unit IIIw-1, irrigated

In this unit are imperfectly drained loams and fine sandy barns on nearly level or gently sloping flood plains.

These soils are deep or moderately deep to loose gravel and sand. Drainage is restricted because of their low position and nearness to streams. Permeability is moderately rapid or moderate, and the available water holding capacity is low to moderate. The organic-matter content is moderately low or low, and fertility is moderate. The soils in this unit are

Moulton fine sandy loam, 0 to 1 percent slopes.
Moulton fine sandy loam, 1 to 3 percent slopes.
Moulton fine sandy loam, deep, 0 to 1 percent slopes.
Moulton loam, 0 to 1 percent slopes.

Row crops, forage crops, grain, and irrigated pasture crops are suitable. Irrigated crops do well, but the choice of crops is restricted because of the occurrence of a high water table. Long-lived, deep-rooted fruit trees are not suitable, and alfalfa generally does not grow well.

The water table can be controlled by the use of open ditches or tile drains. Irrigation water must be applied carefully, so as to conserve water and prevent the occurrence of a temporary high or perched water table. Provisions for the disposal of excess surface water are helpful. The supply of organic matter can be maintained by utilizing crop rotations, green-manure crops, and plant residues. Crops other than legumes respond to nitrogen. All crops are benefited by phosphate. A suitable crop rotation consists of 4 or 5 years of alfalfa hay, then 3 or 4 years of a row crop, such as corn or small grain.

Another suitable rotation consists of clover and grass for hay or pasture for 3 to 5 years, then corn, silage, sugarbeets, or small grain for 2 to *4* years. Irrigation can be by the border, corrugation, furrow, or sprinkler method. Smoothing operations to prepare these soils for surface irrigation generally present no problems.

Capability unit IIIw-2, irrigated

This unit consists of very deep to moderately deep, poorly or imperfectly drained loams and silt loams. These soils occur on level or very gently sloping flood plains and low terraces. Drainage is restricted because of their low position and nearness to streams and drainageways. The organic-matter content generally is high, the available water holding capacity is high to moderate, and permeability is moderate. The soils in this unit are

Bowman silt loam, 0 to 1 percent slopes.
Bowman silt loam, 1 to 3 percent slopes.
Bowman silt loam, moderately deep, 0 to 1 percent slopes.
Catherine loam.
Catherine loam, moderately deep.
Goose Creek loam.

If drainage is adequate, these soils are well suited to a wide variety of irrigated crops. Suitable crops include corn, sugar beets, potatoes, small grain, alfalfa, clover, and grasses. Crops respond well to phosphate. Some crops need nitrogen.

These soils are slightly less permeable, have a higher water-holding capacity, and give higher yields than the soils in unit IIIw-1. They need about the same management as the soils in unit III-w-1, irrigated, but they generally require more care in drainage.

Capability unit IIIw-3, irrigated

This unit consists of moderately deep or deep, very poorly drained organic soils. These soils occur in level old stream channels and in basin areas. The water-holding capacity is high or very high. The soils of this unit are

Mountainview muck.
Mountainview muck, moderately deep.

Drainage is difficult because of the low position of these soils. Associated soils generally are irrigated, and excess water from these areas contributes to the drainage problem. If drainage is provided it should be carefully controlled because these soils tend to shrink when the organic material dries and decomposes.

If adequately drained and fertilized, these soils are well suited to a wide variety of crops. Vegetable crops, corn, small grain, clover, and grass can be grown. Cover crops or stands of hay or pasture help to prevent wind erosion. Irrigation can be by the border, sprinkler, corrugation, or furrow method. Frequent leveling or smoothing may be needed to provide adequate control of water.

Capability unit IIIw-l, irrigated

In this unit there is only one soil, Black Canyon silty clay loam, drained. This soil occurs in basins and on flood plains. It is poorly drained. Permeability is slow, the available water holding capacity is high, and the organic-matter content is high. There is little or no hazard of erosion.

Recurring wetness is a problem on this soil, even after drainage structures have been installed. This soil can be used and managed in about the same way as the soils in unit IIIw-2, irrigated, but drains should be closer together, and more care is needed in the application of irrigation water.

Capability unit IIIw-5, irrigated

In this unit are imperfectly drained silty clays and silty clay loams. These soils occur in level basins and on low terraces. Large areas are moderately saline-alkali. Permeability is slow or very slow because of the fuse texture of these soils and the saline-alkali conditions. There is little or no hazard of erosion. The soils in this unit are

Lahontan silty clay loam, moderately saline-alkali.
Quenzer silty clay, 0 to 1 percent slopes.

Reclamation, especially of the Lahontan soil, is difficult because of the concentrations of salts and alkali, slow permeability, and the problems of drainage.

Pasture crops, hay crops, small grain, and corn are grown. Adequate drainage, use of soil amendments, additions of organic matter, and leaching of harmful alkali are important management practices. Tall wheatgrass or other alkali-tolerant, grasses grow well during the early stages of reclamation. Alfalfa, corn, and sugar beets produce good yields in the later stages. Good response to nitrogen and phosphate can be expected.

A suitable rotation consists of grain for 1 year; alfalfagrass hay for 3 years: and a row crop for 2 years. Irrigation can be by the border, corrugation, furrow, or sprinkler method. Land smoothing is needed to control irrigation water and is important in reclaiming alkali areas and in preventing the recurrence of alkali conditions.

Capability unit IIIw-6, irrigated

The soils in this unit are moderately alkali. They are imperfectly drained loamy soils on level or very gently sloping flood plains and *low* terraces. Drainage is re-

stricted because of their low position and nearness to streams. The organic-matter content generally is low. The soils in this unit are

Baldock silt loam, moderately alkali.
Bramwell silt loam, 0 to 1 percent slopes.
Bramwell silt loam, 1 to 3 percent slopes.
Letha fine sandy loam, 0 to 1 percent slopes.
Letha fine sandy loam, 1 to 3 percent slopes.
Letha fine sandy loam, deep, 0 to 1 percent slopes.
Letha fine sandy loam, deep, 1 to 3 percent slopes.
Moulton fine sandy loam, moderately alkali, 0 to 1 percent slopes.
Moulton fine sandy loam, moderately alkali, 1 to 3 percent slopes.
Moulton fine sandy loam, deep, moderately alkali, 0 to 1 percent slopes.

These soils can be used and managed in the same way as the soils in unit IIIw-5, irrigated. They are more permeable and are easier to reclaim than the soils in unit IIIw-5, irrigated, and they are easier to keep productive and provide slightly higher average yields.

Capability unit IIIs-1, irrigated

In this unit are well drained or moderately well drained, level or very gently sloping sandy loams. These soils are on flood plains and low terraces. They are moderately deep to underlying sand and gravel. The water-holding capacity is low. The soils in this unit are

Emerson fine sandy loam, 0 to 1 percent slopes.
Emerson fine sandy loam, 1 to 3 percent slopes.
Falk fine sandy loam, 0 to 1 percent slopes.
Falk fine sandy loam, 1 to 3 percent slopes.

The Emerson and Falk soils that have slopes of 1 to 3 percent were included in this unit because of their similarity to the other soils in this unit and because of their minor extent, but they require more care in the application of irrigation water than the other soils.

The soils in this unit can be used and managed in about the same war as the soils in unit IIs-2, irrigated, but they need lighter and more frequent applications of irrigation water. Deep-rooted crops are not well suited.

Capability unit IVe-1, irrigated

This unit consists of deep, well-drained loamy soils on sloping uplands, terraces, and alluvial fans. The hazard of erosion is severe in irrigated areas. The soils in this unit are

Chilcott loam, 7 to 12 percent slopes (in LmD).
Gem clay loam, 7 to 12 percent slopes.
Harpt loam, 7 to 12 percent slopes.
Haw loam, 7 to 12 percent slopes.
Jacknife clay loam, 7 to 12 percent slopes.
Jacknife loam, 7 to 12 percent slopes.
Lanktree loam, 7 to 12 percent slopes (LfD, and in LmD).
Lickskillet stony loam, 7 to 12 percent slopes (in LwD).
Newell clay loam, 7 to 12 percent slopes.
Newell stony clay loam, 7 to 12 percent slopes.
Odermott loam, 7 to 12 percent slopes.
Power silt loam, 7 to 12 percent slopes (in PuD).
Purdam silt loam, 7 to 12 percent slopes (in PuD).
Squaw loam, 7 to 12 percent slopes.
Squaw stony loam, 7 to 12 percent slopes.
Sweet loam, 7 to 12 percent slopes.

If carefully managed these soils are suitable for irrigated pasture crops, hay crops, small grain, and row crops. Orchards grow well in the lower areas, where the frost hazard is not too severe. Good response to nitrogen and phosphate can be expected. Cover crops, green-manure crops, and crop residues help to protect the soils, to maintain fertility, and to supply organic matter. Irrigation can be by the sprinkler or furrow method. If a surface system is used, the runs should be kept short and the streams small, to avoid erosion.

Capability unit IVe-2, irrigated

The soils in this unit are on sloping alluvial fans. They are well-drained, moderately coarse textured, and deep or very deep. Permeability is moderate or moderately rapid, the available water holding capacity is moderate, and the organic-matter content generally is low. The hazard of erosion is severe. The soils in this unit are

Cashmere coarse sandy loam, 7 to 12 percent slopes.
Harpt coarse sandy loam, 7 to 12 percent slopes.

These soils are fairly well suited to orchard crops, forage crops, hay crops, and small grain. Nitrogen and phosphate are needed for higher yields. Green manure, crop residues, and crop rotations help to maintain the content of organic matter and to control erosion in cultivated areas. Orchards need cover crops to control erosion. A suitable rotation consists of alfalfa and grass for hay or pasture for 3 to 5 years, then small grain for 1 or 2 years, and a new seeding of alfalfa and grass with the last grain crop. Sprinkler irrigation is preferable, but corrugations can be used if the runs are kept short and the streams small, to avoid erosion.

Capability unit IVe-3, irrigated

The soils in this unit are coarse textured, deep, and moderately well drained or well drained. They occur on very gently sloping or sloping alluvial fans, terraces, and bottom lands. The surface layer generally is low in content of organic matter. The available water holding capacity, is low, permeability is rapid, and fertility is low. The hazard of erosion is moderate to severe. The soils in this unit are

Emerson loamy sand, 1 to 3 percent slopes.
Falk loamy sand, 1 to 3 percent slopes.
Wasatch loamy coarse sand. 1 to 3 percent slopes.
Wasatch loamy coarse sand, 3 to 7 percent slopes.
Wasatch loamy coarse sand, 7 to 12 percent slopes.

These soils are best suited to orchard crops, pasture crops, and hay crops. Cover crops are needed in orchards to maintain the organic-matter content and to control erosion. Good response to nitrogen and phosphate can be expected. A suitable rotation consists of 1 or 2 years of small grain, then alfalfa-grass hay or pasture for 5 to 7 years. The supply of organic matter can be maintained or increased by using crop rotations, growing green-manure crops, and returning all crop residues to the soil. Sprinkler irrigation that is designed to deliver water no more rapidly than the soil will absorb it is preferable. Corrugations are suitable if the runs are very short and the streams are small.

Capability unit IVe-4, dryland

This unit consists of moderately steep, moderately deep to very deep, well-drained loamy soils on alluvial fans and on uplands. `Some areas are stony or rocky. The

steeper soils are susceptible to severe erosion. The soils in this unit are

Brownlee coarse sandy loam, 7 to 12 percent slopes (in BuD).
Brownlee coarse sandy loam, 12 to 30 percent slopes (BrE, and in BuE).
Brownlee loam, 12 to 30 percent slopes.
Brownlee rocky loam, 12 to 30 percent slopes (in BvE).
Elmore loam, 12 to 30 percent slopes.
Gem clay loam, 12 to 30 percent slopes.
Gem stony clay loam, 12 to 30 percent slopes.
Jacknife loam, 12 to 30 percent slopes.
Jacknife stony loam, 12 to 30 percent slopes.
Mehlhorn loam, 12 to 30 percent slopes.
Mehlhorn stony loam, 12 to 30 percent slopes.
Newell clay loam, 12 to 30 percent slopes.
Newell stony clay loam, 12 to 30 percent slopes.
Odermott loam, 12 to 30 percent slopes.
Rainey coarse sandy loam, 7 to 12 percent slopes (in BoD).
Rainey coarse sandy loam, 12 to 30 percent slopes (RaE, and in BuE).
Rainey rocky sandy loam, 12 to 30 percent slopes.
Squaw loam, 12 to 30 percent slopes.
Squaw stony loam, 12 to 30 percent slopes.

These soils are suited to dry-farmed crops and pasture, but their use is limited by lack of available moisture and by slope. Suitable crops include alfalfa-grass hay, small grain, grass for seed, alfalfa for seed, and pasture. Alfalfa-grass hay can be grown for 4 to 8 years, then grain for 2 to 5 years in an alternate grain-fallow cropping system. Cross-slope cultivation, cover crops, and use of crop residues are needed to protect these soils from erosion. If used for pasture, these soils need the same management as the soils in capability unit VIe-2, dryland.

Capability unit IVe-5, dryland

This unit consists of well-drained, moderately deep or deep loamy soils on sloping terraces and uplands. The Haw soils have no restriction to the growth of roots to a depth of about 5 feet. The Sweet and Kepler soils have a hardpan in the lower part of the profile. The organicmatter content is moderately low, permeability is moderately slow, and the available water 'holding capacity is moderate to high. There is a moderate hazard of erosion. The soils in this unit are

Haw loam, 7 to 12 percent slopes.
Kepler loam, 7 to 12 percent slopes (in SnD).
Sweet loam, 7 to 12 percent slopes (SmD, and in SnD).

The lack of water for irrigation and the low amount of precipitation limit the use of these soils for crops. Suitable crops include small grain, forage crops, and hay crops, but most areas are used for small grain grown in a grain-summer fallow system. A suitable rotation consists of wheat-fallow for 4 to 6 years, then alfalfa-grass for hay or pasture for 5 to 8 years. Yields normally are less than on the soils in unit IVe-4 dryland. Cross-slope cultivation, cover crops, and crop residues are needed to control erosion. If used for pasture, these soils need the same management as the soils in capability unit VIs-2, dryland.

Capability unit IVe-6, dryland

The soils in this unit are fine textured and are difficult to manage. They all have a clay subsoil that expands when wet and shrinks when dry. At times wide cracks from 1 to 2 feet deep form in the upper part. Some areas are stony. Permeability is slow or very slow when the soils are wet. The soils in this unit are

Aikman stony clay, 3 to 12 percent slopes.
Aikman stony clay, 12 to 30 percent slopes.
Montour clay loam, 7 to 12 percent slopes.
Montour clay loam, 12 to 30 percent slopes.

These soils are suitable for dry-farmed crops but their use is limited by their clayey texture, which makes tillage difficult, and by the lack of available moisture during the growing season. Suitable crops include alfalfa-grass hay, small grain, grass for seed, and pasture. Alfalfa and crested wheatgrass make a good hay or pasture mixture. Tillage should be carefully timed to prevent puddling. These soils should not, be cultivated when they are too wet or too dry. Livestock should not be allowed in fields when the soils are wet. If used for pasture, these soils need the same management as the soils in capability unit VIe-2, dryland.

Capability unit IVe-7, dryland

This unit consists mainly of moderately steep, well-drained loamy soils. Included are some stony soils and some moderately coarse textured soils. The water-holding capacity is low to high, permeability is moderately slow to moderately rapid, and the organic-matter content is low. The hazard of erosion is moderate to severe. The soils in this unit are

Harpt loam, 7 to 12 percent slopes.
Harpt loam, 12 to 30 percent slopes.
Haw loam, 12 to 30 percent slopes.
Payette coarse sandy loam, 0 to 30 percent slopes.
Perla stony loam, 12 to 30 percent slopes.

These soils generally are considered marginal for dry-farmed crops. Their use is limited by the moderately steep slopes, the erosion hazard, and lack of available moisture during the growing season. Suitable crops include alfalfa-grass hay, small grain, grass for seed, and pasture crops. Cover crops and cross-slope farming help to control erosion. Returning crop residues to the soil and turning under green-manure crops help to maintain or to increase the organic-matter content. If used for pasture, these soils need the same management as the soils in capability unit VIe-2, dryland.

Capability unit IVw-1, irrigated

In this unit are-coarse-textured soils on level or very gently sloping flood plains. Permeability is rapid. Included in this group is a moderately alkali soil that is of minor extent. The soils in this unit are

Moulton loamy sand, 0 to 1 percent slopes.
Moulton loamy sand, 1 to 3 percent slopes.
Moulton loamy sand, moderately alkali, 1 to 3 percent slopes.

These soils are best suited to hay and pasture crops. management is about the same as that for the soils in unit In IIw-1, irrigated, except that these soils should be more carefully irrigated, and more care is needed to supply organic matter and to maintain fertility. Irrigation should be light and frequent because the available water holding capacity is low. The number of successive row crops in the rotation should be limited.

Capability unit IVw-2, irrigated

In this unit are medium-textured or moderately coarse textured soils that are strongly or moderately affected by

salts and alkali. These soils have restricted drainage and are on level or very gently sloping bottom lands or low terraces. The available water holding capacity is low to moderate, and the organic-matter content is low. Because of the saline-alkali condition, crop growth is very poor on much of the acreage. The soils in this unit are

Baldock silt loam, moderately saline-alkali.
Letha fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.
Letha fine sandy loam, strongly saline-alkali, 1 to 3 percent slopes.
Letha fine sandy loam, deep, strongly saline-alkali, 0 to 1 percent slopes.
Letha fine sandy loam, deep, strongly saline-alkali, 1 to 3 percent slopes.
Letha loam, strongly saline-alkali, 0 to 1 percent slopes.

These soils can be used and managed in about the same way as the soils in unit IIIw-5, irrigated. They are more shallow and have stronger concentrations of 'salts and alkali than the soils in unit IIIw-5, irrigated, but they are more permeable and, consequently, are more easily drained and reclaimed.

Capability unit IVw-3, irrigated

In this unit are strongly saline-alkali soils. Reclamation is very difficult because of serious drainage problems, the strong concentrations of salts and alkali, and slow or very slow permeability. The vegetation consists of a sparse growth of greasewood, saltgrass, saltbrush, and alkali weed. The soils in this unit are

Bramwell silt loam, strongly saline-alkali, 0 to 1 percent slopes.
Bramwell silt loam, strongly saline-alkali, 1 to 3 percent slopes.
Lahontan silty clay, strongly saline-alkali.
Lahontan silty clay loam, strongly saline-alkali.

These soils are best suited to plants that will tolerate strong concentrations of salts and alkali, such as tall wheatgrass and barley. Yields generally are low. Management needs are similar to those of the soils in unit IIIw-5, irrigated.

Capability unit IVw-4, dryland

This unit consists of deep or moderately deep, poorly drained or imperfectly drained loams. These soils occur mostly in basins, on level flood plains, or on low terraces. The organic-matter content generally is high. There is little or no hazard of erosion. The soils in this unit are

Catherine loam.
Catherine loam, moderately deep.
Goose Creek loam.

These soils generally have enough available moisture to produce slightly better than average crop yields without supplemental irrigation. If the water level in the open drainage ditches is high enough, plants are able to get enough moisture from below the surface to produce at least average yields. Spring grain and pasture are suitable crops.

Capability unit IVs-1, irrigated

The soils in this unit are sandy and have very low available water holding capacity. They are well drained and moderately well drained and are on the level flood plains and low terraces. Permeability is rapid, and the organic-matter content generally is low. There is a slight hazard of erosion. The soils in this unit are

Emerson loamy sand, 0 to 1 percent slopes.
Palk loamy sand, 0 to 1 percent slopes.

These soils are best suited to irrigated pasture or hay crops, but they also can be used for small grain and vegetable crops. The organic-matter content can be increased or maintained by the use of green-manure crops and cover crops, particularly if hay or pasture crops are grown for long periods in the rotation.

Irrigating these soils is difficult. Water enters the soils very rapidly, and large streams cause erosion. The border method is suitable for hay, pasture, and small grain; the sprinkler method can be used for any crop. The length of runs for border, corrugation, or furrow irrigation should be short, and the size of streams, especially for furrow or corrugation irrigation, should be small.

Capability unit IVs-2, irrigated

In this unit are shallow sandy loams and loamy sands that. have very low available water holding capacity. They occur on level or very gently sloping alluvial bottom lands and low terraces. The organic-matter content generally is low. The hazard of erosion is slight. Gravelly and cobbly spots occur in a few places. The soils in this unit are

Notus coarse sandy loam, 0 to 1 percent slopes.
Notus coarse sandy loam, 1 to 3 percent slopes.
Notus gravelly loamy coarse sand, 0 to 1 percent slopes.
Notus gravelly loamy coarse sand, 1 to 3 percent slopes.

These soils commonly occur as small areas intermixed with larger areas of other soils, and they are used for the same crops as the adjacent soils. The principal crops are pasture crops, alfalfa for hay, and small grain. Row crops are grown in some small areas.

These soils are best suited to hay and pasture crops. A suitable rotation consists of alfalfa-grass hay for 3 to 5 years, then small grain for 2 years. Nitrogen and phosphate and regular additions of organic matter are needed for best yields. Irrigation can be by the border, corrugation, furrow, or sprinkler method. Frequent light applications are best because the available water holding capacity is very low.

Capability unit IVs-3, dryland

Shallow to moderately deep clay loams and loams make up most of this unit. These soils are on very gently sloping or gently sloping terraces and alluvial fans. Some areas are stony. The organic-matter content is moderate, permeability is moderately slow or slow, and the available water holding capacity is low to moderate. The root zone is limited in most areas by a hardpan at a depth of about 2 feet. There is a slight hazard of erosion. The soils in this unit are

Kepler loam, 1 to 3 percent slopes (in SnB).
Kepler loam, 3 to 7 percent slopes (in SnC).
Kepler stony loam, 3 to 7 percent slopes (in SpC).
Salisbury clay loam, 3 to 7 percent slopes.
Salisbury stony clay loam, 1 to 3 percent slopes.
Sweet clay loam, shallow, 1 to 3 percent slopes.
Sweet clay loam, shallow, 3 to 7 percent slopes.
Sweet loam, 1 to 3 percent slopes (SmB, and in SnB).
Sweet loam, 3 to 7 percent slopes (SmC, and in SnC).
Sweet stony loam, 3 to 7 percent slopes (SpC).

These soils are marginal for dry-farmed crops. Their shallow root zone and restricted available water holding capacity limit the choice of crops and crop yields. Shallow-rooted grasses and other crops capable of making fast growth in spring and early in summer when moisture is available are best suited. A grain-fallow system of management is used. The use of cover crops, crop residues, and green-manure crops helps to increase the organic-matter content. If used for pasture, these soils need the same management as the soils in capability unit IIIs-2, dryland.

Capability unit IVc-1, dryland

The soils in this emit are level to gently sloping, very deep, well-drained loams. There are no restrictions on the growth of roots to a depth of 5 feet or more. Permeability is moderate or moderately slow, and the available water holding capacity is high. The hazard of erosion is slight. The soils in this unit are

Harpt loam, 0 to 1 percent slopes.
Harpt loam, 1 to 3 percent slopes.
Harpt loam, 3 to 7 percent slopes.
Raw loam, 1 to 3 percent slopes.
Haw loam, 3 to 7 percent slopes.

Low precipitation limits the choice of crops and restricts crop yields on these soils. Crops that mature early in summer before the available moisture is gone or deeprooted crops and others that are capable of enduring a dormant period in summer are best suited. Wheat anal barley are grown under a grain-fallow system. Alfalfa and grass can be grown for hay, seed, or pasture.

Careful tillage to conserve moisture, use of crop residues and green-manure crops, and a crop rotation in which alfalfa or grass is grown most of the time are important management practices. If used for pasture, these soils need the same management as the soils in capability unit VIc-1, dryland.

Capability unit Vw-1, dryland

In this unit are poorly or very poorly drained soils that occur in level, low-lying areas where drainage is very difficult or impractical. These soils are mostly fine sandy loams or silty clay loams. They are

Black Canyon silty clay loam.
Chance fine sandy loam.
Wet alluvial land.

Cultivated crops cannot be grown, because of wetness. Most of the acreage is used for native pasture, -which produces fair yields of herbage. Some areas are too wet to be used for pasture. Reed canarygrass, alsike clover, and meadow foxtail can be seeded in areas that are dry enough to permit the use of equipment.

Capability unit VIe-1, irrigated

This unit consists of moderately steep soils on alluvial fans, terraces, and uplands. These soils are coarse textured to moderately fine textured and well drained to excessively drained. Some areas are stony. Permeability is dominantly moderate but ranges from rapid to slow. The available water holding capacity also is variable. Generally it is high, but it ranges from low to very high. The erosion hazard is moderate to severe. The soils in this unit are

Cashmere coarse sandy loam, 12 to 30 percent slopes.
Chilcott loam, 12 to 30 percent slopes (in LmE).
Harpt coarse sandy loam, 12 to 30 percent slopes.
Harpt loam. 12 to 30 percent slopes.
Haw loam, 12 to 30 percent slopes.
Lanktree loam, 12 to 30 percent slopes (LfE, and in LmE).
Lanktree sandy loam. 12 to 30 percent slopes.
Lickskillet stony loam, 12 to 30 percent slopes (in LwE).
Lolalita sandy loam, 12 to 30 percent slopes (in PrE).
Newell clay loam, 12 to 30 percent slopes.
Newell stony clay loam, 12 to 30 percent slopes.
Power silt loam, 12 to 30 percent slopes (in PrE).
Wasatch loamy coarse sand, 12 to 30 percent slopes.

These soils are suitable for irrigated orchards and pasture, but permanent cover crops are needed to control erosion. Orchard cover crops can be mowed or chopped and left on the ground to help protect the soils from erosion and from damage by trampling. This practice also supplies organic matter. Some areas are used for hay crops. When cover crops, hay crops, or pastures need to be reestablished, a small grain can be grown to help prepare the soil and establish the new cover crop. Favorable response to nitrogen and phosphate can be expected. The sprinkler method of irrigation is preferable.

Capability unit VIe-2, dryland

In this unit are moderately steep or steep, well-drained to excessively drained loamy soils. A few areas are rocky or stony. Most of these soils are in the uplands, on high terraces, or along the breaks between these areas. The soils in this unit are

Brownlee rocky coarse sandy loam, 30 to 60 percent slopes (in BtF).
Cashmere coarse sandy loam, 12 to 30 percent slopes.
Chilcott loam, 12 to 30 percent slopes (in LmE).
Chilcott sandy loam, 12 to 30 percent slopes (in LnE).
De Masters stony loam. 30 to 60 percent slopes.
Elmore rocky loam, 30 to 60 percent slopes.
Gem stony clay loam, 30 to 60 percent slopes.
Gross stony loam,' 0 to 60 percent slopes.
Gwin stony loam, 12 to 30 percent slopes.
Harpt coarse sandy loam, 12 to 30 percent slopes.
Jenness sandy loam, 12 to 30 percent slopes.
Lanktree gravelly loam, 12 to 30 percent slopes.
Lanktree gravelly sandy loam, 12 to 30 percent slopes.
Lanktree loam. 12 to 30 percent slopes.
Lanktree sandy loam, 12 to 30 percent slopes.
Lanktree loam, 12 to 30 percent slopes (in LmE).
Lanktree sandy loam, 12 to 30 percent slopes (in LnE).
Lickskillet stony loam, 12 to 30 percent slopes.
Lickskillet stony loam, 12 to 30 percent slopes (in LwE).
Lolalita coarse sandy loam, 12 to 30 percent slopes.
Lolalita sandy loam, 12 to 30 percent slopes (in PrE).
Mehlhorn stony loam. 30 to 60 percent slopes.
Montour clay loam, 30 to 60 percent slopes.
Odermott clay loam, 30 to 60 percent slopes.
Odermott loam, 30 to 60 percent slopes.
Ola rocky loam, 30 to 60 percent slopes (OrF, and in BtF).
Power silt loam, 12 to 30 percent slopes (in PrE).
Rainey rocky coarse sandy loam, 12 to 30 percent slopes (in BvE).
Squaw stony loam, 30 to 60 percent slopes (in SfF).
tan Dusen loam. 30 to 60 percent slopes.
Van Dusen stony loam, 30 to 60 percent slopes.

The vegetation on many of these soils consists mainly of annuals, shrubs, and such forbs as Medusahead wildrye, cheatgrass, needlegrass, sagebrush, and wild mustard. Where the native grasses are severely depleted (that is, the plant cover is in poor condition), the soils can be seeded with such pasture plants as Whitmar beardless wheatgrass, pubescent wheat grass, Ladak alfalfa, Siberian wheatgrass, bulbous bluegrass, intermediate wheatgrass, and Sherman big bluegrass.

Where the native grasses are growing in sufficient quantity (that is, the plant cover is in fair to excellent condition), the soils are used for range. The Guide to Mapping Units gives the range site in which each soil has been placed.

Capability unit VIs-1, dryland

In this unit are very stony and extremely stony foams of the uplands. These soils generally are moderately steep or steep. Most of them are deep, but some are shallow. The soils in this unit are

Gross very stony loam, 30 to 60 percent slopes (in GsF).
Gwin extremely stony loam. 0 to 30 percent slopes (GwE, and in WE).
Gwin extremely stony loam. 30 to 60 percent slopes (GwF, and in MdF).
Haw extremely stony loam. 12 to 30 percent slopes.
Jackknife extremely stony loam, 0 to 30 percent slopes.
Kepler extremely stony loam, 0 to 12 percent slopes (in SsC).
Mehlhorn extremely stony loam, 0 to 30 percent slopes (McE, and in MdE).
Mehlhorn extremely stony loam, 30 to 60 percent slopes (in MdF).
Odermott very stony loam, 0 to 30 percent slopes.
Perla extremely stony loam, 12 to 30 percent slopes (PnE, and in PpE).
Payette extremely stony coarse sandy loam (in PpE).
Squaw extremely stony loam, 0 to 30 percent slopes.
Sweet clay loam, 12 to 30 percent slopes, eroded.
Sweet extremely stony loam, 0 to 12 percent slopes (in SsC).
Van Dusen extremely stony loam, 30 to 60 percent slopes.

These soils are too stony or too shallow for cultivation. The vegetation consists mainly of annuals, forbs, and sagebrush. Where the native grasses are severely depleted (that is, the plant cover is in poor condition), the soils can be seeded with such pasture plants as Whitmar beardless wheatgrass, pubescent wheatgrass, and bulbous bluegrass.

Where the native grasses are growing in sufficient quantity (that is, the plant cover is in fair to excellent condition), the soils are used for range. The Guide to Mapping Units gives the range site in which each soil has been placed.

Capability unit VIs-2, dryland

This unit consists of nearly level to sloping, medium-textured or moderately coarse textured, well-drained soils. These soils are mostly on high terraces or on alluvial fans. There is little hazard of erosion. The soils are too dry for dryland farming. The soils in this unit are

Cashmere coarse sandy loam, 1 to 3 percent slopes.
Cashmere coarse sandy loam, 3 to 7 percent slopes.
Cashmere coarse sandy loam, 7 to 12 percent slopes.
Chilcott loam, 1 to 3 percent slopes (in LoB).
Chilcott loam, 3 to 7 percent slopes (in LmC).
Chilcott loam, 7 to 12 percent slopes (in LmD).
Chilcott silt loam, 0 to 12 percent slopes (in CrC).
Harpt coarse sandy loam, 1 to 3 percent slopes.
Harpt coarse sandy loam, 3 to 7 percent slopes.
Harpt coarse sandy loam, 7 to 12 percent slopes.
Lanktree loam. 3 to 7 percent slopes (LfC, and in LmC).
Lanktree loam, 7 to 12 percent slopes (LfD, and in LmD).
Lanktree loam, 1 to 3 percent slopes (in LoB).
Lickskillet stony loam, 7 to 12 percent slopes (in LwD).
Sebree silt loam, 1 to 3 percent slopes (in LoB).
Vickery silt loam. 0 to 12 percent slopes (in CrC).

On many of these soils the vegetation consists mainly of annuals, shrubs, and such forbs as wild onion, sagebrush, fiddleneck, and wild mustard. Where the native grasses are severely depleted (that is, the plant cover is in poor condition), the soils can be seeded with such pasture plants as Whitmar beardless wheatgrass, pubescent wheatgrass, Ladak alfalfa, Siberian wheatgrass, crested wheatgrass, bulbous bluegrass, intermediate wheatgrass, and Sherman big bluegrass.

Where the native grasses are growing in sufficient quantity (that is, the plant cover is in fair to excellent condition), the soils are used for range. The Guide to Mapping Units gives the range site in which each soil has been placed.

Capability unit VIc-1, dryland

In this unit are very gently sloping or gently sloping, well-drained, deep or very deep loamy soils of the bottom lands and alluvial fans. Fertility is high, and the hazard of erosion is slight. The organic-matter content is low, and generally the available water holding capacity is high. Permeability is moderate to slow. The soils in this unit are

Jenness loam, 1 to 3 percent slopes.
Jenness loam, 3 to 7 percent slopes.
Jenness sandy loam, 3 to 7 percent slopes.

These soils can be tilled to prepare a seedbed for desirable grasses. The vegetation in many areas consists mainly of cheatgrass, big sagebrush, and wild mustard. Where the native grasses are severely depleted (that is, the plant cover is in poor condition), the soils can be seeded with such pasture plants as Whitmar beardless wheatgrass, pubescent wheatgrass, Ladak alfalfa, Siberian wheatgrass, crested wheatgrass, intermediate wheatgrass, and Sherman big bluegrass.

Where the native grasses are growing in sufficient quantity (that is, the plant cover is in fair to excellent condition), the soils are used for range. The Guide to Mapping Units gives the range site in which each soil has been placed.

Capability unit VIIe-1, dryland

Most of the soils in this unit are steep sandy loams and coarse sandy loams. Some are rocky or stony. All of these soils are droughty, and they are susceptible to severe erosion. The soils in this unit are

Lanktree sandy loam. 30 to 60 percent slopes.
Lickskillet stony loam, 30 to 60 percent slopes.
Lolalita coarse sandy loam, 30 to 60 percent slopes.
Payette coarse sandy loam, 30 to 60 percent slopes.
Rainey rocky sandy loam, 30 to 60 percent slopes.

These soils are not suited to cultivation. The vegetation consists mainly of cheatgrass, big sagebrush, and wild mustard. Steep slopes prevent adequate seedbed preparation. Where native grasses are severely depleted (that is, the plant cover is in poor condition), the stand can be improved by broadcast seedings of such pasture plants as Whitmar beardless wheatgrass, pubescent wheatgrass, and crested wheatgrass.

Where native grasses are growing in sufficient quantity (that is, the plant cover is in fair to excellent condition), the soils are used for range. The Guide to flapping Units gives the range site in which each soil has been placed.

Capability unit VIIe-2, dryland

In this unit are very steep, moderately deep or deep loamy soils. Some areas are stony, very stony, or rocky. These soils are subject to very severe erosion. The soils in this unit are-

De Masters stony loam, 60 to 73 percent slopes.
Gross stony loam, 60 to 75 percent slopes.
Gross very stony loam. 60 to 80 percent slopes (in GsG).
Ola rocky loam, 60 to 80 percent slopes.
Rainey rocky sandy loam, 60 to 73 percent slopes.
Van Dusen loam, 60 to 73 percent slopes.

These soils can be used for limited grazing, for watershed areas, or for wildlife habitats. Protection from fire and from trampling by livestock are important. The vegetation consists mainly of bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, big sagebrush, cheatgrass, and other forbs and shrubs. Where the native grasses are severely depleted (that is, the plant cover is in poor condition), pasture grasses can be established by broadcast seedings, or adjoining sites can be used as a source of seed. Very steep slopes and stones prevent adequate seedbed preparation.

Where native grasses are rowing in sufficient quantity (that is, the plant cover is in fair to excellent condition), the soils are used for range. The Guide to Mapping Units gives the range site in which each soil has been placed.

Capability unit VIIs-1, dryland

The soils in this unit are extremely stony or extremely rocky. They are moderately coarse textured to moderately fine textured and occur on gentle to moderately steep slopes. They have limited use for range. The soils in this unit are

Aikman extremely stony clay, 0 to 30 percent slopes.
Bakeoven extremely rocky loam, 0 to 30 percent slopes (in BaE).
Bakeoven extremely stony loam, 0 to 30 percent slopes (in LxE and GnE).
Dishner extremely rocky loam, 0 to 12 percent slopes.
Dishner extremely stony loam, 0 to 12 percent slopes.
Gem extremely stony clay loam, 0 to 30 percent slopes (GmE, and in GnE).
Gem extremely stony clay loam, 30 to 60 percent slopes (in GnF).
Lickskillet extremely rocky loam, 0 to 30 percent slopes (in BaE).
Lickskillet extremely stony loam, 0 to 30 percent slopes (in LxE).
Salisbury extremely stony clay loam, 0 to 30 percent slopes.

The vegetation consists mainly of annuals, forbs, and shrubs, such as Medusahead wildrye, wild onion, cheatgrass, and sagebrush. Steep slopes, stones, and rock outcrops prevent adequate seedbed preparation. Where the native grasses are severely depleted (that is, the plant cover is in poor condition), the sites can be improved by broadcast seedings of such pasture plants as Whitmar beardless wheatgrass, pubescent wheatgrass, and crested wheatgrass.

Where native grasses are growing in sufficient quantity (that is, the plant cover is in fair to excellent condition), the soils are used for range. The Guide to Mapping Units gives the range site in which each soil has been placed.

Capability unit VIIs-2, dryland

This unit consists of extremely rocky, very stony, and extremely stony soils on steep slopes of the uplands. The soils are shallow to deep and droughty. The soils in this unit are

Bakeoven extremely rocky loam, 30 to 60 percent slopes (in BcF).
Bakeoven very stony loam, 30 to 60 percent slopes (in GsF).
Bakeoven extremely stony loam, 30 to 60 percent slopes (in LxF and GnF).
Lickskillet extremely rocky loam, 30 to 60 percent slopes (in BoF).
Lickskillet extremely stony loam, 30 to 60 percent slopes (in LxF).
Payette very stony soils, 30 to 60 percent slopes.
Payette extremely stony coarse sandy loam, 30 to 60 percent slopes (in PpF).
Perla extremely stony loam, 30 to 60 percent slopes (PnF, and in PpF).

The vegetation consists mainly of annuals, such as cheatgrass. Medusahead wildrye, and sagebrush. Where the native grasses are severely depleted (that is, the plant cover is in poor condition), pasture grasses can be established by broadcast seedings, or adjoining sites can be used as a source of seed. Steep slopes and stones prevent adequate seedbed preparation.

Where the native grasses are growing in sufficient quantity (that is, the plant cover is in fair to excellent condition), the soils are used for range. The Guide to Mapping Units gives the range site in which each soil has been placed.

Capability unit VIIIe-1, dryland

The only soil in this unit is Payette coarse sandy loam, 60 to 75 percent slopes. This soil has a moderate to low content of organic a ratter and has low available water holding capacity. The hazard of erosion is very severe.

This soil is suitable only for watersheds and wildlife habitats. Grazing would cause serious erosion. Most of this soil is on the southern border of the Emmett Valley and generally occurs above soils that are used for orchards. The undisturbed plant cover provides good habitats for game birds and protects the soil from erosion.

Capability unit VIIIs-1, dryland

This unit consists of extremely rocky and extremely stony, very shallow to shallow foams and loamy sands on very steep slopes. The soils in this unit are

Bakeoven extremely rocky loam, 60 to 80 percent slopes (in BcG).
Bakeoven very stony loam, 60 to SO percent slopes (in GsG).
Gwin extremely stony loam, 60 to 80 percent slopes.
Lickskillet extremely rocky loam, 60 to 80 percent slopes (in BaG).
Lolalita loamy coarse sand, 60 to 75 percent slopes.

These soils should be protected to maintain or increase their value as watershed areas or as wildlife habitats. Protection from fire and from trampling by livestock is important.

Capability unit VIIIs-2, dryland

This unit consists of miscellaneous land types not suited to the commercial production of plants. They are

Riverwash.
Rock land and rubble land.

These areas can be used ˜as a source of material to be used in highway and other construction. They can be managed to maintain or increase their value as wildlife habitats and as a source of water.

Estimated Yields of Cropland

The estimated yields in this report are based on observations of soil yields who surveyed the Area, and also on information furnished by farmers in the Area, by the county agricultural extension agent, by agricultural products processing companies, by the local office of

the Agricultural Conservation and Stabilization Service, and by the 1959 census. If no information could be obtained for a particular soil, estimates were made on the basis of information pertaining to a similar soil.

Table 2 gives estimates of yields for the principal crops grown in the Area, both irrigated and dry farmed, under two levels of management.

Yields of irrigated crops, shown in columns A, are based on the management most common in the Area. Under this level of management, no regular cropping system is followed. Alfalfa hay generally is grown for 6 to 9 years. Undesirable grasses invade stands of alfalfa and cause a decrease in the quality and quantity of production. Row crops may be alternated with grain for indefinite periods. The amount of fertilizer and soil amendments used is insufficient. The application of irrigation water is not closely controlled.

Some farmers obtain higher yields of irrigated crops. These yields are shown in columns B. To obtain these yields, a systematic cropping system is used. Alfalfa, clover, and grass, for hay or pasture, are commonly grown for 3 to 5 years, then a crop such as corn for silage, sugar beets, or small grain, then grain and a new seeding of alfalfa and grass. Generally, fertilizer is applied according to need as indicated by soil tests. All available barnyard manure is used, and the application of commercial fertilizer is reduced accordingly. Irrigation water generally is adequate for all crops. Water is applied by the border, corrugation, furrow, or sprinkler method. Crops are irrigated as they need water. The length of the runs is limited to ensure uniform wetting of the soil to the root-

In the original manuscript, there was a table in this space.
All tables have been updated and are available as a separate document.

ing depth of the crop being grown. The soil is prepared for irrigation by leveling or smoothing. Insects and weeds are controlled.

About the same varieties of irrigated crops are grown under both levels of management. The varieties of alfalfa grown generally are Ranger, Lahontan, or common. Most of the wheat grown is Lemhi 53 and Federation. Gem and Velvon are the most common varieties of barley. Most of the corn grown is an adapted hybrid. The increased yields of hay result primarily from seeding improved grasses and legumes, proper application of fertilizer, and better water management. Improved grasses for hay and pasture are orchardgrass, smooth brome, Alta fescue, tall wheatgrass, and Chewings fescue.

The yields in columns A for dry-farmed crops are based on the management most common in the Area, which usually consists of a grain-fallow cropping system and some use of stubble-mulch tillage during the fallow year.

The farmers that obtain the yields given in columns B also use a grain-fallow cropping system and stubble-mulch tillage during the fallow year. In addition, their tillage operations generally are on the contour or across the slope, and more attention is given to controlling weeds, disease, and insects and to timeliness of planting, cultivating, and harvesting.

About the same varieties of dry-farmed crops are grown under both levels of management. Turkey red is the most common variety of winter wheat. Lemhi is the most common variety of spring wheat, and Gem the most common variety of barley. Ladak is the alfalfa variety generally used, but some alfalfa of the Lahontan and common varieties is grown also.

In the original manuscript, there was a table in this space.
All table have been updated and are available as a separate document.

Range Management

Range is land on which the potential plant community is composed principally of native grasses, forbs, and shrubs valuable for forage, in sufficient quantity to justify grazing use. Both cattle and sheep are raised on the range in the Gem County Area. Sheep are raised both for meat and for wool.

Prior to about 1900, the native plants in this Area consisted mainly of bunchgrasses. Now, sagebrush and annual grasses dominate on much of the range, and herbage commonly is less than half of what could be produced if the best grasses of the original vegetation were reestablished.

A few areas used for grazing are suitable for crops, but generally the soils are too steep, too shallow, or too droughty. At the higher elevations, bitterbrush and other plants provide valuable forage for deer and elk.

Medusahead wildrye is rapidly invading the plant cover on all of the fine-textured soils and on all soils that have a clayey subsoil.

Principles of range management

High production of forage, as well as the conservation of soil, water, and plants, can be ensured by maintaining the native vegetation or improving it to its highest potential. In their green leaves, grasses manufacture the food they need to grow, flower, and reproduce. If too much of this green foliage is removed by grazing or mowing, the plant is weakened and stunted.

Livestock seek out and graze the more palatable plants. If grazing is not carefully regulated, the better plants are eventually eliminated and less desirable plants or weeds increase. Generally, if about half of the grass produced yearly is left, damage to the more desirable plants is minimized. On slopes of more than 30 percent, more of the top growth should be left. Forage left on the ground does the following things

1. Serves as a mulch and encourages the intake and storage of water. The more water stored in the soil, the better the growth of grasses for grazing.
2. Allows roots to reach moisture deep in the soil. Overgrazed grass cannot do this, because not enough green shoots are left to provide food needed for good root growth.
3. Protects the surface layer from erosion by wind or by water.
4. Allows the better grasses to crowd out weeds. When this happens the range improves.
5. Enables plants to store in their roots the food they need for quick, vigorous growth in spring and after droughts.
6. Catches and holds snow where it falls, so that the water from melting snow soaks into the soil.
7. Provides a reserve of feed for use in dry periods.

Range sites

A range site is a group of similar soils with like topography. In its original condition, each range site produced a distinct kind and amount of vegetation, measurably different from the kind and amount of other range sites. For proper range management, a rancher should know the different kinds of range sites in his holdings and then use the type of management that will favor the growth of the best forage plants on each.

The production of usable forage may vary from year to year depending on variations in climate, especially variations in time and anoint of precipitation. In years of drought, yields on all sites are drastically reduced. Consequently, average forage production figures are not a reliable basis for stocking the range. Stocking on the basis of the current year's production is the safest policy.

Range condition

Range condition is determined by comparing the kind and amount of present vegetation with that of the original plant community for a given range site. The purpose in classifying range condition is to provide an approximate measure of any deterioration that has taken place in the plant cover in order to predict the degree of improvement possible. Four classes are used to indicate the degree to which the composition of the present plant community has departed from that of the original. A range is in *excellent* condition if from 76 to 100 percent of the vegetation is characteristic of the original plant community on the same site; in *good* condition if the percentage is 51 to 75; in *fair* condition if the percentage is 26 to 50; and in *poor* condition if it is 25 or less.

One of the objects of good range management is to keep rangelands in excellent or good condition. If this is done, yields improve, water is conserved, and the soils are protected. Knowledge of the range site and condition class helps the operator to evaluate the range resources and gives an indication of what needs to be done to maintain or improve the range.

Descriptions of range sites

The soils of the surveyed Area have been grouped into 24 range sites. Soils that are too steep or too stony to be used as range and soils that are used only for crops are not included. Following is a description of each site, the principal grasses on each site, and some information about use.

LOAMY-SIEROZEM RANGE SITE

This site consists of deep loamy soils on uplands, narrow flood plains, and alluvial fans, both north and south of the Emmett Valley, in the western part of the county. The annual precipitation is 8 toll inches. The soils are

Chilcott loam, 1 to 3 percent slopes (in LoB).
Chilcott loam, 3 to 7 percent slopes (in LmC).
Chilcott loam, 7 to 12 percent slopes (in LmD).
Chilcott loam, 12 to 30 percent slopes (in LmE).
Chilcott sandy loam, 12 to 30 percent slopes (in LnE).
Chilcott silt loam, 0 to 12 percent slopes (in CrC).
Jenness loam, 1 to 3 percent slopes.
Jenness loam, 3 to 7 percent slopes.
Jenness sandy loam, 3 to 7 percent slopes.
Jenness sandy loam, 12 to 30 percent slopes.
Lanktree gravelly loam, 12 to 30 percent slopes.
Lanktree gravelly sandy loam, 12 to 30 percent slopes.
Lanktree loam, 1 to 3 percent slopes (in LoB).
Lanktree loam, 3 to 7 percent slopes (LfC, and in LmC).
Lanktree loam, 7 to 12 percent slopes (LID, and in LmD).
Lanktree loam, 12 to 30 percent slopes (LIE, and in LmE).
Lanktree sandy loam, 12 to 30 percent slopes (LkE, and in LnE).
Lolalita coarse sandy loam, 12 to 30 percent slopes.
Lolalita sandy loam, 12 to 30 percent slopes (in PrE).

By Frank J. Kline and Roy L. Shipley, Soil Conservation Service.

Power silt loam, 12 to 30 percent slopes (in PrE).
Sebree silt loam, 1 to 3 percent slopes (in LoB).
Vickery silt loam, 0 to 12 percent slopes (in CrC).

Normally, the grasses on this site are bluebunch wheatgrass, beardless wheatgrass, prairie junegrass, needleandthread, Sandberg bluegrass, and squirreltail. If these soils are overgrazed, big sagebrush, rabbitbrush, yellowbrush, and annual grasses and weeds will invade.

LOAMY-BROWN RANGE SITE

This site is on benches and rolling hills along the Payette River, both north and east of Emmett. It includes areas adjacent to the Sweet and Montour Valleys. The annual precipitation is 11 to 13 inches. The soils are deep or moderately deep, slightly dark-colored loams and stony loams. They are

Haw loam, 1 to 3 percent slopes.
Haw loam, 3 to 7 percent slopes.
Haw loam, 7 to 12 percent slopes.
Haw loam, 12 to 30 percent slopes.
Kepler loam, 1 to 3 percent slopes (in SnB).
Kepler loam, 3 to 7 percent slopes (in SnC).
Kepler loam, 7 to 12 percent slopes (in SnD).
Kepler stony loam, 3 to 7 percent slopes (in SpC).
Lickskillet stony loam, 12 to 30 percent slopes.
Lickskillet stony loam, 7 to 12 percent slopes (in LwD).
Lickskillet stony loam, 12 to 30 percent slopes (in LwE).
Perla stony loam, 12 to 30 percent slopes.
Sweet clay loam, 12 to 30 percent slopes, eroded.
Sweet clay loam, shallow, 1 to 3 percent slopes.
Sweet clay loam, shallow. 3 to 7 percent slopes.
Sweet loam, 1 to 3 percent slopes (SmB, and in SnB).
Sweet loam, 3 to 7 percent slopes (SmC, and in SnC).
Sweet loam, 7 to 12 percent slopes (SmD, and in SnD).
Sweet stony loam, 3 to 7 percent slopes (in SpC).

This site will support a cover of bluebunch wheatgrass, Sandberg bluegrass, and lesser amounts of giant wildrye, squirreltail, needle-and-thread, and dryland sedges. The dominant forbs and shrubs include tapertip hawksbeard, butterweed, balsamroot, and bitterbrush. An increase in big sagebrush, rabbitbrush, and annual grasses and weeds is a sign that the range is overgrazed.

LOAMY-CHESTNUT RANGE SITE

This site occurs on benches, foothills, gently rolling hills, and gentle upland slopes along Squaw Creek, oil the west side of Squaw Butte ridge, and south of Montour. The annual precipitation is 13 to 16 inches. The soils are dark-colored barns, stony loams, silt loam¯is, clay barns, and stony clay foams. They are

Elmore loam, 12 to 30 percent slopes.
Gem clay loam, 3 to 7 percent slopes.
Gem clay loam, 7 to 12 percent slopes.
Gem clay loam, 12 to 30 percent slopes.
Gem stony clay loam, 12 to 30 percent slopes.
Newell clay loam, 3 to 7 percent slopes.
Newell clay loam, 7 to 12 percent slopes.
Newell clay loam, 12 to 30 percent slopes.
Newell silt loam, 1 to 3 percent slopes.
Newell silt loam, 3 to 7 percent slopes.
Newell stony clay loam, 7 to 12 percent slopes.
Newell stony clay loam, 12 to 30 percent slopes.
Squaw clay loam, 1 to 3 percent slopes.
Squaw loam, 1 to 3 percent slopes.
Squaw loam, 3 to 7 percent slopes.
Squaw loam, 7 to 12 percent slopes.
Squaw loam, 12 to 30 percent slopes.
Squaw stony clay loam, 3 to 7 percent slopes.
Squaw stony loam, 3 to 7 percent slopes.
Squaw stony loam, 7 to 12 percent slopes.
Squaw stony loam, 12 to 30 percent slopes.

Normally, this site supports stands of bluebunch wheat grass, Idaho fescue, beardless wheatgrass, Sandberg bluegrass, giant wildrye, needlegrasses, lupine, littlesunflower, and geranium. If this site is overgrazed for long periods, the whe'atgrasses, fescue, and giant wildrye decrease, and the needlegrasses, less desirable grasses. big sagebrush, and weeds increase. Improvement in the condition of the range is indicated by a bunchy, vigorous growth of giant wildrye and other tall grasses in areas that receive extra moisture.

LOAMY-PRAIRIE RANGE SITE

This site occurs on hills, foothills, and alluvial fans near Gross. The annual precipitation is 16 to 23 inches. The soils are well-drained, dark-colored loams, stony loams, and clay loams. They are

Jacknife clay loam, 1 to 3 percent slopes.
Jacknife clay loam, 3 to 7 percent slopes.
Jacknife clay loam, 7 to 12 percent slopes.
Jacknife loam, 1 to 3 percent slopes.
Jacknife loam, 3 to 7 percent slopes.
Jacknife loam, 7 to 12 percent slopes.
Jacknife loam, 12 to 30 percent slopes.
Jacknife stony loam. 12 to 30 percent slopes.
Mehlhorn loam, 12 to 30 percent slopes.
Mehlhorn stony loam, 12 to 30 percent slopes.
Odermott loam, 3 to 7 percent slopes.
Odermott loam, 7 to 12 percent slopes.
Odermott loam, 12 to 30 percent slopes.

Much of this site is used for crops. The soils are well suited to tillage for seedbed preparation. The native vegetation is about 60 percent grasses, 20 percent forbs, and 20 percent shrubs. The dominant species are Idaho fescue, bluebunch wheatgrass, Nevada bluegrass, beardless wheatgrass, giant wildrye, arrowleaf balsamroot, aster, yarrow, geranium, penstemon, snowberry, and choke cherry. The presence of big sagebrush, annual grasses, and small needlegrasses indicates the site is overgrazed. Medusahead wildrye rapidly invades if this site is in poor condition.

GRANITIC-BROWN RANGE SITE

In this site are nearly level to moderately steep coarse sandy loams and loams. These soils occur east and north of the Emmett Valley, adjacent to the Montour Valley, and along the south county line. The annual precipitation is 11 to 13 inches. The soils are

Cashmere coarse sandy loam, 1 to 3 percent slopes.
Cashmere coarse sandy loam, 3 to 7 percent slopes.
Cashmere coarse sandy loam, 7 to 12 percent slopes.
Cashmere coarse sandy loam, 12 to 30 percent slopes.
Harpt coarse sandy loam, 1 to 3 percent slopes.
Harpt coarse sandy loam, 3 to 7 percent slopes.
Harpt coarse sandy loam, 7 to 12 percent slopes.
Harpt coarse sandy loam, 12 to 30 percent slopes.
Harpt loam, 1 to 3 percent slopes.
Harpt loam, 3 to 7 percent slopes.
Harpt loam, 7 to 12 percent slopes.
Harpt loam, 12 to 30 percent slopes.
Payette coarse sandy loam, 0 to 30 percent slopes.

Grasses make up about 80 percent of the vegetation if the site is in excellent condition. The dominant grasses are bluebunch wheatgrass and Indian ricegrass, and there are lesser amounts of Sandberg bluegrass, needle-andthread, and squirreltail and some red three-awn. Giant wildrye occurs throughout the site, especially in old badger diggings or in other disturbed areas. Wild buckwheat, false yarrow, and penstemon are characteristic

perennial forbs. A sparse growth of bitterbrush occurs throughout the site. Poor management results in a dense growth of brush or annual grasses and weeds.

GRANITIC-CHESTNUT RANGE SITE

This site is south of Montour and near Crown Point. It consists of well-drained to excessively drained, dark-colored coarse sandy loams, rocky coarse sandy barns, and rocky sandy loams that have low water-holding capacity. The annual precipitation is 13 to 16 inches. The soils are

Rainey coarse sandy loam, 7 to 12 percent slopes (in BuD).
Rainey coarse sandy loam, 12 to 30 percent slopes (RaE, and in BuE).
Rainey rocky coarse sandy loam, 12 to 30 percent slopes (in BeE).
Rainey rocky sandy loam, 12 to 30 percent slopes.

This site generally is well suited to tillage for seedbed preparation. Normally, it will support stands of bluebunch wheatgrass, beardless wheatgrass, needle-andthread, Indian ricegrass, Sandberg bluegrass, squirreltail, Idaho fescue, red three-awn, and dryland sedges. Such forbs as balsamroot, phlox, wild buckwheat, and penstemon commonly make up about 10 percent of the vegetation. About 15 percent consists of such shrubs as bitterbrush, big sagebrush, and smaller amounts of rabbitbrush, yellowbrush, and snowberry. Deterioration of the range is indicated by an increase in big sagebrush and an invasion of annual grasses.

GRANITIC-PRAIRIE RANGE SITE

This site is on gently sloping to hilly uplands northeast of Sweet and east of Ola, above the Squaw Creek Valley. The annual precipitation is 16 to 23 inches. The soils are dark-colored loams, coarse sandy loams, rocky coarse, sandy foams, and rocky foams. They are

Brownlee coarse sandy loam, 7 to 12 percent slopes (in BuD).
Brownlee coarse sandy loam, 12 to 30 percent slopes (BrE, and in BuE).
Brownlee loam, 3 to 7 percent slopes.
Brownlee loam, 7 to 12 percent slopes.
Brownlee loam, 12 to 30 percent slopes.
Brownlee rocky loam, 12 to 30 percent slopes (in BvE).

The site is well suited to tillage, and much of it is used for crops. It supports good stands of Idaho fescue and beardless wheatgrass. Other less abundant grasses are Nevada bluegrass, Sandberg bluegrass, giant wildrye. and squirreltail. Prominent forbs and shrubs include balsamroot, phlox, pussytoes, sweet vetch, stoneseed, bitterbrush, and snowberry.

If this site is overgrazed for long periods, the wheatgrasses and Idaho fescue decrease and less desirable grasses, weeds, and shrubs increase. Improvement in the condition of the range is indicated by a bunchy, vigorous growth of Idaho fescue or the wheatgrasses.

CLAY-BROWN RANGE SITE

This site is mostly on low hills and gently sloping benches about 6 to 8 miles east of Emmett and near Montour. The annual precipitation is 11 to 13 inches. The soils are clay foams, stony clays, and extremely stony clays that have a slowly or very slowly permeable subsoil. The soils are

Aikman stony clay, 3 to 12 percent slopes.
Aikman stony clay, 12 to 30 percent slopes.
Aikman extremely stony clay, 0 to 30 percent slopes.
Montour clay loam, 7 to 12 percent slopes.
Montour clay loam, 12 to 30 percent slopes.
Montour clay loam, 30 to 60 percent slopes.

These soils are extremely susceptible to damage by trampling if grazed when wet. The native vegetation consisted mostly of bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, Sandberg bluegrass, aster, lupine, and balsamroot. On deteriorated sites, the vegetation is dominated by cheatgrass, Medusahead wildrye, wild carrot, and rabbitbrush. Medusahead wildrye is an aggressive and undesirable invader. Montour clay loam, 30 to 60 percent slopes, needs somewhat different management than the other soils because of the steep slopes.

STONY-BROWN RANGE SITE

This site is on benches and foothills above the Payette River, northeast and southeast of Emmett, near Montour, and south of Pearl. The annual precipitation is 11 to 13 inches. The soils are dark-colored, extremely stony loams and coarse sandy loams. They are

Haw extremely stony loam. 12 to 30 percent slopes.
Kepler extremely stony loam, 0 to 12 percent slopes (in SsC).
Payette extremely stony coarse sandy loam, 12 to 30 percent slopes (in PPE).
Perla extremely stony loam, 12 to 30 percent slopes (PnE, and in PpE).
Sweet extremely stony loam, 0 to 12 percent slopes (in SsC).

This site will support a cover of bluebunch wheatgrass and beardless wheatgrass mixed with lesser amounts of giant wildrye, Sandberg bluegrass. squirreltail, needleandthread, and some dryland sedges. The perennial forbs are mainly tapertip hawksbeard, butterweed. balsamroot, lupine, and wild buckwheat. The dominant shrub is bitterbrush. Small amounts of big sagebrush and rabbitbrush also occur. Continued overgrazing will cause big sagebrush and rabbitbrush to increase and annual weeds and grasses to invade.

STONY-CHESTNUT RANGE SITE

This site consists of extremely stony loam¯is and clay loams. It occupies sloping and undulating hills, benches, foothills, and alluvial fans along Squaw Creek, west of the Squaw Butte ridge, and south of Montour. The annual precipitation is 13 to 16 inches. The soils are

Gem extremely stony clay loam, 0 to 30 percent slopes (GmE, and in GnE).
Squaw extremely stony loam, 0 to 30 percent slopes.

Idaho fescue, bluebunch wheatgrass, and beardless wheatgrass are the dominant grasses, but there are lesser amounts of needlegrasses, mountain brome, giant wildrye, big bluegrass, anal prairie junegrass. Such shrubs and forbs as bitterbrush, snowberry, sagebrush, ninebark, wild rose, geranium, phlox, and yarrow make up as much as 40 percent of the vegetation on some sites. A decrease of Idaho fescue and wheatgrasses or an increase of shrubs, forbs, and annual weeds and grasses indicates deterioration of the range.

STONY-PRAIRIE RANGE SITE

This site consists of very stony and extremely stony loams in the vicinity of Squaw Butte and in the upper part of the Squaw Creek Valley. The annual precipitation is 16 to 23 inches. The soils are-

Jacknife extremely stony loam, 0 to 30 percent slopes.
Mehlhorn extremely stony loam, 0 to 30 percent slopes (McE, and in MdE) .
Mehlhorn extremely stony loam, 30 to 60 percent slopes (in MdF).
Odermott very stony loam, 0 to 30 percent slopes.

If this site is in excellent condition, grasses, mainly bluebunch wheatgrass, beardless wheatgrass, and Idaho fescue, make up 60 percent or more of the vegetation. If the site is overgrazed, needlegrasses and squirreltail increase. If overgrazing is continued needlegrasses and squirreltail decrease, and big sagebrush and other shrubby species invade.

SHALLOW STONY-BROWN RANGE SITE

This site consists of very shallow and shallow, extremely rocky and extremely stony loams that have very low to low water-holding capacity. The annual precipitation is I1 to 13 inches. The soils are

Bakeoven extremely rocky loam, 0 to 30 percent slopes (in BcE).
Bakeoven extremely stony loam, 0 to 30 percent slopes (in GnE, and in LxE).
Dishner extremely rocky loam. 0 to 12 percent slopes.
Dishner extremely stony loam, 0 to 12 percent slopes.
Lickskillet extremely rocky loam, 0 to 30 percent slopes (in BcE).
Lickskillet extremely stony loam, 0 to 30 percent slopes (in LxE).

The use of ordinary machinery for reseeding is impractical on these very shallow and shallow, stony and rocky soils. If this site is in excellent condition, the vegetation is about 60 percent grasses, 15 percent forbs, and 25 percent shrubs. Bluebunch wheatgrass is dominant. Other grasses include Sandberg bluegrass. squirreltail, needlegrasses, Nevada bluegrass, and dryland sedges. Low sagebrush, threetip sagebrush, and rabbitbrush generally occur in small amounts. but these shrubs and annual weeds and grasses increase rapidly if the more desirable vegetation is reduced by heavy grazing.

SHALLOW STONY-CHESTNUT RANGE SITE

This site occurs on alluvial fans along Squaw Creek, west of the Squaw Butte ridge, and in the vicinity of Montour. It is made up of only one soil, Salisbury extremely stony clay loam, 0 to 30 percent slopes. This dark-colored soil is underlain at a depth of less than 20 inches by an indurated or strongly cemented hardpan. The annual precipitation on this site ranges from 13 to 16 inches.

The growth of plant roots is restricted on this shallow soil. Consequently, the native vegetation is easily destroyed. The native grasses are bluebunch wheatgrass, beardless wheatgrass. Idaho fescue, western wheatgrass, prairie junegrass, and needlegrasses. Forbs and shrubs include wyethia, tapertip hawksbeard, lupine, aster, bitterbrush, big sagebrush, and yellowbrush. Big sagebrush, rabbitbrush, wyethia, and annual grasses and weeds in crease or invade if the site is overgrazed.

SHALLOW STONY-PRAIRIE RANGE SITE

This site consists of shallow, dark-colored, stony and extremely stony loams that occur at high elevations along the Squaw Butte ridge and at the upper end of the Squaw Creek Valley. These soils are gently sloping to steep. The annual precipitation on this site ranges from 16 to 23 inches, The soils are

Gwin extremely stony loam, 0 to 30 percent slopes (GwE, and in MdE).
Gwin extremely stony loam, 30 to 60 percent slopes (GwF, and in MdF).
Gwin stony loam, 12 to 30 percent slopes.

If this site is in excellent condition, the vegetation is about 50 percent grasses, 15 percent forbs, and 35 percent shrubs. The dominant grasses are bluebunch wheatgrass, beardless wheatgrass, and Idaho fescue, and there are lesser amounts of needle grass, big bluegrass, and squirreltail. The perennial forbs include yarrow, phlox, balsamroot, lupine, and buckwheat. The shrubs are mainly bitterbrush and low sagebrush. There are also smaller amounts of rabbitbrush, wild rose, and snowberry. Big sagebrush and needlegrasses commonly increase if the taller grasses and more desirable forbs and shrubs are reduced by heavy grazing.

NORTH SLOPE-CHESTNUT RANGE SITE

This site is on steep or very steep north-facing slopes on both sides of the Squaw Creek Valley, between Sweet and Ola; on the west side of the Squaw Butte ridge; and near Prospect Peak, south of Pearl. The annual precipitation is 13 to 16 inches. The soils are dark-colored loams and stony loams. They are

Gross stony loam, 30 to 60 percent slopes.
Gross very stony loam, 30 to 60 percent slopes (in GsF).
Gross stony loam, 00 to 75 percent slopes.
Gross very stony loam, 60 to 80 percent slopes (in GsG).
Squaw stony loam, 30 to 60 percent slopes (in SfF).

Because of its northern exposure, this site warms slowly in spring and generally is not ready for grazing until 1 to 3 weeks later than other sites nearby. Idaho fescue, bluebunch wheatgrass, and beardless wheatgrass are the dominant grasses. Sandburg bluegrass, needlegrasses, arrowleaf balsamroot, tapertip hawk-beard. lupine, and wild buckwheat also grow on this site. Bitterbrush, snowberry, serviceberry, chokecherry, wild -rose, aspen, and mountain maple make up as much as 40 percent of the vegetation. An increase in the percentage of shrubs or a decrease in the dominant grasses indicates that the range is overgrazed.

NORTH SLOPE-PRAIRIE RANGE SITE

The soils on this site are dark-colored loams and stony loams that occur at high elevations on steep or very steep north-facing slopes from Squaw Butte northward to the Area boundary and across the north end of Squaw Creek Valley. The annual precipitation is 16 to 23 inches. The soils are

De Masters stony loam, 30 to 60 percent slopes.
De Masters stony loam, 60 to 75 percent slopes.
Van Dusen loam, 60 to 75 percent slopes.

Normally, this site will support a stand of mixed grasses, forbs, and shrubs. The dominant species are Idaho fescue, bluebunch wheatgrass, and beardless wheatgrass. These and other perennial grasses make up about 65 percent of the vegetation if the site is in excellent condition.

SOUTH SLOPE-CHESTNUT RANGE SITE

This site is on steep south-facing slopes, which may have a broken appearance because of the outcrops of rock. The annual precipitation is 13 to 16 inches. The soils are dark-colored rocky loams and stony clay loams. They' are

Elmore rocky loam, 30 to 60 percent slopes.
Gem stony clay loam, 30 to 60 percent slopes.

Gem extremely stony clay loam, 30 to 60 percent slopes (in GnF).

If this site is in excellent condition, the cover consists primarily of such grasses as bluebunch wheatgrass and beardless wheatgrasses, and there are lesser amounts of Sandberg bluegrass, needlegrasses, squirreltail, and red three-awn. If the vegetation is overgrazed, annual grasses and weeds, big sagebrush, and rabbitbrush invade and increase. Medusahead wildrye rapidly invades when the plant cover on the Gem soils is in poor condition.

SOUTH SLOPE-PRAIRIE RANGE SITE

This site consists of dark-colored loams and stony loams on steep south-facing slopes. It extends from Squaw Butte northward to the Area boundary and across the north end of the Squaw Creek Valley. The annual precipitation is 16 to 23 inches. The soils are

Mehlhorn stony loam, 30 to 60 percent slopes.
Odermott loam, 30 to 60 percent slopes.

Because of its southern exposure, this site warms rapidly in spring and generally is ready for grazing about 15 days earlier than other nearby sites. The native grasses are bluebunch wheatgrass, beardless wheatgrass, Sandberg bluegrass, needlegrasses, giant wildrye, and squirreltail. If the site is overgrazed, the bluegrass and wheatgrasses decrease, and the other grasses increase. If overgrazing is continued, big sagebrush becomes dominant.

GRANITIC NORTH SLOPE-CHESTNUT RANGE SITE

This site consists of deep loams, stony loams, and extremely stony loams on steep north-facing slopes south of Montour and near Crown Point. The annual precipitation is 13 to 16 inches. The soils in this site are

Van Dusen loam, 30 to 60 percent slopes.
Van Dusen stony loam, 30 to 60 percent slopes.
Van Dusen extremely stony loam, 30 to 60 percent slopes.

Normally, the vegetation is about 65 percent grasses, 15 percent forbs, and 20 percent shrubs. The dominant species are Idaho fescue, bluebunch wheatgrass. beardless wheatgrass, needlegrasses, Sandberg bluegrass, squirreltail, yarrow, mustard, balsamroot, oysterplant, annual fireweed, lupine, and vetch. The important shrubs are bitterbrush, snowberry, big sagebrush, and rabbitbrush. Aspen and chokecherry occur along drainageways and near seeps or springs. Overgrazing is indicated by heavy increases of snowberry and big sagebrush.

GRANITIC NORTH SLOPE-PRAIRIE RANGE SITE

This site is on steep or very steep north-facing slopes. The annual precipitation is 16 to 23 inches. The soils are dark-colored clay loams, rocky loam¯is, and rocky coarse sandy loams that formed in material weathered from granite. They are

Brownlee rocky coarse sandy loam, 30 to 60 percent slopes (in BtF).
Odermott clay loam, 30 to 60 percent slopes.
Ola rocky loam, 30 to 60 percent slopes (OrF, and in BtF).
Ola rocky loam, 60 to 80 percent slopes.

Tall bunchgrasses, forbs, and shrubs grow on this site. The dominant grasses are Idaho fescue, bluebunch wheatgrass, and beardless wheatgrass. If the range is continually overgrazed, the tall grasses tend to decrease and such shrubs as wild rose, yellowbrush, and big sagebrush, and such trees as chokecherry, rapidly increase or invade.

GRANITIC SOUTH SLOPE-SIEROZEM AND BROWN RANGE SITE

This site consists of steep soils on south-facing slopes in both the southern and western parts of the Area and in the Montour Valley. The annual precipitation is 8 to 13 inches. Generally, the soils are sandy loam¯is, coarse sandy loams, or loams, and some are very stony or extremely stony. They are

Lanktree sandy loam, 30 to 60 percent slopes.
Lolalita coarse sandy loam, 30 to 60 percent slopes.
Payette coarse sandy loam, 30 to 60 percent slopes.
Payette very stony coarse sandy loam, 30 to 60 percent slopes (in PgF).
Payette extremely stony coarse sandy loam, 30 to 60 percent slopes (in PpF).
Perla extremely stony loam, 30 to 60 percent slopes (PnF, and in PpF).

These soils are highly erodible, and the vegetation may be severely damaged by excessive trampling or trailing. Normally, this site supports good stands of bluebunch wheatgrass, Indian ricegrass, Sandberg bluegrass, and needle-and-thread. Other less dominant grasses are squirreltail and red three-awn. Red three-awn is an aggressive increaser. The principal forbs and shrubs are Wild' buckwheat, mallow, big sagebrush, and rabbitbrush. Overgrazing causes big sagebrush, rabbitbrush, and annual weeds and grasses to increase rapidly.

GRANITIC SOUTH SLOPE-CHESTNUT RANGE SITE

This site consists of dark-colored rocky sandy loams on steep or very steep south-facing slopes south of Montour, near Crown Point. The annual precipitation is 13 to 16 inches. The soils are

Rainey rocky sandy loam, 30 to 60 percent slopes.
Rainey rocky sandy loam, 60 to 75 percent slopes.

This site will support good stands of bluebunch wheatgrass, Idaho fescue, beardless wheatgrass, Sandberg bluegrass, Nevada bluegrass, squirreltail, and red three-awn. The dominant forbs and shrubs include yarrow, lupine, balsamroot, fireweed. bitterbrush, big sagebrush, wild rose, and rabbitbrush.

If this site is overgrazed for long periods, Idaho fescue and wheatgrasses decrease and less desirable grasses, weeds, and shrubs increase. Improvement in the condition of the range is indicated by a bunchy, vigorous growth of Idaho fescue or wheatgrasses.

SHALLOW SOUTH SLOPE-BROWN RANGE SITE

This site consists of very shallow or shallow, extremely rocky and stony loams that are on steep south-facing slopes. The annual precipitation is 11 to 13 inches. Outcrops of rock are numerous. The soils are

Bakeoven extremely rocky loam, 30 to 60 percent slopes (in BaF).
Bakeoven very stony loam, 30 to 60 percent slopes (in GsF).
Bakeoven extremely stony loam, 30 to 60 percent slopes (in GnF, and in LxF).
Lickskillet extremely rocky loam, 30 to 60 percent slopes (in BaF).
Lickskillet extremely stony loam, 30 to 60 percent slopes (in LxF).
Lickskillet stony loam, 30 to 60 percent slopes.

Bluebunch wheatgrass was dominant in the native vegetation. Other grasses were needlegrasses, Sandberg bluegrass, squirreltail, Nevada bluegrass, and red three-awn. Yarrow, lupine, wild buckwheat, penstemon, bitterbrush, and sagebrush grow on this site. If management is poor,

big sagebrush, rabbitbrush, and annual weeds and grasses increase rapidly, and Medusahead wildrye invades.

WET MEADOW RANGE SITE

This site consists of one land type, Wet alluvial land. The soils are poorly drained or very poorly drained and occupy basins and swales, mostly on the flood plains of the Payette River and along Squaw Creek. The water table is at or near the surface much of the year, and some areas are very shallow permanent ponds. These soils are too wet for cultivation.

The vegetation consists of rushes, sedges, cattails, and watercress. Forage yields can be increased by seeding orchardgrass, reed canarygrass, and legumes in the native vegetation, especially on the drier areas.

Practices for rangeland

Following are some practices that are applicable to the rangelands in the Gem County Area.

Rotation-deferred grazing.-In this system, range units are rested at planned intervals throughout the growing season. In each successive year, a range unit is rested at a different time than in the previous year, in order to permit all of the important forage plants to develop fully and to produce seed every second, third, or fourth year.

Rotation-deferred grazing (1) keeps desirable species vigorous and productive, (2) helps establish desirable species through the development of a seed crop prior to grazing, (3) encourages seedling survival, (4) allows efficient and orderly grazing of the Forage crop, (5) maintains top forage production, and (6) permits earlier grazing than the year-long system. A rotation-deferred grazing system can be established by setting up two grazing units that have nearly equal production if grazed during the summer season, and three or more units that have nearly equal production if grazed during the spring and fall seasons or during the spring, summer, and fall seasons.

Proper grazing use.-Sound grazing management is based on the intensity of use that will maintain the most desirable vegetation on a site, or that will improve the amount and the quality of the vegetation on a site that has deteriorated.

Livestock should not be put on the range until the soil is dry and firm; otherwise, forage plants will be damaged and the soil will be puddled trampling. The new growth of grasses should be well esta-blished before livestock are allowed to graze.

On some range sites that are at low elevations, forage plants may be ready for grazing as early as April 1 to May 30; Whereas on sites at high elevations, the earliest date may be as late as June 1 to July 30. On some sites, such as the Clay-Brown site, the soils are slow to dry and cannot be grazed without. damage to the soil or plants until about 2 to 3 Weeks after adjacent sites are ready for use. Soils developed from granitic materials generally are loose and are much more susceptible to damage by trampling than other soils in the Area.

To avoid uneven grazing, watering places need to be well spaced over the entire pasture, so that livestock will not have to walk too far. The number of watering places needed will vary somewhat because of differences in range sites. For example, if the movement of livestock is impeded by areas of broken topography, watering places need to be spaced more closely. The use of steep or rough areas or wet sites generally can be increased by building stock trails. Salting is needed in some places to distribute grazing. The salt can be moved from time to time.

Control o f brush and weeds.-Control of brush and weeds generally is necessary if the grass cover is to improve greatly in a relatively short time, and it is particularly important if the range is seeded. If mechanical or chemical method of control is used, enough plant litter should be left on the surface to prevent erosion and to provide food and cover for wildlife. A good way to control weeds is to allow the natural succession of native plants to crowd out undesirable plants.

Range seeding.-Seeding perennial grasses or legumes on rangeland helps to restore a range that is in poor condition and to establish forage plants on soils that have been converted to range. Seeding increases forage yields more quickly than natural revegetation. Grasses and legumes suitable for the particular site should be used.

Estimated yields of herbage

Production of herbage in the Gem County Area varies greatly because of the wide variations in climate and soils. As a result, most operators have a supplemental feed and forage program that provides for good reserves of range forage, concentrates, hay pasture, and tame pasture. Deferred grazing, light grazing, and storage of hay and silage help to maintain the feed reserve.

Table 3 gives estimated yields of herbage for favorable and unfavorable years if the range is in excellent condition. Favorable years are those in which the precipitation is at or near the maximum and other growing conditions are favorable. In such years, forage production will be near the maximum for the site. Unfavorable years are

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those in which precipitation is at or near the minimum and other growing conditions are unfavorable. In such years forage production will be near the minimum for the site. Total yield of herbage is based on air-dry weight. Average herbage production figures shown for the respective sites are based on measurements of a limited number of clippings, on knowledge of the site, and on estimates.

Engineering Properties of the Soils

This soil survey report contains information that can be used by engineers to

1. Make soil and land-use studies that will aid in selecting and developing industrial, commercial, residential, and recreational sites.
2. Make preliminary estimates of the soil properties that are important in planning agricultural drainage systems, farm ponds, irrigation systems, dikes, and waterways.
3. Make preliminary evaluations of soil and ground, conditions that will aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of road and highway construction material.
5. Correlate performance of engineering structures with soil mapping units to develop information for overall planning that will be useful in designing structures and in planning certain engineering practices.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

HAROLD W. BIGGERSTAFF and VERL G. KING, SCS, assisted in the preparation of this section.

This report will not eliminate the need for on-site sampling and testing of soils when the design and construction of specific engineering works are being considered. It should be used primarily for planning detailed field investigations to determine the condition of the soil material in place at the proposed site. The information in the report will enable soil engineers to concentrate on the most suitable soils, to take fewer soil samples, and to make an adequate investigation at minimum cost.

Some of the terms used by soil scientists may not be familiar to engineers, and some words--for example, *soil, clay, silt,* and *sand* may have special meanings in soil science. These terms are defined in the Glossary at the back of this report.

Engineering classification systems

Three systems of classifying soils are used in this report-the classification used by the U.S. Department of Agriculture and the two systems that are in general use among engineers.

The system of soil classification used by the U.S. Department of Agriculture is based partly on the texture of the soil. In some ways it is comparable to the two systems used by engineers.

The American Association of State Highway Officials has developed a classification based on the field performance of soils (1). In this system, classification is based on the gradation, liquid limit, and plasticity index of the soil. The performance of materials for highway con-

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struction has been related to this system of classification. All soil materials are classified in seven principal groups. The groups range from A-1 (gravelly soils of high bearing capacity, the best soils for subgrades) to A-7 (clayey soils having low strength when wet, the poorest soils for subgrades). Within each group, the relative engineering value of the soil material is indicated by a group index number. Group indexes range from 0 for the best materials to 20 for the poorest. The group index number is shown in parentheses after the soil group symbol.

Some engineers prefer to use the Unified soil classification system established by the Waterways Experiment Station, Corps of Engineers (18). This system is based on identification of soils according to their texture and plasticity and their performance as engineering construction materials. Soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic. In the Unified system, the symbols SM and SC represent sands with fines of silt and clay; ML and CL, silts and clays of low liquid limit; and GP and GM, gravels and gravel-sand mixtures. Some soil materials have characteristics that are borderline between the major classes and are given a borderline classification, such as CL-CH.

Engineering test data

Soil samples from 13 of the principal soil series of the Gem County Area have been tested by standard AASHO procedures to help evaluate the soils for engineering purposes. The results of these tests are given in table 4.

The engineering soil classifications in table 4 are based on data obtained by mechanical analysis and by tests to determine liquid limits and plastic limits. Mechanical analysis was made according to the AASHO procedure. The results frequently differ somewhat from results that would have been obtained by the USDA procedure. In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the USDA procedure, the material less than 2 millimeters in diameter is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data in table 4 are not suitable for use in naming USDA textural classes of soils.

The liquid limit and plastic limit tests measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a solid to a semisolid or plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a solid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition. Some silty and sandy soils are nonplastic; that is, they will not become plastic at any moisture content.

Table 4 also gives compaction, or moisture-density, data for the tested soils. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material will increase until the optimum moisture content is reached. After that the density decreases -with increase in moisture content. The highest dry density obtained in the compaction test is termed maximum dry density. Moisture-density data are important in earthwork. Optimum stability is obtained at the maximum dry density.

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Engineering interpretations of the soils

Table 5 gives grief descriptions of the soils and their sites. It also gives the USDA textural classification and estimates of the Unified classification and the AASHO classification. In addition., grain-size distribution, permeability, available water capacity, reaction, aggregate stability, and shrink-swell potential are estimated. More detailed descriptions of the soils are given in the section "Descriptions of the Soils."

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The column showing reaction gives the intensity of the acidity or alkalinity of the soil, expressed in pH value. A notation of pH 7.0 is neutral; a value lower than this indicates acidity, and a higher value indicates alkalinity.

The ratings in the column showing aggregate stability indicate the extent to which soil structure breaks down when water is applied. An easily dispersed soil seals over and resists penetration by water, roots, and air, and it is readily eroded by wind and water.

The ratings in the column showing shrink-swell potential indicate volume change, that is, the shrinking of the soil when it dries and swelling of the soil as it takes up

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moisture. Soils that have a high shrink-swell potential are not suitable sites for concrete structures.

In table 6 are estimates of the suitability of the soils as sources of topping or fill material and of their suitability as locations for roads, farm ponds, waterways, and sewage disposal fields. It gives the characteristics that affect the suitability of the soils for drainage or irrigation, and ratings of their in-place compressibility, compactibility, piping hazard, and shear strength.

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Roads constructed on the bottom lands should be built so that the finished grade is above flood level.

In the Gem County Area, there are a number of sand or gravel pits that are used commercially, and river deposits and rock from outcrops are crushed and used for construction materials. Table 6 indicates the soils that are probable sources of sand and gravel.

The suitability of said material for road fill depends mainly on the texture of the soil material and its natural water content. Highly plastic soil materials with high natural content of water are rated *poor*. Highly erodible soils (silts and fine sands) are difficult to compact, require moderately gentle slopes and fast vegetative cover, and are therefore rated as *fair*.

Frost heaving affects road location. The rating of a soil as to susceptibility to frost heaving depends on the texture of the soil material and the depth to the water table during the freezing period. Silts and fine sands that have a high water table are particularly susceptible to frost heavings.

Sewage disposal

Adequate sewage disposal becomes more important as urban development increases. Faulty and nonfunctioning systems may become a health hazard to a community. To ensure proper sewage disposal, the systems should 'be designed for the specific soil conditions of the site.

Soil factors that affect the functioning of septic tank filter fields are permeability ; ground-water level ; depth to rock, sand, or gravel; slope; and distance to streams or other bodies of water (2).

Soils should be moderately to rapidly permeable and should have a percolation rate of at least 1 inch per hour. If there is any doubt about the absorptive rate, a percolation test should be made.

During the wettest part of the year, the ground-water level should be at least 4 feet below the surface for the proper operation of a subsurface-tile filter field and 4 feet below the pit floor for a seepage pit.

The depth to rock formations or other impervious layers should be more than 4 feet below the bottom of the trench, the seepage-bed floor, or the pit floor.

Slopes of less than 10 percent generally do not create serious problems in either the construction or the maintenance of filter fields, provided the soils are otherwise suitable. On steeper slopes, trench filter fields are more difficult to lay out and construct, and seepage beds are impractical. If there is a layer of rock or other impervious material near the surface on a steep slope, the lateral flow of effluent to the surface is likely to be a serious problem.

The distance to streams or other bodies of water should be at least 50 feet. Bottom lands that are subject to flooding are not suitable for filter fields.

Differences in the type of soils within a filter field are important only if the soils differ greatly in absorptive ability. If they do, percolation tests should be run for the entire field.

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Listed in table 6 are the major features of each soil that affect its performance in sewage filter fields.

Formation and Classification of the Soils

This section discusses the factors of soil formation and their effect on the soils in the Gem County Area. In addition, it discusses the classification of the soils by order and great soil group, and it gives laboratory data for some representative soils.

Factors of Soil Formation

Five factors-time, parent material, climate, living organisms, and topography-influence soil formation (16). The relative importance of the factors varies from one soil to another, and in some cases one factor may dominate in the formation of a soil and fix most of its properties. A very young soil, for example, shows little influence from climate or vegetation; its characteristics are very much like those of its parent material. In time, weathering and the interaction of the other factors will decrease the relative importance of the parent material.

Soils that developed from different kinds of parent materials may have similar characteristics if they are weathered enough and if they have similar climate, vegetation, and topography.

Commonly, soil-forming factors interact with one another. Topography, for instance, influences the microclimate; changes in climate cause charges in the kind and amount of vegetation; so topography, climate, and vegetation may all change together. Different kinds of parent materials weather and erode at different rates and, therefore, tend to form - unlike topographic surfaces. For example, where the Payette River passed through basaltic materials, it cut a fairly narrow valley ; where it entered the unconsolidated sandy material of the Idaho formation, it cut the broad, level Emmett Valley. Even small side drainageways have eroded the Idaho formation and left steep hills that have narrow tops. Thus, parent material and topography are related. In valleys the nearly level slopes favor a high water table, which in turn favors vegetation consisting of water-tolerant plants.

Time.-The length of time required for a soil to develop depends largely on the other factors of soil formation. Water moving downward through a soil can, within a short timespan, remove the most readily soluble materials from the surface layer. Plants, on the other hand, leave residues on and in the soil. These residues form organic matter, which darkens the uppermost part of the soil. Micro-organisms break down the residues and make the elements available for future plant growth. Hence,

complex chemical reactions take place and chemical and biological balances are established.

Less time generally is required for a soil to develop in humid, warm areas where the vegetation is rank than in dry or cold areas where the vegetation is scant. Also, less time is required if the parent material is coarse textured than if it is fuse textured, other factors being equal.

The length of time that parent materials have remained in place is commonly reflected in the distinctness of the horizons in the soil profile. Generally, older soils show a greater degree of horizon differentiation than younger ones. For example, on the smoother parts of the uplands and on the older stream terraces the soils have developed to maturity. but on the stronger slopes geologic erosion has removed the soil material as fast as it has formed. On flood plains and in areas of local alluvium, periodic deposits of new material have prevented the development of distinct horizons.

The Rainey and Brownlee soils developed from the same kind of parent material. They are associated geographically and are similarly influenced by climate, vegetation, and topography. The principal difference between these soils is their age.

The Rainey soils are in an early stage of formation. Their soil material is still loose and highly erodible and much like the parent material, which weathered from granitic rock. Both the surface layer and the subsoil are coarse sandy loam. Removal of material from the surface soil and accumulation of this material in the subsoil has not progressed very far.

The Brownlee soils are in a more advanced stage of formation than the Rainey soils. Continued weathering has broken down feldspar and other minerals into small particles; thus, the clay content has increased. Water has carried some of the clay from the A horizon to the B horizon. Because of impeded water movement below the B horizon or because of other forces, the clay was deposited in the B horizon. Now, the B2t horizon contains about twice as much clay as the A horizon. At first, the clay coated the sand particles in the B horizon and lined the root channels and pores. Because of the higher clay content in the B2t horizon, the soil swells when wet and shrinks when dry. Cracks form as a result of this swelling and shrinking. Water and clay concentrate in these cracks, which tend to recur in the same places each season. Because of the cracks, the B horizon has blocky and prismatic structure. The clay coatings and the oxidized iron give the B horizon a browner color than that of either the A horizon or the C horizon.

As a result of freezing and thawing, and of wetting and drying, the A horizon of the Brownlee soils has platy and granular structure. Organic matter, which has accumulated from the residue of plants and animals, gives the A horizon a darker, grayer color than that of the other horizons. The C horizon consists of coarse, sandy, weathered parent material similar to the material in the lower part of the Rainey soils.

Parent material.-The soils in the Gem County Area have formed from granitic, basaltic, or rhyolitic parent materials and from alluvial. colluvial, or loessal material of granitic, basaltic, or rhyolitic origin. The younger soils are still very much like their parent materials. The older soils show the influence of climate, living organisms, and topography.

Across the Squaw Creek Valley from the granitic area where the Rainey and Brownlee soils occur, there is an extensive basaltic area. The Gem soils in the basaltic area have about the same colors as the Brownlee soils, but are noticeably different in other ways. For example, the basalt contains less quartz but more ferromagnesium than the granite, and it weathers more slowly than the granite and forms finer particles. Consequently, the Gem soils are more clayey and more shallow than the Brownlee soils, and they contain more stones and outcrops of rock. Movement of clay from the A horizon to the B horizon, in which strong structural aggregates have formed, is evident in the Gem soils. The Gem soils are less erodible than the Brownlee soils because their structure is more stable and they have more clay to bind the soil particles together. They have a higher content of most plant nutrients, so less fertilizer is needed to produce good crops, but they are more difficult to till than the Brownlee soils because of their finer texture.

Rhyolitic materials weather somewhat faster than basaltic materials and produce a soil with characteristics between those of Brownlee soils and Gem soils. The Elmore soils developed from rhyolitic materials in the same climatic zone as the Gem soils. Their mineral content is about the same as that of the Brownlee soils, but their texture is finer, and detached stones are more common. The Elmore soils are deeper than the Gem soils and shallower than the Brownlee soils.

Water-deposited sediments of granitic formations, such as the Idaho, the Payette, and related formations (7, 8), occupy large areas in the Gem County Area and are the parent materials of several soils. These sediments are mostly of granitic origin, so the mineral content of these soils is similar to that of the Brownlee and Rainey soils. Differences between the soils of these two series and the soils that formed inn alluvium result from differences in the other soil-forming factors and from permeable layers in the sedimentary parent materials.

Each of the different kinds of parent material in the Gem County Area is derived from a different geologic formation (7,8). The geologic layers of a large area in southern Idaho and eastern Oregon slope toward an axis near the Snake River; the slope becomes progressively steeper as one moves away from the river. The theory is that the area along the river gradually sank, thereby tilting the strata along the edges of the sinking action. This process has been called the Snake River Downwarp. The Gem County Area is in the outer limits of the sunken area, and it has been strongly affected by it. Nearly all of its geologic formations slope in a southwesterly direction toward the Snake river, and the deepest, or oldest, formations are exposed in the eastern part of the county.

The oldest of the exposed formations is the granitic Idaho batholith, which is believed to have once formed a peneplain over much of southern Idaho, including all of the Gem County Area. Basaltic, rhyolitic, and sandy sedimentary materials covered this old peneplain at the time of the Snake River Downwarp. Figure 9 shows the present position of these materials. Figure 10 shows the present extent of the formations immediately underlying the soils in the Gem County Area.

The first material to cover the granitic peneplain was the lower series of the Columbia River basalt. This series was formed by a number of lava flows that occurred during

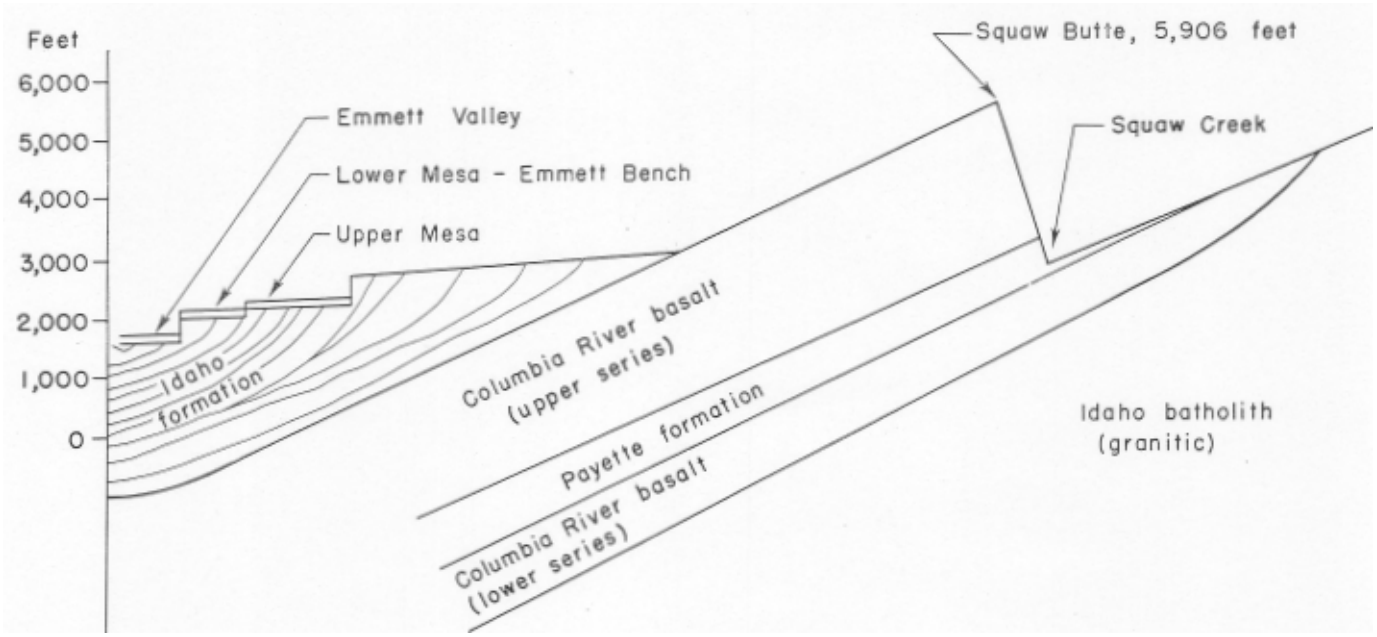

Figure 9.-Schematic sketch showing relative positions of geologic formations in the Gem County Area. In some places a formation was completely eroded away before the next one was deposited.

the Miocene age, after which volcanic activity subsided for a considerable period of time. Parts of the basalt were eroded away, and the Payette formation, which consists of lakebeds and terrestrial material, was deposited. These deposits, mostly of granitic origin, were in all about a thousand feet thick. During the latter part of the Miocene age, the Payette formation was covered by the upper series of the Columbia River basalt, but subsequent tilting and erosion exposed areas of it in the eastern part of the county.

The upper series of the Columbia River basalt reaches most of the length of the Gem County Area. Where it is exposed, almost at the geographic center of the Area. it forms Squaw Butte, the highest point in the area. The steep westerly slope of the lava flows is apparent on the southern end of the butte. The upper series of the basalt has been thinned by erosion, and in some places in the southern part of the Area it has been completely removed. South of Pearl, it is partly covered or replaced by rhyolite. Pearl was an important gold-mining center in the early part of this century because of the numerous geologic contacts in the vicinity.

The Idaho formation overlies the basalt and rhyolite and extends from their borders to the western border of the county. This formation is mostly of granitic origin. The material probably eroded from exposed areas of the Idaho batholith. It is water deposited, and the part that is in Gem County generally is sandy. This formation likely is several thousand feet thick, and its base is well below sea level. At its outer edge, where the lower layers are exposed, the formation slopes steeply downward toward the southwest. Farther in, the slope is progressively less steep.

Sandstone has formed in places where some of the layers of sand have been cemented. The sandy strata are readily eroded by the Payette River and its tributaries; valley floors at three distinct levels (see fig. 9) have been cut by the river. The uppermost of these valley floors is called the Upper Mesa formation. It occurs on gently sloping hilltops north of the Emmett bench, which is the next highest valley floor. The Emmett bench is called the Lower Mesa formation. Below it are the low terraces and river flood plains. Several feet of gravelly material was deposited at each level; later a few feet of sandy or silty material was deposited. and soils formed in this material.

Within the Idaho formation are water-carrying layers that build up artesian pressure beneath the Emmett Valley. Water moves to the surface through fractures in the layers or at the contact places in materials brought in from different directions.

Climate.-Records at the Emmett weather station show an average annual precipitation of 12.4 inches; those at the Tripod Mountain weather station, 20.9 inches; and those at the Ola weather station, 19.3 inches. The Ola station, however, has not been operating long enough that reliable averages can be established. The average annual temperature reported by the Emmett station is 51.4° F. (See table 9 for temperature and precipitation data recorded at the Emmett weather station.)

In general the southwestern part of the county is the driest and warmest, and the northern part is the wettest and coldest. The valleys are considerably drier and warmer than the adjacent hills. Precipitation is greatest in winter, when it occurs mostly as snow. Stunners are relatively dry. The prevailing winds are from west to east.

Each kind of parent material in the Gem County Area occurs in more than one climatic zone and has given rise to several related soils. The basaltic material, for example, crosses four climatic zones: and the Gem soils, which developed from basaltic material in one zone, have a counterpart in each of the other zones.

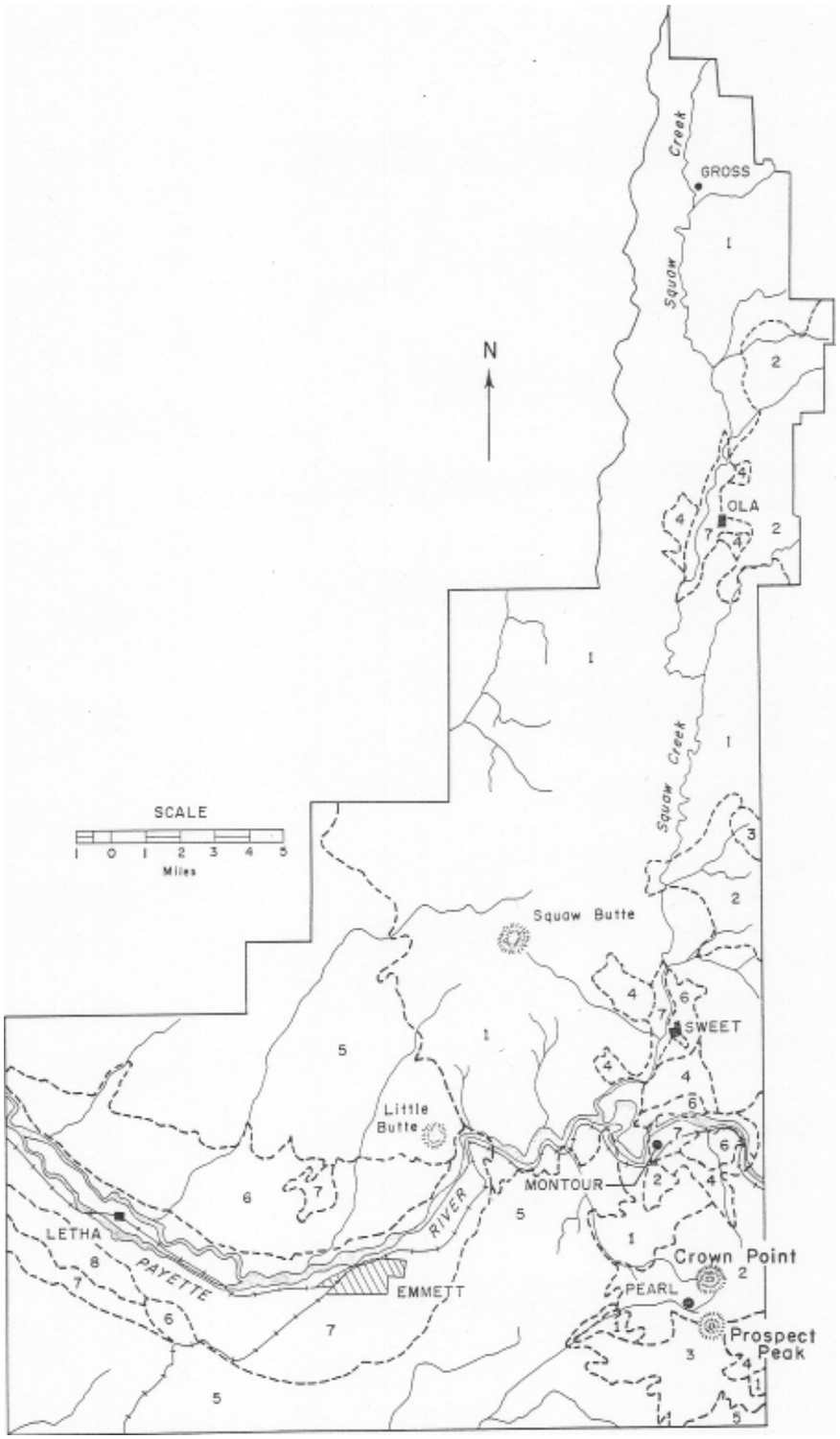

Figure 10.-Geologic formations in the Gem County Area: (1) basaltic material; (2) granitic or coarse-grained acid igneous rock; (3) rhyolitic material; (4) Payette for mation; (5) Idaho formation and Upper Mesa formation; (6) old alluvium (Lower Mesa formation); (7) recent alluvium; (8) lacustrine material.

The Mehlhorn soils are in a climatic zone of lower temperatures than that of the Gem soils, and their development was slower. Consequently, the Mehlhorn soils are less clayey than the Gem soils. The annual rainfall of 16 to 23 inches in this zone is enough to leach the lime, whereas an accumulation of lime is common in the lower part of the Gem soils.

The Lickskillet soils developed from basaltic material in the climatic zone that is next driest to that in which the Gem soils developed. In this zone the annual precipitation ranges from 11 to 13 inches, and the average annual temperature in near 50° F. The low precipitation slows the soil-forming processes. The Lickskillet soils are dry in summer and early in fall. They are not so deep as the Gem soils and generally not so clayey. Because vegetation is less abundant, the surface layer of the Lickskillet soils is not so dark colored, so granular, or so thick as that of soils in the higher rainfall zones, and the organic-matter content is not so high. Lime is common at a lesser depth (18 to 24 inches) in Lickskillet soils than in Gem soils.

The basaltic material does not extend into the driest climatic zone in the Gem County Area, where the annual precipitation is about 9 to 11 inches. In this zone the soils most nearly comparable to the Gem soils are the Lanktree soils. The moisture limitation on soil formation is more severe here than in areas where the Lickskillet soils occur, but the easily weathered parent material has permitted a fairly deep soil to develop. The Lanktree soils are lower in organic-matter content than either the Gem or the Lickskillet soils; they have less plant cover and are shallower to lime, which occurs at a depth of 15 to 22 inches. In the Lanktree soils, the surface layer is dark colored to a depth of less than one inch, and its granular structure is weakly developed.

Living organisms.-Plant and animal life play a vital part in soil formation. The kind and amount of vegetation that grow on a soil over a long period of time strongly influence the kind, amount, anti position of organic matter in the soil. Bunchgrasses dominated in the native plant cover throughout most of the Gem County Area. Because the fine grass roots penetrated the soil, organic matter is fairly well distributed throughout the A horizon. Decomposed grass roots tend to darken the surface layer and to give it a granular structure. The extent of the influence of plant and animal life on soil formation depends on grass growth, which in turn depends largely on climate. The greasewood vegetation on some alkali soils absorbs sodium from the lower part of the soil and deposits it on the surface when the leaves fall; thus, the alkali problem is increased.

Soils of the Mountainview series consist mostly of organic matter--the remains of cattails, reeds, and sedges. Such soils hold more water than do mineral soils. They are light in weight, and they will burn.

The tap roots of such deep-rooted plants as sagebrush and alfalfa open channels in soils that might otherwise have a slowly permeable subsoil. Some animal activityburrowing by earthworms, rodents, and some insects, for example-also opens channels. Badgers churn the soil and mix the A and the B horizons.

Using the soil for agriculture can cause considerable change. For example, the vegetation is changed; the upper horizons are mixed together to plow depth; and a tight subsoil is ripped to increase permeability. An artificial climate may be produced by irrigation. In some places, areas of soil are physically moved from one place to another by leveling. The cropping system and other management practices largely determine whether or not a favorable organic-matter content will be maintained over a long period. When cultivated, soils that have a high organic-matter content commonly lose part of their organic matter.

Animals grazing on wet rangeland can destroy the surface structure of the soil. Overgrazing can destroy part of the plant cover and expose the soil to erosion.

Topography.-Topography influences soil formation mostly through its effect on microclimate. On southerly slopes, the microclimate is hotter and drier than that in level areas or on gentle slopes, and maximum evaporation takes place because the soils are exposed to the sun during the warmest part of the day. On steep northerly slopes, the microclimate is cooler and evaporation is less. Thus, precipitation is used more effectively on northerly slopes. soils on northerly slopes generally are not in the same great soil group as soils on southerly slopes.

Water erosion is more severe in sloping areas than in level or nearly level ones, and soil slips, which expose fresh surfaces and thus keep the soils young, are more likely to occur on steep slopes. The steep south-facing phases of the Lanktree and Lolalita soils have been affected by such factors. The geologic erosion that formed the Emmett Valley and the nearby hills occurred long enough ago that the Lanktree soils have accumulated considerable clay in their B horizon and have developed moderate prismatic and blocky structure. The very young Lolalita soils occur where more recent erosion or landslides have left younger surfaces. At the foot of slopes, colluvial and alluvial fans have built up. In the process of being transported and deposited, the soil materials are sorted so that most of the larger and heavier particles are deposited near their source on the upper and steeper part of the slope. The finer particles are carried farther out to where the slope is more gentle and water movement is slower. Consequently, the alluvial fans have a broadly concave surface and the soils on these fans have a gradation of textures, as in the Wasatch, Cashmere, Harpt, and Bissell soils.

The coarse-textured Wasatch soils occur at the top of the alluvial fans and generally have moderate slopes. The moderately coarse textured Cashmere soils are adjacent to the Wasatch soils and are gently to moderately sloping. Next are the moderately coarse textured to medium-textured Harpt soils, which are mostly gently sloping. The medium-textured to moderately fine textured Bissell soils are at the toe of the fans and are level to gently sloping. The Wasatch, Cashmere, and Harpt soils have little development because they receive new material periodically. The Bissell soils, which are at the toe of fans, seldom receive new material. Consequently, they have developed a Bt horizon.

In the level to gently undulating Emmett Valley floor, surface drainage is so slow in places that water ponds on the surface until it either penetrates the soil or evaporates. Artesian pressure in the underlying formations acids more water to the surface instead of allowing the excess to drain away. Lateral drainage through the gravelly material beneath the soil is too slow to carry

away all of the water. When enough water accumulates, a water table forms. The water pushes air out of the lower part of the soil, thereby producing a low-oxygen (anaerobic) condition. Iron oxides and other reduced compounds accumulate in the wet part of the soil and cause mottling and gleying. The roots of most plants die if they extend into the water table. Roots in the moist soil above the water table absorb additional moisture. Thus, plant growth is encouraged, the organic-matter content is increased, and the surface layer is enriched and darkened. An enriched and darkened surface layer may be the only apparent effect that a deep water table has on soils such as the Falk and Draper soils.

If the water table is near the surface, the soil is mottled and gleyed near the surface. If the water table fluctuates, as in the Moulton soils, the mottles are distributed throughout the profile but are not so prominent in any one part. The Moulton soils occur near the river, where the water table rises and falls with the water level of the river.

A water table that is high enough to enable soil moisture to reach the surface by capillary action can cause saline and alkali conditions. The water moving upward through the soil carries various dissolved salts with it. When the water evaporates, the salts are left on the surface. In semiarid areas, rainfall often is insufficient to wash the salts out of the soil, so they accumulate and make the soil saline. In the many areas where the salts move upward during the dry summer and downward during the moist winter, sodium compounds are likely to accumulate in amounts sufficient to make the soil alkaline. If a soil contains a large amount of salt and more than 15 percent of the exchangeable cations are sodium, it is described as saline-alkali (1-7). Saline spots, alkali spots, and saline-alkali spots occur in the Baldock, Bramwell, Letha, and Lahontan soils (4).

In some soils--the Chance soils, for example--the water table is high enough to keep the soils moist to the surface. Consequently, the salts remain in solution, and the soils do not develop saline or alkaline spots. Such soils are mottled and gleyed up to the surface. The vegetation consists of rushes, sedges, cattails, reeds, and other plants that grow well under wet conditions. The plant remains fall on the wet surface and decompose very slowly. Over a long period of time, soils that are high in organic-matter content, such as the Black Canyon, Catherine, and Bowman soils, form. If the plant remains make up more than 30 percent of the soil material, the soil is classed as an organic soil. If the plant remains are sufficiently fresh and intact to permit identification, the material is called peat. If, on the other hand, decomposition has made recognition of the plant remains impossible. the material is called muck. The Mountainview series includes both peat and muck.

Classification of the Soils

The soil classification system used in the United States consists of six categories that are progressively more inclusive. Beginning with the most inclusive, these categories are the order, the suborder, the great soil group, the family, the series, and the type. There are three orders and thousands of types. The suborder and family categories have never been fully developed and consequently have been little used. Attention has been concentrated on the classification of soils into types and series within comities or comparable areas and on the subsequent grouping of series into great soil groups and orders.

The zonal order is represented in the Gem County Area by the Sierozem, Brown, Chestnut, and Prairie (Brunizem) great soil groups; the intrazonal order by the Bog, Calcium Carbonate Solouchak, Grumusol, Humic Gley, Planosol (gleyless), and Solodized Solonetz groups; and the azonal order by the Alluvial and Regosol groups. All of these great soil groups, and the three orders, are discussed in the pages that follow. Also, the characteristics of the soils in each great soil group are described.

All of the soil series of the Gem County Area are listed, by great soil groups, in table 7, and some of the distinguishing characteristics of each series are given.

Zonal order

The zonal order is made up of well-developed soils that reflect the dominant influence of climate and vegetation. All zonal soils have accumulated enough clay in their subsoil to have a Bt horizon, or they have a B horizon that has been formed in other ways. If the nature of the climate and native vegetation are known, several other characteristics of the soils can be estimated, including the kind and sequence of soil horizons; the thickness, color, and organic-matter content of the surface layer; and the depth to or absence of a lime horizon. Zonal soils are the typical soils of their zone-the kind that can be expected to form in a reasonable length of time from most parent materials where the topography is gently undulating. About three-fourths of the soils in the Gem County Area are zonal soils.

Sierozem great soil group (15).-Soils of this great soil group occur in the western part of the Gem County Area, group the annual precipitation ranges from 9 to 11 inches. The native vegetation consisted of bluebunch wheatgrass, Sandberg bluegrass, other bunchgrasses, big sagebrush, and forbe. The parent materials are mostly alluvium and sediments from granitic formations. Some of the soils appear to have formed partly in a mantle of loess. The Power, Purdam, Chilcott, Lanktree, Vickery, and Wardwell soils are in this great soil group.

The Power soils are typical of the Sierozem soils in the Gem County Area. An undisturbed Power soil has a very thin (1/2 inch or less) A1 horizon that is dark grayish brown or grayish brown when dry and has weak, very fine, granular structure. The A2 horizon is 5 to 10 inches thick. It is light brownish gray when dry and dark grayish brown when moist; it has very weak, very fine, granular structure, or it is platy in the uppermost few inches. The upper part commonly is vesicular. In virgin areas, the A2 horizon contains about 0.6 to 1.2 percent organic matter; it has a base saturation of 80 to 100 percent, and it is nearly neutral in reaction. The B2t horizon contains about 1.5 to 2.2 times as much clay as the A horizon. It has weak or moderate, prismatic structure and strong or moderate. subangular blocky structure. Thin or medium, nearly continuous clay films are present. The base saturation is 80 to 100 percent and the reaction is mildly alkaline or moderately alkaline. Depth to calcareous material ranges from 15 to 21 inches. The ca horizon has strong or moderate accumulation of calcium carbonate and is moderately alkaline.

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All tables have been updated and are available as a separate document.

The Purdam soils are similar to the Power soils, but they have a hardpan that is weakly cemented by silica and calcium carbonate. In places the-hardpan formed where downward moving water encountered a sandier layer, which slowed the capillary movement of the water. As the water evaporated, the dissolved material that remained formed the hardpan. Water accumulates above the hardpan, and plant roots may selectively absorb and use the water but leave silica and calcium carbonate to further cement the hardpan. In places the hardpan may be part of a buried soil.

Soils in the Chilcott series occur on the older land surfaces in the Gem County Area. They have a strong, clayey B2t horizon and a silica. calcium carbonate indurated or strongly cemented hardpan.

The Lanktree soils have a strong B2t horizon but no hardpan.

The Vickery soils have a very weak Bt horizon over a silica-calcium carbonate indurated or strongly cemented hardpan. The Bt horizon is probably very weak because of churning by badgers or rodents.

The Wardwell soils have a moderately deep or deep water table. They have a medial to minimal, medium-textured or moderately fine textured B2t horizon that contains less than 15 percent exchangeable sodium. The soil material is mottled above a depth of 40 inches.

Brown great soil group.-Soils of this great soil group make up a part: of the Haw-Payette-Van Dusen soil association, the Lickskillet-Bakeoven soil association, and the Sweet-Kepler soil association. In the areas covered by these associations, the annual precipitation ranges from about 11 to 13 inches. The native vegetation was similar to that on soils in the Sierozem great soil group, but the grasses were thicker and more luxuriant. The parent ma-

terials include basalt, rhyolite, granitic formations, and alluvium. The Brown soils have an A1 or Ap horizon that is darker, thicker, more granular, and higher in organic-matter content. (about 1.2 to 2.2 percent) than that of the Sierozems. The Haw, Bissell, Payette, Perla, Sweet, Bakeoven, and Lickskillet soils are in this great soil group.

The Haw soils are typical Brown soils in the Gem County Area. Their parent material is the deep, sandy material of the Idaho and the Payette formations. Because water moves readily through them, the Haw soils have a somewhat thicker solum than the Brown soils that formed over hard bedrock. Their 6- to 10-inch A1 or Ap horizon is grayish brown when dry and very dark grayish brown wheat moist. It contains 1.2 to 2.2 percent organic matter; it has weak to moderate, granular structure; it is slightly acid or neutral in reaction; and it has a base saturation of 60 to 90 percent. The medial B2t horizon is moderately fine textured and contains 1.5 to 2 times as much clay as the Al or Ap horizon. It has moderate, prismatic structure and weak or moderate, subangular blocky structure, and there are thin or medium, nearly continuous clay films on the peds. Its base saturation is 70 to 80 percent. At a depth of 25 to 40 inches, there is a slight accumulation of calcium carbonate.

The Bissell soils are somewhat younger than the Haw soils, having formed in recent mixed alluvium. Their B2t horizon lies weaker structure and contains less clay than that of the Haw soils. The clay coatings are thin.

The Payette soils have steep or hilly slopes on which geologic erosion has been rapid. They have the sandiest texture and the weakest horizonation of any of the Brown soils. Barely enough clay lies accumulated to form a textural B horizon. The structural development is weak throughout, and the clay coatings on the peels are thin and patchy.

The Perle soils, which formed in residuum from rhyolitic bedrock, are the most strongly developed of the soils in the Brown great soil group. They generally are noncalcareous, probably because of the low calcium content of the parent material; however, the pH of the lower part of the subsoil commonly is about 7.0 or above. The B2t horizon has strong, prismatic structure and thick, continuous clay coatings on the peds. There is a weak accumulation of calcium carbonate in the lower part of some profiles, in cracks in the bedrock, and under rock fragments.

The Sweet soils differ from the Haw soils and the Bissell soils in having a hardpan very weakly to moderately cemented with silica and calcium carbonate.

Chestnut great soil group.-Soils of this great soil group occur principally in the Gem-Newell soil association, where the annual precipitation is about 13 to 16 inches. The native vegetation consisted mostly of bluebunch wheatgrass, Idaho fescue, and other bunchgrasses, but it included a variety of forbs and some shrubs, including big sagebrush and bitterbrush. The parent materials included basalt. rhyolite, granite, and alluvium. The A1 horizon is darker colored than that of either the Brown soils or the Sierozems. The A horizon has a moderate organic-matter content (mostly between 2 and 3 percent). The Elmore, Gem, Montour, Newell, Rainey, Squaw, and Salisbury soils are members of the Chestnut great soil group.

The Gem soils are typical Chestnut soils in the Gem County Area. Their 11 horizon has moderately developed granular structure. Their 4- to 10-inch A horizon is dark grayish brown when dry and very dark brown when moist. It is slightly acid and lies a base saturation near 70 percent; its organic-matter content generally is between 2 and 3 percent. The BA horizon contains from 50 to 100 percent more clay than the A1 horizon and has moderately thick clay coatings on the prismatic and blocky pods. The prismatic structure is moderate, and the blocky structure is moderate to strong. Base saturation in the B2t horizon is about 70 to 90 percent; the reaction is nearly neutral. The Gem soils are 1.5 to 3.5 feet thick over basaltic bedrock. Soil formation has kept pace with the weathering processes, so the shallower soils have no C horizon, and the deeper soils may or may not have a C horizon. Generally, the shallow soils have a B3ca horizon about 1 inch thick, and the deeper soils have a B3ca as much as 6 inches thick. This horizon has a base saturation of more than 85 percent and a mildly alkaline reaction. Most of the Gem soils are extremely stony. The basaltic stones weather very slowly and persist for a long tune on and in the soils.

The Elmore soils are like the Gem soils, except that they formed in residuum from rhyolitic bedrock. They are generally noncalcareous.

The Montour soils developed in weakly consolidated sediments from granitic formations. They are finer textured than the underlying formation and the other soils that formed from the granitic sediments. The finer texture may be due to weathering or to volcanic ash or tuff in the parent material. Because of their fine texture, the Montour soils are transitional to Grumusols. They crack during the dry season. Their subsoil contains more clay than their surface layer, and it has either slickensides or clay coatings. A ca horizon is in the upper part. of the underlying sandy material.

The Newell soils developed mostly from basaltic alluvium on terraces and alluvial fans. Their A horizon is dark colored ; their BA horizon is moderately fine textured and has weak to moderate structure and medium to thick clay coatings. Their ca horizon is at a depth of 30 to 55 inches. These soils may receive some runoff from steeper slopes.

The Rainey soils formed in residuum from coarsegrained, intrusive, acid, igneous rock. Their slopes are mostly moderately steep to very steep, except on ridgetops. The Al horizon has weak, fine and very fine, granular structure. It is slightly acid. and its organic-matter content is moderate (probably between 2 and 3 percent.) The AC and C1 horizons may have some thin, patchy, clay coatings around sand grains, in pores, and in root channels, but evidently they have none on the peel surfaces. In many places the AC or C horizons have one or a few, very thin (1/16 inch), horizontal, wavy, continuous, darker and brighter colored bands or lamellae that contain more clay and iron oxides than the other parts of these horizons.

The AC and C horizons have weak, blocky structure or are structureless (massive) ; they are nearly neutral in reaction. More or less disintegrated and weathered, granitic bedrock is below the C horizon. Water moves readily through Rainey soils, and calcium carbonate or salt accumulations are not evident in the profile.

The Squaw soils formed in basaltic local alluvium and colluvium but are younger than the other soils formed in basaltic material. They have weak structure, for the most part; their B2t horizon has thin, patchy clay coatings.

The Squaw soils are nonstony to extremely stony and are underlain by material that contains basaltic stones, cobblestones, or gravel.

The Salisbury soils have a strong clay B2t horizon over an indurated hardpan. The hardpan probably is cemented with silica and possibly some iron, and in most places it is noncalcareous in the upper part. The Salisbury soils are somewhat transitional to gley less Planosols.

Prairie (Brunizem) great soil group.-Soils of this great soil group have a dark colored or very dark colored A1 horizon that is high in organic-matter content. In the Gem County Area, Prairie (Brunizein) soils are dominant in the Gwin-Mehlhorn-Jacknife and the Brownlee-Rainey-O1a soil associations. They also occur on some steep northerly slopes, interspersed with Chestnut or Brown soils. The annual precipitation in most areas where they occur is about 18 to 23 inches. These soils developed from basaltic, granitic, or alluvial materials. The native vegetation consisted of bluegrass, Idaho fescue, bluebunch wheatgrass, other bunchgrasses, forbs, bitterbrush, and other shrubs. The Brownlee, De Masters, Gross, Gwin, Jacknife, Mehlhorn, Odermott, Ola, and Van Dusen series represent the Prairie (Brunizem) great soil group in the Gem County Area.

Soils in the Brownlee series are typical Prairie (Brunizem) soils. They formed in residuum weathered from granitic bedrock and contain considerable coarse sand, very coarse sand, very fine quartz gravel, and mica. The A horizon is 9 to 16 inches thick and is about 12 to 20 percent clay. It is dark grayish brown when dry and very dark brown or darker colored when moist, and it has weak or moderate, granular structure but may have weak, platy structure in the uppermost few inches. It is slightly acid or medium acid, and its base saturation is about 70 to 85 percent. The organic-matter content is about 3 to 3.5 percent. The B2t horizon contains about 60 to 100 percent more clay than the A1 horizon. It has weak, prismatic structure and weak or moderate, subangular blocky structure and medium or thick, continuous clay films. It is medium acid, and its base saturation is 42 to 77 percent. The C horizon consists of decomposed granitic material that is high in quartz and mica. The Brownlee soils lack a ca horizon mainly because rainfall penetrates the soil and leaches any calcium carbonate that is present. Weathered granitic rock is at a depth of 36 to 65 inches. Stones are scarce in these soils because the rock disintegrates readily.

The De Masters soils formed in residuum from basaltic bedrock on steep and very steep northerly slopes. They commonly have an 01 horizon, derived mostly from shrubby vegetation, and a very dark colored A1 horizon. The structure of the B2t horizon is weak or very weak, and textural development is minimal.

The Gwin soils resemble the Mehlhorn soils, but they are shallower to basaltic bedrock (5 to 20 inches), and their B2t horizon is either immediately above bedrock or in cracks in the bedrock.

The Jacknife soils are very deep soils that developed from basaltic material on alluvial and colluvial fans. They have a strong to moderate textural and structural B2t horizon but lack a ca horizon.

The Mehlhorn soils formed in residuum weathered from basaltic bedrock. Their B2t horizon has moderate textural and structural development. The clay coatings in the B2t horizon are thick and continuous. These soils are mostly stony or extremely stony. They differ from the Gem soils in' having no accumulation of calcium carbonate and in having more organic matter in their A1 horizon. Their Bt horizon has slightly weaker textural and structural development than the Bt horizon of Gem soils, and their A horizon commonly is thicker.

The Odermott soils developed from sandy sediments from granitic formations. They have stronger structural development than the other Prairie soils in the area, and they have a greater accumulation of clay. The clay coatings on the peds are medium and continuous throughout most of the B2t horizon.

The Ola soils resemble the Rainey soils, except for some characteristics that result from the cooler temperatures on the steep northerly slopes. The Ola soils are darker colored than the Rainey soils, and they are higher in organic-matter content. They are slightly acid throughout and generally are several inches thicker than the Rainey soils. They have granular structure to a greater depth than do the Rainey soils, and their structure is moderate.

Gross soils formed in residuum from basaltic bedrock on steep northerly slopes. These soils have an 8- to 12 inch A1 horizon that has moderate, granular structure. This horizon is slightly acid to nearly neutral in reaction, and it is high in organic-matter content. The B2t horizon contains about 1.5 times as much clay as the A1 horizon. It has weak, prismatic structure and moderate, subangular blocky structure. The clay coatings are thin to moderately thick. The horizon is slightly acid to neutral in reaction. The B3t horizon is neutral in reaction. Calcium carbonate has accumulated in the lowest layers in some places where the soils are deepest, and in cracks in the underlying basaltic bedrock, 20 to 50 inches below the soil surface. Loose basaltic stones are common throughout the profile.

The Van Dusen soils occur on steep northerly slopes in areas of granitic formations. Because of the cooler climate and the lower rate of evaporation, these soils are classified as Chernozems. Structural development is weak to moderate, and clay coatings in the B2t horizon are thin.

Intrazonal order

The intrazonal order consists of soils that have soil characteristics that reflect the dominant influence of topography, parent material, or time over the effects of climate and living organisms. Some soils in nearly level or depressed positions are influenced by a high water table. Soils that have clay parent materials develop characteristics resulting from the shrinking and swelling of the clay and therefore are intrazonal. Some soils are intrazonal because an impervious claypan dominates their characteristics and behavior. About one-twelfth of the soils in the Gem County Area are intrazonal soils.

Bog great soil group.-Soils of this great soil group are more than 30 percent organic matter. They developed in wet areas where plant residues accumulate faster than they decompose. The only Bog soils in the Gem County Area are those of the Mountainview series. These soils occur in the Emmett Valley, in marshes where the vegetation consists mostly of cattails, reeds, rushes, sedges, and other water-tolerant plants. They are mostly nearly neutral in reaction.

Calcium Carbonate Solonchak great soil group (9, 11).-This great soil group consists of imperfectly drained soils that formed under the influence of a high or intermittently high water table in nearly level areas or in depressions. The parent material is calcareous, and most of the soils are calcareous throughout. In some places, however, the upper part of the A horizon is free of lime. The lower part or all of the thin to thick A1 horizon may be strongly calcareous, and a strongly or very strongly calcareous horizon is just below the Al horizon. The. lower part of the profile is gleyed. Calcium carbonate apparently is carried to the Cca horizon by capillary rise of ground water.

The Bramwell soils are in the Calcium Carbonate Solonchak great soil group, although they are transitional to the Solonetz and possibly the Sierozem and the Regosol great soil groups. These soils are in the western part of the Emmett Valley, where the annual precipitation is about 9 to 11 inches. The parent material consists of lake-laid, laminated, calcareous, silty sediments. The native vegetation consisted mainly of greasewood, saltgrass, and giant wildrye. The A horizon is a fete inches thick; it is less than 2 percent organic matter and has moderate, thin, platy structure. The Cca horizon generally is at a depth of 10 to 40 inches. The calcium carbonate content of the A horizon is less than 10 percent; that of the C horizon, below the Cca, is about 10 percent; and that of the Cca horizon is about 12 to 20 percent. All horizons are calcareous. Within the C horizon are laminated layers that are very slowly permeable and that cause a, temporary perched water table. The water table has caused a. salinealkali condition. A textural B horizon has not formed, because of the age of the soil and the inhibiting influence of the calcium carbonate on clay formation and movement.

Grumusol great soil group (6, 10).-This great soil group consists of clayey soils that crack when they dry. Generally, a parent material that readily breaks down into fine particles is responsible for the clayey texture. When the soils crack, granular material from the surface layer falls into the lower part; thus, Grunnusols show signs of self swallowing or churning.

The Aikman soils are Grumusols-the only ones in the Gem County Area. They are transitional to Chestnut. They developed from rhyolitic tuff and have a reddish color. The native vegetation consists mainly of bunchgrasses, big sagebrush, and forbs. The A11 horizon is 1 to 3 inches thick. It is nearly neutral in reaction, and it has moderate, fine, granular structure. The A12 and the A13 horizons together extend to a depth of 12 to 22 inches. They have moderate prismatic structure that opens into cracks half an inch to one inch wide when the soils are dry. Granular material from the A11 horizon falls into these cracks. Slickensides on the sides of the prisms result; from pressure that accompanies the swelling of the soils when they again become wet. The self-swallowing A horizon is underlain by a few inches of C horizon, which generally is over a Cca horizon of partially decomposed rhyolitic tuff that has splotches and veins of calcium carbonate.

Humic Gley great soil group (14) .-This great soil group consists of soils that have a thick, black A horizon, high in organic-matter content, over a gray or mottled B or C horizon. Humic Gley soils in the Gem County Area are those in the Black Canyon, Bowman, Catherine, and Roystone series.

Soils in the Bowman series are typical Humic Gley soils. Their A1 or Ap horizon generally is 10 to 15 inches thick. It has moderate granular structure; it is mildly alkaline or moderately alkaline and calcareous; and it has an organic-matter content of 5 to 10 percent. The A1 or Ap horizon is underlain by a gleyed Cg horizon, which has common faint to prominent mottles and which is nearly neutral in reaction. The subsoil has no clay coatings nor evidence of other clay accumulation. Gray, bluish-gray, or greenish layers overlie the gravelly substratum. The highest concentration of calcium carbonate is near the surface.

The Black Canyon soils differ from the Bowman soils in being fine, textured and noncalcareous.

The Catherine soils differ from the Bowman soils in being noncalcareous throughout the profile, probably because of higher annual precipitation.

The Roystone soils developed on bottom lands from mixed alluvium derived from basaltic and acid igneous rock. They are transitional to Chernozems. Natural drainage probably was imperfect or poor, but drainage has been improved by deep channels cut by the main drainageways. However, the soils still receive some seepage water. The A1 horizon is very dark colored and high in organicmatter content. The B2t horizon has moderate structure and thin to moderately thick, continuous coatings of clay. The ca horizon is at a, depth of only 15 to 25 inches.

Planosol (gleyless) great soil group.-The soils of this great soil group have an A2 horizon abruptly overlying a dense, slowly permeable claypan (the B2t horizon). They are old soils, in terms of soil formation, and are past the stage of development of zonal soils. In the Gem County Area, the soils in this great soil group receive from 11 to 13 inches of precipitation annually. The parent materials include sandstone and old river alluvium. The native vegetation consisted of bunchgrasses, dwarf sagebrush, and forbs. Slopes are less than 10 percent; thus, runoff is slow and erosion is not a serious hazard. The Dishner and Kepl.er soils represent this great soil group in the Gem County Area.

The Kepler soils are typical gleyless Planosols. They have a thin Al horizon underlain by a 1- to 4-inch, somewhat bleached, medium-textured A2 horizon that has weak, blocky structure and is nearly neutral in reaction. Abruptly below the A2 horizon is the fine-textured B2t horizon, which has strong, columnar structure, thick coatings of clay, and about 80 percent base saturation. The B2t is nearly neutral in reaction, and it contains more than twice as much clan as the A1 and A2 horizons. Calcium carbonate has accumulated at a depth of about 25 inches. The B3ca horizon has calcium carbonate coatings in the vertical cracks. This horizon is moderately alkaline and has 100 percent base saturation. Below it is a hardpan that is weakly cemented to moderately cemented by silica and calcium carbonate.

The Dishner soils have a very thin A1 horizon. Their stony loam A2 horizon is about 5 inches thick. It overlies the stony clay B2t horizon. These soils lack a ca horizon. They are shallow to sandstone bedrock.

Solodized Solonetz great soil group.-The soils of this great soil group have a nonsaline, nonalkali, noncalcareous A2 horizon over a columnar or prismatic, textural B horizon that in places contains more than 15 percent exchangeable sodium.

The Sebree series represents the Solodized Solonetz great soil group in the Gem County Area. The Sebree soils formed in unconsolidated, or very poorly consolidated, sediments of granitic formations that in places were overlain by a thin layer of loess. Under natural conditions, these soils occur in small spots (several feet across) that are barren or nearly barren. An A1 horizon is uncommon, and the light colored or very light colored A2 horizon is only a fraction of an inch thick in most places; it is 2 inches thick or somewhat thicker in a few places. In uncultivated areas, the A2 horizon abruptly overlies a prismatic B21t horizon that ranges from less than an inch to 1 1/2 inches in thickness. The thin B22t horizon has strong, fine and very fine, granular structure or very fine, subangular blocky structure. The B22t overlies the moderate prismatic and strong angular blocky B23 horizon. The B2t horizon is moderately fine textured to fine textured (light clay). Both the A2 and B2t horizons are noncalcareous, and the A2 horizon is slightly acid to mildly alkaline. The lower part of the B23t or the B3tsa horizon contains soluble salts, 20 to 50 percent exchangeable sodium, and in places some gypsum. In many places the soluble salts have their upper boundary above the upper boundary of the ca horizon. An indurated or strongly cemented silica-calcium carbonate hardpan has its upper boundary 20 to 40 inches below the surface.

Azonal order

The azonal order is made up of soils that lack distinct, genetically related horizons, commonly because of youth, resistant parent materials, or steep topography. Azonal soils do not differ greatly from their parent materials, except that enough organic matter may have accumulated in the surface layer to darken it, and some of the most soluble materials may have been removed by leaching. These are some of the most productive soils in the Area. Most are simply in the earliest stages of soil formation and, given enough time, will develop into zonal soils. Others are young because a new surface is exposed periodically by landslides, or new material is deposited periodically by landslides or by water, or because of some other factor. About one-sixth of the soils in the Gem County Area are azonal soils.

Alluvial great soil group.- Soils of this great soil group formed in relatively recent alluvium. The soil-forming processes have not changed the alluvium much since it was deposited. Alluvial soils occur on bottom lands or on alluvial fans. The climate and vegetation have had little influence on the formation of these soils. Most of the soil characteristics are determined by the nature of the alluvium and by other features, including the water table. In the Gem County Area, the parent material is mostly acid igneous alluvium, but in some places it is mixed acid and basic igneous alluvium. The vegetation consists of grasses, forbs, and shrubs. The annual precipitation ranges from 9 to 18 inches. The texture of the soils ranges from coarse to fine, because of the sorting action of water. In the Gem County Area, the Baldock. Cashmere, Chance, Draper, Falk, Goose Creek, Harpt, Jenness, Lahontan, Letha, Moulton, Notus, Quenzer, and Wasatch series represent the Alluvial great soil group.

Soils in the Falk series are typical Alluvial soils. They have an A or an Ap horizon that is only a few inches thick and not much different from the underlying C horizon. The subsoil shows either no evidence of structural development or only very weak structural development. It lacks clay coatings and other accumulations of clay; it also lack accumulations of calcium carbonate. The reaction is nearly neutral, and the base saturation is near 100 percent throughout the profile. The organic-matter content of the surface layer is about 1 percent. Below a depth of 20 to 40 inches, the soil is somewhat mottled dark gray and dark brown, indicating the presence of a water table in the gravel beneath. Water rises into the lower part of the soil at times.

The Notus soils are similar to the Falk soils, but they are only 10 to 20 inches thick to the underlying gravel.

The Moulton series is the imperfectly drained member of the noncalcareous Falk-Moulton-Chance catena. They are transitional to Humic Gley. The three soils of this catena are forming in recent alluvium that washed mainly from areas of intrusive, acid, igneous rock. They are dominantly moderately coarse textured to a depth of 20 inches. The Moulton soils are mottled from below the plow layer or above a depth of 16 to 20 inches.

The Chance soils are similar to Moulton soils, but they are poorly drained or very poorly drained. Even their Al horizon is gleyed. They are transitional to Humic Gley.

The Draper soils are similar to Falk soils, but they formed in dominantly loamy alluvium. The Falk soils are mostly fine sandy loams. The Draper soils have thin clay films in pores and in root channels, indicating the beginning of a textural B horizon. They have mostly weak structure, instead of very weak like the Falk soils.

The Goose Creek soils are similar to the Draper soils, except that they formed in mixed basaltic and acid igneous alluvium. They are transitional to Humic Gley. They have no clay coatings and are subject to more frequent overflows in spring than the Draper soils. The Goose Creek soils occur in an area of higher precipitation (12 to 20 inches annually) and contain more organic matter than the other alluvial soils in the area.

The Lahontan soils are clayey, strongly alkaline or very strongly alkaline, and calcareous.

The Baldock soils are mostly medium textured, calcareous, and mildly alkaline to strongly alkaline. They are transitional to Humic Gley.

The Wasatch, Cashmere, and Harpt soils are well drained and occur on alluvial fans. There are slight differences in color, but otherwise the differences among these soils are confined mainly to the texture of the alluvium. The Wasatch soils occur on the upper, steeper part of the fans, where coarse-textured material is deposited. The Cashmere soils occur on the middle, less steep part of the fans, where the moderately coarse textured material is deposited. The Harpt soils occur on the lower part of the fans, where mostly medium-textured material is deposited. Different layers in a particular place. however, may have different textures, because the layers are deposited at different times.

The Jenness soils are much like Harpt soils, but they are lighter colored and lower in organic-matter content.

The Quenzer soils formed in fine-textured alluvium that must have been deposited by slow-moving or nearly still water. Percolation of water through this fine-textured material is slow. The Ap horizon is somewhat gleyed.

The Letha soils are calcareous throughout and are strongly affected by alkali.

Regosol great soil *group* (14).-This great soil group consists of young soils that formed in alluvium or other unconsolidated material. Regosols differ from Alluvial soils in that they no longer are subject to deposition. Given more time, many of them will develop into zonal soils. In the Gem County Area, Regosols occur where the precipitation is 9 to 11 inches annually. The parent material is acid igneous alluvium. The native vegetation consisted of bunchgrasses, big sagebrush, and forbs. The Emerson and Lolalita series represent the Regosol great soil group in the Gem County Area.

The Emerson soils are typical Regosols. They formed in alluvial material that is now above flood level. They are slightly acid, and their base saturation is about 90 percent. The organic-matter content is about 1 percent. The C1 horizon has a very weak, blocky structure or is structureless (massive). It is slightly acid, and its base saturation is 90 to 100 percent. In some places it has thin, patchy coatings of clay around the sand grains, in pores, and in root channels. The coatings indicate the beginning of a textural B2 horizon. If given enough time., the Emerson soils would probably become Sierozems.

The Lolalita soils are somewhat like the Emerson soils, but they have even less soil development. They formed on steep southerly slopes of granitic formations. A slight darkening in the uppermost part of the profile is the most noticeable evidence of soil development. A little calcium carbonate has accumulated in some places below a depth of 1 1/2 to 3 feet.

Laboratory Data

Physical and chemical characteristics of some representative soils in the Gem County Area are given in table 8. The particle-size distribution was determined at the Soil Survey Laboratory, Soil Conservation Service, Riverside, Calif. All other data, were obtained at the Idaho Agricultural Experiment Station.

General Nature of the Area

This section discusses the climate, water supply, and vegetation in the Gem County Area. It also gives some statistics from the census of agriculture.

Climate

From the timbered mountain slopes at the upper end of Squaw Creek to the level, fertile valley along the Payette River, the Gem County Area offers contrasts in climate as well as in topography.

Located in the prevailing westerlies, the Area is affected by changing weather patterns throughout much of the year. Because of topographic influences, changes are often less violent than in plains areas in similar latitudes.

The source of moisture in the air masses traversing Gem County is almost exclusively the North Pacific Ocean. Much moisture is taken from these air masses as they travel across mountain ranges in their journey inland. Consequently, the precipitation resulting from further lifting or from storm action in relatively light. For example, Emmett receives an average of about 12 1/2 inches of precipitation each year; Squaw Creek Valley, South of O1a, a little more than 17 inches; and the foothills northeast of Ola, about 21 inches and somewhat greater totals at higher elevations. The precipitation in the Area is less than that received along the coast, in the mountains near the coast, and in the Cascade Mountains.

Typical of much of Idaho, the precipitation pattern shows a maximum, in winter and a minimum in summer, when an occasional thunderstorm is about the only source of rainfall. Rainfall of great intensity is not a common occurrence, and a fall of 0.5 inch in 30 minutes occurs only about once in 10 years. The maximum 1-hour fall once in 10 years is about 0.6 inch. Rainfall of about that intensity occurred during a 2- or 3-day rain in mid-September 1959, when slides temporarily blocked State Highway No. 52 between Emmett and Horseshoe Bend.

The last two columns under the heading "Precipitation" in table 9 reveal some interesting probabilities in rainfall distribution. For example, in 7 of the months, a monthly total of 2 1/2 inches or more of precipitation may be expected 1 year in 10, but in July and August the total is only about 0.4 inch in 1 year in 10. Conversely, July, August, or September may have no precipitation about once in 10 years, whereas, even in dry years, spring and autumn months can be expected to have about 0.2 inch, and mid-winter months no less than about 0.5 inch.

Temperatures in the Gem County Area show the seasonal variations typical of continental locations in middle latitudes, but the winter extremes are tempered somewhat by the influence of maritime air masses moving eastward from the Pacific. Thus, subzero readings are relatively infrequent; they occur on the average about twice each year at Emmett and seven times each year at Ola.

Spring is a time of variable weather, with pronounced variations from year to year, as well as from week to week and from day to day. Freezing temperatures normally threaten the fruit crop in the Emmett Valley several times each spring, but orchard heating during the past 15 years or more has been effective in reducing damage.

In summer, temperatures of 100° F. or higher occur on at least 1 day, and temperatures of 90° F. or higher on about 50 days, each year. The effects of these fairly high daytime temperatures in summer are tempered by relatively low humidity and by cool nights. Spells of oppressively hot weather are uncommon and generally short. Relative humidity of 20 percent or less is common during the heat of the day in July and August.

By D. J. STEVLINGSON. State climatologist for Idaho. U.S. Weather Bureau, Department of Commerce.

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All tables have been updated and are available as a separate document.

As summer gives way to autumn, days frequently are sunny and moderately warm, and nights are cool. The frequency and amount of precipitation increase through October and November and generally reach a peak in December and January.

At Emmett, snowfall has averaged only a little more than 17 inches each year, whereas at the Tripod Mountain weather station, which is 5 or 6 miles north-northeast of Ola at an elevation of about 4,300 feet, the average snowfall over a period of 30 years or more is more than 71 inches. At Emmett, the greatest daily snowfall in a 30year period was 12 inches, recorded in January 1950. No more than 6 1/2 inches fell in any other one day during 30 years. Records of snow on the ground are too sketchy to produce satisfactory statistics, but consideration of the amount of snowfall and the typical winter-temperature pattern indicate that the Emmett Valley, like so many localities in the southwestern valleys of Idaho, would only occasionally have an accumulation of more than 6 inches.

Strong winds are experienced occasionally during thunderstorms and during the passage of strong storm fronts in the colder seasons, but damage commonly is light. Tornadoes are virtually unknown in the Area, although a small funnel-shaped cloud may be observed occasionally. Hailstorm statistics are not available, but hail damage is relatively light. Hailstones in the Area generally do not exceed one-half to three-fourths of an inch in diameter.

Table 10 presents statistically determined probabilities of temperatures of 32° F. and 28° F. after listed dates in spring and before listed dates in fall. These values cannot be used as forecasts for any given year, of course, but they are helpful in long-range planning. The temperatures are for an elevation of about 5 feet above ground, in standard instrument shelters, at the stations known as Emmett 2E and Ola 5S. At Emmett the statistics were computed from a 30-year record, from 1931 to 1960. At Ola the period of record was 11 years, from 1952 to 1962. Because of the short period of record at Ola, freeze probabilities cannot be considered as firm as those for Emmett. Nevertheless, they are included to give some indication of the differences in freeze dates between the two locations.

This table show that in 90 percent of the years, that is in 9 years in 10, the last 32° F. minimum temperature in spring at Emmett will occur on or after April 15; in half of the years, that is 5 years in 10, the last freeze will occur

on May 8 or later; in only 1 year in 10 will freezing temperatures occur on or after May 31. In fall there is a 1 in 10 chance of a 32° F. temperature as early as September 17 at Emmett, and a 9 in 10 chance that a freezing temperature will be reached by October 23.

On the basis of the dates at the 50-percent level, the average length of the season between the last 32° temperature in spring and the first 32° temperature in fall is 150 days at Emmett and 117 days at Ola. The average length of the season between the last 28° temperature in spring and first 28° temperature in fall is 184 days at Emmett and 149 days at Ola.

Water Supply

Rainfall in the Gem County Area is not adequate to produce maximum crop yields without supplemental water. Consequently, irrigation water is applied wherever it is available. The largest water storages are the Deadwood and Cascade Reservoirs on the Payette River in Valley County and the Sage Hen Reservoir on a tributary of Squaw Creek. By far the largest diversion is at Black Canyon Dam. About 300 cubic feet of water per second is pumped from there into the Emmett Irrigation District's canal to irrigate the Emmett bench, and another 1,200 cubic feet per second is diverted into the Black Canyon Canal, which conveys water around the south side of the Emmett Valley and extends into Payette County. Part of this water is used to irrigate the "¯slope" and adjoining areas around the valley. Part of it is used to irrigate the 44,000acre Black Canyon reclamation project in Gem and Canyon Counties.

Black Canyon Dam has a minimum flow of 1,600 to 1700 cubic feet of water per second for power production. The maximum flow is about 18,000 cubic feet per second in an average year and about 28,000 cubic feet per second in a year when runoff is high. Part of this water is diverted into several farmer-owned canals to irrigate the floor of the Emmett Valley. These include the Last Chance Canal, Farmers Cooperative Canal, Enterprise Canal, Reid Canal, and several smaller canals. Montour Valley is irrigated from the Montour Canal with water diverted from the Payette River. The Ola and Sweet Valleys are irrigated by canals that divert water from Squaw Creek. The Younnie ditch and the East Side ditch irrigate the Ola Valley. The Sweet ditch and the West Side ditch irrigate the Sweet Valley.

A few farms have private irrigation systems, supplied by water diverted from some of the smaller streams. South of Squaw Butte, there is some irrigation from springs and wells. In the Emmett Valley, there are many artesian wells, but none supply enough water to irrigate large acreages. In this valley, irrigation and drainage could be combined by pumping water from deep drainage ditches.

Vegetation

The Gem County Area is characterized by contrasts in soils, climate, and topography, and, consequently, the vegetation includes many kinds of grasses, shrubs, trees, and other plants. Most plants are native species, but some have been brought from other continents or from other parts of North America. Some plants, such as crested wheatgrass or redtop, were intentionally brought from outside of the Area; others, such as Medusahead wildrye or cheatgrass. have invaded the Area. Following is a list of the plants that commonly occur.

Common name	*Scientific name*
Alkali bluegrass	*Poejuncifolia*
Alkali weed (bassia)	*Bassia hyssopifolium*
Aster	*Aster spp.*
Astragalus	*Astragalusspp.*
Balsamroot	*Balsamorhiza spp.*
Beardless bluebunch wheatgrass	*Agropyrom inerme*
Big bluegrass	*Poa amply*
Bedstraw	*Galium spp.*
Big sagebrush	*Artemisia tridentata*
Biscuitroot	*Cogswellia spp. (Lomatium geyeri)*
Bitterbrush	*Pur.shia tridentata*
Black cottonwood	*Pop-ulus trichocarpa*
Blue bunch wheatgrass (big bunchgrass).	*Agropyronspinetum*
Bulbous bluegrass	*Poa bulbosa*
Butterweed	*Senecio serra*
Canada thistle	*Cirsium arvense*
Chokecherry	*Prunus demissa*
Cheatgrass (downy chess)	*Bromustectorunt*
Chicory	*Cichorium spp.*
Columbia needlegrass (subalpine needlegrass).	*Stipa columbiana*
Common cattail	*Typha latifolia*
Common serviceberry	*Amelanchieralnifolia*
Cowparsnip	*Heracleun lanatum*
Crested wheatgrass	*Agropyron cristalum*
Deathcamas	*Zygadenus spp. (Zigadenus)*
Douglas-fir	*Pseudotsuga menziesii*
Elk sedge	*Carex geyeri*
Fiddleneck	*Amsinckia retrorsa*
Field pennycress	*Thlaspi errense*
Fireweed	*Chamaenerion angustifolium (Epi-lobium angustifolium)*
Flax	*Linum spp.*
Foxtail barley	*Hordeurn jubatunt*
Fritellary	*Fritillaria pudica*
Geranium	*Geranium spp.*
Giant wildrye	*Elymus condensatus*
Greasewood	*Sctrcobatus vermiculatus*
Groundsel	*Senecio spp,*
Horsebrush	*Tetradymia canescens*
Idaho fescue	*Festuca idahoensis*
Indian ricegrass	*Oryzopsis hymenoides*
Intermediate wheatgrass	*Agropyron intermedium*
Junegrass	*Koeleria cristata*
Kentucky bluegrass	*Poa pratensi.s*
Larkspur	*Delpeiniam* spp.
Little fescue	*Festuca spp.*
Little-sunflower	*Heliantleella spp.*
Low sagebrush	*Artemisia arbuscula*
Lupine	*Lupinus spp.*
Mallow	*lfalva app.*
Medusahead wildrye	*Elynius caput-medusae*
Morning glory or bindweed (perennial)	*Convolvulus arvensis*
Mountain bluebell	*ller•tensie ciliata*
Mountain brome	*Brornus marginatus*
Mountain maple	*4cer glabrum*
Mustard	*Norta altissima (Sisymbrium altis.sinues)*
Needle-and-thread	*Stipa comata*
Nettles	*Urtica spp.*
Nevada bluegrass	*Poa nevadensis*
Ninebark	*Physocarpus ntalraceus*
Oregongrape	*Odoste,non aquifoliunt (Berberis aquifolium)*
Oysterplant	*Tragopogon porrifolius*
Peavine	*Lath-yr-us spp.*
Penstemon	*Penstemon spp.*
Phlox	*Phlox spp.*
Pinegrass	*Calanragrostis rubescens*
Ponderosa pine	Pintos *ponderosa*
Potenrilla (einqueeoii)	*Potentilla spp.*
Pussytoes'	*Antenrtaria spp.*
Rabbitbrush	*Chry.sothananus spp.*

Rattle brome (rattlesnake chess)	*Brornu.s brizaeformis*
Red threeawn	*Aristida longiseta*
Rabbitbrush (yellowbrush)	*Chrysothamnus lanceolatus*
Reed canarygrass	*Phalaris arundinacea*
Rushes	*Juncos spp.*
Russianthistle	*Salsola pestifer*
Sandberg bluegrass	*Poe secunda*
Saltgrass	*Distichlis stricta*
Sedges	*Carex spp.*
Serviceberry	*rnelanch-ier alnifolia*
Shadscale saltbush	*ltriplex confertifolia*
Sheep fescue	*Festuce ovine*
Shepherdspurse	*Capsella bursa-pastoris*
Snakeweed	*Gutierrezia. sarothrae*
Snowberry	*Symphoricarpos spp.*
Snowbrush (sticky laurel)	*Ceanothus velutinus*
Spirea	*Spiraea spp.*
Squaw currant	*Ribes inebrian.s*
Squirreltail	*Sitanion hystrix*
Staghorn sumac	*Rhus hirta*
Stoneseed	*Sedum spp.*
Tall oatgrass	*Arrhenatheruoa elatius*
Tall wheatgrass	*Agropyron elongatum*
Tapertip hawksbeard	*Crepis acuminata*
Tarweed fiddleneck	*Amsinckia spp.*
Thickspike wheatgrass	*A gropyron dasystachyum*
Threetip sagebrush	*Artemisia tripartite*
Turnblemustard (Jim Hill mustard)	*Vorta altissirna (Slsymbrium altissianum)*
Vetch	*Vicia spp.*
Watercress	*Rorippa spp.*
Western aspen	*Populus tremuloides a urea*
Western chokecherry	*Prunus demissa*
Western yarrow	*Achillee lanulosa*
Wildbuckwheat	*Driogonum spp.*
Wildcarrot	*Leptotaenia multiifSe*
Wild rose	*Rosa spp.*
Willow	*Salix spp.*
Wyethia (mulesears)	*Wyethia amplexicaulis*
Wyethia (whitehead)	*Wyethia helianthoides*
Yarrow	*Ach.illea lanulosa*

Agriculture

Most of the agriculture in the Gem County Area is centered around livestock production and fruit orchards. About 80 percent of the cultivated land is in the irrigated valleys along the Payette River and Squaw Creek. Farming in these areas generally is diversified, but livestock is raised on many of these farms, and pasture crops, hay crops, and grain are grown to be utilized as feed for dairy cattle, beef cattle, sheep, or hogs. Sweet corn, sugar beets. and wheat are grown as cash crops, and some alfalfa hay is sold.

Most fruit is produced on the "slope" along the east and south sides of the Emmett Valley. Some truck crops are also produced here. The fruit crops include prunes, apples, peaches, cherries, pears, and apricots. The principal hazards in this area are erosion, frost, and depletion of fertility.

The valley floor west of Emmett contrasts sharply with the "slope" (see fig. 3). The high water table, the accumulation of soluble salts and alkali, and the very gently undulating relief make this a problem area for farming. Pasture crops. hay crops, corn, and small grain are the principal crops, but their growth is spotty. Some soils still have a cover of native greasewood and saltgrass. A number of farmers in this area work at the lumber mill near Emmett or have other sources of income.

Irrigated cropland that is nearly free of alkali occurs east of Emmett; on the bench north of Emmett; in the Montour, Sweet, and Ola Valleys; and in the Black Canyon irrigation tract in the southwestern part of the county. In these areas the principal problems are low organicmatter content, slow water-intake rate in some soils, and erosion of the more sloping soils. Alfalfa hay commonly is grown in rotation with small grain, corn, beans, and sugar beets. The steeper, more erodible soils generally are seeded for pasture.

Nearly all of the 11,500 acres of dry farmland in the Area is in the eastern half of the county. In much of this area, nonirrigated crops are grown under an alternate crop and summer fallow system of management. The principal crops are small grain, alfalfa hay, alfalfa for seed, and pasture crops. The hazard of erosion is serious, especially on the rolling and hilly granitic soils.

More than 80 percent of the acreage in the surveyed Area is range used for grazing cattle and sheep. Much of the vegetation on the range is depleted because of overgrazing. Consequently, the production of usable forage is limited, especially in the drier areas, and Medusahead wildrye, which is not eaten by livestock, has invaded extensive areas. Some of these areas are suitable for reseeding, and some could be used for crops if water for irrigation were available.

According to the 1959 Census of Agriculture, there are 774 farms in the Gem County Area that average 469 acres in size. Of this total. 519 are classed as commercial farms, and they average 678 acres in size. There are 5 farms classed as vegetable farms; 67 as fruit-and-nut farms; 271 as dairy farms; 120 as livestock farms other than poultry and dairy farms; 2 as livestock ranches; and 50 as general farms. The rest are miscellaneous and unclassified. The land in farms was distributed according to use in 1959 as follows

	acres
Cropland harvested	40,675
Cropland used only for pasture	16,004
Cropland not harvested and not pastured	3,785
Woodland not pastured	164
Woodland pastured	[1]61,983
Other pasture (not cropland and not woodland)	231,866
Other land (house lots, roads, wasteland, etc.)	8,552

[1]This figure includes 60.480 acres that are in the Boise National Forest and that are not included in the surveyed area.

In 1959, of the 774 farms in the Area, 574 were operated by full owners. 125 by part owners. 7 by managers, and 68 by tenants.

Crops

The production of crops in the Gene County Area is concentrated on the irrigated soils. In 1959, 93 percent of the farms were classified as irrigated farms. Irrigated land included 37.674 acres of harvested cropland and 14,256 acres of irrigated pasture. Alfalfa hay occupies the largest acreage of cropland, but fruit crops lead in value of produce. Table 11 shows the acreage of principal crops in the Area for stated years.

Livestock

The Gem County Area has large acreages of range and pasture that make possible extensive livestock operations. This acreage, combined with the irrigated acreage of hay and other feed, provides conditions favorable for livestock operations in the Area. Table 12 gives the number and kind of livestock on farms for stated years. Of the beef breeds, Hereford predominates. There are some Shorthorn and Angus cattle, mainly on irrigated farms and in

In the original manuscript, there was a table in this space.
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feedlots. Most beef animals are sold as grass-fed feeders to purchasers outside the county. Sheep are mainly the combination meat- and wool-producing Columbia and Targhee breeds. The income from these is primarily from the sale of fat lambs and wool.

Of the dairy breeds, Holstein-Friesian predominates. There are also some Jersey and Guernsey cattle, but comparatively few dairy animals of other breeds. Practically all milk is marketed as whole milk in the nearby cities of Boise, Nampa, and Caldwell.

Settlement and Development

A trading post, established in 1864 at the present site of Emmett, was the first settlement in the valley. Two years later a ferry was built to cross the Payette River at Emmett. Explorers, traders, and settlers, traveling through the valley between Boise Basin. Idaho, and Walla Walla, Washington, were the first white inhabitants. The early settlers raised cattle. A1 more diversified type of agriculture was developed with the introduction of irrigation.

The location of a sawmill, planing mill, and box factory at Emmett helped to develop this city as the industrial and commercial center for the agricultural area.

In 1960, the population of Gem County was 9,127. Of this, 5,358 was rural and 3,769 was urban. Emmett, the county seat, had a population of 3,769. There was a slight increase in population over 1950, when the county had a population of 8,7130, and Emmett a population of 3,067. The rural population is concentrated mainly in the vicinity of Emmett. It is nearly equally distributed over the eastern part of the valley, the Emmett bench north of the river, and the coalescing alluvial fans that constitute the "slope." The saline-alkali lands west of Emmett and the range and forested areas are sparsely settled.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has 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 the growth of most crop plants is reduced.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available moisture capacity. The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Bottom land. A flood plain.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter, As a textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a published soil map.

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: will not hold together in a mass.

Friable.-When moist, easily crushed under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.-When moist, can be crushed 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 hump : 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 and brittle; little affected by moistening.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless pro tected artificially.

Gravel. A mass of rounded or angular rock fragments one-fourth inch to 3 inches in diameter.

Green-manure crop. A crop grown for the purpose of being turned under in an early stage of maturity, or soon after maturity, for soil improvement.

Horizon, soil. A layer of soil, approximately parallel to the sur face, that has distinct characteristics produced by soil-forming processes. These are the major soil horizons

A horizon. The mineral horizon at the surface. It has an ac cumulation of organic matter, has been leached of soluble minerals and clay, or shows the effects of both.

B horizon. A horizon in which clay minerals or other material has accumulated, or that has developed a characteristic blocky or prismatic structure, or that shows the character istics of both processes.

C horizon. The unconsolidated material immediately under the true soil. In chemical, physical, and mineral composition it is presumed to be similar to the material from which at least part of the overlying solum has developed.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percola tion, which is movement of water through soil layers or material.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are

Border.-Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.-Water is applied rapidly to relatively level plots sur rounded by levees or dikes.

Controlled flooding.-Water is released at intervals from closely spaced field ditches 'and distributed uniformly over the field.

Corrugation.-Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards, so that the flow of water is in one direction.

Furrow.-Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.-Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.-Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.-Water is released at high points and flows onto the field without controlled distribution.

Natural drainage. Refers to the conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irriga tion but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized.

Excessively drained soils are commonly very porous and rapidly perrireable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are com monly of intermediate texture

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uni form color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Imperfectly or somewhat poorly drained soils are wet for signifi cant periods but not all the time, and in podzolic soils com monly have mottlings below 6 to 16 inches in the lower A horizons and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling in the deeper parts of the profile.

Land leveling. The reshaping of the ground surface to make for a more uniform application of irrigation water.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows : Abundance-feat, *common,* and *many; size-fine, me dium,* and *coarse;* and contrast-faint, *distinct.* and *prominent.* The size measurements are: fine, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension: *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse.*

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Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil, and carbon, hydrogen, and oxygen. obtained largely from the air and water, are plant nutrients.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity ; and a lower value, acidity.

Poorly graded soil (engineering). A soil material consisting mainly of particles nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pil 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degree of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid____	below 4.5,	Neutral ----------	6.6 to 7.3
Very strongly acid__	4.5 to 5.0	Mildly alkaline ----------	7.4 to 7.8
Strongly acid----------	5.1 to 5.5	'Moderately alkaline__	7.9 to 8.4
Medium acid ----------	5.6 to 6.0	Strongly alkaline ----------	8.5 to 9.0
Slightly acid ----------	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Rotation grazing. Grazing two or more pastures, or parts of a range, in regular order, with definite recovery periods between grazing periods. Contrasts with continuous grazing.

Runoff. The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff ; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but does not contain excess exchangeable sodium.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; or contains harmful salts and has a highly alkaline reaction; or contains harmful salts and exchangeable sodium and is strongly alkaline in reaction. The ,salts, exchangeable sodium, and alkaline reaction impair the growth of most crop plants.

Sand. As a soil separate, individual rock or mineral fragments 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz, but sand may be of any mineral composition. As a textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. A rock composed of particles deposited from suspension in water. The chief sedimentary rocks are conglomerate, from gravel ; sandstone, from sand ; shale, from clay ; and limestone, from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sands have been consolidated into sandstone.

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 textural class, soil that is SO 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 relatively steep slopes and in swelling clays, where there is marked change in moisture content.

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). The separates recognized by the International Society of Soil Science are as follows: I (2.0 millimeters to 0.2 millimeter) ; II (0.2 to 0.02 millimeter) ; III (0.02 to 0.002 millimeter) ; IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil includes 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 characteristic of the soil are largely confined to the solum_

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 *(1) single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon ; roughly, the part of the profile below plow depth.

Substratum. Any layer beneath the solute, or true soil ; the C or D horizon.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about .5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating. bordering a river, a lake. or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam. sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil (engineering). A soil or soil material consisting of particles that are 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.