United States
Department of
Agriculture

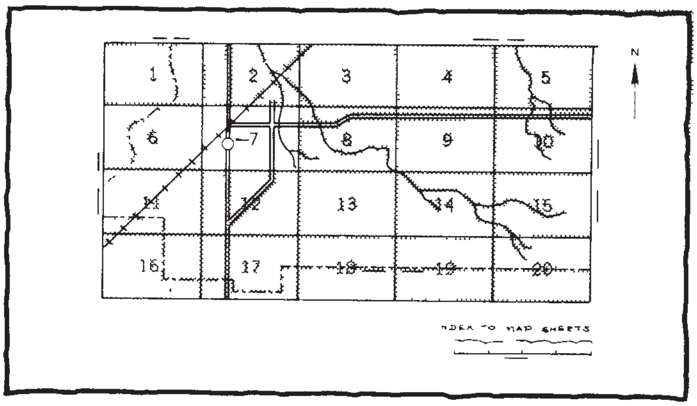
Soil
Conservation
Service

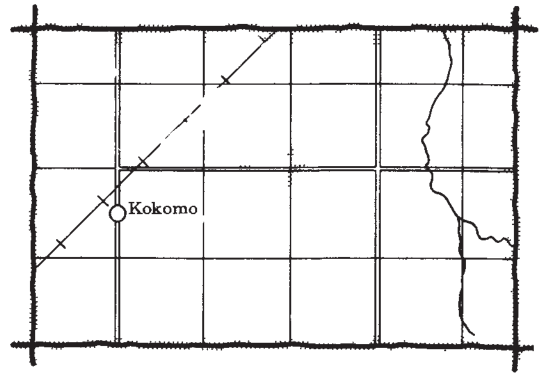
In cooperation with
United States Department
of the Interior, Bureau
of Land Management, and
Oregon Agricultural
Experiment Station

Soil Survey of Linn County Area Oregon

HOW TO USE

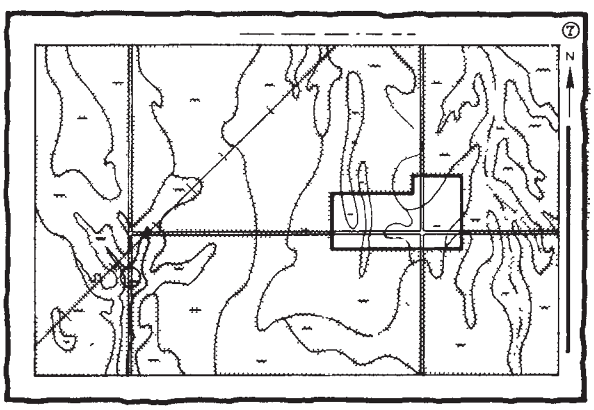
1. Locate your area of interest on the "Index to Map Sheets."

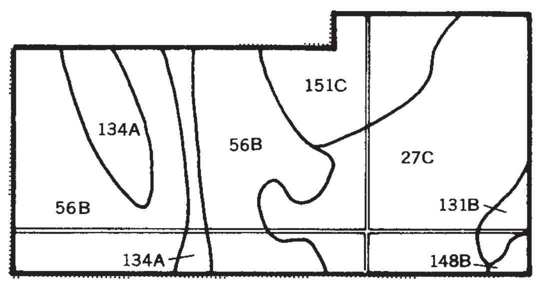




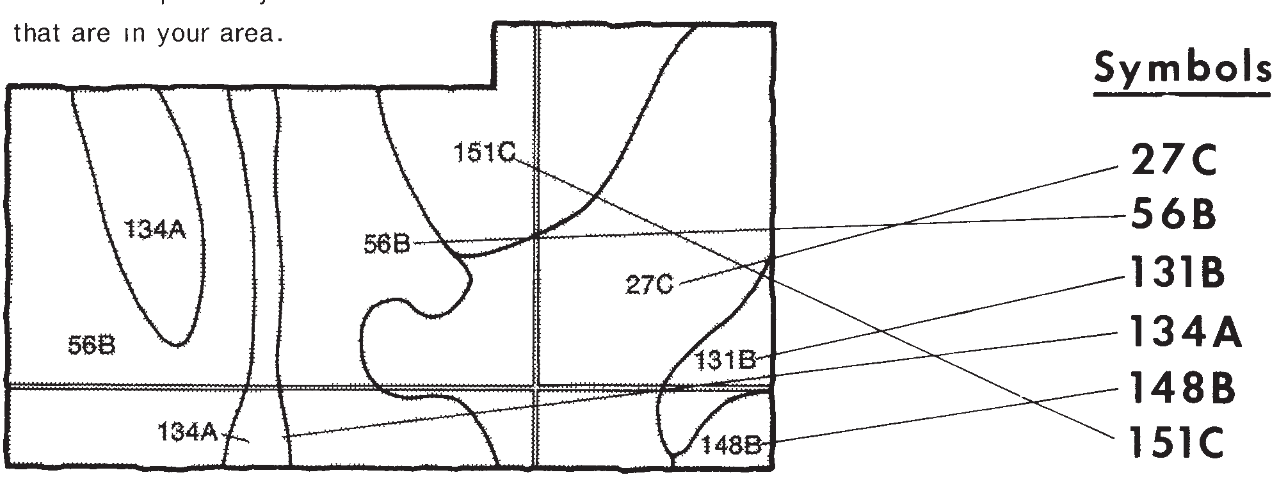
2. Note the number of the map sheet and turn to that sheet.

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



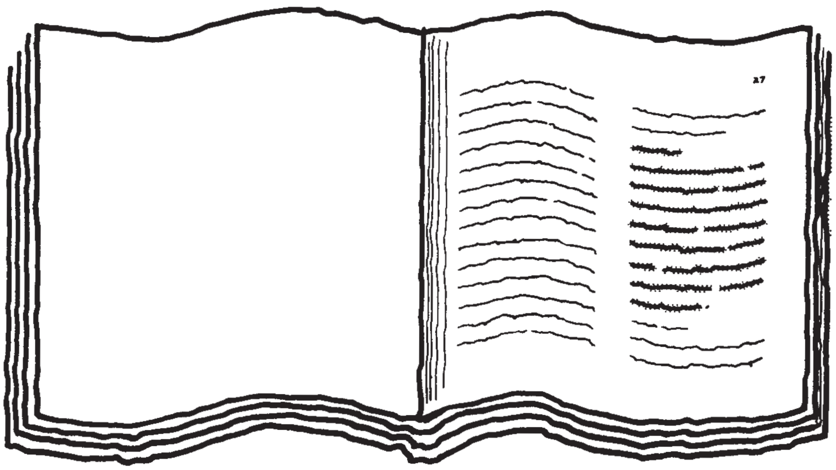


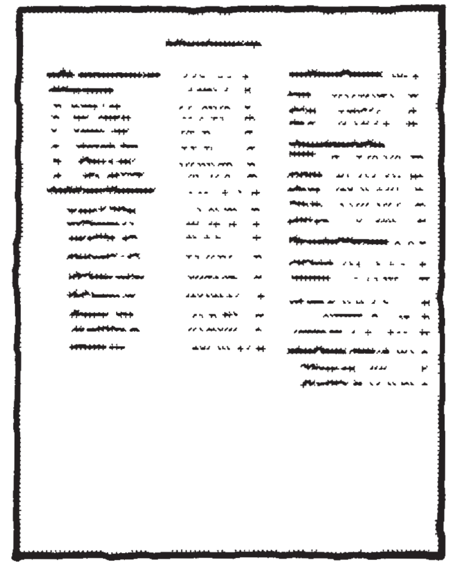
4. List the map unit symbols that are in your area.



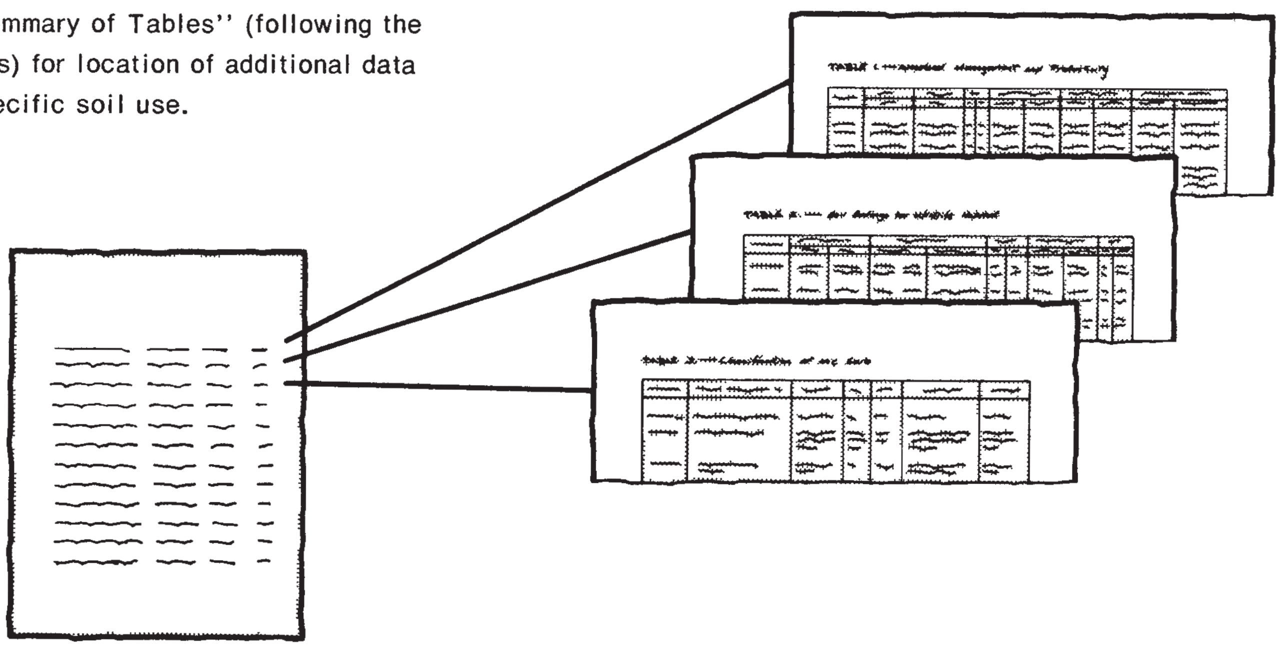
THIS SOIL SURVEY

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





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



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

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

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made cooperatively by the Soil Conservation Service, the Bureau of Land Management, and the Oregon Agricultural Experiment Station. It is part of the technical assistance furnished to the Linn County Soil and Water Conservation District.

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

Cover: Aerial view of a part of the survey area used as woodland and agricultural land. Nekia soils are in foreground, and Awbrig, Coburg, and Clackamas soils are in background.

Contents

Soil Series

Issued July 1987

Index to Map Units

Summary of Tables

Foreword

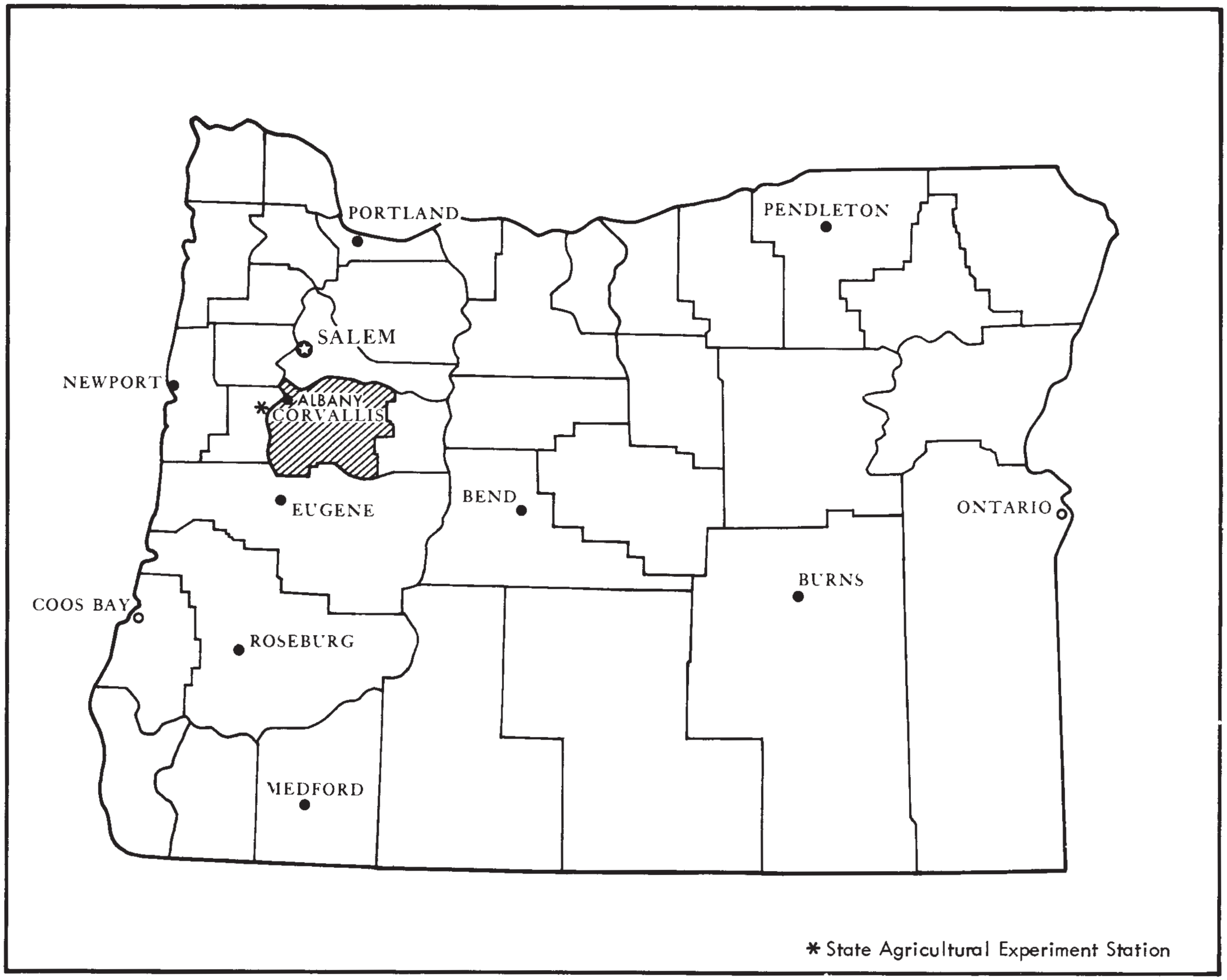
This soil survey contains information that can be used in land-planning programs in Linn County Area, Oregon. It contains predictions of soil behavior for selected uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact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

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

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

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

Jack P. Kanalz
State Conservationist
Soil Conservation Service



Location of Linn County Area in west-central Oregon.

Soil Survey of
Linn County Area, Oregon

By Russell W. Langridge, Soil Conservation Service

Fieldwork by Russell W. Langridge, Matthew H. Fillmore,
William R. Patching, Philip R. Smith, and
Stanley C. Winther, Soil Conservation Service

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

LINN COUNTY AREA is in the west-central part of Oregon. Albany, the county seat, has a population of 26,900. The survey area includes 956,560 acres, or about 1,495 square miles, of private land and 143,483 acres, or about 379 square miles, of federally administered land. Of this acreage, about 133,918 acres is managed by the Bureau of Land Management and 9,565 by the Forest Service.

The survey area is principally that part of Linn County that is not included in the Willamette National Forest. Included in the area are those parts of the Willamette Valley and the valleys of the North Santiam, South Santiam, and Calapooya Rivers that are used for intensive farming and community development. Rolling foothills in the area rise abruptly from valley terraces and extend in a general north-south direction, paralleling the east side of the Willamette Valley. These areas are used for limited cultivated farming, hay and pasture, and community development. East of the rolling foothills, the survey area is steep and mountainous and consists of forest land. Elevation ranges from 185 feet near the Willamette River to 4,966 feet at Galena Mountain, in the Cascade Range. The survey area is mainly in the Willamette Valley and Western Slope Cascade Mountains major land resource areas (*27*).

An older survey, "Soil Survey of Linn County, Oregon," was published in 1924 (*28*). This earlier survey covers a part of the present survey. The present survey, however, updates the earlier survey and provides additional information and larger maps that show the soils in greater detail.

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

General Nature of the Survey Area

This section briefly discusses the natural resources; physiography, relief, and drainage; farming; woodland; and climate of the survey area.

Natural Resources

The natural resources in the survey area are related to water, minerals, soil, and timber. Clear mountain streams and rivers provide habitat for several species of fish and provide water for domestic use and hydroelectric power. The natural and manmade lakes, as well as numerous rivers and streams, provide many opportunities for recreation. Dense stands of Douglas-fir and western hemlock grow in the mountainous areas of the Cascade Range. Gold has been mined in the mountains due north of Cascadia, and there is still much gold panning taking place both in Quartzville Creek and in the Calapooya River. Lava flows and intrusive volcanic outcrops are good sources of rock for construction of logging roads and highways.

Physiography, Relief, and Drainage

On the broad flood plains along the Willamette and Santiam Rivers, in the western and northern parts of the survey area, the soils are well drained to excessively drained, except for the soils in remnant channels that have been filled with sediment. The soils on terraces adjacent to the flood plains are well drained; however, internal drainage problems increase as the terraces broaden and become more nearly level to depressional. Elevation of these flood plains and terraces ranges from 125 feet along the Willamette River and the western boundary of the survey area to 900 feet along the North Fork of the Santiam River and the northern boundary of the survey area.

Adjacent to the broad terraces of the Willamette Valley to the west and the mountainous uplands of the western part of the Cascade Range to the east are low foothills that range in elevation from 300 to 1,400 feet. The soils in these areas are well drained to poorly drained, are in gently sloping areas on low plateaus to steeply sloping areas on side slopes, and formed in material derived from igneous or sedimentary rock. The South Santiam and Calapooya Rivers dissect these low foothills in the central and southern parts of the survey area and form major valleys that have both narrow flood plains and stream terraces. Minor streams such as Thomas, Crabtree, and Cochran Creeks dissect the low foothills and form minor valleys characterized by narrow stream terraces of recent alluvium.

The mountainous uplands of the western part of the Cascade Range include the eastern half of the survey area and have elevations of as much as about 5,000 feet. Mt. Jefferson, Three-Fingered Jack, and Mt. Washington mark the eastern boundary of Linn County and have elevations of 10,497, 7,847, and 7,794 feet, respectively. The Cascade Range formed from volcanic material such as hard basalt and soft pyroclastic and sedimentary material. Volcanic ash covers much of the higher areas. The differences in the hardness of these materials have influenced the rate of dissection; thus, these areas are characterized by gently sloping soils on high plateaus and steep to very steep soils on canyon walls and side slopes. Steep headwalls and rolling slump blocks are indicative of the slumping problems encountered in some areas of the Cascade Range. All parts of the Cascade Range in the survey area are drained by tributaries of the Willamette River. The upper valleys of the tributaries are narrow and have stream terraces of recent origin. The streams are characterized by waterfalls and numerous rapids until they reach the Willamette Valley, which is nearly level.

The U.S. Army Corps of Engineers has built flood control dams on the North, South, and Middle Forks of the Santiam River. These structures have controlled flooding in the lower reaches of the valleys, especially those of the Willamette Valley. Many areas that were active flood plains in the past are no longer subject to flooding.

Farming

Farming in the survey area is limited to the valleys and lower foothills adjacent to valley terraces. The soils on the flood plains in the area are used for cash crops such as snap beans, sweet corn, mint, strawberries, carrots, and garlic. The soils on terraces are used for many of the same crops, but they are also used for small grain and grass seed production. Grass seed has become the main crop on the poorly drained soils, which are extensive throughout the western part of the survey area. Dairy cattle, beef cattle, and sheep are raised on the valley terraces, high terraces, and foothills in the area; fruit and nuts are grown mainly on the well drained soils on terraces and foothills; wheat, oats, barley, hay, and pasture are grown on most of the soils in the agricultural areas; and Christmas tree farming is expanding on most of the better drained soils in the valleys and foothills. Water for irrigating farm crops generally is pumped from wells or from nearby rivers and streams.

Woodland

The survey area is one of the better timber growing areas in North America. About 56 percent of the area is classified as commercial forest land. About 80 percent of the commercial forest land is privately owned. The rest is publicly owned; of this about 14 percent is admininstered by the Bureau of Land Management, 5 percent by the state and county, and 1 percent by the Forest Service.

The principle forest cover type is the Pacific Douglas-fir type, which typically includes small amounts of western hemlock and western redcedar. The other dominant forest cover types are the Douglas-fir-western hemlock type at intermediate elevations and the Pacific silver-fir-hemlock type at the higher elevations. Nobel fir and Douglas-fir commonly are present in areas of this forest cover type, and some stands of mountain hemlock is present instead of western hemlock. Stands of Oregon white oak, bigleaf maple, and red alder can be harvested for specialty purposes such as furniture, fuelwood, and chips.

The forest land in the survey area is protected by fire by the state department of Forestry, by the Forest Service, and by local fire districts. The increasing population and subsequently increasing recreational activities in the area make accidental fires a constant threat, especially during dry summers.

Climate

By the National Climatic Center, Asheville, North Carolina.

The survey area is characterized by a temperate climate. Summers are fairly warm, but hot days are rare. Winters are cool, but snow and freezing temperatures are not common except at higher elevations. Rainfall is extremely light in summer, so crops growing actively during this period need irrigation. Several weeks often pass without precipitation. Rains are frequent during the rest of the year, especially late in fall and in winter.

Table 1 gives data on temperature and precipitation in the survey area, as recorded at Albany for the period 1951-74, at Cascadia for the period 1951-79, and at Detroit for the period 1953-77. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperatures at Albany, Cascadia, and Detroit are 42, 40, and 37 degrees, respectively, and the average daily minimum temperature is 35 degrees at Albany, 32 degrees at Cascadia, and 29 degrees at Detroit. The lowest temperature, -6 degrees, occurred at Albany on December 9, 1972. In summer, the average temperature is 64 degrees at Albany, 63 degrees at Cascadia, and 64 degrees at Detroit and the average daily maximum temperature is about 78 degrees. The highest recorded temperature, 103 degrees, occurred at Albany on July 28, 1958.

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

The total annual precipitation is 42 inches at Albany, 62 inches at Cascadia, and 88 inches at Detroit. Of this, 20 to 25 percent usually falls in April through September, which includes the growing season for most crops. The heaviest 1-day rainfall during the period of record was 3.37 inches at Detroit on January 28, 1965. Thunderstorms occur on about 5 days each year, and most occur in summer.

Average seasonal snowfall is 12 inches at Cascadia and 25 inches at Detroit. The greatest snow depth at any one time during the period of record was 61 inches at Detroit, 17 inches at Cascadia, and 9 inches at Albany. On an average, Albany has 1 to 2 days with at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The percentage of possible sunshine is 65 percent in summer and 25 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 9 miles per hour, in winter.

In most winters, one or two storms over the whole area bring strong and sometimes damaging winds, and in some years the accompanying heavy rains cause serious flooding. Every few years, either in winter or summer, a large invasion of a continental airmass from the east causes abnormal temperatures. In winter several consecutive days are well below freezing; in summer a week or longer is sweltering.

How This Survey Was Made

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

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

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

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy (26), the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While the soil survey was in progress, samples of some of the soils in the area were collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses and under different levels of management. Some interpretations were modified to fit local conditions, and some new interpretations were developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

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

General Soil Map Units

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

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

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

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

Map Unit Descriptions

Dominantly nearly level, deep, somewhat excessively drained, well drained, moderately well drained, and poorly drained soils on flood plains and stream terraces

This group consists of four map units. It is mainly on flood plains and low alluvial terraces along the major rivers and streams throughout the survey area. Elevation ranges from 125 to 900 feet. The average annual precipitation ranges from 40 to 60 inches, the average annual temperature is 52 to 54 degrees F, and the frost-free period is 165 to 210 days.

1. Chehalis-McBee-Chapman

Deep, well drained and moderately well drained, nearly level to undulating silty clay loams and loams that formed in recent alluvial deposits

This map unit consists of soils that are mainly on broad flood plains immediately adjacent to the Willamette, Santiam, and Calapooya Rivers. The soils are subject to rare or occasional periods of flooding in winter. Nearly all of this unit is cleared and cropped, but the areas that are not cleared support Douglas-fir, bigleaf maple, black cottonwood, Oregon white oak, blackberry, and grasses. Elevation ranges from 150 to 700 feet. The average annual precipitation is about 40 to 50 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This unit makes up about 3 percent of the survey area. It is about 35 percent Chehalis soils, 25 percent McBee soils, and 20 percent Chapman soils. The rest is soils of minor extent.

Chehalis soils are deep and well drained. They have a very dark grayish brown and very dark brown silty clay loam surface layer and a dark brown silty clay loam subsoil. These soils are in the areas farthest away from the rivers and are adjacent to the Chapman soils.

McBee soils are deep and moderately well drained. They have a dark brown silty clay loam surface layer and a dark brown and dark grayish brown, mottled silty clay loam subsoil. These soils are in old meander channels and depressional areas away from the active stream and river channels.

Chapman soils are deep and well drained. They have a very dark grayish brown loam surface layer and a very dark grayish brown and dark brown clay loam and loam subsoil. These soils are on flood plains and low alluvial river terraces and are adjacent to the Chehalis soils.

Of minor extent in this unit are somewhat excessively drained Newberg soils and excessively drained Camas soils in areas immediately adjacent to the active and recently abandoned river channels, well drained Cloquato soils on flood plains between areas of the Chehalis soils and the Newberg and Camas soils, and poorly drained Wapato soils in old meander channels away from the active stream channels.

The soils in this unit are some of the most intensively cultivated soils in the survey area. They are used mainly for orchard crops, small grain, hay, pasture, and vegetables. Vegetables, berries, specialty crops, and pasture are sprinkler irrigated. Irrigation water is available from streams and shallow wells. Drainage is needed on the McBee soils. The soils in this unit are easily worked and respond well to fertilizer. Soil compaction is a problem on the Chehalis and McBee soils if they are disturbed when wet.

Small-acreage homesites are scattered throughout this unit. Serious floods from the major streams occur in winter about once in 5 years.

Some areas of this unit can be used as a source of gravel.

Recreational uses of this unit are mainly boating, fishing, and hunting.

2. Newberg-Cloquato-Fluvents

Deep, somewhat excessively drained and well drained, nearly level to undulating fine sandy loams, silt loams, gravelly sandy loams, and sandy loams that formed in recent alluvial deposits

This map unit consists of soils on broad flood plains immediately adjacent to the Willamette, Santiam, and Calapooya Rivers. The soils are subject to occasional periods of flooding in winter. Nearly all of this unit is cleared and cropped, but the areas that are not cleared support Douglas-fir, bigleaf maple, black cottonwood, Oregon white oak, blackberry, and grasses. Elevation ranges from 125 to 700 feet. The average annual precipitation is about 40 to 50 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This unit makes up about 3.5 percent of the survey area. It is about 40 percent Newberg and similar soils, 25 percent Cloquato soils, and 15 percent Fluvents. The rest is soils of minor extent.

Newberg soils are deep and somewhat excessively drained. They have a dark brown fine sandy loam surface layer and a brown and dark grayish brown coarse sandy loam and loamy fine sand substratum. These soils are in areas immediately adjacent to the active and recently abandoned river channels.

Cloquato soils are deep and well drained. They have a very dark grayish brown silt loam surface layer and a dark brown silt loam subsoil. These soils are on the flood plains between areas of the Newberg soils and the minor Chehalis soils.

Fluvents are deep and well drained. They have a very dark brown, dark brown, or dark yellowish brown, highly stratified silt loam, sandy loam, or gravelly sandy loam surface layer and a loose gravel, extremely gravelly loamy sand, or extremely gravelly sand substratum. The soils are in areas immediately adjacent to active river and stream channels.

Of minor extent in this unit are moderately well drained McBee soils and poorly drained Wapato soils in old meander channels away from the active stream channels, well drained Chehalis soils in the areas farthest from the river, and excessively drained Riverwash and moderately well drained to poorly drained Fluvaquents in areas immediately adjacent to active river and stream channels.

The Newberg and Cloquato soils are used primarily for orchard crops, small grain, hay, pasture, and vegetables. In summer, sprinkler irrigation is needed for maximum production of most crops. Irrigation water is available from streams and shallow wells. The soils are easily worked and respond well to fertilizer. Cover crops are needed to protect the soils in this unit from occasional flooding in winter. Some areas of Fluvents produce stands of timber, mainly black cottonwood, that can be harvested if the soils are protected from flooding.

The soils in this unit are poorly suited to homesite development. Flooding and the potential for pollution of ground water because of very rapid permeability are the main limitations.

Some areas of Fluvents are a good source of gravel.

Recreational uses of this unit are limited by flooding. They mainly consist of boating, fishing, and hunting.

3. McAlpin-Waldo-Abiqua

Deep, well drained, moderately well drained, and poorly drained, nearly level silty clay loams that formed in recent alluvial deposits

This map unit consists of soils on alluvial fans, low alluvial stream terraces, and flood plains immediately adjacent to the rivers and streams tributary to the Willamette River. Nearly all of this unit is cleared and cropped, but the areas not cleared support Douglas-fir, bigleaf maple, Oregon white oak, black cottonwood, trailing blackberry, and grasses. Elevation ranges from 250 to 900 feet. The average annual precipitation is about 40 to 60 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This unit makes up about 2 percent of the survey area. It is about 40 percent McAlpin soils, 35 percent Waldo soils, and 10 percent Abiqua soils. The rest is soils of minor extent.

McAlpin soils are deep and moderately well drained. They have a dark brown silty clay loam surface layer and a dark reddish brown silty clay loam and reddish brown, mottled silty clay subsoil. These soils are on low alluvial stream terraces and alluvial fans.

Waldo soils are deep and poorly drained. They have a very dark gray, mottled silty clay loam surface layer and a dark gray and dark grayish brown, mottled silty clay subsoil. These soils are in depressional areas of the high flood plains and low alluvial stream terraces. They are subject to occasional periods of flooding.

Abiqua soils are deep and well drained. They have a dark brown silty clay loam surface layer and a dark reddish brown silty clay loam and silty clay subsoil. These soils are in the areas farthest from the rivers and streams on low alluvial stream terraces.

Of minor extent in this unit are somewhat excessively drained Newberg soils in areas immediately adjacent to active and recently abandoned river and stream channels and poorly drained Bashaw soils in slightly concave areas on flood plains, alluvial terraces, and alluvial fans.

The soils in this unit are some of the most intensively cultivated soils in the survey area. They are used primarily for hay, pasture, small grain, and row crops. In summer, sprinkler irrigation is needed for maximum production of most crops. Irrigation water is available from streams and wells. Drainage is needed on the McAlpin and Waldo soils for maximum production. Soil compaction is a problem if the soils are disturbed when wet. Cover crops are needed to protect the Waldo soils from occasional flooding in winter.

The McAlpin and Abiqua soils are suited to timber production. Plant competition and equipment limitations are the main concerns in producing and harvesting timber. Reforestation must be carefully managed to reduce competition from undesirable plants. If wheeled and tracked equipment is used when the soils are moist, puddling and compaction occur.

The Waldo soils are poorly suited to sanitary facilities and homesite development. Wetness, occasional flooding, and a high shrink-swell potential are the main limitations. Wetness and high shrink-swell potential are concerns on the McAlpin soils. High shrink-swell potential is a concern on the Abiqua soils.

Recreational uses of this unit are mainly boating, fishing, and hunting.

4. Bashaw

Deep, poorly drained, nearly level silty clays that formed in alluvial deposits

This map unit consists of soils in slightly concave areas on flood plains, alluvial terraces, and alluvial fans in valleys of the Willamette River and its tributaries. The soils are subject to frequent flooding in winter and spring. The vegetation in areas not cultivated consists mainly of Oregon ash, willow, hawthorn, rushes, sedges, and grasses. Elevation ranges from 200 to 400 feet. The average annual precipitation is 40 to 50 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This unit makes up about 3 percent of the survey area. It is about 80 percent Bashaw and similar soils. The rest is soils of minor extent.

Bashaw soils are deep and poorly drained. They have a black silty clay surface layer and a very dark gray and dark gray, mottled clay and silty clay substratum. These soils are in slightly concave areas on flood plains, alluvial terraces, and alluvial fans.

Of minor extent in this unit are poorly drained Awbrig, Conser, and Courtney soils and somewhat poorly drained Clackamas soils in slightly concave areas of low alluvial stream terraces; poorly drained Waldo soils in depressional areas of the high flood plains and low alluvial stream terraces; and poorly drained Dayton soils in slightly concave areas on broad valley terraces.

This unit is used mainly for hay, pasture, grass seed, and some spring grain. The main limitations are wetness and frequent flooding in winter and spring. Drainage is needed for maximum production. Soil compaction is a problem if the soil is disturbed when wet. Cover crops are needed for protection from flooding in winter.

This unit is poorly suited to sanitary facilities and homesite development. Wetness, flooding, and high shrink-swell potential are the main limitations.

This unit is poorly suited to recreational development, mainly because of wetness, flooding, and the clayey texture of the soil. Areas of this unit that support native vegetation provide habitat for various species of wildlife.

Dominantly nearly level, deep, well drained to poorly drained soils on terraces of the Willamette Valley

This group is made up of five map units. It is on low alluvial terraces and broad valley terraces throughout the survey area. Elevation ranges from 200 to 700 feet. The average annual precipitation is 40 to 50 inches, the average annual temperature is 52 to 54 degrees F, and the frost-free period is 165 to 210 days.

5. Clackamas-Courtney-Salem

Deep, well drained, somewhat poorly drained, and poorly drained, nearly level gravelly silt loams and gravelly silty clay loams that formed in old alluvial deposits

This map unit consists of soils on low alluvial terraces in valleys of the Willamette River and its tributaries. The vegetation in areas not cultivated is mainly Oregon ash, Oregon white oak, hawthorn, rose, grasses, and sedges. Elevation ranges from 200 to 700 feet. The average annual precipitation is about 40 to 50 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This map unit makes up about 3.5 percent of the survey area. It is about 30 percent Clackamas soils, 25 percent Courtney soils, and 15 percent Salem soils. The rest is soils of minor extent.

Clackamas soils are deep and somewhat poorly drained. They have a very dark grayish brown and dark brown gravelly silt loam surface layer, a very dark gray, mottled very gravelly silty clay loam subsoil, and a dark gray, mottled extremely gravelly clay loam substratum. These soils are in slightly concave areas on low alluvial stream terraces.

Courtney soils are deep and poorly drained. They have a very dark brown, mottled gravelly silty clay loam surface layer, a very dark grayish brown, mottled gravelly clay subsoil, and a dark brown, mottled very gravelly clay loam and extremely gravelly sand substratum. These soils are in slightly concave areas on low alluvial stream terraces.

Salem soils are deep and well drained. The surface layer is dark brown gravelly silt loam in the upper part and gravelly clay loam in the lower part. The subsoil is dark brown gravelly clay loam. These soils are in slightly convex areas on low alluvial stream terraces.

Of minor extent in this unit are poorly drained Conser and Awbrig soils in slightly concave areas on low alluvial stream terraces and moderately well drained Coburg soils in slightly convex areas on low alluvial stream terraces.

This unit is used mainly for hay, pasture, grass seed, and spring grain. It is also used for row crops, which are grown mainly on the Salem soils. The main limitations are wetness of the Clackamas and Courtney soils and the gravelly surface layer of the soils, which interferes with close tillage of young row crops. Drainage is needed for maximum production on the Clackamas and Courtney soils. The Salem soils have no major limitations. The soils in this unit respond well to fertilizer. Irrigation is needed in summer.

The Clackamas and Courtney soils are poorly suited to sanitary facilities and homesite development. Wetness, low soil strength, and high shrink-swell potential are the main concerns on the Courtney soils, and wetness is the main concern on the Clackamas soils. The Salem soils have no major limitations for homesite development.

This unit is limited for recreational development mainly because of wetness of the Clackamas and Courtney soils and the presence of gravel on the surface. Areas of this unit that support native vegetation are used for hunting.

6. Malabon-Coburg-Conser

Deep, well drained to poorly drained, nearly level silty clay loams that formed in old alluvial deposits

This map unit consists of soils on low alluvial stream terraces in the valleys of the Willamette River and its tributaries. The vegetation in areas not cultivated is mainly Douglas-fir, Oregon white oak, Pacific poison-oak, blackberry, shrubs, and grasses. Elevation ranges from 200 to 600 feet. The average annual precipitation is 40 to 50 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This unit makes up about 3 percent of the survey area. It is about 40 percent Malabon soils, 25 percent Coburg soils, and 10 percent Conser soils. The rest is soils of minor extent.

Malabon soils are deep and well drained. They have a very dark grayish brown silty clay loam surface layer and a dark brown and brown silty clay subsoil. These soils are in slightly convex areas on low alluvial stream terraces.

Coburg soils are deep and moderately well drained. They have a very dark grayish brown silty clay loam surface layer and a very dark brown and brown, mottled silty clay and silty clay loam subsoil. These soils are in slightly convex areas on low alluvial stream terraces.

Conser soils are deep and poorly drained. They have a very dark brown, mottled silty clay loam surface layer. The upper part of the subsoil is very dark grayish brown and dark grayish brown, mottled silty clay, and the lower part is dark grayish brown, mottled silty clay loam. These soils are in slightly concave areas on low alluvial stream terraces.

Of minor extent in this unit are poorly drained Awbrig and Courtney soils and somewhat poorly drained Clackamas soils in slightly concave areas on low alluvial stream terraces and well drained Salem soils in slightly convex areas on low alluvial stream terraces.

The soils in this unit are used mainly for small grain, grass seed, orchard crops, hay, pasture, and row crops. The Malabon soils have no major limitations. Drainage is needed for maximum production on the Coburg and Conser soils. Irrigation is needed in summer. Soil compaction is a problem if the soils are disturbed when wet. The soils respond well to fertilizer.

The Malabon and Coburg soils have good potential for homesite development. The main limitations are high shrink-swell potential and low soil strength. The Coburg and Conser soils are limited for sanitary facilities by wetness.

If this unit is used for recreational development, the main limitations are the clayey surface layer, which is sticky during rainy periods, and the wetness of the Coburg and Conser soils. Areas of this unit that support native vegetation are used for hunting.

7. Awbrig-Coburg-Conser

Deep, moderately well drained to poorly drained, nearly level silty clay loams that formed in old alluvial deposits

This map unit consists of soils on low alluvial stream terraces in valleys of the Willamette River and its tributaries. The vegetation in areas not cultivated is mainly Oregon ash, black cottonwood, hawthorn, rose, grasses, sedges, and rushes. Douglas-fir is in the better drained areas. Elevation ranges from 200 to 600 feet. The average annual precipitation is 40 to 50 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This unit makes up 3.5 percent of the survey area. It is about 30 percent Awbrig soils, 25 percent Coburg soils, and 20 percent Conser soils. The rest is soils of minor extent.

Awbrig soils are deep and poorly drained. The surface layer is very dark grayish brown silty clay loam. The upper part of the subsoil is very dark grayish brown, mottled silty clay loam, and the lower part is very dark gray, mottled clay. The upper part of the substratum is grayish brown, mottled silty clay loam, and the lower part is grayish brown, mottled silty clay. These soils are in slightly concave areas on low alluvial stream terraces.

Coburg soils are deep and moderately well drained. The surface layer is very dark grayish brown silty clay loam, and the subsoil is very dark brown and brown, mottled silty clay and silty clay loam. These soils are in slightly higher, slightly convex areas adjacent to depressional areas and drainageways on low alluvial stream terraces.

Conser soils are deep and poorly drained. The surface layer is very dark brown, mottled silty clay loam. The upper part of the subsoil is very dark grayish brown and dark grayish brown, mottled silty clay, and the lower part is dark grayish brown, mottled silty clay loam. These soils are in slightly concave areas on low alluvial stream terraces.

Of minor extent in this unit are poorly drained Courtney soils and somewhat poorly drained Clackamas soils in slightly concave areas on low alluvial stream terraces, well drained Malabon and Salem soils in slightly convex areas on low alluvial stream terraces, and Bashaw soils in slightly concave areas on flood plains, alluvial terraces, and alluvial fans.

The soils in this unit are used mainly for hay, pasture, small grain, and grass seed. Drainage is needed for maximum production of crops. Soil compaction is a problem if the soils are disturbed when wet. The soils respond well to fertilizer.

This unit is poorly suited to sanitary facilities and homesite development because of wetness. A high shrink-swell potential is a concern for buildings and roads.

This unit is poorly suited to recreational development. The main limitations are wetness and the clayey texture of the surface layer.

Areas of this unit under native vegetation provide good habitat for various species of wildlife.

8. Woodburn-Amity-Willamette

Deep, well drained to somewhat poorly drained, nearly level silt loams that formed in old alluvial deposits

This map unit consists of soils on broad terraces of the Willamette Valley. Nearly all of this unit is cleared and cropped, but the areas not cleared support Douglas-fir, Oregon white oak, Pacific poison-oak, blackberry, shrubs, and grasses. Elevation ranges from 200 to 400 feet. The average annual precipitation is 40 to 50 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This unit makes up 7 percent of the survey area. It is about 45 percent Woodburn soils, 20 percent Amity soils, and 10 percent Willamette soils. The rest is soils of minor extent.

Woodburn soils are deep and moderately well drained. The surface layer is very dark brown and dark brown silt loam. The upper part of the subsoil is dark brown, dark grayish brown, and brown, mottled silty clay loam, and the lower part is brown silty clay loam. These soils are in slightly convex areas on broad terraces.

Amity soils are deep and somewhat poorly drained. The surface layer is very dark grayish brown and dark gray silt loam, and the subsoil is grayish brown and olive brown, mottled silty clay loam. The substratum is olive brown, mottled silt loam. These soils are in slightly concave areas on broad terraces.

Willamette soils are deep and well drained. The surface layer is very dark brown and very dark grayish brown silt loam, and the subsoil is dark brown and dark yellowish brown silty clay loam. The substratum is dark yellowish brown silty clay loam. These soils are in slightly convex areas on broad terraces.

Of minor extent in this unit are poorly drained Dayton and Concord soils and somewhat poorly drained Holcomb soils in slightly concave areas on broad valley terraces and well drained Malabon soils and moderately well drained Coburg soils in slightly convex areas of low alluvial stream terraces adjacent to the higher, broad valley terraces.

The soils in this unit are used mainly for small grain, grass seed, orchard crops, berries, and vegetables. Drainage is needed for maximum production on the Woodburn and Amity soils. The Willamette soils have no major limitations. Irrigation is needed in summer. Soil compaction may be a problem if the soils are disturbed when wet. The soils respond well to fertilizer.

The main limitations of this unit for homesite development are moderate shrink-swell potential and low soil strength. The Woodburn and Amity soils are limited for use as sanitary facilities because of wetness.

The Woodburn and Willamette soils have no major limitations for recreational development. Wetness is a limitation of the Amity soils. Areas of this unit that support native vegetation are used for hunting.

9. Dayton-Amity-Holcomb

Deep, somewhat poorly drained and poorly drained, nearly level silt loams that formed in old alluvial deposits

This map unit consists of soils on broad terraces of the Willamette Valley. Nearly all of this unit is cleared and cropped, but the areas not cleared support Oregon white oak, Oregon ash, hawthorn, rose, poison-oak, grasses, sedges, and rushes. Douglas-fir is in the better drained areas. Elevation ranges from 200 to 400 feet. The average annual precipitation is 40 to 50 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This unit makes up 9.5 percent of the survey area. It is about 55 percent Dayton soils, 15 percent Amity soils, and 15 percent Holcomb soils. The rest is soils of minor extent.

Dayton soils are deep and poorly drained. The surface layer is dark brown silt loam, and the subsurface layer is dark gray silt loam. The upper part of the subsoil is dark gray and olive gray silty clay, and the lower part is gray, mottled silty clay and dark gray, mottled silt loam. The substratum is brown, mottled silt loam. These soils are in slightly concave areas on broad valley terraces.

Amity soils are deep and somewhat poorly drained. The upper part of the surface layer is very dark grayish brown silt loam, and the lower part is dark gray silt loam. The subsoil is grayish brown and olive brown, mottled silty clay loam. The substratum is olive brown, mottled silt loam. These soils are in the slightly higher lying areas on broad terraces. They are adjacent to the Dayton soils

Holcomb soils are deep and somewhat poorly drained. The upper part of the surface layer is very dark grayish brown silt loam, and the lower part is very dark grayish brown, mottled silty clay loam. The subsurface is dark grayish brown, mottled silty clay loam. The subsoil is grayish brown, mottled clay and silty clay. The substratum is dark grayish brown silty clay loam. These soils are in the slightly convex areas on broad terraces.

Of minor extent in this unit are poorly drained Concord soils, moderately well drained Woodburn soils, and well drained Willamette soils. The Concord soils are in slightly concave areas on broad valley terraces, and the Woodburn and Willamette soils are in slightly convex areas on broad terraces.

The soils in this unit are used mainly for hay, pasture, small grain, and grass seed. Drainage is needed for maximum production. Irrigation is needed in summer. Soil compaction is a problem if the soils are disturbed when wet. The soils respond well to fertilizer.

This unit is poorly suited to sanitary facilities and homesite and recreational development because of wetness. A high shrink-swell potential in the Dayton and Holcomb soils is a limitation for buildings and roads.

Areas of this unit that support native vegetation provide good habitat for various species of birds and other wildlife.

Dominantly gently sloping to steep, deep to shallow, well drained to somewhat poorly drained soils on the foothills of the western part of the Cascade Range

This group consists of two map units. It is on the foothills along the western part of the Cascade Range, adjacent to the Willamette Valley. Elevation ranges from 300 to 1,400 feet. The average annual precipitation ranges from 40 to 60 inches, the average annual temperature is 52 to 54 degrees F, and the frost-free period is 165 to 210 days.

10. Hazelair-Dixonville-Philomath

Moderately deep and shallow, well drained to somewhat poorly drained, gently sloping to steep silty clay loams, silty clays, and cobbly silty clays that formed in material weathered from basic igneous or sedimentary rock

This map unit consists of soils on foothills adjacent to terraces of the Willamette Valley. The native vegetation is mainly Douglas-fir, Oregon white oak, bigleaf maple, Pacific poison-oak, western hazel, rose, and other shrubs, and grasses. Elevation ranges from 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This unit makes up 7 percent of the survey area. It is about 25 percent Hazelair soils, 20 percent Dixonville soils, and 20 percent Philomath soils. The rest is soils of minor extent.

Hazelair soils are moderately deep and are moderately well drained and somewhat poorly drained. They have a very dark grayish brown silty clay loam surface layer, a very dark grayish brown silty clay subsoil, and a variegated, yellowish brown and light yellowish brown, mottled clay substratum. These soils are in gently sloping to moderately steep areas on foothills.

Dixonville soils are moderately deep and well drained. They have a very dark grayish brown silty clay loam surface layer and a dark brown clay subsoil. These soils are in gently sloping to steep areas on foothills.

Philomath soils are shallow and well drained. They have a very dark brown silty clay or cobbly silty clay surface layer and a very dark brown and very dark grayish brown clay subsoil. These soils are in gently sloping to steep areas on foothills.

Of minor extent in this unit are well drained Chehulpum, Ritner, Steiwer, and Witzel soils, somewhat poorly drained Dupee and Witham soils, and poorly drained Panther soils. The Chehulpum, Ritner, Steiwer, and Witzel soils are on low foothills. The Dupee, Panther, and Witham soils are in depressional areas and drainageways and on alluvial fans of low foothills.

The soils in this unit are used mainly for hay and pasture. A few areas are used for small grain. Slope is a major limitation for the use of equipment in some areas. Irrigation is needed in summer for maximum production of crops. Soil compaction is a problem if the soils are disturbed when wet. Drainage is needed on the Hazelair soil.

This unit is limited for homesite development and sanitary facilities because of slope in some areas and high shrink-swell potential. The Hazelair soils are also limited for sanitary facilities by wetness, and the Philomath soils are limited by shallow depth to bedrock.

This unit is poorly suited to the production of Douglas-fir. It is limited by the dense clay texture and wetness of the Hazelair soil and the shallow depth to bedrock in the Philomath soil. Compaction occurs if wheeled and tracked equipment is used when the soils are moist.

If this unit is used for recreational development, the main limitations are slope in some areas and the clayey texture of the soils. Large areas of this unit support native vegetation and are used for hunting.

11. Nekia-Bellpine-Jory

Deep and moderately deep, well drained, gently sloping to steep silty clay loams that formed in material weathered from basic igneous, sedimentary, or tuffaceous rock

This map unit consists of soils on foothills adjacent to terraces of the Willamette Valley. The native vegetation is mainly Douglas-fir, Oregon white oak, bigleaf maple, western hazel, Pacific poison-oak, common snowberry, rose, and other shrubs, and grasses. Elevation ranges from 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual temperature is about 53 degrees F, and the frost-free period is 165 to 210 days.

This unit makes up 10 percent of the survey area. It is about 35 percent Nekia soils, 20 percent Bellpine soils, and 15 percent Jory soils. The rest is soils of minor extent.

Nekia soils are moderately deep and well drained. The surface layer is dark brown and dark reddish brown silty clay loam, and the subsoil is dark reddish brown clay. These soils are on foothills.

Bellpine soils are moderately deep and well drained. The surface layer is dark reddish brown silty clay loam. The upper part of the subsoil is dark reddish brown silty clay, and the lower part is reddish brown and yellowish red clay. These soils are on foothills.

Jory soils are deep and well drained. The surface layer is dark reddish brown silty clay loam. The upper part of the subsoil is dark reddish brown and reddish brown clay, and the lower part is yellowish red silty clay. These soils are on foothills.

Of minor extent in this unit are well drained Ritner, Steiwer, Willakenzie, and Witzel soils on foothills and somewhat poorly drained Dupee soils in depressional areas and drainageways and on alluvial fans of low foothills.

The soils in this unit are used mainly for small grain, hay, pasture, orchard crops, and berries. Slope is a major limitation for the use of equipment in some areas. Irrigation is needed in summer for maximum production of crops. Soil compaction is a problem if the soils in this unit are disturbed when wet. When wet, the soils are sticky and plastic and trafficability is restricted. The soils respond well to fertilizer.

This unit is suited to the production of Douglas-fir. When harvesting timber on the unit, use of management that minimizes erosion is essential. Compaction occurs if wheeled and tracked equipment is used when the soils are moist. Seedling mortality may be a concern because of the droughtiness of the soils in summer. Reforestation should be carefully managed to reduce competition from undesirable plants.

If this unit is used for homesite development, the main limitations are high shrink-swell potential and low soil strength. Slope in some areas also limits building site development and sanitary facilities. The depth to bedrock in the Nekia and Bellpine soils is a concern when installing septic tank absorption fields.

If this unit is used for recreational development, the main limitations are slope in some areas and the clayey texture of the soils.

Areas of this unit that support native vegetation are used for hunting.

Dominantly gently sloping to very steep, deep and moderately deep, well drained, warm soils of the western part of the Cascade Range

This group consists of three map units. It is on uplands in the western part of the Cascade Range. Elevation ranges from 700 to 2,700 feet. The average annual precipitation ranges from 60 to 100 inches, the average annual temperature is 45 to 52 degrees F, and the frost-free period is 140 to 200 days.

12. Honeygrove-Peavine-Apt

Deep and moderately deep, well drained, gently sloping to very steep silty clay loams that formed in colluvium derived from sedimentary or tuffaceous rock

This map unit consists of soils on broad bench tops and side slopes of uplands. The native vegetation is mainly Douglas-fir, western hemlock, bigleaf maple, red alder, vine maple, salal, cascade Oregon-grape, western swordfern, and trailing blackberry. Elevation ranges from 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual temperature is about 50 degrees F, and the frost-free period is 160 to 200 days.

This unit makes up 13.5 percent of the survey area. It is about 45 percent Honeygrove soils, 10 percent Peavine soils, and 10 percent Apt soils. The rest is soils of minor extent.

Honeygrove soils are deep and well drained. They have a dark reddish brown silty clay loam surface layer, a dark reddish brown silty clay subsoil, and a strong brown silty clay substratum. These soils are on broad, rolling bench tops and on side slopes of uplands.

Peavine soils are moderately deep and well drained. They have a dark reddish brown silty clay loam surface layer and a dark reddish brown, reddish brown, and yellowish red silty clay subsoil. These soils are on broad, rolling bench tops and on side slopes of uplands.

Apt soils are deep and well drained. They have a dark reddish brown silty clay loam surface layer and a dark brown silty clay and variegated brown, yellow, and dark reddish brown very gravelly silty clay loam subsoil. These soils are on broad, rolling bench tops and on side slopes of uplands.

Of minor extent in this unit are well drained Harrington, Kilchis, Klickitat, and McDuff soils, moderately well drained Cumley soils, and somewhat poorly drained and poorly drained Minniece soils. The Harrington, Kilchis, and Klickitat soils are on ridgetops and side slopes of uplands. The McDuff soils are on side slopes of uplands. The Cumley and Minniece soils are in depressional areas, basins, and narrow drainageways of uplands.

This unit is used mainly for timber production. When harvesting timber on the unit, using management that minimizes erosion is essential. Puddling and compaction occur if wheeled and tracked equipment is used when the soils are moist. Cable or highlead logging systems should be used in the steeper areas. Reforestation should be carefully managed to reduce competition from undesirable plants.

If this unit is used for homesite development, the main limitations are low soil strength and high shrink-swell potential. The depth to bedrock in the Peavine soils should be considered when installing septic tank absorption fields. Slope limits use of some areas of this unit for homesite development.

Recreational use of this unit is limited by slope in some areas and the clayey texture of the surface layer. The unit is used for hiking, picnicking, and camping. Much of the unit is under native vegetation and is used for hunting.

13. Blachly-Klickitat-Harrington

Deep and moderately deep, well drained, gently sloping to very steep clay loams, stony loams, and gravelly loams that formed in colluvium derived from sedimentary or basic igneous rock

This map unit consists of soils on broad bench tops, ridgetops, and side slopes of uplands. The native vegetation is mainly Douglas-fir, western hemlock, bigleaf maple, red alder, vine maple, salal, cascade Oregon-grape, western swordfern, and trailing blackberry. Elevation ranges from 800 to 2,700 feet. The average annual precipitation is 60 to 100 inches, the average annual temperature is about 49 degrees F, and the frost-free period is 140 to 200 days.

This unit makes up 7 percent of the survey area. It is about 50 percent Blachly soils, 15 percent Klickitat soils, and 15 percent Harrington soils. The rest is soils of minor extent.

Blachly soils are deep and well drained. The surface layer is dark reddish brown clay loam. The upper part of the subsoil is reddish brown silty clay and clay, and the lower part is dark brown silty clay loam. These soils are on broad bench tops and side slopes of uplands.

Klickitat soils are deep and well drained. The surface layer is dark reddish brown stony loam, and the subsoil is dark reddish brown very cobbly clay loam. These soils are on ridgetops and side slopes of uplands.

Harrington soils are moderately deep and well drained. The surface layer is dark reddish brown gravelly loam. The upper part of the subsoil is dark reddish brown very gravelly clay loam, and the lower part is very cobbly loam. These soils are on ridgetops and side slopes of uplands.

Of minor extent in this unit are well drained Kilchis and Kinney soils, moderately well drained Cumley soils, and somewhat poorly drained to poorly drained Minniece soils. The Kilchis soils are on side slopes of uplands. The Kinney soils are on broad bench tops, ridgetops, and side slopes of uplands. The Cumley and Minniece soils are in depressional areas, basins, and narrow drainageways of uplands.

This unit is used mainly for timber production. When harvesting timber on the unit, use of management that minimizes erosion is essential. Puddling and compaction occur if wheeled and tracked equipment is used when the soils are moist. Cable or highlead logging systems should be used in the steeper areas. Stones on the surface of the Klickitat and Harrington soils may interfere with equipment use. Reforestation should be carefully managed to reduce competition from undesirable plants.

Recreational use of this unit is limited by slope in some areas, the clayey surface layer of the Blachly soil, and stones on the surface of the Klickitat and Harrington soils. The unit is used for hiking, picnicking, camping, and hunting.

14. Kinney-Klickitat-Harrington

Deep and moderately deep, well drained, gently sloping to very steep cobbly loams, stony loams, and gravelly loams that formed in glacial till or colluvium derived from basic igneous or tuffaceous rock

This map unit consists of soils on broad bench tops, ridgetops, and side slopes of uplands. The native vegetation is mainly Douglas-fir, western hemlock, bigleaf maple, red alder, vine maple, cascade Oregon-grape, western brackenfern, western swordfern, salal, and red huckleberry. Elevation ranges from 800 to 2,700 feet. The average annual precipitation is 60 to 100 inches, the average annual temperature is about 48 degrees F, and the frost-free period is 140 to 200 days.

This unit makes up 11 percent of the survey area. It is about 45 percent Kinney soils, 20 percent Klickitat soils, and 15 percent Harrington soils. The rest is soils of minor extent.

Kinney soils are deep and well drained. The surface layer is dark brown cobbly loam, the subsoil is dark yellowish brown cobbly clay loam, and the substratum is dark yellowish brown very cobbly loam. These soils are on broad bench tops, ridgetops, and side slopes of uplands.

Klickitat soils are deep and well drained. The surface layer is dark reddish brown stony loam, and the subsoil is dark reddish brown very cobbly clay loam. These soils are on ridgetops and side slopes of uplands.

Harrington soils are moderately deep and well drained. The surface layer is dark reddish brown gravelly loam. The upper part of the subsoil is dark reddish brown very gravelly clay loam, and the lower part is very cobbly loam. These soils are on ridgetops and side slopes of uplands.

Of minor extent in this unit are well drained Blachly, Bohannon, Kilchis, and Quartzville soils and moderately well drained Acanod soils. The Blachly and Quartzville soils are on broad bench tops and side slopes of uplands. The Bohannon and Kilchis soils are on ridges and side slopes of uplands. The Acanod soil is in basins and depressional areas of uplands.

This unit is used mainly for timber production. When harvesting timber on this unit, use of management that minimizes erosion is essential. Using standard wheeled and tracked equipment when the soils are dry causes rutting and displacement of soil material. Cable or highlead logging systems should be used in the steeper areas. Stones on the surface of the soils may interfere with equipment use. Reforestation should be carefully managed to reduced competition from undesirable plants.

Recreational use of this unit is limited by slope in some areas and by stones on the surface. The unit is used for hunting.

Dominantly gently sloping to extremely steep, deep to shallow, somewhat excessively drained and well drained, cold soils of the western part of the Cascade Range

This group consists of three map units. It is on the high ridgetops and side slopes of uplands in the western part of the Cascade Range. Elevation ranges from 2,700 to 5,000 feet. The average annual precipitation ranges from 70 to 120 inches, the average annual temperature is 41 to 45 degrees F, and the frost-free period is 70 to 120 days.

15. Keel-Hummington-Cruiser

Deep and moderately deep, well drained, gently sloping to very steep gravelly silt loams, very gravelly loams, and gravelly loams that formed in colluvium derived from basic igneous rock and volcanic ash

This map unit consists of soils on narrow to broad ridgetops and side slopes of uplands. The native vegetation is mainly Douglas-fir, mountain hemlock, noble fir, Pacific rhododendron, tall blue huckleberry, red huckleberry, vine maple, and common beargrass. Elevation ranges from 2,700 to 4,700 feet. The average annual precipitation is 70 to 120 inches, the average annual temperature is about 43 degrees F, and the frost-free period is 70 to 110 days.

This unit makes up 6.5 percent of the survey area. It is about 50 percent Keel soils, 20 percent Hummington soils, and 10 percent Cruiser soils. The rest is soils of minor extent.

Keel soils are moderately deep and well drained. The upper part of the surface layer is very dark brown gravelly silt loam, and the lower part is very dark grayish brown and dark brown silt loam. The upper part of the subsoil is brown clay loam, and the lower part is brown cobbly loam. These soils are on broad ridgetops and side slopes of uplands.

Hummington soils are moderately deep and well drained. The upper part of the surface layer is very dark grayish brown very gravelly loam, and the lower part is dark brown very cobbly loam. The upper part of the subsoil is dark yellowish brown very cobbly loam, and the lower part is yellowish brown extremely cobbly loam. These soils are on narrow to broad ridgetops and side slopes of uplands.

Cruiser soils are deep and well drained. The surface layer is dark brown and dark reddish brown gravelly loam. The upper part of the subsoil is reddish brown gravelly loam, and the lower part is reddish brown and yellowish red gravelly clay loam. The substratum is yellowish red very cobbly clay loam. These soils are on broad ridgetops and side slopes of uplands.

Of minor extent in this unit are somewhat excessively drained Yellowstone soils, well drained Bensley, Henline, and Valsetz soils, moderately well drained Crabtree soils, and Rock outcrop. The Bensley, Henline, Valsetz, and Yellowstone soils are on narrow to broad ridgetops and on side slopes of uplands. The Crabtree soils are on ridgetops and in concave areas on side slopes of uplands.

This unit is used mainly for timber production. Snowpack limits the use of equipment and limits access. Cable or highlead logging systems should be used in the steeper areas. The large amount of rock fragments in the soils increases seedling mortality. Windthrow is a hazard on the Keel and Hummington soils because of the limited depth to bedrock, which restricts rooting depth.

Recreational use of this unit is limited by snowpack, which restricts access, and by stones on the surface. The unit is used for hiking and hunting.

16. Henline-Yellowstone-Bensley

Deep to shallow, somewhat excessively drained and well drained, gently sloping to extremely steep stony loams and very stony sandy loams that formed in glacial till and colluvium derived from basic igneous rock

This map unit consists of soils on narrow to broad ridgetops and on side slopes of uplands. The native vegetation is mainly Douglas-fir, mountain hemlock, noble fir, Pacific rhododendron, tall blue huckleberry, vine maple, and common beargrass. Elevation ranges from 2,700 to 5,000 feet. The average annual precipitation is 70 to 120 inches, the average annual temperature is about 43 degrees F, and the frost-free period is 70 to 110 days.

This unit makes up 3.5 percent of the survey area. It is about 30 percent Henline soils, 30 percent Yellowstone soils, and 15 percent Bensley soils. The rest is soils of minor extent.

Henline soils are moderately deep and well drained. The upper part of the surface layer is very dark grayish brown very stony sandy loam, and the lower part is very dark grayish brown and dark brown very cobbly sandy loam. The substratum is dark yellowish brown very cobbly sandy loam. These soils are on ridgetops and side slopes of uplands.

Yellowstone soils are shallow and somewhat excessively drained. The upper part of the surface layer is dark brown stony loam, and the lower part is dark brown very stony sandy loam. These soils are on narrow ridgetops and on side slopes of uplands.

Bensley soils are deep and well drained. The surface layer is very dark brown and very dark grayish brown stony loam. The upper part of the subsoil is brown very gravelly clay loam, and the lower part is brown and dark grayish brown very cobbly clay loam. These soils are on ridgetops and side slopes of uplands.

Of minor extent in this unit are well drained Cruiser, Keel, Hummington, and Valsetz soils on narrow to broad ridgetops and on side slopes of uplands, moderately well drained Crabtree soils on ridgetops and concave side slopes of uplands, and Rock outcrop.

This unit is used mainly for timber production. Snowpack limits the use of equipment and limits access. Cable or highlead logging systems should be used in the steeper areas. The large amount of rock fragments in the soils increases seedling mortality. Stones on the surface may interfere with equipment use. Windthrow is a hazard on the Henline and Yellowstone soils because of the limited depth to bedrock, which restricts rooting depth.

Recreational use of this unit is limited by snowpack, which restricts access, and by stones on the surface. The unit is used for hiking and hunting.

17. Moe-Flane

Deep, well drained, gently sloping to very steep gravelly loams that formed in colluvium derived from basic igneous rock, tuffaceous rock, and breccia

This map unit consists of soils on broad bench tops and on side slopes of uplands. The native vegetation is mainly Douglas-fir, western hemlock, western redcedar, Pacific rhododendron, vine maple, cascade Oregon-grape, common beargrass, and trailing blackberry. Elevation ranges from 2,800 to 3,600 feet. The average annual precipitation is 70 to 90 inches, the average annual temperature is 45 degrees F, and the frost-free period is 90 to 120 days.

This unit makes up 3.5 percent of the survey area. It is about 50 percent Moe soils and 25 percent Flane soils. The rest is soils of minor extent.

Moe soils are deep and well drained. The surface layer is very dark grayish brown and very dark brown gravelly loam. The upper part of the subsoil is dark brown silty clay loam, and the lower part is dark yellowish brown and dark brown silty clay. These soils are on broad bench tops and on side slopes of uplands.

Flane soils are deep and well drained. The surface layer is very dark grayish brown and dark yellowish brown gravelly loam. The subsoil is brown and yellowish brown very cobbly silty clay loam. The substratum is dark grayish brown extremely cobbly clay loam. These soils are on broad bench tops and on side slopes of uplands.

Of minor extent in this unit are excessively drained Zango soils and well drained Apt, Cruiser, Dobbins, Kinney, Quartzville, and Mulkey soils. The Apt, Kinney, and Quartzville soils are on broad bench tops, ridgetops, and side slopes of uplands. The Dobbins and Zango soils are on side slopes of uplands. The Cruiser and Mulkey soils are at elevations above 2,800 feet on ridgetops and side slopes of uplands.

This unit is used mainly for timber production. Snowpack limits the use of equipment and limits access. Cable or highlead logging systems should be used in the steeper areas. When harvesting timber, use of management that minimizes erosion is essential. Reforestation should be carefully managed to reduce competition from undesirable plants.

Recreational use of this unit is limited by snowpack, which restricts access. The unit is used for hiking and hunting.

Broad Land Use Considerations

Never before has so much emphasis been placed on the conservation of our basic natural resources in this country. In the past, agricultural and forest lands were considered as an unlimited source from which land needed for other uses could be drawn. The resulting impact on the remaining area was given little thought. As people began to see the steady decline of agricultural and forest lands, they started to become concerned about land use problems such as declining acreage for food and fiber production, uncontrolled development, lack of land for recreation and esthetic needs, and development of land areas subject to flooding.

Developments that result in irreversible land use changes represent a loss of valuable natural resources. Individual losses may appear small; however, the overall impact on the production and economy of the survey area can be drastic. Alternatives should be considered when decisions are being made to irrevocably commit agricultural and forest lands to other uses so that options of future generations are not lost.

Approximately 39,000 acres of the survey area is considered to be urban or developed land. In general, those soils in the survey area that have good potential for cultivated crops also have good potential for urban use or for other development. Soils on the foothills and in the mountainous areas have good potential for timber production, water supply, wildlife habitat, and recreation. The soil data in this survey will assist decision makers and enhance the general public's understanding of the kind, extent, and location of soils in the area. It will be a valuable resource tool in planning future land use patterns.

Approximately 22 percent of the land in the survey area is used for cultivated crops, including 3 percent that is used for hay and pasture. This land is scattered throughout the Willamette Valley and adjoining valleys of tributaries in the county, and it is represented largely by units 1 through 9 and 11. Irrigation is required for high yields of most cultivated crops. Some areas are limited by wetness, susceptibility to flooding, or slope. Limited or complete drainage needs to be provided for units 3, 4, 5, 7, and 9. Bashaw, Clackamas, Courtney, Awbrig, Coburg, Conser, Dayton, Amity, and Holcomb soils are the main soils in these units. Occasional to frequent flooding in winter or early in spring can occur on units 1, 2, and 4 and include the Chehalis, Cloquato, Newberg, Camas, and Bashaw soils. These soils need protection from erosion as a result of flooding. Map unit 11 is in the foothill areas and is represented by the sloping Jory, Nekia, and Bellpine soils. The two main concerns are soil erosion and equipment use on these soils when they are wet. Generally, units 1, 2, 3, 6, and 8 are well suited to a variety of crops and cultural practices and include the Chehalis, Cloquato, Newberg, Malabon, Salem, Coburg, Willamette, Woodburn, and Amity soils.

In general, the gently sloping Jory, Nekia, and Bellpine soils on foothills in unit 11 and the Abiqua, McAlpin, Malabon, Salem, Coburg, Willamette, Woodburn, and Amity soils on valley terraces in units 3, 6, and 8 have a high potential for urban uses. Soil limitations such as shrinking and swelling, low strength, wetness, and steepness of slope must be considered when these soils are used for urban development. Soils on flood plains, such as the soils in units 1, 2, and 4, have limited potential for urban development because of susceptibility to flooding. Low soil strength, shrinking and swelling of the soil, and wetness are major obstacles that must be overcome to make map units 5, 7, 9, and 10 suitable for development. Clackamas, Courtney, Awbrig, Conser, Dayton, Amity, Holcomb, Dixonville, Hazelair, and Philomath soils are representative soils in these units.

About 75 percent of the land in the survey area is woodland. Soils that are favorable for timber production include the Jory, Nekia, and Bellpine soils on foothills in map unit 11 and the Honeygrove, Peavine, Harrington, Blachly, Klickitat, Kinney, and Quartzville soils on uplands in units 12, 13, and 14. The potential for the production of timber on these soils may vary widely, but it is generally good. Proper management practices need to be used to ensure successful harvesting and reforestation. The major concerns of management are equipment limitations on the soils that are wet, clayey, and steep; erosion; and competition from undesirable plants. In unit 11 there has been some conversion of forest land to farmland or subdivision for homesites, or both. The soils in the mountainous uplands, such as those in units 15, 16, and 17 are limited in their potential to produce timber mainly by cold temperatures. The Keel, Hummington, Cruiser, Bensley, Henline, Yellowstone, Flane, and Moe soils are the main soils in these map units.

The potential for recreational use of all units ranges from low to high, depending on the intensity of use and the restrictive characteristics of the soils. Some restrictive characteristics for recreational use are susceptibility to flooding, excessive slope, wetness, restricted depth to bedrock, and presence of stones. The potential for the recreational use of units 1 and 2 is rated low because of the hazard of flooding. If protected from flooding, these units can be intensively developed for recreational uses. The hilly to steep soils in map units 10 through 17 are limited for intensive recreational developments such as playgrounds and camp areas, but they do have limited use for hiking and picnicking.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

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

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Jory silty clay loam, 2 to 12 percent slopes, is one of several phases in the Jory series.

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

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Dixonville-Philomath-Hazelair complex, 3 to 12 percent slopes, is an example.

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

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

Map Unit Descriptions

1A—Abiqua silty clay loam, 0 to 3 percent slopes. This deep, well drained soil is on low alluvial stream terraces in valleys of streams tributary to the Willamette River. It formed in fine textured alluvium derived from mixed sources. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 900 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown silty clay loam about 7 inches thick. The upper 22 inches of the subsoil is dark reddish brown silty clay loam, and the lower 31 inches is dark reddish brown and dark brown silty clay. In some areas of similar included soils, the subsoil is gravelly below a depth of 40 inches.

Included in this unit are small areas of McAlpin and Waldo soils and Abiqua soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Abiqua soil is moderately slow. Available water capacity is about 8 to 12 inches. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for small grain, vegetables, orchards, hay, and pasture. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It has few limitations.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Sufficient water for irrigation generally can be obtained from nearby streams or wells.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are the moderately slow permeability, low soil strength, and the shrink-swell potential of the subsoil.

Septic tank absorption fields may function poorly in winter. If this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling.

Buildings and roads should be designed to offset the effects of shrinking and swelling. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability class I.

1B—Abiqua silty clay loam, 3 to 5 percent slopes. This deep, well drained soil is on low alluvial stream terraces in valleys of streams tributary to the Willamette River. It formed in fine textured alluvium derived from mixed sources. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 900 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown silty clay loam about 7 inches thick. The upper 22 inches of the subsoil is dark reddish brown silty clay loam, and the lower 31 inches is dark reddish brown and dark brown silty clay. In some areas of similar included soils, the subsoil is gravelly below a depth of 40 inches.

Included in this unit are small areas of McAlpin, Waldo, and Abiqua soils that have slopes of less than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Abiqua soil is moderately slow. Available water capacity is about 8 to 12 inches. Effective rooting depth is more than 60 inches. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for small grain, vegetables, orchards, hay, and pasture. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It has few limitations.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Sufficient water for irrigation generally can be obtained from nearby streams or wells.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Farming on the contour or across the slope, where practical, reduces runoff and helps to control erosion. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are the moderately slow permeability, low soil strength, and shrink-swell potential of the subsoil.

Septic tank absorption fields may function poorly in winter. If this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling.

Buildings and roads should be designed to offset the effects of shrinking and swelling. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIe.

2D—Acanod silt loam, 2 to 25 percent slopes. This deep, moderately well drained soil is in basins and other depressional areas on uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,500 to 2,700 feet. The average annual precipitation is 80 to 100 inches, the average annual air temperature is 46 to 51 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of needles, twigs, and leaves about 2 inches thick. The surface layer is very dark grayish brown silt loam about 9 inches thick. The next layer is very dark grayish brown silty clay loam about 5 inches thick. The upper 7 inches of the subsoil is dark brown silty clay loam, and the lower 31 inches is dark yellowish brown and yellowish brown silty clay. The substratum to a depth of 68 inches is light yellowish brown stony silty clay.

Included in this unit are small areas of Kinney and Quartzville soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Acanod soil is slow. Available water capacity is about 8 to 12 inches. Effective rooting depth is more than 60 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. A seasonal high water table is at a depth of 1.5 to 3.0 feet from November to March.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 160, the potential production per acre is 10,200 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 95,200 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 125. Douglas-fir, western hemlock, western redcedar, bigleaf maple, and red alder commonly grow on this unit (fig. 1). The main concerns in producing and harvesting timber are equipment limitations and plant competition.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in

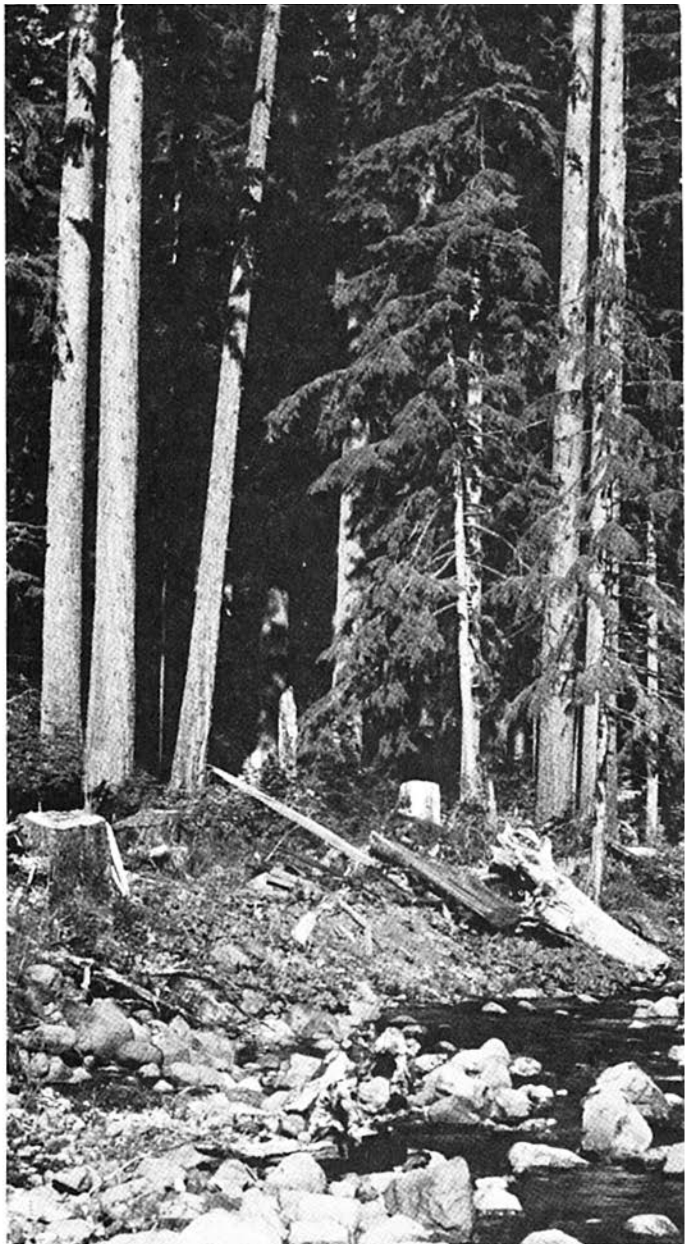


Figure 1.—Stand of Douglas-fir and western hemlock in an area of Acanod silt loam, 2 to 25 percent slopes, along Crabtree Creek.

advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, and western redcedar.

The understory vegetation commonly growing on this unit includes western brackenfern, Oregon oxalis, salal, western swordfern, and vine maple.

This map unit is in capability subclass VIe.

3—Amity silt loam. This deep, somewhat poorly drained soil is in slightly concave areas on broad terraces of the Willamette Valley. It formed in silty alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly hardwoods, scattered conifers, shrubs, and grasses. Elevation is 200 to 400 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 16 inches thick. The subsurface layer is dark gray, faintly mottled silt loam about 6 inches thick. The upper 6 inches of the subsoil is grayish brown, mottled silty clay loam, and the lower 7 inches is light olive brown, mottled silty clay loam. The substratum to a depth of 72 inches or more is olive brown, mottled silt loam. In some areas of similar included soils, the substratum is silty clay loam or silty clay averaging more than 35 percent clay.

Included in this unit are small areas of Concord, Dayton, Holcomb, Willamette, and Woodburn soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Amity soil is moderately slow. Available water capacity is about 9 to 12 inches. Effective rooting depth is more than 60 inches; however, penetration of roots is restricted by a seasonal high water table. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 0.5 foot to 1.5 feet from November to May.

This unit is used mainly for small grain, vegetables, grass seed, hay, and pasture. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It is limited mainly by wetness because of the seasonal high water table.

Drainage is needed if the soil in this unit is to be used to its maximum potential. Most climatically adapted crops can be grown if artificial drainage is provided. If a suitable outlet is available, subsurface drainage can be used to reduce wetness.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, subsoiling, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. To minimize damage to crops and compaction of the soil, vehicles that have large, low-pressure tires should be used to apply fertilizer early in spring. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness and low soil strength. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness as a result of a seasonal high water table and moderately slow permeability. The moderately slow permeability and the seasonal high water table adversely affect the treatment and absorption processes.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIw.

4D—Apt silty clay loam, 2 to 25 percent slopes. This deep, well drained soil is on broad, rolling bench tops and side slopes of uplands. It formed in colluvium derived dominantly from sedimentary rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of needles, twigs, and moss about 1 inch thick. The surface layer is dark brown silty clay loam about 13 inches thick. The upper 25 inches of the subsoil is dark brown silty clay, and the lower 28 inches is variegated brown, yellow, and dark reddish brown very gravelly silty clay loam.

Included in this unit are small areas of Cumley, Honeygrove, Peavine, and McDuff soils and Apt soils that have slopes of more than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Apt soil is moderately slow. Available water capacity is about 7 to 10 inches. Effective rooting depth is more than 60 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 175, the potential production per acre is 11,160 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 106,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 60 years old. On the basis of a 50-year site curve, the mean site index is 120. Douglas-fir, western hemlock, western redcedar, bigleaf maple, and red alder commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, management that minimizes erosion is essential. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment are used when the soil in this unit is moist, puddling and compaction can occur. Compaction seriously reduces the productivity of the soil. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes western hazel, creambush oceanspray, salal, vine maple, cascade Oregon-grape, trailing blackberry, and western swordfern.

This map unit is in capability subclass VIe.

5F—Apt silty clay loam, 25 to 50 percent north slopes. This deep, well drained soil is on north aspects of uplands. It formed in colluvium derived dominantly from sedimentary rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of needles, twigs, and moss about 1 inch thick. The surface layer is dark brown silty clay loam about 13 inches thick. The upper 25 inches of the subsoil is dark brown silty clay, and the lower 28 inches is variegated brown, yellow, and dark reddish brown very gravelly silty clay loam.

Included in this unit are small areas of Cumley, Honeygrove, Peavine, and McDuff soils and Apt soils that have slopes of less than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Apt soil is moderately slow. Available water capacity is about 7 to 10 inches. Effective rooting depth is 60 inches or more. Runoff is moderate to rapid, and the hazard of erosion is high.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 175, the potential production per acre is 11,160 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 106,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 60 years old. On the basis of a 50-year site curve, the mean site index is 120. Douglas-fir, western hemlock, western redcedar, bigleaf maple, and red alder commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Road location and maintenance costs are greater in the more steeply sloping areas. Hauling away waste material minimizes damage to the sil and to the plant cover downslope of roadbuilding sites.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes western hazel, creambush oceanspray, salal, vine maple, cascade Oregon-grape, trailing blackberry, and western swordfern.

This map unit is in capability subclass VIe.

6F—Apt silty clay loam, 25 to 50 percent south slopes. This deep, well drained soil is on south aspects of uplands. It formed in colluvium derived dominantly from sedimentary rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of needles, twigs, and moss about 1 inch thick. The surface layer is dark brown silty clay loam about 13 inches thick. The upper 25 inches of the subsoil is dark brown silty clay, and the lower 28 inches is variegated brown, yellow, and dark reddish brown very gravelly silty clay loam.

Included in this unit are small areas of Cumley, Honeygrove, Peavine, and McDuff soils and Apt soils that have slopes of less than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Apt soil is moderately slow. Available water capacity is about 7 to 10 inches. Effective rooting depth is more than 60 inches. Runoff is moderate to rapid, and the hazard of erosion is high.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 135, the potential production per acre is 8,280 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 72,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 60 years old. On the basis of a 50-year site curve, the mean site index is 95. Douglas-fir, western hemlock, western redcedar, bigleaf maple, and red alder commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Road location and maintenance costs are greater in the more steeply sloping areas. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Ground skidding methods of harvesting timber are difficult to use because of slope. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. The use of low-pressure ground equipment or cable or aerial systems reduces the risk of soil puddling and compaction. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes western hazel, creambush oceanspray, salal, vine maple, cascade Oregon-grape, trailing blackberry, and western swordfern.

This map unit is in capability subclass VIe.

7—Awbrig silty clay loam. This deep, poorly drained soil is in slightly concave areas on low alluvial stream terraces. It formed in silty and clayey alluvium derived from mixed sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, grasses, sedges, and rushes. Elevation is 200 to 600 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silty clay loam about 6 inches thick. The upper 5 inches of the subsoil is very dark grayish brown, mottled silty clay loam, and the lower 20 inches is very dark gray, mottled clay. The substratum to a depth of 60 inches or more is grayish brown, mottled silty clay loam. In some areas of similar included soils, the surface layer is silt loam or the substratum is stratified with sand and gravel below a depth of 40 inches.

Included in this unit are small areas of Clackamas, Coburg, Conser, Courtney, and Dayton soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Awbrig soil is very slow. Available water capacity is about 7 to 9 inches. Effective rooting depth is more than 60 inches; however, penetration of roots is restricted by the dense clay and seasonal high water table. Runoff is slow to ponded, and the hazard of erosion is slight. A seasonal high water table is at a depth of 0.5 foot above the surface to 1.0 foot below the surface from November to May. This soil is subject to rare periods of flooding.

This unit is used mainly for grass seed, hay, pasture, and small grain. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitation is wetness. This unit generally is not suited to deep-rooted perennial crops, because adequate drainage usually cannot be maintained in winter and spring.

Drainage is needed if the soil in this unit is to be used to its maximum potential. Open ditches and tile drains can be used to remove excess water on the surface. Tile drains have limited suitability for removing subsurface water from the soil because of the very slow permeability and inadequate outlets. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. Drainage of the soil is difficult and expensive because the dense clay requires close spacing of the tile drains. Where tile drains have been properly installed and maintained, however, they have functioned properly for more than 10 years.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, subsoiling, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. To minimize damage to crops and compaction of the soil, vehicles that have large, low-pressure tires should be used to apply fertilizer early in spring (fig. 4). Grain and grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

Increased construction of homes on this unit. If this unit is used for homesite development, the main limitations are wetness, very slow permeability, shrink-swell potential, low soil strength, and rare periods of flooding. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness as a result of a seasonal high water table and very slow permeability. The seasonal high water table and very slow permeability adversely affect the treatment and absorption processes.

Buildings and roads should be designed to offset the effects of shrinking and swelling. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Roads and streets can be built if they are designed to compensate for the instability of the soil. Ponding and rare periods of flooding on this unit makes it necessary to locate roads and streets above the expected high water level.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IVw.

8—Bashaw silty clay. This deep, poorly drained soil is in slightly concave areas on flood plains, alluvial terraces, and alluvial fans. It formed in clayey alluvium derived from mixed sources. Slope is 0 to 1 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, grasses, sedges, and rushes. Elevation is 200 to 400 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is black silty clay about 4 inches thick. The next layer is black, mottled clay about 32 inches thick. The upper 24 inches of the substratum is very dark gray, mottled clay, and the lower part to a depth of 70 inches is dark gray, mottled silty clay. In some areas of similar included soils, the surface layer is silty clay loam or clay.

Included in this unit are small areas of Awbrig, Clackamas, Conser, Courtney, and Dayton soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Bashaw soil is very slow. Available water capacity is about 8 to 10 inches. Effective rooting depth is more than 60 inches; however, penetration of roots is restricted by the dense clay and seasonal high water table. Runoff is slow to ponded, and the hazard of erosion is slight. A seasonal high water table is at a depth of 1.0 foot above the surface to 0.5 foot below the surface from November to May. This soil is frequently flooded from December to April.

This unit is used mainly for hay, pasture, grass seed, and spring grain. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are wetness and susceptibility to slumping. This unit generally is not suited to deep-rooted perennial crops, because adequate drainage usually cannot be maintained in winter and spring.

Drainage is needed if the soil in this unit is to be used to its maximum potential. Open ditches and tile drains can be used to remove excess water on the surface. Tile drains have limited suitability for removing subsurface water from the soil because of the very slow permeability and inadequate outlets. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. Drainage of the soil is difficult and expensive because the dense clay requires close spacing of the tile drains.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Erosion caused by seasonal flooding and runoff from higher lying areas can be controlled by growing a winter cover crop each year and by properly managing crop residue. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots. The soil cracks when dry and takes in water rapidly. When saturated with water, the soil swells and the cracks close. Once the soil has dried and the cracks have opened again, a favorable moisture and air relationship is difficult to maintain in the soil.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. To minimize damage to crops and compaction of the soil, vehicles that have large, low-pressure tires should be used to apply fertilizer early in spring. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, very slow permeability, shrink-swell potential, low soil strength, and the hazard of flooding. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness as a result of a seasonal high water table and very slow permeability. The very slow permeability and the seasonal high water table adversely affect the treatment and absorption processes.

Buildings and roads should be designed to offset the effects of shrinking and swelling. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Roads and streets can be built if they are designed to compensate for the limited ability of the soil in this unit to support a load. Ponding and frequent periods of flooding on this unit make it necessary to locate roads and streets above the expected high water level.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IVw.

9C—Bellpine silty clay loam, 3 to 12 percent slopes. This moderately deep, well drained soil is on smooth, convex foot slopes and foothills adjacent to terraces of the Willamette Valley. It formed in colluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark reddish brown silty clay loam about 7 inches thick. The upper 7 inches of the subsoil is dark reddish brown silty clay, and the lower 18 inches is reddish brown and yellowish red clay. Partially weathered tuffaceous siltstone is at a depth of 32 inches. In some areas of similar included soils, the surface layer is cobbly silty clay loam.

Included in this unit are small areas of Jory, Nekia, and Willakenzie soils and Bellpine soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Bellpine soil is slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for small grain, hay, pasture, orchards, and Christmas trees. It is also used for timber production, homesite development, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It has few limitations.

In summer, irrigation is needed for maximum production of most crops. Water for irrigation is often not available; when available, however, it is stored in reservoirs. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Orchards, grain, and grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 155, the potential production per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 120. Douglas-fir, grand fir, Oregon white oak, and bigleaf maple commonly grow on this unit. If the unit is used for timber production, the main concerns are equipment limitations and the hazard of windthrow.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes western hazel, cascade Oregon-grape, Pacific poison-oak, common snowberry, trailing blackberry, and rose.

If this unit is used for homesite development, the main limitations are depth to bedrock, slow permeability, low soil strength, and shrink-swell potential of the subsoil.

Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock and slow permeability. Septic tank absorption fields can be installed in some areas where the depth to bedrock is greater. The limitation of slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling. Cutbanks are subject to slumping when the soil is saturated.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Excavation for roads and buildings increases the risk of erosion. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIIe.

9D—Bellpine silty clay loam, 12 to 20 percent slopes. This moderately deep, well drained soil is on smooth, convex foot slopes and foothills adjacent to terraces of the Willamette Valley. It formed in colluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark reddish brown silty clay loam about 7 inches thick. The upper 7 inches of the subsoil is dark reddish brown silty clay, and the lower 18 inches is reddish brown and yellowish red clay. Partially weathered tuffaceous siltstone is at a depth of 32 inches. In some areas of similar included soils, the surface layer is cobbly silty clay loam.

Included in this unit are small areas of Jory, Nekia, and Willakenzie soils and Bellpine soils that have slopes of less than 12 percent or more than 20 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Bellpine soil is slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate to high.

This unit is used mainly for small grain, hay, pasture, orchards, and Christmas trees. It is also used for timber production, homesite development, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It is limited mainly by slope in some areas.

In summer, irrigation is needed for maximum production of most crops. Water for irrigation is often not available; when available, however, it is stored in reservoirs. Only a few areas are irrigated by sprinklers.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots. All tillage should be on the contour or across the slope. Constructing terraces reduces runoff and the risk of erosion and conserves moisture.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Orchards, grain, and grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 155, the potential production per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 120. Douglas-fir, grand fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes western hazel, cascade Oregon-grape, Pacific poison-oak, common snowberry, trailing blackberry, and rose.

If this unit is used for homesite development, the main limitations are depth to bedrock, slow permeability, slope, low soil strength, and shrink-swell potential of the subsoil.

Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock, slope, and slow permeability. Septic tank absorption fields can be installed in some areas where the depth to bedrock is greater and the unit is less sloping. Absorption lines should be installed on the contour. The limitation of slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling. Cutbanks are subject to slumping when the soil is saturated.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIIe.

9E—Bellpine silty clay loam, 20 to 30 percent slopes. This moderately deep, well drained soil is on smooth, convex foot slopes and foothills adjacent to terraces of the Willamette Valley. It formed in colluvium derived dominantly from sedimentary rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark reddish brown silty clay loam about 7 inches thick. The upper 7 inches of the subsoil is dark reddish brown silty clay, and the lower 18 inches is reddish brown and yellowish red clay. Partially weathered tuffaceous siltstone is at a depth of 32 inches. In some areas of similar included soils, the surface layer is cobbly silty clay loam.

Included in this unit are small areas of Jory, Nekia, and Willakenzie soils and Bellpine soils that have slopes of less than 20 percent or more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Bellpine soil is slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is high.

This unit is used mainly for timber production and pasture. It is also used for orchards, homesite development, wildlife habitat, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 155, the potential production per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 120. Douglas-fir, grand fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes western hazel, cascade Oregon-grape, Pacific poison-oak, common snowberry, trailing blackberry, and rose.

Because of the steeper areas of this unit, it is unsuitable for cultivation. If this unit is used for pasture and orchards, the main limitation is slope. The unit is suited to limited tillage only as a pasture management practice.

If this unit is used for hay and pasture, a permanent plant cover is needed to prevent excessive runoff and erosion in winter. Seedbed preparation should be on the contour or across the slope where practical. Using management that maintains optimum vigor and quality of forage plants is a good practice. Rotation grazing helps to maintain the quality of forage. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff.

If this unit is used for homesite development, the main limitations are depth to bedrock, slow permeability, slope, low soil strength, and shrink-swell potential of the subsoil.

Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock, slope, and slow permeability. Septic tank absorption fields can be installed in some areas of this unit where the depth to bedrock is greater and the unit is less sloping. Absorption lines should be installed on the contour. The limitation of slow permeability can be overcome by increasing the size of the absorption field.

Slope limits use of some areas of this unit for building site development. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling. Cutbanks are subject to slumping when the soil is saturated.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IVe.

9F—Bellpine silty clay loam, 30 to 50 percent slopes. This moderately deep, well drained soil is on smooth, convex foot slopes and foothills adjacent to terraces of the Willamette Valley. It formed in colluvium derived dominantly from sedimentary rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark reddish brown silty clay loam about 7 inches thick. The upper 7 inches of the subsoil is dark reddish brown silty clay, and the lower 18 inches is reddish brown and yellowish red clay. Partially weathered tuffaceous siltstone is at a depth of 32 inches. In some areas of similar included soils, the surface layer is cobbly silty clay loam.

Included in this unit are small areas of Jory, Nekia, and Willakenzie soils and Bellpine soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Bellpine soil is slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 155, the potential production per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 120. Douglas-fir, grand fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry improves the growth of trees. Road location and maintenance costs are greater in the more steeply sloping areas.

The soil in this unit is subject to landsliding and slumping when the soil becomes saturated and is disturbed by constructing roads or harvesting timber.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes western hazel, cascade Oregon-grape, Pacific poison-oak, common snowberry, trailing blackberry, and rose.

This map unit is in capability subclass VIe.

10E—Bensley stony loam, 2 to 30 percent slopes. This deep, well drained soil is on ridgetops and side slopes of uplands. It formed in colluvium and glacial till derived from various kinds of rock. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,900 feet. The average annual precipitation is 80 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is very dark brown and very dark grayish brown stony loam about 11 inches thick. The upper 11 inches of the subsoil is brown very gravelly clay loam, and the lower 40 inches is brown and dark grayish brown very cobbly clay loam.

Included in this unit are small areas of Crabtree, Cruiser, Henline, Hummington, Keel, Yellowstone, and Valsetz soils. Also included are small areas of Bensley soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Bensley soil is moderate. Available water capacity is about 6 to 8 inches. Effective rooting depth is more than 60 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 110, the potential production per acre is 5,040 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 46,700 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. Douglas-fir, western redcedar, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion and equipment limitations.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Snowpack limits the use of equipment and restricts access.

Undesirable plants may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir, mountain hemlock, noble fir, and western redcedar.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, cascade Oregon-grape, Pacific rhododendron, and salal.

This map unit is in capability subclass VIs.

11F—Bensley-Valsetz stony loams, 30 to 50 percent slopes. This map unit is on the side slopes of uplands. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,900 feet. The average annual precipitation is 80 to 120 inches, the average annual air temperature is 41 to 55 degrees F, and the average frost-free period is 80 to 110 days.

This unit is about 45 percent Bensley stony loam and 40 percent Valsetz stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Crabtree, Cruiser, Henline, Hummington, and Yellowstone soils. Also included are other Bensley and Valsetz stony loams that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Bensley soil is deep and well drained. It formed in colluvium and glacial till derived from various kinds of rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is very dark brown and very dark grayish brown stony loam about 11 inches thick. The upper 11 inches of the subsoil is brown very gravelly clay loam, and the lower 40 inches is brown and dark grayish brown very cobbly clay loam.

Permeability of the Bensley soil is moderate. Available water capacity is about 6 to 8 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Valsetz soil is moderately deep and well drained. It formed in colluvium derived dominantly from basalt. Typically, the surface is covered with a mat of twigs, needles, and leaves about 2 inches thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is reddish brown very gravelly loam about 9 inches thick. The subsoil is reddish brown very gravelly loam about 24 inches thick. Fractured basalt is at a depth of 36 inches.

Permeability of the Valsetz soil is moderately rapid. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 110 for the Bensley soil, the potential production per acre of merchantable timber is 5,040 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 46,700 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. On the basis of a site index of 115 for the Valsetz soil, the potential production per acre of merchantable timber is 5,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 52,400 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. Douglas-fir, western redcedar, mountain hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs are less damaging to the soil and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

On the Valsetz soil, droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard on the Valsetz soil when it is wet and the winds are strong.

On the Valsetz soil, undesirable plants may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on the Bensley soil include Douglas-fir, mountain hemlock, noble fir, and western redcedar. Trees suitable for planting on the Valsetz soil include Douglas-fir, mountain hemlock, and noble fir.

The understory vegetation commonly growing on this unit includes common beargrass, Pacific rhododendron, tall blue huckleberry, cascade Oregon-grape, and salal.

This map unit is in capability subclass VIs.

11G—Bensley-Valsetz stony loams, 50 to 75 percent slopes. This map unit is on ridges and side slopes of uplands. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,900 feet. The average annual precipitation is 80 to 120 inches, the average annual air temperature is 41 to 55 degrees F, and the average frost-free period is 80 to 110 days.

This unit is about 45 percent Bensley stony loam and 40 percent Valsetz stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Crabtree, Cruiser, Henline, Hummington, and Yellowstone soils. Also included are Bensley and Valsetz stony loams that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

The Bensley soil is deep and well drained. It formed in colluvium and glacial till derived from various kinds of rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is very dark brown and very dark grayish brown stony loam about 11 inches thick. The upper 11 inches of the subsoil is brown very gravelly clay loam, and the lower 40 inches is brown and dark grayish brown very cobbly clay loam.

Permeability of the Bensley soil is moderate. Available water capacity is about 6 to 8 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Valsetz soil is moderately deep and well drained. It formed in colluvium derived dominantly from basalt. Typically, the surface is covered with a mat of twigs, needles, and leaves about 2 inches thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is reddish brown very gravelly loam about 9 inches thick. The subsoil is reddish brown very gravelly loam about 24 inches thick. Fractured basalt is at a depth of 36 inches.

Permeability of the Valsetz soil is moderately rapid. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 110 for the Bensley soil, the potential production per acre is 5,040 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 46,700 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. On the basis of a site index of 115 for the Valsetz soil, the potential production per acre is 5,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 52,400 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. Douglas-fir, western redcedar, mountain hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment imitations, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion is minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

On the Valsetz soil, droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil in this unit is wet and the winds are strong.

Undesirable plants may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on the Bensley soil include Douglas-fir, mountain hemlock, noble fir, and western redcedar. Trees suitable for planting on the Valsetz soil include Douglas-fir, mountain hemlock, and noble fir.

The understory vegetation commonly growing on this unit includes common beargrass, Pacific rhododendron, tall blue huckleberry, cascade Oregon-grape, and salal.

This map unit is in capability subclass VIIs.

12E—Blachly clay loam, 3 to 30 percent slopes. This deep, well drained soil is on bench tops and on side slopes of uplands. It formed in colluvium derived dominantly from sedimentary or basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 45 to 51 degrees F, and the average frost-free period is 140 to 200 days.

Typically, the surface is covered with a mat of moss, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown clay loam about 25 inches thick. The upper 28 inches of the subsoil is reddish brown silty clay and clay, and the lower 7 inches is dark brown silty clay loam. In some areas of similar included soils, the surface layer is silty clay loam. Cobbles are on the surface in some areas.

Included in this unit are small areas of Bohannon, Cumley, Harrington, Kilchis, Kinney, and Klickitat soils and Blachly soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Blachly soil is moderately slow. Available water capacity is about 8 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 150, the potential production per acre is 9,480 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 86,800 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, western hemlock, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes vine maple, salal, cascade Oregon-grape, western swordfern, red huckleberry, trailing blackberry, and Oregon oxalis.

This map unit is in capability subclass VIe.

13F—Blachly clay loam, 30 to 50 percent north slopes. This deep, well drained soil is on north-facing slopes of uplands. It formed in colluvium derived dominantly from sedimentary or basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 45 to 51 degrees F, and the average frost-free period is 140 to 200 days.

Typically, the surface is covered with a mat of moss, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown clay loam about 25 inches thick. The upper 28 inches of the subsoil is reddish brown silty clay and clay, and the lower 7 inches is dark brown silty clay loam. In some areas of similar included soils, the surface layer is silty clay loam. Cobbles are on the surface in some areas.

Included in this unit are small areas of Bohannon, Harrington, Kilchis, Kinney, and Klickitat soils and Blachly soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Blachly soil is moderately slow. Available water capacity is about 8 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 165, the potential production per acre is 10,560 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 99,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year curve, the mean site index is 120. Douglas-fir, western hemlock, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, management that minimizes erosion is essential. Erosion is minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs are less damaging to the soil and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

This unit is subject to landsliding and slumping when the soil becomes saturated and is disturbed by constructing roads or harvesting timber.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes vine maple, salal, cascade Oregon-grape, western swordfern, red huckleberry, trailing blackberry, and Oregon oxalis.

This map unit is in capability subclass VIe.

13G—Blachly clay loam, 50 to 75 percent north slopes. This deep, well drained soil is on north-facing slopes of uplands. It formed in colluvium derived dominantly from sedimentary or basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 45 to 51 degrees F, and the average frost-free period is 140 to 200 days.

Typically, the surface is covered with a mat of moss, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown clay loam about 25 inches thick. The upper 28 inches of the subsoil is reddish brown silty clay and clay, and the lower 7 inches is dark brown silty clay loam. In some areas of similar included soils, the surface layer is silty clay loam. Cobbles are on the surface in some areas.

Included in this unit are small areas of Bohannon, Harrington, Kilchis, Kinney, and Klickitat soils and Blachly soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Blachly soil is moderately slow. Available water capacity is about 8 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 165, the potential production per acre is 10,560 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 99,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 120. Douglas-fir, western hemlock, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The soil in this unit is subject to landsliding and slumping when the soil becomes saturated and is disturbed by constructing roads or harvesting timber.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes vine maple, salal, cascade Oregon-grape, western swordfern, red huckleberry, trailing blackberry, and Oregon oxalis.

This map unit is in capability subclass VIIe.

14F—Blachly clay loam, 30 to 50 percent south slopes. This deep, well drained soil is on south-facing slopes of uplands. It formed in colluvium derived dominantly from sedimentary or basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 45 to 51 degrees F, and the average frost-free period is 140 to 200 days.

Typically, the surface is covered with a mat of moss, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown clay loam about 25 inches thick. The upper 28 inches of the subsoil is reddish brown silty clay and clay, and the lower 7 inches is dark brown silty clay loam. In some areas are similar included soils that have a surface layer of silty clay loam. Cobbles are on the surface in some areas.

Included in this unit are small areas of Bohannon, Harrington, Kilchis, Kinney, and Klickitat soils and Blachly soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Blachly soil is moderately slow. Available water capacity is about 8 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 150, the potential production per acre is 9,480 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 86,800 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year curve, the mean site index is 110. Douglas-fir, western hemlock, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

When harvesting timber on this unit, management that minimizes erosion is essential. Erosion is minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs are less damaging to the soil and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The soil in this unit is subject to landsliding and slumping when the soil becomes saturated and is disturbed by constructing roads or harvesting timber.

The droughtiness of the surface layer increases seeding mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes vine maple, salal, cascade Oregon-grape, western swordfern, red huckleberry, trailing blackberry, and Oregon oxalis.

This map unit is in capability subclass VIe.

14G—Blachly clay loam, 50 to 75 percent south slopes. This deep, well drained soil is on south-facing slopes of uplands. It formed in colluvium derived dominantly from sedimentary or basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 45 to 51 degrees F, and the average frost-free period is 140 to 200 days.

Typically, the surface is covered with a mat of moss, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown clay loam about 25 inches thick. The upper 28 inches of the subsoil is reddish brown silty clay and clay, and the lower 7 inches is dark brown silty clay loam. In some areas of similar included soils, the surface layer is silty clay loam. Cobbles are on the surface in some areas.

Included in this unit are small areas of Bohannon, Harrington, Kilchis, Kinney, and Klickitat soils and Blachly soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Blachly soil is moderately slow. Available water capacity is about 8 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 150, the potential production per acre is 9,480 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 86,800 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, western hemlock, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The soil in this unit is subject to landsliding and slumping when the soil becomes saturated and is disturbed by constructing roads or harvesting timber.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes vine maple, salal, cascade Oregon-grape, western swordfern, red huckleberry, trailing blackberry, and Oregon oxalis.

This map unit is in capability subclass VIIe.

15D—Bohannon cobbly loam, 3 to 25 percent slopes. This moderately deep, well drained soil is on ridgetops and side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 45 to 51 degrees F, and the average frost-free period is 140 to 200 days.

Typically, the surface is covered with a mat of leaves, twigs, and needles about 0.5 inch thick. The surface layer is very dark brown cobbly loam about 14 inches thick. The next layer is dark brown gravelly loam about 4 inches thick. The subsoil is dark yellowish brown cobbly loam about 13 inches thick. The substratum is dark yellowish brown cobbly loam about 7 inches thick. Weathered andesite is at a depth of 38 inches.

Included in this unit are small areas of Harrington, Kinney, and Klickitat soils and Bohannon soils that have slopes of more than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Bohannon soil is moderately rapid. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 150, the potential production per acre is 9,480 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 86,800 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, western hemlock, bigleaf maple, and red alder commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, grand fir, and western redcedar.

The understory vegetation commonly growing on this unit includes vine maple, salal, cascade Oregon-grape, and red huckleberry.

This map unit is in capability subclass VIe.

16B—Briedwell silt loam, 0 to 7 percent slopes. This deep, well drained soil is on old alluvial terraces. It formed in silty and gravelly alluvium derived from mixed sources. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 650 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown silt loam about 12 inches thick. The next layer is dark yellowish brown silt loam about 9 inches thick. The subsoil is brown and dark yellowish brown very gravelly clay loam about 15 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown very gravelly clay loam.

Included in this unit are small areas of Clackamas, Courtney, and Salem soils and Briedwell soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Briedwell soil is moderate. Available water capacity is about 6 to 9 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for hay, pasture, small grain, and Christmas trees. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. Orchards and deep-rooted crops are not ordinarily grown on this unit because of the depth to very gravelly material and associated droughtiness.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adapted to the available water capacity, the water intake rate, and the crop needs.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is wet results in the compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grasses and grain respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

This unit is suited to homesite development. Septic tank absorption fields may function poorly during winter because of the moderate permeability. This limitation can be overcome by increasing the size of the absorption field.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

Removal of gravel and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

This map unit is in capability subclass IIe.

17C—Bull Run silt loam, 3 to 15 percent slopes. This deep, well drained soil is on hillsides and benches in the lower lying valleys of uplands. It formed in silty material mixed with volcanic ash. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,500 feet. The average annual precipitation is 60 to 80 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface layer is very dark grayish brown silt loam about 12 inches thick. The upper 10 inches of the subsoil is dark brown silt loam, and the lower 44 inches is strong brown silt loam.

Included in this unit are small areas of Cumley, Harrington, Honeygrove, and Klickitat soils and Bull Run soils that have slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Bull Run soil is moderate. Available water capacity is about 11 to 15 inches. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for timber production. It is also used for homesite development, hay and pasture, wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 170, the potential production per acre is 10,860 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 102,800 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 135. Douglas-fir, bigleaf maple, and red alder commonly grow on this unit. The main concern in producing and harvesting timber is plant competition.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using vehicles that have large, low-pressure tires damages the soil less and helps to maintain productivity.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes vine maple, creambush oceanspray, trailing blackberry, Oregon oxalis, western swordfern, and western brackenfern.

If this unit is used for homesite development, the main limitations are moderate permeability, slope, and low soil strength. Septic tank absorption fields may function poorly during winter because of the moderate permeability. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This unit is suited to hay and pasture. A permanent plant cover is needed to prevent excessive erosion in winter. Planting improved varieties of grasses early in spring ensures a better plant cover than if these varieties are planted later. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This map unit is in capability subclass VIe.

17E—Bull Run silt loam, 15 to 30 percent slopes. This deep, well drained soil is on hillsides and benches in the lower valleys of uplands. It formed in silty material mixed with volcanic ash. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,500 feet. The average annual precipitation is 60 to 80 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface layer is very dark grayish brown silt loam about 12 inches thick. The upper 10 inches of the subsoil is dark brown silt loam, and the lower 44 inches is strong brown silt loam.

Included in this unit are small areas of Cumley, Harrington, Honeygrove, and Klickitat soils and Bull Run soils that have slopes of less than 15 percent or more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Bull Run soil is moderate. Available water capacity is about 11 to 15 inches. Effective rooting depth 60 inches. Runoff is medium, and the hazard of erosion is moderate to high.

This unit is used mainly for timber production. It is also used for homesite development, hay and pasture, wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 170, the potential production per acre is 10,860 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 102,800 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 135. Douglas-fir, bigleaf maple, and red alder commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using vehicles that have large, low-pressure tires damages the soil less and helps to maintain productivity. Use of these vehicles is more difficult in;vthe more steeply sloping areas. In steeper areas, cable logging is better suited than tractor logging because its use results in less disturbance to the soil.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes vine maple, creambush oceanspray, trailing blackberry, Oregon oxalis, western swordfern, and western brackenfern.

If this unit is used for homesite development, the main limitation is slope. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Additional spacing between septic tank absorption lines may be needed.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This unit is suited to hay and pasture. A permanent plant cover is needed to prevent excessive erosion in winter. Planting improved varieties of grasses early in spring ensures a better plant cover than if these varieties are planted later. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. All tillage should be on the contour or across the slope. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This map unit is in capability subclass VIe.

18—Camas gravelly sandy loam. This deep, excessively drained soil is on flood plains. It formed in recent sandy and gravelly alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, and grasses. Elevation is 125 to 700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown gravelly sandy loam about 10 inches thick. The upper 3 inches of the substratum is brown gravelly sandy loam, and the lower part to a depth of 60 inches or more is multicolored brown, dark brown, and grayish brown extremely gravelly coarse sand.

Included in this unit are small areas of Cloquato and Newberg soils. Also included are small areas of Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Camas soil is moderately rapid in the surface layer and very rapid below. Available water capacity is about 2 to 4 inches. Effective rooting depth is 60 inches or more; however, the substratum may restrict penetration of roots because of droughtiness. Runoff is slow, and the hazard of erosion is slight except during periods of flooding. This soil is subject to occasional, brief periods of flooding from November to May.

This unit is used mainly for small grain, hay, pasture, and limited vegetable production. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitation is the hazard of flooding. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Because the soil in this unit is droughty, applications of irrigation water should be light and frequent. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize the leaching of plant nutrients.

Cover crops are needed to protect the soil from erosion during periods of flooding in winter. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium.

If this unit is used for homesite development, the main limitations are the hazard of flooding and very rapid permeability.

Use of this unit for septic tank absorption fields is limited because of the risk of seepage and the hazard of polluting water supplies. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level. The risk of flooding has been reduced in some areas by constructing large dams and reservoirs upstream.

This map unit is in capability subclass IVw.

19—Chapman loam. This deep, well drained soil is on low alluvial river terraces and flood plains. It formed in mixed silty, clayey, and sandy alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 175 to 700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown loam about 13 inches thick. The upper 28 inches of the subsoil is very dark grayish brown and dark yellowish brown clay loam, and the lower 11 inches is dark yellowish brown loam. The substratum to a depth of 60 inches or more is dark yellowish brown gravelly sandy loam. In some areas of similar included soils, the substratum is very gravelly sandy loam or sandy loam, or both.

Included in this unit are small areas of Chehalis, Malabon, McBee, and Salem soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Chapman soil is moderate. Available water capacity is about 8 to 10 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight. This soil is subject to rare periods of flooding.

This unit is used mainly for hay, pasture, small grain, orchards, and vegetables. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to nearly all climatically adapted crops. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, subsoiling, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitation is rare periods of flooding. Septic tank absorption fields do not function properly during periods of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level. The risk of flooding has been reduced in some areas by constructing large dams and reservoirs upstream.

This map unit is in capability class I.

20C—Chehalem silt loam, 3 to 12 percent slopes. This deep, somewhat poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 900 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The upper 11 inches of the subsoil is mottled, very dark grayish brown silty clay loam, and the lower 35 inches is mottled, dark grayish brown silty clay. In some areas of similar included soils, the surface layer is silty clay loam.

Included in this unit are small areas of Hazelair, Panther, Wapato, and Willakenzie soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Chehalem soil is slow. Available water capacity is 9 to 11 inches. Effective rooting depth is 60 inches or more; however, penetration of roots is restricted by a seasonal high water table. Runoff is slow to medium, and the hazard of erosion is slight to moderate. A seasonal high water table is at a depth of 1.5 to 3.0 feet from December through April.

This unit is used mainly for hay, pasture, grass seed, and small grain. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for hay and pasture, the main limitations are wetness and the clayey texture of the soil. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of fertilizer promotes good growth of forage plants.

If this unit is used for grain, grass seed, and orchard crops, the main limitations are wetness and the clayey texture of the soil. Drainage is needed if the soil in this unit is to be used to its maximum potential. Unless the soil is drained, long-lived, deep-rooted deciduous fruit and nut trees, strawberries, cranberries, and alfalfa are adversely affected by wetness. Tile drainage can be used to reduce wetness if a suitable outlet is available.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. The soil in this unit is sticky and plastic when wet, which restricts trafficability. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, slow permeability, low soil strength, and shrink-swell potential. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is poorly suited to septic tank absorption fields because of the seasonal high water table and slow permeability. Septic tank absorption fields can be installed in some areas where the water table is not so high. The limitation of slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

This map unit is in capability subclass IIIe.

21—Chehalis silty clay loam. This deep, well drained soil is on flood plains. It formed in moderately fine textured recent alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 150 to 600 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown and very dark brown silty clay loam about 16 inches thick. The subsoil is dark brown silty clay loam about 44 inches thick.

Included in this unit are small areas of Camas, Chapman, Cloquato, McBee, and Newberg soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Chehalis soil is moderate. Available water capacity is about 10 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight except during occasional, brief periods of flooding from November to March.

This unit is used mainly for hay, pasture, small grain, orchards, and vegetables (fig. 2). It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for cultivated crops, the main limitation is the susceptibility to occasional, brief periods of flooding.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Cover crops are needed to protect the soil from erosion during periods of flooding in winter. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are occasional, brief periods of flooding and low soil strength.

Figure 2.—Orchard stock in an area of Chehalis silty clay loam.

Septic tank absorption fields do not function properly during periods of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level. The risk of flooding has been reduced in some areas by constructing large dams and reservoirs upstream.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction.

This map unit is in capability subclass IIw.

22C—Chehulpum silt loam, 3 to 12 percent slopes. This shallow, well drained soil is on low foothills. It formed in colluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly hardwoods, scattered conifers, shrubs, and grasses. Elevation is 300 to 1,200 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown loam about 2 inches thick. The next layer is very dark grayish brown silt loam about 14 inches thick. Weathered sandstone is at a depth of 16 inches. In some areas of similar included soils, the surface layer is loam.

Included in this unit are small areas of Dupee, Hazelair, Steiwer, and Willakenzie soils and Chehulpum soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Chehulpum soil is moderate. Available water capacity is about 2 to 4 inches. Depth to soft bedrock and effective rooting depth are 10 to 20 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for pasture. It is also used for limited homesite development, wildlife habitat, and recreation.

This unit is not suited to cultivated crops. If it is used for hay and pasture, the main limitation is droughtiness.

The soil in this unit is droughty because of low rainfall in summer and shallow depth to bedrock. Planting improved varieties of grasses early in spring ensures a better plant cover than if these grasses are planted later. Lack of sufficient moisture limits the amount of fertilizer that can be used by plants. A small amount of fertilizer can be applied in fall to take advantage of the moisture available in winter. Control of erosion is important on this unit because of the shallow depth to bedrock.

If this unit is used for hay and pasture, a permanent plant cover is needed to prevent excessive erosion in winter. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the unit from erosion.

This unit is poorly suited to homesite and urban development. The main limitation is shallow depth to soft bedrock. Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

Septic tank absorption fields are not suited to this unit because of the shallow depth to bedrock.

This map unit is in capability subclass VIe.

22E—Chehulpum silt loam, 12 to 35 percent slopes. This shallow, well drained soil is on low foothills. It formed in colluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly hardwoods, scattered conifers, shrubs, and grasses. Elevation is 300 to 1,200 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 2 inches thick. The next layer is very dark grayish brown silt loam about 14 inches thick. Weathered sandstone is at a depth of 16 inches. In some areas of similar included soils, the surface layer is loam.

Included in this unit are small areas of Dupee, Hazelair, Steiwer, and Willakenzie soils and Chehulpum soils that have slopes of less than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Chehulpum soil is moderate. Available water capacity is about 2 to 4 inches. Depth to soft bedrock and effective rooting depth are 10 to 20 inches. Runoff is medium, and the hazard of erosion is moderate to high.

This unit is used mainly for pasture. It is also used for limited homesite development, wildlife habitat, and recreation.

If this unit is used for hay and pasture, the main limitations are droughtiness and slope.

The soil in this unit is droughty because of low rainfall in summer and shallow depth to bedrock. Planting improved varieties of grasses early in spring ensures a better plant cover than if these grasses are planted later. Lack of sufficient moisture limits the amount of fertilizer that can be used by plants. A small amount of fertilizer can be applied in fall to take advantage of the moisture available in winter. Control of erosion is important on this unit because of the shallow depth to rock and steepness of slope in some areas.

If this unit is used for hay and pasture, a permanent plant cover is needed to prevent excessive erosion in winter. All tillage should be on the contour or across the slope. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This unit is poorly suited to homesite and urban development. The main limitations are shallow depth to soft bedrock and steepness of slope in some areas. Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

Septic tank absorption fields are not suited to this unit because of the shallow depth to bedrock and slope.

This map unit is in capability subclass VIe.

23—Clackamas gravelly silt loam. This deep, somewhat poorly drained soil is in slightly concave areas on low alluvial stream terraces. It formed in gravelly alluvium derived from mixed sources. Slope is 0 to 3 percent. Areas are elongated in shape and are 2 to 200 acres in size. The vegetation in areas not cultivated is mainly hardwoods, shrubs, and grasses. Elevation is 200 to 700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown and dark brown gravelly silt loam about 12 inches thick. The subsoil is very dark grayish brown, mottled gravelly silty clay loam about 9 inches thick. The substratum to a depth of 60 inches or more is dark gray extremely gravelly clay loam.

Included in this unit are small areas of Awbrig, Coburg, Conser, Courtney, and Salem soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Clackamas soil is moderately slow. Available water capacity is about 4 to 7 inches. Effective rooting depth is 60 inches or more; however, penetration of roots is restricted by a seasonal high water table. Runoff is slow. The hazard of erosion generally is slight; however, it is moderate in areas along drainageways during periods of heavy runoff from winter snows. A seasonal high water table is at a depth of 0.5 foot to 1.5 feet from November to May.

This unit is used mainly for pasture, hay, grass seed, and small grain. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are wetness and the gravelly surface, which interferes with close tillage of young row crops. Most climatically adapted crops can be grown if artificial drainage is provided. Deep-rooted crops are suited to areas where the natural drainage is adequate or where a drainage system has been installed. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. The gravelly texture of the substratum in some areas restricts the deep penetration of roots and promotes droughtiness in summer.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grasses and grain respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables respond to nitrogen, phosphorus, boron, sulfur, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness as a result of the seasonal high water table and moderately slow permeability. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness as a result of the seasonal high water table and moderately slow permeability. The seasonal high water table and moderately slow permeability adversely affect the treatment and absorption processes.

This map unit is in capability subclass IIIw.

24—Clackamas Variant silt loam. This deep, moderately well drained soil is in slightly concave areas on low alluvial stream terraces. It formed in gravelly alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, and grasses. Elevation is 200 to 700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 13 inches thick. The upper 7 inches of the subsoil is dark brown silty clay loam, and the lower 7 inches is dark brown gravelly silty clay loam. The substratum to a depth of 60 inches or more is mottled, dark grayish brown very gravelly clay.

Included in this unit are small areas of Awbrig, Clackamas, Coburg, Conser, Courtney, and Salem soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Clackamas Variant soil is slow. Available water capacity is about 5 to 10 inches. Effective rooting depth is 60 inches or more; however, penetration of roots is restricted by the very gravelly clay substratum and a seasonal high water table. Runoff is slow. The hazard of erosion generally is slight; however, it is moderate in areas along drainageways during periods of heavy runoff from winter storms. The seasonal high water table is at a depth of 2 to 3 feet from November to May.

This unit is used mainly for pasture, hay, grass seed, and small grain. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitation is wetness. Most climatically adapted crops can be grown if artificial drainage is provided. Deep-rooted crops are suited to areas where the natural drainage is adequate or where a drainage system has been installed. If a suitable outlet is available, subsurface drainage can be used to reduce wetness.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grasses, grain, and row crops respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, slow permeability, low soil strength, and shrink-swell potential. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is poorly suited to septic tank absorption fields because of the seasonal high water table and slow permeability. Septic tank absorption fields can be installed in some areas where the depth to the seasonal high water table is greater. The limitation of slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches for diverting subsurface water improves the operation of septic tank absorption fields.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load and the effects of shrinking and swelling. Properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

This map unit is in capability subclass IIw.

25—Cloquato silt loam. This deep, well drained soil is on flood plains. It formed in recent alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 125 to 700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 21 inches thick. The subsoil is dark brown silt loam about 20 inches thick. The substratum to a depth of 60 inches or more is dark brown silt loam. In some areas of similar included soils, stratified sand to silt loam is below a depth of 40 inches.

Included in this unit are small areas of Camas, Chehalis, and Newberg soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Cloquato soil is moderate. Available water capacity is about 10 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight except during occasional, brief periods of flooding from November to March.

This unit is used mainly for small grain, grass seed, orchards, pasture, and vegetables. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitation is the hazard of flooding. Most climatically adapted crops can be grown if the soil is protected from flooding late in spring and early in summer.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Cover crops are needed to protect the soil from erosion during periods of flooding in winter. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Cutbanks are not stable and are subject to slumping. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitation is the hazard of flooding. Septic tank absorption fields do not function properly during periods of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level. The risk of flooding has been reduced in some areas by constructing large dams and reservoirs upstream.

This map unit is in capability subclass IIw.

26—Coburg silty clay loam. This deep, moderately well drained soil is in nearly level to slightly convex areas on low alluvial stream terraces. It formed in silty and clayey alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 200 to 600 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silty clay loam about 17 inches thick. The upper 7 inches of the subsoil is very dark brown silty clay, the next layer is brown, mottled silty clay about 8 inches thick, and the lower 30 inches is brown, mottled silty clay loam. In some areas of similar included soils, the soil is very gravelly below a depth of 40 inches.

Included in this unit are small areas of Awbrig, Clackamas, Conser, Courtney, Malabon, and Salem soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Coburg soil is moderately slow. Available water capacity is about 10 to 12 inches. Effective rooting depth is 60 inches or more; however, penetration of roots is restricted by a seasonal high water table. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 1.5 to 2.5 feet from November to May.

This unit is used mainly for small grain, grass seed, orchards, pasture, and vegetables. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitation is wetness as a result of the seasonal high water table. Most climatically adapted crops can be grown if artificial drainage is provided. Deep-rooted crops are suited to areas where the natural drainage is adequate or where a drainage system has been installed. If a suitable outlet is available, subsurface drainage can be used to reduce wetness.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. Compaction limits the movement of air and water in the soil, and it restricts the growth of roots. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, moderately slow permeability, low soil strength, and moderate shrink-swell potential. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is poorly suited to septic tank absorption fields because of the seasonal high water table and moderately slow permeability. Septic tank absorption fields can be installed in some areas where the depth to the seasonal high water table is greater. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

This map unit is in capability subclass IIw.

27—Concord silt loam. This deep, poorly drained soil is in slightly concave areas on broad terraces of the Willamette Valley. It formed in silty and clayey alluvium derived from mixed sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, grasses, and sedges. Elevation is 200 to 400 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is dark gray, mottled silt loam about 10 inches thick. The next layer is gray and dark gray, mottled silty clay about 16 inches thick. The subsoil is grayish brown, mottled silty clay about 4 inches thick. The substratum to a depth of 72 inches is dark grayish brown silty clay loam and silt loam.

Included in this unit are small areas of Amity, Holcomb, Dayton, and Woodburn soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Concord soil is slow. Available water capacity is about 9 to 12 inches. Effective rooting depth is 60 inches or more; however, penetration of roots is restricted by dense clay and a seasonal high water table. Runoff is slow to ponded. The hazard of erosion is generally slight; however, it is moderate in areas along drainageways during periods of heavy runoff from winter storms. A seasonal high water table is at a depth of 0.5 foot above the surface to 0.5 foot below the surface from November to May.

This unit is used mainly for hay, pasture, small grain, and grass seed. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitation is wetness. Drainage is needed if the soil in this unit is to be used to its maximum potential. Most climatically adapted crops can be grown if artificial drainage is provided. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. This unit generally is not suited to deep-rooted perennial crops, because adequate drainage usually cannot be maintained in winter and spring.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil, and it restricts the growth of roots.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. To minimize damage to crops and compaction of the soil, vehicles that have large, low-pressure tires should be used to apply fertilizer early in spring. Grasses and grain respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, slow permeability, shrink-swell potential, and low soil strength. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness as a result of slow permeability and the seasonal high water table. The seasonal high water table and slow permeability adversely affect the treatment and absorption processes.

If buildings are constructed on this unit, using properly designed foundations and footings and diverting runoff away from the buildings help to prevent structural damage as a result of shrinking and swelling.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction.

Ponding on this unit makes it necessary to locate roads and streets above the expected high water level.

This map unit is in capability subclass IIIw.

28—Conser silty clay loam. This deep, poorly drained soil is in nearly level to slightly concave areas on low alluvial stream terraces. It formed in silty and clayey alluvium derived from mixed sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, grasses, sedges, and rushes. Elevation is 200 to 600 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown, mottled silty clay loam about 17 inches thick. The upper 33 inches of the subsoil is very dark grayish brown and dark grayish brown, mottled silty clay, and the lower 14 inches is dark grayish brown, mottled silty clay loam.

Included in this unit are small areas of Awbrig, Clackamas, Coburg, and Courtney soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Conser soil is slow. Available water capacity is about 9 to 12 inches. Effective rooting depth is 60 inches or more; however, penetration of roots is restricted by a seasonal high water table. Runoff is slow to ponded. The hazard of erosion generally is slight; however, it is moderate in areas along drainageways during periods of heavy runoff from winter storms. A seasonal high water table is at a depth of 0.5 foot above the surface to 1.5 feet below the surface from November to May. These soils are subject to rare periods of flooding.

This unit is used mainly for hay, pasture, small grain, and grass seed. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitation is wetness. The unit generally is not suited to deep-rooted perennial crops, because adequate drainage usually cannot be maintained in winter and spring. Drainage is needed if this unit is to be used to its maximum potential. Most climatically adapted crops can be grown if artificial drainage is provided. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. Drainage is difficult and expensive because the dense clay requires close spacing of the tile drains.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. Compaction limits the movement of air and water in the soil, and it restricts the growth of roots.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. To minimize damage to crops and compaction of the soil, vehicles that have large, low-pressure tires should be used to apply fertilizer early in spring. Grasses and small grain respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, slow permeability, the hazard of flooding, shrink-swell potential, and low soil strength. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness as a result of a seasonal high water table and slow permeability. The slow permeability and seasonal high water table adversely affect the treatment and absorption processes.

If buildings are constructed in this unit, using properly designed foundations and footings and diverting runoff away from the buildings help to prevent structural damage as a result of shrinking and swelling.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load.

Ponding and the hazard of flooding make it necessary to locate buildings and roads above the expected high water level.

This map unit is in capability subclass IIIw.

29—Courtney gravelly silty clay loam. This deep, poorly drained soil is in slightly concave areas on low alluvial stream terraces. It formed in gravelly and clayey alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, grasses, and sedges. Elevation is 200 to 700 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown, mottled gravelly silty clay loam about 17 inches thick. The subsoil is very dark grayish brown, mottled gravelly clay about 16 inches thick. The upper 15 inches of the substratum is dark brown very gravelly clay loam, and the lower part to a depth of 60 inches is dark brown extremely gravelly sand. In some areas of similar included soils, the substratum is extremely gravelly clay.

Included in this unit are small areas of Awbrig, Bashaw, Clackamas, and Conser soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Courtney soil is very slow. Available water capacity is about 5 to 8 inches. Effective rooting depth is 60 inches or more; however, penetration of roots is restricted by the gravelly clay and a seasonal high water table. Runoff is slow to ponded. The hazard of erosion is generally slight; however, it is moderate in areas along drainageways during periods of heavy runoff from winter storms. A seasonal high water table is at a depth of 0.5 foot above the surface to 1.5 feet below the surface from November to May. This soil is subject to rare periods of flooding.

This unit is used mainly for hay, pasture, grass seed, and small grain. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are wetness and the gravelly surface, which interferes with tillage. Drainage is needed if this unit is to be used to its maximum potential. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. This unit generally is not suited to deep-rooted perennial crops, because adequate drainage usually cannot be maintained in winter and spring.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grasses and small grain respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, very slow permeability, and the hazard of flooding. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness as a result of the seasonal high water table and very slow permeability. The very slow permeability and seasonal high water table adversely affect the treatment and absorption processes.

Buildings and roads should be built above the expected flood level.

This map unit is in capability subclass IVw.

30D—Crabtree stony loam, 2 to 25 percent slopes. This deep, moderately well drained soil is on ridgetops and concave side slopes of uplands. It formed in colluvium and glacial till derived from mixed sources. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,800 to 4,500 feet. The average annual precipitation is 80 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown stony loam about 8 inches thick. The next layer is very dark grayish brown very gravelly loam about 18 inches thick. The subsoil is mottled, dark grayish brown very gravelly loam over variegated, weakly consolidated very gravelly loam and is about 29 inches thick. The substratum to a depth of 60 inches or more is variegated, strongly consolidated very stony loam.

Included in this unit are small areas of Bensley, Cruiser, Henline, Keel, Valsetz, and Yellowstone soils and Crabtree soils that have slopes of more than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Crabtree soil is slow. Available water capacity is about 3 to 5 inches. Effective rooting depth is only 40 to 60 inches because penetration of roots is restricted by the strongly consolidated substratum. Runoff is slow to medium, and the hazard of erosion is slight to high. A seasonal high water table is perched above the strongly consolidated substratum between depths of 2 to 3 feet from November to June.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 105, the potential production per acre is 4,620 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 46,200 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. Douglas-fir, noble fir, Pacific silver fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Snowpack limits the use of equipment and restricts access.

Because roots are restricted by the seasonal high water table and depth to the strongly consolidated substratum, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir, noble fir, western hemlock, and western redcedar.

The understory vegetation commonly growing on this unit includes common beargrass, cascade Oregon-grape, tall blue huckleberry, Pacific rhododendron, vine maple, and red huckleberry.

This map unit is in capability subclass VIs.

30F—Crabtree stony loam, 25 to 45 percent slopes. This deep, moderately well drained soil is in concave areas of uplands. It formed in colluvium and glacial till derived from mixed sources. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,800 to 4,500 feet. The average annual precipitation is 80 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown stony loam about 8 inches thick. The next layer is very dark grayish brown very gravelly loam about 18 inches thick. The subsoil is mottled, dark grayish brown very gravelly loam over variegated, weakly consolidated very gravelly loam and is about 29 inches thick. The substratum to a depth of 60 inches or more is variegated, strongly consolidated very stony loam.

Included in this unit are small areas of Bensley, Cruiser, Henline, Keel, Valsetz, and Yellowstone soils and Crabtree soils that have slopes of less than 25 percent or more than 45 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Crabtree soil is slow. Available water capacity is about 3 to 5 inches. Effective rooting depth is only 40 to 60 inches because penetration of roots is restricted by the strongly consolidated substratum. Runoff is rapid, and the hazard of erosion is high. A seasonal high water is perched above the strongly consolidated substratum between depths of 2 to 3 feet from November to June.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 105, the potential production per acre is 4,620 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 46,200 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. Douglas-fir, noble fir, Pacific silver fir, western hemlock, and western redcedar commonly grow on this unit (fig. 3). The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and the hazard of windthrow.

Figure 3.—Old growth stand of noble-fir, western hemlock, and Douglas-fir in an area of Crabtree stony loam, 25 to 45 percent slopes. Crabtree Lake is in foreground.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Snowpack limits the use of equipment and restricts access.

Because roots are restricted by the seasonal high water table and depth to the strongly consolidated substratum, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, noble fir, western hemlock, and western redcedar.

The understory vegetation commonly growing on this unit includes common beargrass, cascade Oregon-grape, tall blue huckleberry, Pacific rhododendron, vine maple, and red huckleberry.

This map unit is in capability subclass VIs.

30G—Crabtree stony loam, 45 to 75 percent slopes. This deep, moderately well drained soil is in concave areas on uplands. It formed in colluvium and glacial till derived from mixed sources. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,800 to 4,500 feet. The average annual precipitation is 80 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown stony loam about 8 inches thick. The next layer is very dark grayish brown very gravelly loam about 18 inches thick. The subsoil is mottled, dark grayish brown very gravelly loam and variegated, weakly consolidated very gravelly loam that is about 29 inches thick. The substratum to a depth of 60 inches or more is variegated, strongly consolidated very stony loam.

Included in this unit are small areas of Bensley, Cruiser, Henline, Keel, Valsetz, and Yellowstone soils and Crabtree soils that have slopes of less than 45 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Crabtree soil is slow. Available water capacity is about 3 to 5 inches. Effective rooting depth is only 40 to 60 inches because the penetration of roots is restricted by the strongly consolidated substratum. Runoff is rapid, and the hazard of erosion is high. A seasonal high water table is perched above the strongly consolidated substratum between depths of 2 and 3 feet from November to June.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 105, the potential production per acre is 4,620 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 46,200 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. Douglas-fir, noble fir, Pacific silver fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

Because roots are restricted by a seasonal high water table and depth to the strongly consolidated substratum, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, noble fir, western hemlock, and western redcedar.

The understory vegetation commonly growing on this unit includes common beargrass, cascade Oregon-grape, tall blue huckleberry, Pacific rhododendron, vine maple, and red huckleberry.

This map unit is in capability subclass VIIs.

31D—Cruiser gravelly loam, 3 to 25 percent slopes. This deep, well drained soil is on ridgetops and side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock and volcanic ash. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,700 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown and dark reddish brown gravelly loam about 14 inches thick. The upper 6 inches of the subsoil is reddish brown gravelly loam, and the lower 25 inches is reddish brown and yellowish red gravelly clay loam. The substratum to a depth of 60 inches or more is yellowish red very cobbly clay loam.

Included in this unit are small areas of Crabtree, Henline, Hummington, and Keel soils and Cruiser soils that have slopes of more than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Cruiser soil is moderate. Available water capacity is about 9 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140, the potential production per acre is 7,740 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 75,690 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. Douglas-fir, noble fir, western hemlock, and western redcedar commonly grow on this unit. The main concern in producing and harvesting timber is equipment limitations.

Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Snowpack limits the use of equipment and restricts access.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir, noble fir, Pacific silver fir, and western hemlock.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, cascade Oregon-grape, Pacific rhododendron, and red huckleberry.

This map unit is in capability subclass VIe.

31F—Cruiser gravelly loam, 25 to 50 percent slopes. This deep, well drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock and volcanic ash. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,700 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown and dark reddish brown gravelly loam about 14 inches thick. The upper 6 inches of the subsoil is reddish brown gravelly loam, and the lower 25 inches is reddish brown and yellowish red gravelly clay loam. The substratum to a depth of 60 inches or more is yellowish red very cobbly clay loam.

Included in this unit are small areas of Crabtree, Henline, Hummington, and Keel soils and Cruiser soils that have slopes of less than 25 percent and more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Cruiser soil is moderate. Available water capacity is about 9 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140, the potential production per acre is 7,740 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 75,690 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. Douglas-fir, noble fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion and equipment limitations.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Snowpack limits the use of equipment and restricts access.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, noble fir, Pacific silver fir, and western hemlock.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, cascade Oregon-grape, Pacific rhododendron, and red huckleberry.

This map unit is in capability subclass VIe.

31G—Cruiser gravelly loam, 50 to 70 percent slopes. This deep, well drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock and volcanic ash. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,700 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown and dark reddish brown gravelly loam about 14 inches thick. The upper 6 inches of the subsoil is reddish brown gravelly loam, and the lower 25 inches is reddish brown and yellowish red gravelly clay loam. The substratum to a depth of 60 inches or more is yellowish red very cobbly clay loam.

Included in this unit are small areas of Crabtree, Henline, Hummington, and Keel soils and Cruiser soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Cruiser soil is moderate. Available water capacity is about 9 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat and water supply.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140, the potential production per acre is 7,740 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 75,690 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. Douglas-fir, noble fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion and equipment limitations.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, noble fir, Pacific silver fir, and western hemlock.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, cascade Oregon-grape, Pacific rhododendron, and red huckleberry.

This map unit is in capability subclass VIIe.

32D—Cumley silty clay loam, 2 to 20 percent slopes. This deep, moderately well drained soil is in basins or other depressional areas of uplands. It formed in fine textured colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to

2,500 feet. The average annual precipitation is 60 to 80 inches, the average annual air temperature is 47 to 51 degrees F, and the average frost-free period is 165 to 190 days.

Typically, the surface is covered with a mat of leaves, twigs, and moss about 2 inches thick. The surface layer is dark brown silty clay loam about 18 inches thick. The upper 23 inches of the subsoil is dark brown, mottled silty clay, and the lower 19 inches is brown, mottled clay.

Included in this unit are small areas of Honeygrove, Kinney, Minniece, and Peavine soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Cumley soil is moderately slow. Available water capacity is 9 to 11 inches. Effective rooting depth is 60 inches or more; however, penetration of roots is restricted by a seasonal high water table. Runoff is slow to medium, and the hazard of erosion is slight to high. A seasonal high water table is at a depth of 2 to 3 feet from November to May.

This unit is used mainly for timber production. It is also used for limited hay and pasture, limited homesite development, water supply, and wildlife habitat.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 155, the potential production per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year curve, the mean site index is 115. Douglas-fir, western hemlock, western redcedar, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations, the hazard of windthrow, and plant competition.

If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity.

Windthrow is a hazard when the soil is wet and the winds are strong. Because roots are restricted by the seasonal high water table, trees are subject to windthrow.

Reforestation must be carefully managed to reduce competition from undesirable plants, which prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

When harvesting timber on this unit, use of management that minimizes erosion is essential. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, and western redcedar.

The understory vegetation commonly growing on this unit includes vine maple, salal, creambush oceanspray, trailing blackberry, cascade Oregon-grape, and western swordfern.

If this unit is used for hay and pasture, the main limitations are wetness and the clayey texture of the soil. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.

If this unit is used for homesite development, the main limitations are wetness, slope, and shrink-swell potential of the subsoil. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

Septic tank absorption fields may function poorly in winter. The moderately slow permeability and the seasonal high water table adversely affect the treatment and absorption processes. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

Slope limits use of the steeper areas of this unit for building site development. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

This map unit is in capability subclass VIe.

33—Dayton silt loam. This deep, poorly drained soil is in slightly concave areas on broad valley terraces of the Willamette Valley. It formed in silty and clayey alluvial and lacustrine material. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, grasses, sedges, and rushes. Elevation is 200 to 400 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is grayish brown silt loam about 9 inches thick. The subsurface layer is dark gray silt loam about 6 inches thick. The upper 25 inches of the subsoil is dark gray, olive gray, and mottled gray silty clay, and the lower 13 inches is mottled, dark gray silt loam. The substratum to a depth of 76 inches is mottled, brown silt loam.

Included in this unit are small areas of Amity, Concord, Holcomb, Willamette, and Woodburn soils. Also included are small areas of Dayton soils that have a gravelly and clayey substratum and occur in complex patterns on valley terraces above 305 feet in elevation. Included areas make up about 15 percent of the total acreage.

Permeability of this Dayton soil is very slow. Available water capacity is about 6 to 9 inches. Effective rooting depth is 60 inches or more; however, penetration of roots may be restricted by dense clay and a seasonal high water table. Runoff is very slow to ponded. The hazard of erosion is generally slight; however, it is moderate in areas along drainageways during periods of heavy runoff from winter storms. A seasonal high water table is at a depth of 0.5 foot above the surface to 1.5 feet below the surface from November to May.

This unit is used mainly for hay and pasture, small grain, and grass seed. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are wetness as a result of the seasonal high water table and very slow permeability and the high content of clay in the soil. This unit generally is not suited to deep-rooted perennial crops, because adequate drainage usually cannot be maintained in winter and spring. Drainage is needed if this unit is to be used to its maximum potential. Open ditches and tile drains can be used to remove excess water on the surface (fig. 4). Tile drains have limited suitability for removing subsurface water from the soil because of the very slow permeability and inadequate outlets. Where a suitable outlet is available, subsurface drainage can be used to reduce wetness. Drainage of this unit is difficult and expensive because the dense clay requires close spacing of the tile drains. Where tile drains have been properly installed and maintained, however, they have functioned properly for more than 10 years.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, subsoiling, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. To minimize damage to crops and compaction of the soil, vehicles that have large, low-pressure tires should be used to apply fertilizer early in spring. Grain and grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble

Figure 4.—Cultivated area of Dayton silt loam. Open surface ditches are used to remove excess water in winter and early in spring.

mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, very slow permeability, shrink-swell potential, and low soil strength. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness as a result of the seasonal high water table and very slow permeability. The very slow permeability and the seasonal high water table adversely affect the treatment and absorption processes.

Buildings and roads should be designed to offset the effects of shrinking and swelling and the limited ability of the soil to support a load. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Ponding on this unit makes it necessary to locate roads and streets above the expected high water level.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IVw.

34C—Dixonville silty clay loam, 3 to 12 percent slopes. This moderately deep, well drained soil is on low foothills adjacent to terraces of the Willamette Valley. It formed in colluvium derived dominantly from basic igneous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silty clay loam about 12 inches thick. The subsoil is dark brown clay about 14 inches thick. Weathered basalt is at a depth of 26 inches.

Included in this unit are small areas of Bellpine, Nekia, Philomath, and Ritner soils and Dixonville soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Dixonville soil is slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for small grain, hay and pasture, and timber production. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It has few limitations.

In summer, irrigation is needed for maximum production of most crops. Water for irrigation is often not available; when available, however, it is stored in reservoirs. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 120, the potential production per acre is 6,900 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 63,900 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir, grand fir, and Oregon white oak commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations, seedling mortality, and plant competition.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts.

Trees suitable for planting on this unit include Douglas-fir and ponderosa pine.

The understory vegetation commonly growing on this unit includes common snowberry, Pacific poison-oak, rose, western brackenfern, and western hazel.

If this unit is used for homesite development, the main limitations are depth to bedrock, slow permeability, low soil strength, and shrink-swell potential of the subsoil. Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock and slow permeability. Septic tank absorption fields can be installed in some areas where the depth to bedrock is greater. The limitation of slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIIe.

34E—Dixonville silty clay loam, 12 to 30 percent slopes. This moderately deep, well drained soil is on low foothills adjacent to terraces in the Willamette Valley. It formed in colluvium derived dominantly from basic igneous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silty clay loam about 12 inches thick. The subsoil is dark brown clay about 14 inches thick. Weathered basalt is at a depth of 26 inches.

Included in this unit are small areas of Bellpine, Nekia, Philomath, and Ritner soils and Dixonville soils that have slopes of less than 12 percent or more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Dixonville soil is slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate to high.

This unit is used mainly for small grain in the less sloping areas, hay and pasture, orchards, and timber production. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It is limited mainly by slope in some areas.

In summer, irrigation is needed for maximum production of most crops. Water for irrigation is often not available; when available, however, it is stored in reservoirs. Only a few areas are irrigated by sprinklers.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. Compaction limits the movement of air and water in the soil and restricts the growth of roots. All tillage should be on the contour or across the slope. Constructing terraces reduces runoff and the risk of erosion and conserve moisture.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 120, the potential production per acre is 6,900 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 63,900 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir, grand fir, and Oregon white oak commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and ponderosa pine.

The understory vegetation commonly growing on this unit includes common snowberry, Pacific poison-oak, rose, western brackenfern, and western hazel.

If this unit is used for homesite development, the main limitations are depth to bedrock, slow permeability, slope, low soil strength, and shrink-swell potential of the subsoil.

Cuts needed to provide essentially level building sites can expose bedrock. Cutbanks are subject to slumping when the soil is saturated. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock, slope, and slow permeability. Septic tank absorption fields can be installed in some areas of this unit where the depth to bedrock is greater and the areas are less sloping. Absorption lines should be installed on the contour. The limitation of slow permeability can be overcome by increasing the size of the absorption fields.

Slope limits the use of steeper areas of this unit for building site development.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IVe.

34F—Dixonville silty clay loam, 30 to 50 percent slopes. This moderately deep, well drained soil is on low foothills adjacent to the terraces of the Willamette Valley. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silty clay loam about 12 inches thick. The subsoil is dark brown clay about 14 inches thick. Weathered basalt is at a depth of 26 inches.

Included in this unit are small areas of Bellpine, Nekia, Philomath, and Ritner soils and Dixonville soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Dixonville soil is slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 120, the potential production per acre is 6,900 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 63,900 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir, grand fir, and Oregon white oak commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry improves the growth of trees. Road location and maintenance costs are greater in the more steeply sloping areas.

The soil in this unit is subject to landsliding and slumping when saturated, because it is very plastic and is underlain by highly fractured bedrock.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and ponderosa pine.

The understory vegetation commonly growing on this unit includes common snowberry, Pacific poison-oak, rose, western brackenfern, and western hazel.

This map unit is in capability subclass VIe.

35C—Dixonville-Philomath-Hazelair complex, 3 to 12 percent slopes. This map unit is on low foothills adjacent to the Willamette Valley. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

This unit is about 30 percent Dixonville silty clay loam, 30 percent Philomath silty clay, and 30 percent Hazelair silty clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ritner and Witzel soils and Dixonville, Philomath, and Hazelair soils that have slopes of more than 12 percent. Also included are small areas of Rock outcrop and Orthents. Included areas make up about 10 percent of the total acreage.

The Dixonville soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface layer is very dark grayish brown silty clay loam about 12 inches thick. The subsoil is dark brown clay about 14 inches thick. Weathered basalt is at a depth of 26 inches.

Permeability of this Dixonville soil is slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

The Philomath soil is shallow and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface layer is very dark brown silty clay about 4 inches thick. The next layer is very dark brown and very dark grayish clay about 15 inches thick. Weathered basalt is at a depth of 19 inches. In some areas of similar soils, the surface layer is cobbly silty clay.

Permeability of this Philomath soil is slow. Available water capacity is about 2 to 4 inches. Depth to soft bedrock and effective rooting depth are 12 to 20 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

The Hazelair soil is moderately deep and is moderately well drained to somewhat poorly drained. If formed in stratified medium textured and moderately fine textured colluvium derived from mixed sources and overlying older, very clayey material that is underlain by sedimentary bedrock. Typically, the surface layer is very dark grayish brown silty clay loam about 5 inches thick. The subsoil is very dark grayish brown silty clay about 10 inches thick. The substratum is variegated yellowish brown and light yellowish brown, mottled clay about 19 inches thick. Weathered siltstone is at a depth of 34 inches.

Permeability of this Hazelair soil is very slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. A seasonal high water table is at a depth of 1 foot to 2 feet from December to April.

This unit is used mainly for hay and pasture. It is also used for homesite development, wildlife habitat, and recreation. A few areas of the Dixonville soil are used for timber production.

If this unit is used for hay and pasture, the main limitations are wetness of the Hazelair soil because of the seasonal high water table, the shallow depth to bedrock in the Philomath soil, and the high clay content. Drainage is needed if the Hazelair soil is to be used to its maximum potential.

The soils in this unit are sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soils are wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soils are moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soils from erosion.

The intricate pattern of the shallow and droughty Philomath soil, the moderately deep and well drained Dixonville soil, and the moderately well drained to somewhat poorly drained Hazelair soil make cultivation of this unit difficult. It is restricted dominantly to small gardens.

Use of fertilizer promotes good growth of forage plants. Grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.

This unit is poorly suited to Douglas-fir. On the basis of a site index of 120 for the Dixonville soil, the potential production per acre is 6,900 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 63,900 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir, grand fir, and Oregon white oak commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations, seedling mortality, and plant competition.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on the Dixonville soil include Douglas-fir and ponderosa pine.

The understory vegetation commonly growing on this unit includes common snowberry, Pacific poison-oak, rose, western brackenfern, and western hazel.

If this unit is used for homesite development, the main limitations are shallow depth to bedrock, wetness, slow permeability, low soil strength, and shrink-swell potential. Costs of construction to overcome these limitations is high. Construction of houses and roads should be restricted to areas of the Philomath and Dixonville soils. Cuts needed to provide essentially level building sites can expose bedrock. Cutbanks are subject to slumping when the soil is saturated. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock, wetness as a result of the seasonal high water table in the Hazelair soil, and slow permeability. Septic tank absorption fields can be installed in some areas of the Dixonville soil where the depth to bedrock is greater. The limitation of slow permeability can be overcome by increasing the size of the absorption field.

Roads and streets can be built if they are designed to compensate for the limited ability of the soils in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

This map unit is in capability subclass VIs.

35E—Dixonville-Philomath-Hazelair complex, 12 to 35 percent slopes. This map unit is on low foothills adjacent to the Willamette Valley (fig. 5). The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

This unit is about 30 percent Dixonville silty clay loam, 30 percent Philomath silty clay, and 30 percent Hazelair silty clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ritner and Witzel soils and Dixonville, Philomath, and Hazelair soils that have slopes of less than 12 percent. Also included are small areas of Rock outcrop and Orthents. Included areas make up about 10 percent of the total acreage.

The Dixonville soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface layer is very

Figure 5.—Typical area of Dixonville-Philomath-Hazelair complex, 12 to 35 percent slopes, on the foot slopes of Rogers Mountain.

dark grayish brown silty clay loam about 12 inches thick. The subsoil is dark brown clay about 14 inches thick. Weathered basalt is at a depth of 26 inches.

Permeability of this Dixonville soil is slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate to high.

The Philomath soil is shallow and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface layer is very dark brown silty clay about 4 inches thick. The next layer is very dark brown and very dark grayish brown clay about 15 inches thick. Weathered basalt is at a depth of 19 inches. In some areas of similar soils, the surface layer is cobbly silty clay.

Permeability of this Philomath soil is slow. Available water capacity is about 2 to 4 inches. Depth to soft bedrock and effective rooting depth are 12 to 20 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

The Hazelair soil is moderately deep and moderately well drained to somewhat poorly drained. It formed in stratified, medium textured and moderately fine textured colluvium derived from mixed sources and overlying older, very clayey material that is underlain by sedimentary rock. Typically, the surface layer is very dark grayish brown silty clay loam about 5 inches thick. The subsoil is very dark grayish brown silty clay about 10 inches thick. The substratum is variegated yellowish brown and light yellowish brown, mottled clay about 19 inches thick. Weathered siltstone is at a depth of 34 inches.

Permeability of this Hazelair soil is very slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate to high. A seasonal high water table is at a depth of 1 foot to 2 feet from December to April.

This unit is used mainly for hay and pasture. It is also used for homesite development, wildlife habitat, and recreation. A few areas of the Dixonville soil are used for timber production.

If this unit is used for hay and pasture, the main limitations are wetness of the Hazelair soil, because of the seasonal high water table, the shallow depth to bedrock in the Philomath soil, the high clay content, and slope in some areas. Drainage is needed if the Hazelair soil is to be used to its maximum potential.

The soils in this unit are sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soils are wet can reduce soil tilth and destroy structure, which results in excessive runoff and increased erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. All tillage should be on the contour or across the slope. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

The intricate pattern of the shallow and droughty Philomath soil, the moderately deep and well drained Dixonville soil, and the moderately well drained to somewhat poorly drained Hazelair soil makes cultivation of this unit difficult. It is restricted dominantly to small gardens in the less sloping areas.

Use of fertilizer promotes good growth of forage plants. Grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.

This unit is poorly suited to Douglas-fir. On the basis of a site index of 120 for the Dixonville soil, the potential production per acre is 6,900 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 63,900 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir, grand fir, and Oregon white oak commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on the Dixonville soil include Douglas-fir and ponderosa pine.

The understory vegetation commonly growing on this unit includes common snowberry, Pacific poison-oak, rose, western brackenfern, and western hazel.

If this unit is used for homesite development, the main limitations are shallow depth to bedrock, wetness of the Hazelair soil, because of the seasonal high water table slow permeability, slope, low soil strength, and shrink-swell potential. Cost of construction to overcome these limitations is high. Construction of houses and roads should be restricted to areas of Philomath and Dixonville soils.

Cuts needed to provide essentially level building sites can expose bedrock. Cutbanks occasionally slump when the soils in this unit are saturated. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

The soils in this unit are poorly suited to septic tank absorption fields because of the depth to bedrock, wetness of the Hazelair soil, the seasonal high table, slow permeability, and slope. Septic tank absorption fields may be installed in some areas of the Dixonville soil where the depth to bedrock is greater and the areas are less sloping. The limitation of slow permeability may be overcome by increasing the size of the absorption field. Absorption lines should be installed on the contour.

Slope limits use of the steeper areas of this unit for building site development. Steepness of slope and high content of clay in the subsoil are limitations for dwellings and commercial buildings.

Roads and streets can be built if they are designed to compensate for the limited ability of the soils in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

This map unit is in capability subclass VIs.

36D—Dupee silt loam, 3 to 20 percent slopes. This deep, somewhat poorly drained soil is in depressional areas and drainageways of foothills and on alluvial fans. It formed in mixed colluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, sedges, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown silt loam about 4 inches thick. The next layer is very dark brown silty clay loam about 7 inches thick. The upper 14 inches of the subsoil is brown silty clay loam, and the lower 11 inches is brown silty clay. The substratum to a depth of 65 inches is light olive gray and light gray clay. In some areas of similar included soils, weathered sedimentary rock is at a depth of 40 to 60 inches.

Included in this unit are small areas of Bellpine, Hazelair, Panther, and Willakenzie soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Dupee soil is moderately slow. Available water capacity is 9 to 13 inches. Effective rooting depth is 60 inches or more; however, penetration of roots is restricted by dense clay and a seasonal high water table. Runoff is slow to medium, and the hazard of erosion is slight to high. A seasonal high water table is at a depth of 1.5 to 3.0 feet from December to April.

This unit is used mainly for hay and pasture, small grain, orchards, and limited timber production. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for hay and pasture, the main limitations are wetness and the moderately slow permeability of the subsoil. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Proper grazing practices, weed control, and fertilizer are needed to ensure maximum quality of forage.

If this unit is used for grain and orchard crops, the main limitations are wetness and slope. Drainage is needed if this unit is to be used to its maximum potential. Unless the unit is drained, long-lived, deep-rooted deciduous fruit and nut trees, strawberries, caneberries, and alfalfa are adversely affected by the seasonal high water table. Tile drainage can be used to reduce wetness if a suitable outlet is available.

The risk of sheet and rill erosion on the steeper slopes can be reduced by use of gradient terraces and contour farming. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation can be used, but water needs to be applied slowly to minimize runoff.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium.

This unit is poorly suited to the production of Douglas-fir for saw logs. The seasonal high water table retards the growth of Douglas-fir after about 30 years; the resulting timber is more suitable for posts or pulp than for moist other uses.

If this unit is used for homesite development, the main limitations are wetness, moderately slow permeability, low soil strength, and slope. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is poorly suited to septic tank absorption fields because of wetness as a result of the seasonal high water table, the moderately slow permeability, and slope. Septic tank absorption fields can be installed in some areas where the depth to the seasonal high water table is greater and the unit is less sloping. Absorption lines should be installed on the contour. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

Slope limits use of the steeper areas of this unit for building site development. Slope is a concern in installing septic tank absorption fields. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass IIIe.

37D—Flane gravelly loam, 3 to 25 percent slopes. This deep, well drained soil is on broad bench tops and side slopes of uplands. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock and from breccia. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 70 to 90 inches, the average annual air temperature is 43 to 45 degrees F, and the average frost-free period is 90 to 120 days.

Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 6 inches thick. The next layer is dark yellowish brown gravelly loam about 7 inches thick. The subsoil is brown and yellowish brown very cobbly silty clay loam about 24 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown extremely cobbly clay loam.

Included in this unit are small areas of Apt, Cruiser, Dobbins, Kinney, Moe, Mulkey, Quartzville, and Zango soils and Flane soils that have slopes of more than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Flane soil is moderate. Available water capacity is about 3 to 6 inches. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 130, the potential production per acre is 7,740 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 75,690 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 105. Douglas-fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber is equipment limitations.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Snowpack limits the use of equipment and restricts access.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, Pacific rhododendron, red huckleberry, salal, tall blue huckleberry, trailing blackberry, vine maple, western brackenfern, and western swordfern.

This map unit is in capability subclass VIe.

37F—Flane gravelly loam, 25 to 50 percent slopes. This deep, well drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock and from breccia. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 70 to 90 inches, the average annual air temperature is 43 to 45 degrees F, and the average frost-free period is 90 to 120 days.

Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 6 inches thick. The next layer is dark yellowish brown gravelly loam about 7 inches thick. The subsoil is brown and yellowish brown very cobbly silty clay loam about 24 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown extremely cobbly clay loam.

Included in this unit are small areas of Apt, Cruiser, Dobbins, Kinney, Moe, Mulkey, Quartzville, and Zango soils and Flane soils that have slopes of less than 25 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Flane soil is moderate. Available water capacity is about 3 to 6 inches. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 130, the potential production per acre is 7,740 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 75,690 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 105. Douglas-fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion and equipment limitations.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, Pacific rhododendron, red huckleberry, salal, tall blue huckleberry, trailing blackberry, vine maple, western brackenfern, and western swordfern.

This map unit is in capability subclass VIe.

37G—Flane gravelly loam, 50 to 75 percent slopes. This deep, well drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock and from breccia. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 70 to 90 inches, the average annual air temperature is 43 to 45 degrees F, and the average frost-free period is 90 to 120 days.

Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 6 inches thick. The next layer is dark yellowish brown gravelly loam about 7 inches thick. The subsoil is brown and yellowish brown very cobbly silty clay loam about 24 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown extremely cobbly clay loam.

Included in this unit are small areas of Apt, Cruiser, Dobbins, Kinney, Moe, Mulkey, Quartzville, and Zango soils and Flane soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Flane soil is moderate. Available water capacity is about 3 to 6 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 130, the potential production per acre is 7,740 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 75,690 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 105. Douglas-fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion and equipment limitations.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, Pacific rhododendron, red huckleberry, salal, tall blue huckleberry, trailing blackberry, vine maple, western brackenfern, and western swordfern.

This map unit is in capability subclass VIIe.

38F—Flane-Moe gravelly loams, 25 to 50 percent slopes. This map unit is on the side slopes of uplands (fig. 6). The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 70 to 90 inches, the average annual air temperature is 43 to 45 degrees F, and the average frost-free period is 90 to 120 days.

This unit is about 45 percent Flane gravelly loam and 40 percent Moe gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Apt, Cruiser, Dobbins, Kinney, Mulkey, Quartzville, and Zango soils. Also included are Flane and Moe gravelly loams that

Figure 6.—Typical area of Flane-Moe gravelly loams, 25 to 50 percent slopes, in right foreground. Detroit Reservoir is in left foreground, and Mt. Jefferson is in background.

have slopes of less than 25 percent. Included areas make up about 15 percent of the total acreage.

The Flane soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous, and tuffaceous rock and from breccia. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 6 inches thick. The next layer is dark yellowish brown gravelly loam about 7 inches thick. The subsoil is brown and yellowish brown very cobbly silty clay loam about 24 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown extremely cobbly clay loam.

Permeability of the Flane soil is moderate. Available water capacity is about 3 to 6 inches. Effective rooting depth is more than 60 inches. Runoff is medium to rapid, and the hazard of erosion is high.

The Moe soil is deep and well drained. It formed in colluvium derived dominantly from tuffaceous rock and breccia. Typically, the surface is covered with a mat of needles, twigs, and leaves about 1 inch thick. The surface layer is very dark grayish brown and very dark brown gravelly loam about 15 inches thick. The upper 9 inches of the subsoil is dark brown silty clay loam, and the lower 37 inches is dark yellowish brown and dark brown silty clay.

Permeability of the Moe soil is moderately slow. Available water capacity is about 10 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 130 for the Flane soil, the potential production per acre is 7,740 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 75,690 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 105. On the basis of a site index of 145 for the Moe soil, the potential production per acre is 9,170 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eigth inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year curve, the mean site index is 115. Douglas-fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

Reforestation must be carefully managed to reduce competition from undesirable plants on the Moe soil. Undesirable plants can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, Pacific rhododendron, red huckleberry, salal, tall blue huckleberry, trailing blackberry, vine maple, western brackenfern, and western swordfern.

This map unit is in capability subclass VIe.

38G—Flane-Moe gravelly loams, 50 to 75 percent slopes. This map unit is on the side slopes of uplands. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 70 to 90 inches, the average annual air temperature is 43 to 45 degrees F, and the average frost-free period is 90 to 120 days.

This unit is about 45 percent Flane gravelly loam and 40 percent Moe gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Apt, Cruiser, Dobbins, Kinney, Mulkey, Quartzville, and Zango soils. Also included are Flane and Moe gravelly loams that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

The Flane soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock and from breccia. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 6 inches thick. The next layer is dark yellowish brown gravelly loam about 7 inches thick. The subsoil is brown and yellowish brown very cobbly silty clay loam about 24 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown extremely cobbly clay loam.

Permeability of the Flane soil is moderate. Available water capacity is about 3 to 6 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Moe soil is deep and well drained. It formed in colluvium derived dominantly from tuffaceous rock and breccia. Typically, the surface is covered with a mat of needles, twigs, and leaves about 1 inch thick. The surface layer is very dark grayish brown and very dark brown gravelly loam about 15 inches thick. The upper 9 inches of the subsoil is dark brown silty clay loam, and the lower 37 inches is dark yellowish brown and dark brown silty clay.

Permeability of the Moe soil is moderately slow. Available water capacity is about 10 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 130 for the Flane soil, the potential production per acre is 7,740 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 75,690 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 105. On the basis of a site index of 145 for the Moe soil, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 115. Douglas-fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

Reforestation must be carefully managed to reduce competition from undesirable plants on the Moe soil. Undesirable plants can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, Pacific rhododendron, red huckleberry, salal, tall blue huckleberry, trailing blackberry, vine maple, western brackenfern, and western swordfern.

This map unit is in capability subclass VIIe.

39—Fluvents-Fluvaquents complex, nearly level. This map unit occurs as islands, bars, low flood plains, overflow channels, oxbows, and sloughs along major rivers and streams. The native vegetation is mainly scattered hardwoods, shrubs, grasses, and sedges. Elevation is 125 to 1,200 feet. The average annual precipitation is 40 to 80 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 160 to 210 days.

This unit is about 50 percent Fluvents and 35 percent Fluvaquents. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Camas, Chehalis, Cloquato, McBee, and Newberg soils and Riverwash. Small areas of Abiqua, McAlpin, and Waldo soils are along the smaller streams. In some areas at elevations where rainfall is greater, Saturn soils are present in place of the other inclusions. Included areas make up about 15 percent of the total acreage.

The Fluvents are highly variable. These soils are moderately well drained and well drained and formed in coarse textured and medium textured recent alluvium that has been stabilized by plant cover. The surface layer and subsoil are very dark brown, dark brown, or dark yellowish brown, highly stratified silt loam, sandy loam, or gravelly sandy loam that is as much as 30 percent gravel. The substratum is loose gravel, extremely gravelly loamy sand, or extremely gravelly sand.

The Fluvaquents are highly variable. These soils are poorly drained and formed in medium textured to moderately fine textured alluvium that has been stabilized by plant cover. The surface layer and subsoil are very dark grayish brown, dark grayish brown, dark gray, very dark gray, or gray, stratified silty clay loam to loam that is as much as 30 percent gravel. The substratum is stratified silt loam to sandy loam that is 0 to 65 percent gravel and cobbles.

Permeability is moderate to rapid. Available water capacity is highly variable. Runoff is slow, and the hazard of erosion is very high because of overflow.

This unit is used mainly for wildlife habitat, limited timber production, and recreation. The main limitation is the hazard of flooding.

Some areas of this unit produce marketable stands of timber, mainly black cottonwood, that can be harvested if the areas are protected from flooding.

This unit is poorly suited to homesite, urban, and recreational development because of the hazard of flooding.

This map unit is in capability subclass VIIw.

40G—Harrington-Klickitat complex, 50 to 75 percent north slopes. This map unit is on north-facing slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Harrington gravelly loam and 40 percent Klickitat stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Blachly, Honeygrove, Kilchis, and Kinney soils. Also included are Harrington and Klickitat soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

The Harrington soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 4 inches thick. The upper 19 inches of the subsoil is dark reddish brown very gravelly clay loam, and the lower 11 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 34 inches.

Permeability of the Harrington soil is moderately rapid. Available water capacity is about 2 to 5 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Klickitat soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown stony loam about 9 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. The substratum to a depth of 56 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 56 inches.

Permeability of the Klickitat soil is moderate. Available water capacity is about 3 to 5 inches. Depth to hard bedrock and effective rooting depth are 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

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

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140 for the Harrington soil, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 100. On the basis of a site index of 160 for the Klickitat soil, the potential production per acre is 10,200 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 95,200 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 125. Douglas-fir, grand fir, and western hemlock commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface may interfere with felling, yarding, and other operations involving the use of equipment on the Klickitat soil. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs are less damaging to the soil and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The droughtiness of the surface layer and the large amount of rock fragments increase seedling mortality on the Harrington soil. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the moderate depth to bedrock in the Harrington soil, trees on this soil are subject to windthrow. Trees commonly are subject to windthrow during periods when the soil is excessively wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Landsliding and slumping may occur when the soils in this unit become saturated and are disturbed by constructing roads or harvesting timber.

Trees suitable for planting on the Harrington soil include Douglas-fir and grand fir. Trees suitable for planting on the Klickitat soil include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, creambush oceanspray, red huckleberry, salal, thimbleberry, vine maple, western brackenfern, and western hazel.

This map unit is in capability subclass VIIs.

41G—Harrington-Klickitat complex, 50 to 75 percent south slopes. This map unit is on south-facing slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Harrington gravelly loam and 40 percent Klickitat stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Blachly, Honeygrove, Kilchis, and Kinney soils. Also included are Harrington and Klickitat soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

The Harrington soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 4 inches thick. The upper 19 inches of the subsoil is dark reddish brown very gravelly clay loam, and the lower 11 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 34 inches.

Permeability of the Harrington soil is moderately rapid. Available water capacity is about 2 to 5 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Klickitat soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown stony loam about 9 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches. The substratum to a depth of 56 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 56 inches.

Permeability of the Klickitat soil is moderate. Available water capacity is about 3 to 5 inches. Depth to hard bedrock and effective rooting depth are 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140 for the Harrington soil, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 100. On the basis of a site index of 145 for the Klickitat soil, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir and grand fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface may interfere with felling, yarding, and other operations involving the use of equipment on the Klickitat soil. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems (fig. 7). Road location and maintenance costs are greater in the more steeply sloping areas.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the moderate depth to bedrock in the Harrington soil, trees are subject to windthrow. Trees commonly are subject to windthrow during periods when the soil is excessively wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Landsliding and slumping may occur when the soils in this unit become saturated and are disturbed by constructing roads or harvesting timber.

Trees suitable for planting on the Harrington soil include Douglas-fir and grand fir. Trees suitable for planting on the Klickitat soil include Douglas-fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, creambush oceanspray, red huckleberry, salal, thimbleberry, vine maple, western brackenfern, and western hazel.

This map unit is in capability subclass VIIs.

Figure 7.—Balloon logged area of Harrington-Klickitat complex, 50 to 75 percent south slopes.

42H—Harrington-Rock outcrop complex, 50 to 90 percent slopes. This map unit is on the side slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 50 percent Harrington gravelly loam and 35 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Kilchis and Klickitat soils and Harrington soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

The Harrington soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 4 inches thick. The upper 19 inches of the subsoil is dark reddish brown very gravelly clay loam, and the lower 11 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 34 inches.

Permeability of the Harrington soil is moderately rapid. Available water capacity is about 2 to 5 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

The Harrington soil is suited to the production of Douglas-fir. On the basis of a site index of 140, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir and grand fir commonly grow on this soil. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, plant competition, and the areas of Rock outcrop.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Areas of Rock outcrop can interfere with felling, yarding and other operations involving the use of equipment on this unit. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the moderate depth to bedrock in the Harrington soil, trees are subject to windthrow. Trees commonly are subject to windthrow during periods when the soil is excessively wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Landsliding and slumping may occur when the Harrington soil becomes saturated and is disturbed by constructing roads or harvesting timber.

Trees suitable for planting on the Harrington soil include Douglas-fir and grand fir.

The understory vegetation commonly growing on the Harrington soil includes red huckleberry, salal, vine maple, and western swordfern.

This map unit is in capability subclass VIIs.

43B—Hazelair silty clay loam, 2 to 7 percent slopes. This moderately deep, moderately well drained to somewhat poorly drained soil is on low foothills adjacent to the Willamette Valley. It formed in stratified, medium textured and moderately fine textured colluvium derived from mixed sources overlying older, very clayey material of unknown origin and underlain by sedimentary rock. The vegetation in areas not cultivated is mainly hardwoods, some conifers, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silty clay loam about 5 inches thick. The subsoil is very dark grayish brown silty clay about 10 inches thick. The substratum is variegated yellowish brown and light yellowish brown, mottled clay about 19 inches thick. Weathered siltstone is at a depth of 34 inches.

Included in this unit are small areas of Dixonville, Philomath, Dupee, and Panther soils and Hazelair soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Hazelair soil is very slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 1 foot to 2 feet from December to April.

This unit is used mainly for hay, pasture, limited small grain, and grass seed. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are wetness, very slow permeability, and high clay content of the soil. Drainage is needed if this soil is to be used to its maximum potential. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. Drainage is difficult and expensive because the dense clay requires close spacing of the tile drains. The unit generally is not suitable for deep-rooted perennial crops, because adequate drainage usually cannot be maintained in winter and spring.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet can reduce soil tilth and destroy structure, resulting in excessive runoff and increased erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, very slow permeability, depth to bedrock, low soil strength, and shrink-swell potential. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness and very slow permeability, which adversely affect the treatment and absorption processes.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Cutbanks are not stable and are subject to slumping. Roads need to be provided with large amounts of base rock to prevent settling. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This unit is poorly suited to the production of Douglas-fir. Douglas-fir trees grown on this unit generally do not produce good saw logs, but they can be used for poles or pulp. The trees grow well until they are about 35 years old, at which time the root system becomes restricted by the clay and high water table and the trees become highly susceptible to root rot and windthrow.

This map unit is in capability subclass IIIe.

43D—Hazelair silty clay loam, 7 to 20 percent slopes. This moderately deep, moderately well drained to somewhat poorly drained soil is on low foothills adjacent to the Willamette Valley. It formed in stratified, medium textured and moderately fine textured colluvium derived from mixed sources and overlying older, very clayey material of unknown origin underlain by sedimentary rock. The vegetation in areas not cultivated is mainly hardwoods, limited conifers, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silty clay loam about 5 inches thick. The subsoil is very dark grayish brown silty clay about 10 inches thick. The substratum is variegated yellowish brown and light yellowish brown, mottled clay about 19 inches thick. Weathered siltstone is at a depth of 34 inches.

Included in this unit are small areas of Dixonville, Philomath, Dupee, and Panther soils and Hazelair soils that have slopes of less than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Hazelair soil is very slow. Available water capacity is about 3 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate to high. A seasonal high water table is at a depth of 1 foot to 2 feet from December to April.

This unit is used mainly for hay, pasture, and grass seed. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are wetness, very slow permeability, and high clay content of the soil. Drainage is needed if this unit is to be used to its maximum potential. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. Drainage is difficult and expensive because the dense clay requires close spacing of the tile drains. This unit generally is not suitable for deep-rooted perennial crops, because adequate drainage usually cannot be maintained in winter and spring.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet can reduce soil tilth and destroy structure, resulting in excessive runoff and increased erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. All tillage should be on the contour or across the slope.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, very slow permeability, depth to bedrock, slope, low soil strength, and shrink-swell potential. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness and very slow permeability, which adversely affect the treatment and absorption processes.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Cutbanks are not stable and are subject to slumping. Roads need to be provided with large amounts of base rock to prevent settling. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This unit is poorly suited to the production of Douglas-fir. Douglas-fir trees grown on this unit generally do not produce good saw logs, but they can be used for posts or pulp. The trees grow well until they are about 35 years old, at which time the root system becomes restricted by the clay and high water table and the trees become highly susceptible to root rot and windthrow.

This map unit is in capability subclass IVe.

44E—Henline very stony sandy loam, 6 to 30 percent slopes. This moderately deep, well drained soil is on ridgetops and side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,700 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface layer is very dark grayish brown very stony sandy loam about 5 inches thick. The next layer is very dark grayish brown and dark brown very cobbly sandy loam about 14 inches thick. The substratum is dark yellowish brown very cobbly sandy loam about 9 inches thick. Basalt is at a depth of 28 inches.

Included in this unit are small areas of Bensley, Cruiser, Hummington, and Keel soils, Rock outcrop, Yellowstone soils, and Henline soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Henline soil is moderately rapid. Available water capacity is about 1 to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is moderate to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 135, the potential production per acre is 7,320 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 69,840 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. Douglas-fir, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

Stones on the surface can interfere with felling, yarding, and operations involving the use of equipment. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Undesirable plants may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, and noble fir.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, cascade Oregon-grape, and Pacific rhododendron.

This map unit is in capability subclass VIs.

44F—Henline very stony sandy loam, 30 to 55 percent slopes. This moderately deep, well drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,700 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface layer is very dark grayish brown very stony sandy loam about 5 inches thick. The next layer is very dark grayish brown and dark brown very cobbly sandy loam about 14 inches thick. The substratum is dark yellowish brown very cobbly sandy loam about 9 inches thick. Basalt is at a depth of 28 inches.

Included in this unit are small areas of Bensley, Cruiser, Hummington, and Keel soils, Rock outcrop, Yellowstone soils, and Henline soils that have slopes of less than 30 percent or more than 55 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Henline soil is moderately rapid. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 135, the potential production per acre is 7,320 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 69,840 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. Douglas-fir, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface can interfere with felling, yarding, and operations involving the use of equipment. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Undesirable plants may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, and noble fir.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, cascade Oregon-grape, and Pacific rhododendron.

This map unit is in capability subclass VIs.

44G—Henline very stony sandy loam, 55 to 80 percent slopes. This moderately deep, well drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,700 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface layer is very dark grayish brown very stony sandy loam about 5 inches thick. The next layer is very dark grayish brown and dark brown very cobbly sandy loam about 14 inches thick. The substratum is dark yellowish brown very cobbly sandy loam about 9 inches thick. Fractured basalt is at a depth of 28 inches.

Included in this unit are small areas of Bensley, Cruiser, Hummington, and Keel soils, Rock outcrop, Yellowstone soils, and Henline soils that have slopes of less than 55 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Henline soil is moderately rapid. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 135, the potential production per acre is 7,320 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 69,840 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. Douglas-fir, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface can interfere with felling, yarding, and operations involving the use of equipment. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Undesirable plants may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, and noble fir.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, cascade Oregon-grape, and Pacific rhododendron.

This map unit is in capability subclass VIIs.

45F—Henline-Yellowstone-Rock outcrop complex, 25 to 50 percent slopes. This map unit is on the side slopes of uplands. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 5,000 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 70 to 110 days.

This unit is about 35 percent Henline very stony sandy loam, 30 percent Yellowstone stony loam, and 20 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bensley, Hummington, Keel, and Valsetz soils. Also included are Henline and Yellowstone soils that have slopes of less than 25 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Henline soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface layer is very dark grayish brown very stony sandy loam about 5 inches thick. The next layer is very dark grayish brown and dark brown very cobbly sandy loam about 14 inches thick. The substratum is dark yellowish brown very cobbly sandy loam about 9 inches thick. Fractured basalt is at a depth of 28 inches.

Permeability of the Henline soil is moderately rapid. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium to rapid, and the hazard of erosion is high.

The Yellowstone soil is shallow and somewhat excessively drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, needles, and moss about 1 inch thick. The surface layer is dark brown stony loam about 5 inches thick. The next layer is dark brown very stony sandy loam about 7 inches thick. The substratum is dark brown extremely stony sandy loam about 6 inches thick. Basalt is at a depth of 18 inches.

Permeability of the Yellowstone soil is moderately rapid. Available water capacity is about 1 inch to 2 inches. Depth to hard bedrock and effective rooting depth are 10 to 20 inches. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation (fig. 8).

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 135 for the Henline soil, the potential production per acre is 7,320 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 69,840 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a site index of 80 for the Yellowstone soil, the potential production per acre is 3,920 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 22,990 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully

Figure 8.—Black-tailed deer in an area of Henline-Yellowstone-Rock outcrop complex, 25 to 50 percent slopes.

stocked stand of trees 110 years old. Douglas-fir, western hemlock, mountain hemlock, western white pine, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and the areas of Rock outcrop.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface and areas of Rock outcrop can interfere with felling, yarding, and other operations involving the use of equipment. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the limited depth to bedrock in this unit, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Undesirable plants may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on the Henline and Yellowstone soils include Douglas-fir, western hemlock, mountain hemlock, and noble fir.

The understory vegetation commonly growing on the Henline and Yellowstone soils includes common beargrass, tall blue huckleberry, cascade Oregon-grape, Pacific rhododendron, and western swordfern.

This map unit is in capability subclass VIIs.

45H—Henline-Yellowstone-Rock outcrop complex, 50 to 90 percent slopes. This map unit is on ridgetops and side slopes of uplands. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 5,000 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 70 to 110 days.

This unit is about 35 percent Henline very stony sandy loam, 30 percent Yellowstone stony loam, and 20 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bensley, Hummington, Keel, and Valsetz soils. Also included are Henline and Yellowstone soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

The Henline soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface layer is very dark grayish brown very stony sandy loam about 5 inches thick. The next layer is very dark grayish brown and dark brown very cobbly sandy loam about 14 inches thick. The substratum is dark yellowish brown very cobbly sandy loam about 9 inches thick. Fractured basalt is at a depth of 28 inches.

Permeability of the Henline soil is moderately rapid. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Yellowstone soil is shallow and somewhat excessively drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, needles, and moss about 1 inch thick. The surface layer is dark brown stony loam about 5 inches thick. The next layer is dark brown very stony sandy loam about 7 inches thick. The substratum is dark brown extremely stony sandy loam about 6 inches thick. Basalt is at a depth of 18 inches.

Permeability of the Yellowstone soil is moderately rapid. Available water capacity is about 1 inch to 2 inches. Depth to hard bedrock and effective rooting depth are 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 135 for the Henline soil, the potential production per acre is 7,320 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 69,840 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a site index of 80 for the Yellowstone soil, the potential production per acre is 3,920 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 22,990 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 110 years old. Douglas-fir, western hemlock, mountain hemlock, western white pine, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and the areas of Rock outcrop.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface and areas of Rock outcrop can interfere with felling, yarding, and other operations involving the use of equipment on this unit. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the limited depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Undesirable plants may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on the Henline and Yellowstone soils include Douglas-fir, western hemlock, mountain hemlock, and noble fir.

The understory vegetation commonly growing on the Henline and Yellowstone soils includes common beargrass, tall blue huckleberry, cascade Oregon-grape, Pacific rhododendron, and western swordfern.

This map unit is in capability subclass VIIs.

46—Holcomb silt loam. This deep, somewhat poorly drained soil is in slightly convex areas on broad valley terraces of the Willamette Valley. It formed in silty and clayey alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, and grasses. Elevation is 200 to 400 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick over very dark grayish brown, mottled silty clay loam about 14 inches thick. The subsurface layer is dark grayish brown, mottled silty clay loam about 6 inches thick. The subsoil is grayish brown, mottled clay and silty clay 20 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown silty clay loam.

Included in this unit are small areas of Amity, Concord, Dayton, Willamette, and Woodburn soils. Also included are small areas of Holcomb soils that have a gravelly substratum and are at an elevation of more than 305 feet. Included areas make up about 15 percent of the total acreage.

Permeability of this Holcomb soil is very slow. Available water capacity is about 6 to 9 inches. Effective rooting depth is 60 inches or more; however, penetration of roots is restricted by dense clay and a seasonal high water table. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 1.0 foot to 1.5 feet from November to May.

This unit is used mainly for hay, pasture, small grain, and grass seed. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitation is wetness. Most climatically adapted crops can be grown if artificial drainage is provided. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. Drainage is difficult and expensive because the dense clay requires close spacing of the tile drains.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Because of the very slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. To minimize damage to crops and compaction of the soil, vehicles that have large, low-pressure tires should be used to apply fertilizer early in spring. Grasses and small grain respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, very slow permeability, shrink-swell, and low soil strength.

This unit is not suited to septic tank absorption fields because of wetness and very slow permeability, which adversely affect the treatment and absorption processes.

If buildings are constructed on the soil in this unit, using properly designed foundations and footings and diverting runoff away from the buildings help to prevent structural damage as a result of shrinking and swelling. Roads should be designed to offset the limited ability of the soil in this unit to support a load.

This map unit is in capability subclass IIIw.

47C—Honeygrove silty clay loam, 3 to 12 percent slopes. This deep, well drained soil is on the broad, rolling bench tops of uplands. It formed in residuum and colluvium derived dominantly from sedimentary, basic igneous, or tuffaceous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of needles, leaves, and moss about 1 inch thick. The surface layer is dark reddish brown silty clay loam about 13 inches thick. The subsoil is dark reddish brown silty clay about 42 inches thick. The substratum to a depth of 75 inches is strong brown silty clay. In some areas of similar included soils, the surface layer is cobbly silty clay loam.

Included in this unit are small areas of Apt, Cumley, McDuff, and Peavine soils and Honeygrove soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Honeygrove soil is moderately slow. Available water capacity is about 8 to 10 inches. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for hay, pasture, limited small grain and orchards, Christmas trees, and timber production. It is also used for homesite development, wildlife habitat, and recreation.

This unit provides forage for livestock. If it is used for hay and pasture, the main limitation is the clayey texture of the soil.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Fertilizer is needed to ensure optimum growth of grasses and legumes. Pasture grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.

This unit is suited to most climatically adapted crops. It is limited mainly by the clayey texture of the surface layer.

In summer, irrigation is needed for maximum production of most crops. Water for irrigation is often not available; when available, however, it is stored in reservoirs. Suitable sites for reservoirs are limited. Only a few areas are irrigated by sprinklers.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. All tillage should be on the contour or across the slope.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 165, the potential production per acre is 10,560 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 99,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year curve, the mean site index is 135. Douglas-fir, western hemlock, and grand fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes creambush oceanspray, western hazel, vine maple, cascade Oregon-grape, trailing blackberry, and salal.

If this unit is used for homesite development, the main limitations are moderately slow permeability, low soil strength, and shrink-swell potential.

Septic tank absorption fields may function poorly in winter. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass VIe.

47D—Honeygrove silty clay loam, 12 to 25 percent slopes. This deep, well drained soil is on the broad, rolling bench tops and side slopes of uplands. It formed in colluvium derived dominantly from sedimentary, basic igneous, or tuffaceous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of needles, leaves, and moss about 1 inch thick. The surface layer is dark reddish brown silty clay loam about 13 inches thick. The subsoil is dark reddish brown silty clay about 42 inches thick. The substratum to a depth of 75 inches is strong brown silty clay. In some areas of similar included soils, the surface layer is cobbly silty clay loam.

Included in this unit are small areas of Apt, Cumley, McDuff, and Peavine soils and Honeygrove soils that have slopes of less than 12 percent or more than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Honeygrove soil is moderately slow. Available water capacity is about 8 to 10 inches. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate to high.

This unit is used mainly for timber production. It is also used for limited homesite development, wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 165, the potential production per acre is 10,560 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 99,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year curve, the mean site index is 135. Douglas-fir, western hemlock, and grand fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes creambush oceanspray, western hazel, vine maple, cascade Oregon-grape, trailing blackberry, and salal.

If this unit is used for homesite development, the main limitations are moderately slow permeability, slope, and low soil strength.

Septic tank absorption fields may function poorly in winter. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Cutbanks may not be stable and can be subject to slumping when saturated because of the very plastic subsoil.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass VIe.

48F—Honeygrove silty clay loam, 25 to 50 percent north slopes. This deep, well drained soil is on north-facing slopes of uplands. It formed in colluvium derived dominantly from sedimentary, basic igneous, and tuffaceous bedrock. The vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of needles, leaves, and moss about 1 inch thick. The surface layer is dark reddish brown silty clay loam about 13 inches thick. The subsoil is dark reddish brown silty clay about 42 inches thick. The substratum to a depth of 75 inches is strong brown silty clay. In some areas of similar included soils, the surface layer is cobbly silty clay loam.

Included in this unit are small areas of Apt, Cumley, McDuff, and Peavine soils and Honeygrove soils that have slopes of less than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Honeygrove soil is moderately slow. Available water capacity is about 8 to 10 inches. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 165, the potential production per acre is 10,560 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 99,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year curve, the mean site index is 135. Douglas-fir, western hemlock, and grand fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, management that minimizes erosion is essential. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs are less damaging to the soil and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The soil in this unit is subject to landsliding and slumping when saturated and disturbed by constructing roads or harvesting timber.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement. Because plant competition is greater in areas on north- and east-facing slopes, it may be necessary to plant larger trees in these areas.

Trees suitable for planting include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes creambush oceanspray, western hazel, vine maple, cascade Oregon-grape, trailing blackberry, and salal.

This map unit is in capability subclass VIe.

49F—Honeygrove silty clay loam, 25 to 50 percent south slopes. This deep, well drained soil is on south-facing slopes of uplands. It formed in colluvium derived dominantly from sedimentary, basic igneous, and tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of needles, leaves, and moss about 1 inch thick. The surface layer is dark reddish brown silty clay loam about 13 inches thick. The subsoil is dark reddish brown silty clay about 42 inches thick. The substratum to a depth of 75 inches is strong brown silty clay. In some areas of similar included soils, the surface layer is cobbly silty clay loam.

Included in this unit are small areas of Apt, Cumley, McDuff, and Peavine soils and Honeygrove soils that have slopes of less than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Honeygrove soil is moderately slow. Available water capacity is about 8 to 10 inches. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 155, the potential production per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040- board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year curve, the mean site index is 130. Douglas-fir, western hemlock, and grand fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

When harvesting timber on this unit, management that minimizes erosion is essential. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs are less damaging to the soil and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The soil in this unit is subject to landsliding and slumping when saturated and disturbed by constructing roads or harvesting timber.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes creambush oceanspray, western hazel, vine maple, cascade Oregon-grape, trailing blackberry, and salal.

This map unit is in capability subclass VIe.

50D—Hummington very gravelly loam, 5 to 25 percent slopes. This moderately deep, well drained soil is on narrow to broad ridgetops and on deeply dissected side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,000 to 4,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 42 to 44 degrees F, and the average frost-free period is 70 to 100 days.

Typically, the surface is covered with a mat of moss, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown very gravelly loam about 8 inches thick. The next layer is dark brown very cobbly loam about 12 inches thick. The upper 4 inches of the subsoil is dark yellowish brown very cobbly loam, and the lower 12 inches is dark yellowish brown extremely cobbly loam. Basalt is at a depth of 36 inches.

Included in this unit are small areas of Cruiser, Keel, and Yellowstone soils and Hummington soils that have slopes of more than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Hummington soil is moderately rapid. Available water capacity is about 7 to 11 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 145, the potential production per acre is 8,280 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 72,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. Douglas-fir, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, use of management that minimizes erosion is essential. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Because roots are restricted by shallow depth to bedrock, windthrow is a hazard when the soil is wet and the winds are strong.

After harvesting, reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing vegetation can be controlled by spraying, cutting, girdling, or scarifying to eliminate unwanted weeds, brush, or trees.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, noble fir, and Pacific silver fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, red huckleberry, tall blue huckleberry, and Pacific rhododendron.

This map unit is in capability subclass VIs.

50F—Hummington very gravelly loam, 25 to 50 percent slopes. This moderately deep, well drained soil is on deeply dissected side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,000 to 4,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 42 to 44 degrees F, and the average frost-free period is 70 to 100 days.

Typically, the surface is covered with a mat of moss, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown very gravelly loam about 8 inches thick. The next layer is dark brown very cobbly loam about 12 inches thick. The upper 4 inches of the subsoil is dark yellowish brown very cobbly loam, and the lower 12 inches is dark yellowish brown extremely cobbly loam. Basalt is at a depth of 36 inches.

Included in this unit are small areas of Cruiser, Keel, and Yellowstone soils and Hummington soils that have slopes of more than 50 percent or less than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Hummington soil is moderately rapid. Available water capacity is about 7 to 11 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 145, the potential production per acre is 8,280 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 72,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. Douglas-fir, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, use of management that minimizes erosion is essential. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation.

Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of surface material. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Windthrow is a hazard when the soil is wet and the winds are strong. Because roots are restricted by shallow depth to bedrock, trees are subject to windthrow.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing vegetation can be controlled by spraying, cutting, girdling, or scarifying to eliminate unwanted weeds, brush, or trees. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, noble fir, and Pacific silver fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, red huckleberry, tall blue huckleberry, and Pacific rhododendron.

This map unit is in capability subclass VIs.

50G—Hummington very gravelly loam, 50 to 75 percent slopes. This moderately deep, well drained soil is on deeply dissected side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,000 to 4,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 42 to 44 degrees F, and the average frost-free period is 70 to 100 days.

Typically, the surface is covered with a mat of moss, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown very gravelly loam about 8 inches thick. The next layer is dark brown very cobbly loam about 12 inches thick. The upper 4 inches of the subsoil is dark yellowish brown very cobbly loam, and the lower 12 inches is dark yellowish brown extremely cobbly loam. Basalt is at a depth of 36 inches.

Included in this unit are small areas of Cruiser, Keel, and Yellowstone soils and Hummington soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Hummington soil is moderately rapid. Available water capacity is about 7 to 11 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat and water supply.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 145, the potential production per acre is 8,280 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 72,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. Douglas-fir, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, use of management that minimizes erosion is essential. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation.

Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Windthrow is a hazard when the soil is wet and the winds are strong. Because roots are restricted by shallow depth to bedrock, trees are subject to windthrow.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing vegetation can be controlled by spraying, cutting, girdling, or scarifying to eliminate unwanted weeds, brush, or trees. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, noble fir, and Pacific silver fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, red huckleberry, tall blue huckleberry, and Pacific rhododendron.

This map unit is in capability subclass VIIs.

51C—Jory silty clay loam, 2 to 12 percent slopes. This deep, well drained soil is on low, rolling foothills. It formed in colluvium derived dominantly from basic igneous or tuffaceous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark redish brown silty clay loam about 6 inches thick. The upper 40 inches of the subsoil is dark reddish brown and reddish brown clay, and the lower 14 inches is yellowish red silty clay. In some areas of similar included soils, around the foothills near Stayton and Kingston, the surface layer is silt loam.

Included in this unit are small areas of Bellpine, Nekia, and Ritner soils and Jory soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Jory soil is moderately slow. Available water capacity is about 9 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for timber production, hay and pasture, grass seed, small grain, and orchards. It is also used for homesite development, Christmas trees, wildlife habitat, and recreation (fig 9).

Figure 9.—Area of Jory silty clay loam, 2 to 12 percent slopes, used for homesite development.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 155, the potential production per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 115. Douglas-fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concern in producing and harvesting timber is plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes western hazel, cascade Oregon-grape, rose, trailing blackberry, common snowberry, and Pacific poison-oak.

This unit is suited to most climatically adapted crops. It is limited mainly by the clayey surface layer.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

In summer, irrigation is needed for maximum production of most crops. Water for irrigation is often not available; when available, however, it is stored in reservoirs. Sprinkler irrigation can be used, but water needs to be applied slowly to minimize runoff.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are moderately slow permeability, low soil strength, and shrink-swell potential.

Septic tank absorption fields may function poorly in winter. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling. Cutbanks are subject to slumping when the soil is saturated.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIe.

51D—Jory silty clay loam, 12 to 20 percent slopes. This deep, well drained soil is on low, rolling foothills. It formed in colluvium derived dominantly from basic igneous or tuffaceous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark reddish brown silty clay loam about 6 inches thick. The upper 40 inches of the subsoil is dark reddish brown and reddish brown clay, and the lower 14 inches is yellowish red silty clay. In some areas of similar included soils, around the foothills near Stayton and Kingston, the surface layer is silt loam.

Included in this unit are small areas of Bellpine, Nekia, and Ritner soils and Jory soils that have slopes of less than 12 percent or more than 20 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Jory soil is moderately slow. Available water capacity is about 9 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is moderate to high.

This unit is used mainly for timber production, hay and pasture, grass seed, small grain, and orchards. It is also used for homesite development, Christmas trees, wildlife habitat, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 155, the potential production per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 115. Douglas-fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer may increase seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes western hazel, cascade Oregon-grape, rose, trailing blackberry, common snowberry, and Pacific poison-oak.

This unit is suited to most climatically adapted crops. It is limited mainly by the clayey texture of the surface layer and slope in some areas.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Because of the susceptibility of the soil to compaction, grazing should be restricted when the water table is high and immediately after irrigation. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

All tillage should be on the contour or across the slope. Constructing terraces reduces runoff and the risk of erosion and conserves moisture.

In summer, irrigation is needed for maximum production of most crops. Water for irrigation is often not available; when available, however, it is stored in reservoirs. Sprinkler irrigation can be used, but water needs to be applied slowly to minimize runoff.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are moderately slow permeability, slope, low soil strength, and shrink-swell potential.

If this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields.

Slope limits use of the steeper areas of this unit for building site development. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Additional spacing between septic tank absorption lines may be required because of the steepness of slope. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling. Cutbanks are subject to slumping when the soil is saturated.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIIe.

51E—Jory silty clay loam, 20 to 30 percent slopes. This deep, well drained soil is on low, rolling foothills. It formed in colluvium derived dominantly from basic igneous or tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark reddish brown silty clay loam about 6 inches thick. The upper 40 inches of the subsoil is dark reddish brown and reddish brown clay, and the lower 14 inches is yellowish red silty clay. In some areas of similar included soils, around the foothills near Stayton and Kingston, the surface layer is silt loam.

Included in this unit are small areas of Bellpine, Nekia, and Ritner soils and Jory soils that have slopes of less than 20 percent or more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Jory soil is moderately slow. Available water capacity is about 9 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is high.

This unit is used mainly for timber production and limited pasture. It is also used for homesite development, wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 155, the potential production

per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 115. Douglas-fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees. These activities are more difficult to perform in the more steeply sloping areas.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes western hazel, cascade Oregon-grape, rose, trailing blackberry, common snowberry, and Pacific poison-oak.

The steepness of slope makes this unit unsuitable for cultivation. The unit is suited only to limited tillage for pasture management. If the unit is used for hay and pasture, a permanent plant cover is needed to prevent excessive runoff and erosion in winter. A proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for homesite development, the main limitations are moderately slow permeability, slope, low soil strength, and shrink-swell potential.

If this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields.

Slope limits use of the steeper areas of this unit for building site development. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Additional spacing between septic tank absorption lines may be required because of the steepness of slope. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before construction is begun. Roads need to be provided with large amounts of base rock to prevent settling. Cutbanks are subject to slumping when the soil is saturated.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IVe.

51F—Jory silty clay loam, 30 to 50 percent slopes. This deep, well drained soil is on low, rolling foothills. It formed in colluvium derived dominantly from basic igneous or tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark reddish brown silty clay loam about 6 inches thick. The upper 40 inches of the subsoil is dark reddish brown and reddish brown clay, and the lower 14 inches is yellowish red silty clay. In some areas of similar included soils, around the foothills near Stayton and Kingston, the surface layer is silt loam.

Included in this unit are small areas of Bellpine, Nekia, and Ritner soils and Jory soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Jory soil is moderately slow. Available water capacity is about 9 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 155, the potential production per acre is 9,840 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 91,040 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year curve, the mean site index is 115. Douglas-fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, management that minimizes erosion is essential. Erosion is minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Soil compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes western hazel, cascade Oregon-grape, rose, trailing blackberry, common snowberry, and Pacific poison-oak.

This map unit is in capability subclass VIe.

52D—Keel gravelly silt loam, 2 to 25 percent slopes. This moderately deep, well drained soil is on broad ridgetops and side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock and volcanic ash. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface layer is very dark brown gravelly silt loam about 5 inches thick. The next layer is very dark grayish brown and dark brown silt loam about 10 inches thick. The upper 4 inches of the subsoil is brown clay loam, and the lower 5 inches is brown cobbly loam. Soft breccia and andesite are at a depth of 24 inches.

Included in this unit are small areas of Bensley, Crabtree, Cruiser, Henline, and Hummington soils and Keel soils that have slopes of more than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Keel soil is moderate. Available water capacity is about 5 to 8 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 130, the potential production per acre is 6,900 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 63,900 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. Douglas-fir, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations and the hazard of windthrow.

Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. The snowpack limits the use of equipment and restricts access.

Because roots are restricted by the moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, noble fir, and Pacific silver fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, Pacific rhododendron, red huckleberry, and vine maple.

This map unit is in capability subclass VIe.

52F—Keel gravelly silt loam, 25 to 45 percent slopes. This moderately deep, well drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock and volcanic ash. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface layer is very dark brown gravelly silt loam about 5 inches thick. The next layer is very dark grayish brown and dark brown silt loam about 10 inches thick. The upper 4 inches of the subsoil is brown clay loam, and the lower 5 inches is brown cobbly loam. Soft breccia and andesite are at a depth of 24 inches.

Included in this unit are small areas of Bensley, Crabtree, Cruiser, Henline, and Hummington soils and Keel soils that have slopes of less than 25 percent or more than 45 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Keel soil is moderate. Available water capacity is about 5 to 8 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 130, the potential production per acre is 6,900 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 63,900 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. Douglas-fir, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. The snowpack limits the use of equipment and restricts access.

Because roots are restricted by the moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, noble fir, and Pacific silver fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, Pacific rhododendron, red huckleberry, and vine maple.

This map unit is in capability subclass VIe.

52G—Keel gravelly silt loam, 45 to 75 percent slopes. This moderately deep, well drained soil is on the side slopes of uplands (fig. 10). It formed in colluvium derived dominantly from basic igneous rock and volcanic ash. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,700 feet. The average annual precipitation is 70 to 100 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface layer is very dark brown gravelly silt loam about 5 inches thick. The next layer is very dark grayish brown and dark brown silt loam about 10 inches thick. The upper 4 inches of the subsoil is brown clay loam, and the lower 5 inches is brown cobbly loam. Soft breccia and andesite are at a depth of 24 inches.

Included in this unit are small areas of Bensley, Crabtree, Cruiser, Henline, and Hummington soils and Keel soils that have slopes of less than 45 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Keel soil is moderate. Available water capacity is about 5 to 8 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 130, the potential production per acre is 6,900 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 63,900 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. Douglas-fir, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and the hazard of windthrow.

Figure 10.—Area of Keel gravelly silt loam, 45 to 75 percent slopes. Indian Prairie Lake, in foreground, provides an important water supply and habitat for wildlife.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. The snowpack limits the use of equipment and restricts access. Road location and maintenance costs are greater in the more steeply sloping areas.

Because roots are restricted by the moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, noble fir, and Pacific silver fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, common beargrass, Pacific rhododendron, red huckleberry, and vine maple.

This map unit is in capability subclass VIIe.

53G—Kilchis-Harrington complex, 30 to 60 percent slopes. This map unit is on the side slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Kilchis stony loam and 40 percent Harrington gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Klickitat soils, Orthents, and Rock outcrop. Also included are Kilchis and Harrington soils that have slopes of more than 60 percent. Included areas make up about 15 percent of the total acreage.

The Kilchis soil is shallow and is well drained to excessively drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, moss, and twigs about 2 inches thick. The surface layer is dark brown stony loam about 4 inches thick. The subsoil is dark brown very cobbly loam about 8 inches thick. Basalt is at a depth of 12 inches.

Permeability of the Kilchis soil is moderately rapid. Available water capacity is 1 inch to 2 inches. Depth to hard bedrock and effective rooting depth are 12 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

The Harrington soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 4 inches thick. The upper 19 inches of the subsoil is dark reddish brown very gravelly clay loam, and the lower 11 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 34 inches.

Permeability of the Harrington soil is moderately rapid. Available water capacity is about 2 to 5 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 120 for the Kilchis soil, the potential production per acre is 6,900 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 63,900 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 100. On the basis of a site index of 140 for the Harrington soil, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, grand fir, red alder, and western hemlock commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment on the Kilchis soil. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by shallow depth to bedrock in the Kilchis soil and moderate depth to bedrock in the Harrington soil, trees are subject to windthrow. Trees commonly are subject to windthrow during periods when the soil is excessively wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Landsliding or slumping may occur when the soils become saturated and are disturbed by constructing roads or harvesting timber.

Trees suitable for planting on the Kilchis soil include Douglas-fir. Trees suitable for planting on the Harrington soil include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes red alder, red huckleberry, salal, vine maple, and western swordfern.

This map unit is in capability subclass VIs.

53H—Kilchis-Harrington complex, 60 to 90 percent slopes. This map unit is on the side slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Kilchis stony loam and 40 percent Harrington gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Klickitat soils, Orthents, and Rock outcrop. Also included are Kilchis and Harrington soils that have slopes of less than 60 percent. Included areas make up about 15 percent of the total acreage.

The Kilchis soil is shallow and is well drained to excessively drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, moss, and twigs about 2 inches thick. The surface layer is dark brown stony loam about 4 inches thick. The subsoil is dark brown very cobbly loam about 8 inches thick. Basalt is at a depth of 12 inches.

Permeability of the Kilchis soil is moderately rapid. Available water capacity is 1 inch to 2 inches. Depth to hard bedrock and effective rooting depth are 12 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

The Harrington soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 4 inches thick. The upper 19 inches of the subsoil is dark reddish brown very gravelly clay loam, and the lower 11 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 34 inches.

Permeability of the Harrington soil is moderately rapid. Available water capacity is about 2 to 5 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 120 for the Kilchis soil, the potential production per acre is 6,900 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 63,900 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 100. On the basis of a site index of 140 for the Harrington soil, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, grand fir, red alder, and western hemlock commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment on the Kilchis soil. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by shallow depth to bedrock in the Kilchis soil and moderate depth to bedrock in the Harrington soil, trees are subject to windthrow. Trees commonly are subject to windthrow during periods when the soil is excessively wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Landsliding or slumping may occur when the soils become saturated and are disturbed by constructing roads or harvesting timber.

Trees suitable for planting on the Kilchis soil include Douglas-fir. Trees suitable for planting on the Harrington soil include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes red alder, red huckleberry, salal, vine maple, and western swordfern.

This map unit is in capability subclass VIIs.

54D—Kinney cobbly loam, 3 to 20 percent slopes. This deep, well drained soil is on broad bench tops, ridgetops, and side slopes of uplands. It formed in volcanic ash mixed with till or with colluvium derived dominantly from tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of leaves, stems, and twigs about 2 inches thick. The surface layer is dark brown cobbly loam about 15 inches thick. The subsoil is dark yellowish brown cobbly clay loam about 20 inches thick. The substratum is dark yellowish brown very cobbly loam about 20 inches thick. Weathered rhyolite is at a depth of 55 inches. In some areas of similar included soils, depth to bedrock is 60 inches or more.

Included in this unit are small areas of Acanod, Blachly, Harrington, Honeygrove, Klickitat, and Quartzville soils and Kinney soils that have slopes of more than 20 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Kinney soil is moderate. Available water capacity is about 8 to 12 inches. Depth to soft bedrock and effective rooting depth are 40 to 60 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 180, the potential production per acre is 11,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 110,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 130. Douglas-fir, western hemlock, grand fir, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations, seedling mortality, and plant competition.

Cobbles on the surface may interfere with felling, yarding, and other operations involving the use of equipment on this unit. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir, grand fir, and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, red huckleberry, salal, vine maple, and western swordfern.

This map unit is in capability subclass VIe.

55F—Kinney cobbly loam, 20 to 50 percent north slopes. This deep, well drained soil is on north-facing slopes of uplands. It formed in volcanic ash mixed with till or with colluvium derived dominantly from tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of leaves, stems, and twigs about 2 inches thick. The surface layer is dark brown cobbly loam about 15 inches thick. The subsoil is dark yellowish brown cobbly clay loam about 20 inches thick. The substratum is dark yellowish brown very cobbly loam about 20 inches thick. Weathered bedrock is at a depth of 55 inches. In some areas of similar included soils, depth to bedrock is 60 inches or more.

Included in this unit are small areas of Acanod, Blachly, Harrington, Honeygrove, Klickitat, and Quartzville soils and Kinney soils that have slopes of less than 20 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Kinney soil is moderate. Available water capacity is about 8 to 12 inches. Depth to soft bedrock and effective rooting depth are 40 to 60 inches. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 180, the potential production per acre is 11,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 110,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 130. Douglas-fir, western hemlock, grand fir, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Cobbles on the surface may interfere with felling, yarding, and other operations involving the use of equipment on this unit. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement. Because plant competition is greater in areas on north- and east-facing slopes, it may be necessary to plant larger trees in these areas.

Trees suitable for planting on this unit include Douglas-fir, grand fir, and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, red huckleberry, salal, vine maple, and western swordfern.

This map unit is in capability subclass VIe.

55G—Kinney cobbly loam, 50 to 70 percent north slopes. This deep, well drained soil is on north-facing slopes of uplands. It formed in volcanic ash mixed with till or with colluvium derived dominantly from tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of leaves, stems, and twigs about 2 inches thick. The surface layer is dark brown cobbly loam about 15 inches thick. The subsoil is dark yellowish brown cobbly clay loam about 20 inches thick. Weathered rhyolite is at a depth of 55 inches. In some areas of similar included soils, depth to bedrock is 60 inches or more.

Included in this unit are small areas of Acanod, Blachly, Harrington, Honeygrove, Klickitat, and Quartzville soils and Kinney soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Kinney soil is moderate. Available water capacity is about 8 to 12 inches. Depth to soft bedrock and effective rooting depth are 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 180, the potential production per acre is 11,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 110,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 130. Douglas-fir, western hemlock, grand fir, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Landsliding or slumping may occur when the soil becomes saturated and is disturbed by constructing roads or harvesting timber.

Cobbles on the surface may interfere with felling, yarding, and other operations involving the use of equipment on this unit. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

Reforestation must be carefully managed to reduce competition from undesirable plants, which prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement. Because plant competition is greater in areas on north- and east-facing slopes, it may be necessary to plant larger trees in these areas.

Trees suitable for planting on this unit include Douglas-fir, grand fir, and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, red huckleberry, salal, vine maple, and western swordfern.

This map unit is in capability subclass VIIe.

56F—Kinney cobbly loam, 20 to 50 percent south slopes. This deep, well drained soil is on south-facing slopes of uplands. It formed in volcanic ash mixed with till or with colluvium derived dominantly from tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of leaves, stems, and twigs about 2 inches thick. The surface layer is dark brown cobbly loam about 15 inches thick. The subsoil is dark yellowish brown cobbly clay loam about 20 inches thick. The substratum is dark yellowish brown very cobbly loam about 20 inches thick. Weathered rhyolite is at a depth of 55 inches. In some areas of similar included soils, depth to bedrock is 60 inches or more.

Included in this unit are small areas of Acanod, Blachly, Harrington, Honeygrove, Klickitat, and Quartzville soils and Kinney soils that have slopes of less than 20 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Kinney soil is moderate. Available water capacity is about 8 to 12 inches. Depth to soft bedrock and effective rooting depth are 40 to 60 inches. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 180, the potential production per acre is 11,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 110,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 130. Douglas-fir, western hemlock, grand fir, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding.

Figure 11.—Slumping in an area of Kinney cobbly loam, 50 to 70 percent south slopes.

Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Cobbles on the surface may interfere with felling, yarding, and other operations involving the use of equipment on this unit. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, grand fir, and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, red huckleberry, salal, vine maple, and western swordfern.

This map unit is in capability subclass VIe.

56G—Kinney cobbly loam, 50 to 70 percent south slopes. This deep, well drained soil is on south-facing slopes of uplands. It formed in volcanic ash mixed with till or with colluvium derived dominantly from tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of leaves, stems, and twigs about 2 inches thick. The surface layer is dark brown cobbly loam about 15 inches thick. The subsoil is dark yellowish brown cobbly clay loam about 20 inches thick. The substratum is dark yellowish brown very cobbly loam about 20 inches thick. Weathered rhyolite is at a depth of 55 inches. In some areas of similar included soils, depth to bedrock is 60 inches or more.

Included in this unit are small areas of Acanod, Blachly, Harrington, Honeygrove, Klickitat, and Quartzville soils and Kinney soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Kinney soil is moderate. Available water capacity is about 8 to 12 inches. Depth to soft bedrock and effective rooting depth are 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 180, the potential production per acre is 11,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 110,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 130. Douglas-fir, western hemlock, grand fir, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Landsliding or slumping may occur when the soil becomes saturated and is disturbed by constructing roads or harvesting timber (fig. 11).

Cobbles on the surface may interfere with felling, yarding, and other operations involving the use of equipment on this unit. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Reforestation must be carefully managed to reduce competition from undesirable plants, which prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, grand fir, and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, red huckleberry, salal, vine maple, and western swordfern.

This map unit is in capability subclass VIIe.

57E—Kinney cobbly loam, slump, 3 to 30 percent slopes. This deep, well drained soil is in old, stabilized slump areas on uplands. It formed in volcanic ash mixed with till or with colluvium derived dominantly from tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,000 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of leaves, stems, and twigs about 2 inches thick. The surface layer is dark brown cobbly loam about 15 inches thick. The subsoil is dark yellowish brown cobbly clay loam about 20 inches thick. The substratum is dark yellowish brown very cobbly loam about 20 inches thick. Weathered rhyolite is at a depth of 55 inches. In some areas of similar included soils, depth to bedrock is 60 inches or more.

Included in this unit are small areas of Acanod, Blachly, Harrington, Honeygrove, Klickitat, and Quartzville soils and Kinney soils that have not slumped. Also included are small seeps and poorly drained areas. Included areas make up about 15 percent of the total acreage.

Permeability of this Kinney soil is moderate. Available water capacity is about 8 to 12 inches. Depth to soft bedrock and effective rooting depth are 40 to 60 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 180, the potential production per acre is 11,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 110,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 130. Douglas-fir, western hemlock, grand fir, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations and plant competition.

Cobbles on the surface may interfere with felling, yarding, and other operations involving the use of equipment on this unit. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is moist. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir, grand fir, and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, red huckleberry, salal, vine maple, and western swordfern.

This map unit is in capability subclass VIe.

58F—Kinney-Klickitat complex, 20 to 50 percent north slopes. This map unit is on north-facing slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 140 to 200 days.

This unit is about 45 percent Kinney cobbly loam and 40 percent Klickitat stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Acanod, Blachly, Harrington, Honeygrove, and Quartzville soils. Also included are Kinney and Klickitat soils that have slopes of less than 20 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Kinney soil is deep and well drained. It formed in volcanic ash mixed with till or colluvium derived dominantly from tuffaceous rock. Typically, the surface is covered with a mat of leaves, stems, and twigs about 2 inches thick. The surface layer is dark brown cobbly loam about 15 inches thick. The subsoil is dark yellowish brown cobbly clay loam about 20 inches thick. The substratum is dark yellowish brown very cobbly loam about 20 inches thick. Weathered rhyolite is at a depth of 55 inches. In some areas of similar included soils, depth to bedrock is 60 inches or more.

Permeability of the Kinney soil is moderate. Available water capacity is about 8 to 12 inches. Depth to soft bedrock and effective rooting depth are 40 to 60 inches. Runoff is medium to rapid, and the hazard of erosion is high.

The Klickitat soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown stony loam about 9 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. The substratum to a depth of 56 inches is reddish brown very cobbly loam. Basalt is at a depth of 56 inches.

Permeability of the Klickitat soil is moderate. Available water capacity is about 3 to 5 inches. Depth to hard bedrock and effective rooting depth are 40 to 60 inches. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 180 for the Kinney soil, the potential production per acre is 11,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 110,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 130. On the basis of a site index of 160 for the Klickitat soil, the potential production per acre is 10,200 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 95,200 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 125. Douglas-fir, western hemlock, grand fir, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones and cobbles on the surface interfere with felling, yarding, and other operations involving the use of equipment on this unit. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

Landsliding or slumping may occur when the soils become saturated and are disturbed by constructing roads or harvesting timber.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement. Because plant competition is greater in areas on north- and east-facing slopes, it may be necessary to plant larger trees in these areas.

Trees suitable for planting on the Kinney soil include Douglas-fir, grand fir, and western hemlock. Trees suitable for planting on the Klickitat soil include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, creambush oceanspray, red huckleberry, salal, thimbleberry, vine maple, western brackenfern, and western swordfern.

This map unit is in capability subclass VIe.

58G—Kinney-Klickitat complex, 50 to 70 percent north slopes. This map unit is on north-facing slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 140 to 200 days.

This unit is about 45 percent Kinney cobbly loam and 40 percent Klickitat stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Acanod, Blachly, Harrington, Honeygrove, and Quartzville soils. Also included are Kinney and Klickitat soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

The Kinney soil is deep and well drained. It formed in volcanic ash mixed with till or colluvium derived dominantly from tuffaceous rock. Typically, the surface is covered with a mat of leaves, stems, and twigs about 2 inches thick. The surface layer is dark brown cobbly loam about 15 inches thick. The subsoil is dark yellowish brown cobbly clay loam about 20 inches thick. The substratum is dark yellowish brown very cobbly loam about 20 inches thick. Weathered bedrock is at a depth of 55 inches. In some areas of similar included soils, bedrock is at a depth of 60 inches or more.

Permeability of the Kinney soil is moderate. Available water capacity is about 8 to 12 inches. Depth to soft bedrock and effective rooting depth are 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Klickitat soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown stony loam about 9 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. The substratum to a depth of 56 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 56 inches.

Permeability of the Klickitat soil is moderate. Available water capacity is about 3 to 5 inches. Depth to hard bedrock and effective rooting depth are 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 180 for the Kinney soil, the potential production per acre is 11,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 110,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 130. On the basis of a site index of 160 for the Klickitat soil, the potential production per acre is 10,200 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 95,200 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 125. Douglas-fir, western hemlock, grand fir, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones and cobbles on the surface interfere with felling, yarding, and other operations involving the use of equipment on this unit. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

Landsliding or slumping may occur when the soils become saturated and are disturbed by constructing roads or harvesting timber.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement. Because plant competition is greater in areas on north- and east-facing slopes, it may be necessary to plant larger trees in these areas.

Trees suitable for planting on the Kinney soil include Douglas-fir, grand fir, and western hemlock. Trees suitable for planting on the Klickitat soil include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, creambush oceanspray, red huckleberry, salal, thimbleberry, vine maple, western brackenfern, and western swordfern.

This map unit is in capability subclass VIIe.

59F—Kinney-Klickitat complex, 20 to 50 percent south slopes. This map unit is on south-facing slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 140 to 200 days.

This unit is about 45 percent Kinney cobbly loam and 40 percent Klickitat stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Acanod, Blachly, Harrington, Honeygrove, and Quartzville soils. Also included are Kinney and Klickitat soils that have slopes of less than 20 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Kinney soil is deep and well drained. It formed in volcanic ash mixed with till or colluvium derived dominantly from tuffaceous rock. Typically, the surface is covered with a mat of leaves, stems, and twigs about 2 inches thick. The surface layer is dark brown cobbly loam about 15 inches thick. The subsoil is dark yellowish brown cobbly clay loam about 20 inches thick. The substratum is dark yellowish brown very cobbly loam about 20 inches thick. Weathered bedrock is at a depth of 55 inches. In some areas of similar included soils, bedrock is at a depth of 60 inches or more.

Permeability of the Kinney soil is moderate. Available water capacity is about 8 to 12 inches. Depth to soft bedrock and effective rooting depth are 40 to 60 inches. Runoff is medium to rapid, and the hazard of erosion is high.

The Klickitat soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown stony loam about 9 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. The substratum to a depth of 56 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 56 inches.

Permeability of the Klickitat soil is moderate. Available water capacity is about 3 to 5 inches. Depth to hard bedrock and effective rooting depth are 40 to 60 inches. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation (fig. 12).

This unit is suited to the production of Douglas-fir. On the basis of a site index of 180 for the Kinney soil, the potential production per acre is 11,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 110,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80

Figure 12.—Green Peter Reservoir in an area of Kinney-Klickitat complex, 20 to 50 percent south slopes. The reservoir provides a ready supply of water for domestic and recreational use.

years old. On the basis of a 50-year site curve, the mean site index is 130. On the basis of a site index of 145 for the Klickitat soil, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, western hemlock, grand fir, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones and cobbles on the surface interfere with felling, yarding, and other operations involving the use of equipment on this unit. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

Landsliding or slumping may occur when the soils become saturated and are disturbed by constructing roads or harvesting timber.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on the Kinney soil include Douglas-fir, grand fir, and western hemlock. Trees suitable for planting on the Klickitat soil include Douglas-fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, creambush oceanspray, red huckleberry, salal, thimbleberry, vine maple, western brackenfern, and western swordfern.

This map unit is in capability subclass VIe.

59G—Kinney-Klickitat complex, 50 to 70 percent south slopes. This map unit is on south-facing slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 140 to 200 days.

This unit is about 45 percent Kinney cobbly loam and 40 percent Klickitat stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Acanod, Blachly, Harrington, Honeygrove, and Quartzville soils. Also included are Kinney and Klickitat soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

The Kinney soil is deep and well drained. It formed in volcanic ash mixed with till or colluvium derived dominantly from tuffaceous rock. Typically, the surface is covered with a mat of leaves, stems, and twigs about 2 inches thick. The surface layer is dark brown cobbly loam about 15 inches thick. The subsoil is dark yellowish brown cobbly clay loam about 20 inches thick. The substratum is dark yellowish brown very cobbly loam about 20 inches thick. Weathered rhyolite is at a depth of 55 inches. In some areas of similar included soils, bedrock is at a depth of 60 inches or more.

Permeability of the Kinney soil is moderate. Available water capacity is about 8 to 12 inches. Depth to soft bedrock and effective rooting depth are 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Klickitat soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown stony loam about 9 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. The substratum to a depth of 56 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 56 inches.

Permeability of the Klickitat soil is moderate. Available water capacity is about 3 to 5 inches. Depth to hard bedrock and effective rooting depth are 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 180 for the Kinney soil, the potential production per acre is 11,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 110,880 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 130. On the basis of a site index of 145 for the Klickitat soil, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, western hemlock, grand fir, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones and cobbles on the surface interfere with felling, yarding, and other operations involving the use of equipment on this unit. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems (fig. 13). Road location and maintenance costs are greater in the more steeply sloping areas.

Landsliding or slumping may occur when the soils become saturated and are disturbed by constructing roads or harvesting timber.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on the Kinney soil include Douglas-fir, grand fir, and western hemlock. Trees suitable for planting on the Klickitat soil include Douglas-fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, creambush oceanspray, red huckleberry, salal, thimbleberry, vine maple, western brackenfern, and western swordfern.

This map unit is in capability subclass VIIe.

60E—Klickitat-Harrington complex, 3 to 30 percent slopes. This map unit is on ridgetops and side slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 50 percent Klickitat stony loam and 35 percent Harrington gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Blachly, Honeygrove, Kilchis, and Kinney soils. Also included are Klickitat and Harrington soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

The Klickitat soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown stony loam about 9 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. The substratum to a depth of 56 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 56 inches.

Permeability of the Klickitat soil is moderate. Available water capacity is about 3 to 5 inches. Depth to hard bedrock and effective rooting depth are 40 to 60 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

The Harrington soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 4 inches thick. The upper 19 inches of the subsoil is dark reddish brown very gravelly clay loam, and the lower 11 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 34 inches.

Permeability of the Harrington soil is moderately rapid. Available water capacity is about 2 to 5 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 145 for the Klickitat soil, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. On the basis of a site index of 140 for the Harrington soil, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir, grand fir, and western hemlock commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Figure 13.—Balloon logging in a mountainous area of Kinney-Klickitat complex, 50 to 70 percent south slopes.

Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding.

Stones on the surface of the Klickitat soil may interfere with felling, yarding, and other operations involving the use of equipment. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity.

The droughtiness of the surface layer and the large amount of rock fragments increase seedling mortality on this unit. To compensate for the higher mortality rate that can be expected, larger trees can be planted or more trees than normal can be planted.

Because roots are restricted by the moderate depth to bedrock in the Harrington soil, trees are subject to windthrow. Trees commonly are subject to windthrow during periods when the soil is excessively wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on the Klickitat soil include Douglas-fir, and western hemlock. Trees suitable for planting on the Harrington soil include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, creambush oceanspray, red huckleberry, salal, thimbleberry, vine maple, western brackenfern, and western hazel.

This map unit is in capability subclass VIs.

61F—Klickitat-Harrington complex, 30 to 50 percent north slopes. This map unit is on north-facing slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Klickitat stony loam and 40 percent Harrington gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Blachly, Honeygrove, Kilchis, and Kinney soils. Also included are Klickitat and Harrington soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Klickitat soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown stony loam about 9 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. The substratum to a depth of 56 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 56 inches.

Permeability of the Klickitat soil is moderate. Available water capacity is about 3 to 5 inches. Depth to hard bedrock and effective rooting depth are 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Harrington soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 4 inches thick. The upper 19 inches of the subsoil is dark reddish brown very gravelly clay loam, and the lower 11 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 34 inches.

Permeability of the Harrington soil is moderately rapid. Available water capacity is about 2 to 5 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 160 for the Klickitat soil, the potential production per acre is 10,200 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 95,200 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 125. On the basis of a site index of 140 for the Harrington soil, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, grand fir, and western hemlock commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface of the Klickitat soil may interfere with felling, yarding, and other operations involving the use of equipment. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

Landsliding or slumping may occur when the soils become saturated and are disturbed by constructing roads or harvesting timber.

The droughtiness of the surface layer of the Harrington soil and the large amount of rock fragments increase seedling mortality or this unit. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the moderate depth to bedrock in the Harrington soil, trees are subject to windthrow. Trees commonly are subject to windthrow during periods when the soil is excessively wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on the Klickitat soil include Douglas-fir and western hemlock. Trees suitable for planting on the Harrington soil include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, creambush oceanspray, red huckleberry, salal, thimbleberry, vine maple, western brackenfern, and western hazel.

This map unit is in capability subclass VIs.

62F—Klickitat-Harrington complex, 30 to 50 percent south slopes. This map unit is on south-facing slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,700 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Klickitat stony loam and 40 percent Harrington gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Blachly, Honeygrove, Kilchis, and Kinney soils. Also included are Klickitat and Harrington soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Klickitat soil is deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown stony loam about 9 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. The substratum to a depth of 56 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 56 inches.

Permeability of the Klickitat soil is moderate. Available water capacity is about 3 to 5 inches. Depth to hard bedrock and effective rooting depth are 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Harrington soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, twigs, and moss about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 4 inches thick. The upper 19 inches of the subsoil is very gravelly clay loam, and the lower 11 inches is dark reddish brown very cobbly loam. Basalt is at a depth of 34 inches.

Permeability of the Harrington soil is moderately rapid. Available water capacity is about 2 to 5 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 145 for the Klickitat soil, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. On the basis of a site index of 140 for the Harrington soil, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir and grand fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface of the Klickitat soil may interfere with felling, yarding, and other operations involving the use of equipment. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

Landsliding or slumping may occur when the soils become saturated and are disturbed by constructing roads or harvesting timber.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the moderate depth to bedrock in the Harrington soil, trees are subject to windthrow. Trees commonly are subject to windthrow during periods when the soil is excessively wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on the Klickitat soil include Douglas-fir. Trees suitable for planting on the Harrington soil include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, creambush oceanspray, red huckleberry, salal, thimbleberry, vine maple, western brackenfern, and western hazel.

This map unit is in capability subclass VIs.

63—Malabon silty clay loam. This deep, well drained soil is in nearly level to slightly convex areas on low alluvial stream terraces. It formed in silty and clayey alluvium derived from mixed sources. Slopes are 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 200 to 600 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average annual frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silty clay loam about 17 inches thick. The subsoil is dark brown and brown silty clay about 43 inches thick. In some areas of similar included soils, the subsoil has strata of silt loam or sandy loam.

Included in this unit are small areas of Coburg and Salem soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Malabon soil is moderately slow. Available water capacity is about 10 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for small grain, grass seed, orchards, hay and pasture, and vegetables. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to the production of most climatically adapted crops. It has few limitations.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, subsoiling, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

The main limitations of this unit for homesite development are the moderately slow permeability and the moderate shrink-swell potential.

Septic tank absorption fields may function poorly in winter. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability class I.

64—Malabon Variant loam. This deep, well drained soil is on stream terraces. It formed in mixed alluvium that is high in content of ash and is derived from mixed sources. Slopes are 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 600 to 1,100 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface is covered with a mat of leaves, twigs, moss, and needles about 2 inches thick. The surface layer is black loam about 14 inches thick. The subsoil is very dark grayish brown and dark brown sandy loam about 41 inches thick. The substratum to a depth of 60 inches or more is dark brown very gravelly sandy loam.

Included in this unit are small areas of Clackamas, Salem, and Sifton Variant soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Malabon Variant soil is moderately rapid to rapid to a depth of 55 inches and very rapid below this depth. Available water capacity is about 6 to 9 inches. Effective rooting depth is 40 to 60 inches; however, root penetration may be restricted by the very gravelly sandy loam substratum. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for hay and pasture and small grain. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitation is droughtiness.

All adapted pasture plants can be grown, but bunch-type species planted alone generally are not suitable because of the hazard of erosion. Using management that maintains optimum vigor and quality of forage plants is a good practice. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Sufficient water for irrigation generally can be obtained from nearby streams or wells.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are the moderately rapid to very rapid permeability and low soil strength.

Use of this unit for septic tank absorption fields is limited because of the risk of seepage and the hazard of polluting water supplies. If the density of housing is moderate to high, community sewage systems may be needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. The possibility of settlement can be minimized by compacting the building site before construction is begun.

Excavation for roads and buildings increases the risk of erosion. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIc.

65B—Marcola cobbly silty clay loam, 2 to 7 percent slopes. This deep, moderately well drained soil is on fans at the mouth of steep canyons around the margins of large valleys. It formed in alluvium and colluvium derived from mixed sedimentary and volcanic rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 400 to 1,200 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown cobbly silty clay loam about 12 inches thick. The upper 18 inches of the subsoil is dark brown and dark yellowish brown very cobbly clay, and the lower 7 inches is mottled, brown extremely cobbly clay. The substratum to a depth of 60 inches or more is variegated brown and dark grayish brown extremely cobbly clay.

Included in this unit are small areas of Dixonville, Hazelair, Panther, and Witham soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Marcola soil is slow. Available water capacity is about 7 to 10 inches. Effective rooting depth is 60 inches or more; however, root penetration may be restricted by a seasonal high water table. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 3.5 to 4.5 feet from November to May.

This unit is used mainly for hay and pasture, small grain, and limited orchards. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are wetness and slow permeability. Drainage is needed if the unit is to be used to its maximum potential. Response to drainage is good if adequate outlets are available.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

The main limitations of this unit for homesite development are slow permeability, wetness, shrink-swell potential, and coarse fragment content. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

Septic tank absorption fields can be expected to function poorly on this unit because of the slow permeability and wetness. The limitation of slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields.

If buildings and roads are constructed, the effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

Preserving the existing plant cover during construction helps to control erosion. Removal of gravel and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass IVs.

66B—McAlpin silty clay loam, 3 to 6 percent slopes. This deep, moderately well drained soil is on low alluvial stream terraces in valleys of streams tributary to the Willamette River. It formed in fine textured alluvium derived from mixed sources. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 900 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown silty clay loam about 14 inches thick. The upper 11 inches of the subsoil is dark reddish brown silty clay loam, and the lower 35 inches is reddish brown, mottled silty clay. In some small areas of similar included soils, the subsoil is gravelly below a depth of 40 inches.

Included in this unit are small areas of Abiqua and Waldo soils. Included areas make up about 15 percent of the total acreage.

Permeability of this McAlpin soil is moderately slow. Available water capacity is about 10 to 12 inches. Effective rooting depth is 60 inches; however, root penetration may be restricted by a seasonal high water table. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 2 to 3 feet from November to March.

This unit is used mainly for hay and pasture, small grain, and row crops. It is also used for homesite development, wildlife habitat, and recreation (fig. 14).

If this unit is used for crops, the main limitation is wetness. Most climatically adapted crops can be grown if artificial drainage is provided. Drainage is needed if this unit is to be used to its maximum potential. Unless the soil is drained, long-lived, deep-rooted deciduous fruit and nut trees, strawberries, caneberries, and alfalfa are adversely affected by wetness. Response to drainage is good if adequate outlets are available.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, moderately slow permeability, shrink-swell potential, and low soil strength. Drainage is needed if roads and building foundations are

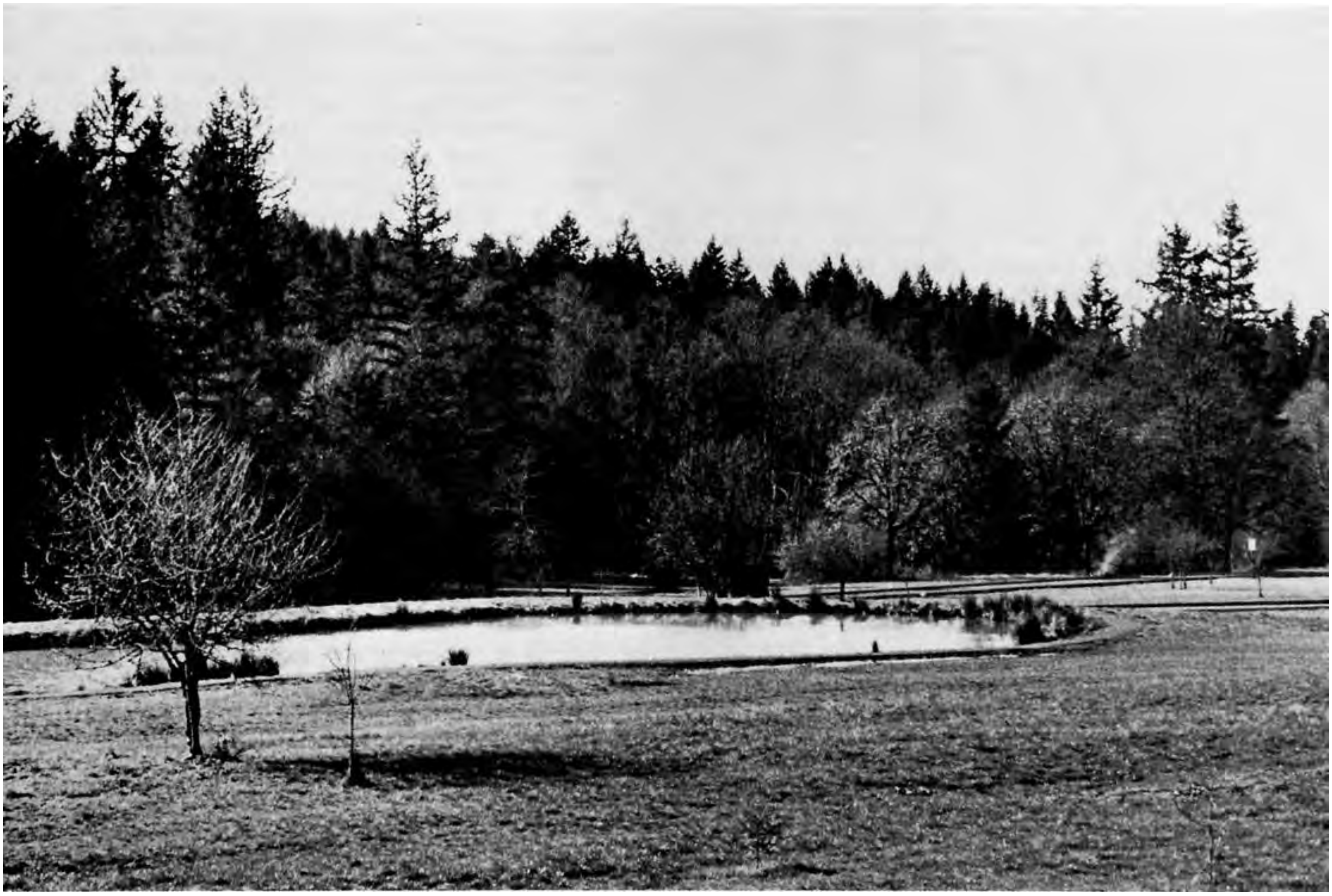


Figure 14.—Area of McAlpin silty clay loam, 3 to 6 percent slopes, used for recreation.

constructed. Wetness can be reduced by installing drain tile around footings.

This unit is poorly suited to septic tank absorption fields because of the seasonal high water table and moderately slow permeability. Septic tank absorption fields can be installed in some areas where the restrictive feature water table is at a greater depth. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction.

If buildings and roads are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIe.

67—McBee silty clay loam. This deep, moderately well drained soil is on flood plains. It formed in moderately fine textured alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 150 to 600 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown silty clay loam about 19 inches thick. The upper 9 inches of the subsoil is dark brown, mottled silty clay loam, and the lower 16 inches is dark grayish brown, mottled silty clay loam. The substratum to a depth of 60 inches or more is dark grayish brown, mottled silty clay loam. In some areas of similar included soils, the substratum is gravelly or very gravelly.

Included in this unit are small areas of Chehalis, Cloquato, Newberg, and Wapato soils. Included areas make up about 15 percent of the total acreage.

Permeability of this McBee soil is moderate. Available water capacity is about 11 to 13 inches. Effective rooting depth is 60 inches; however, root penetration may be restricted by a seasonal high water table. Runoff is slow, and the hazard of erosion is slight except during occasional periods of flooding from November to May (fig. 15). A seasonal high water table is at a depth of 2 to 3 feet from November to April.

This unit is used mainly for hay, pasture, small grain, vegetables, and orchards. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for cultivated crops, the main limitation is the hazard of flooding. Most climatically adapted crops can be grown if the soil is protected from flooding late in spring and early in summer.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Cover crops are needed to protect the soil from erosion during periods of flooding in winter. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium.

If this unit is used for homesite development, the main limitations are the hazard of flooding, wetness, and low soil strength. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

Buildings and roads should be located above the expected flood level. The risk of flooding has been reduced in some areas by constructing large dams and reservoirs upstream. Septic tank absorption fields can be expected to function poorly on this unit because of the seasonal high water table and the hazard of flooding. Absorption fields can be installed in some areas where the water table is at a greater depth.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction.

This map unit is in capability subclass IIw.

68F—McDuff silty clay loam, 25 to 50 percent slopes. This moderately deep, well drained soil is on uplands. It formed in fine textured colluvium derived dominantly from tuffaceous and sedimentary rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of leaves, moss, needles, and twigs 1 inch thick. The surface layer is dark brown silty clay loam about 7 inches thick. The upper 25 inches of the subsoil is dark brown clay, and the lower 4 inches is strong brown silty clay. Partially weathered tuffaceous siltstone is at a depth of 36 inches.

Included in this unit are small areas of Apt, Cumley, Honeygrove, and Peavine soils and McDuff soils that have slopes of more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this McDuff soil is moderately slow. Available water capacity is 4 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium to rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, homesite development, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 145, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, western hemlock, bigleaf maple, and red alder commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Ground skidding methods of harvesting timber are difficult to use because of slope. Wheeled and tracked

Figure 15.—Flooding in an area of McBee silty clay loam.

equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. The use of vehicles that have large, low-pressure tires or cable or aerial logging systems decrease the risk of soil puddling and compaction. When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Road location and maintenance costs are greater in the more steeply sloping areas. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The soil can be subject to landsliding and slumping when saturated. Landsliding or slumping may occur when the soil becomes saturated and is disturbed by constructing roads or harvesting timber.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Because plant competition is greater in areas on north- and east-facing slopes, it may be necessary to plant larger trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes creambush oceanspray, western hazel, salal, vine maple, cascade Oregon-grape, trailing blackberry, and swordfern.

This map unit is in capability subclass VIe.

68G—McDuff silty clay loam, 50 to 75 percent slopes. This moderately deep, well drained soil is on the side slopes of uplands. It formed in fine textured colluvium derived dominantly from tuffaceous and sedimentary rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of leaves, moss, needles, and twigs 1 inch thick. The surface layer is dark brown silty clay loam about 7 inches thick. The upper 25 inches of the subsoil is dark brown clay, and the lower 4 inches is strong brown silty clay. Partially weathered tuffaceous siltstone is at a depth of 36 inches.

Included in this unit are small areas of Apt, Cumley, Honeygrove, and Peavine soils and McDuff soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this McDuff soil is moderately slow. Available water capacity is 4 to 6 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 145, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, western hemlock, bigleaf maple, and red alder commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Ground skidding methods of harvesting timber are difficult to use because of slope. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Road location and maintenance costs are greater in the more steeply sloping areas. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Landsliding or slumping may occur when the soil becomes saturated and is disturbed by constructing roads or harvesting timber.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Because plant competition is greater in areas on north- and east-facing slopes, it may be necessary to plant larger trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes creambush oceanspray, western hazel, salal, vine maple, cascade Oregon-grape, trailing blackberry, and western swordfern.

This map unit is in capability subclass VIIe.

69B—Minniece silty clay loam, 0 to 8 percent slopes. This deep, somewhat poorly drained and poorly drained soil is in narrow drainageways and other depressional areas of uplands. It formed in colluvium and alluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 47 to 50 degrees F, and the average frost-free period is 145 to 190 days.

Typically, the surface is covered with a mat of leaves, twigs, and moss about 1 inch thick. The surface layer is very dark gray silty clay loam about 10 inches thick. The upper 18 inches of the subsoil is dark gray, mottled silty clay, and the lower 8 inches is grayish brown, mottled silty clay. The substratum to a depth of 65 inches is gray, mottled silty clay loam.

Included in this unit are small areas of Blachly, Cumley, Honeygrove, Kinney, and Peavine soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Minniece soil is very slow. Available water capacity is 5 to 7 inches. Effective rooting depth is 60 inches; however, root penetration may be restricted by a seasonal high water table. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 0 to 2 feet from November to May.

This unit is used mainly for timber production. It is also used for wildlife habitat, limited pasture, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir, western hemlock, western redcedar, red alder, bigleaf maple, and Oregon ash commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity.

Mortality of seedlings may be high in some areas because of restricted drainage.

Because roots are restricted by the seasonal high water table, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, and western redcedar.

The understory vegetation commonly growing on this unit includes vine maple, salal, creambush oceanspray, trailing blackberry, cascade Oregon-grape, and western swordfern.

If this unit is used for pasture, the main limitations are wetness and the clayey texture of the soil. Wetness limits the choice of plants and the period of grazing and increases the risk of winterkill. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff.

This map unit is in capability subclass VIw.

70D—Moe gravelly loam, 3 to 25 percent slopes. This deep, well drained soil is on broad bench tops and side slopes of uplands. It formed in colluvium derived dominantly from tuffaceous rock and breccia. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 70 to 90 inches, the average annual air temperature is 43 to 45 degrees F, and the average frost-free period is 90 to 120 days.

Typically, the surface is covered with a mat of needles, twigs, and leaves about 1 inch thick. The surface layer is very dark grayish brown and very dark brown gravelly loam about 15 inches thick. The upper 9 inches of the subsoil is dark brown silty clay loam, and the lower 37 inches is dark yellowish brown and dark brown silty clay.

Included in this unit are small areas of Dobbins, Flane, Mulkey, and Zango soils and Moe soils that have slopes of more than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Moe soil is moderately slow. Available water capacity is about 10 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 145, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations and plant competition.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Snowpack limits the use of equipment and restricts access.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes red huckleberry, cascade Oregon-grape, Pacific rhododendron, salal, trailing blackberry, western brackenfern, western swordfern, common beargrass, and tall blue huckleberry.

This map unit is in capability subclass VIe.

70F—Moe gravelly loam, 25 to 50 percent slopes. This deep, well drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from tuffaceous rock and breccia. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 70 to 90 inches, the average annual air temperature is 43 to 45 degrees F, and the average frost-free period is 90 to 120 days.

Typically, the surface is covered with a mat of needles, twigs, and leaves about 1 inch thick. The surface layer is very dark grayish brown and very dark brown gravelly loam about 15 inches thick. The upper 9 inches of the subsoil is dark brown silty clay loam, and the lower 37 inches is dark yellowish brown and dark brown silty clay.

Included in this unit are small areas of Dobbins, Flane, Mulkey, and Zango soils and Moe soils that have slopes of less than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Moe soil is moderately slow. Available water capacity is about 10 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 145, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, western hemlock, and western redcedar commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes red huckleberry, cascade Oregon-grape, Pacific rhododendron, salal, trailing blackberry, western brackenfern, western swordfern, common beargrass, and tall blue huckleberry.

This map unit is in capability subclass VIIe.

71F—Mulkey loam, 25 to 50 percent slopes. This moderately deep, well drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,000 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 43 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Typically, the surface layer is very dark brown loam about 8 inches thick. The next layer is very dark grayish brown gravelly loam about 11 inches thick. The subsoil is dark brown cobbly loam about 12 inches thick. Basalt is at a depth of 31 inches.

Included in this unit are small areas of Henline, Keel, Valsetz, and Yellowstone soils and Mulkey soils that have slopes of less than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Mulkey soil is moderately rapid. Available water capacity is about 3 to 6 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 110, the potential production per acre is 5,040 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 46,700 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. Douglas-fir, western hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and noble fir.

The understory vegetation commonly growing on this unit includes common beargrass, cascade Oregon-grape, Pacific rhododendron, western brackenfern, and tall blue huckleberry.

This map unit is in capability subclass VIe.

72C—Nekia silty clay loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on foothills adjacent to the terraces of the Willamette Valley. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown and dark reddish brown silty clay loam about 10 inches thick. The subsoil is dark reddish brown clay about 19 inches thick. Fractured basalt is at a depth of 29 inches. In some areas of similar included soils, the surface layer is silt loam.

Included in this unit are small areas of Bellpine, Dupee, Jory, Ritner, and Witzel soils and Nekia soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Nekia soil is moderately slow. Available water capacity is about 3 to 6 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for timber production, hay and pasture, grass seed, small grain, and orchards. It is also used for homesite development, Christmas trees, wildlife habitat, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 150, the potential production per acre is 9,480 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 86,800 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, bigleaf maple, grand fir, and Oregon white oak commonly grow on this unit. The main concerns in producing and harvesting timber are seedling mortality, the hazard of windthrow, and plant competition.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction.

Trees suitable for planting on this unit include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes Pacific poison-oak, common snowberry, western brackenfern, trailing blackberry, rose, and western swordfern.

This unit is suited to most climatically adapted crops. It has few limitations.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Water for irrigation is often not available and usually must be stored in reservoirs. Only a few acres are irrigated by sprinklers.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for homesite development, the main limitations are depth to bedrock, moderately slow permeability, and low soil strength. Cuts needed to provide essentially level building sites can expose bedrock.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock and moderately slow permeability. Septic tank absorption fields can be installed in some areas where the depth to bedrock is greater. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIIe.

72D—Nekia silty clay loam, 12 to 20 percent slopes. This moderately deep, well drained soil is on foothills adjacent to the terraces of the Willamette Valley. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown and dark reddish brown silty clay loam about 10 inches thick. The subsoil is dark reddish brown clay about 19 inches thick. Fractured basalt is at a depth of 29 inches. In some areas of similar included soils, the surface layer is silt loam.

Included in this unit are small areas of Bellpine, Dupee, Jory, Ritner, and Witzel soils and Nekia soils that have slopes of less than 12 percent or more than 20 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Nekia soil is moderately slow. Available water capacity is about 3 to 6 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate to high.

This unit is used mainly for timber production, hay and pasture, grass seed, small grain, and orchards. It is also used for homesite development, Christmas trees, wildlife habitat, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 150, the potential production per acre is 9,480 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 86,800 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, bigleaf maple, grand fir, and Oregon white oak commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes Pacific poison-oak, common snowberry, western brackenfern, trailing blackberry, rose, and western swordfern.

This unit is suited to most climatically adapted crops. It is limited mainly by slope in some areas.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Water for irrigation is often not available and usually must be stored in reservoirs. Only a few acres are irrigated by sprinklers.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. All tillage should be on the contour or across the slope. Constructing terraces reduces runoff and the risk of erosion and conserves moisture.

If this unit is used for homesite development, the main limitations are depth to bedrock, moderately slow permeability, slope, and low soil strength. Cuts needed to provide essentially level building sites can expose bedrock.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock, slope, and moderately slow permeability. Septic tank absorption fields can be installed in some areas of this unit where the depth to bedrock is greater and the unit is less sloping. Absorption lines should be installed on the contour. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption fields.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIIe.

72E—Nekia silty clay loam, 20 to 30 percent slopes. This moderately deep, well drained soil is on foothills adjacent to the terraces of the Willamette Valley. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown and dark reddish brown silty clay loam about 10 inches thick. The subsoil is dark reddish brown clay about 19 inches thick. Fractured basalt is at a depth of 29 inches. In some areas of similar included soils, the surface layer is silt loam.

Included in this unit are small areas of Bellpine, Dupee, Jory, Ritner, and Witzel soils and Nekia soils that have slopes of less than 20 percent or more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Nekia soil is moderately slow. Available water capacity is about 3 to 6 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is high.

This unit is used mainly for timber production and pasture. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 150, the potential production

per acre is 9,480 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 86,800 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, bigleaf maple, grand fir, and Oregon white oak commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Ripping skid trails and landings when the soil is dry improves the growth of trees. These activities are more difficult to perform in the more steeply sloping areas.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes Pacific poison-oak, common snowberry, western brackenfern, trailing blackberry, rose, and western swordfern.

The steepness of slope makes this unit is unsuitable for cultivation. If the unit is used for pasture, the main limitation is slope and the clayey texture of the soil. The unit is suited only to limited tillage for pasture management practice.

If this unit is used for hay and pasture, a permanent plant cover is needed to prevent excessive runoff and erosion in winter. Seedbed preparation should be on the contour or across the slope where practical. Using management that maintains optimum vigor and quality of forage plants is a good practice. Rotation grazing helps to maintain the quality of forage. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff.

If this unit is used for homesite development, the main limitations are depth to bedrock, moderately slow permeability, slope, and low soil strength. Cuts needed to provide essentially level building sites can expose bedrock.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock, slope, and moderately slow permeability. Septic tank absorption fields can be installed in some areas of this unit where the depth to bedrock is greater and that are less sloping. Absorption lines should be installed on the contour. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption fields.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IVe.

72F—Nekia silty clay loam, 30 to 50 percent slopes. This moderately deep, well drained soil is on foothills adjacent to the terraces of the Willamette Valley. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown and dark reddish brown silty clay loam about 10 inches thick. The subsoil is dark reddish brown clay about 19 inches thick. Fractured basalt is at a depth of 29 inches. In some areas of similar included soils, the surface layer is silt loam.

Included in this unit are small areas of Bellpine, Dupee, Jory, Ritner, and Witzel soils and Nekia soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Nekia soil is moderately slow. Available water capacity is about 3 to 6 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 145, the potential production per acre is 9,120 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 82,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, bigleaf maple, grand fir, and Oregon white oak commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes the damage to the soil and to plant cover downslope of roadbuilding sites.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and grand fir.

The understory vegetation commonly growing on this unit includes Pacific poison-oak, common snowberry, western brackenfern, trailing blackberry, rose, and western swordfern.

This map unit is in capability subclass VIe.

73—Newberg fine sandy loam. This deep, somewhat excessively drained soil is on flood plains. It formed in recent alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 125 to 700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown fine sandy loam about 7 inches thick. The next layer is dark brown fine sandy loam about 12 inches thick. The upper 9 inches of the substratum is brown coarse sandy loam, and the lower part to a depth of 64 inches or more is dark grayish brown loamy fine sand and loamy sand. In some areas of similar included soils, the surface layer is silt loam or very gravelly or sandy material is below a depth of 40 inches.

Included in this unit are small areas of Camas, Chehalis, Cloquato, and McBee soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Newberg soil is moderately rapid to a depth of 28 inches and rapid below this depth. Available water capacity is about 6 to 9 inches. Effective rooting depth is 24 to 40 inches; however, root penetration is restricted by the sandy substratum. Runoff is slow, and the hazard of erosion is slight except during periods of flooding. This soil is subject to occasional, brief periods of flooding from December to March.

This unit is used mainly for small grain, grass seed, orchards, pasture, and vegetables (fig. 16). It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for cultivated crops, the main limitation is the hazard of flooding. Most climatically adapted crops can be grown if the soil is protected from flooding late in spring and early in summer.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Cover crops are needed to protect the soil from erosion during periods of flooding in winter. Returning all

Figure 16.—Double cropping of apples and pumpkins in an area of Newberg fine sandy loam.

crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium.

If this unit is used for homesite development, the main limitations are the hazard of flooding and rapid permeability. Septic tank absorption fields do not function properly during periods of flooding. The rapid permeability of the substratum may result in contamination of ground water. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level. The risk of flooding has been reduced in some areas by constructing large dams and reservoirs upstream.

This map unit is in capability subclass IIw.

74H—Ochrepts, very steep. These well drained and moderately well drained soils are on long, narrow escarpments along the small streams that have cut deeply into the valley terraces and where the terraces meet the bottom lands and flood plains along major streams and rivers. These soils formed in stratified silty, loamy, or gravelly alluvium and in the accumulation of material that has creeped downslope. Soil depth ranges from 20 to 60 inches or more. Slopes are 20 to 60 percent. The native vegetation is conifers, hardwoods, shrubs, and grasses. Elevation is 50 to 1,500 feet. The average annual precipitation is 40 to 90 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 150 to 210 days.

These soils are highly variable. They generally are silty, loamy, or gravelly and are stratified. In some areas the surface layer is dark colored.

Included in this unit, in areas of the Willamette Valley that receive 40 to 60 inches of rainfall, is as much as 20 percent Chehalis, Cloquato, Malabon, Newberg, Salkum, and Willamette soils. Included in the higher rainfall areas on uplands is as much as 20 percent Blachly, Harrington, Honeygrove, Klickitat, and Peavine soils. Also included are small areas of less steeply sloping soils, small seep areas, and some very narrow, nearly vertical areas.

Permeability, available water capacity, and effective rooting depth are highly variable. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for wildlife habitat. The lower rainfall areas are also used for pasture and for limited homesite development in the more gentle sloping areas. The higher rainfall areas on uplands, are also used for limited timber production and recreational activities such as picnicking, hiking, or camping.

If this unit is used for pasture, the main limitation is steepness of slope. Control of erosion is critical on this unit. A permanent plant cover is needed to prevent excessive runoff and erosion in winter.

If this unit is used for homesite development, the main limitation is slope. Slumping of cuts and fills may occur, making additional maintenance of roads and building foundations necessary. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed.

Some merchantable timber grows on this unit, but it is not a significant commercial timber producing unit. The major concern for management and harvesting timber is equipment limitations because of slope.

Ground skidding methods of harvesting timber can be difficult to use because of slope. In the steeper areas, highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Landsliding and slumping can occur if the soil is disturbed when harvesting timber.

This unit is in capability subclass VIe.

75C—Panther silty clay loam, 2 to 12 percent slopes. This deep, poorly drained soil is in drainageways and on concave slopes of low foothills. It formed in colluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly hardwoods, shrubs, grasses, and sedges. Elevation is 300 to 1,200 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is black silty clay loam about 7 inches thick. The next layer is very dark brown, mottled clay about 13 inches thick. The subsoil is dark grayish brown, mottled clay 28 inches thick. Sedimentary bedrock is at a depth of 48 inches. In some areas of similar included soils, bedrock is at a depth of more than 60 inches.

Included in this unit are small areas of Dixonville, Dupee, Hazelair, Willakenzie, and Witham soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Panther soil is very slow. Available water capacity is 5 to 8 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches; however, root penetration is restricted by a seasonal high water table and the dense clay layer. Runoff is slow to medium, and the hazard of erosion is slight to moderate. A seasonal high water table is at a depth of 0 to 1 foot from December through April.

This unit is used mainly for hay and pasture. It is also used for recreation, wildlife habitat, and limited homesite development.

If this unit is used for hay and pasture, the main limitations are wetness and very slow permeability. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Drainage is needed if this unit is to be used to its maximum potential.

Using management that maintains optimum vigor and quality of forage plants is a good practice. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This unit is poorly suited to homesite development. The main limitations are wetness, very slow permeability, low soil strength, and the shrink-swell potential. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is not suited to septic tank absorption fields because of wetness and the very slow permeability, which adversely affect the treatment and absorption processes.

Roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction. Roads built on this unit need to be provided with a large amount of base rock to prevent settling.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

This map unit is in capability subclass VIw.

76E—Peavine silty clay loam, 3 to 30 percent slopes. This moderately deep, well drained soil is on broad, rolling bench tops and side slopes of uplands. It formed in colluvium derived dominantly from sedimentary and tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to

52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of leaves, moss, needles, and twigs 1 inch thick. The surface layer is dark reddish brown silty clay loam about 10 inches thick. The upper 18 inches of the subsoil is dark reddish brown and reddish brown silty clay, and the lower 9 inches is yellowish red silty clay. Weathered siltstone is at a depth of 37 inches.

Included in this unit are small areas of Apt, Cumley, Honeygrove, and McDuff soils and Peavine soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Peavine soil is moderately slow. Available water capacity is 5 to 7 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for homesite development, wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 160, the potential production per acre is 10,200 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 95,200 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 125. Douglas-fir, grand fir, western redcedar, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. The use of vehicles that have large, low-pressure tires, horse logging, or cable or aerial logging systems decrease the risk of soil puddling and compaction. Ripping skid trails and landings when the soil is dry improves the growth of trees.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes Pacific poison-oak, common snowberry, western swordfern, salal, vine maple, red huckleberry, western hazel, and trailing blackberry.

If this unit is used for homesite development, the main limitations are slope, depth to bedrock, moderately slow permeability, and low soil strength.

Slope limits use of some areas of this unit for building site development. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Cuts needed to provide essentially level building sites can expose bedrock.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock, slope, and the moderately slow permeability. Septic tank absorption fields can be installed in some areas of this unit where the depth to bedrock is greater and the areas are less sloping. Absorption lines should be installed on the contour.

Buildings and roads should be designed to offset the limited ability of this soil in this unit to support a load. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings. Roads need large amounts of base rock to prevent settling. Cutbanks may be subject to slumping when the soil is saturated.

This map unit is in capability subclass VIe.

76G—Peavine silty clay loam, 30 to 60 percent slopes. This moderately deep, well drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from sedimentary and tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 700 to 2,400 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of leaves, moss, needles, and twigs 1 inch thick. The surface layer is dark reddish brown silty clay loam about 10 inches thick. The upper 18 inches of the subsoil is dark reddish brown and reddish brown silty clay, and the lower 9 inches is yellowish brown silty clay. Weathered siltstone is at a depth of 37 inches.

Included in this unit are small areas of Apt, Cumley, Honeygrove, and McDuff soils and Peavine soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Peavine soil is moderately slow. Available water capacity is 5 to 7 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 160, the potential production per acre is 10,200 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 95,200 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 125. Douglas-fir, grand fir, western redcedar, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Ground skidding methods of harvesting timber are difficult to use because of slope. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Road location and maintenance costs are greater in the more steeply sloping areas. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites. The use of vehicles that have large, low-pressure tires or cable or aerial logging systems decrease the risk of soil puddling and compaction. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer increases seedling mortality, especially on the south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedling.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Because plant competition is greater in areas on north- and east-facing slopes, it may be necessary to plant larger trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

The soil in this unit is subject to landsliding and slumping because it is very plastic and is underlain by highly fractured bedrock. Landsliding or slumping may occur when the soil becomes saturated and is disturbed by constructing roads or harvesting timber.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes western hazel, cascade Oregon-grape, Pacific poison-oak, common snowberry, trailing blackberry, and rose.

This map unit is in capability subclass VIe.

77A—Pengra silt loam, 1 to 4 percent slopes. This deep, somewhat poorly drained soil is on toe slopes and alluvial fans of foothills. It formed in clayey alluvium derived from mixed sources. The vegetation in areas not cultivated is mainly hardwoods, scattered conifers, shrubs, and grasses. Elevation is 350 to 700 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsoil is dark grayish brown silty clay loam about 19 inches thick. The upper 21 inches of the substratum is grayish brown clay, and the lower part to a depth of 60 inches or more is olive gravelly clay. In some areas of similar included soils, gravelly clay is below a depth of 40 inches.

Included in this unit are small areas of Hazelair, Natroy, and Panther soils. Also included are small areas of Bellpine soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Pengra soil is moderately slow to a depth of 29 inches and very slow below this depth. Available water capacity is 8 to 10 inches. Effective rooting depth is 60 inches; however, root penetration is restricted by the dense clay layer and a seasonal high water table. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 1.5 to 2.5 feet from November to May.

This unit is used mainly for native and improved pasture, grass seed, and blackberries. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for hay and pasture, the main limitations are wetness and very slow permeability. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Drainage is needed if this unit is to be used to its maximum potential.

Using management that maintains optimum vigor and quality of forage plants is a good practice. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for cultivated crops, the main limitations are wetness and very slow permeability. Drainage is needed if this unit is to reach its maximum potential. If a suitable outlet is available, subsurface drainage can be used.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grasses and small grain respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

This unit is poorly suited to homesite development. The main limitations are the very slow permeability, wetness, high shrink-swell potential, and low soil strength. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is poorly suited to septic tank absorption fields because of the seasonal high water table and very slow permeability. Septic tank absorption fields can be installed in some areas where the depth to the water table is greater. The limitation of very slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction. Roads need to be provided with a large amount of base rock to prevent settling.

This map unit is in capability subclass IIIw.

78C—Philomath silty clay, 3 to 12 percent slopes. This shallow, well drained soil is on low foothills adjacent to the Willamette Valley. It formed in colluvium derived dominantly from basic igneous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown silty clay about 4 inches thick. The next layer is very dark brown and very dark grayish brown clay about 15 inches thick. Weathered basalt is at a depth of 19 inches. In some areas of similar included soils, the surface layer is cobbly silty clay.

Included in this unit are small areas of Dixonville, Hazelair, Ritner, Witham, and Witzel soils and Philomath soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Philomath soil is slow. Available water capacity is about 2 to 4 inches. Depth to soft bedrock and effective rooting depth are 12 to 20 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for pasture. It is also used for limited homesite development, wildlife habitat, and recreation.

If this unit is used for pasture, the main limitations are the high clay content and depth to bedrock.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion.

Using management that maintains optimum vigor and quality of forage plants is a good practice. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

If this unit is used for homesite development, the main limitations are depth to bedrock, low soil strength, and shrink-swell potential of the subsoil. Cuts needed to provide essentially level building sites can expose bedrock.

This unit is not suited to septic tank absorption fields because of the shallow depth to bedrock.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

The hazard of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

Much of this unit supports Oregon white oak, scattered Douglas-fir, ponderosa pine, Pacific poison-oak, rose, and shrubs, and grasses. The unit is poorly suited to the production of Douglas-fir.

This map unit is in capability subclass VIe.

79C—Philomath cobbly silty clay, 3 to 12 percent slopes. This shallow, well drained soil is on low foothills adjacent to the Willamette Valley. It formed in colluvium derived dominantly from basic igneous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown cobbly silty clay about 4 inches thick. The next layer is very dark brown and very dark grayish brown clay about 15 inches thick. Weathered basalt is at a depth of 19 inches. In some areas of similar included soils, the surface layer is not cobbly.

Included in this unit are small areas of Dixonville, Hazelair, Ritner, Witham, and Witzel soils and Philomath soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Philomath soil is slow. Available water capacity is about 2 to 4 inches. Depth to soft bedrock and effective rooting depth are 12 to 20 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for pasture. It is also used for limited homesite development, wildlife habitat, and recreation.

If this unit is used for pasture, the main limitations are the high clay content, cobbles on the surface, and depth to bedrock.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. The use of equipment is limited by stones on the surface.

Using management that maintains optimum vigor and quality of forage plants is a good practice. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

If this unit is used for homesite development, the main limitations are depth to bedrock, low soil strength, shrink-swell potential of the subsoil, and cobbles on the surface. Cuts needed to provide essentially level building sites can expose bedrock.

This unit is not suited to septic tank absorption fields because of the shallow depth to bedrock.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need large amounts of base rock to prevent settling.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion. Removal of gravel and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

Much of this unit supports Oregon white oak, scattered Douglas-fir, ponderosa pine, Pacific poison-oak, rose, and shrubs and grasses. The unit is poorly suited to the production of Douglas-fir.

This map unit is in capability subclass VIs.

79F—Philomath cobbly silty clay, 12 to 45 percent slopes. This shallow, well drained soil is on low foothills adjacent to the Willamette Valley. It formed in colluvium derived dominantly from basic igneous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown cobbly silty clay about 4 inches thick. The next layer is very dark brown and very dark grayish brown clay about 15 inches thick. Weathered basalt is at a depth of 19 inches. In some areas of similar included soils, the surface layer is not cobbly.

Included in this unit are small areas of Dixonville, Hazelair, Ritner, Witham, and Witzel soils and Philomath soils that have slopes of less than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Philomath soil is slow. Available water capacity is about 2 to 4 inches. Depth to soft bedrock and effective rooting depth are 12 to 20 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This unit is used mainly for pasture. It is also used for limited homesite development, wildlife habitat, and recreation.

If this unit is used for pasture, the main limitations are the high clay content, cobbles on the surface, depth to bedrock, and slope.

The soil in this unit is sticky and plastic when wet, which restricts trafficability. Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. The use of equipment is limited by cobbles on the surface and by slope.

Using management that maintains optimum vigor and quality of forage plants is a good practice. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

If this unit is used for homesite development, the main limitations are depth to bedrock, slope, low soil strength, shrink-swell potential of the subsoil, and cobbles on the surface. Cuts needed to provide essentially level building sites can expose bedrock. Slope limits use of some areas of this unit for building site development.

This unit is not suited to septic tank absorption fields because of shallow depth to bedrock and slope in the steeper areas of the unit.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Removal of gravel and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

Much of this unit supports Oregon white oak, scattered Douglas-fir, ponderosa pine, Pacific poison-oak, rose, and shrubs and grasses. This unit is poorly suited to the production of Douglas-fir.

This map unit is in capability subclass VIs.

80—Pits. This miscellaneous area consists of sand and gravel pits, borrow pits, and basalt quarries. It is on flood plains, broad terraces, foothills, and uplands.

Sand and gravel occur in deposits along the flood plains of the rivers and major streams in the survey area. The materials are removed by excavations in stream channels, bars, and gravelly alluvial deposits underlying areas of farm land. The sand and gravel pits are the major sources of mineral aggregates for construction of roads. Borrow pits occur along Interstate Highway 5 and along broad terraces in the Willamette Valley. The material from these pits was excavated for use as fill material for roads.

Crushed gravel is mined from quarries of igneous rock on foothills and in uplands. Most of these quarries are in remote areas, and they provide an excellent source of rock for logging roads. The igneous rock is very extensive, and it provides high quality crushed rock. Quarrying costs and transportation limitations restrict the extensive development of this resource.

This unit is in capability subclass VIIIs.

81D—Quartzville silt loam, 2 to 25 percent slopes. This deep, well drained soil is on bench tops and side slopes of uplands. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,500 to 2,700 feet. The average annual precipitation is 80 to 100 inches, the average annual air temperature is 46 to 51 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of leaves, twigs, moss, and needles about 1 inch thick. The surface layer is dark brown and very dark grayish brown silt loam about 9 inches thick. The subsoil is dark brown, brown, and yellowish brown silty clay loam about 49 inches thick. The substratum to a depth of 65 inches is yellowish brown clay loam. In some areas of similar included soils, the surface layer and subsoil are cobbly.

Included in this unit are small areas of Acanod and Kinney soils and Quartzville soils that have slopes of more than 25 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Quartzville soil is moderately slow. Available water capacity is about 10 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 190, the potential production per acre is 12,000 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 118,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 150. Douglas-fir, western hemlock, western redcedar, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations and plant competition.

If wheeled and tracked equipment is used on this unit when the soil is moist, rutting and compaction occur. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity.

Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, and western redcedar.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, Oregon oxalis, red huckleberry, salal, trailing blackberry, vine maple, and western swordfern.

This map unit is in capability subclass VIe.

82F—Quartzville silt loam, 25 to 50 percent north slopes. This deep, well drained soil is on north-facing slopes of uplands. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,500 to 2,700 feet. The average annual precipitation is 80 to 100 inches, the average annual air temperature is 46 to 51 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of leaves, twigs, moss, and needles about 1 inch thick. The surface layer is dark brown and very dark grayish brown silt loam about 9 inches thick. The subsoil is dark brown, brown, and yellowish brown silty clay loam about 49 inches thick. The substratum to a depth of 65 inches is yellowish brown clay loam. In some areas of similar included soils, the surface layer and subsoil are cobbly.

Included in this unit are small areas of Acanod and Kinney soils and Quartzville soils that have slopes of less than 25 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Quartzville soil is moderately slow. Available water capacity is about 10 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 190, the potential production per acre is 12,000 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 118,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 150. Douglas-fir, western hemlock, western redcedar, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. If wheeled and tracked equipment is used on this unit when the soil is moist, rutting and compaction occur. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is dry. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems.

Reforestation must be carefully managed to reduce competition from undesirable plants, which prevent natural or artificial reforestation. Because plant competition is greater in areas on north- and east-facing slopes, it may be necessary to plant larger trees in these areas. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, and western redcedar.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, Oregon oxalis, red huckleberry, salal, trailing blackberry, vine maple, and western swordfern.

This map unit is in capability subclass VIe.

82G—Quartzville silt loam, 50 to 75 percent north slopes. This deep, well drained soil is on north-facing slopes of uplands. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,500 to 2,700 feet. The average annual precipitation is 80 to 100 inches, the average annual air temperature is 46 to 51 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of leaves, twigs, moss, and needles about 1 inch thick. The surface layer is dark brown and very dark grayish brown silty clay loam about 9 inches thick. The subsoil is dark brown and yellowish brown silty clay loam about 49 inches thick. The substratum to a depth of 65 inches is yellowish brown clay loam. In some areas of similar included soils, the surface layer and subsoil are cobbly.

Included in this unit are small areas of Acanod and Kinney soils, Quartzville soils that have south-facing slopes, and Quartzville soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Quartzville soil is moderately slow. Available water capacity is about 10 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 190, the potential production

per acre is 12,000 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 118,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 150. Douglas-fir, western hemlock, western redcedar, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Because plant competition is greater in areas on north- and east-facing slopes, it may be necessary to plant larger trees in these areas. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, and western redcedar.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, Oregon oxalis, red huckleberry, salal, trailing blackberry, vine maple, and western swordfern.

This map unit is in capability subclass VIIe.

83F—Quartzville silt loam, 25 to 50 percent south slopes. This deep, well drained soil is on south-facing slopes of uplands. It formed in colluvium derived dominantly from basic igneous and tuffaceous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 1,500 to 2,700 feet. The average annual precipitation is 80 to 100 inches, the average annual air temperature is 46 to 51 degrees F, and the average frost-free period is 140 to 190 days.

Typically, the surface is covered with a mat of leaves, twigs, moss, and needles about 1 inch thick. The surface layer is dark brown and very dark grayish brown silt loam about 9 inches thick. The subsoil is dark brown, brown, and yellowish brown silty clay loam about 49 inches thick. The substratum to a depth of 65 inches is yellowish brown clay loam. In some areas of similar included soils, the surface layer and subsoil are cobbly.

Included in this unit are small areas of Acanod, and Kinney soils and Quartzville soils that have slopes of less than 25 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Quartzville soil is moderately slow. Available water capacity is about 10 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 190, the potential production per acre is 12,000 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 118,080 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 150. Douglas-fir, western hemlock, western redcedar, red alder, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. If wheeled and tracked equipment is used on this unit when the soil is moist, rutting and compaction occur. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is dry. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Highlead logging or other logging systems that fully or partially suspend logs are less damaging to the soil and generally are less costly than tractor systems.

Seedling mortality is greater in areas on south-facing slopes, which are more droughty than other areas. Seedling mortality can be reduced by providing shade for seedlings. Excessive use of browse by deer in winter is also more of a concern on south-facing slopes.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, western hemlock, and western redcedar.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, Oregon oxalis, red huckleberry, salal, trailing blackberry, vine maple, and western swordfern.

This map unit is in capability subclass VIe.

84E—Ritner cobbly silty clay loam, 2 to 30 percent slopes. This moderately deep, well drained soil is on low foothills adjacent to the terraces of the Willamette Valley. It formed in cobbly colluvium derived dominantly from basic igneous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark reddish brown cobbly silty clay loam about 6 inches thick. The upper 9 inches of the subsoil is dark reddish brown cobbly silty clay loam, and the lower 19 inches is dark reddish brown very cobbly silty clay. Fractured basalt is at a depth of 34 inches.

Included in this unit are small areas of Nekia, Jory, and Witzel soils and Ritner soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Ritner soil is moderately slow. Available water capacity is 3 to 6 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for pasture, homesite development, wildlife habitat, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 130, the potential production per acre is 7,740 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 75,690 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir, Oregon white oak, bigleaf maple, and ponderosa pine commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting includes Douglas-fir and ponderosa pine.

The understory vegetation commonly growing on this unit includes common snowberry, rose, western brackenfern, Pacific poison-oak, and trailing blackberry.

If this unit is used for hay and pasture, the main limitations are cobbles in the surface layer and the texture of the surface layer. The use of equipment is limited by cobbles and stones on the surface and by slope. Seedbed preparation should be on the contour or across the slope where practical.

Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Periodic mowing and clipping help to maintain uniform growth, discourage selective grazing, and reduce clumpy growth.

If this unit is used for homesite development, the main limitations are slope, depth to bedrock, moderately slow permeability, and the shrink-swell potential. Slope in the steeper areas of this unit limits the unit for building site development. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving existing plant cover during construction helps control erosion. Cuts needed to provide essentially level building sites can expose bedrock.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock, slope, and moderately slow permeability. Septic tank absorption fields can be installed in some areas of this unit where the depth to bedrock is greater and the areas are less sloping. Absorption lines should be installed on the contour. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption fields or backfilling the trench with a porous material, or both.

Buildings and roads should be designed to offset the effects of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

This map unit is in capability subclass VIs.

84G—Ritner cobbly silty clay loam, 30 to 60 percent slopes. This moderately deep, well drained soil is on low foothills adjacent to the terraces of the Willamette Valley. It formed in cobbly colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark reddish brown cobbly silty clay loam about 6 inches thick. The upper 9 inches of the subsoil is dark reddish brown cobbly silty clay loam, and the lower 19 inches is dark reddish brown very cobbly silty clay. Fractured basalt is at a depth of 34 inches.

Included in this unit are small areas of Nekia and Witzel soils and Ritner soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Ritner soil is moderately slow. Available water capacity is 3 to 6 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 130, the potential production per acre is 7,740 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 75,690 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir, Oregon white oak, bigleaf maple, and ponderosa pine commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are more than in the more steeply sloping areas. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope. Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Ripping skid trails and landings when the soil is dry improves the growth of trees.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Trees are subject to windthrow because of the limited rooting depth. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and ponderosa pine.

The understory vegetation commonly growing on this unit includes common snowberry, rose, western brackenfern, Pacific poison-oak, and trailing blackberry.

This map unit is in capability subclass VIIs.

85—Riverwash. This deep, excessively drained to poorly drained miscellaneous area occurs as islands or gravel and sand bars in and along major streams and rivers. It formed in recently deposited sand and gravel. It does not have a plant cover. Elevation is 125 to 1,200 feet. The average annual precipitation is 40 to 80 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 160 to 210 days.

Riverwash consists of highly stratified sand and gravel. It is highly variable.

Included in this unit are small areas of Fluvents and Fluvaquents. Included areas make up about 15 percent of the total acreage.

Permeability of Riverwash is very rapid. Available water capacity is highly variable. Runoff is slow, and the hazard of erosion is very high because of overflow.

This unit is used mainly as a source of sand and gravel. It is also used as a source of roadfill and for wildlife habitat and recreation.

In some areas excess silt and clay restricts the suitability of this unit for use as sand and gravel, and reduce its quality as roadfill as well. Its season of use is limited by seasonal flooding.

Riverwash is subject to overflow when the water level of the streams and rivers is high, and it is extremely droughty when the water level is low. During periods of overflow, materials are deposited or eroded away. For these reasons, it is unsuited to agricultural or woodland uses.

This unit is poorly suited to urban and recreational development. It is limited mainly by seasonal flooding, wetness, and small stones.

This unit is in capability subclass VIIIw.

86G—Rock outcrop-Orthents complex, steep. This unit is on foothills and uplands. Slope is 5 to 70 percent. At the lower elevations, the vegetation consists of scattered, stunted hardwoods and conifers, shrubs, forbs, and grasses. At the higher elevations, the vegetation consists of scattered, stunted conifers, shrubs, forbs, and grasses. Elevation is 400 to 4,900 feet. The average annual precipitation is 40 to 120 inches, the average annual air temperature is 41 to 54 degrees F, and the average frost-free period is 70 to 210 days.

This unit is about 60 percent Rock outcrop and 30 percent Orthents. It is on the sides and ridgetops of foothills and uplands (fig. 17). The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ritner and Witzel soils at the lower elevations and Kilchis and Yellowstone soils at the higher elevations. Included areas make up about 10 percent of the total acreage.

Rock outcrop consists of barren exposures of basalt.

The Orthents are highly variable. They are well drained and moderately well drained and formed in a mixture of silt and sand and an accumulation of material that has creeped downslope. These soils are dark reddish brown, reddish brown, yellowish red, very dark brown, very dark grayish brown, dark yellowish brown, yellowish brown, brown, or dark brown loam or sandy loam that is as much as 75 percent gravel, cobbles, or stones. Depth to fractured basalt ranges from 5 to 60 inches or more.

Permeability, available water capacity, and effective rooting depth are highly variable. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for native pasture and wildlife habitat and as rock quarries. It also has esthetic value from surrounding recreational areas.

This map unit is in capability subclass VIIIs.

87—Salem gravelly silt loam. This deep, well drained soil is in slightly convex areas on low alluvial stream terraces. It formed in gravelly alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 200 to 700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown gravelly silt loam about 9 inches thick. The next layer is dark brown gravelly clay loam about 7 inches thick. The subsoil is dark brown gravelly clay loam about 19 inches thick. The upper 12 inches of the substratum is very gravelly loamy sand, and the lower part to a depth of 60 inches or more is very gravelly sand.

Included in this unit are small areas of Clackamas, Coburg, Courtney, and Malabon soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Salem soil is moderate to a depth of 35 inches and very rapid below this depth. Available water capacity is about 4 to 8 inches. Effective rooting depth is 60 inches or more; however, root penetration is restricted by the substratum of very gravelly sand. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for small grain, grass seed, hay, pasture, and row crops. It is also used for homesite development, wildlife habitat, and recreation.

This unit is well suited to all climatically adapted crops. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation

Figure 17.—Typical area of Rock outcrop-Orthents complex, steep.

water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, subsoiling, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

The main limitations of this unit for homesite development are the very rapid permeability of the substratum and the shrink-swell potential.

If this unit is used for septic tank absorption fields, the risk of seepage and the hazard of polluting water supplies are concerns. If the density of housing is moderate to high, community sewage systems may be needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability subclass IIs.

88B—Salkum silty clay loam, 2 to 8 percent slopes. This deep, well drained soil is on old terraces. It formed in old, weathered gravelly alluvium derived from mixed sources. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 400 to 850 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown silty clay loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown silty clay loam, and the lower 8 inches is dark brown clay. Below this is variegated yellow, brownish yellow, light gray, grayish brown, very pale brown, and pink silty clay loam about 33 inches thick.

Included in this unit are small areas of Bellpine and Jory soils, Salkum soils that have slopes of more than 8 percent, and soils that are 20 to 40 inches deep to highly weathered clayey gravel. Included areas make up about 15 percent of the total acreage.

Permeability of this Salkum soil is moderately slow. Available water capacity is about 9 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for small grain, grass seed, orchards, and hay and pasture crops. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It has few limitations.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for homesite development, the main limitations are moderately slow permeability and low soil strength.

Septic tank absorption fields may function poorly in winter. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIe.

88C—Salkum silty clay loam, 8 to 15 percent slopes. This deep, well drained soil is on old terraces. It formed in old, weathered gravelly alluvium derived from mixed sources. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 400 to 850 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown silty clay loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown silty clay loam, and the lower 8 inches is dark brown clay. The next layer is variegated yellow, brownish yellow, light gray, grayish brown, very pale brown, and pink silty clay loam about 33 inches thick.

Included in this unit are small areas of Bellpine and Jory soils, Salkum soils that have slopes of less than 8 percent, and soils that are 20 to 40 inches deep to highly weathered clayey gravel. Included areas make up about 15 percent of the total acreage.

Permeability of this Salkum soil is moderately slow. Available water capacity is about 9 to 12 inches. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate.

This unit is used mainly for small grain, grass seed, orchards, and hay and pasture. It is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It has few limitations.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. All tillage should be on the contour or across the slope.

If this unit is used for homesite development, the main limitations are slope, moderately slow permeability, and low soil strength.

Septic tank absorption fields may function poorly in winter. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Absorption lines should be installed on the contour.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIIe.

89B—Santiam silt loam, 3 to 6 percent slopes. This deep, moderately well drained soil is on high terrace remnants and foot slopes of low foothills. It formed in silty alluvium overlying older, weathered gravelly and clayey alluvium or weathered basic igneous rock. Slope is 3 to 6 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 375 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown and dark brown silt loam about 14 inches thick. The upper 20 inches of the subsoil is dark brown and brown, mottled silty clay loam, and the lower 26 inches is brown, mottled clay.

Included in this unit are small areas of Dayton, Hazelair, Pengra, Steiwer, and Woodburn soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Santiam soil is moderately slow to a depth of 34 inches and slow below this depth. Available water capacity is 9 to 11 inches. Effective rooting depth is 60 inches or more; however, root penetration is restricted by the dense clay layer and a seasonal high water table. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 2 to 3 feet from December to March.

Most areas of this unit are used for small grain, grass seed, and hay and pasture. Among the other crops grown are orchard and cannery crops. Some areas are used for wildlife habitat, recreation, and homesites.

If this unit is used for cultivated crops, the main limitations are slow permeability and wetness. Drainage is needed if this unit is to be used to its maximum potential. If a suitable outlet is available, subsurface drainage can be used to reduce wetness.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitations are wetness, slow permeability, shrink-swell potential, and low soil strength.

Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is poorly suited to septic tank absorption fields because of the seasonal high water table and slow permeability. Septic tank absorption fields can be installed in some areas where the depth to the water table is greater. The limitation of slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction. Roads need to be provided with a large amount of base rock to prevent settling.

This map unit is in capability subclass IIe.

90B—Saturn clay loam, 0 to 5 percent slopes. This deep, well drained soil is on low alluvial terraces along streams of uplands. It formed in poorly sorted alluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 800 to 1,500 feet. The average annual precipitation is 60 to 80 inches, the average annual air temperature is 47 to 51 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface is covered with a mat of leaves, twigs, and moss 1 inch thick. The surface layer is very dark grayish brown and dark brown clay loam about 10 inches thick. The upper 9 inches of the subsoil is dark brown clay loam, and the lower 17 inches is dark brown gravelly clay loam. The substratum to a depth of 60 inches or more is dark brown extremely gravelly loamy sand. In some areas of similar included soils, the surface layer is cobbly loam, cobbly silt loam, loam, or silt loam.

Included in this unit are small areas of Cumley and Minniece soils and Fluvaquents and Fluvents. Included areas make up about 20 percent of the total acreage.

Permeability of this Saturn soil is moderate to a depth of 36 inches and rapid below this depth. Available water capacity is 4 to 8 inches. Effective rooting depth is 60 inches; however, root penetration is restricted by the substratum of extremely gravelly loamy sand. Runoff is slow, and hazard of erosion is slight. A seasonal high water table is at a depth of 3.5 to 5.0 feet from December to March. This soil is subject to rare the periods of flooding.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, red alder, western hemlock, bigleaf maple, black cottonwood, and grand fir commonly grow on this unit. The main concerns in producing and harvesting timber are equipment limitations, seedling mortality, and plant competition.

When moist, unsurfaced roads and skid trails are sticky and plastic. They may be impassable during rainy periods. If wheeled and tracked equipment is used on this unit when the soil is moist, puddling and compaction occur. Compaction seriously reduces the productivity of the soil. Compaction can be reduced by using suitable methods for removing timber, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity.

The droughtiness of the surface layer increases seedling mortality. In areas that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings or by planting more trees than normal.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes vine maple, western swordfern, salal, cascade Oregon-grape, and trailing blackberry.

This map unit is in capability subclass IIIs.

91—Saturn Variant silt loam. This deep, moderately well drained soil is on stream terraces. It formed in mixed alluvium that is high in content of ash and is derived from mixed sources. Slopes are 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 350 to 550 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is black silt loam about 10 inches thick. The subsoil is very dark grayish brown and dark brown silty clay loam about 14 inches thick. The substratum to a depth of 60 inches or more is mottled, dark yellowish brown very gravelly clay loam.

Included in this unit are small areas of Courtney, Clackamas, and Salem soils. Included areas make up about 15 percent of the total acreage.

Permeability of the Saturn Variant soil is moderate to a depth of 24 inches and slow below this depth. Available water capacity is about 7 to 10 inches. Effective rooting depth is 60 inches or more; however, root penetration is restricted by the compacted very gravelly clay loam substratum and a seasonal high water table. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 2 to 3 feet from November to May.

This unit is used mainly for hay and pasture, small grain, and vegetables. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are droughtiness in summer and the seasonal high water table in winter.

All adapted pasture plants can be grown, but bunch-type species planted alone generally are not suitable because of the hazard of erosion. Using management that maintains optimum vigor and quality of forage plants is a good practice. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Sufficient water for irrigation generally can be obtained from nearby streams or wells. Drainage is needed if this soil is to be used to its maximum potential. Response to drainage is good if adequate outlets are available. Ripping and shattering the compacted substratum increases the effective rooting depth and improves internal drainage.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, subsoiling, or stubble mulching.

If this unit is used for homesite development, the main limitations are wetness, slow permeability, and moderate depth to the compacted substratum.

Septic tank absorption fields can be expected to function poorly on this unit in winter because the seasonal high water table and slow permeability of the substratum. Septic tank absorption fields can be installed in some areas where the depth to the water table is greater. The limitations of slow permeability and limited soil depth necessitate use of large septic tank absorption fields. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IVw.

92—Sifton Variant gravelly loam. This deep, somewhat excessively drained soil is on stream terraces. It formed in gravelly alluvium that is high in content of ash and is derived from mixed sources. Slopes are 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 600 to 1,100 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is black gravelly loam about 9 inches thick. The subsoil is very dark grayish brown very gravelly loam about 6 inches thick. The upper 9 inches of the substratum is dark brown extremely gravelly loamy sand, and the lower part to a depth of 60 inches or more is dark brown and dark yellowish brown extremely gravelly coarse sand. In some areas depth to the substratum is more than 18 inches.

Included in this unit are small areas of Clackamas, Malabon Variant, and Salem soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Sifton Variant soil is moderately rapid to rapid to the substratum and very rapid through it. Available water capacity is about 3 to 5 inches. Effective rooting depth is more than 60 inches; however, root penetration may be restricted by the substratum of extremely gravelly coarse sand. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for hay and pasture and small grain. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are droughtiness because of shallow depth to sand and gravelly material, and rock fragments on the surface.

All adapted pasture plants can be grown, but bunch-type species planted alone generally are not suitable because of the hazard of erosion. Using management that maintains optimum vigor and quality of forage plants is a good practice. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Sufficient water for irrigation generally can be obtained from nearby streams or wells.

Rock fragments on the surface limit the use of most equipment.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

If this unit is used for homesite development, the main limitation is the very rapid permeability of the substratum.

If this unit is used for septic tank absorption fields, the very rapid permeability of the substratum may result in contamination of ground water. If the density of housing is moderate to high, community sewage systems may be needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

Excavation for roads and buildings increases the risk of erosion. Preserving the existing plant cover during construction helps to control erosion. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

This map unit is in capability subclass IVs.

93C—Silverton silt loam, 3 to 12 percent slopes. This moderately deep, well drained soil is on low terraces and foot slopes of low foothills. It formed in colluvium derived dominantly from basic igneous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 225 to 325 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 11 inches thick. The upper 11 inches of the subsoil is very dark grayish brown silty clay loam, and the lower 15 inches is dark grayish brown and brown gravelly silty clay and clay. Basalt is at a depth of 37 inches.

Included in this unit are small areas of Nekia and Santiam soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Silverton soil is slow. Available water capacity is about 6 to 8 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. A seasonal high water table is at a depth of 2.5 to 5.0 feet from November to May.

This unit is used mainly for small grain, grass seed, orchards, and hay and pasture. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are wetness and depth to bedrock.

Drainage is needed if the unit is to be used to its maximum potential. Unless the soil is drained, long-lived, deep-rooted deciduous fruit and nut trees, strawberries, caneberries, and alfalfa are adversely affected by wetness. Tile systems are difficult to install because of the moderate depth to bedrock. They should be installed across the slope.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. All tillage should be on the contour or across the slope.

If this unit is used for homesite development, the main limitations are wetness, slow permeability, depth to bedrock, low soil strength, and shrink-swell potential. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock and slow permeability. Septic tank absorption fields can be installed in some areas where the depth to bedrock is greater. The limitation of slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIe.

94B—Stayton silt loam, 0 to 7 percent slopes. This shallow, well drained soil is in drainageways and other depressional areas of foothills. It formed in colluvium that is high in content of ash and is derived dominantly from basic igneous rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 250 to 1,200 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is black silt loam about 4 inches thick. The subsoil is dark reddish brown silt loam about 9 inches thick. Basalt is at a depth of 13 inches.

Included in this unit are small areas of Jory, Nekia, and Witzel soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Stayton soil is moderate. Available water capacity is 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 12 to 20 inches. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for pasture and small grain. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for hay and pasture, the main limitation is droughtiness because of the shallow depth to bedrock. Water for irrigation is often not available and usually must be stored in reservoirs. Suitable sites for reservoirs are limited.

Lack of sufficient moisture limits the amount of fertilizer that can be used by plants. A small amount of fertilizer can be applied in fall to take advantage of the moisture available in winter. Small grain and grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.

Returning all crop residue to the soil and using a cropping system that includes grasses or legumes or grass-legume mixtures help to maintain fertility and tilth. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Planting improved varieties of grasses early in spring ensures a better plant cover than if these grasses are planted later.

If this unit is used for homesite development, the main limitation is the shallow depth to bedrock, which restricts the installation of septic tank absorption fields and construction of roads and streets.

This map unit is in capability subclass VIe.

95C—Steiwer silt loam, 3 to 12 percent slopes. This moderately deep, well drained soil is on low foothills. It formed in colluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly hardwoods, scattered conifers, shrubs, and grasses. Elevation is 300 to 650 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The subsoil is dark yellowish brown silty clay loam about 18 inches thick. Weathered siltstone is at a depth of 32 inches.

Included in this unit are small areas of Chehulpum, Hazelair, Willakenzie, and Steiwer soils that have slopes of more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability of this Steiwer soil is moderately slow. Available water capacity is about 5 to 7 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for small grain, hay, pasture, and orchards. It is also used for homesites development, wildlife habitat, recreation, and limited timber production.

If this unit is used for cultivated crops, the main limitation is droughtiness because of the depth to bedrock. Water for irrigation is often not available and usually must be stored in reservoirs. Suitable sites for reservoirs are limited.

Lack of sufficient moisture limits the amount of fertilizer that can be used by plants. A small amount of fertilizer can be applied in fall to take advantage of the moisture available in winter. Small grain and grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Planting improved varieties of grasses early in spring ensures a better plant cover than if these grasses are planted later.

If this unit is used for hay and pasture, a permanent plant cover is needed to prevent runoff and erosion in winter. Using management that maintains optimum vigor and quality of forage plants is a good practice. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Rotation grazing helps to maintain the quality of forage.

If this unit is used for homesite development, the main limitations are depth to bedrock, low soil strength, and the shrink-swell potential.

Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock. Septic tank absorption fields can be installed in some areas where the depth to bedrock is greater.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

This unit is poorly suited to commercial timber production.

This map unit is in capability subclass IIIe.

95D—Steiwer silt loam, 12 to 20 percent slopes. This moderately deep, well drained soil is on low foothills. It formed in colluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly hardwoods, scattered conifers, shrubs, and grasses. Elevation is 300 to 650 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The subsoil is dark yellowish brown silty clay loam about 18 inches thick. Weathered siltstone is at a depth of 32 inches.

Included in this unit are small areas of Chehulpum, Hazelair, and Willakenzie soils. Also included are small areas of Steiwer soils that have slopes of less than 12 percent or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability of this Steiwer soil is moderately slow. Available water capacity is about 5 to 7 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate to high.

This unit is used mainly for small grain, hay, and pasture. It is also used for homesite development, wildlife habitat, recreation, and limited timber production and orchards.

If this unit is used for cultivated crops, the main limitations are droughtiness because of depth to bedrock and slope.

Water for irrigation is often not available and usually must be stored in reservoirs. Suitable sites for reservoirs are limited.

Lack of sufficient moisture limits the amount of fertilizer that can be used by plants. A small amount of fertilizer can be applied in fall to take advantage of the moisture available in winter. Small grain and grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Control of erosion is important on this unit because of the steepness of slope. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Planting improved varieties of grasses early in spring ensures a better plant cover than if these grasses are planted later.

If this unit is used for hay and pasture, a permanent plant cover is needed to prevent excessive erosion in winter. Using management that maintains optimum vigor and quality of forage plants is a good practice. Grazing when the soil is wet results in the compaction of the surface layer, poor tilth, and excessive runoff. Rotation grazing helps to maintain the quality of forage.

If this unit is used for homesite development, the main limitations are depth to bedrock, slope, low soil strength, and shrink-swell potential of the subsoil. Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock and slope. Septic tank absorption fields can be installed in some areas of this unit where the depth to bedrock is greater and the areas are less sloping. Absorption lines should be installed on the contour.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving existing plant cover during construction helps to control erosion.

This unit is poorly suited to commercial timber production.

This map unit is in capability subclass IVe.

95F—Steiwer silt loam, 20 to 50 percent slopes. This moderately deep, well drained soil is on low foothills. It formed in colluvium derived dominantly from sedimentary rock. The native vegetation is mainly hardwoods, scattered conifers, shrubs, and grasses. Elevation is 300 to 650 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The subsoil is dark yellowish brown silty clay loam about 18 inches thick. Weathered siltstone is at a depth of 32 inches.

Included in this unit are small areas of Chehulpum, Hazelair, and Willakenzie soils. Also included are small areas of Rock outcrop and Steiwer soils that have slopes of less than 20 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Steiwer soil is moderately slow. Available water capacity is about 5 to 7 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for pasture and wildlife habitat. It is also used for limited homesite development, limited timber production, and recreation.

The steepness of slope makes this unit is unsuitable for cultivation. If the unit is used for pasture the main limitations are droughtiness because of depth to bedrock and steepness of slope, which restrict equipment use and make control of erosion critical.

Lack of sufficient moisture limits the amount of fertilizer that can be used by plants. A small amount of fertilizer can be applied in fall to take advantage of the moisture available in winter. Planting improved varieties of grasses early in spring ensures a better plant cover than if these grasses are planted later.

Using management that maintains optimum vigor and quality of forage plants is a good practice. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Rotation grazing helps to maintain the quality of forage.

If this unit is used for homesite development, the main limitations are depth to bedrock and steepness slope. Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses. Slope limits use of some areas of this unit for building site development.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings helps to prevent structural damage because of shrinking and swelling.

This unit is poorly suited to commercial timber production.

This map unit is in capability subclass VIe.

96E—Valsetz stony loam, 3 to 30 percent slopes. This moderately deep, well drained soil is on ridgetops and side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 4,900 feet. The average annual precipitation is 80 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface is covered with a mat of twigs, needles, and leaves about 2 inches thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is reddish brown very gravelly loam about 9 inches thick. The subsoil is reddish brown very gravelly loam about 24 inches thick. Fractured basalt is at a depth of 36 inches.

Included in this unit are small areas of Bensley, Cruiser, Henline, Hummington, and Yellowstone soils and Valsetz soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Valsetz soil is moderate. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 115, the potential production per acre is 5,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 52,400 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. Douglas-fir, mountain hemlock, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Undesirable plants can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir, mountain hemlock, and noble fir.

The understory vegetation commonly growing on this unit includes tall blue huckleberry, Pacific rhododendron, salal, cascade Oregon-grape, and common beargrass.

This map unit is in capability subclass VIs.

97E—Valsetz-Yellowstone stony loams, 3 to 30 percent slopes. This map unit is on ridgetops and side slopes of uplands. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 5,000 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 70 to 110 days.

This unit is about 45 percent Valsetz stony loam and 40 percent Yellowstone stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Crabtree, Cruiser, Bensley, Henline, and Hummington soils. Also included are Valsetz and Yellowstone soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

The Valsetz soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of twigs, needles, and leaves about 2 inches thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is reddish brown very gravelly loam about 9 inches thick. The subsoil is reddish brown very gravelly loam about 24 inches thick. Fractured basalt is at a depth of 36 inches.

Permeability of the Valsetz soil is moderately rapid. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

The Yellowstone soil is shallow and somewhat excessively drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, needles, and moss about 1 inch thick. The surface layer is dark brown stony loam about 5 inches thick. The next layer is dark brown very stony sandy loam about 7 inches thick. The substratum is dark brown extremely stony sandy loam about 6 inches thick. Basalt is at a depth of 18 inches.

Permeability of the Yellowstone soil is moderately rapid. Available water capacity is about 1 inch to 2 inches. Depth to hard bedrock and effective rooting depth are 10 to 20 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 115 for the Valsetz soil, the potential production per acre is 5,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 52,400 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. On the basis of a site index of 80 for the Yellowstone soil, the potential production per acre is 3,920 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 22,990 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 110 years old. Douglas-fir, mountain hemlock, western white pine, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the depth to bedrock in this unit, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Undesirable plants, which can prevent or prolong natural or artificial reforestation on the Valsetz soil. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees to plant on this unit include Douglas-fir, mountain hemlock, and noble fir.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, cascade Oregon-grape, Pacific rhododendron, salal, and western swordfern.

This map unit is in capability subclass VIs.

97H—Valsetz-Yellowstone stony loams, 30 to 90 percent slopes. This map unit is on the side slopes of uplands. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 5,000 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 70 to 110 days.

This unit is about 45 percent Valsetz stony loam and 40 percent Yellowstone stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Crabtree, Cruiser, Bensley, Henline, and Hummington soils. Also included are Valsetz and Yellowstone soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

The Valsetz soil is moderately deep and well drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of twigs, needles, and leaves about 2 inches thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is reddish brown very gravelly loam about 9 inches thick. The subsoil is reddish brown very gravelly loam about 24 inches thick. Fractured basalt is at a depth of 36 inches.

Permeability of the Valsetz soil is moderately rapid. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Yellowstone soil is shallow and somewhat excessively drained. It formed in colluvium derived dominantly from basic igneous rock. Typically, the surface is covered with a mat of leaves, needles, and moss about 1 inch thick. The surface layer is dark brown stony loam about 5 inches thick. The next layer is dark brown very stony sandy loam about 7 inches thick. The substratum is dark brown extremely stony sandy loam about 6 inches thick. Basalt is at a depth of 18 inches.

Permeability of the Yellowstone soil is moderately rapid. Available water capacity is about 1 inch to 2 inches. Depth to hard bedrock and effective rooting depth are 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 115 for the Valsetz soil, the potential production per acre is 5,460 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 52,400 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. On the basis of a site index of 80 for the Yellowstone soil, the potential production per acre is 3,920 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 22,990 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 110 years old. Douglas-fir, mountain hemlock, western white pine, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

Droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the depth to bedrock in this unit, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Undesirable plants may prolong natural or artificial reforestation on the Valsetz soil. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, mountain hemlock, and noble fir.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, cascade Oregon-grape, Pacific rhododendron, salal, and western swordfern.

This map unit is in capability subclass VIIs.

98—Waldo silty clay loam. This deep, poorly drained soil is in depressional areas of the high flood plains and low alluvial stream terraces. It formed in silty and clayey alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, sedges, rushes, and grasses.

Elevation is 250 to 900 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark gray silty clay loam about 6 inches thick. The next layer is very dark gray, mottled silty clay loam about 14 inches thick. The upper 18 inches of the subsoil is dark gray, mottled silty clay, and the lower 9 inches is dark grayish brown, mottled silty clay. The substratum to a depth of 72 inches is grayish brown, mottled silty clay. In some areas of similar included soils, the surface layer is silt loam.

Included in this unit are small areas of Bashaw and McAlpin soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Waldo soil is slow. Available water capacity is about 9 to 11 inches. Effective rooting depth is 60 inches; however, root penetration may be restricted by the dense clay layer and a seasonal high water table. Runoff is slow, and the hazard of erosion is slight except during periods of flooding. A seasonal high water table is at a depth of 0 to 0.5 foot from November to May. This soil is subject to occasional periods of flooding from January to April.

This unit is used mainly for small grain, grass seed, and hay and pasture. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are wetness and the hazard of flooding. Drainage is needed if this unit is to be used to its maximum potential. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. Drainage is difficult and expensive because the dense clay requires close spacing of the tile drains.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Erosion caused by the occasional periods of flooding and by runoff from higher lying areas can be controlled by growing a winter cover crop each year and by properly managing crop residue. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. To minimize damage to crops and compaction of the soil, vehicles with large, low-pressure tires should be used to apply fertilizer early in spring. Grasses respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.

If this unit is used for homesite development, the main limitations are wetness, slow permeability, the hazard of flooding, shrink-swell potential, and low soil strength. Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings. Excess water can be removed by using suitably designed drainage ditches. Roads and streets should be located above the expected flood level.

This unit is not suited to septic tank absorption fields because of wetness, slow permeability, and the hazard of flooding, which adversely affect the treatment and absorption processes.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling.

This map unit is in capability subclass IIIw.

99—Wapato silty clay loam. This deep, poorly drained soil is in old abandoned river channels and depressional areas of flood plains. It formed in moderately fine textured recent alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, grasses, and sedges. Elevation is 150 to 600 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown, mottled silty clay loam about 17 inches thick. The subsoil is dark grayish brown, mottled silty clay loam about 31 inches thick. The substratum to a depth of 60 inches or more is grayish brown, mottled silty clay. In some areas of similar included soils, the surface layer is silt loam.

Included in this unit are small areas of Chehalis, McBee, and Waldo soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Wapato soil is moderately slow. Available water capacity is about 10 to 12 inches. Effective rooting depth is 60 inches; however, root penetration may be restricted by a seasonal high water table. Runoff is slow to ponded, and the hazard of erosion is slight except during frequent periods of flooding from December to April. A seasonal high water table is at a depth of 1 foot above the surface to 1 foot below the surface from November to May.

This unit is used mainly for small grain, hay, pasture, and grass seed. It is also used for homesite development, wildlife habitat, and recreation (fig. 18).

If this unit is used for crops, the main limitations are wetness and the hazard of flooding. Drainage is needed if this unit is to be used to its maximum potential. Unless

Figure 18.—Area of Wapato silty clay loam used extensively by waterfowl and other wetland wildlife.

the soil is drained, long-lived, deep-rooted deciduous fruit and nut trees, strawberries, caneberries, and alfalfa are adversely affected by wetness. Response to drainage is good if adequate outlets are available.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation can be used, but water needs to be applied slowly to minimize runoff. Sprinkler irrigation is a suitable method of applying water. Because of the moderately slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Erosion caused by the frequent periods of flooding and by runoff from higher lying areas can be controlled by growing a winter cover crop each year and by properly managing crop residue. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. To minimize damage to crops and compaction of the soil, vehicles with large, low-pressure tires should be used to apply fertilizer early in spring. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

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

This unit is not suited to septic tank absorption fields because of wetness, moderately slow permeability, and flooding, which adversely affect the treatment and absorption processes. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Buildings, roads, and streets should be located above the expected flood level.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling.

This map unit is in capability subclass IIIw.

100—Whiteson silt loam. This deep, somewhat poorly drained to poorly drained soil is on flood plains. It formed in medium textured recent alluvium overlying fine textured, older alluvium derived from mixed sources. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly hardwoods, shrubs, and grasses. Elevation is 200 to 700 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 11 inches thick. The subsoil is mottled, dark grayish brown clay loam about 4 inches thick. The upper 28 inches of the substratum is mottled, gray and olive gray silty clay and clay, and the lower part to a depth of 60 inches or more is variegated olive gray and dark grayish brown gravelly sandy clay loam.

Included in this unit are small areas of Bashaw, Chehalis, McBee, Waldo, and Wapato soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Whiteson soil is very slow. Available water capacity is about 5 to 7 inches. Effective rooting depth is 60 inches; however, root penetration may be restricted by the dense clay layer and a seasonal high water table. Runoff is slow, and the hazard of erosion is slight except during frequent periods of flooding from December to April. A seasonal high water table is at a depth of 0 to 1 foot from November to May.

This unit is used mainly for hay, pasture, and grass seed. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for crops, the main limitations are wetness and the hazard flooding. This unit generally is not suited to deep-rooted perennial crops, because adequate drainage usually cannot be maintained in winter and spring. Drainage is needed if this unit is to be used to its maximum potential. If a suitable outlet is available, subsurface drainage can be used to reduce wetness. Drainage is difficult and expensive because the dense clay requires close spacing of the tile drains.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil, and it restricts the growth of roots. Erosion caused by the frequent periods of flooding and by runoff from higher lying areas can be controlled by growing a winter cover crop each year and by properly managing crop residue. Grasses respond to nitrogen.

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

This unit is not suited to septic tank absorption fields because of wetness, very slow permeability, and the hazard of flooding, which adversely affect the treatment and absorption process. Buildings, roads, and streets should be located above the expected flood level.

Buildings and roads should be designed to offset the effects of shrinking and swelling.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high clay content in the substratum requires reinforcement in foundations and footings of buildings.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction. Roads need to be provided with a large amount of base rock to prevent settling.

This map unit is in capability subclass IVw.

101C—Willakenzie clay loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on low foothills. It formed in colluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is reddish brown clay loam, and the lower 12 inches is reddish brown and yellowish red silty clay loam. Weathered sandstone is at a depth of 22 inches.

Included in this unit are small areas of Bellpine, Hazelair, Jory, and Nekia soils and Willakenzie soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Willakenzie soil is moderately slow. Available water capacity is 3 to 5 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for small grain, hay, pasture, orchards, and Christmas trees. It is also used for timber production, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It has few limitations.

In summer, irrigation is needed for maximum production of most crops. Water for irrigation is often not available and usually must be stored in reservoirs. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Lack of sufficient moisture limits the amount of fertilizer that can be used by plants. A small amount of fertilizer can be applied in fall to take advantage of the moisture available in winter. Small grain, grasses, and orchards respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of windthrow and plant competition.

Because roots are restricted by moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes Pacific poison-oak, common snowberry, western brackenfern, trailing blackberry, and rose.

If this unit is used for homesite development, the main limitations are depth to bedrock, moderately slow permeability, low soil strength, and the shrink-swell potential of the subsoil. Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock and moderately slow permeability. Septic tank absorption fields can be installed in some areas where the depth to bedrock is greater. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling. Settling can be minimized by compacting the disturbed areas before beginning construction.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Excavation for roads and buildings increases the risk of erosion. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIIe.

101D—Willakenzie clay loam, 12 to 20 percent slopes. This moderately deep, well drained soil is on low foothills. It formed in colluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is reddish brown clay loam, and the lower 12 inches is reddish brown and yellowish red silty clay loam. Weathered sandstone is at a depth of 22 inches.

Included in this unit are small areas of Bellpine, Hazelair, Jory, and Nekia soils and Willakenzie soils that have slopes of less than 12 percent or more than 20 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Willakenzie soil is moderately slow. Available water capacity is about 3 to 5 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate to high.

This unit is used mainly for small grain, hay, pasture, orchards, and Christmas trees. It is also used for timber production, wildlife habitat, and recreation.

This unit is suited to most climatically adapted crops. It is limited mainly by slope in some areas.

In summer, irrigation is needed for maximum production of most crops. Water for irrigation is often not available and usually must be stored in reservoirs. Only a few areas are irrigated by sprinklers.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching. Constructing terraces reduces runoff and the risk of erosion and conserve moisture. All tillage should be on the contour or across the slope. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Small grain, grasses, and orchards respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of windthrow and plant competition.

Because roots are restricted by moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes Pacific poison-oak, common snowberry, western brackenfern, trailing blackberry, and rose.

If this unit is used for homesite development, the main limitations are depth to bedrock, moderately slow permeability, slope, low soil strength, and the shrink-swell potential of the subsoil. Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is poorly suited to septic tank absorption fields because of depth to bedrock, slope, and moderately slow permeability. Septic tank absorption fields can be installed in some areas of this unit where the depth to bedrock is greater and the areas are less sloping. Absorption lines should be installed on the contour. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling. Settling can be minimized by compacting the disturbed areas before beginning construction.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IIIe.

101E—Willakenzie clay loam, 20 to 30 percent slopes. This moderately deep, well drained soil is on low foothills. It formed in colluvium derived dominantly from sedimentary rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is

300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is reddish brown clay loam, and the lower 12 inches is reddish brown and yellowish red silty clay loam. Weathered sandstone is at a depth of 22 inches.

Included in this unit are small areas of Bellpine, Hazelair, Jory, and Nekia soils and Willakenzie soils that have slopes of less than 20 percent percent or more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Willakenzie soil is moderately slow. Available water capacity is about 3 to 5 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is medium, and the hazard of erosion is high.

This unit is used mainly for timber production and pasture. It is also used for homesite development, orchards, wildlife habitat, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Logging roads, skid trails, cutbanks, and landings can be protected from erosion by constructing water bars and by seeding.

Because roots are restricted by moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes Pacific poison-oak, common snowberry, western brackenfern, trailing blackberry, and rose.

The steepness of slope makes this unit is unsuitable for cultivation. If the unit is used for pasture and orchards, the main limitation is slope. This unit is suited to limited tillage only for management of pasture.

If this unit is used for hay and pasture, a permanent plant cover is needed to prevent excessive runoff and erosion in winter. Seedbed preparation should be on the contour or across the slope where practical. Using management that maintains optimum vigor and quality of forage plants is a good practice. Rotation grazing helps to maintain the quality of forage. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for homesite development, the main limitations are depth to bedrock, moderately slow permeability, slope, low soil strength, and the shrink-swell potential of the subsoil. Cuts needed to provide essentially level building sites can expose bedrock. The bedrock is rippable and therefore is not a serious limitation for most engineering uses.

This unit is not suited to septic tank absorption fields because of depth to bedrock, slope, and moderately slow permeability.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling. Settling can be minimized by compacting the disturbed areas before beginning construction.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass IVe.

101F—Willakenzie clay loam, 30 to 50 percent slopes. This moderately deep, well drained soil is on low foothills. It formed in colluvium derived dominantly from sedimentary rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,400 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is reddish brown clay loam, and the lower 12 inches is reddish brown and yellowish red silty clay loam. Weathered sandstone is at a depth of 22 inches.

Included in this unit are small areas of Bellpine, Hazelair, Jory, and Nekia soils and Willakenzie soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Willakenzie soil is moderately slow. Available water capacity is about 3 to 5 inches. Depth to soft bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 140, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 110. Douglas-fir, Oregon white oak, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, the hazard of windthrow, and plant competition.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

Landsliding or slumping may occur when the soil becomes saturated and is disturbed by constructing roads or harvesting timber.

Because roots are restricted by the moderate depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Reforestation must be carefully managed to reduce competition from undesirable plants, which can prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir.

The understory vegetation commonly growing on this unit includes Pacific poison-oak, common snowberry, western brackenfern, trailing blackberry, and rose.

This map unit is in capability subclass VIe.

102—Willamette silt loam. This deep, well drained soil is in slightly convex areas on broad valley terraces. It formed in silty alluvium derived from mixed material. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 200 to 300 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown silt loam about 13 inches thick. The next layer is very dark grayish brown silt loam about 9 inches thick. The upper 21 inches of the subsoil is dark brown silty clay loam, and the lower 8 inches is dark yellowish brown silty clay loam. The substratum to a depth of 60 inches or more is dark yellowish brown silty clay loam. In some areas of similar included soils, faint mottles are below a depth of 30 inches.

Included in this unit are small areas of Amity, Concord, Dayton, Holcomb, and Woodburn soils and Willamette soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Willamette soil is moderate. Available water capacity is about 11 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for small grain, grass seed, orchards, berries, and vegetables. It is also used for homesite development, wildlife habitat, and recreation.

This unit is well suited to all climatically adapted crops. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Compaction limits the movement of air and water in the soil, and it restricts the growth of roots. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, subsoiling, or stubble mulching.

If this unit is used for homesite development, it is limited mainly by shrink-swell potential and low soil strength.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling.

Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability class I.

103C—Witham silty clay, 2 to 12 percent slopes. This deep, somewhat poorly drained soil is on alluvial fans, foot slopes, and terraces. It formed in alluvium and colluvium derived from mixed sources. The vegetation in areas not cultivated is mainly hardwoods, scattered conifers, shrubs, and grasses. Elevation is 300 to 1,200 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 11 inches thick. The subsoil is dark brown clay about 16 inches thick. The upper 19 inches of the substratum is dark grayish brown clay, and the lower part to a depth of 60 inches or more is dark brown clay.

Included in this unit are small areas of Bashaw, Dixonville, Philomath, and Ritner soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Witham soil is very slow. Available water capacity is 7 to 9 inches. Effective rooting depth is 60 inches; however, root penetration may be restricted by the dense clay layer and a seasonal high water table. Runoff is slow to medium, and the hazard of erosion is slight to moderate. A seasonal high water table is at a depth of 1.5 to 2.5 feet from November to May.

This unit is used mainly for hay, pasture, and limited small grain. It is also used for homesite development, wildlife habitat, and recreation.

If this unit is used for hay and pasture, the main limitations are the very slow permeability and wetness. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff.

Using management that maintains optimum vigor and quality of forage plants is a good practice. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for cultivated crops, the main limitations are wetness and very slow permeability. Drainage is needed if this unit is to be used to its maximum potential. If a suitable outlet is available, subsurface drainage can be used to reduce wetness.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, resulting in excessive runoff and erosion. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, or stubble mulching.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grasses and row crops respond to nitrogen, and legumes respond to phosphorus, boron, sulfur, and lime.

This unit is poorly suited to homesite development. The main limitations are the very slow permeability, wetness, high shrink-swell potential, and low soil strength.

Drainage is needed if roads and building foundations are constructed. Wetness can be reduced by installing drain tile around footings.

This unit is poorly suited to septic tank absorption fields because of the seasonal high water table and very slow permeability. Septic tank absorption fields can be installed in some areas where the depth to the water table is greater. The limitation of very slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. The high content of clay in the subsoil makes it necessary to reinforce foundations and footings for buildings.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Roads need to be provided with a large amount of base rock to prevent settling.

This map unit is in capability subclass IIIe.

104E—Witzel very cobbly loam, 3 to 30 percent slopes. This shallow, well drained soil is on low foothills adjacent to the Willamette Valley. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown very cobbly loam about 5 inches thick. The subsoil is dark brown very cobbly clay loam about 11 inches thick. Basalt is at a depth of 16 inches.

Included in this unit are small areas of Jory, Nekia, and Ritner soils and Witzel soils that have slopes of more than 30 percent. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Witzel soil is moderately slow. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 12 to 20 inches. Runoff is slight to medium, and the hazard of erosion is slight to high.

This unit is used mainly for native pasture. It is also used for limited timber production and homesite development, wildlife habitat, and recreation.

If this unit is used for native pasture, the main limitations are droughtiness and slope. The soil in this unit is droughty because of low rainfall in summer and shallow depth to bedrock. Lack of sufficient moisture limits the amount of fertilizer that can be used by plants. A small amount of fertilizer can be applied in fall to take advantage of the moisture available in winter.

The use of equipment is limited by stones on the surface and by slope.

Using management that maintains optimum vigor and quality of forage plants is a good practice. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen promotes good growth of forage plants.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 115, the potential production per acre is 6,360 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 57,960 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 90. Douglas-fir, Oregon white oak, and ponderosa pine commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large number of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the shallow depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Trees suitable for planting on this unit include ponderosa pine and Douglas-fir.

The understory vegetation commonly growing on this unit includes rose, Pacific poison-oak, and common snowberry.

If this unit is used for homesite development, the main limitations are the shallow depth to bedrock, slope, and stones on the surface. Cuts needed to provide essentially level building sites can expose bedrock. The large cobbles and stones in the soil interfere with excavations for installing utilities.

Septic tank absorption fields are not suited to this unit because of the shallow depth to bedrock and slope.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass VIs.

104G—Witzel very cobbly loam, 30 to 70 percent slopes. This shallow, well drained soil is on low foothills adjacent to the Willamette Valley. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 300 to 1,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown very cobbly loam about 5 inches thick. The subsoil is dark brown very cobbly clay loam about 11 inches thick. Basalt is at a depth of 16 inches.

Included in this unit are small areas of Jory, Nekia, and Ritner soils and Witzel soils that have slopes of less than 30 percent. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Witzel soil is moderately slow. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 12 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for wildlife habitat. It is also used for limited timber production and recreation.

This unit is poorly suited to Douglas-fir. On the basis of a site index of 115, the potential production per acre is 6,360 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 57,960 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 90 years old. On the basis of a 50-year site curve, the mean site index is 90. Douglas-fir, Oregon white oak, and ponderosa pine commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large number of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the shallow depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and winds are strong.

Trees suitable for planting on this unit include ponderosa pine and Douglas-fir.

The understory vegetation commonly growing on this unit includes rose, Pacific poison-oak, and common snowberry.

This map unit is in capability subclass VIs.

105C—Witzel Variant very cobbly silt loam, 0 to 12 percent slopes. This shallow, well drained soil is on low foothills. It formed in colluvium that is high in content of volcanic ash and is derived dominantly from basic igneous rock. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 500 to 1,200 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is dark brown very cobbly silt loam about 6 inches thick. The next layer is dark brown very cobbly silt loam about 12 inches thick. Partially fractured basalt is at a depth of 18 inches.

Included in this unit are small areas of Jory, Nekia, Ritner, and Stayton soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Witzel Variant soil is moderate. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 12 to 20 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for hay and pasture. It is also used for limited homesite development, wildlife habitat, and recreation.

If this unit is used for hay and pasture, the main limitation is droughtiness. The soil in this unit is droughty because of low rainfall in summer and shallow depth to bedrock. Lack of sufficient moisture limits the amount of fertilizer that can be used by plants. A small amount of fertilizer can be applied in fall to take advantage of the moisture available in winter.

Stones on the surface limit the use of most equipment.

Using management that maintains optimum vigor and quality of forage plants is a good practice. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rate, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen promotes good growth of forage plants.

If this unit is used for homesite development, the main limitations are shallow depth to bedrock and stones on the surface. Cuts needed to provide essentially level building sites can expose bedrock. The large cobbles and stones in the soil interfere with excavations for installing utilities.

Septic tank absorption fields are not suited to this unit because of the shallow depth to bedrock.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability subclass VIs.

106A—Woodburn silt loam, 0 to 3 percent slopes. This deep, moderately well drained soil is in slightly convex areas on broad valley terraces. It formed in silty alluvium derived from mixed sources. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 200 to 300 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown silt loam about 6 inches thick. The next layer is dark brown silt loam about 13 inches thick. The upper 35 inches of the subsoil is dark brown and brown, mottled silty clay loam, and the lower 6 inches is brown silty clay loam.

Included in this unit are small areas of Amity, Concord, Dayton, Holcomb, and Willamette soils and Woodburn soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Woodburn soil is moderately slow to a depth of 54 inches and slow below this depth.

Available water capacity is about 11 to 13 inches. Effective rooting depth is 60 inches; however, root penetration may be restricted by a seasonal high water table. Runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 2 to 3 feet from December to April.

This unit is used mainly for small grain, grass seed, orchards, berries, and vegetables. It is also used for homesite development, wildlife habitat, and recreation.

This unit is well suited to cultivated crops. It is limited mainly by wetness in winter. Drainage is needed if this unit is to be used to its maximum potential. Response to drainage is good if adequate outlets are available.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Compaction limits the movement of air and water in the soil, and it restricts the growth of roots. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, subsoiling, or stubble mulching.

If this unit is used for homesite development, the main limitations are the shrink-swell potential, low soil strength, wetness, and slow permeability.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction.

The risk of erosion is increased if the soil is left exposed during site development. Preserving the existing plant cover during construction helps to control erosion.

This unit is poorly suited to septic tank absorption fields because of slow permeability and the seasonal high water table. Septic tank absorption fields can be installed in some areas where the depth to the water table is greater. The limitation of slow permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass IIw.

106C—Woodburn silt loam, 3 to 12 percent slopes. This deep, moderately well drained soil is in convex areas on broad valley terraces. It formed in silty alluvium derived from mixed sources. The vegetation in areas not cultivated is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 200 to 300 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark brown silt loam about 6 inches thick. The next layer is dark brown silt loam about 13 inches thick. The upper 35 inches of the subsoil is dark brown and brown, mottled silty clay loam, and the lower 6 inches is brown silty clay loam.

Included in this unit are small areas of Amity, Concord, Dayton, Holcomb, and Willamette soils and Woodburn soils that have slopes of less than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Woodburn soil is moderately slow to a depth of 54 inches and slow below this depth. Available water capacity is about 11 to 13 inches. Effective rooting depth is 60 inches; however, root penetration may be restricted by a seasonal high water table. Runoff is slow to medium, and the hazard of erosion is slight to moderate. A seasonal high water table is at a depth of 2 to 3 feet from December to April.

This unit is used mainly for small grain, grass seed, orchards, berries, and vegetables. It is also used for homesite development, wildlife habitat, and recreation.

This unit is well suited to cultivated crops. It is limited mainly by wetness in winter. Drainage is needed if this unit is to be used to its maximum potential. Response to drainage is good if adequate outlets are available. Tile drainage can be used to reduce wetness if a suitable outlet is available.

In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. Where stubble mulching is practiced or crop residue is used, additional nitrogen is needed to maintain yields.

Conducting field operations during periods when the soil is wet reduces tilth and destroys structure, which results in increased runoff and erosion. Compaction limits the movement of air and water in the soil, and it restricts the growth of roots. All tillage should be on the contour or across the slope. Runoff and erosion can be controlled by managing residue, using rough or minimum tillage, growing winter cover crops, subsoiling, or stubble mulching.

If this unit is used for homesite development, the main limitations are the shrink-swell potential, low soil strength, wetness, and slow permeability. Slope is a limitation for small commercial buildings.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from the buildings help to prevent structural damage because of shrinking and swelling. Roads and streets should be designed to offset the limited ability of the soil in this unit to support a load. Settling can be minimized by compacting the disturbed areas before beginning construction.

This unit is poorly suited to septic tank absorption fields because of slow permeability and seasonal high water table. Septic tank absorption fields can be installed in some areas where the depth to the water table is greater. The limitation of slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches for diverting subsurface water improve the operation of septic tank absorption fields.

This map unit is in capability subclass IIe.

107E—Yellowstone stony loam, 3 to 30 percent slopes. This shallow, somewhat excessively drained soil is on narrow ridgetops and side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,700 to 5,000 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 70 to 110 days.

Typically, the surface is covered with a mat of leaves, needles, and moss about 1 inch thick. The surface layer is dark brown stony loam about 5 inches thick. The next layer is dark brown very stony sandy loam about 7 inches thick. The substratum is dark brown extremely stony sandy loam about 6 inches thick. Basalt is at a depth of 18 inches.

Included in this unit are small areas of Bensley, Cruiser, Henline, and Hummington soils, Orthents, Rock outcrop, Valsetz soils, and Yellowstone soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Yellowstone soil is moderately rapid. Available water capacity is about 1 inch to 2 inches. Depth to hard bedrock and effective rooting depth are 10 to 20 inches. Runoff is slow to medium, and the hazard of erosion is slight to high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 80, the potential production per acre is 3,920 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 22,990 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 110 years old. Douglas-fir, mountain hemlock, western white pine, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Using standard wheeled and tracked equipment when the soil is dry causes rutting and displacement of the surface layer. Using vehicles that have large, low-pressure tires reduces damage to the soil and helps to maintain productivity. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the shallow depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Undesirable plants may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

Trees suitable for planting on this unit include Douglas-fir, mountain hemlock, and noble fir.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, Pacific rhododendron, and western swordfern.

This map unit is in capability subclass VIs.

107H—Yellowstone stony loam, 30 to 90 percent slopes. This shallow, somewhat excessively drained soil is on the side slopes of uplands. It formed in colluvium derived dominantly from basic igneous rock. The native vegetation is mainly conifers, shrubs, and grasses.

Elevation is 2,700 to 5,000 feet. The average annual precipitation is 70 to 120 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 70 to 110 days.

Typically, the surface is covered with a mat of leaves, needles, and moss about 1 inch thick. The surface layer is dark brown stony loam about 5 inches thick. The next layer is dark brown very stony sandy loam about 7 inches thick. The substratum is dark brown extremely stony sandy loam about 6 inches thick. Basalt is at a depth of 18 inches.

Included in this unit are small areas of Bensley, Cruiser, Henline, and Hummington soils, Orthents, Rock outcrop, Valsetz soils, and Yellowstone soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Yellowstone soil is moderately rapid. Available water capacity is about 1 inch to 2 inches. Depth to hard bedrock and effective rooting depth are 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber production. It is also used for wildlife habitat, water supply, and recreation.

This unit is poorly suited to the production of Douglas-fir. On the basis of a site index of 80, the potential production per acre is 3,920 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 22,990 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 110 years old. Douglas-fir, mountain hemlock, western white pine, and noble fir commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and the hazard of windthrow.

When harvesting timber on this unit, it is essential to use management that minimizes erosion. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems. Road location and maintenance costs are greater in the more steeply sloping areas. Snowpack limits the use of equipment and restricts access.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the shallow depth to bedrock, trees are subject to windthrow. Windthrow is a hazard when the soil is wet and the winds are strong.

Undesirable plants may prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir, mountain hemlock, and noble fir.

The understory vegetation commonly growing on this unit includes common beargrass, tall blue huckleberry, Pacific rhododendron, and western swordfern.

This map unit is in capability subclass VIIs.

108H—Zango-Dobbins gravelly loams, 60 to 90 percent slopes. This map unit is on the side slopes of uplands. The native vegetation is mainly conifers, hardwoods, shrubs, and grasses. Elevation is 650 to 2,800 feet. The average annual precipitation is 60 to 90 inches, the average annual air temperature is 45 to 53 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Zango gravelly loam and 40 percent Dobbins gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Apt, Flane, Kilchis, Klickitat, and Moe soils. Included areas make up about 15 percent of the total acreage.

The Zango soil is shallow and excessively drained. It formed in colluvium derived dominantly from andesite, breccia, and light-colored tuff. Typically, the surface layer is very dark grayish brown gravelly loam about 5 inches thick. The subsoil is dark yellowish brown very cobbly loam about 8 inches thick. Basalt is at a depth of 13 inches.

Permeability of the Zango soil is moderate. Available water capacity is about 1 inch to 2 inches. Depth to hard bedrock and effective rooting depth are 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

The Dobbins soil is moderately deep and well drained. It formed in colluvium derived dominantly from tuffaceous and basic igneous rock and breccia. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is very

Figure 19.—Cable-yard logging in an area of Zango-Dobbins gravelly loams, 60 to 90 percent slopes.

dark grayish brown gravelly loam about 4 inches thick. The next layer is dark yellowish brown very gravelly silty clay loam about 8 inches thick. The subsoil is dark brown and dark yellowish brown very cobbly silty clay about 22 inches thick. Fractured basalt is at a depth of 34 inches.

Permeability of the Dobbins soil is moderately slow. Available water capacity is about 1 inch to 3 inches. Depth to hard bedrock and effective rooting depth are 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is mainly used for timber production. It is also used for wildlife habitat, water supply, and recreation.

The Zango soil is poorly suited to the production of Douglas-fir. On the basis of a site index of 110 for the Zango soil, the potential production per acre is 5,880 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 58,100 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 100 years old. On the basis of a 50-year site curve, the mean site index is 90. The Dobbins soil is suited to the production of Douglas-fir. On the basis of a site index of 140 for the Dobbins soil, the potential production per acre is 8,700 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 77,280 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old. On the basis of a 50-year site curve, the mean site index is 100. Douglas-fir, western hemlock, western redcedar, and bigleaf maple commonly grow on this unit. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and the hazard of windthrow.

Minimizing the risk of erosion is essential in harvesting timber. Erosion can be minimized by not disturbing the soil excessively while logging; by seeding roads, cutbanks, and landings; and by installing water bars or culverts. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. Casting material to the side when building roads can damage vegetation and is a potential source of sedimentation. Hauling away waste material minimizes damage to the soil and to the plant cover downslope of roadbuilding sites.

Steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and disturbs the soil less. Highlead logging or other logging systems that fully or partially suspend logs damage the soil less and generally are less costly than tractor systems (fig. 19). Road location and maintenance costs are greater in the more steeply sloping areas.

The droughtiness of the surface layer increases seedling mortality, especially on south- and southwest-facing slopes. In areas on south-facing slopes that are droughty in summer, seedling mortality can be reduced by providing shade for seedlings. The large amount of rock fragments in the soil limits seedling survival. To compensate for the higher mortality rate that can be expected, larger trees or more trees than normal can be planted.

Because roots are restricted by the depth to bedrock in this unit, trees are subject to windthrow. Trees commonly are subject to windthrow when the soil is wet and the winds are strong.

Undesirable plants may prevent or prolong natural or artificial reforestation. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

Trees suitable for planting on this unit include Douglas-fir and western hemlock.

The understory vegetation commonly growing on this unit includes cascade Oregon-grape, red huckleberry, rose, salal, trailing blackberry, vine maple, western brackenfern, and western swordfern.

This map unit is in capability subclass VIIe.

Prime Farmland

In this section, prime farmland is defined and discussed and the prime farmland soils in this survey area are listed.

Prime farmland is of major importance in providing the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, seed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. Adequate moisture and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal units of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils either are used for producing food or fiber or are available for these uses. Urban or developed land and water areas cannot be considered prime farmland.

Prime farmland soils commonly get an adequate and dependable supply of moisture from precipitation or irrigation. Temperature and growing season are favorable, and level of acidity or alkalinity is acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 220,750 acres, or nearly 25 percent of the survey area, would meet the requirements for prime farmland if adequate drainage and a dependable supply of irrigation water were available.

The major areas are in general soil map units 1, 2, 5, 6, 7, 8, 9, and 11. The major crops grown are ryegrass seed, winter wheat, sweet corn, snap beans, and pasture. Soils in the area that have been drained are identified by an asterisk.

The following map units meet the soil requirements for prime farmland when irrigated. On some soils included in the list, measures should be used to overcome a hazard or limitation, such as flooding, wetness, or droughtiness. The location of each map unit is shown on the detailed soil maps at the back of this publication. Soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Soils in the area that have been drained are identified by an asterisk.

1A Abiqua silty clay loam, 0 to 3 percent slopes
1B Abiqua silty clay loam, 3 to 5 percent slopes
3 Amity silt loam*
9C Bellpine silty clay loam, 3 to 12 percent slopes
16B Briedwell silt loam, 0 to 7 percent slopes
19 Chapman loam
21 Chehalis silty clay loam
24 Clackamas Variant silt loam
25 Cloquato silt loam
26 Coburg silty clay loam
46 Holcomb silt loam*
51C Jory silty clay loam, 2 to 12 percent slopes
63 Malabon silty clay loam
64 Malabon Variant loam
66B McAlpin silty clay loam, 3 to 6 percent slopes
67 McBee silty clay loam
72C Nekia silty clay loam, 2 to 12 percent slopes
73 Newberg fine sandy loam
77A Pengra silt loam, 1 to 4 percent slopes*
87 Salem gravelly silt loam
88B Salkum silty clay loam, 2 to 8 percent slopes
89B Santiam silt loam, 3 to 6 percent slopes
91 Saturn Variant silt loam
101C Willakenzie clay loam, 2 to 12 percent slopes
102 Willamette silt loam
106A Woodburn silt loam, 0 to 3 percent slopes

Use and Management of the Soils

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

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

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

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

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification used by the Soil Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants commonly grown are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1981 about 233,475 acres in the survey area was used as cropland. Of this total acreage, about 148,950 acres was in grass seed, mainly ryegrass; 40,800 acres in small grain, mainly wheat; 26,400 acres in hay; 6,500 acres in mint; 3,590 acres in sweet corn; 2,360 acres in snap beans; 1,100 acres in corn for silage; and 3,775 acres in tree fruit, nuts, berries, vegetables, and other specialty crops (*16*). The cropland in the area is mainly in the Willamette Valley, but smaller acreages are in the North Santiam, South Santiam, and Calapooya River valleys. Not included in the total cropland acreage is an additional 180,000 acres used for small woodland operations.

The soils in the survey area have many characteristics that affect their behavior and response to management for various uses. Productivity on each soil under specific management conditions can be maintained or improved only if the unique characteristics of the soil are understood and the best management practices are used. One such characteristic is the susceptibility of the soils to compaction when farm machinery, vehicles, or livestock come in contact with the soil at improper times. Soil compaction results in reduced permeability, a lower water intake rate, restricted root development, and increased runoff and erosion, all of which adversely affect both the productivity of the soils and conservation of soil and water.

The prevention or reduction of soil compaction can be accomplished by several means. Changing the types of tillage tools used and periodically adjusting the operating depth of tillage tools help to minimize compaction. Restricting tillage practices and traffic from both equipment and livestock when the soils are too wet can prevent or reduce compaction. On soils such as those of the Awbrig, Concord, Conser, and Dayton series, which are wet for extended periods because of a high water table, low pressure floatation equipment can be used to limit compaction.

The hazard of erosion is of great concern, especially on those soils that are subject to flooding and on the more sloping soils.

Soils that are subject to flooding are those of the Awbrig, Bashaw, Camas, Chapman, Chehalis, Cloquato, Conser, Courtney, McBee, Newberg, Saturn, Waldo, Wapato, and Whiteson series. Bare soils are subject to detachment of individual soil particles by rainfall and by sprinkler irrigation. Once detached, the particles can be transported by surface runoff.

Use of plant cover or crop residue is of extreme importance in reducing soil erosion. Such cover provides protection from the impact of falling raindrops or sprinkler irrigation water and prevents the loss of both soil and water. Other factors remaining constant, the greater the slope of the soil, the greater the erosion because of the increased velocity of water. Length of slope can compound the problem by providing greater concentrations of runoff water. Soils farmed in the foothill areas, such as those of the Bellpine, Jory, Nekia, Steiwer, and Willakenzie series, must be carefully managed because of the greater slope and the consequent need for erosion control practices. Minimum tillage, contour plowing, and terracing help to minimize erosion.

The effects of erosion can be very dramatic or very subtle. Losses can be incurred at the source of erosion, over the area where the materials are in transit, or where the soil is deposited. Erosion results in the loss of organic matter, the breakdown of the soil's natural structure, and the alteration of the soil's texture through the loss of clay and silt. All of these effects of erosion lead to the degradation of the soil's tilth and workability.

The productivity of the soil is impaired by the loss of plant nutrients and soil particles. The severity of the erosion determines how much of the productivity will be lost and for how long. The soil resource will not be renewed through natural processes over a short time period. Many to hundreds of years may be required to replace a part of the eroded surface layer, although cultural practices and additions may hasten the redevelopment of the soil. Soil particles, nutrients, and chemicals carried by water into streams and ponds may cause excessive enrichment. With increased plant and animal growth, the oxygen demand may be too great for some organisms to survive. Turbidity of streams and rivers may be increased by erosion. Domestic water supplies may be contaminated or their quality degraded as a result. Deposition of soil material may destroy spawning beds for fish. Also, it is costly to clean sediment out of irrigation and drainage ditches and ponds.

For each kind of soil and crop, specific practices need to be identified and applied to keep the soil loss at an acceptable level. Soil drainage is a concern on both fine textured and coarse textured soils. A seasonal high water table in soils can restrict the choice of crops and the selection of management practices. Soils in this survey area that have a seasonal high water table are those of the Amity, Awbrig, Bashaw, Clackamas, Concord, Conser, Courtney, Dayton, Waldo, Wapato, and Whiteson series. Imperfect drainage occurs primarily because of the topography and internal characteristics of the soil. Drainage problems may be compounded by inefficient irrigation water application systems. These problems can be corrected or prevented. The shape of the natural landscape can direct the flow of water and concentrate it, causing the saturation of soils for varying lengths of time. Unless the soils are artificially drained, the root zone may become water-logged for long periods and the roots of crops may not get enough oxygen. Internal soil characteristics such as a dense clay layer or other impervious layers, which are present in the Awbrig, Bashaw, Concord, Dayton, and Courtney soils, restrict the movement of water. This results in a seasonal high water table and limited rooting depth.

Drainage can be improved in most areas by providing surface or subsurface drainage systems. Surface systems include diversions, open drainage ditches, grassed waterways, impoundments, and land shaping to eliminate depressional areas. Subsurface systems are tile drains either of the pattern or interceptor types.

Problems associated with drainage are poor outlets, shallow soil depth, and soil texture. If outlets are not available, the site cannot be drained unless excess water is pumped. Shallow soil depth increases installation costs and limits the effectiveness of the drainage. Drainage lines in fine textured soils need to be close because of the slow permeability of these soils.

There are many advantages to draining soils for agricultural purposes. On drained soils a wider variety of crops can be grown because of the improved movement of water in the soil and better root aeration, increasing the development and penetration of roots. In addition, drainage provides for better water management, earlier soil warming, and accessibility of fields. Productivity can be increased for crops that were limited by rooting depth prior to drainage.

When considering irrigation, important factors that need to be determined are the available water capacity and water intake rate of the soils, crop needs, and availability of water for irrigation.

The available water capacity is the amount of water a soil can store for use by plants. Factors that affect the ability of a soil to store water are depth, soil texture, rock fragment content, and organic matter content.

The water intake rate is determined by the soil's texture, structure, and organic matter content. Sandy soils absorb water rapidly and have low water storage capacity, and clayey soils absorb water slowly and have comparatively high water storage capacity. Water moves through soils that have good structure at a more desirable rate than it does through soils that have poor structure.

Crops require water at critical periods for maximum quality and production. To maintain desirable growth rates, adequate soil moisture must be available to crops. The amount of acreage irrigated is determined by the amount of water stored and by streamflow, especially when they are at a minimum.

Availability of water is dependent upon the competitive demands of agriculture, recreation, wildlife, industry, and municipalities. Irrigation systems need to be designed efficiently so that all water applied is used beneficially. Runoff or drainage water can be filtered, collected, and then reused or returned to streams.

A lack of adequate rainfall during the growing season makes irrigation necessary for high crop yields. Sprinkler irrigation systems are the main ones used in the survey area. The choice of a system is dependent on the soil characteristics, cropping system, crops grown, available labor, and relative costs. The irrigation system needs to be designed for the crop and the soil. Sprinkler irrigation is quite adaptable to various slopes, water intake rates, and crops; therefore water is applied more evenly and precisely by sprinklers than it is by other systems.

For high yields and top quality crops, a fertilizer program is needed for all soils in the survey area. Fertilizer is used to replace or supplement the soil's supply of elements required in plant nutrition. Generally, five things can happen to a fertilizer when it is added to a soil: (1) It can be used by the crop; (2) it can become part of the soil; (3) it can be leached downward by drainage water; (4) it can be washed away by erosion; (5) it can volatilize and escape as a gas.

Elements that have shown a favorable response in plant growth are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, and boron. When added to the soil, they react differently.

To a significant extent, nitrogen is the only fertilizer element that enters into all five processes that affect fertilizers. All forms of nitrogen can be converted to nitrite nitrogen, which is used by plants. In this form it moves freely in water and is held weakly, or not at all, by soil particles. When adding nitrogen, it should be in amounts adequate for efficient plant growth without risking excessive growth or in excessive amounts.

The activity of phosphorus when applied to the soil sharply contrasts with that of nitrogen. When phosphate is added to the soil, it reacts rapidly to form many new compounds. Phosphate stays where it is placed and moves very little, unless it is washed away by erosion.

Potassium, calcium, and magnesium all react similarly in the soil. After being dissolved in the soil, each is either attracted and held by the clay particles and organic matter or it forms a compound with an anion. Basically, potassium is much less mobile than nitrate nitrogen and more mobile than phosphate. Leaching of potassium is only a concern in coarse textured soils. Calcium and magnesium, if leached, can be replaced by adding gypsum, lime, or dolomite.

When sulfur is applied to well drained soils, it may be absorbed by the soil, leached by drainage water, or used by plants. When added to a poorly drained soil, it may be converted to a gas and lost to the atmosphere.

Boron is a micronutrient and is relatively immobile, although some of it may be leached in coarse textured soils. Because movement is limited, it must be applied in such a way that it has widespread contact with the soil. There is a very narrow range between boron deficiency and excess.

Organic farming has become popular in recent years. Use of organic material such as animal manure, green manure, plant refuse, and compost is beneficial in maintaining and improving soil productivity and promoting the draining and warming of the soil. Adding organic matter to coarse textured soils helps them to retain moisture and plant nutrients. Additions to fine textured soils improve soil workability, water intake rate, structure, and aeration. Supplies of organic matter often are adequate for home or specialty gardens, but general availability is limited for large-scale commercial production.

On all soils the amount of fertilizer and other amendments used should be based on the results of soil tests, on the needs of the crop grown, and on the expected yield.

The management practices needed to achieve high yields and top quality crops vary depending on the kind of soil and the kind of crop grown. Applying management practices designed for specific crops and soils is essential for obtaining sustained high crop yields. The local office of the Cooperative Extension Service can help to determine the kind and amount of fertilizer and other soil amendments to apply.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change. Specific varieties of any given crop may be more suitable for some soils than for others.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation. No class V soils are in this survey area.

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

Woodland Management and Productivity

By James F. McClinton, forester, and Russell W. Langridge, soil scientist, Soil Conservation Service.

The Linn County Area is one of the better timber producing areas in North America. The best timber growing sites generally are in the mountainous areas of the Cascade Range. The foothills above the valley terraces receive less rainfall and therefore are slightly less productive than the mountainous areas. The poorer timber producing sites generally are at the higher elevations. Favorable climate, fertile soils, and well suited timber species account for the high productive capacity of the woodland in much of Linn County. About 56 percent of the survey area is classified as commercial forest land. About 80 percent of the commercial forest land is privately owned, and 20 percent is publicly owned; of the latter, 14 percent is administered by the Bureau of Land Management, 5 percent by the state and county, and 1 percent by the Forest Service.

The paper pulp industry is centered near Albany, where abundant supplies of water are available from the Willamette River. The county also has several large sawmills that produce lumber, veneer, and wood chips suitable for pulp. Most of the sawmills are in the Lebanon and Sweethome areas. Most of the chips suitable for use in making both high grade and low grade paper products are processed within the county, although some are shipped outside the county. There are several smaller sawmills and various specialty mills. The specialty mills mostly work with hardwoods, such as red alder, or make shakes and fencing material from western redcedar.

Sawmill capacity in the county exceeds current growth rates; however, by applying intensive management practices, growth rates can be increased significantly. Thinning overstocked stands and applying nitrogen fertilizer to stands growing on soils that will respond can greatly increase timber yields. Both public and private land managers have begun applying intensive management practices in recent years.

The forest land in the survey area is protected from fire by the State Department of Forestry, the Forest Service, and local fire districts. The increasing population and recreational activities in the area make accidental fires a constant threat, especially during dry periods in summer.

Many diseases and insects are present in the forest, and they may be a serious threat to individual stands of trees. Damage varies from year to year. Douglas-fir has several natural enemies. The principal insect that attacks Douglas-fir is the Douglas-fir beetle (*Denodroctonus pseudotsugae*). Laminated root rot is the most serious fungus enemy of Douglas-fir. Western hemlock is attacked by several trunk, butt, and root rots as well as by the hemlock looper (*Lambdina fiscellaria*), which presents the most serious threat of damage by insects. The balsam woolly aphid (*Chermes piceae*) is the most serious insect threat to Pacific silver fir and noble fir. Several types of rot also attack these two species.

The principal forest cover type in the survey area is the Pacific Douglas-fir type, which typically includes small amounts of western hemlock and western redcedar. The other dominant forest cover types are the Douglas-fir-western hemlock type at intermediate elevations and the Pacific silver fir-hemlock type at the higher elevations. Noble fir and Douglas-fir commonly are present in this type, and mountain hemlock is present in some areas instead of western hemlock.

Most of the forest land in the survey area does not provide forage suitable for livestock grazing, but it does provide forage for many species of wildlife. Elk and deer commonly use the forage available in recently harvested areas, and they use dense stands of timber for cover. The most common understory plants are listed in the map units in the section "General Soil Map Units."

Soils vary in their ability to produce trees. Depth, fertility, texture, and the available water capacity influence tree growth. Elevation, aspect, soils, and climate determine the kinds of trees that can be expected to grow in any area. Available water capacity and the thickness of the root zone are of major importance. Elevation and aspect are of particular importance in mountainous areas.

Soil surveys are important to forest land managers as they seek ways to increase the productivity of forest land. Some soils respond better to fertilizer than do others, some are more susceptible to landsliding and erosion after roads are built and timber is harvested, and some require special effort when harvesting timber and reforesting. In this survey the description of each map unit suitable for producing timber presents information concerning forest land productivity and limitations for harvesting timber and names common forest understory plants. Table 6 summarizes the forestry information given in the detailed map unit descriptions. The soils are rated for a number of factors to be considered in management. In table 6, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Equipment limitations ratings refer to the limits placed upon the use of equipment, year-round or seasonally, as a result of soil characteristics. A rating of *slight* indicates that use of equipment is not normally restricted in kind or time of year because of soil factors; *moderate* indicates a seasonal limitation because of soil wetness, a fluctuating water table, susceptibility to compaction, or some other factor, and *severe* indicates a seasonal limitation, a need for special equipment (such as a cable-yard logging system), or a hazard in the use of equipment. Steepness of slope, wetness, and susceptibility of the soil to compaction are the main factors that cause equipment limitations. As slope gradient and length increase, it becomes more difficult to use wheeled equipment. Where slopes are even steeper, tracked equipment cannot be operated safely and more sophisticated systems must be used. Soil wetness, especially in combination with fine soil texture, can severely limit the use of equipment, making harvesting practical only during dry periods.

Seedling mortality ratings refer to the probability or mortality of naturally occurring or planted tree seedlings as influenced by kinds of soil or topography. Plant competition is not considered in this rating. The ratings apply to seedlings from good stock that are planted properly during a period of sufficient soil moisture. *Slight* indicates that no problem is expected under usual conditions; *moderate* indicates that some problems of mortality can be expected and that extra precautions are advisable; and *severe* indicates that mortality will be high and extra precautions are essential for successful reforestation. Wetness of the soil, droughtiness of the surface layer (especially on south- and southwest-facing side slopes), or position on ridgetops account for seedling mortality problems. To offset these limitations, larger than usual planting stock, special site preparation, surface drainage, or reinforcement plantings may be needed.

Ratings of *windthrow hazard* consider the soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees normally are not blown down by wind; *moderate* indicates that an occasional tree may blow down during periods of excessive wetness combined with strong winds; and *severe* indicates that many trees may be expected to be blown down during periods of soil wetness and moderate or strong winds. Restricted rooting depth because of a high water table, underlying bedrock, an impervious layer, and poor anchoring of roots because the surface layer and subsoil are loose make trees more subject to windthrow. *Moderate* and *severe* ratings indicate the need for more care in thinning the edges of timber stands, a plan calling for periodic salvage of windthrown trees, and an adequate road and trail system to allow for salvage operations.

Ratings of *plant competition* refer to likelihood of invasion of brushy plants when openings are made in the tree canopy. A rating of *slight* indicates that unwanted brushy plants are not likely to delay the establishment of natural regeneration and that planted seedlings have good prospects for development without undue competition; *moderate* indicates that competition can be expected to reduce the survivial and growth of natural or planted seedlings unless site preparation and maintenance are intensive; and *severe* indicates that competition can be expected to prevent adequate growth of natural or planted seedlings unless intensive site preparation and maintenance are provided. Favorable climate and productive soils encourage plant competition. Generally, brush invades less as elevation increases. The key to predicting brush competition problems commonly is the quantity and proximity of seed sources of undesirable plants. Moderate and severe ratings indicate the need for careful and thorough postharvest cleanup in preparation for reforestation and the possibility of mechanically or chemically treating brush to retard the growth and allow seedlings to develop.

The *potential productivity* of important trees on a soil is expressed as a *site index*. This index is determined by taking height and age measurements on selected trees within stands of a given species. The procedure for doing this is given in the site index tables used for this survey area (*8, 10, 12, 14, 15*).

Each map unit in this survey area that commonly is used to produce timber presents the predicted yield both in cubic feet and in board feet. The yield is predicted at the point where the mean annual increment culminates. Where the Curtis site index curves were used to determine productivity, timber yields were estimated using the relationship (fig. 7) of Curtis et al. (*10*).

The productivity of the soils in this survey area generally is based on Douglas-fir; however, on soils where western hemlock or noble fir are listed as trees to plant, production of these species may be greater than that of Douglas-fir. Important trees are listed in the same order as that of their general occurrence. Commonly, only one or two tree species are dominant.

Trees to plant are those that are used for reforestation or, if suitable conditions exist, natural regeneration. Species listed are suited to the soils and will produce a commercial wood crop. Desired product, topographic position, and personal preference are three factos of many that can influence the choice of trees to use for reforestation.

Recreation

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is also considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb effluent from septic tanks and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in table 8 and interpretations for septic tank absorption fields in table 9.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

By Clyde A. Scott, biologist, Soil Conservation Service.

This survey area is characterized by varied climatic conditions, topography, land uses, and vegetation. These varied environmental conditions provide many kinds of wildlife habitat and therefore an abundance of wildlife species. The conditions in the survey area range from those of warm areas of the low elevations (125 to 700 feet) of the river bottoms in the main part of the Willamette Valley and in the valleys of the Willamette River tributaries to those of a cold mountainous area at high elevations (3,500 to 5,000 feet) in the Cascade Range.

Urbanization, industrial development, and intensive agriculture have had an adverse influence on wildlife populations in the northern and western parts of the survey area.

Water resources are abundant in ponds, lakes, reservoirs, and rivers, which provide high quality habitat for many species of fish. Species of anadromous fish using the rivers and streams in the survey area include Chinook salmon, coho salmon, steelhead trout, and cutthroat trout.

The map units shown on the Linn County Area general soil map have been grouped according to their potential to provide similar kinds of wildlife habitat. The four groups are described below along with the kinds of fish and wildlife that inhabit the area.

Group 1 (general soil map units 1, 2, 3, and 4).—This group makes up about 11.5 percent of the survey area. It is along the flood plains of the lower part of the Calapooya, Santiam, and Willamette Rivers. Wildlife habitat is provided by riparian vegetation and cultivated crops. There has been a heavy influence of urbanization and suburban development encroaching upon wildlife populations in this group. The vegetation in the areas not cultivated is mainly Douglas-fir, cottonwood, bigleaf maple, Oregon white oak, ash, willow, blackberry, and sedges. Cultivated areas include hay, pasture, and vegetables.

This group is inhabited mainly by upland wildlife including ring-necked pheasant, California quail, dove, raccoon, skunk, rabbit, squirrel, and mink. Nongame birds are hawk, owl, crow, raven, jay, woodpecker, flycatcher, heron, meadowlark, robin, and numerous other songbirds, which are seasonally abundant. Waterfowl are seasonally present on the rivers and adjoining wetlands.

Anadromous fish as well as rainbow trout and some warmwater species of fish are in the rivers and streams.

Group 2 (general soil map units 5, 6, 7, 8, and 9).—This group makes up about 26.5 percent of the survey area. It is on the level to gently undulating terraces.

Most of the soils in this group are used for cultivated crops, which include corn, beans, winter wheat, ryegrass, berries, alfalfa, filberts, and nursery stock. The native vegetation intermingled with areas of cropland are Douglas-fir, Oregon white oak, western redcedar, bigleaf maple, western hazel, blackberry, rose, sedge, and grasses.

Ponds constructed on this group can be stocked with rainbow trout and warmwater species of fish.

Upland wildlife populations are abundant in areas that are not adversely influenced by suburban development. Species present on this group include ring-necked pheasant, California quail, dove, rabbit, squirrel, skunk, songbirds, hawk, and owl.

Group 3 (general soil map units 10 and 11).—This group is on rolling foothills. It makes up about 17 percent of the survey area. The vegetation in areas not cultivated is mainly Douglas-fir, Oregon white oak, ash, bigleaf maple, western hazel, Oregon-grape, and trailing blackberry. Cultivated crops such as berries, small grain, hay, and pasture are present in limited acreages. This group also provides some timber production and homesites. This is an important area for wildlife habitat because of the varied plant communities and range in elevation. The forested areas provide habitat for black-tailed deer, some Roosevelt elk, and black bear and for smaller animals such as raccoon, coyote, rabbit, squirrel, skunk, and numerous species of rodent.

Upland areas provide habitat for wildlife such as blue and ruffed grouse, limited populations of ring-necked pheasant, California quail, mountain quail, band-tailed pigeon, dove, hawk, owl, raven, jay, woodpecker, and other songbirds.

The streams in the area support a fair population of rainbow trout. They also can provide water for farm ponds in areas where the terrain is adequate for their construction.

Group 4 (general soil map units 12, 13, 14, 15, 16, and 17).—This group is on uplands. It makes up about 45 percent of the survey area. The group is characterized by highly productive forest land and associated bottomland that provide important habitat for black-tailed deer and Roosevelt elk. Changes in habitat in this group are rapid because of logging and fire in the dense woodlands.

The native vegetation in this group is mainly Douglas-fir, western hemlock, western redcedar, red alder, vine maple, Oregon-grape, salal, red huckleberry, and western swordfern. At the higher elevations in this group are noble fir, mountain hemlock, western white pine, Pacific rhododendron, and common beargrass. Some of the bottom lands are in pasture. A limited number of areas is used as homesites.

Other important species of mammal in this group include raccoon, bobcat, coyote, beaver, mink, weasel, otter, skunk, marten, squirrel, black bear, and numerous rodents.

Important birds in this group include hawk, owl, jay, crow, raven, band-tailed pigeon, blue and ruffed grouse, vulture, woodpecker, and numerous small birds.

Nearly all streams are important habitat for anadromous fish and resident trout.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building Site Development, Sanitary Facilities, Construction Materials, and Water Management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps and soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 8 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

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

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

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

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness. The specific regulations for installation of septic tank absorption fields can be obtained from the Department of Environmental Quality or other authorized agent.

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

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

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

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

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

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

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

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

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

Construction Materials

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

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 10, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

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

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

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

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

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

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

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

Water Management

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

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

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

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

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone. Availability of drainage outlets is not considered in the ratings.

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

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

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils (*11, 13, 25*).

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

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

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

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

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials (*2*) and the Unified soil classification system (*3*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

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

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

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

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

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

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

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

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

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

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

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

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (up to 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.64. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

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

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 13, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

Table 14 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

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

Table 14 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 14 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in the table.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

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

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

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*26*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 15 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquents (*Hapl*, meaning minimal horizonation, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

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

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic Typic Haplaquents.

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

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*24*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*26*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

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

Abiqua Series

The Abiqua series consists of deep, well drained soils on nearly level to undulating terraces along streams tributary to the Willamette River. These soils formed in fine textured alluvium derived from various kinds of rock. Slopes are 0 to 5 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Abiqua silty clay loam, 0 to 3 percent slopes; 2 miles south of Crawfordsville; in the NW1/4SE1/4NW1/4 of sec. 20, T. 14 S., R. 1 W.

A1—0 to 7 inches; dark brown (7.5YR 3/2) silty clay loam, brown (7.5YR 5/2) dry; strong fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; medium acid (pH 5.8); clear smooth boundary.

B21—7 to 29 inches; dark reddish brown (5YR 3/3) silty clay loam, reddish brown (5YR 5/3) dry; strong fine subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many very fine and fine tubular pores; strongly acid (pH 5.2); gradual smooth boundary.

B22—29 to 47 inches; dark reddish brown (5YR 3/4) silty clay, reddish brown (5YR 5/3) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many fine tubular pores; strongly acid (pH 5.2); gradual smooth boundary.

B23—47 to 60 inches; dark brown (7.5YR 3/4) silty clay, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; hard, firm, very sticky and very plastic; common fine roots; common fine tubular pores; medium acid (pH 5.6).

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 30 inches thick. The solum is 0 to 15 percent gravel and cobbles.

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

The B horizon has hue of 5YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is silty clay loam, silty clay, or clay.

Acanod Series

The Acanod series consists of deep, moderately well drained soils in basins or depressional areas on uplands. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 2 to 25 percent. The mean annual precipitation is about 90 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Acanod silt loam, 2 to 25 percent slopes; 3.5 miles northeast of Snow Peak; in the NE1/4SW1/4SE1/4 of sec. 14, T. 11 S., R. 2 E.

O1—2 inches to 0; layer of needles, leaves, and twigs.

A1—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; strong fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine irregular pores; very strongly acid (pH 4.8); clear wavy boundary.

A3—9 to 14 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; 5 percent stones; very strongly acid (pH 4.8); clear wavy boundary.

B21—14 to 21 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine and fine tubular pores; 10 percent stones and boulders; very strongly acid (pH 4.6); clear wavy boundary.

B22—21 to 34 inches; dark yellowish brown (10YR 3/4) silty clay, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; common very fine roots; common very fine and fine tubular pores; common thin dark brown (10YR 3/3) coatings on faces of peds; 15 percent stones and boulders; very strongly acid (pH 4.6); clear wavy boundary.

B3—34 to 52 inches; yellowish brown (10YR 5/4) silty clay, light yellowish brown (10YR 6/4) dry; common fine distinct very dark grayish brown (10YR 3/2) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; 10 percent stones and boulders; very strongly acid (pH 4.6); clear wavy boundary.

C—52 to 68 inches; light yellowish brown (10YR 6/4) stony silty clay, very pale brown (10YR 7/4) dry; many coarse distinct grayish brown (10YR 5/2), reddish brown (10YR 4/4), and yellowish brown (10YR 5/8) mottles; massive; very hard, very firm, very sticky and very plastic; 20 percent stones and boulders; very strongly acid (pH 4.6).

Depth to bedrock is more than 60 inches. The umbric epipedon is 20 to 30 inches thick. The solum is 40 to 60 inches thick or more. The content of rock fragments, dominantly stones and boulders, ranges from 0 to 15 percent in the upper 40 inches of the solum and from 15 to 30 percent below a depth of 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The B2 horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. It is clay loam, silty clay loam, silty clay, or clay and averages 35 to 45 percent clay. The lower part of the horizon has few to common mottles that have chroma of 2 to 8. The upper part of the horizon in some areas has a few mottles that have high chroma.

The C horizon is stony silty clay loam, stony silty clay, or stony clay loam.

Amity Series

The Amity series consists of deep, somewhat poorly drained soils in slightly concave areas on broad terraces of the Willamette Valley. These soils formed in silty alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Amity silt loam; about 1 mile east of Grand Prairie School; in the SE1/4SE1/4NW1/4 of sec. 15, T. 11 S., R. 3 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; medium acid (pH 5.8); clear smooth boundary.

A1—7 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine irregular pores and few very fine tubular pores; medium acid (pH 5.8); clear smooth boundary.

A2—16 to 22 inches; dark gray (10YR 4/1) silt loam, light gray (5YR 7/1) dry; common fine faint brown (10YR 5/3) and black (10YR 2/1) mottles; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine irregular pores; common medium brown (10YR 5/3) and black (10YR 2/1) iron and manganese concretions; medium acid (pH 5.8); clear wavy boundary.

B21t—22 to 28 inches; grayish brown (10YR 5/2) silty clay loam, pale brown (10YR 6/3) dry; common fine faint brown (10YR 5/3) and black (10YR 2/1) mottles; weak medium prismatic structure parting to moderate very coarse subangular blocky; hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; silt and sand grains on faces of peds; common moderately thick clay films in pores and on all vertical faces of peds; medium acid (pH 6.0); gradual wavy boundary.

B22t—28 to 35 inches; light olive brown (2.5Y 5/4) silty clay loam, very pale brown (10YR 7/4) dry; common fine distinct reddish brown (5YR 5/3), gray (10YR 5/1), and black (10YR 2/1) mottles; weak coarse prismatic structure parting to moderate coarse subangular blocky; very hard, very firm, sticky and plastic; few very fine roots; common very fine tubular pores; common moderately thick clay films in pores and on vertical faces of peds; slightly acid (pH 6.2); diffuse wavy boundary.

C—35 to 72 inches; olive brown (2.5Y 4/4) silt loam, very pale brown (10YR 7/4) dry; common fine faint brown (10YR 5/3) mottles; massive; hard, friable, slightly sticky and slightly plastic; common very fine tubular pores; slightly acid (pH 6.4).

Depth to bedrock is more than 60 inches.

The Ap and A1 horizons have value of 2 or 3 when moist and 4 or 5 when dry, and they have chroma of 2 or 3 when moist or dry. They are 10 to 18 inches thick. The A2 horizon has value of 3 to 5 when moist and 6 or 7 when dry, and it has chroma of 0 to 2. It has faint or distinct mottles.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist or dry. It has weak to moderate structure in the upper part, and it is slightly brittle in the lower part. It has less than 15 percent sand that is coarser than very fine sand.

Apt Series

The Apt series consists of deep, well drained soils on broad rolling bench tops and side slopes of uplands. These soils formed in colluvium derived dominantly from sedimentary rock. Slopes are 2 to 50 percent. The mean annual precipitation is about 75 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Apt silty clay loam, 2 to 25 percent slopes; about 3.5 miles north-northeast of Swamp Mountain; in the SW1/4SW1/4NE1/4 of sec. 9, T. 14 S., R. 3 E.

O1—1 inch to 0; fir needles and twigs.

A11—0 to 7 inches; dark brown (7.5YR 3/2) silty clay loam, dark brown (7.5YR 4/2) dry; strong very fine granular structure; hard, friable, sticky and plastic; common fine and medium roots; many very fine tubular pores; very strongly acid (pH 4.9); clear wavy boundary.

A12—7 to 13 inches; dark brown (7.5YR 3/2) silty clay loam, dark brown (7.5YR 4/2) dry; moderate fine and medium subangular blocky structure; hard, firm, very sticky and plastic; common fine and medium roots; common fine tubular pores; very strongly acid (pH 4.6); clear wavy boundary.

B21t—13 to 22 inches; dark brown (7.5YR 4/4) silty clay, light brown (7.5YR 6/4) dry; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common medium roots; common fine tubular pores; few thick clay films on peds; very strongly acid (pH 4.8); clear wavy boundary.

B22t—22 to 38 inches; dark brown (7.5YR 4/4) silty clay, light brown (7.5YR 6/4) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few medium roots; common very fine tubular pores; common thin and few moderately thick clay films on peds; 10 percent siltstone gravel; very strongly acid (pH 4.6); clear wavy boundary.

B3t—38 to 66 inches; variegated brown (7.5YR 4/4), yellow (10YR 7/6), and dark reddish brown (5YR 4/4) very gravelly silty clay loam; weak coarse subangular blocky structure parting to moderate medium subangular blocky; few very fine and fine roots; few fine tubular pores; many moderately thick clay films on peds; 35 percent siltstone gravel; very strongly acid (pH 4.6).

Depth to bedrock is more than 60 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry. It has 0 to 5 percent gravel.

The B2t horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 to 6 when moist or dry. It is silty clay or clay and has 45 to 60 percent clay. It has 5 to 10 percent gravel.

The B3t horizon is very gravelly silty clay loam, gravelly silty clay, or clay. It has 5 to 40 percent gravel and cobbles.

Awbrig Series

The Awbrig series consists of deep, poorly drained soils in slightly concave areas on low alluvial stream terraces. These soils formed in silty and clayey alluvium derived from various kinds of rock. Slopes are 0 to 2 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Awbrig silty clay loam; in the SW1/4NE1/4NE1/4 of sec. 2, T. 11 S., R. 3 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam, light brownish gray (10YR 6/2) dry; moderate very fine subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine irregular pores; slightly acid (pH 6.2); abrupt wavy boundary.

B1—6 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam, light brownish gray (10YR 6/2) dry; common fine faint dark brown (10YR 3/3) mottles; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; slightly acid (pH 6.2); abrupt smooth boundary.

IIB2t—11 to 31 inches; very dark gray (10YR 3/1) clay, gray (10YR 5/1) dry; common fine distinct dark brown (10YR 3/3) mottles; strong coarse prismatic and angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; few very fine tubular pores; continuous thick clay films in pores; many pressure faces; slightly acid (pH 6.5); clear wavy boundary.

IIIC1—31 to 45 inches; grayish brown (10YR 5/2) silty clay loam, pale brown (10YR 6/3) dry; many fine distinct dark yellowish brown (10YR 4/6) mottles; massive; hard, firm, sticky and plastic; few fine roots; common very fine tubular pores; many fine black (10YR 2/1) manganese stains; neutral (pH 6.6); clear wavy boundary.

IIIC2—45 to 60 inches; grayish brown (10YR 5/2) silty clay loam, pale brown (10YR 6/2) dry; many fine distinct dark yellowish brown (10YR 4/6) mottles; massive; hard, firm, very sticky and very plastic; few fine roots; common very fine tubular pores; many fine black (10YR 2/1) manganese stains; neutral (pH 6.6).

Depth to bedrock is more than 60 inches. The solum is 30 to 50 inches thick. Depth to the dense clay IIB2t horizon is 5 to 12 inches.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or less when moist or dry.

The IIB2t horizon has value of 3 or 4 when moist and 5 or 6 when dry, it has and chroma of 1 or 2 when moist or dry. It is silty clay or clay and has 50 to 60 percent clay.

The IIIC horizon is silty clay loam or clay loam.

Bashaw Series

The Bashaw series consists of deep, poorly drained soils in slightly concave areas on flood plains, alluvial terraces, and alluvial fans. These soils formed in clayey alluvium derived from various kinds of rock. Slopes are 0 to 1 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Bashaw silty clay; about 0.5 mile north of Diamond Hill Road; in the NW1/4NE1/4NW1/4 of sec. 10, T. 15 S., R. 3 W.

A11—0 to 4 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; strong fine subangular blocky structure; very hard, very firm, very sticky and very plastic; many fine roots; many very fine tubular pores; medium acid (pH 5.6); clear smooth boundary.

A12g—4 to 36 inches; black (10YR 2/1) clay, dark gray (N 4/0) dry; few medium prominent yellowish brown (10YR 5/6) mottles; strong medium prismatic structure; very hard, very firm, very sticky and very plastic; common fine roots; many fine tubular pores; many intersecting slickensides; medium acid (pH 5.8); clear smooth boundary.

C1g—36 to 60 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; common fine and medium prominent strong brown (7.5YR 5/8) mottles; massive; very hard, very firm, very sticky and very plastic; few fine roots; few very fine tubular pores; common intersecting slickensides; slightly acid (pH 6.4); clear wavy boundary.

C2g—60 to 70 inches; dark gray (10YR 4/1) silty clay, gray (10YR 5/1) dry; common fine and medium prominent strong brown (7.5YR 5/8) mottles; massive; very hard, very firm, very sticky and very plastic; few very fine tubular pores; common intersecting slickensides; neutral (pH 7.0).

Depth to bedrock is more than 60 inches. Slickensides intersect throughout or in some part of the profile between depths of 10 and 40 inches. Below a depth of 40 inches, the soil is massive and has slickensides in some areas. Between depths of 10 and 40 inches, the soil is more than 60 percent clay. Below a depth of 40 inches, the soil is clay, silty clay, or sandy clay. The soil commonly has faint to prominent mottles throughout to a depth of 40 inches or more.

The A horizon has hue of 10YR, 2.5Y, 5Y, or neutral, and it has value of 2 or 3 when moist and 3 or 4 when dry. The horizon has hue of 10YR, 2.5Y, 5Y, or neutral, and it has value of 2 to 4 when moist and 3 to 6 when dry. Chroma is 1 or less to a depth of 40 inches, but it ranges to 2 below a depth of 40 inches.

Bellpine Series

The Bellpine series consists of moderately deep, well drained soils on smooth, convex foot slopes and foothills adjacent to terraces of the Willamette Valley. These soils formed in colluvium derived dominantly from sedimentary rock. Slopes are 3 to 50 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Bellpine silty clay loam, 12 to 20 percent slopes; in the NW1/4NW1/4NE1/4 of sec. 36, T. 12 S., R. 1 W.

A1—0 to 7 inches; dark reddish brown (5YR 3/3) silty clay loam, reddish brown (5YR 5/3) dry; strong very fine granular structure and strong fine subangular blocky; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; medium acid (pH 5.8); clear wavy boundary.

B1—7 to 14 inches; dark reddish brown (5YR 3/4) silty clay, reddish brown (5YR 5/4) dry; moderate fine and very fine subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; many very fine tubular pores; medium acid (pH 5.6); clear wavy boundary.

B21t—14 to 21 inches; reddish brown (5YR 4/4) clay, light reddish brown (5YR 6/4) dry; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; common moderately thick clay films on peds; strongly acid (pH 5.4); gradual wavy boundary.

B22t—21 to 32 inches; yellowish red (5YR 4/6) clay, reddish yellow (5YR 6/6) dry; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; common moderately thick clay films on peds; strongly acid (pH 5.2); abrupt wavy boundary.

Cr—32 inches; partially weathered tuffaceous siltstone; yellowish red (5YR 4/6) clay films on siltstone fragments.

Depth to soft bedrock and thickness of the solum are 20 to 40 inches. The content of rock fragments is as much as 35 percent, but commonly it is less than 15 percent.

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

The B1 horizon has hue of 7.5YR or 5YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 4 to 6 when moist or dry.

The B2t horizon has hue of 5YR or 2.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 4 to 6 when moist or dry. It is silty clay or clay. It has common thin clay films or common or many moderately thick clay films.

Bensley Series

The Bensley series consists of deep, well drained soils on ridgetops and side slopes of uplands. These soils formed in colluvium and glacial till derived from various kinds of rock. Slopes are 2 to 75 percent. The mean annual precipitation is about 100 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Bensley stony loam, 2 to 30 percent slopes; 2.5 miles northwest of Crabtree Lake; in the SW1/4SE1/4NE1/4 of sec. 8, T. 11 S., R. 3 E.

O1—1 inch to 0; layer of needles, twigs, leaves, and moss.

A11—0 to 5 inches; very dark brown (10YR 2/2) stony loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine irregular pores; 15 percent fine and medium gravel and 15 percent stones and cobbles; very strongly acid (pH 4.8); clear wavy boundary.

A12—5 to 11 inches; very dark grayish brown (10YR 3/2) stony loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many fine irregular pores; 15 percent fine and medium gravel and 15 percent cobbles and stones; very strongly acid (pH 4.8); clear wavy boundary.

B21—11 to 22 inches; brown (10YR 4/3) very gravelly clay loam, light brownish gray (10YR 6/2) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine irregular pores; 20 percent fine and medium gravel and 15 percent cobbles and stones; very strongly acid (pH 4.8); clear wavy boundary.

B22—22 to 30 inches; brown (10YR 4/3) very cobbly clay loam, light brownish gray (10YR 6/2) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; many very fine irregular pores; 20 percent cobbles and stones and 20 percent fine and medium gravel; very strongly acid (pH 4.8); clear wavy boundary.

B23—30 to 44 inches; dark grayish brown (10YR 4/2) very cobbly clay loam, light brownish gray (10YR 6/2) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; common fine irregular pores; 30 percent cobbles and stones and 10 percent fine and medium gravel; very strongly acid (pH 4.8); clear wavy boundary.

B3—44 to 62 inches; brown (10YR 4/3) very cobbly clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common fine irregular pores; 25 percent cobbles and stones and 20 percent fine and medium gravel; very strongly acid (pH 4.6).

Depth to bedrock is more than 60 inches. Content of rock fragments is 35 to 60 percent.

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

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. It is very cobbly loam, very cobbly clay loam, or very gravelly clay loam and has 18 to 30 percent clay.

Blachly Series

The Blachly series consists of deep, well drained soils on broad bench tops and side slopes of uplands. These soils formed in colluvium derived dominantly from sedimentary or basic igneous rock. Slopes are 3 to 75 percent. The mean annual precipitation is about 85 inches. The mean annual temperature is about 48 degrees F.

Typical pedon of Blachly clay loam, 3 to 30 percent slopes; in the SW1/4SW1/4 of sec. 2, T. 15 S., R. 2 W.

O1—1 inch to 0; moss, leaves, and twigs.

A11—0 to 6 inches; dark reddish brown (5YR 3/3) clay loam, reddish brown (5YR 4/3) dry; moderate very fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular pores; 10 percent gravel and 10 percent nodules 2 to 5 millimeters in diameter; medium acid (pH 5.6); clear smooth boundary.

A12—6 to 25 inches; dark reddish brown (5YR 3/4) clay loam, dark brown (7.5YR 4/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; 10 percent gravel and 20 percent nodules 2 to 5 millimeters in diameter; medium acid (pH 5.8); gradual smooth boundary.

B21—25 to 43 inches; reddish brown (5YR 4/4) silty clay, reddish brown (5YR 5/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many very fine tubular pores; 10 percent gravel and 15 percent nodules 2 to 5 millimeters in diameter; medium acid (pH 6.0); gradual smooth boundary.

B22—43 to 53 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many very fine tubular pores; 5 percent gravel and 15 percent nodules 2 to 5 millimeters in diameter; medium acid (pH 6.0); gradual smooth boundary.

B3—53 to 60 inches; dark brown (7.5YR 4/4) silty clay loam, brown (7.5YR 5/4) dry; weak fine and medium subangular blocky structure; slightly hard, very firm, slightly sticky and slightly plastic; many very fine tubular pores; 5 percent gravel and 20 percent nodules 2 to 5 millimeters in diameter; medium acid (pH 5.8).

Depth to bedrock and thickness of the solum are more than 60 inches. The content of rock fragments is as much as 15 percent throughout the profile.

The A horizon has hue of 7.5YR or 5YR and chroma of 3 or 4 when moist or dry.

The B2 horizon has hue of 5YR or 2.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 4 to 6 when moist and 4 to 8 when dry. It is silty clay or clay.

The B3 horizon has hue of 7.5YR or 5YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 4 to 8 when moist or dry. It is silty clay loam, silty clay, or clay.

Bohannon Series

The Bohannon series consists of moderately deep, well drained soils on ridgetops and side slopes of uplands. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 3 to 25 percent. The mean annual precipitation is about 80 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Bohannon cobbly loam, 3 to 25 percent slopes; in a road cut in the NW1/4NE1/4NW1/4 of sec. 6, T. 16 S., R. 2 W.

O1—1/2 inch to 0; layer of leaves, twigs, and needles.

A1—0 to 14 inches; very dark brown (10YR 2/2) cobbly loam, dark grayish brown (10YR 4/2) dry; strong fine granular structure; slightly hard, friable, nonsticky and nonplastic; many fine roots; many very fine irregular pores; 15 percent iron and manganese concretions 1 to 2 millimeters in diameter; 15 percent cobbles; strongly acid (pH 5.2); clear wavy boundary.

A3—14 to 18 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 4/3) dry; moderate fine granular structure; slightly hard, friable, nonsticky and nonplastic; many fine roots; many very fine tubular pores; 20 percent gravel and 10 percent cobbles; strongly acid (pH 5.4); clear wavy boundary.

B2—18 to 31 inches; dark yellowish brown (10YR 3/4) cobbly loam, yellowish brown (10YR 5/4) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; many very fine tubular pores; 20 percent cobbles and 10 percent gravel; very strongly acid (pH 4.8); abrupt wavy boundary.

C1—31 to 38 inches; dark yellowish brown (10YR 3/4) cobbly loam, yellowish brown (10YR 5/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; many fine tubular pores; 20 percent cobbles and 15 percent gravel; very strongly acid (pH 4.8); abrupt irregular boundary.

Cr—38 inches; weathered andesite.

Depth to soft bedrock is 20 to 40 inches. The solum is 5 percent to 35 percent rock fragments.

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

The B horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 or 4 when moist or dry. It is cobbly loam, gravelly loam, or cobbly clay loam and has 18 to 30 percent clay.

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

Briedwell Series

The Briedwell series consists of deep, well drained soils on old alluvial terraces. These soils formed in silty and gravelly alluvium derived from various kinds of rock. Slopes are 0 to 7 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Briedwell silt loam, 0 to 7 percent slopes; in the NW1/4SE1/4NE1/4 of sec. 32, T. 13 S., R. 1 E.

A11—0 to 6 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine irregular pores; 5 percent cobbles; medium acid (pH 6.0); abrupt smooth boundary.

A12—6 to 12 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine irregular pores; 5 percent cobbles; medium acid (pH 6.0); clear wavy boundary.

A3—12 to 21 inches; dark yellowish brown (10YR 3/4) silt loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; 10 percent cobbles; medium acid (pH 5.8); clear smooth boundary.

IIB2—21 to 29 inches; brown (10YR 4/3) very gravelly clay loam, pale brown (10YR 6/3) dry; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many fine tubular pores; 55 percent gravel; medium acid (pH 5.8); clear wavy boundary.

IIB22—29 to 36 inches; dark yellowish brown (10YR 4/4) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine tubular pores; 50 percent gravel; medium acid (pH 6.2); gradual smooth boundary.

IIC—36 to 60 inches; dark yellowish brown (10YR 4/4) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; massive; hard, firm, sticky and plastic; common very fine tubular pores; 50 percent gravel; medium acid (pH 6.2).

Depth to bedrock is more than 60 inches. The 10- to 40-inch control section averages 35 to 55 percent rock fragments. Depth to the IIC horizon is 20 to 36 inches. Thickness of the mollic epipedon is 12 to 20 inches.

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

The IIB horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is very gravelly clay loam, gravelly clay loam, or gravelly silty clay loam and has 27 to 35 percent clay.

The IIC horizon is extremely gravelly clay loam or very gravelly clay loam and has 50 to 80 percent rock fragments.

Bull Run Series

The Bull Run series consists of deep, well drained soils on hillsides and benches in the lower valleys of uplands. These soils formed in silty material mixed with volcanic ash. Slopes are 3 to 30 percent. The mean annual precipitation is about 70 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Bull Run silt loam, 3 to 15 percent slopes; in the NE1/4NW1/4NE1/4 of sec. 35, T. 9 S., R. 2 E.

A1—0 to 12 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; strong very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots and common medium roots; many very fine irregular pores; 25 percent nodules 2 to 5 millimeters in diameter; medium acid (pH 5.6); clear smooth boundary.

B1—12 to 22 inches; dark brown (7.5YR 3/4) silt loam, yellowish brown (10YR 5/4) dry; strong very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots and few medium roots; many very fine irregular pores; 40 percent nodules 2 to 5 millimeters in diameter; medium acid (pH 5.8); clear smooth boundary.

B21—22 to 33 inches; strong brown (7.5YR 4/6) silt loam, yellowish brown (7.5YR 5/6) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; common thin silt coatings on peds; medium acid (pH 5.8); clear smooth boundary.

B22—33 to 43 inches; strong brown (7.5YR 4/6) silt loam, yellowish brown (7.5YR 5/6) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and slightly plastic; few very fine roots; common very fine tubular pores; common thin silt coatings on peds; medium acid (pH 5.8); gradual smooth boundary.

B23—43 to 55 inches; strong brown (7.5YR 4/6) silt loam, yellowish brown (7.5YR 5/6) dry; weak medium subangular blocky structure; very hard, very firm, slightly sticky and slightly plastic; few very fine roots; few fine tubular pores; common thin silt coatings on peds; medium acid (pH 5.8); gradual smooth boundary.

B3—55 to 66 inches; strong brown (7.5YR 4/6) silt loam, yellowish brown (7.5YR 5/6) dry; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; medium acid (pH 5.8).

Depth to bedrock is more than 60 inches. The profile is about 12 to 18 percent clay. Bulk density is about 0.70 to 0.85 gram per cubic centimeter. The umbric epipedon is 10 to 20 inches thick.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry, and it has chroma of 2 when moist.

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

Camas Series

The Camas series consists of deep, excessively drained soils on nearly level flood plains. These soils formed in recent sandy and gravelly alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Camas gravelly sandy loam; south of Green Bridge; in the NW1/4SE1/4SE1/4 of sec. 19, T. 10 S., R. 2 W.

Ap1—0 to 2 inches; dark brown (10YR 3/3) gravelly sandy loam, brown (10YR 5/3) dry; slightly hard, very friable, nonsticky and nonplastic; many fine roots; many fine irregular pores; 20 percent gravel; slightly acid (pH 6.3); clear smooth boundary.

Ap2—2 to 10 inches; dark brown (10YR 3/3) gravelly sandy loam, brown (10YR 5/3) dry; weak coarse and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many fine roots; many fine irregular pores; 25 percent gravel; slightly acid (pH 6.3); clear smooth boundary.

C1—10 to 13 inches; brown (10YR 4/3) gravelly sandy loam, pale brown (10YR 6/3) dry; massive; soft, very friable, nonsticky and nonplastic; many fine roots; many fine irregular pores; multicolored dark and light sand grains; 30 percent gravel; slightly acid (pH 6.3); abrupt smooth boundary.

IIC2—13 to 60 inches; multicolored extremely gravelly coarse sand that is mainly brown (10YR 4/3), dark brown (10YR 3/3), and grayish brown (10YR 4/2); single grain; loose, nonsticky and nonplastic; 50 percent gravel and 20 percent cobbles; slightly acid (pH 6.3).

Depth to bedrock is more than 60 inches. The content of rock fragments primarily gravel, ranges from 20 to 50 percent in the upper 15 inches and from 35 to 85 percent below this depth. The mollic epipedon is 10 to 14 inches thick.

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

The IIC horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist or dry. It is extremely gravelly coarse sand, very gravelly sand, or very gravelly loamy sand.

Chapman Series

The Chapman series consists of deep, well drained soils on low alluvial river terraces and flood plains. These soils formed in mixed alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches. The mean annual temperature is about 53 degrees F.

Typical pedon of Chapman loam; in the NW1/4SE1/4SW1/4 of sec. 36, T. 11 S., R. 5 W.

Ap1—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; medium acid (pH 6.0); abrupt smooth boundary.

Ap2—3 to 13 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; medium acid (pH 7.0); abrupt smooth boundary.

B21—13 to 27 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; slightly acid (pH 6.2); clear wavy boundary.

B22—27 to 41 inches; dark yellowish brown (10YR 3/4) clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; slightly acid (pH 6.2); clear smooth boundary.

B3—41 to 52 inches; dark yellowish brown (10YR 3/4) loam, brown (10YR 5/3) dry; weak very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; slightly acid (pH 6.2); clear smooth boundary.

C—52 to 60 inches; dark yellowish brown (10YR 3/4) gravelly sandy loam, brown (10YR 5/3) dry; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores; 15 percent gravel; slightly acid (pH 6.2).

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 30 inches thick. The 10- to 40-inch textural control section averages 20 to 35 percent clay, 15 to 30 percent sand that is coarser than very fine sand, and 0 to 10 percent gravel.

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

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

The C horizon is gravelly sandy loam or gravelly loam.

Chehalem Series

The Chehalem series consists of deep, somewhat poorly drained soils on alluvial fans. These soils formed in alluvium derived from sedimentary rock. Slopes are 3 to 12 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Chehalem silt loam, 3 to 12 percent slopes; 0.25 mile north of Rock Hill; in the SE1/4SE1/4SE1/4 of sec. 32, T. 12 S., R. 2 W.

A11—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; medium acid (pH 6.0); clear smooth boundary.

A12—8 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; medium acid (pH 6.0); abrupt smooth boundary.

B1—14 to 25 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 4/3) dry; common fine distinct very dark gray (10YR 3/1) and yellowish red (5YR 5/8) mottles; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; many very fine and fine tubular pores; medium acid (pH 6.0); gradual smooth boundary.

B21—25 to 41 inches; dark grayish brown (10YR 4/2) silty clay, brown (10YR 5/3) dry; common fine and medium distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; hard, firm, very sticky and plastic; common fine roots; common very fine and fine tubular pores; medium acid (pH 6.0); gradual smooth boundary.

B22—41 to 60 inches; dark grayish brown (10YR 4/2) silty clay, brown (10YR 5/3) dry; common fine distinct strong brown (7.5YR 5/8) mottles; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common very fine and fine tubular pores; few fine black (10YR 2/1) manganese concretions; medium acid (pH 6.0).

The depth to bedrock is more than 60 inches. The solum is 30 to 60 inches thick. Soft sedimentary rock fragments are throughout the B horizon.

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

The B horizon has hue of 10YR or 2.5Y. When moist, it has value of 2 or 3 to a depth of 25 inches but ranges to 4 below this depth. The horizon has chroma of 2 or 3 when moist or dry. It has faint to prominent mottles to a depth of 20 inches and distinct or prominent mottles below this depth. It is silty clay loam, silty clay, or clay and averages 35 to 45 percent clay.

Chehalis Series

The Chehalis series consists of deep, well drained soils on nearly level to gently undulating flood plains. These soils formed in recent alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Chehalis silty clay loam; in the SE1/4NE1/4SW1/4 of sec. 27, T. 13 S., R. 3 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 5/3) dry; moderate fine granular structure; hard, friable, slightly sticky and slightly plastic; many fine roots; few fine irregular pores; slightly acid (pH 6.2); clear smooth boundary.

A3—6 to 16 inches; very dark brown (10YR 3/2) silty clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine tubular pores; slightly acid (pH 6.2); clear smooth boundary.

B21—16 to 24 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate very fine and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine tubular pores; neutral (pH 6.6); clear smooth boundary.

B22—24 to 38 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine tubular pores; neutral (pH 6.6); clear smooth boundary.

B3—38 to 60 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many fine tubular pores; neutral (pH 6.6).

Depth to bedrock is more than 60 inches. The 10- to 40-inch textural control section averages 25 to 35 percent clay and less than 15 percent sand that is coarser than very fine sand. The mollic epipedon is 24 to 60 inches thick or more.

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

The B horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 to 6 when dry (value of 6 is below a depth of 20 inches), and chroma of 2 or 3 when moist or dry. It is silty clay loam or silt loam.

Chehulpum Series

The Chehulpum series consists of shallow, well drained soils on low foothills. These soils formed in colluvium derived dominantly from sedimentary rock. Slopes are 3 to 35 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Chehulpum silt loam, 3 to 12 percent slopes; in the SE1/4NW1/4NE1/4 of sec. 31, T. 10 S., R. 1 W.

A11—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, dark brown (10YR 4/3) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; slightly acid (pH 6.2); abrupt smooth boundary.

A12—2 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, dark brown (10YR 4/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent sandstone gravel; medium acid (pH 5.8); clear smooth boundary.

A13—6 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; many fine tubular pores; 5 percent sandstone gravel; medium acid (pH 5.8); abrupt wavy boundary.

IICr—16 inches; weathered sandstone.

Depth to soft bedrock is 10 to 20 inches. The content of rock fragments in the profile ranges from 0 to 35 percent. The profile is 18 to 30 percent clay.

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

Clackamas Series

The Clackamas series consists of deep, somewhat poorly drained soils in slightly concave areas on low alluvial stream terraces. These soils formed in gravelly alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Clackamas gravelly silt loam, about 3/4 mile northwest of Denny School; in the NE1/4NE1/4NE1/4 of sec. 18, T. 12 S., R. 2 W.

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly silt loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 15 percent gravel 2 to 5 millimeters in diameter; medium acid (pH 5.6); gradual smooth boundary.

A12—4 to 12 inches; dark brown (10YR 3/3) gravelly silt loam, dark brown (10YR 4/3) dry; moderate fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 15 percent gravel 2 to 5 millimeters in diameter; medium acid (pH 5.6); clear smooth boundary.

B2tg—12 to 21 inches; very dark gray (10YR 3/1) gravelly silty clay loam, grayish brown (10YR 5/2) dry; many very fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; 20 percent gravel; few thin clay films in pores and on peds; medium acid (pH 5.6); abrupt smooth boundary.

IICg—21 to 60 inches; dark gray (10YR 4/1) extremely gravelly clay loam, light brownish gray (10YR 6/2) dry; many very fine distinct dark yellowish brown (10YR 4/4, 4/6) mottles; massive; hard, firm, sticky and plastic; few fine roots; few fine tubular pores; 65 percent gravel; strongly acid (pH 5.4).

Depth to bedrock is more than 60 inches. Depth to the IICg horizon is 20 to 36 inches. The solum is 10 to 35 percent rock fragments. In some areas the lower part of the B2tg horizon is 35 to 50 percent gravel.

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

The B2tg horizon has hue of 10YR to 5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 1 or 2 when moist or dry. It has common to many, faint to prominent mottles. It is silty clay loam, gravelly silty clay loam, or gravelly clay loam that is 27 to 35 percent clay and 10 to 25 percent gravel.

The IICg horizon has hue of 10YR or 7.5YR, value of 3 to 6 when moist or dry, and chroma of 1 to 4 when moist or dry. It has distinct or prominent mottles. It is extremely gravelly clay loam, extremely gravelly silty clay loam, or extremely gravelly loam.

Clackamas Variant

The Clackamas Variant consists of deep, moderately well drained soils in slightly concave areas on low alluvial stream terraces. These soils formed in silty alluvium over gravelly alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Clackamas Variant silt loam; about 0.25 mile west of Lebanon Airport; in the SW1/4NE1/4 of sec. 16, T. 12 S., R. 2 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; strong very fine granular structure and moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; medium acid (pH 5.6); clear smooth boundary.

A1—6 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; hard, friable, sticky and slightly plastic; common very fine roots; common very fine tubular pores; medium acid (pH 5.8); clear wavy boundary.

B21—13 to 20 inches; dark brown (10YR 3/3) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; many fine and medium tubular pores; medium acid (pH 5.6); clear wavy boundary.

B22—20 to 27 inches; dark brown (10YR 3/3) gravelly silty clay loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; few very fine roots; many fine and medium tubular pores; common light gray (10YR 7/1) sand coatings on peds; 20 percent gravel; few fine distinct brownish yellow (10YR 6/6) weathered rock fragments; strongly acid (pH 5.4); abrupt smooth boundary.

IIC—27 to 60 inches; dark grayish brown (10YR 4/2) very gravelly clay, light grayish brown (10YR 6/2) dry; many coarse distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; massive; hard, firm, very sticky and very plastic; few very fine roots; common fine tubular pores; common fine black (10YR 2/1) manganese stains; 40 percent hard gravel and 30 percent soft gravel; strongly acid (pH 5.4).

Depth to bedrock is more than 60 inches. The mollic epipedon is 10 to 20 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The B horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry. It is silty clay loam or gravelly silty clay loam with 27 to 35 percent clay and 0 to 20 percent gravel.

The IIC horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 or 3 when moist or dry. It has distinct or prominent mottles. It is 40 to 60 percent gravel.

Cloquato Series

The Cloquato series consists of deep, well drained soils on nearly level to gently undulating flood plains. These soils formed in recent alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Cloquato silt loam; 3/4 mile south of Harrisburg; in the NE1/4SE1/4SE1/4 of sec. 16, T. 15 S., R. 4 W.

Ap1—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine irregular pores; slightly acid (pH 6.2); gradual smooth boundary.
Ap2—9 to 21 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine and medium tubular pores; slightly acid (pH 6.4); gradual smooth boundary.
B2—21 to 34 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common medium roots; many fine tubular pores; slightly acid (pH 6.4); clear wavy boundary.
B3—34 to 41 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and medium roots; common fine tubular pores; slightly acid (pH 6.4); abrupt wavy boundary.
C—41 to 60 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; neutral (pH 6.6).

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 40 inches thick. The 10- to 40-inch textural control section is silt loam and has less than 15 percent sand that is coarser than very fine sand.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry.

The B horizon has hue of 10YR or 2.5Y. It has value of 3 or 4 when moist or dry to a depth of 30 inches, but value ranges to 6 below this depth. The horizon has chroma of 2 or 3 when moist or dry.

The C horizon has hue of 10YR or 2.5Y, value of 3 to 6 when moist or dry, and chroma of 2 to 4 when moist or dry.

Coburg Series

The Coburg series consists of deep, moderately well drained soils in slightly convex areas on low alluvial stream terraces. These soils formed in silty and clayey alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Coburg silty clay loam; 3 miles north of Harrisburg; in the SE1/4SE1/4SE1/4 of sec. 30, T. 14 S., R. 4 W.

A11—0 to 8 inches; very dark grayish brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; hard, friable, sticky and plastic; many fine roots; many fine irregular pores; slightly acid (pH 6.2); clear wavy boundary.
A12—8 to 17 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; many fine roots; many fine tubular pores; slightly acid (pH 6.0); gradual smooth boundary.
B21t—17 to 24 inches; very dark grayish brown (7.5YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; hard, firm, very sticky and very plastic; common fine roots; many fine tubular pores; many thick clay films in pores; slightly acid (pH 6.0); gradual smooth boundary.
B22t—24 to 32 inches; brown (7.5YR 4/4) silty clay, light brown (7.5YR 6/4) dry; common medium distinct dark yellowish brown (10YR 4/6) mottles; moderate medium and fine subangular blocky structure; hard, firm, sticky and very plastic; common fine roots; many fine tubular pores; many moderately thick clay films on peds and in pores; slightly acid (pH 6.2); gradual smooth boundary.
B23t—32 to 42 inches; brown (7.5YR 4/4) silty clay loam, light brown (7.5YR 6/4) dry; common medium distinct dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; few fine and medium roots; many fine and medium tubular pores; common moderately thick clay films on peds and in pores; slightly acid (pH 6.2); clear smooth boundary.
B3t—42 to 62 inches; brown (10YR 5/3) silty clay loam, pale brown (10YR 6/3) dry; many medium distinct reddish brown (5YR 4/4) mottles; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; few fine roots; few fine and medium tubular pores; few moderately thick clay films on peds and in pores; slightly acid (pH 6.1).

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 30 inches thick.

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

The B horizon has hue of 10YR or 7.5YR. To a depth of 20 inches, it has value of 3 when moist and 4 or 5 when dry and chroma of 2 or 3 when moist or dry. Below this depth, the horizon has value of 3 to 5 when moist and 4 to 6 when dry and chroma of 2 to 4 when moist or dry. The horizon is silty clay loam or silty clay. It has mottles that have chroma of 2 or less below a depth of 30 inches.

The C horizon, where present, is fine sandy loam, loam, or clay loam.

Concord Series

The Concord series consists of deep, poorly drained soils in slightly concave areas on broad terraces of the Willamette Valley. These soils formed in silty and clayey alluvium derived from various kinds of rock. Slopes are 0 to 2 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Concord silt loam; 0.5 mile north of Peoria; in the NE1/4NW1/4NW1/4 of sec. 8, T. 13 S., R. 4 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine irregular pores; common fine nodules; medium acid (pH 5.6); abrupt smooth boundary.

A21—10 to 15 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; common fine distinct dark brown (7.5YR 4/2) mottles; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine tubular pores; common fine nodules; medium acid (pH 5.8); clear smooth boundary.

A22—15 to 20 inches; dark gray (10YR 4/1) silt loam, light gray (10YR 7/1) dry; common fine distinct very dark brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; few fine roots; many very fine and fine tubular pores; common fine nodules; medium acid (pH 5.8); clear smooth boundary.

IIABg—20 to 36 inches; gray and dark gray (10YR 5/1, 4/1) silty clay, light gray (10YR 7/1) dry; common fine distinct dark brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; few fine roots; many very fine and fine tubular pores; many fine nodules; slightly acid (pH 6.2); clear smooth boundary.

IIB2tg—36 to 40 inches; grayish brown (2.5Y 5/2) silty clay, light brownish gray (2.5Y 6/2) dry; common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to moderate medium and fine angular blocky; hard, firm, sticky and plastic; few fine roots; many very fine and fine tubular pores; few thin and moderately thick clay films on peds and in pores; many fine nodules; slightly acid (pH 6.4); clear smooth boundary.

IIIC1g—40 to 52 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; massive; very hard, firm, sticky and plastic; few fine roots; common fine tubular pores; few fine dark brown (10YR 3/3) and black (10YR 2/1) iron and manganese concretions; neutral (pH 6.6); gradual smooth boundary.

IIIC2g—52 to 72 inches; dark grayish brown (2.5Y 4/2) silt loam, light gray (2.5Y 7/2) dry; massive; hard, friable, sticky and plastic; common very fine tubular pores; few fine black (10YR 2/1) manganese stains; neutral (pH 6.6).

Depth to bedrock is more than 60 inches. Thickness of the solum is 24 to 40 inches. The soil is mottled at a depth of 10 to 40 inches.

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

The A2 horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist or dry. It is silt loam or silty clay loam.

The IIAB horizon has color similar to that of the A2 horizon. It is silty clay or silty clay loam.

The IIBtg horizon has hue of 10YR to 5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist or dry. It is silty clay, clay, or silty clay loam and averages 35 to 50 percent clay.

The IIIC horizon is silt loam or silty clay loam.

Conser Series

The Conser series consists of deep, poorly drained soils in slightly concave areas on low alluvial stream terraces. These soils formed in silty and clayey alluvium derived from various kinds of rock. Slopes are 0 to 2 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Conser silty clay loam; in the NW1/4SW1/4SE1/4 of sec. 35, T. 13 S., R. 3 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; many fine distinct reddish brown (5YR 4/4) mottles; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; common fine nodules; medium acid (pH 5.6); clear wavy boundary.

A1—8 to 17 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; many fine and medium distinct dark reddish brown (5YR 3/4) mottles; moderate fine subangular blocky structure; hard, firm, sticky and plastic; many fine roots; many fine and medium tubular pores; common fine nodules; medium acid (pH 5.6); clear smooth boundary.

B21t—17 to 26 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; many medium distinct brown (10YR 4/3) mottles; moderate medium and coarse subangular blocky structure; hard, firm, very sticky and very plastic; common fine roots; many medium tubular pores; few moderately thick clay films on peds and in pores; medium acid (pH 5.6); clear smooth boundary.

B22t—26 to 50 inches; dark grayish brown (10YR 4/2) silty clay, light brownish gray (10YR 6/2) dry; many medium distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; common fine and medium roots; many coarse and medium tubular pores; common moderately thick clay films on peds and in pores; medium acid (pH 6.0); gradual wavy boundary.

B3—50 to 64 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; many medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; hard, firm, sticky and plastic; many coarse and medium tubular pores; common fine black (10YR 2/1) manganese coatings and streaks; few fine black (10YR 2/1) manganese nodules; slightly acid (pH 6.5).

Depth to bedrock is more than 60 inches. The mollic epipedon is 24 to 32 inches thick. The profile is mottled from the surface to a depth of 60 inches. It is 0 to 10 percent gravel throughout.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry, and it has chroma of 1 or 2 when moist or dry.

The Bt horizon has value of 3 to 5 when moist and 4 to 6 when dry, and it has chroma of 1 to 3 when moist or dry. It is silty clay loam, silty clay, or clay and is 35 to 60 percent clay.

Courtney Series

The Courtney series consists of deep, poorly drained soils in slightly concave areas on low alluvial stream terraces. These soils formed in gravelly and clayey alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Courtney gravelly silty clay loam; in the SW1/4SW1/4SW1/4 of sec. 6, T. 11 S., R. 2 W.

A11—0 to 8 inches; very dark brown (10YR 2/2) gravelly silty clay loam, dark grayish brown (10YR 4/2) dry; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots; few fine tubular pores; 20 percent gravel; medium acid (pH 5.6); clear smooth boundary.

A12—8 to 17 inches; very dark brown (10YR 2/2) gravelly silty clay loam, dark grayish brown (10YR 4/2) dry; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many fine roots; few fine tubular pores; 25 percent gravel; medium acid (pH 5.8); abrupt smooth boundary.

IIB21t—17 to 24 inches; very dark grayish brown (10YR 3/2) gravelly clay, grayish brown (10YR 5/2) dry; few medium distinct yellowish brown (10YR 5/6) mottles; strong medium subangular blocky structure; hard, firm, sticky and plastic; many fine roots; few fine tubular pores; common thin clay films on peds; 25 percent gravel; medium acid (pH 5.8); abrupt smooth boundary.

IIB22t—24 to 33 inches; very dark grayish brown (10YR 3/2) gravelly clay, grayish brown (10YR 5/2) dry; few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; few fine roots; many fine tubular pores; many thin clay films on peds; 30 percent gravel; medium acid (pH 5.8); clear smooth boundary.

IIIC1—33 to 48 inches; dark brown (7.5YR 4/4) very gravelly clay loam, brown (7.5YR 5/4) dry; few medium distinct yellowish brown (10YR 5/6) mottles; massive; hard, firm, sticky and plastic; many coarse tubular pores; 50 percent gravel and 5 percent cobbles; medium acid (pH 5.8); clear smooth boundary.

IVC2—48 to 60 inches; dark brown (7.5YR 4/4) extremely gravelly sand, brown (7.5YR 5/4) dry; massive; soft, friable; many fine irregular pores; 70 percent gravel and 10 percent cobbles; medium acid (pH 5.8).

Depth to bedrock is more than 60 inches. Depth to the IIIC horizon is 20 to 36 inches.

The A horizon has hue of 10YR or neutral, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 0 to 2 when moist or dry. It has few to many distinct or prominent mottles. It is 15 to 30 percent rock fragments, mostly gravel.

The IIB horizon has hue of 10YR or neutral, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 0 to 2 when moist or dry. It is gravelly clay or gravelly silty clay. It generally has few to many, distinct or prominent mottles, but it is not mottled in some areas where chroma is 1 or less. The horizon 15 to 35 percent rock fragments, mostly gravel.

The IIIC and IVC horizons are 50 to 85 percent rock fragments, mostly gravel. The IIIC horizon is very gravelly clay loam or extremely gravelly clay loam, and IVC part is extremely gravelly sand or very gravelly sand.

Crabtree Series

The Crabtree series consists of deep, moderately well drained soils on ridgetops and concave side slopes of uplands. These soils formed in colluvium and glacial till derived from various kinds of rock. Slopes are 2 to 75 percent. The mean annual precipitation is about 100 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Crabtree stony loam, 25 to 45 percent slopes; 2 miles south of Crabtree Mountain; in the NE1/4SE1/4SE1/4 of sec. 29, T. 11 S., R. 3 E.

O1—1 inch to 0; litter of needles, leaves, and twigs.

A11—0 to 8 inches; very dark grayish brown (10YR 3/2) stony loam, light brownish gray (10YR 6/2) dry; moderate medium and fine granular structure; soft, friable, nonsticky and nonplastic; many fine roots; many very fine and fine irregular pores; 20 percent cobbles and stones and 10 percent gravel; medium acid (pH 6.0); clear wavy boundary.

A12—8 to 26 inches; very dark grayish brown (10YR 3/2) very gravelly loam, pale brown (10YR 6/2) dry; moderate fine granular structure; soft, friable, nonsticky and nonplastic; many fine roots; many very fine and fine tubular pores; 25 percent cobbles and stones and 30 percent gravel; slightly acid (pH 6.2); clear wavy boundary.

B2—26 to 39 inches; dark grayish brown (10YR 4/2) very gravelly loam, light gray (10YR 7/2) dry; many fine distinct brown (7.5YR 4/4) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; many very fine and fine tubular pores; 20 percent cobbles and stones and 35 percent gravel; medium acid (pH 6.0); clear wavy boundary.

B3—39 to 55 inches; variegated gray (10YR 5/1), brown (10YR 4/3), yellowish brown (10YR 5/6), dark brown (7.5YR 3/2), and dark reddish brown (5YR 3/3) very gravelly loam; weak medium subangular blocky structure; weakly consolidated; hard, firm, nonsticky and nonplastic; few fine roots; many very fine and fine tubular pores; 20 percent cobbles and stones and 35 percent gravel; thin discontinuous layer of very pale brown (10YR 8/3) ash at base of horizon; medium acid (pH 5.8); abrupt wavy boundary.

IICm—55 to 60 inches; variegated very stony loam; massive; strongly consolidated; hard, firm, nonsticky and nonplastic; few fine irregular pores; 30 percent stones and cobbles and 25 percent gravel; medium acid (pH 5.6).

Depth to bedrock is more than 60 inches. Depth to the IICm horizon is 40 to 60 inches.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5.5 to 7 when dry, and chroma of 2 or 3 when moist or dry.

The B horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist or dry. It is very gravelly loam or extremely gravelly loam.

Cruiser Series

The Cruiser series consists of deep, well drained soils on broad ridgetops and side slopes of uplands. These soils formed in colluvium derived dominantly from basic igneous rock and volcanic ash. Slopes are 3 to 70 percent. The mean annual precipitation is about 95 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Cruiser gravelly loam, 3 to 25 percent slopes; 2.5 miles east of Indian Prairie Lake; in the NE1/4NW1/4SW1/4 of sec. 2, T. 11 S., R. 2 E.

O1—1 inch to 0; layer of needles, leaves, and twigs.

A1—0 to 7 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; moderate fine granular structure and moderate fine subangular blocky; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 20 percent gravel; very strongly acid (pH 5.0); clear wavy boundary.

A3—7 to 14 inches; dark reddish brown (5YR 3/4) gravelly loam, reddish brown (5YR 5/3) dry; moderate fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular pores; 25 percent gravel; very strongly acid (pH 5.0); clear wavy boundary.

B21—14 to 20 inches; reddish brown (5YR 4/4) gravelly loam, light reddish brown (5YR 6/3) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common fine roots; common very fine tubular pores; 25 percent gravel; very strongly acid (pH 4.8); clear wavy boundary.

B22—20 to 30 inches; reddish brown (5YR 4/4) gravelly clay loam, light reddish brown (5YR 6/3) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; few fine roots; common very fine tubular pores; 30 percent gravel; very strongly acid (pH 4.8); clear smooth boundary.

B23—30 to 45 inches; yellowish red (5YR 4/6) gravelly clay loam, light reddish brown (5YR 6/4) dry; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common very fine tubular pores; 30 percent gravel; very strongly acid (pH 4.8); clear smooth boundary.

C—45 to 60 inches; yellowish red (5YR 4/6) very cobbly clay loam, light reddish brown (5YR 6/4) dry;

massive; slightly hard, firm, sticky and plastic; few fine tubular pores; 20 percent gravel and 25 percent cobbles; very strongly acid (pH 4.8).

Depth to bedrock is more than 60 inches.

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

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

The C horizon has hue of 7.5YR or 5YR, and it has chroma of 4 to 6 when moist or dry. It is very cobbly clay loam, cobbly loam, or gravelly loam. It is 15 to 30 percent gravel and 20 to 35 percent cobbles.

Cumley Series

The Cumley series consists of deep, moderately well drained soils in depressional areas and basins of uplands. These soils formed in fine textured colluvium derived dominantly from basic igneous rock. Slopes are 2 to 20 percent. The mean annual precipitation is about 70 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of Cumley silty clay loam, 2 to 20 percent slopes; in the SE1/4SE1/4SW1/4 of sec. 35, T. 14 S., R. 1 W.

O1—2 inches to 0; layer of moss, leaves, and twigs.

A11—0 to 10 inches; dark brown (7.5YR 3/2) silty clay loam, dark brown (7.5YR 4/2) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 10 percent nodules 2 to 5 millimeters in diameter; medium acid (pH 5.8); clear smooth boundary.

A12—10 to 18 inches; dark brown (7.5YR 3/2) silty clay loam, dark brown (7.5YR 4/2) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 10 percent nodules 2 to 5 millimeters in diameter; medium acid (pH 5.8); clear smooth boundary.

B21t—18 to 32 inches; dark brown (7.5YR 4/4) silty clay, brown (7.5YR 5/4) dry; common fine faint dark brown (7.5YR 4/2) and strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; 5 percent gravel; few thin clay films on peds; medium acid (pH 5.6); clear smooth boundary.

B22t—32 to 41 inches; dark brown (7.5YR 4/4) silty clay, brown (7.5YR 5/4) dry; few fine faint dark brown (7.5YR 4/2) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; many very fine tubular pores; 5 percent gravel; common thin clay films on peds; medium acid (pH 5.6); clear smooth boundary.

B3t—41 to 60 inches; brown (7.5YR 5/4) silty clay, light brown (7.5YR 6/4) dry; few fine faint dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; many very fine tubular pores; few fine black (10YR 2/1) manganese concretions; 10 percent gravel; few thin clay films on peds; medium acid (pH 5.6).

Depth to bedrock is more than 60 inches. Depth to mottles ranges from 16 to 34 inches. The profile has 0 to 5 percent cobbles and 5 to 10 percent gravel.

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

The B2t horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is silty clay or clay and has 40 to 50 percent clay.

Dayton Series

The Dayton series consists of deep, poorly drained soils in slightly concave areas on broad terraces of the Willamette Valley. These soils formed in mixed alluvial and lacustrine material. Slopes are 0 to 2 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Dayton silt loam; in the SW1/4NE1/4SE1/4 of sec. 19, T. 12 S., R. 3 W.

Ap—0 to 9 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; strongly acid (pH 5.1); abrupt smooth boundary.

A21—9 to 12 inches; dark gray (10YR 4/1) silt loam, light gray (10YR 6/1) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many fine irregular pores; common fine black (10YR 2/1) and dark reddish brown (5YR 3/3) iron and manganese stains and small concretions; strongly acid (pH 5.1); clear smooth boundary.

A22—12 to 15 inches; dark gray (5Y 4/1) silt loam, light gray (10YR 6/1) dry; moderate fine subangular blocky structure; slightly hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; strongly acid (pH 5.4); abrupt smooth boundary.

IIB21t—15 to 22 inches; dark gray (5Y 4/1) silty clay, light brownish gray (10YR 6/2) and light gray (10YR 6/1) dry; moderate coarse prismatic structure; very hard, very firm, very sticky and very plastic; common very fine roots; many fine tubular pores; few medium black (10YR 2/1) and gray (10YR 5/1) coatings on peds; strongly acid (pH 5.2); clear smooth boundary.

IIB22t—22 to 29 inches; olive gray (5Y 5/2) silty clay, light olive gray (5Y 6/2) dry; moderate medium and coarse prismatic structure; very hard, very firm, very sticky and very plastic; many very fine tubular pores; common medium black (10YR 2/1) and dark reddish brown (5YR 3/3) iron and manganese stains and fine concretions; medium acid (pH 5.7); clear smooth boundary.

IIB31t—29 to 40 inches; gray (5Y 5/1) silty clay, light gray (5Y 7/2) dry; few fine faint yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure; hard, firm, very sticky and very plastic; many fine tubular pores; thick continuous clay films on peds and in pores; neutral (pH 6.8); gradual wavy boundary.

IIIB32t—40 to 53 inches; dark gray (5Y 4/1) silt loam, light olive gray (5Y 6/2) dry; few fine faint dark brown (10YR 4/3) mottles; massive; hard, firm, sticky and plastic; few coarse tubular pores; thin continuous clay films on fractures and thick clay films in pores; neutral (pH 6.8); gradual wavy boundary.

IIIC1—53 to 64 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/4) dry; common fine faint brown (10YR 4/3) mottles; massive; slightly hard, friable, sticky and plastic; neutral (pH 7.0); gradual wavy boundary.

IIIC2—64 to 76 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/4) dry; massive; slightly hard, friable, sticky and plastic; neutral (pH 7.2).

Depth to bedrock is more than 60 inches. The solum is 30 to 48 inches thick. Depth to the IIB2t horizon is 12 to 24 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 to 5 when moist, and chroma of 1 or 2.

The A2 horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist or dry. It is silt loam or silty clay loam.

The IIB horizon has hue of 2.5Y, 5Y, or neutral when moist and 10YR when dry, value of 4 or 5 when moist, and chroma of 0 to 2. It is silty clay or clay and has 40 to 50 percent clay and 5 to 10 percent sand. In some areas are pressure faces or thin continuous clay films.

The IIIB and IIIC horizons are silt loam or silty clay loam.

Dixonville Series

The Dixonville series consists of moderately deep, well drained soils on low foothills adjacent to terraces of the Willamette Valley. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 3 to 50 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Dixonville silty clay loam, 12 to 30 percent slopes; in the NW1/4SW1/4NE1/4 of sec. 20, T. 13 S., R. 2 W.

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 4/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 3 percent gravel; medium acid (pH 5.6); clear smooth boundary.

A12—4 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 4/3) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; many very fine irregular pores; slightly acid (pH 6.2); clear smooth boundary.

B21t—12 to 19 inches; dark brown (7.5YR 3/3) clay, brown (7.5YR 4/3) dry; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; many very fine and fine roots; many very fine tubular pores; many thick clay films on peds; slightly acid (pH 6.2); clear smooth boundary.

B22t—19 to 26 inches; dark brown (7.5YR 3/3) clay, dark brown (7.5YR 4/3) dry; moderate coarse subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine and fine tubular pores; many thick clay films on peds; slightly acid (pH 6.2); clear smooth boundary.

Cr—26 inches; weathered basalt.

Depth to soft bedrock is 20 to 40 inches. The mollic epipedon is 20 to 30 inches thick.

The A horizon has hue of 10YR or 5YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 2 or 3 when moist or dry. It has 0 to 10 percent gravel and cobbles.

The B2t horizon has hue of 7.5YR or 5YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 2 to 4 when moist or dry. It is silty clay, clay, or cobbly clay. It has 0 to 30 percent gravel and cobbles. Some areas have a few stones in the lower part.

Dobbins Series

The Dobbins series consists of moderately deep, well drained soils on side slopes of uplands. These soils formed in colluvium derived dominantly from tuff, breccia, and basic igneous rock. Slopes are 60 to 90 percent. The mean annual precipitation is about 75 inches. The mean annual temperature is about 49 degrees F.

Typical pedon of a Dobbins gravelly loam in an area of Zango-Dobbins gravelly loams, 60 to 90 percent slopes; about 2 miles southeast of Cascadia State Park; in the NE1/4NE1/4NW1/4 of sec. 9, T. 14 S., R. 3 E.

O1—1 inch to 0; layer of leaves, needles, and twigs.

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; strong very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and medium roots; common very fine irregular pores; 30 percent gravel; strongly acid (pH 5.2); clear wavy boundary.

A12—4 to 12 inches; dark yellowish brown (10YR 3/4) very gravelly silty clay loam, brown (10YR 5/3) dry; strong fine subangular blocky structure; hard, very firm, very sticky and very plastic; many fine and medium roots; common very fine tubular pores; 45 percent gravel; strongly acid (pH 5.2); clear wavy boundary.

B21—12 to 18 inches; dark brown (7.5YR 3/4) very cobbly silty clay, light brown (7.5YR 6/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many fine and medium roots; common very fine tubular pores; 20 percent cobbles, 15 percent gravel, and 5 percent stones; strongly acid (pH 5.2); abrupt wavy boundary.

B22—18 to 34 inches; dark yellowish brown (7.5YR 3/4) very cobbly silty clay, brown (7.5YR 5/4) dry; weak medium subangular blocky structure; hard, very firm, very sticky and plastic; common fine and medium roots; few fine tubular pores; 30 percent cobbles, 15 percent stones, and 10 percent gravel; strongly acid (pH 5.4); abrupt wavy boundary.

IIR—34 inches; fractured basalt with soil material in interstices.

Depth to hard bedrock and thickness of the solum are 20 to 40 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 to 4 when moist. When moist, the horizon has chroma of 4 at a depth of less than 10 inches. It has 10 to 45 percent rock fragments, dominantly gravel.

The B horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma 3 or 4 when moist or dry. It is very cobbly silty clay or very gravelly silty clay loam. It has 35 to 45 percent clay and 35 to 60 percent rock fragments.

Dupee Series

The Dupee series consists of deep, somewhat poorly drained soils in depressional areas and drainageways on foothills and alluvial fans. These soils formed in mixed colluvium derived dominantly from sedimentary rock. Slopes are 3 to 20 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Dupee silt loam, 3 to 20 percent slopes; 1 mile southwest of Providence Church; in the NE1/4NE1/4NE1/4 of sec. 16, T. 11 S., R. 1 W.

Ap—0 to 4 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many very fine irregular pores; strongly acid (pH 5.2); clear smooth boundary.

A3—4 to 11 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular pores; very strongly acid (pH 5.0); clear smooth boundary.

B1—11 to 25 inches; brown (10YR 5/3) silty clay loam, pale brown (10YR 6/3) dry; few fine faint brown (10YR 4/3) mottles; strong fine subangular blocky structure; hard, friable, sticky and plastic; few fine and medium roots; many very fine tubular pores; many fine black (10YR 2/1) manganese concretions; very strongly acid (pH 5.0); clear smooth boundary.

B2t—25 to 36 inches; brown (10YR 5/3) silty clay, light yellowish brown (10YR 6/4) dry; common fine faint grayish brown (10YR 5/2) mottles; strong coarse subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few fine tubular pores; common thick patchy clay films on peds; many fine black (10YR 2/1) manganese concretions; 5 percent gravel and pieces of petrified wood; very strongly acid (pH 5.0); clear wavy boundary.

C1—36 to 50 inches; light olive gray (5Y 6/2) clay, grayish brown (2.5Y 5/2) dry; massive; extremely hard, firm, very sticky and very plastic; few fine tubular pores; very strongly acid (pH 5.0); clear smooth boundary.

C2—50 to 65 inches; light gray (2.5Y 7/2) clay; massive; extremely hard, firm, very sticky and very plastic; few fine tubular pores; very strongly acid (pH 5.0).

Depth to bedrock is more than 60 inches. Mottles are in the Bt horizon or at a depth of 30 inches or less.

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

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 3 to 4 when moist or dry. It is silty clay loam, silty clay, or clay. Content of clay is 35 to 50 percent.

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

Flane Series

The Flane series consists of deep, well drained soils on broad bench tops and side slopes of uplands. These soils formed in colluvium derived dominantly from basic igneous rock, tuff, and breccia. Slopes are 3 to 75 percent. The mean annual precipitation is about 80 inches. The mean annual temperature is about 44 degrees F.

Typical pedon of Flane gravelly loam, 25 to 50 percent slopes; about 1.5 miles northwest of Swamp Mountain; in the SE1/4SE1/4 of sec. 20, T. 14 S., R. 3 E.

O1—1 inch to 0; layer of leaves, needles, and twigs.

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly loam, dark grayish brown (10YR 4/2) dry; strong very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 25 percent fine gravel; very strongly acid (pH 4.8); clear wavy boundary.

A12—6 to 13 inches; dark yellowish brown (10YR 3/4) gravelly loam, brown (10YR 5/3) dry; moderate very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 20 percent gravel and 10 percent cobbles; very strongly acid (pH 4.8); clear wavy boundary.

B21—13 to 22 inches; brown (10YR 4/3) very cobbly silty clay loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; hard, firm, very sticky and very plastic; common fine roots; many very fine tubular pores; 25 percent gravel, 25 percent cobbles, and 5 percent stones; very strongly acid (pH 4.8); clear wavy boundary.

B22—22 to 37 inches; yellowish brown (10YR 5/4) very cobbly silty clay loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine roots; common very fine tubular pores; 30 percent cobbles, 20 percent gravel, and 5 percent stones; very strongly acid (pH 4.8); abrupt wavy boundary.

IIC—37 to 60 inches; dark grayish brown (2.5Y 4/2) extremely cobbly clay loam, light brownish gray (2.5Y 6/2) dry; common medium prominent yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few very fine tubular pores; 35 percent cobbles, 25 percent gravel, and 5 percent stones; very strongly acid (pH 4.8).

Depth to bedrock is more than 60 inches. The thickness of the solum ranges from 40 to 60 inches or more. The upper part of the solum is 15 to 30 percent rock fragments, and the lower part is 35 to 60 percent rock fragments.

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

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is very cobbly silty clay loam or very cobbly silty clay and has 35 to 45 percent clay.

The IIC horizon is extremely cobbly clay loam or very cobbly clay loam.

Fluvaquents

Fluvaquents are deep, poorly drained soils that formed in medium textured to moderately fine textured alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 60 inches, and the mean annual temperature is about 51 degrees F.

Reference pedon of Fluvaquents in an area of Fluvents-Fluvaquents complex, nearly level; in the SE1/4SW1/4SE1/4 of sec. 31, T. 12 S., R. 4 W.

A11—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; strongly acid (pH 5.4).

A12—8 to 24 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; many fine and medium distinct strong brown (7.5YR 4/6) mottles; moderate fine granular structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine irregular pores; strongly acid (pH 5.2); clear smooth boundary.

C1—24 to 60 inches; grayish brown (10YR 5/2) loam, light brownish gray (10YR 6/2) dry; common fine distinct strong brown (7.5YR 4/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; strongly acid (pH 5.2).

Depth to bedrock is more than 60 inches. The soils are saturated, but they are dry between depths of 4 and 24 inches for 20 to 60 consecutive days.

The A horizon has hue of 7.5YR, 10YR, or 2.5YR, value of 2 to 4 when moist and 5 or 6 when dry, and chroma of 1 or 2 when moist or dry. It is silty clay loam to loam and is 0 to 30 percent gravel.

The C horizon has hue of 10YR, 2.5YR, or neutral. It has distinct or prominent mottles. It is silt loam to sandy loam and is 0 to 65 percent gravel and cobbles.

Fluvents

Fluvents are deep, moderately well drained and well drained soils that formed in recent alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 60 inches, and the mean annual temperature is about 51 degrees F.

Reference pedon of Fluvents in an area of Fluvents-Fluvaquents complex, nearly level; in the NE1/4NE1/4SE1/4 of sec. 13, T. 9 S., R. 1 E.

A11—0 to 9 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; strong medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; medium acid (pH 5.6); gradual smooth boundary.

A12—9 to 27 inches; dark brown (10YR 3/3) loam, dark yellowish brown (10YR 3/4) dry; moderate medium and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; medium acid (pH 5.6); gradual smooth boundary.

A13—27 to 35 inches; dark yellowish brown (10YR 3/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) dry; weak medium and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine irregular pores; 20 percent gravel; medium acid (pH 5.8); abrupt wavy boundary.

IIC—35 to 60 inches; dark yellowish brown (10YR 3/4) extremely gravelly loamy sand, dark yellowish brown (10YR 4/4) dry; single grain; loose, nonsticky and nonplastic; common very fine irregular pores; 50 percent gravel and 15 percent cobbles; slightly acid (pH 6.2).

Depth to bedrock is more than 60 inches. The depth to the IIC ranges from 20 inches to more than 60 inches. Thin strata of gravelly loamy sand are in some areas. The soils usually are moist, but they are dry between depths of 4 and 24 inches for 20 to 60 consecutive days.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 2 to 4 when moist or dry. It is silt loam to sandy loam and is 0 to 30 percent gravel.

The IIC horizon is gravel, extremely gravelly loamy sand, or extremely gravelly sand.

Harrington Series

The Harrington series consists of moderately deep, well drained soils on ridgetops and side slopes of uplands. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 3 to 90 percent. The mean annual precipitation is about 75 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of a Harrington gravelly loam in an area of Klickitat-Harrington complex, 30 to 50 percent north slopes; in the NE1/4NE1/4SW1/4 of sec. 21, T. 13 S., R. 2 E.

O1—1 inch to 0; layer of leaves, twigs, and moss.

A1—0 to 4 inches; dark reddish brown (5YR 3/2) gravelly loam, brown (7.5YR 4/2) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; 30 percent gravel; many very fine concretions; medium acid (pH 5.8); clear smooth boundary.

B21—4 to 10 inches; dark reddish brown (5YR 3/2) very gravelly clay loam, brown (7.5YR 4/2) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; 35 percent gravel and 10 percent cobbles; many very fine concretions; medium acid (pH 5.8); clear smooth boundary.

B22—10 to 23 inches; dark reddish brown (5YR 3/3) very gravelly clay loam, brown (7.5YR 4/4) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; 40 percent gravel and 10 percent cobbles; many very fine concretions; medium acid (pH 5.6); clear smooth boundary.

B3—23 to 34 inches; dark reddish brown (5YR 3/4) very cobbly loam, brown (7.5YR 4/4) dry; weak very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; 40 percent cobbles and 30 percent gravel; many very fine concretions; medium acid (pH 5.6); clear wavy boundary.

IIR—34 inches; basalt.

Depth to hard bedrock is 20 to 40 inches. The textural control section is 35 to 80 percent rock fragments throughout.

The A horizon has hue of 7.5YR or 5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry.

The B horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 2 to 6 when moist or dry. It is very gravelly clay loam, very cobbly loam, or extremely gravelly loam and averages 25 to 35 percent clay.

Hazelair Series

The Hazelair series consists of moderately deep, moderately well drained to somewhat poorly drained soils on low foothills adjacent to the Willamette Valley. These soils formed in stratified, medium textured and moderately fine textured colluvium derived from various kinds of rock. Slopes are 2 to 35 percent. The mean annual precipitation is about 50 inches. The mean annual temperature is about 53 degrees F.

Typical pedon of Hazelair silty clay loam, 7 to 20 percent slopes; 330 feet north of Cochran Creek Road; in the SE1/4NE1/4SE1/4 of sec. 17, T. 13 S., R. 2 W.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; slightly acid (pH 6.2); clear smooth boundary.

B2—5 to 15 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; hard, firm, very sticky and very plastic; many very fine roots; many very fine tubular pores; slightly acid (pH 6.2); clear smooth boundary.

IIC—15 to 34 inches; variegated yellowish brown (10YR 5/4) and light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 6/4) dry; many fine distinct grayish brown (10YR 5/2) mottles; massive; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; slightly acid (pH 6.2); clear smooth boundary.

IIICr—34 inches; weathered siltstone.

Depth to soft sedimentary rock is 20 to 40 inches.

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

The B horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. It is silty clay loam or silty clay. Few fine siltstone and sandstone fragments are embedded in the lower part of the B horizon in some pedons.

The IIC horizon is strata of clay that is 60 to 70 percent clay. Hue is dominantly 2.5Y or 10YR, but it ranges to 7.5YR. The horizon has value of 4 to 6 when moist or dry, and it has chroma of 2 to 4 when moist.

Henline Series

The Henline series consists of moderately deep, well drained soils on ridgetops and side slopes of uplands. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 6 to 90 percent. The mean annual precipitation is about 95 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of a Henline very stony sandy loam in an area of Henline-Yellowstone-Rock outcrop complex, 50 to 90 percent slopes; on Crabtree Mountain Road; in the SW1/4NE1/4SE/1/4 of sec. 15, T. 11 S., R. 3 E.

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) very stony sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 40 percent stones and cobbles; medium acid (pH 6.0); gradual smooth boundary.

A12—5 to 12 inches; very dark grayish brown (10YR 3/2) very cobbly sandy loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 40 percent cobbles; medium acid (pH 6.0); clear smooth boundary.

A3—12 to 19 inches; dark brown (10YR 3/3) very cobbly sandy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; 30 percent gravel and 20 percent cobbles; medium acid (pH 5.8); gradual wavy boundary.

C—19 to 28 inches; dark yellowish brown (10YR 4/4) very cobbly sandy loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; 35 percent gravel and 25 percent cobbles; medium acid (pH 5.8); abrupt irregular boundary.

R—28 inches; partially fractured basalt.

Depth to hard bedrock is 20 to 40 inches. The profile is 40 to 85 percent rock fragments and 7 to 15 percent clay. Less than 1 percent to about 3 percent of the surface is covered with stones.

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

The C horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is very gravelly sandy loam, very cobbly sandy loam, or very gravelly fine sandy loam.

Holcomb Series

The Holcomb series consists of deep, somewhat poorly drained soils in slightly convex areas on broad terraces of the Willamette Valley. These soils formed in silty and clayey alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Holcomb silt loam; about 250 feet west of Courtney Road; in the SE1/4SW1/4SW1/4 of sec. 29, T. 14 S., R. 4 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; strong fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many fine tubular pores; medium acid (pH 5.8); clear smooth boundary.

A1—7 to 21 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots; many fine tubular pores; medium acid (pH 5.6); clear smooth boundary.

A2—21 to 27 inches; dark grayish brown (10YR 4/2) silty clay loam, light gray (10YR 7/2) dry; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; few fine roots; many very fine tubular pores; medium acid (pH 5.6); clear smooth boundary.

IIB21t—27 to 39 inches; grayish brown (10YR 5/2) clay, gray (5Y 5/1) dry; common fine distinct yellowish brown (10YR 5/6) mottles; strong coarse subangular blocky structure; firm, extremely hard, very sticky and very plastic; few very fine roots; few fine tubular pores; common moderately thick clay films on peds; slightly acid (pH 6.2); clear smooth boundary.

IIB22tg—39 to 47 inches; grayish brown (10YR 5/2) silty clay, light olive gray (5Y 6/2) dry; moderate fine subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine tubular pores; common moderately thick clay films on peds; slightly acid (pH 6.4); clear smooth boundary.

IIIC—47 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam, pale olive (5Y 6/3) dry; massive; hard, firm, sticky and plastic; few coarse tubular pores; slightly acid (pH 6.4).

Depth to bedrock is more than 60 inches. The thickness of the solum ranges from 36 to 60 inches. Distinct or prominent mottles are in the IIBt horizon.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The A2 horizon, where present, has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when moist. It is silt loam or silty clay loam.

The IIB2t horizon has hue of 10YR to 5Y, and it has value of 4 or 5 when moist and 5 or 6 when dry. It is silty clay or clay.

The IIIC horizon has hue of 10YR to 5Y, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. It is silt loam, silty clay loam, or clay loam.

Honeygrove Series

The Honeygrove series consists of deep, well drained soils on broad rolling bench tops and side slopes of uplands. These soils formed in colluvium derived dominantly from sedimentary, basic igneous, or tuffaceous rock. Slopes are 3 to 50 percent. The mean annual precipitation is about 75 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Honeygrove silty clay loam, 12 to 25 percent slopes; about 4 miles east of Lacomb; in the NE1/4SE1/4SE1/4 of sec. 27, T. 11 S., R. 1 E.

O1—1 inch to 0; layer of needles, leaves, and moss.

A11—0 to 6 inches; dark reddish brown (5YR 3/2) silty clay loam, reddish brown (5YR 4/3) dry; strong very fine granular structure; hard, friable, sticky and plastic; many fine roots; many fine irregular pores; medium acid (pH 5.6); clear wavy boundary.

A12—6 to 13 inches; dark reddish brown (5YR 3/4) silty clay loam, reddish brown (5YR 4/4) dry; strong fine and medium granular structure; hard, friable, sticky and plastic; many fine roots; common fine irregular pores; strongly acid (pH 5.2); clear wavy boundary.

B1—13 to 29 inches; dark reddish brown (5YR 3/4) silty clay, reddish brown (5YR 5/4) dry; moderate medium granular structure parting to fine and very fine subangular blocky; hard, firm, sticky and plastic; common fine roots; many fine tubular pores; strongly acid (pH 5.2); clear wavy boundary.

B21t—29 to 42 inches; dark reddish brown (5YR 3/4) silty clay, reddish brown (5YR 5/4) dry; moderate fine subangular blocky structure; hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine tubular pores; common moderately thick clay films on peds; very strongly acid (pH 4.8); gradual smooth boundary.

B22t—42 to 55 inches; dark reddish brown (5YR 3/4) silty clay, reddish brown (5YR 5/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; common moderately thick clay films on peds; very strongly acid (pH 4.8); gradual smooth boundary.

C—55 to 75 inches; strong brown (7.5YR 5/6) silty clay, reddish yellow (7.5YR 7/6) dry; weak coarse subangular blocky structure; hard, firm, very sticky and very plastic; few very fine roots; common fine tubular pores; few moderately thick clay films on peds; 30 percent soft sandstone fragments; very strongly acid (pH 4.8).

Depth to bedrock is more than 60 inches. The solum generally has few rock fragments, but in some areas it has as much as 25 percent rock fragments throughout.

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

The Bt horizon has hue of 2.5YR or 5YR, value of 4 or 5 when dry, and chroma of 4 to 6 when moist or dry. It is silty clay or clay and averages 50 to 60 percent clay.

The C horizon is silty clay or clay.

Hummington Series

The Hummington series consists of moderately deep, well drained soils on narrow to broad ridgetops and side slopes of uplands. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 5 to 75 percent. The mean annual precipitation is about 85 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Hummington very gravelly loam, 5 to 25 percent slopes; in the NW1/4NE1/4SE1/4 of sec. 24, T. 15 S., R. 1 E.

O1—1 inch to 0; layer of moss, leaves, and twigs.

A11—0 to 8 inches; very dark grayish brown (10YR 3/2) very gravelly loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine irregular pores; 25 percent gravel and 10 percent cobbles; strongly acid (pH 5.4); clear smooth boundary.

A12—8 to 20 inches; dark brown (10YR 3/3) very cobbly loam, brown (10YR 4/3) dry; moderate fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine irregular pores; 30 percent cobbles and 15 percent gravel; strongly acid (pH 5.4); gradual wavy boundary.

B21—20 to 24 inches; dark yellowish brown (10YR 3/4) very cobbly loam, brown (10YR 4/3) dry; moderate very fine and fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine roots; many very fine irregular pores; 30 percent cobbles and 20 percent gravel; strongly acid (pH 5.4); gradual wavy boundary.

B22—24 to 29 inches; dark yellowish brown (10YR 3/4) extremely cobbly loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; soft, friable, nonsticky and nonplastic; few medium roots; many very fine irregular pores; 55 percent cobbles and 20 percent gravel; strongly acid (pH 5.2); gradual wavy boundary.

B3—29 to 36 inches; dark yellowish brown (10YR 3/4) extremely cobbly loam, brown (10YR 5/3) dry; weak coarse subangular blocky structure; soft, friable, nonsticky and nonplastic; few medium roots; many very fine irregular pores; 55 percent cobbles and 20 percent gravel; strongly acid (pH 5.2); abrupt irregular boundary.

R—36 inches; basalt.

Depth to hard bedrock is 20 to 40 inches. The profile is 7 to 18 percent clay and 35 to 75 percent rock fragments. The umbric epipedon is 20 to 30 inches thick.

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

The B horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 to 4 when moist or dry. The upper part of the B horizon is 35 to 50 percent rock fragments, and the lower part is 50 to 75 percent rock fragments. The horizon is very cobbly loam, extremely cobbly loam, or very gravelly loam.

Jory Series

The Jory series consists of deep, well drained soils on low, rolling foothills. These soils formed in colluvium derived dominantly from basic igneous and tuffaceous rock. Slopes are 2 to 50 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Jory silty clay loam, 2 to 12 percent slopes; in the SW1/4NW1/4NW1/4 of sec. 7, T. 13 S., R. 1 E.

A1—0 to 6 inches; dark reddish brown (5YR 3/3) silty clay loam, reddish brown (5YR 4/4) dry; strong very fine granular structure parting to strong very fine subangular blocky; hard, firm, sticky and plastic; common fine roots; many very fine irregular pores; medium acid (pH 5.8); clear wavy boundary.

B1t—6 to 17 inches; dark reddish brown (5YR 3/4) clay, reddish brown (5YR 4/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and very plastic; few fine roots; common very fine tubular pores; few thin clay films on peds; strongly acid (pH 5.4); gradual smooth boundary.

B21t—17 to 29 inches; reddish brown (5YR 4/4) clay, yellowish red (5YR 4/6) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and very plastic; few very fine roots; common very fine tubular pores; common moderately thick clay films on peds; strongly acid (pH 5.4); gradual smooth boundary.

B22t—29 to 46 inches; reddish brown (5YR 4/4) clay, yellowish red (5YR 4/6) dry; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; common moderately thick clay films on peds; strongly acid (pH 5.4); gradual smooth boundary.

B3t—46 to 60 inches; yellowish red (5YR 4/6) silty clay, yellowish red (5YR 5/6) dry; weak medium and coarse subangular blocky structure; hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; common moderately thick clay films on peds; 5 percent partially weathered siltstone fragments; strongly acid (pH 5.4).

Depth to bedrock is more than 60 inches.

The A horizon has value of 2 or 3 when moist and 3 or 4 when dry, and it has chroma of 3 or 4 when moist and 3 to 6 when dry.

The B2t horizon has hue of 2.5YR or 5YR, and it has chroma of 4 to 6 when moist or dry. It is silty clay or clay and is 45 to 60 percent clay.

Keel Series

The Keel series consists of moderately deep, well drained soils on broad ridgetops and side slopes of uplands. These soils formed in colluvium derived dominantly from basic igneous rock with an admixture of volcanic ash. Slopes are 2 to 75 percent. The mean annual precipitation is about 85 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of Keel gravelly silt loam, 2 to 25 percent slopes; about 0.75 mile west of Lost Dog Rock; in the SW1/4SE1/4SW1/4 of sec. 17, T. 12 S., R. 2 E.

A11—0 to 5 inches; very dark brown (10YR 2/2) gravelly silt loam, grayish brown (10YR 5/2) dry; moderate fine and very fine granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many very fine and fine irregular pores; 10 percent concretions and fine gravel and 5 percent cobbles; strongly acid (pH 5.2); clear smooth boundary.

A12—5 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular pores; 5 percent cobbles; strongly acid (pH 5.2); clear smooth boundary.

A3—10 to 15 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common fine roots; many very fine tubular pores; 5 percent cobbles; strongly acid (pH 5.2); clear smooth boundary.

B2—15 to 19 inches; brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine tubular pores; 5 percent gravel and 5 percent cobbles; strongly acid (pH 5.1); gradual wavy boundary.

B3—19 to 24 inches; brown (10YR 4/3) cobbly loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; 10 percent partially weathered gravel and 20 percent partially weathered cobbles; very strongly acid (pH 4.9); abrupt irregular boundary.

Cr—24 inches; fractured, partially weathered andesitic breccia.

Depth to soft bedrock is 20 to 40 inches. Content of cobbles commonly increases with depth. The textural control section has 5 to 30 percent gravel and cobbles, the percentage of which increases as depth increases.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist, and chroma of 2 or 3 when moist or dry. The lower part of the A horizon is silt loam or clay loam.

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

Kilchis Series

The Kilchis series consists of shallow, well drained or excessively drained soils on side slopes of uplands. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 30 to 90 percent. The mean annual precipitation is about 75 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of a Kilchis stony loam in an area of Kilchis-Harrington complex, 30 to 60 percent slopes; in the NW1/4NW1/4SE1/4 of sec. 6, T. 14 S., R. 2 E.

O1—2 inches to 0; layer of leaves, moss, and twigs.

A1—0 to 4 inches; dark brown (7.5YR 3/2) stony loam, dark brown (7.5YR 4/2) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 10 percent gravel, 10 percent cobbles, and 10 percent stones; strongly acid (pH 5.2); abrupt smooth boundary.

B2—4 to 12 inches; dark brown (7.5YR 3/2) very cobbly loam, dark brown (7.5YR 4/2) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 30 percent cobbles and 25 percent gravel; medium acid (pH 5.8); abrupt smooth boundary.

IIR—12 inches; fractured basalt.

Depth to hard bedrock is 12 to 20 inches. The profile is 18 to 27 percent clay. The textural control section averages more than 35 percent rock fragments. The umbric epipedon is 7 to 20 inches thick.

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

The B horizon has hue of 7.5YR or 5YR, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 2 to 4 when moist or dry. It is very cobbly loam, very stony loam, or extremely gravelly silt loam.

Kinney Series

The Kinney series consists of deep, well drained soils in old slump areas, and on broad bench tops, ridgetops, and side slopes of uplands. These soils formed in volcanic ash mixed with till or with colluvium derived dominantly from tuffaceous rock. Slopes are 3 to 70 percent. The mean annual precipitation is about 75 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Kinney cobbly loam, 20 to 50 percent north slopes; in the SW1/4NE1/4NW1/4 of sec. 2, T. 11 S., R. 2 E.

O1—2 inches to 0; layer of leaves, stems, and twigs.

A1—0 to 7 inches; dark brown (10YR 3/3) cobbly loam, brown (10YR 5/3) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 20 percent cobbles and 10 percent gravel; strongly acid (pH 5.2); clear smooth boundary.

A3—7 to 15 inches; dark brown (10YR 3/3) cobbly loam, brown (10YR 5/3) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; 20 percent cobbles and 5 percent gravel; strongly acid (pH 5.2); clear smooth boundary.

B21—15 to 27 inches; dark yellowish brown (10YR 3/4) cobbly clay loam, yellowish brown (10YR 5/4) dry; moderate fine subangular blocky structure parting to moderate fine granular; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; 20 percent cobbles and 10 percent gravel; very strongly acid (pH 4.8); clear smooth boundary.

B22—27 to 35 inches; dark yellowish brown (10YR 4/4) cobbly clay loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure parting to moderate fine granular; hard, friable, sticky and plastic; common fine roots; many fine tubular pores; 30 percent cobbles; very strongly acid (pH 4.8); clear wavy boundary.

C1—35 to 55 inches; dark yellowish brown (10YR 4/4) very cobbly loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure; hard, friable, sticky and plastic; few fine roots; common fine tubular pores; 45 percent cobbles; very strongly acid (pH 4.8); clear wavy boundary.

Cr—55 inches; weathered rhyolite.

Depth to soft bedrock is 40 to 60 inches. The 10- to 40-inch textural control section averages 25 to 35 percent coarse fragments and 22 to 30 percent clay. The umbric epipedon is 10 to 20 inches thick.

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

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

The C horizon is very cobbly loam or cobbly loam.

Klickitat Series

The Klickitat series consists of deep, well drained soils on ridgetops and side slopes of uplands. These soils formed in cobbly or stony colluvium derived dominantly from basic igneous rock. Slopes are 3 to 75 percent. The mean annual precipitation is about 75 inches. The mean annual temperature is about 49 degrees F.

Typical pedon of a Klickitat stony loam in an area of Harrington-Klickitat complex, 50 to 75 percent south slopes; in the SW1/4SW1/4SW1/4 of sec. 21, T. 11 S., R. 2 E.

O1—1 inch to 0; layer of needles, twigs, leaves, and moss.

A1—0 to 9 inches; dark reddish brown (5YR 3/2) stony loam, reddish brown (5YR 5/3) dry; moderate fine granular structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 15 percent stones, 15 percent gravel, and 5 percent cobbles; strongly acid (pH 5.2); clear smooth boundary.

B2—9 to 20 inches; dark reddish brown (5YR 3/3) very cobbly clay loam, reddish brown (5YR 5/4) dry; weak fine subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; 20 percent cobbles, 20 percent gravel, and 10 percent stones; strongly acid (pH 5.4); clear smooth boundary.

C—20 to 56 inches; dark reddish brown (5YR 3/4) very cobbly loam, reddish brown (5YR 5/4) dry; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine tubular pores; 35 percent cobbles, 15 percent gravel, and 5 percent stones; strongly acid (pH 5.4); clear wavy boundary.

IIR—56 inches; fractured basalt.

Depth to hard bedrock is 40 to 60 inches. Thickness of the solum is 20 to 40 inches. The A horizon has 15 to 50 percent gravel and cobbles. The B horizon has 35 to 70 percent gravel and cobbles, and the percentage increases as depth increases. The umbric epipedon is 10 to 20 inches thick.

The A horizon has hue of 7.5YR or 5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and 3 or 4 when dry.

The B horizon has value of 3 or 4 when moist and 4 to 6 when dry, and it has chroma of 3 to 6 when moist or dry. It is very gravelly, very cobbly, or extremely cobbly clay loam. It is 27 to 33 percent clay.

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

Malabon Series

The Malabon series consists of deep, well drained soils in slightly convex areas on low alluvial stream terraces. These soils formed in silty and clayey alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Malabon silty clay loam; on the Estergard farm; in the SW1/4NE1/4SW1/4 of sec. 19, T. 15 S., R. 3 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; medium acid (pH 5.6); abrupt smooth boundary.

A1—7 to 17 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine and very fine subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; medium acid (pH 5.6); clear smooth boundary.

B21t—17 to 27 inches; dark brown (10YR 3/3) silty clay, brown (10YR 5/3) dry; moderate subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; many thick very dark grayish brown (10YR 3/2) clay films in pores and on peds; slightly acid (pH 6.1); clear wavy boundary.

B22t—27 to 40 inches; brown (10YR 4/3) silty clay, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; many thick very dark grayish brown (10YR 3/2) clay films in pores and on peds; slightly acid (pH 6.2); clear wavy boundary.

B23t—40 to 49 inches; dark brown (10YR 3/3) silty clay, brown (10YR 4/3) dry; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine tubular pores; many thick brown (7.5YR 4/2) clay films in pores; slightly acid (pH 6.2); clear wavy boundary.

B3t—49 to 60 inches; dark brown (10YR 3/3) silty clay, brown (10YR 4/3) dry; weak medium subangular blocky structure; very hard, firm, very sticky and very plastic; few fine roots; common fine tubular pores; many thick strong brown (7.5YR 4/6) clay films in pores; slightly acid (pH 6.2).

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 30 inches thick. The profile is as much as 15 percent gravel in some areas.

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

The B horizon has hue of 10YR or 7.5YR. When moist it has value of 3 to a depth of 20 inches or more and 3 or 4 below this depth, and when dry it has value of 4 or 5. It has chroma of 2 or 3 when moist and 3 or 4 when dry. It is silty clay loam that is more than 35 percent clay or is silty clay.

Malabon Variant

The Malabon Variant consists of deep, well drained soils on stream terraces. These soils formed in mixed alluvium that is high in content of ash and is derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Malabon Variant loam; 0.5 mile northwest of Lyons School; in the SE1/4SW1/4SE1/4 of sec. 13, T. 9 S., R. 1 E.

O1—2 inches to 0; layer of leaves, twigs, moss, and needles.

A11—0 to 7 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; medium acid (pH 6.0); abrupt smooth boundary.

A12—7 to 14 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; medium acid (pH 5.8); clear smooth boundary.

B21—14 to 27 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine irregular pores; medium acid (pH 5.6); gradual smooth boundary.

B22—27 to 40 inches; very dark grayish brown (10YR 3/2) sandy loam, brown (10YR 5/3) dry; weak fine and very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine irregular pores; medium acid (pH 5.6); gradual smooth boundary.

B23—40 to 55 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and medium roots; common very fine and fine irregular pores; 5 percent gravel; strongly acid (pH 5.4); gradual smooth boundary.

IIC—55 to 60 inches; dark brown (10YR 3/3) very gravelly sandy loam, pale brown (10YR 6/3) dry;

massive; soft, very friable, nonsticky and nonplastic; common very fine irregular pores; 30 percent gravel and 15 percent cobbles; strongly acid (pH 5.2).

Depth to bedrock is more than 60 inches. The solum is 0 to 10 percent gravel. Depth to the IIC horizon ranges from 40 to 60 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 1 or 2 when moist or dry.

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

The IIC horizon has value of 3 to 6 when moist or dry, and it has chroma of 3 or 4 when moist or dry. It is very gravelly sandy loam, extremely gravelly sandy loam, or extremely gravelly loamy sand.

Marcola Series

The Marcola series consists of deep, moderately well drained soils on fans at the mouth of steep canyons. These soils formed in alluvium and colluvium derived dominantly from sedimentary and volcanic rock. Slopes are 2 to 7 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Marcola cobbly silty clay loam, 2 to 7 percent slopes; in the SW1/4SW1/4SE1/4 of sec. 1, T. 15 S., R. 3 W.

A1—0 to 5 inches; very dark brown (10YR 3/2) cobbly silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; many very fine tubular pores; 15 percent cobbles and 15 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

A3—5 to 12 inches; very dark brown (10YR 3/2) cobbly silty clay loam, dark grayish brown (10YR 4/2) dry; strong medium subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; many very fine tubular pores; 15 percent cobbles and 15 percent gravel; slightly acid (pH 6.4); abrupt wavy boundary.

B21t—12 to 21 inches; dark brown (10YR 3/3) very cobbly clay, brown (10YR 5/3) dry; moderate fine subangular blocky structure; very hard, firm, very sticky and very plastic; many very fine and fine roots; many very fine tubular pores; 30 percent gravel and 25 percent cobbles; few thin dark yellowish brown (10YR 3/4) clay films on peds; neutral (pH 6.6); gradual smooth boundary.

B22t—21 to 30 inches; dark yellowish brown (10YR 3/4) very cobbly clay, yellowish brown (10YR 5/4) dry; moderate fine subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; many very fine tubular pores; 20 percent cobbles, 20 percent gravel, and 15 percent stones; common thin dark yellowish brown (10YR 3/4) clay films on peds; neutral (pH 6.6); clear wavy boundary.

B3t—30 to 37 inches; brown (10YR 4/3) extremely cobbly clay, pale brown (10YR 6/3) dry; few distinct faint light gray (10YR 7/1) mottles; weak fine subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; 40 percent gravel and 30 percent cobbles; common thin dark yellowish brown (10YR 4/3) clay films on peds; neutral (pH 6.6); clear wavy boundary.

C—37 to 60 inches; variegated brown and dark grayish brown (10YR 4/3, 4/2) extremely cobbly clay, pale brown and light brownish gray (10YR 6/3, 6/2) dry; massive; hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; 45 percent gravel and 30 percent cobbles, partially weathered and unweathered; neutral (pH 6.6).

Depth to bedrock is more than 60 inches.

The A horizon has value of 2 or 3 when moist, and it has chroma of 1 or 2 when moist or dry. It has 15 to 35 percent rock fragments.

The B horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist or dry. Below a depth of 20 inches, the horizon has value of 6 when dry and chroma of 4. It is very cobbly, extremely cobbly, or very gravelly clay. It has 35 to 80 percent rock fragments.

McAlpin Series

The McAlpin series consists of deep, moderately well drained soils on undulating low alluvial terraces in valleys of tributaries to the Willamette River. These soils formed in fine textured alluvium derived from various kinds of rock. Slopes are 3 to 6 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of McAlpin silty clay loam, 3 to 6 percent slopes; about 0.5 mile east of Holley; in the SE1/4NW1/4SW1/4 of sec. 14, T. 14 S., R. 1 W.

A11—0 to 8 inches; dark brown (7.5YR 3/2) silty clay loam, brown (7.5YR 4/2) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; few fine and medium reddish brown (5YR 4/4) iron concretions; strongly acid (pH 5.5); clear smooth boundary.

A12—8 to 14 inches; dark brown (7.5YR 3/2) silty clay loam, brown (7.5YR 4/2) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; many very fine and fine tubular pores; common fine and medium reddish brown (5YR 4/4) iron concretions; medium acid (pH 5.6); clear smooth boundary.

B1—14 to 25 inches; dark reddish brown (5YR 3/3) silty clay loam, reddish brown (5YR 4/3) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; common fine and medium reddish brown (5YR 4/4) iron concretions; medium acid (pH 6.0); clear smooth boundary.

B21—25 to 37 inches; reddish brown (5YR 4/3) silty clay, reddish brown (5YR 5/3) dry; few fine faint dark reddish gray (5YR 4/2) and reddish brown (5YR 4/4) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; many very fine and fine tubular pores; common fine reddish brown (5YR 4/4) iron concretions; medium acid (pH 5.9); gradual smooth boundary.

B22—37 to 60 inches; reddish brown (5YR 4/4) silty clay, reddish brown (5YR 5/4) dry; common fine and medium faint reddish brown (5YR 4/3) mottles; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; few very fine roots; many very fine and fine tubular pores; common fine and medium reddish brown (5YR 4/4) iron concretions; medium acid (pH 5.9).

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 30 inches thick. Mottles that have chroma of 2 or less are at a depth of 20 to 40 inches.

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

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

McBee Series

The McBee series consists of deep, moderately well drained soils on nearly level to gently undulating flood plains. These soils formed in moderately fine textured recent alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of McBee silty clay loam; east of Highway 5; in the SE1/4NW1/4NE1/4 of sec. 21, T. 13 S., R. 3 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine irregular pores; few fine and medium iron concretions; medium acid (pH 5.8); gradual smooth boundary.

A1—10 to 19 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; many fine roots; common medium and coarse tubular pores; few fine and medium iron concretions; medium acid (pH 5.8); gradual wavy boundary.

B1—19 to 28 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; few fine faint dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; hard, firm, sticky and plastic; common fine roots; common medium and coarse tubular pores; few fine and medium iron concretions; medium acid (pH 5.8); gradual smooth boundary.

B2—28 to 44 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; many fine and medium distinct dark reddish brown (5YR 3/3) mottles; weak medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine tubular pores; common thick dark coatings in root channels and wormholes; common medium iron concretions; medium acid (pH 6.0); clear smooth boundary.

C1—44 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; many medium and coarse distinct yellowish red (5YR 5/6) mottles; massive; hard, firm, sticky and plastic; few fine tubular pores; common medium iron concretions; medium acid (pH 6.0).

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 40 inches thick.

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

The B horizon has hue of 10YR or 7.5YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist or dry. It is silty clay loam, clay loam, or silt loam and has less than 15 percent sand that is coarser than very fine sand. It has 25 to 35 percent clay.

McDuff Series

The McDuff series consists of moderately deep, well drained soils on side slopes of uplands. These soils formed in fine textured colluvium derived dominantly from tuffaceous and sedimentary rock. Slopes are 25 to 75 percent. The mean annual precipitation is about 75 inches. The mean annual temperature is about 50 degrees F.

Typical pedon of McDuff silty clay loam, 25 to 50 percent slopes; on the south-facing foot slopes of Moss Butte; in SE1/4NE1/4NE1/4 of sec. 3, T. 14 S., R. 2 E.

O1—1 inch to 0; layer of needles, leaves, ferns, and twigs.

A1—0 to 7 inches; dark brown (7.5YR 3/2) silty clay loam, brown (7.5YR 4/2) dry; strong very fine granular structure; hard, friable, sticky and plastic;

many fine and medium roots; many very fine irregular pores; 10 percent fine iron concretions 2 to 5 millimeters in diameter; strongly acid (pH 5.2); clear wavy boundary.

B1t—7 to 15 inches; dark brown (7.5YR 3/2) clay, brown (7.5YR 4/4) dry; moderate fine and medium subangular blocky structure; hard, very firm, very sticky and very plastic; many fine and medium roots; many very fine tubular pores; few thin dark brown (7.5YR 3/2) clay films on faces of peds; very strongly acid (pH 5.0); clear wavy boundary.

B21t—15 to 24 inches; dark brown (7.5YR 3/4) clay, brown (7.5YR 5/4) dry; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common medium roots; common very fine tubular pores; common moderately thick dark reddish brown (5YR 3/3) clay films on peds; 5 percent soft strong brown (7.5YR 5/8) siltstone fragments; very strongly acid (pH 5.0); clear wavy boundary.

B22t—24 to 32 inches; dark brown (7.5YR 3/4) clay, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine and medium roots; common very fine tubular pores; many moderately thick dark reddish brown (5YR 3/3) clay films on peds; 5 percent soft strong brown (7.5YR 5/8) siltstone fragments; very strongly acid (pH 4.8); clear wavy boundary.

B3t—32 to 36 inches; strong brown (7.5YR 4/6) silty clay, strong brown (7.5YR 5/6) dry; weak medium subangular blocky structure; hard, firm, very sticky and very plastic; common medium roots; few very fine tubular pores; few moderately thick dark reddish brown (5YR 3/3) clay films on peds; 40 percent soft light brown (7.5YR 6/4) tuffaceous siltstone fragments; very strongly acid (pH 4.8); abrupt wavy boundary.

Cr—36 inches; weathered tuffaceous siltstone; dark reddish brown (5YR 3/4) coatings on fragments.

Depth to soft bedrock is 20 to 40 inches.

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

The Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 to 6 when moist or dry. It is silty clay or clay and is 40 to 60 percent clay. The upper part is 0 to 20 percent soft rock fragments, and the lower part is 20 to 50 percent.

Minniece Series

The Minniece series consists of deep, somewhat poorly drained to poorly drained soils in narrow drainageways and depressional areas of uplands. These soils formed in colluvium and alluvium derived dominantly from basic igneous rock. Slopes are 0 to 8 percent. The mean annual precipitation is about 75 inches, and the mean annual temperature is about 48 degrees F.

Typical pedon of Minniece silty clay loam, 0 to 8 percent slopes; in the SW1/4NE1/4SW1/4 of sec. 27, T. 12 S., R. 1 E.

O1—1 inch to 0; layer of leaves, twigs, and moss.

A1—0 to 3 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; strong medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; medium acid (pH 5.6); clear smooth boundary.

A3—3 to 10 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; medium acid (pH 5.6); clear smooth boundary.

B21tg—10 to 20 inches; dark gray (10YR 4/1) silty clay, gray (10YR 6/1) dry; common fine faint dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine and coarse roots; many fine tubular pores; few thin clay films on peds; medium acid (pH 5.6); diffuse smooth boundary.

B22tg—20 to 28 inches; gray (10YR 5/1) silty clay, light gray (10YR 6/1) dry; common medium distinct brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few fine tubular pores; few thin clay films on peds; medium acid (pH 5.6); abrupt smooth boundary.

B3g—28 to 36 inches; grayish brown (10YR 5/2) silty clay, light gray (10YR 7/2) dry; common medium distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few fine tubular pores; medium acid (pH 5.6); abrupt smooth boundary.

C1g—36 to 48 inches; gray (10YR 5/1) silty clay loam, light gray (10YR 7/1) dry; common coarse distinct dark yellowish brown (10YR 4/4) mottles; massive; very hard, firm, sticky and plastic; few fine tubular pores; medium acid (pH 5.6); abrupt smooth boundary.

C2g—48 to 65 inches; gray (10YR 6/1) silty clay loam, light gray (10YR 7/1) dry; few fine distinct yellowish brown (10YR 5/4) mottles; massive; very hard, firm, sticky and plastic; medium acid (pH 5.6).

Depth to bedrock is more than 60 inches. The solum commonly does not have rock fragments, but in some areas it has as much as 5 percent gravel and cobbles. The umbric epipedon is 10 to 15 inches thick. The B and C horizons have distinct or prominent mottles.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 1 or 2 when moist or dry.

The Bg horizon has hue of 10YR to 5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist or dry. It is silty clay or clay.

The Cg horizon is clay, silty clay loam, or clay loam.

Moe Series

The Moe series consists of deep, well drained soils on broad bench tops and side slopes of uplands. These soils formed in colluvium derived dominantly from tuff and breccia. Slopes are 3 to 75 percent. The mean annual precipitation is about 80 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Moe gravelly loam, 3 to 25 percent slopes; about 1.5 miles northeast of Swamp Mountain; in the NW1/4SE1/4 of sec. 22, T. 14 S., R. 3 E.

O1—1 inch to 0; layer of needles, twigs, and leaves.

A11—0 to 9 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; very friable, slightly hard, slightly sticky and slightly plastic; many fine and medium roots; many very fine irregular pores; 20 percent gravel 2 to 5 millimeters in diameter; very strongly acid (pH 5.0); clear wavy boundary.

A12—9 to 15 inches; very dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; moderate very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common medium and coarse roots; many fine irregular pores; 25 percent gravel 2 to 5 millimeters in diameter; very strongly acid (pH 4.8); clear wavy boundary.

B21—15 to 24 inches; dark brown (10YR 4/3) silty clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; hard, firm, very sticky and very plastic; common medium and coarse roots; common very fine tubular pores; few faint dark yellowish brown (10YR 3/4) coatings on peds; very strongly acid (pH 4.8); gradual wavy boundary.

B22—24 to 41 inches; dark yellowish brown (10YR 4/4) silty clay, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, firm, very sticky and very plastic; few coarse roots; common very fine tubular pores; very strongly acid (pH 4.8); gradual smooth boundary.

B3—41 to 61 inches; dark brown (7.5YR 4/4) silty clay, brown (7.5YR 5/4) dry; common medium faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; hard, firm, very sticky and very plastic; few fine and medium roots; common very fine tubular pores; few fine black (10YR 2/1) stains; few partially weathered siltstone fragments 10 to 50 millimeters in diameter; very strongly acid (pH 4.6).

Depth to bedrock is more than 60 inches. Thickness of the solum is 40 to 60 inches. The umbric epipedon is 15 to 20 inches thick. The content of partially weathered rock fragments ranges from a few in the upper part of the solum to 35 percent in the lower part.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 2 or 3 when moist or dry. It is 15 to 35 percent fine gravel.

The B horizon has hue of 10YR or 7.5YR, and it has chroma of 3 or 4 when moist or dry. It is silty clay loam, clay loam, or silty clay and is 35 to 45 percent clay.

Mulkey Series

The Mulkey series consists of moderately deep, well drained soils on side slopes of uplands. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 25 to 50 percent. The mean annual precipitation is about 95 inches, and the mean annual temperature is about 44 degrees F.

Typical pedon of Mulkey loam, 25 to 50 percent slopes; in the NE1/4SE1/4NE1/4 of sec. 30, T. 14 S., R. 3 E.

A11—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; strong very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and few medium roots; many very fine irregular pores; 10 percent gravel; very strongly acid (pH 4.9); clear wavy boundary.

A12—8 to 19 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and medium roots; common very fine tubular pores; 15 percent gravel and 5 percent cobbles; very strongly acid (pH 5.0); clear wavy boundary.

B2—19 to 31 inches; dark brown (10YR 3/3) cobbly loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores; 15 percent gravel and 10 percent cobbles; strongly acid (pH 5.4); abrupt wavy boundary.

IIR—31 inches; basalt.

Depth to hard bedrock is 20 to 40 inches.

The A horizon has hue of 10YR to 5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry. The upper part is 0 to 10 percent coarse fragments, and the lower part is 15 to 30 percent coarse fragments.

The B horizon has hue of 10YR to 5YR, and it has value of 2 or 3 when moist and 4 or 5 when dry. The horizon has chroma of 2 or 3 to a depth of 20 inches and 3 or 4 below this depth. It is cobbly loam or cobbly sandy loam and is 20 to 35 percent coarse fragments.

Nekia Series

The Nekia series consists of moderately deep, well drained soils on foothills adjacent to terraces of the Willamette Valley. These soils formed in colluvium derived dominantly from basic igneous or tuffaceous rock. Slopes are 2 to 50 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Nekia silty clay loam, 12 to 20 percent slopes; about 1 mile southwest of Crawfordsville, on Courtney Road; in the SW1/4SW1/4SE1/4 of sec. 13, T. 14 S., R. 2 W.

A11—0 to 7 inches; dark brown (7.5YR 3/2) silty clay loam, brown (7.5YR 4/2) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 5 percent basalt gravel; medium acid (pH 5.6); clear smooth boundary.

A12—7 to 10 inches; dark reddish brown (5YR 3/3) silty clay loam, reddish brown (5YR 4/3) dry; moderate very fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent basalt gravel; medium acid (pH 5.6); clear smooth boundary.

B21t—10 to 16 inches; dark reddish brown (5YR 3/4) clay, reddish brown (5YR 4/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many very fine and fine tubular pores; 10 percent basalt gravel; few thin yellowish red (5YR 4/6) clay films on faces of peds; strongly acid (pH 5.4) gradual smooth boundary.

B22t—16 to 29 inches; dark reddish brown (5YR 4/3) clay, reddish brown (5YR 4/4) dry; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; common fine roots; common very fine and fine tubular pores; 10 percent basalt gravel; few moderately thick yellowish red (5YR 4/6) clay films on faces of peds; strongly acid (pH 5.4); clear wavy boundary.

IIR—29 inches; fractured basalt.

Depth to hard bedrock is 20 to 40 inches.

The A horizon has hue of 7.5YR or 5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry.

The B horizon has hue of 5YR or 2.5YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist and 3 to 6 when dry. It is silty clay, clay, or gravelly clay and averages 40 to 50 percent clay. It has 0 to 35 percent rock fragments.

Newberg Series

The Newberg series consists of deep, somewhat excessively drained soils on flood plains. These soils formed in recent alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Newberg fine sandy loam; 5 miles north of Albany; 300 feet west of Interstate Highway 5; in the SE1/4SE1/4 of sec. 4, T. 10 S., R. 3 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 4/3) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; few fine roots; many fine irregular pores; medium acid (pH 6.0); clear smooth boundary.

AC—7 to 19 inches; dark brown (10YR 3/3) fine sandy loam, dark yellowish brown (10YR 4/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; many fine irregular pores; medium acid (pH 5.8); clear smooth boundary.

C1—19 to 28 inches; brown (10YR 4/3) coarse sandy loam, pale brown (10YR 6/3) dry; massive; soft, friable, nonsticky and nonplastic; few fine roots; many fine irregular pores; medium acid (pH 5.8); clear smooth boundary.

C2—28 to 48 inches; dark grayish brown (10YR 4/2) loamy fine sand, pale brown (10YR 6/3) and light brownish gray (10YR 6/2) dry; single grain; loose, nonsticky and nonplastic; many very fine irregular pores; medium acid (pH 5.8); gradual smooth boundary.

C3—48 to 64 inches; dark grayish brown (10YR 4/2) loamy sand, light brownish gray (10YR 6/2) dry; single grain; loose, nonsticky and nonplastic; many very fine irregular pores; medium acid (pH 6.0).

Depth to bedrock is more than 60 inches. The mollic epipedon is 10 to 20 inches thick. The content of coarse fragments ranges from 0 to 15 percent throughout.

The upper 10 inches of the A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist. The lower part has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 or 4 when moist or dry.

The upper part of the C horizon is sandy loam, fine sandy loam, or coarse sandy loam, and the lower part is loamy sand, loamy fine sand, or fine sand.

Ochrepts

Ochrepts are well drained and moderately well drained soils on long, narrow escarpments along small streams dissecting terraces adjacent to the bottom lands and flood plains of major streams and rivers. These soils formed in stratified loamy, and gravelly alluvium. Slopes are 20 to 60 percent. The mean annual precipitation is about 65 inches. The mean annual temperature is about 51 degrees F.

Reference pedon of Ochrepts, very steep; in the SW1/4NE1/4SW1/4 of sec. 26, T. 9 S., R. 2 E.

A11—0 to 5 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 5 percent gravel; medium acid (pH 5.6); clear smooth boundary.

A12—5 to 15 inches; dark brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine roots; many very fine and fine tubular pores; 5 percent gravel; medium acid (pH 5.8); clear smooth boundary.

B21—15 to 28 inches; dark yellowish brown (10YR 4/4) clay loam, yellowish brown (10YR 5/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine roots; many very fine tubular pores; 10 percent gravel; medium acid (pH 5.6); gradual wavy boundary.

B22—28 to 42 inches; dark yellowish brown (10YR 4/4) gravelly clay loam, yellowish brown (10YR 5/4) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; many very fine tubular pores; 20 percent gravel and 5 percent cobbles; medium acid (pH 5.6); gradual wavy boundary.

B3—42 to 53 inches; dark yellowish brown (10YR 4/4) gravelly clay loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; 25 percent gravel and 5 percent cobbles; medium acid (pH 5.6); gradual wavy boundary.

C—53 to 60 inches; yellowish brown (10YR 5/4) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; massive; hard, friable, sticky and slightly plastic; few fine roots; common very fine and fine tubular pores; 30 percent gravel and 10 percent cobbles; medium acid (pH 5.6).

Depth to bedrock is 20 to 60 inches or more. The soils are usually moist, but they are dry for 20 to 60 consecutive days between depths of 4 to 24 inches.

The A horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 2 to 4 when moist or dry. It is loam, silt loam, clay loam, or silty clay loam and has 0 to 40 percent coarse fragments.

The B horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is loam, silt loam, clay loam, or silty clay loam and has 0 to 65 percent coarse fragments.

The C horizon has 0 to 65 percent coarse fragments.

Orthents

Orthents are well drained and moderately well drained soils on foothills and uplands. These soils formed in mixed colluvium. Slopes are 5 to 70 percent. The mean annual precipitation is about 90 inches. The mean annual temperature is about 48 degrees F.

Reference pedon of Orthents in an area of Rock outcrop-Orthents complex, steep; in the NW1/4SW1/4SW1/4 of sec. 20, T. 12 S., R. 2 W.

A11—0 to 4 inches; dark brown (10YR 3/3) gravelly loam, dark yellowish brown (10YR 3/4) dry; strong very fine and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 20 percent gravel; medium acid (pH 5.6); clear smooth boundary.

A12—4 to 13 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam, yellowish brown (10YR 5/4) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and few fine roots; common very fine and fine irregular pores; 30 percent gravel; medium acid (pH 5.6); abrupt smooth boundary.

IICr—13 inches; fractured basalt.

Depth to hard or soft bedrock is 5 to 60 inches or more. These soils are loam to sandy loam and have 0 to 75 percent gravel, cobbles, and stones. They are usually moist, but they are dry for 20 to 60 consecutive days between depths of 8 and 35 inches.

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

Panther Series

The Panther series consists of deep, poorly drained soils in drainageways and on concave slopes of low foothills. These soils formed in colluvium derived dominantly from sedimentary rock. Slopes are 2 to 12 percent. The mean annual precipitation is about 50 inches. The mean annual temperature is about 53 degrees F.

Typical pedon of Panther silty clay loam, 2 to 12 percent slopes; 2 miles northwest of Crawfordsville; in the NW1/4SE1/4SE1/4 of sec. 2, T. 14 S., R. 2 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; strong medium subangular blocky structure; hard, firm, sticky and plastic;

common very fine roots; few fine tubular pores; medium acid (pH 5.6); clear smooth boundary.

A3—7 to 20 inches; very dark brown (10YR 2/2) clay, dark grayish brown (10YR 4/2) dry; common fine distinct dark yellowish brown (10YR 3/4) mottles; strong coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; few fine tubular pores; medium acid (pH 5.8); clear smooth boundary.

B2—20 to 48 inches; dark grayish brown (10YR 4/2) clay, light brownish gray (10YR 6/2) dry; many fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; very hard, very firm, very sticky and very plastic; few fine roots; few fine tubular pores; very strongly acid (pH 4.8); clear smooth boundary.

Cr—48 inches; sedimentary rock.

Depth to soft siltstone, shale, or sandstone is 40 to 60 inches.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry, and it has chroma of 1 or 2 when moist or dry. In some areas the lower part of the horizon has many fine distinct dark reddish brown or dark yellowish brown mottles.

The B horizon has hue of 2.5Y, 5Y, or 10YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 1 to 3 when moist or dry. It averages 60 to 70 percent clay.

The C horizon, where present, has 25 to 75 percent soft rock fragments.

Peavine Series

The Peavine series consists of moderately deep, well drained soils on broad rolling bench tops and side slopes of uplands. These soils formed in colluvium derived dominantly from sedimentary or tuffaceous rock. Slopes are 3 to 60 percent. The mean annual precipitation is about 75 inches, and the mean annual temperature is about 50 degrees F.

Typical pedon of Peavine silty clay loam, 3 to 30 percent slopes; in the NE1/4SW1/4NE1/4 of sec. 16, T. 13 S., R. 1 E.

O1—1 inch to 0; layer of leaves, twigs, and moss.

A11—0 to 4 inches; dark reddish brown (5YR 3/2) silty clay loam, reddish brown (5YR 4/3) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 5 percent soft siltstone fragments; medium acid (pH 5.6); abrupt smooth boundary.

A12—4 to 10 inches; dark reddish brown (5YR 3/3) silty clay loam, reddish brown (5YR 4/3) dry; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; medium acid (pH 5.6); clear smooth boundary.

B21t—10 to 23 inches; dark reddish brown (5YR 3/4) silty clay, yellowish red (5YR 4/6) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many fine roots; many very fine tubular pores; common thin reddish brown (5YR 4/4) clay films in pores and on peds; strongly acid (pH 5.1); clear smooth boundary.

B22t—23 to 28 inches; reddish brown (5YR 4/4) silty clay, yellowish red (5YR 5/6) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many very fine tubular pores; common thin reddish brown (5YR 4/4) clay films on peds; 10 percent soft siltstone fragments; strongly acid (pH 5.1); clear smooth boundary.

B3t—28 to 37 inches; yellowish red (5YR 4/6) silty clay, yellowish red (5YR 5/6) dry; weak coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; many moderately thick reddish brown (5YR 4/4) clay films on peds; 35 percent soft siltstone fragments; strongly acid (pH 5.1); clear smooth boundary.

Cr—37 inches; strong brown (7.5YR 5/8, 5/6) weathered siltstone.

Depth to soft bedrock is 20 to 40 inches. Weathered fine siltstone and shale fragments are scattered throughout the solum in some areas.

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

The B2t horizon has hue of 5YR or 2.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 4 to 8 when moist or dry. It is silty clay or clay.

Pengra Series

The Pengra series consists of deep, somewhat poorly drained soils on toe slopes and alluvial fans of foothills. These soils formed in clayey alluvium derived from various kinds of rock. Slopes are 1 to 4 percent. The mean annual precipitation is about 50 inches. The mean annual temperature is about 53 degrees F.

Typical pedon of Pengra silt loam, 1 to 4 percent slopes; at the end of 14th Street in Sweet Home; in the SE1/4SW1/4NW1/4 of sec. 31, T. 13 S., R. 1 E.

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (2.5Y 5/2) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many fine irregular pores; slightly acid (pH 6.2); abrupt smooth boundary.

A12—5 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (2.5Y 5/2) dry; weak fine and medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; medium acid (pH 5.8); abrupt smooth boundary.

IIB21—10 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; few fine distinct yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; medium acid (pH 5.8); abrupt smooth boundary.

IIB22—18 to 29 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; many fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; slightly acid (pH 6.1); clear smooth boundary.

IIIC1—29 to 50 inches; grayish brown (2.5Y 5/2) clay; many common prominent strong brown (7.5YR 5/6) mottles; massive; very hard, firm, very sticky and very plastic; few very fine tubular pores; slightly acid (pH 6.1); abrupt smooth boundary.

IIIC2—50 to 60 inches; olive (5Y 5/3) clay; many common prominent stony brown (7.5YR 5/6) mottles; massive; very hard, firm, very sticky and very plastic; few very fine tubular pores; common fine black (10YR 2/1) manganese stains; slightly acid (pH 6.1).

Depth to bedrock is more than 60 inches. Thickness of the solum ranges from 16 to 30 inches within short distances. In some areas a few gravel are scattered throughout the profile.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry.

The IIB horizon has hue of 5Y to 10YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 2 or 3 when moist or dry. It has distinct mottles to a depth of 12 inches or less. It is less than 15 percent sand that is coarser than very fine sand.

The IIIC horizon has hue of 2.5Y or 5Y, value of 3 to 5 when moist, and chroma of 2 to 4 when moist. It is 60 to 70 percent clay.

Philomath Series

The Philomath series consists of shallow, well drained soils on low foothills adjacent to the Willamette Valley. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 3 to 45 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Philomath silty clay, 3 to 12 percent slopes, in the NE1/4SW1/4NW1/4 of sec. 16, T. 12 S., R. 1 W.

A11—0 to 4 inches; very dark brown (10YR 2/2) silty clay, very dark grayish brown (10YR 3/2) dry; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; many very fine roots; many fine tubular pores; slightly acid (pH 6.4); clear wavy boundary.

A12—4 to 13 inches; very dark brown (10YR 2/2) clay, very dark grayish brown (10YR 3/2) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; common very fine tubular pores; 5 percent partially weathered gravel; neutral (pH 6.6); clear wavy boundary.

A13—13 to 19 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; common very fine tubular pores; 5 percent partially weathered gravel; neutral (pH 6.6); abrupt wavy boundary.

IICr—19 inches; dark yellowish brown (10YR 4/6) saprolite.

Depth to soft bedrock is 12 to 20 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 2 to 4 when dry, and chroma of 1 or 2 when moist or dry. The upper part of the horizon is silty clay or cobbly silty clay. The lower part is clay, cobbly silty clay, or cobbly clay and is 5 to 35 percent coarse fragments.

Quartzville Series

The Quartzville series consists of deep, well drained soils on bench tops and side slopes of uplands. These soils formed in colluvium derived from basic igneous and tuffaceous rock. Slopes are 2 to 75 percent. The mean annual precipitation is about 90 inches. The mean annual temperature is about 50 degrees F.

Typical pedon of Quartzville silt loam, 2 to 25 percent slopes; in the NW1/4NE1/4NE1/4 of sec. 23, T. 11 S., R. 2 E.

O1—1 inch to 0; layer of leaves, twigs, moss, and needles.

A11—0 to 3 inches; dark brown (7.5YR 3/2) silt loam, brown (10YR 5/3) dry; weak very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 10 percent gravel; many nodules 1 to 5 millimeters in diameter; medium acid (pH 5.6); gradual wavy boundary.

A12—3 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; strong very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent gravel; many nodules 1 to 5 millimeters in diameter; medium acid (pH 5.6); clear wavy boundary.

B1—9 to 17 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine roots; common very fine tubular pores; common nodules 1 to 5 millimeters in diameter; medium acid (pH 5.6); gradual smooth boundary.

B21—17 to 32 inches; brown (10YR 4/3) silty clay loam, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; 5 percent gravel; common nodules 1 to 5 millimeters in diameter; strongly acid (pH 5.4); clear smooth boundary.

B22—32 to 40 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; moderate very fine and fine subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; 10 percent soft gravel; many nodules 1 to 2 millimeters in diameter; strongly acid (pH 5.4); gradual smooth boundary.

B3—40 to 58 inches; yellowish brown (10YR 5/4) silty clay loam, very pale brown (10YR 7/3) dry; weak very fine and fine subangular blocky structure; hard, friable, sticky and slightly plastic; few very fine roots; common very fine tubular pores; 35 percent soft gravel; many nodules 1 to 2 millimeters in diameter; strongly acid (pH 5.4); clear wavy boundary.

C—58 to 65 inches; yellowish brown (10YR 5/4 and 5/6) clay loam, light yellowish brown and yellowish brown (10YR 6/4 and 5/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; 65 percent soft gravel; strongly acid (pH 5.2).

Depth to bedrock is more than 60 inches. The umbric epipedon is 10 to 20 inches thick. The solum is 40 to 60 inches thick. The profile is 0 to 15 percent gravel and cobbles throughout. The content of stones ranges from 0 to 5 percent in the solum and from 0 to 10 percent below the solum.

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

The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 3 or 4 when moist or dry. It is silty clay loam, silty clay, or clay loam and averages 35 to 45 percent clay. The lower part of the B horizon ranges from 10 to 40 percent soft tuffaceous gravel.

The C horizon has hue of 10YR or 7.5YR. It is clay loam or silty clay loam and is 40 to 70 percent soft tuffaceous gravel.

Ritner Series

The Ritner series consists of moderately deep, well drained soils on low foothills adjacent to terraces of the Willamette Valley. These soils formed in cobbly colluvium derived dominantly from basic igneous rock. Slopes are 2 to 60 percent. The mean annual precipitation is about 50 inches. The mean annual temperature is about 53 degrees F.

Typical pedon of Ritner cobbly silty clay loam, 30 to 60 percent slopes; about 2 miles east of Courtney School; in the SE1/4SE1/4 of sec. 23, T. 14 S., R. 2 W.

A1—0 to 6 inches; dark reddish brown (5YR 3/3) cobbly silty clay loam, reddish brown (5YR 4/3) dry; strong fine and very fine subangular blocky structure; hard, friable, sticky and plastic; many fine and medium roots; many very fine tubular pores; 15 percent cobbles and 10 percent gravel; medium acid (pH 5.8); clear smooth boundary.

B1—6 to 15 inches; dark reddish brown (5YR 3/4) cobbly silty clay loam, reddish brown (5YR 4/4) dry; strong fine and very fine subangular blocky structure; hard, friable, sticky and plastic; common medium roots; many very fine tubular pores; 20 percent cobbles and 10 percent gravel; medium acid (pH 5.8); clear smooth boundary.

B21—15 to 26 inches; dark reddish brown (5YR 3/4) very cobbly silty clay, reddish brown (5YR 4/4) dry; moderate very fine and fine subangular blocky structure; hard, firm, very sticky and plastic; few fine and medium roots; common very fine tubular pores; 25 percent cobbles and 20 percent gravel; strongly acid (pH 5.4); clear wavy boundary.

B22—26 to 34 inches; dark reddish brown (5YR 3/4) very cobbly silty clay, reddish brown (5YR 4/4) dry; moderate fine and very fine subangular blocky structure; hard, firm, very sticky and very plastic; few fine and medium roots; few very fine tubular pores; 40 percent cobbles and 15 percent stones; common faint dark reddish brown (5YR 3/3) coatings on peds; strongly acid (pH 5.2); abrupt wavy boundary.

IIR—34 inches; fractured basalt; few thin tongues of soil material from B22 horizon in fractures; 20 to 30 percent partially weathered rock fragments.

Depth to hard bedrock is 20 to 40 inches. The content of rock fragments ranges from 15 to 30 percent in the A and B1 horizons and from 35 to 75 percent in the B2 horizon. The content increases as depth increases. Rock fragments range from gravel to stones. An ochric epipedon that has chroma of 4 when moist is at a depth of less than 10 inches.

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

The B2 horizon has hue of 5YR or 2.5YR, value of 3 or 4 when moist, and chroma of 4 to 6 when moist or dry. It is very cobbly silty clay or extremely cobbly silty clay loam and is 35 to 50 percent clay.

Salem Series

The Salem series consists of deep, well drained soils in slightly convex areas on low alluvial stream terraces. These soils formed in gravelly alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Salem gravelly silt loam; 100 feet east of River Road; in the NW1/4SE1/4SW1/4 of sec. 32, T. 13 S., R. 4 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) gravelly silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine irregular pores; 25 percent gravel; slightly acid (pH 6.5); gradual smooth boundary.

A3—9 to 16 inches; dark brown (10YR 3/3) gravelly clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 35 percent gravel; slightly acid (pH 6.5); gradual smooth boundary.

B1—16 to 24 inches; dark brown (10YR 3/3) gravelly clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; 30 percent gravel; neutral (pH 6.6); gradual smooth boundary.

B2t—24 to 35 inches; dark brown (10YR 3/3) gravelly clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; few very fine tubular pores; few thin clay films on peds; 30 percent gravel; slightly acid (pH 6.2); gradual smooth boundary.

IIC1—35 to 47 inches; dark brown (10YR 4/3) very gravelly loamy sand, brown (10YR 5/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine continuous pores; 55 percent gravel; slightly acid (pH 6.2); gradual wavy boundary.

IIC2—47 to 60 inches; dark grayish brown (10YR 4/2) very gravelly sand, pale brown (10YR 6/3) dry; single grain; loose, very friable; many very fine continuous pores; 40 percent gravel; slightly acid (pH 6.4); gradual wavy boundary.

Depth to bedrock is more than 60 inches. Depth to the IIC horizon is 15 to 40 inches. The A and B horizons are 10 to 35 percent coarse fragments. The IIC horizon is 35 to 70 percent coarse fragments, mostly gravel.

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

The B2t horizon has hue of 10YR or 7.5YR, and value of 2 or 3 when moist and 4 or 5 when dry. It has chroma of 2 or 3 to a depth of 20 inches and 2 to 4 below this depth. It is gravelly silty clay loam, gravelly clay loam, or gravelly sandy clay loam. It is 25 to 35 percent clay.

The IIC horizon is very gravelly loamy sand, very gravelly sand, or extremely gravelly sand.

Salkum Series

The Salkum series consists of deep, well drained soils on old terraces. These soils formed in old gravelly alluvium derived from various kinds of rock. Slopes are 2 to 15 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Salkum silty clay loam, 2 to 8 percent slopes; in the NW1/4NW1/4NE1/4 of sec. 27, T. 12 S., R. 2 W.

O1—1 inch to 0; decomposed leaves, twigs, and moss.

A11—0 to 3 inches; dark brown (7.5YR 3/2) silty clay loam, brown (7.5YR 4/4) dry; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 5 percent gravel 5 to 10 millimeters in diameter; medium acid (pH 5.9); abrupt smooth boundary.

A12—3 to 7 inches; dark brown (7.5YR 3/4) silty clay loam, brown (7.5YR 4/4) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent gravel 5 to 10 millimeters in diameter; medium acid (pH 5.9); clear smooth boundary.

A3—7 to 11 inches; dark brown (7.5YR 3/4) silty clay loam, strong brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; hard, friable, sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; 5 percent gravel 5 to 10 millimeters in diameter; medium acid (pH 5.8); clear smooth boundary.

B1—11 to 19 inches; dark brown (7.5YR 3/4) silty clay loam, strong brown (7.5YR 5/6) dry; light yellowish brown (10YR 6/4) coatings on peds; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; common fine tubular pores; 10 percent angular and subangular gravel 1 inch to 3 inches in diameter; common thin dark reddish brown (5YR 3/3) clay films on peds and in pores; medium acid (pH 5.6); clear smooth boundary.

IIB2t—19 to 27 inches; dark brown (7.5YR 4/4) clay, strong brown (7.5YR 5/6) dry; strong fine and very fine subangular blocky structure; very hard, firm, sticky and plastic; common very fine and fine roots; common very fine and fine tubular pores; 25 percent soft rock fragments; many moderately thick light reddish brown (5YR 6/4) clay films on peds and in pores; common fine black (10YR 2/1) manganese stains; strongly acid (pH 5.4); clear wavy boundary.

IIB3t—27 to 40 inches; variegated yellow (10YR 7/6), brownish yellow (10YR 6/6), and light gray (10YR 7/2) silty clay loam; weak medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few fine tubular pores; 60 percent soft rock fragments; many thick light reddish brown (5YR 6/4) clay films on peds and in pores; strongly acid (pH 5.4); gradual wavy boundary.

IIC—40 to 60 inches; variegated very pale brown (10YR 7/3), yellow (10YR 7/6), brownish yellow (10YR 6/6), light gray (10YR 7/2), grayish brown (10YR 5/2), and pink (5YR 7/4) silty clay loam; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; 75 percent soft rock fragments; few thick light reddish brown (5YR 6/4) clay films on faces of rock fragments and in old root channels; strongly acid (pH 5.2).

Depth to bedrock is more than 60 inches. The solum is 40 to 60 inches thick and has 0 to 10 percent hard gravel.

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

The IIB horizon has hue of 5YR to 10YR, value of 3 to 5 when moist and 4 or 5 when dry, and chroma of 4 to 6 when moist or dry. It is silty clay or clay and is 40 to 55 percent clay.

The IIC horizon, where present, has hue of 2.5YR to 10YR, value of 3 to 7 when moist or dry, and chroma of 2 to 6 when moist or dry. It is clay, silty clay loam, or silty clay.

Santiam Series

The Santiam series consists of deep, moderately well drained soils on high terrace remnants and foot slopes of low foothills. These soils formed in silty alluvium over older gravelly clayey alluvium or weathered basic igneous rock. Slopes are 3 to 6 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Santiam silt loam, 3 to 6 percent slopes, in the NE1/4SE1/4NW1/4 of sec. 26, T. 10 S., R. 3 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine irregular pores; 5 percent nodules; strongly acid (pH 5.2); clear smooth boundary.

A3—6 to 14 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; medium acid (pH 5.6); clear smooth boundary.

B1—14 to 22 inches; dark brown (10YR 3/3) silty clay loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; common very fine tubular pores; 5 percent soft gravel; medium acid (pH 6.0); clear smooth boundary.

B21t—22 to 34 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; few fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; many very fine tubular pores; 5 percent soft gravel; common moderately thick clay films on peds and in pores; medium acid (pH 6.0); clear smooth boundary.

IIC1—34 to 46 inches; brown (10YR 5/3) clay, pale brown (10YR 6/3) dry; few fine faint grayish brown (10YR 5/2) mottles; massive; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine tubular pores; 15 percent soft gravel and 10 percent very fine iron and manganese concretions; medium acid (pH 6.0); abrupt smooth boundary.

IIC2—46 to 60 inches; brown (10YR 5/3) clay, pale brown (10YR 6/3) dry; common fine and medium faint grayish brown (10YR 5/2) mottles; massive; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine tubular pores; 15 percent soft gravel and 10 percent very fine iron and manganese concretions; many fine black (10YR 2/1) manganese stains; medium acid (pH 6.0).

Depth to bedrock is more than 60 inches.

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

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

The IIC horizon has value of 4 or 5 when moist and 6 or 7 when dry, and it has chroma of 2 to 4 when dry. It is clay or silty clay.

Saturn Series

The Saturn series consists of deep, well drained soils on low alluvial terraces along streams on uplands. These soils formed in poorly sorted alluvium derived dominantly from basic igneous rock. Slopes are 0 to 5 percent. The mean annual precipitation is about 70 inches. The mean annual temperature is about 49 degrees F.

Typical pedon of Saturn silt loam, 0 to 5 percent slopes; in the SE1/4NW1/4NE1/4 of sec. 17, T. 10 S., R. 2 E.

O1—1 inch to 0; layer of leaves, moss, grass, and twigs.

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 5 percent gravel; strongly acid (pH 5.4); clear smooth boundary.

A12—5 to 10 inches; dark brown (10YR 3/3) clay loam, brown (10YR 5/3) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent gravel; strongly acid (pH 5.4); clear smooth boundary.

B21—10 to 19 inches; dark brown (7.5YR 3/4) clay loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine and fine roots; many fine tubular pores; 10 percent gravel; strongly acid (pH 5.2); clear smooth boundary.

B22—19 to 36 inches; dark brown (7.5YR 4/4) gravelly clay loam, brown (7.5YR 5/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; 15 percent gravel and 5 percent cobbles; strongly acid (pH 5.2); abrupt wavy boundary.

IIC1—36 to 60 inches; dark brown (7.5YR 4/4) extremely gravelly loamy sand, light brown (7.5YR 6/4) dry; massive; soft, very friable, nonsticky and nonplastic; common fine irregular pores; 60 percent gravel and 10 percent cobbles; interstices larger than 1 millimeter are void; strongly acid (pH 5.0).

Depth to bedrock is more than 60 inches. Thickness of the umbric epipedon is 10 to 18 inches. Depth to the IIC horizon is 20 to 40 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist, and chroma of 2 or 3 when moist or dry. It is 5 to 15 percent rock fragments, dominantly gravel.

The B horizon has hue of 10YR or 7.5YR, and it has value of 3 or 4 when moist and 5 or 6 when dry. It is clay loam, gravelly clay loam, or gravelly loam and is 25 to 35 percent clay. It is 10 to 30 percent rock fragments, dominantly gravel.

The IIC horizon is extremely gravelly loamy sand, very gravelly loamy sand, or very gravelly sand. It is 50 to 75 percent rock fragments, dominantly gravel.

Saturn Variant

The Saturn Variant consists of deep, moderately well drained soils on stream terraces. These soils formed in mixed alluvium that is high in content of ash and is derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Saturn Variant silt loam; about 5 miles north of Scio; in the NW1/4NW1/4NW1/4 of sec. 28, T. 9 S., R. 1 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent gravel; many nodules 1 millimeter in diameter; strongly acid (pH 5.4); abrupt smooth boundary.

B1—10 to 15 inches; very dark grayish brown (10YR 3/2) silty clay loam, yellowish brown (10YR 5/4) dry; weak fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 5 percent gravel; many nodules 1 millimeter in diameter; medium acid (pH 5.6); clear smooth boundary.

B2—15 to 24 inches; dark brown (10YR 4/3) silty clay loam, yellowish brown (10YR 5/4) dry; weak fine and very fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few very fine roots; many very fine and fine tubular pores; 10 percent gravel; many nodules 1 millimeter in diameter; common fine dark brown (7.5YR 3/4) stains on peds; medium acid (pH 5.8); abrupt smooth boundary.

IIC—24 to 60 inches; dark yellowish brown (10YR 4/4) very gravelly clay loam, pale brown (10YR 6/3) dry; many fine distinct strong brown (7.5YR 5/6) mottles; massive; extremely hard, extremely firm, sticky and plastic; few fine irregular pores; 45 percent partially weathered gravel and 10 percent partially weathered cobbles; many medium black (10YR 2/1) manganese concretions; many strong brown (7.5YR 4/6) and yellowish red (5YR 4/6) stains on rock fragments; medium acid (pH 6.0).

Depth to bedrock is more than 60 inches. Depth to mottles ranges from 20 to 40 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 2 to 4 when dry, and chroma of 1 or 2 when moist or dry.

The B horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 3 to 5 when dry, and chroma of 2 to 4 when moist or dry. It is silty clay loam or clay loam and is 0 to 10 percent gravel.

The IIC horizon has value of 4 to 6 when moist or dry, and it has chroma of 3 or 4 when moist or dry. It is 40 to 50 percent partially weathered gravel and 5 to 10 percent partially weathered cobbles.

Sifton Variant

The Sifton Variant consists of deep, somewhat excessively drained soils on stream terraces. These soils formed in gravelly alluvium that is high in content of ash and is derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Sifton Variant gravelly loam; about 0.25 mile northwest of Lyons School; in the SE1/4SE1/4SE1/4 of sec. 13, T. 9 S., R. 1 E.

A1—0 to 9 inches; black (10YR 2/1) gravelly loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 25 percent gravel and 5 percent cobbles; medium acid (pH 5.8); abrupt smooth boundary.

B2—9 to 15 inches; very dark grayish brown (10YR 3/2) very gravelly loam, brown (10YR 5/3) dry; weak very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 35 percent gravel and 10 percent cobbles; medium acid (pH 6.0); clear smooth boundary.

IIC1—15 to 24 inches; dark brown (10YR 3/3) extremely gravelly loamy sand, yellowish brown (10YR 5/4) dry; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine and fine irregular pores; 55 percent gravel and 10 percent cobbles; medium acid (pH 6.0); gradual wavy boundary.

IIC2—24 to 60 inches; dark brown and dark yellowish brown (10YR 3/3 and 3/4) extremely gravelly coarse sand, light yellowish brown and yellowish brown (10YR 6/4 and 5/4) dry; single grain; loose; common very fine irregular pores; 55 percent gravel and 15 percent cobbles; slightly acid (pH 6.2).

Depth to bedrock is more than 60 inches. The upper part of the 10- to 40-inch textural control section is 35 to 45 percent gravel and 5 to 10 percent cobbles, and the lower part is 55 to 65 percent gravel and 10 to 15 percent cobbles. Depth to the IIC horizon is 8 to 18 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 2 to 4 when dry, and chroma of 1 or 2 when moist or dry.

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

The IIC horizon has value of 3 or 4 when moist and 3 to 6 when dry, and it has chroma of 2 to 4 when moist or dry. It is extremely gravelly loamy sand or extremely gravelly coarse sand.

Silverton Series

The Silverton series consists of moderately deep, well drained soils on low terraces and foot slopes of low foothills. These soils formed in colluvium derived dominantly from basic igneous bedrock. Slopes are 3 to 12 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Silverton silt loam, 3 to 12 percent slopes; in Powell Hills; in the SW1/4NE1/4SW1/4 of sec. 23, T. 13 S., R. 3 W.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; slightly acid (pH 6.2); abrupt smooth boundary.

A12—5 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; slightly acid (pH 6.2); clear wavy boundary.

B1—11 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; slightly acid (pH 6.2); abrupt wavy boundary.

IIB21t—22 to 28 inches; dark grayish brown (10YR 4/2) gravelly silty clay, light brownish gray (10YR 6/2) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; few medium and many very fine tubular pores; few thin reddish brown (5YR 4/4) clay films on peds; 5 percent cobbles and 15 percent gravel; slightly acid (pH 6.2); clear wavy boundary.

IIB22t—28 to 37 inches; dark brown (10YR 4/3) gravelly clay, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; common very fine and fine tubular pores; nearly continuous moderately thick dark brown (7.5YR 4/4) clay films on peds; 10 percent cobbles and 20 percent gravel; slightly acid (pH 6.2); abrupt irregular boundary.

IIR—37 inches; basalt.

Depth to hard bedrock is 20 to 40 inches. Depth to the IIB horizon ranges from 15 to 30 inches. The A and B horizons have less than 5 percent rock fragments. The mollic epipedon is 20 to 30 inches thick.

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

The IIBt horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 to 4 when moist or dry. It is gravelly silty clay or gravelly clay. It is 15 to 35 percent rock fragments, dominantly gravel.

Stayton Series

The Stayton series consists of shallow, well drained soils in depressional areas and drainageways of foothills. These soils formed in colluvium that is high in content of ash and is derived dominantly from basic igneous rock. Slopes are 0 to 7 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 52 degrees F.

Typical pedon of Stayton silt loam, 0 to 7 percent slopes; 3 miles west of McCully Mountain; in the NE1/4NW1/4SW1/4 of sec. 20, T. 9 S., R. 1 E.

A1—0 to 4 inches; black (5YR 2/1) silt loam, dark reddish brown (5YR 3/3) dry; strong very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; strongly acid (pH 5.4); gradual smooth boundary.

AC—4 to 13 inches; dark reddish brown (5YR 2/2) silt loam, reddish brown (5YR 4/3) dry; moderate fine granular structure and moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; strongly acid (pH 5.4); clear smooth boundary.

R—13 inches; fractured basalt.

Depth to hard bedrock is 12 to 20 inches.

The A horizon has hue of 7.5YR or 5YR, value of 1 or 2 when moist and 3 or 4 when dry, and chroma of 1 or 2 when moist and 2 or 3 when dry.

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

Steiwer Series

The Steiwer series consists of moderately deep, well drained soils on low foothills. These soils formed in colluvium derived dominantly from sedimentary rock. Slopes are 3 to 50 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Steiwer silt loam, 12 to 20 percent slopes; in the NE1/4NE1/4SE1/4 of sec. 32, T. 12 S., R. 2 W.

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; strong very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine irregular pores; strongly acid (pH 5.4); clear smooth boundary.

A12—6 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine tubular pores; strongly acid (pH 5.4); gradual smooth boundary.

B21—14 to 24 inches; dark yellowish brown (10YR 3/4) silty clay loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; strongly acid (pH 5.3); gradual smooth boundary.

B22—24 to 32 inches; dark yellowish brown (10YR 3/4) silty clay loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common fine and medium tubular pores; 10 percent fine siltstone fragments; strongly acid (pH 5.3); abrupt wavy boundary.

IICr—32 inches; weathered siltstone; common moderately thick yellowish red (5YR 4/6) dry films along fractures.

Depth to soft bedrock is 20 to 40 inches. The mollic epipedon is 10 to 20 inches thick. The solum ranges from 0 to 30 percent soft siltstone fragments.

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

The B horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is silty clay loam or clay loam and is 27 to 35 percent clay.

Valsetz Series

The Valsetz series consists of moderately deep, well drained soils on ridgetops and side slopes of uplands.

These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 3 to 90 percent. The mean annual precipitation is about 95 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of a Valsetz stony loam; in an area of Valsetz-Yellowstone stony loams, 30 to 90 percent slopes; about 150 feet northwest of road; in the NE1/4SE1/4NW1/4 of sec. 17, T. 11 S., R. 2 E.

O1—2 inches to 0; twigs, needles, and leaves.

A11—0 to 3 inches; dark reddish brown (5YR 3/4) stony loam, reddish brown (5YR 5/4) dry; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine irregular pores; 10 percent gravel, 10 percent cobbles, and 10 percent stones; very strongly acid (pH 5.0); clear smooth boundary.

A12—3 to 12 inches; reddish brown (5YR 4/4) very gravelly loam, reddish brown (5YR 5/4) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; 30 percent gravel, 10 percent cobbles, and 5 percent stones; very strongly acid (pH 5.0); gradual smooth boundary.

B21—12 to 20 inches; reddish brown (5YR 5/4) very gravelly loam, light reddish brown (5YR 6/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; 35 percent gravel and 15 percent cobbles; very strongly acid (pH 4.8); gradual smooth boundary.

B22—20 to 36 inches; reddish brown (5YR 5/4) very gravelly loam, light reddish brown (5YR 6/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; 40 percent gravel and 15 percent cobbles; very strongly acid (pH 4.8); abrupt wavy boundary.

IIR—36 inches; fractured basalt.

Depth to hard bedrock is 20 to 40 inches. From 1 to 10 percent of the surface is covered with stones.

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

The B horizon has hue of 7.5YR or 5YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist or dry. It is very gravelly loam, extremely gravelly loam, or very gravelly clay loam and is 20 to 30 percent clay.

Waldo Series

The Waldo series consists of deep, poorly drained soils in depressional areas on high flood plains and low alluvial stream terraces. These soils formed in silty and clayey alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Waldo silty clay loam; 2 miles northeast of Shedd; in the NW1/4NE1/4NE1/4 of sec. 31, T. 12 S., R. 4 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; medium acid (pH 5.8); clear smooth boundary.

A3—6 to 20 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; common fine distinct dark brown (7.5YR 4/4) mottles; strong fine subangular blocky structure; many very fine roots; many very fine tubular pores; medium acid (pH 5.8); clear smooth boundary.

B2g—20 to 38 inches; dark gray (N 4/0) silty clay, grayish brown (2.5Y 5/2) dry; common fine distinct brown (10YR 4/3) mottles; weak coarse prismatic structure; hard, firm, sticky and plastic; few very fine and fine roots; few very fine tubular pores; medium acid (pH 6.0); gradual smooth boundary.

B3g—38 to 47 inches; dark grayish brown (2.5Y 4/2) silty clay, grayish brown (10YR 5/2) dry; many medium prominent yellowish brown (10YR 5/6) mottles; strong medium subangular blocky structure; extremely hard, firm, sticky and plastic; few fine tubular pores; many fine black (10YR 2/1) manganese stains; medium acid (pH 6.0); clear smooth boundary.

C—47 to 72 inches; grayish brown (2.5Y 5/2) silty clay, pale brown (10YR 7/3) dry; few medium faint light yellowish brown (2.5Y 6/4) mottles; massive; hard, firm, sticky and plastic; medium acid (pH 6.0).

Depth to bedrock is more than 60 inches. The mollic epipedon is 10 to 24 inches thick. Depth to distinct or prominent mottles ranges from near the surface to 15 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 1 or 2 when moist or dry.

The B2g horizon has hue of 2.5Y or neutral, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 0 to 2 when moist or dry. It is clay or silty clay.

Wapato Series

The Wapato series consists of deep, poorly drained soils in old abandoned river channels and depressional areas of flood plains. These soils formed in moderately fine textured recent alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Wapato silty clay loam; in the SW1/4NW1/4NE1/4 of sec. 21, T. 13 S., R. 3 W.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; medium acid (pH 6.0); clear smooth boundary.

A1—5 to 17 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; many fine distinct brown (10YR 5/3) mottles; moderate fine subangular blocky structure; hard, firm, slightly sticky and plastic; many very fine roots; many very fine tubular pores; medium acid (pH 6.0); clear smooth boundary.

B21g—17 to 37 inches; dark grayish brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) dry; common fine prominent dark reddish brown (5YR 3/3) mottles; moderate medium subangular blocky structure; very hard, firm, slightly sticky and plastic; common very fine roots; common very fine tubular pores; medium acid (pH 5.8); clear smooth boundary.

B22g—37 to 48 inches; dark grayish brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) dry; common fine prominent dark reddish brown (5YR 3/3) mottles; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine and fine tubular pores; medium acid (pH 5.8); clear smooth boundary.

Cg—48 to 60 inches; grayish brown (10YR 5/2) silty clay, light brownish gray (10YR 6/2) dry; many fine prominent yellowish red (5YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; slightly acid (pH 6.2).

Depth to bedrock is more than 60 inches. The mollic epipedon is 10 to 24 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. Distinct mottles are present throughout the horizon in areas that have not been plowed.

The B horizon has hue of 10YR to 5Y, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 1 or 2 when moist or dry. It is silty clay loam or silt loam that is 20 to 35 percent clay and less than 15 percent sand that is coarser than very fine sand.

Whiteson Series

The Whiteson series consists of deep, somewhat poorly drained to poorly drained soils on nearly level flood plains. These soils formed in alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Whiteson silt loam; 1 mile north of Oak Creek School; 100 feet west of road; in the NW1/4NE1/4NW1/4 of sec. 34, T. 11 S., R. 3 W.

A11—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine irregular pores; slightly acid (pH 6.2); clear smooth boundary.

A12—7 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine irregular pores; medium acid (pH 6.0); clear wavy boundary.

B2—11 to 15 inches; dark grayish brown (10YR 4/2) clay loam, light brownish gray (10YR 6/2) dry; common medium distinct gray (10YR 5/1), brown (10YR 4/3), and yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; common very fine tubular pores; common manganese concretions 2 to 5 millimeters in diameter; 5 percent gravel; slightly acid (pH 6.2); abrupt wavy boundary.

IIC1g—15 to 24 inches; gray (10YR 5/1) silty clay, gray (10YR 6/1) dry; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium and coarse subangular blocky structure; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; few large manganese concretions 5 to 12 millimeters in diameter; slightly acid (pH 6.4); clear smooth boundary.

IIC2g—24 to 43 inches; olive gray (5Y 5/2) clay, light brownish gray (10YR 6/2) dry; blue streaks; massive; extremely hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; neutral (pH 6.8); abrupt wavy boundary.

IIIC3g—43 to 60 inches; variegated olive gray (5Y 5/2), gray (10YR 5/1), and dark grayish brown (10YR 4/2) gravelly sandy clay loam; massive; hard, firm, sticky and plastic; 30 percent gravel; neutral (pH 7.3).

Depth to bedrock is more than 60 inches. The depth to the IIC horizon ranges from 14 to 28 inches. The content of clay varies 25 percent or more between the subsoil and substratum.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The B horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 1 or 2 when moist or dry. It is clay loam or silty clay loam and is 27 to 35 percent clay.

The IIC horizon has hue of 5Y to 10YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 or less. It is clay or silty clay and is 55 to 65 percent clay.

The IIIC horizon is 20 to 35 percent gravel.

Willakenzie Series

The Willakenzie series consists of moderately deep, well drained soils on low foothills. These soils formed in colluvium derived dominantly from sedimentary rock. Slopes are 2 to 50 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Willakenzie clay loam, 20 to 30 percent slopes; 0.25 mile south of Providence Church, on Richardson Gap Road; in the NE1/4SE1/4NE1/4 of sec. 16, T. 11 S., R. 1 W.

A11—0 to 3 inches; dark brown (7.5YR 3/2) clay loam, brown (10YR 4/3) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine tubular pores; slightly acid (pH 6.2); abrupt smooth boundary.

A12—3 to 6 inches; dark brown (7.5YR 3/2) clay loam, brown (10YR 4/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular pores; medium acid (pH 6.0); clear smooth boundary.

B1—6 to 10 inches; reddish brown (5YR 3/4) clay loam, dark yellowish brown (10YR 4/4) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many very fine tubular pores; medium acid (pH 5.8); clear smooth boundary.

B22t—10 to 15 inches; reddish brown (5YR 4/4) silty clay loam, brown (7.5YR 5/4) dry; moderate fine and medium subangular blocky structure; very hard, friable, sticky and plastic; common fine roots; many very fine tubular pores; many thick dark reddish brown (5YR 3/4) clay films on peds; medium acid (pH 5.8); clear smooth boundary.

B3t—15 to 22 inches; yellowish red (5YR 4/6) silty clay loam, strong brown (7.5YR 4/6) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many very fine tubular pores; many thick reddish brown (5YR 4/4) clay films on peds; 35 percent soft sandstone fragments; medium acid (pH 5.6); clear smooth boundary.

IICr—22 inches; variegated weathered sandstone.

Depth to soft bedrock is 20 to 40 inches. The B horizon is as much as 35 percent weathered, crushable rock fragments.

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

The Bt horizon has hue of 7.5YR or 5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 4 to 6 when moist or dry. It is 30 to 35 percent clay and less than 15 percent sand that is coarser than very fine sand.

Willamette Series

The Willamette series consists of deep, well drained soils in slightly convex areas on broad valley terraces. These soils formed in silty alluvium derived from various kinds of rock. Slopes are 0 to 3 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Willamette silt loam; 2 miles east of Peoria and 250 feet north from the county road that lies east and west; in the NE1/4NW1/4 of sec. 16, T. 13 S., R. 4 W.

Ap—0 to 6 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; medium acid (pH 5.6); abrupt smooth boundary.

A1—6 to 13 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular and irregular pores; medium acid (pH 5.6); clear smooth boundary.

A3—13 to 24 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate coarse prismatic structure and moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; medium acid (pH 5.6); clear smooth boundary.

B1—24 to 33 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate coarse prismatic structure and moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; medium acid (pH 5.8); clear smooth boundary.

B2t—33 to 45 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate medium prismatic structure and moderate medium subangular blocky; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; common moderately thick and thin discontinuous clay films in pores and on peds; gray (10YR 5/1) silt particles on 20 percent of vertical faces of peds; few very fine black (10YR 2/1) manganese stains; medium acid (pH 5.8); diffuse smooth boundary.

B3t—45 to 53 inches; dark yellowish brown (10YR 3/4) silty clay loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; medium acid (pH 5.8); clear wavy boundary.

C—53 to 60 inches; dark yellowish brown (10YR 4/4) silty clay loam, light yellowish brown (10YR 6/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine and few medium tubular pores; medium acid (pH 5.9).

Depth to bedrock is more than 60 inches. Thickness of the solum is 40 to 60 inches. The mollic epipedon is 20 to 30 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The B horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. It is silty clay loam or silt loam and is 25 to 35 percent clay and less than 15 percent sand that is coarser than very fine sand.

The C horizon is silty clay loam or silt loam.

Witham Series

The Witham series consists of deep, somewhat poorly drained soils on alluvial fans, foot slopes, and terraces. These soils formed in alluvium and colluvium derived from various kinds of rock. Slopes are 2 to 12 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Witham silty clay, 2 to 12 percent slopes; in the SW1/4NE1/4SW1/4 of sec. 7, T. 12 S., R. 1 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure parting to moderate fine granular; hard, firm, very sticky and very plastic; common fine roots; many fine irregular pores; slightly acid (pH 6.4); abrupt smooth boundary.

A1—6 to 11 inches; very dark grayish brown (10YR 3/2) silty clay, dark grayish brown (10YR 4/2) dry; strong medium and fine subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; many fine irregular pores; slightly acid (pH 6.4); clear smooth boundary.

B21g—11 to 17 inches; dark brown (10YR 3/3) clay, dark grayish brown (10YR 4/2) dry; weak medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, very firm, very sticky and very plastic; common fine roots; common fine tubular pores; slightly acid (pH 6.2); clear smooth boundary.

B22g—17 to 27 inches; dark brown (10YR 3/3) clay, dark grayish brown (10YR 4/2) dry; few fine distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; very hard, very firm, very sticky and very plastic; few fine roots; common very fine and fine tubular pores; 15 percent soft weathered gravel; medium acid (pH 6.0); gradual smooth boundary.

C1g—27 to 46 inches; dark grayish brown (10YR 4/2) clay; common fine distinct strong brown (7.5YR 5/6) mottles; massive; very hard, very firm, very sticky and very plastic; few fine roots; few fine tubular pores; medium acid (pH 6.0); gradual smooth boundary.

C2g—46 to 60 inches; dark brown (10YR 4/3) clay; massive; very hard, very firm, very sticky and very plastic; common fine distinct strong brown (7.5YR 5/6) mottles on weathered rock fragments; medium acid (pH 6.0).

Depth to bedrock is more than 60 inches. Faint to distinct mottles are at a depth of 16 to 30 inches.

The A horizon has value of 2 or 3 when moist, and it has chroma of 2 or 3 when moist or dry.

The B horizon has hue of 2.5Y or 10YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry. It is silty clay or clay.

Witzel Series

The Witzel series consists of shallow, well drained soils on low foothills adjacent to terraces of the Willamette Valley. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 3 to 70 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Witzel very cobbly loam, 3 to 30 percent slopes; on Washburn Butte; in the SW1/4NW1/4NE1/4SW1/4 of sec. 18, T. 13 S., R. 2 W.

A1—0 to 5 inches; dark brown (7.5YR 3/2) very cobbly loam, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 20 percent gravel and 35 percent cobbles; medium acid (pH 5.8); clear smooth boundary.

B2—5 to 16 inches; dark brown (7.5YR 3/2) very cobbly clay loam, very dark grayish brown (10YR 3/2) dry;

weak very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 20 percent gravel and 35 percent cobbles; medium acid (pH 5.8); abrupt wavy boundary.

IIR—16 inches; basalt.

Depth to hard bedrock is 12 to 20 inches.

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

The B horizon has hue of 10YR to 5YR, value of 3 to 5 when dry, and chroma of 2 to 4 when moist or dry. It is very cobbly clay loam or very stony silty clay loam and is 50 to 60 percent coarse fragments.

Witzel Variant

The Witzel Variant consists of shallow, well drained soils on low foothills. These soils formed in colluvium that is high in content of volcanic ash and is derived dominantly from basic igneous rock. Slopes are 0 to 12 percent. The mean annual precipitation is about 50 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Witzel Variant very cobbly silt loam, 0 to 12 percent slopes; 175 yards northeast of house; in the NE1/4SW1/4NW1/4SW1/4 of sec. 24, T. 9 S., R. 1 W.

A1—0 to 6 inches; dark brown (7.5YR 3/2) very cobbly silt loam, brown (7.5YR 5/4) dry; common fine distinct strong brown (7.5YR 4/6) stains in root channels; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 15 percent gravel and 20 percent cobbles; medium acid (pH 6.0); clear wavy boundary.

A3—6 to 18 inches; dark brown (7.5YR 3/2) very cobbly silt loam, brown (7.5YR 5/4) dry; common fine distinct strong brown (7.5YR 4/6) stains in root channels; weak very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine irregular pores; 25 percent gravel and 25 percent cobbles; medium acid (pH 6.0); abrupt wavy boundary.

R—18 inches; partially fractured basalt.

Depth to hard bedrock is 12 to 20 inches.

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

Woodburn Series

The Woodburn series consists of deep, moderately well drained soils in slightly convex areas on broad valley terraces. These soils formed in silty alluvium derived from various kinds of rock. Slopes are 0 to 12 percent. The mean annual precipitation is about 45 inches, and the mean annual temperature is about 53 degrees F.

Typical pedon of Woodburn silt loam, 0 to 3 percent slopes; 3 miles northwest of Shedd; about 100 feet south of the east-west gravelled county road; in the SW1/4NE1/4SW1/4 of sec. 34, T. 12 S., R. 4 W.

Ap—0 to 6 inches; very dark brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; few medium tubular pores; medium acid (pH 6.0); clear smooth boundary.

A1—6 to 19 inches; dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; weak moderate subangular blocky structure; hard, friable, sticky and slightly plastic; many very fine roots; few fine tubular pores; medium acid (pH 6.0); clear smooth boundary.

B1—19 to 25 inches; dark brown (10YR 3/3) silty clay loam, pale brown (10YR 6/3) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; common very fine roots; many medium tubular pores; slightly acid (pH 6.2); clear smooth boundary.

B21t—25 to 37 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; common medium distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; strong medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few fine tubular pores; common moderately thick clay films on peds; slightly acid (pH 6.2); abrupt smooth boundary.

B22t—37 to 54 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; common medium distinct dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many fine tubular pores; common thin clay films on peds; few fine black (10YR 2/1) manganese stains; slightly acid (pH 6.2); clear smooth boundary.

B3t—54 to 60 inches; brown (10YR 4/3) silty clay loam, light yellowish brown (10YR 6/4) dry; weak coarse prismatic structure; extremely hard, firm, sticky and plastic; few fine roots; many fine tubular pores; few thin clay films on peds; slightly acid (pH 6.2).

Depth to bedrock is more than 60 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The B2t horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is silty clay loam or silt loam and is 20 to 35 percent clay and less than 15 percent sand that is coarser than very fine sand.

The B3t horizon is silt loam or silty clay loam and is 15 to 30 percent clay.

Yellowstone Series

The Yellowstone series consists of shallow, somewhat excessively drained soils on narrow ridgetops and side slopes of uplands. These soils formed in colluvium derived dominantly from basic igneous rock. Slopes are 3 to 90 percent. The mean annual precipitation is about 95 inches, and the mean annual temperature is about 43 degrees F.

Typical pedon of a Yellowstone stony loam in an area of Henline-Yellowstone-Rock outcrop complex, 50 to 90 percent slopes; 1/4 mile southeast of Crabtree Lake; in the SE1/4SE1/4 of sec. 16, T. 11 S., R. 3 E.

O1—1 inch to 0; layer of leaves, needles, and twigs.

A—0 to 5 inches; dark brown (10YR 3/3) stony loam, brown (10YR 4/3) dry; moderate fine granular structure; slightly hard, friable, nonsticky and nonplastic; many fine roots; many fine irregular pores; 35 percent angular gravel, cobbles, and stones; very strongly acid (pH 5.0); clear smooth boundary.

AC—5 to 12 inches; dark brown (10YR 3/3) very stony sandy loam, brown (10YR 4/3) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine roots; many fine irregular pores; 50 percent angular gravel, cobbles, and stones; very strongly acid (pH 4.8); clear smooth boundary.

C—12 to 18 inches; dark brown (10YR 4/3) extremely stony sandy loam, pale brown (10YR 6/3) dry; massive; soft, very friable, nonsticky and nonplastic; many fine roots; many fine irregular pores; 80 percent angular stones, cobbles, and gravel; very strongly acid (pH 4.6); abrupt irregular boundary.

R—18 inches; basalt.

Depth to hard bedrock is 10 to 20 inches.

The A and AC horizons have hue of 10YR to 5YR, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 2 or 3 when moist or dry. They have 25 to 50 percent rock fragments in the upper part and 45 to 80 percent in the lower part.

The C horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It has 50 to 80 percent rock fragments. It is extremely stony sandy loam, very stony sandy loam, or extremely cobbly loam.

Zango Series

The Zango series consists of shallow, excessively drained soils on dissected side slopes of uplands. These soils formed in colluvium derived dominantly from light-colored tuff, breccia, and basic igneous rock. Slopes are 60 to 90 percent. The mean annual precipitation is about 75 inches, and the mean annual temperature is about 49 degrees F.

Typical pedon of a Zango gravelly loam in an area of Zango-Dobbins gravelly loams, 60 to 90 percent slopes; 2 miles southeast of Cascadia State Park; in the NE1/4NE1/4NW1/4 of sec. 9, T. 14 S., R. 3 E.

A1—0 to 5 inches; very dark grayish brown (10YR 4/2) gravelly loam, pale brown (10YR 6/3) dry; strong very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine irregular pores; 20 percent fine gravel strongly acid (pH 5.2); clear wavy boundary.

B2—5 to 13 inches; dark yellowish brown (10YR 4/3) very cobbly loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; many fine tubular pores; 20 percent cobbles and 30 percent gravel; strongly acid (pH 5.2); abrupt irregular boundary.

IIR—13 inches; fractured basalt.

Depth to hard bedrock is 10 to 20 inches.

The A horizon has value of 4 to 6 when moist and 6 to 8 when dry, and it has chroma of 1 to 3 when moist or dry.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5 when moist and 6 to 8 when dry, and chroma of 3 to 5 when moist or dry. It is very gravelly loam, very gravelly clay loam, or very cobbly loam and is 18 to 30 percent clay.

Formation of the Soils

Dr. R. B. Parsons, research soil scientist, Soil Conservation Service, assisted in writing this section.

Soil is a natural, three-dimensional body on the Earth's surface that supports plants. Its characteristics and properties have been determined by physical and chemical processes that result from the interaction of five factors—climate, living organisms, time, topography, and parent material (*21*). The influence of any one of these factors varies from place to place, but the interaction of all the factors determines the kind of soil that forms.

The soils in this survey area have been greatly influenced by such factors as the very cold, wet, short growing season at the higher elevations in the Cascade Range and the warm, dry, long growing season at the lower elevations along the Willamette River. The age and type of parent material have greatly influenced the soil development in areas of recent alluvium along the river flood plains and in areas of old alluvium on terraces. In the higher areas of eastern Linn County, colluvium and glacial till derived from andesite and basalt mixed with volcanic ash have imparted special characteristics to the soils.

In this section the soil-forming factors of climate and living organisms are discussed separately. The factors of time, topography, and parent material are grouped and discussed under the heading "Geomorphic Surfaces and Soil Development."

Climate

Climate has a strong influence on soil formation. Heat and moisture greatly influence the kind of vegetation that grows and the rate at which organic matter decomposes and minerals weather. Heat and moisture also influence the rate of removal of material from some soil horizons and the rate of accumulation in others.

In Linn County there are three major climatic areas that greatly influence soil genesis: (1) areas that have warm, dry summers and cool, moist winters; (2) areas that have warm, moist summers and cool, moist winters; and (3) areas that have cool, moist summers and cold, moist winters. In the Willamette Valley, the summers are warm and dry and the growing season is long. The winters are cool and moist. Plant growth begins early in spring and continues through midsummer. Many of the soils have a xeric moisture regime. On young surfaces, the accumulation of organic matter and limited leaching of bases have produced Xerolls such as the Chapman, Coburg, and Malabon soils. On the older surfaces, where soil forming factors have been active for long periods of time, Xeralfs such as the Dupee and Santiam soils have developed. On the oldest surfaces Xeric Haplohumults, such as the Salkum soils, have developed.

In the lower foothills, summers are warm and dry and the growing season is slightly shorter than that on the terraces at the lower elevations. The winters are cool and moist. Plant growth begins late in spring and continues until midsummer for soils with a xeric moisture regime. On the younger surfaces, the accumulation of organic matter and the rapid leaching of bases have formed Ochrepts and Umbrepts such as the Ritner and Stayton soils. On the older surfaces, an agillic horizon is evident in Xeric Haplohumults such as the Bellpine, Jory, and Nekia soils.

On the western slopes of the Cascade Range, summers are cool and moist and the growing season is short to medium. The winters are cold and moist, and there are short periods of snow cover. Plant growth and the kinds of plants that are included in the climax community are quite varied. This area is within the Western Cascade Mountain resource area of Oregon. The area is further divided into two plant zones, in which there are major differences in the soils. At elevations between 1,200 and 2,800 feet in the Cascade Range, soils are developing under a native plant community that is within the Douglas-fir-western hemlock zone (*29*). This environment produces enough plant growth for the development of an umbric epipedon. Leaching has been such that base saturation is not excessively low and there is not sufficient accumulation of aluminum, iron, and organic carbon for spodic horizons to form. On the younger surfaces, Umbrepts such as the Acanod, Harrington, Kinney, and Quartzville soils have developed. In some areas where iron content is high, soils such as those of the Blachly series have developed reddish hues and have high chroma. These soils are classified as Ochrepts even though their organic matter content is high enough for them to be classified as Umbrepts. On older, more stable surfaces, Humults such as the Honeygrove and Peavine soils have developed (*17*).

At elevations above 3,000 feet in the Cascade Range, the plant composition changes to include noble fir (*29*). An umbric epipedon has developed in the soils, and leaching has not produced albic and spodic horizons in soils that have reaction above 4.5. Soils common to these areas are Dystric Cryandepts, which are represented by the Hummington and Keel soils, and Cryochrepts, which are represented by the Bensley, Crabtree, and Cruiser soils.

Living organisms, especially the higher plants, are an active factor in soil formation. The changes they bring about depend mainly on life processes peculiar to each kind of organism. The kinds of organisms that live on and in the soil are determined in turn by climate and by the parent material, topography or relief, and age of the soil.

Plants provide a cover that reduces erosion and stabilizes the soil surface. Leaves, twigs, roots, and remains of entire plants accumulate on the surface of forest soils and are decomposed by micro-organisms, earthworms, and other soil fauna. Plant roots widen cracks in the underlying rock, permitting water to penetrate. The uprooting of trees by wind also mixes soil layers and loosens the underlying material.

The soils in this survey area formed under three major types of plant cover. In the xeric soil zone, grass is a prominent member of the plant community along with a mixed conifer and deciduous forest of Oregon white oak, bigleaf maple, and Douglas-fir. The annual dieback of grass roots provides a large amount of organic material. The deciduous trees absorb calcium and other bases and return them to the soil surface annually through the falling of the leaves, thus reducing the effects of leaching. Under these conditions Mollisols such as the Malabon soils have developed. In the udic soil zone, the proportion of grasses and deciduous trees is less and the proportion of conifers is greater. Organic matter still has accumulated; however, bases have been absorbed by the conifers and therefore are not so readily returned to the soil. Also, the greater precipitation in the udic soil zone has resulted in more leaching of bases, so that soils with an umbric epipedon, such as the Harrington soils, have formed.

Small animals, earthworms, insects, and micro-organisms influence the formation of soils in several ways. They mix organic matter into the mineral soil material and accelerate the decomposition of organic matter by breaking down the remains of plants. Small animals burrow into the soil and mix the layers. Earthworms and other small invertebrates feed on the organic matter in the upper few inches of the soil material. They slowly but continually mix the soil material and can alter its chemistry. Bacteria, fungi, and other micro-organisms hasten the weathering of rocks and the decomposition of organic matter.

In this survey area, conditions generally are favorable for most organisms to function. Earthworms are very common to all areas except the frigid and cryic zones. Small animals such as gophers and moles are common in the lower, warmer areas and are very prominent in areas of the Bull Run and Kinney soils, as well as in areas of most other medium textured and moderately coarse textured soils.

Geomorphic Surfaces and Soil Development

The geomorphic surfaces in this survey area were mapped by Balster and Parsons (*6*), using high-altitude aerial photographs. The surfaces were visually traced throughout the Willamette Valley part of the survey area. Sequential relationships among surfaces, stereoscopic observations, elevation, and photo interpretation of tonal patterns were used to map the surfaces. Each geomorphic surface is named for a locality (*6, 22*) where that particular surface is well expressed.

The geomorphic surfaces fit a time sequence, but there are exceptions that are noted in the discussion of individual surfaces. A complete sequence of the surfaces in the order of their age from the youngest to the oldest is as follows—Horseshoe, Ingram, Winkle, Senecal, Calapooyia, Dolph, and Eola.

Steep, broken topography that has some slopes of more than 100 percent characterizes the Looney geomorphic unit. Because of variable stability of the landscape, the soils and surfaces of the Looney unit fit no particular span of time; therefore, it is not considered a geomorphic surface. The Luckiamute unit as mapped in narrow valleys includes the Horseshoe and Ingram surfaces and some areas of the Winkle surface.

Horseshoe surface.—The Horseshoe surface is the lower of the two flood plains in the area. It has low relief and includes stream channels and associated areas such as point bar deposits, channel fillings, and abandoned meanders. The surface generally is underlain by coarse textured or moderately coarse textured alluvium. Many areas of the Horseshoe surface are not vegetated or support young stands of willows or cottonwoods. Areas of this surface in the survey area are dominantly less than 10 feet above the normal stream level. Annual flooding inundates the Horseshoe surface. Rapid changes of the Horseshoe landscape result from the cutting of new channels, abandonment of older channels, lateral migration of meanders, and downstream movement of alluvial deposits. In some third order valleys, there are not two identifiable flood plains (Horseshoe and Ingram), which attests to the recent age of the surface. The Horseshoe surface began to form only a short time ago, as shown by the presence of metallic artifacts in the alluvium. It is estimated that it is of postsettlement age—since the middle of the 19th century.

Soils of the Horseshoe surface are typified by Fluventic Haploxerolls, which formed on the dynamic surfaces of the flood plains and show little evidence of soil development in the unweathered gravelly or sandy sediment. Since the building of large dams on the upper tributaries, farming activities have invaded the higher lying areas of this surface. The soils exhibit some darkening by organic matter in the A horizon and weak subangular blocky structure in the AC horizon. These soils are so young that they have no diagnostic horizons other than a minimal umbric or mollic epipedon. Among the soils that are associated with this surface are those of the Camas and Newberg series.

Ingram surface.—The Ingram surface is the higher of the two flood plains in the area. The topography of the Ingram surface is typically undulating, and as much as 10 feet of relief is produced by overbank channeling during flood stage (*22*). The bars and channels have an approximate orientation parallel to the stream. The expression of microrelief on the surface is related to the competence of the stream that flowed through the area. Longitudinal stream profiles with segmented gradients also add to the complexity of the Ingram surface as a flood plain. Elevations generally are 10 to 20 feet above the usual flow level of the stream. Texture generally is gravelly loam, silt loam, or silty clay loam, although some sandy strata are common.

Radiocarbon tests date sediment associated with the Ingram surface is 550 to 3,290 years old (*22*); therefore, the change in the stream system that caused abandonment of the Winkle surface as a flood plain occurred 3,290 to 5,250 years ago (*6*). The partial abandonment of the Ingram surface as a flood plain occurred less than 550 years ago, which indicates the dynamic nature of the landscape.

Soils that formed in the alluvial sediment of the Ingram surface include Fluvaquentic Haplaquolls, Cumulic Ultic Haploxerolls, and Fluventic Haploxerolls. The Wapato soils represent the first group, the Chapman and Chehalis soils the second, and the Camas and Newberg soils the third. These soils have a mollic epipedon, presumably in part inherited from the alluvial parent material, that has a presumed irregular decrease in organic matter content with an increase in depth. The Wapato soils have weak to strong structure and have been in place long enough to exhibit evidence of gleying and the oxidation of ferrous iron to ferric iron to form distinct mottles. Camas and Newberg soils show little development other than accumulation of organic matter in the surface layer. Chapman and Chehalis soils have a cambic horizon that shows some evidence of clay movement but not in amounts sufficient to qualify it as an argillic horizon.

Luckiamute unit.—This unit is on flood plains or in small drainageways that contain local alluvium derived from the erosion of material associated with the Dolph and Eola surfaces and the Looney unit. As defined, the concept of the Luckiamute unit includes areas of the Horseshoe and Ingram surfaces and, in places, areas of the Winkle surface that are too small to separate at the scale used.

The topography of the Luckiamute unit is typical of that of flood plains of small streams. Relief is absent except for minor corrugations as a result of channeling. A few small alluvial fans that extend out from small valleys are included in the Luckiamute unit. These fans contain sediment of variable composition, depending upon what was eroded in the immediate source area. Because the Luckiamute unit can be directly traced to the Horseshoe and Ingram surfaces, it is assumed that the age of the unit brackets the age of the surfaces in the larger valleys.

Winkle surface.—The middle to early Holocene Winkle surface is the oldest surface related to the present drainage systems of western Oregon (*22*). Most of the Winkle surface has the morphology typical of abandoned flood plains of aggrading streams. The elevation differences between the bars and channels are largely a result of the competence of the stream. The braided, overloaded stream channel that deposited sediment associated with the Winkle surface reflects the size of the stream responsible for the formation of the bars and channels. Elevations of the Winkle surface in this area generally are 15 to 30 feet above the usual flow level of the present streams. Texture of the sediment is dominated by silt and clay, which commonly are underlain by stratified sand and gravel at a depth of 4 to 6 feet.

The sediment beneath the Winkle surface ranges in age from 5,250 to 10,850 years, as determined by Carbon-14 dating. Many areas of the Winkle surface along the Columbia River contain strata of volcanic ash from the eruption of Mt. Mazama.

The well drained Malabon and Sifton Variant soils are typical of soils that formed in sediment associated with the Winkle surface. This terrace has been stable long enough for the Malabon soils to have developed a mollic epipedon and to have an organic matter content resulting from pedogenesis rather than from organic matter inherited from the alluvial parent material. The fine texture of the parent material of these soils over time has facilitated the eluviation of clay from the surface to form a fine textured argillic horizon. Bases have been depleted to less than 75 percent of base saturation since the early Holocene. Areas of the Malabon soils have a gentle bar and channel microrelief, which suggests that the parent material was frequently scoured by overflow during the early stages of soil development.

The Sifton Variant soils (Andic Xerumbrepts) have an umbric epipedon and contain pyroclastic material derived from the eruption of Mt. Mazama. Carbon-14 dates obtained for the Winkle surface span the time of the Mt. Mazama eruption. Areas of the Sifton Variant soils are gravel bars of the Winkle surface on which ash, either as ash fall or alluvium, filled the interstices between the gravel. Other major soils of the Winkle surface are the Bashaw (*23*), Coburg, Conser, and Salem soils.

Senecal surface.—The Senecal surface in the Willamette Valley has been derived from minor incision, with integration of drainage, of the Calapooyia surface, which is the main valley floor (*6*). The stratigraphy of deposits associated with the Calapooyia and Senecal surfaces has been extensively studied in the southern part of the Willamette Valley. They are considered to be silty and clayey sediment of the Willamette Sound, described by Condon in 1871 (*7,9*). In the southern part of the Willamette Valley, the Senecal surface is typified by very slight relief and organization of drainage with little incision (*22, 21*). Elevations generally are 200 to 400 feet.

Typical soils of the Senecal surface are those of the Willamette, Woodburn, Amity, Concord, and Dayton series. In an area in Linn County, the Willamette series and associated series were studied in detail (*21*). It was found that the Amity soils are on slightly convex islands encircled by Dayton and Coburg soils, which occupy the more nearly concave positions or swales. Both Willamette and Woodburn soils are adjacent to streams where overbank flow has left alluvial deposits that form natural levees (*21*).

Calapooyia surface.—The Calapooya surface is an extensive landscape on the main valley floor of the Willamette Valley. It is best expressed in the survey area and is particularly prominent along the eastern side of the Calapooya River, from which it takes its name (*6*). This surface is at elevations between 200 and 400 feet.

Absence of appreciable local relief is characteristic of the Calapooyia topography. In this survey area, the surface slopes in a northwesterly direction at a rate of about 5 feet per mile. As is expected on a surface with these characteristics, drainage is poorly organized and drainage of surface water is extremely slow (*6, 22*). This surface is mantled with the silty late Pleistocene Irish Bend Member of the Willamette Formation (*7*), and in some places it is mantled by sediment associated with the Winkle surface and Luckiamute unit. This surface contains most of the glacial erratics described by Allison as having been ice-rafted into the Willamette Valley (*1*). Alluvial toe slopes of valley-side alluvium, probably of Holocene age, also help to merge the Calapooyia surface with the next higher surface. The Calapooyia surface is considered to be late Pleistocene (*22*).

Dayton soils (Typic Albaqualfs) and Holcomb soils (Mollic Albaqualfs) are extensive on the Calapooyia surface. These soils formed in the Greenback and Malpass Members of the Willamette Formation and have been stable long enough to be somewhat depleted of bases (*7*). Dayton soils have an ochric epipedon, a prominent A2 horizon, and a dense silty clay argillic horizon. The Holcomb soils have a mollic epipedon, an A2 horizon, and a dense clay argillic horizon (*21*). The master horizons of the Dayton and Holcomb soils are contrasting strata of the Greenback, Malpass, and Irish Bend Members of the Willamette Formation. Pedogenic features formed across the lithologic discontinuities include organic matter, clay films, iron mottles and concretions, base eluviation, and structural development (*20*).

It is important to note that in some areas of Linn County the Dayton, Greenback, and Malpass Members of the Willamette Formation are underlain by a gravelly or clayey substratum. The gravelly substratum is Linn Gravel, and the clayey substratum is the Diamond Hill Paleosol; these are the two members of the Rowland Formation (*7, 18*). The soils in these areas occur in complex patterns with typical soils associated with the Willamette Formation, and their present use and management do not differ significantly.

Dolph surface.—The Dolph surface is next to the oldest group of landforms in the survey area. Topography of the Dolph surface varies, but it is well above the general level of the valley floors. The Dolph surface occurs as remnants of extensive flats that have been dissected to form a rolling topography composed of a complex group of landforms that would be further divided into terraces, pediments, and upland remnants for detailed study (*6*). Strath terraces along the eastern margin of the part of the Willamette Valley that is in the survey area were also mapped as Dolph surface. The shoulders of valleys graded to the Luckiamute unit (equivalent to the Ingram surface, except that it is underlain by local alluvium) are included in the Dolph surface, and the back slopes, foot slopes, and alluvial toe slopes of small tributary valleys are included in the concept of the Luckiamute surface and its local alluvium. The Dolph surface in places is underlain by bedrock, weathered gravel, saprolite, or clay deposits. The gravel under the Dolph surface in this area is the Leffler Gravel and the highly weathered Lacomb Gravel (*22*). The Dolph surface is considered to be middle Pleistocene, based on its position on the landscape and the degree of weathering of the underlying material. Elevations are commonly 300 to 680 feet in the Albany, Lebanon, and Brownsville areas.

The soils representative of the Dolph surface in the survey area are Salkum soils (Xeric Haplohumults), Willakenzie soils (Ultic Haploxeralfs), and Steiwer soils (Ultic Haploxerolls). Dolph surface soils commonly are Alfisols or Mollisols that have hue of 7.5YR, and many of them have a Bt horizon, as do the Salkum and Willakenzie soils. Steiwer soils do not have a Bt horizon, and it is thought that they formed in more recent pedisediment resulting from modification of the Dolph surface and, as yet, have not had sufficient time to develop a Bt horizon (*4, 6, 19*).

Eola surface.—The Eola surface consists of erosional remnants of the oldest stable geomorphic surface in the area. The crests and saddles of low foothills around the Willamette, North and South Santiam, and Calapooya Valleys are representative of the Eola surface. Relief of the Eola surface is moderate; typical remnants have rounded hill and valley topography with as much as 150 feet of local relief. Hanging valleys are common. Slope ranges from 2 to 20 percent, and elevation generally exceeds 600 feet.

The Eola surface is considered to be middle to early Pleistocene in age and was undoubtedly quite extensive (*6*) at one time; however, late Pleistocene and Holocene erosion, as discussed previously, removed much of this surface so that only small remnants remain. Landforms of the Looney unit generally adjoin the Eola surface and join it to younger, lower lying surfaces.

The Eola surface in the survey area is typified by Jory, Nekia, and Bellpine soils at elevations of less than 1,200 feet in the area adjacent to the Willamette Valley and by Honeygrove and Peavine soils at elevations of 1,200 to 2,800 feet in the western foothills of the Cascade Range. These soils are all Ultisols, and therefore they represent the most advanced stage of weathering and leaching of bases in the survey area. The Jory, Nekia, and Bellpine soils have a xeric moisture regime, and the Honeygrove and Peavine soils have an udic moisture regime.

Looney unit.—The Looney unit has no particular age connotation; therefore, is not considered to be a geomorphic surface. The terrain of the Looney unit is completely dissected and is predominantly steeply sloping. Slope exceeds 100 percent in some areas. Steep, broken topography mapped as the Looney unit may join any other two surfaces, or it may make up large areas of mountainous terrain so thoroughly dissected that no geomorphic surfaces are recognizable. Erosion is active on much of the Looney unit, and there are some areas of mass soil movement. Occasional remnants of some of the oldest geomorphic surfaces are in the unit (*6*).

The variability in age makes the Looney unit useful for geomorphic mapping of mountainous terrain. The mountainous parts of the survey area that are in the Cascade Range are considered to be Looney unit. The Looney unit could be subdivided into several smaller geomorphic units if it were mapped at a larger scale. Three significant gradient breaks are apparent, and they correspond to stable, metastable, and active slopes (*17*). Valley floors and small alluvial cones are Luckiamute unit inclusions in the Looney unit. The soils in the Looney unit formed in glacial till and colluvium, derived from sandstone, andesite, and basalt mixed with volcanic ash.

In xeric areas below 1,200 feet, the Looney unit is represented by Ritner, Chehulpum, and Witzel soils. The Ritner soils are moderately deep Dystric Xerochrepts, have high chroma in the epipedon, and have developed on metastable slopes of the Looney unit. The Chehulpum soils are shallow Entic Haploxerolls and are on metastable slopes of the Looney unit. In some places a cambric horizon has developed where the soil material has been stable for a sufficient time (*6, 19*). Witzel soils commonly are on buttes and other steep, active slopes in the Willamette Valley (*5*). In areas of the Looney unit where faulting has occurred, base-rich ground water seeping from the faults may result in black or very dark gray, somewhat poorly drained or poorly drained soils on active or metastable slopes. Panther and Philomath soils are representative of these soils.

The soils in the Cascade Range that represent the Looney unit include those of the Hummington, Keel, Bensley, Crabtree, and Cruiser series, which generally are above 3,000 feet, and those of the Harrington, Kinney, Quartzville, Blachly, Honeygrove, and Peavine series, which are at 1,200 to 2,800 feet. The characteristics of these soils were discussed in the sections on climate and vegetation.

In areas where the surfaces are stable and where the annual precipitation ranges from 60 to 90 inches, soils such as those of the Honeygrove and Peavine series have developed. Blachly and Quartzville soils are more common on those surfaces where the precipitation ranges from 85 to 120 inches. For these soils the development of an argillic horizon within the control section appears to be inhibited on tuffaceous parent material that has a probable component of surficial volcanic ash weathered under high-rainfall udic conditions. Mesic soils such as those of the Harrington and Kilchis series and cryic soils such as those of the Hummington series are on the more steeply sloping, metastable and active slopes.

References

(1) Allison, I. S. 1935. Glacial erractics in Willamette Valley. New version of the Spokane Flood. Geol. Soc. Am. Bull. 46:615-632, illus.

(2) American Association of State Highway and Transportation Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(3) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(4) Balster, C. A. and R. B. Parsons. 1965. A fault-soils relationship in the Oregon Coast Range: II. Mineralogy and classification. Soil Sci. 100:335-339, illus.

(5) Balster, C. A. and R. B. Parsons. 1966. A soil-geomorphic study in the Oregon Coast Range. OR State Univ. Agric. Exp. Stn. Tech. Bull. 89, 30 pp., illus.

(6) Balster, C. A. and R. B. Parsons. 1968. Geomorphology and soils. Willamette Valley, Oregon. OR Agric. Exp. Stn. Spec. Rep. 265, 311 pp., illus.

(7) Balster, C. A. and R. B. Parsons. 1969. Late Pleistocene stratigraphy, southern Willamette Valley, Oregon. NW Sci. 43:116-129, illus.

(8) Barnes, George H. 1962. Yield of even-aged stands of western hemlock. U.S. Dep. Agric., Forest Serv. Tech. Bull. 1273, illus.

(9) Condon, Thomas. 1910. The Willamette Sound. *In* Oregon Geology. pp. 134-147.

(10) Curtis, R. O., Francis R. Herman, and Donald J. DeMars. 1974. Height growth and site index for Douglas-fir in high elevation forests of the Oregon-Washington Cascades. Forest Sci., Vol. 20, No. 4.

(11) Fields, M. and others. 1951. Estimation of exchangeable cations in soils with the Beckman flame spectrophotometer. Soil Sci. 72.

(12) Herman, Francis R., Robert O. Curtis, and Donald J. Demars. 1978. Height growth and site index for noble fir in high elevation forests of the Oregon-Washington Cascades. U.S. Dep. Agric., Forest Serv. Res. Pap. PNW-243.

(13) Kilmer, Victor J. and Joseph F. Mullins. 1954. Improved stirring and pipetting apparatus for mechanical analysis of soils. Soil Sci. 77:437-441, illus.

(14) King, James E. 1966. Site index curves for Douglas-fir in the Pacific Northwest. Weyerhaeuser Forest. Pap. No. 8.

(15) McArdle, R. E., W. H. Meyer, and D. Bruce. 1961. The yield of Douglas-fir in the Pacific Northwest. U.S. Dep. Agric. Tech. Bull. 201, 74 pp., illus.

(16) Oregon State University Extension Service. 1981. Oregon county and state agricultural estimates. Spec. Rep. No. 651.

(17) Parsons, R. B. 1978. Soil-geomorphology relations in mountains of Oregon, U.S.A. Geoderma 21:25-39, illus.

(18) Parsons, R. B. 1979. Land use implications of the Diamond Hill Paleosol, Willamette Valley, Oregon. Geoderma 22:67-70.

(19) Parsons, R. B. and C. A. Balster. 1965. A fault-soils relationship in the Oregon Coast Range: I. Morphology and composition. Soil Sci. 100:280-296, illus.

(20) Parsons, R. B. and C. A. Balster. 1967. Dayton—A depositional Planosol, Willamette Valley, Oregon. Soil Sci. Soc. Am. Proc. 31:225-258, illus.

(21) Parsons, R. B., G. H. Simonson, and C. A. Balster. 1968. Pedogenic and geomorphic relationships of

associated Aqualfs, Albolls, and Xerolls in western Oregon. Soil Sci. Soc. Am. Proc. 32:556-563, illus.

(22) Parsons, R. B., C. A. Balster, and A. O. Ness. 1970. Soil development and geomorphic surfaces, Willamette Valley, Oregon. Soil Sci. Soc. Am. Proc. 34:485-491, illus.

(23) Parsons, R. B., L. Monocharoan, and E. G. Knox. 1973. Geomorphic occurrence of Pelloxererts, Willamette Valley, Oregon. Soil Sci. Soc. Am. Proc. 37:924-927, illus.

(24) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(25) United States Department of Agriculture. 1967. Soil survey laboratory methods and procedures for collecting soil samples. Soil Surv. Invest. Rep. 1, 50 pp., illus.

(26) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(27) United States Department of Agriculture. 1981. Land resource regions and major land resource areas of the United States. Agric. Handb. 296, 156 pp., illus.

(28) United States Department of Agriculture. 1924. Soil Survey of Linn County, Oregon. No. 25., 72 pp., illus.

(29) Zobel, Donald B., Arthur McKee, and Glen M. Hawk. 1976. Relationships of environment to composition, structure and diversity of forest communities of the central western Cascades of Oregon. Ecol. Monogr. 46:135-156, illus.

Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Anion. Charge of electricity.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench. A platform-type, nearly level to gently sloping erosional surface that developed on resistant strata in areas where valleys are cut in alternating strong and weak layers.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breccia. A coarse grained clastic rock composed of angular rock fragments (larger than 2 millimeters) commonly cemented together in a finer grained matrix of varying composition and origin. The consolidated equivalent of rubble.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Compaction. An alteration of soil structure in which the soil particles are rearranged so that pore space is decreased and bulk density is increased.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. If soil improving crops and practices used in the system more than offset the soil depleting crops and deteriorating practices, then it is a good conservation cropping system. Cropping systems are needed on all tilled soils. Soil improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose. —Noncoherent when dry or moist; does not hold together in a mass.

Friable. —When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm. —When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic. —When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky. —When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard. —When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft rock. —When dry, breaks into powder or individual grains under very slight pressure.

Cemented. —Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops using a planned system of rotation and management practices.

Culmination of the Mean Annual Increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Debris flow (mudflow). A mass movement process involving the rapid flow of highly viscous mixtures of debris, water, and entrapped air. A mudflow is a type of debris flow with clastic particles that are sand-sized and finer.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diameter Breast Height (DBH). Diameter of a tree, excluding the bark, at a height of 4.5 feet above the average ground level.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained. —Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained. —Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained. —Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained. —Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained. —Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained. —Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained. —Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature; for example, fire that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (or 300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard rock. Rock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

High-residue crops. Crops such as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon. —An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon. —The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

A2 horizon. —The mineral horizon in which the main feature is loss of silicate clay, iron, alluminum, or some combination of these.

B horizon. —The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon. —The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer. —Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors of predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0 75	moderately low
0.75 to 1.25	moderate
1.25 to 1 75	moderately high
1.75 to 2 5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border. —Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin. —Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding. —Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation. —Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle). —Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow. —Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler. —Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation. —Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding. —Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables) Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low-residue crops. Crops such as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Major Land Resource Area (MLRA). A geographically associated land resource unit important in statewide agricultural planning. It also has value in interstate, regional, and national planning.

Mean Annual Increment (MAI). The total growth of a stand of trees divided by the stated age.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Open space. A relatively undeveloped green or wooded area provided mainly within an urban area to minimize feelings of congested living.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pediment. A gently sloping erosional surface developed at the foot of a receding hill or mountain slope.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to premit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed. (See climax plant community.)

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Puddling. The act of destroying soil structure by handling a soil when it is wet. It results in dense soil that is dominantly massive or single grain and nearly impervious to air and water.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8 4
Strongly alkaline	8.5 to 9 0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, gravel, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site class. A grouping of site indexes into 5 to 7 production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant trees for the range of ages on soils that differ in productivity. such level is represented by a curve. The basis of the curves is the height of dominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that show the average height of dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Skid trail. Trail or furrow caused by skidding logs over the surface of the ground.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

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:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Turbidity. A state in which sediment is stirred up in a body of water.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Volatilize. A process in which a substance is caused to pass off as a vapor.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Yarding. The act of moving logs from a cutting area to a landing or loading area.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
Recorded in the period 1951-74 at Albany, OR											
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	46.4	33.7	40.1	62	15	102	7.63	4.02	10.80	16	0.5
February---	52.1	34.8	43.5	66	23	132	4.53	2.34	6.44	10	0.5
March------	55.5	35.7	45.6	72	25	179	4.83	2.61	6.78	13	0.0
April------	61.3	38.9	50.1	80	29	307	2.38	1.21	3.39	8	0.0
May--------	67.9	43.9	55.9	90	33	493	2.06	1.02	2.94	7	0.0
June-------	73.5	49.0	61.3	94	38	639	1.45	0.59	2.18	5	0.0
July-------	80.9	51.2	66.1	100	43	809	0.32	---	0.57	1	0.0
August-----	80.5	51.0	65.8	99	42	800	0.62	---	1.06	2	0.0
September--	76.1	47.3	61.7	96	36	651	1.45	0.43	2.26	4	0.0
October----	65.1	41.6	53.4	84	30	415	3.53	1.73	5.09	8	0.0
November---	53.6	37.5	45.6	69	22	187	6.22	3.15	8.88	13	0.0
December---	47.4	35.0	41.2	62	17	98	7.43	4.71	9.88	16	0.0
Yearly:											
Average--	63.4	41.6	52.5	---	---	---	---	---	---	---	---
Extreme--	---	---	---	101	11	---	---	---	---	---	---
Total----	---	---	---	---	---	4,812	42.45	37.26	47.45	103	1.0

See footnote at end of table.

TABLE 1.--TEMPERATURE AND PRECIPITATION--Continued

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
Recorded in the period 1951-79 at Cascadia, OR											
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	45.1	30.6	37.9	63	10	82	9.21	5.09	12.85	16	5.3
February---	51.2	33.1	42.2	71	20	110	6.46	3.91	8.74	14	1.3
March------	53.3	33.4	43.4	75	22	133	7.08	4.27	9.59	15	2.8
April------	59.1	36.3	47.7	82	27	239	4.96	2.95	6.75	12	0.3
May--------	64.9	40.9	52.9	90	30	400	4.02	2.25	5.57	10	0.0
June-------	72.1	46.5	59.3	93	34	579	2.52	0.93	3.83	6	0.0
July-------	80.1	48.0	64.1	98	36	747	0.53	0.04	0.90	2	0.0
August-----	80.1	47.5	63.8	98	35	738	1.36	0.16	2.26	4	0.0
September--	75.0	44.1	59.6	95	31	588	2.38	0.86	3.66	5	0.0
October----	64.3	38.5	51.4	86	27	353	5.26	2.56	7.60	10	0.0
November---	52.3	35.2	43.8	71	20	143	8.30	4.45	11.69	14	0.3
December---	45.8	32.7	39.3	60	15	68	10.05	6.05	13.63	16	1.8
Yearly:											
Average--	61.9	38.9	50.5	---	---	---	---	---	---	---	---
Extreme--	---	---	---	101	5	---	---	---	---	---	---
Total----	---	---	---	---	---	4,180	62.13	54.33	69.81	124	11.8

See footnote at end of table.

TABLE 1.--TEMPERATURE AND PRECIPITATION--Continued

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
Recorded in the period 1953-77 at Detroit, OR											
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	42.3	32.1	37.2	59	14	55	13.76	6.73	19.50	17	8.2
February---	47.3	34.3	40.9	63	23	98	9.56	5.64	13.04	14	5.6
March------	50.1	34.5	42.3	69	25	107	10.13	6.27	13.59	16	5.2
April------	55.7	37.8	46.7	79	31	213	6.45	4.12	8.56	13	0.6
May--------	63.5	43.4	53.5	90	33	419	4.77	2.89	6.45	11	0.0
June-------	70.3	49.8	60.1	93	40	603	2.83	1.35	4.02	6	0.0
July-------	78.2	53.5	65.9	99	45	803	0.64	0.05	1.06	2	0.0
August-----	78.1	53.9	66.0	99	45	806	1.56	0.21	2.58	4	0.0
September--	72.6	50.4	61.3	96	40	645	3.45	0.69	5.57	6	0.0
October----	61.3	44.3	52.8	84	34	397	7.28	3.94	10.00	11	0.0
November---	49.8	38.5	44.2	66	27	147	12.92	6.97	17.78	16	1.4
December---	44.5	34.8	39.7	59	20	69	14.92	8.52	20.13	17	4.3
Yearly:											
Average--	59.5	42.3	50.9	---	---	---	---	---	---	---	---
Extreme--	---	---	---	103	11	---	---	---	---	---	---
Total----	---	---	---	---	---	4,362	88.27	77.68	98.51	133	25.3

*A growing degree day is an index of the amount of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 °F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Recorded in the period 1951-74 at Albany, OR			
Last freezing temperature in spring:			
1 year in 10 later than--	March 4	April 6	May 8
2 years in 10 later than--	February 18	March 27	May 1
5 years in 10 later than--	January 23	March 7	April 19
First freezing temperature in fall:			
1 year in 10 earlier than--	November 4	October 28	September 30
2 years in 10 earlier than--	November 17	November 6	October 10
5 years in 10 earlier than--	December 10	November 24	October 28

TABLE 2.--FREEZE DATES IN SPRING AND FALL--Continued

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Recorded in the period 1951-79 at Cascadia, OR			
Last freezing temperature in spring:			
1 year in 10 later than--	March 26	May 4	June 6
2 years in 10 later than--	March 15	April 24	May 30
5 years in 10 later than--	February 24	April 4	May 16
First freezing temperature in fall:			
1 year in 10 earlier than--	October 31	October 5	September 16
2 years in 10 earlier than--	November 11	October 15	September 23
5 years in 10 earlier than--	December 2	November 4	October 6

TABLE 2.--FREEZE DATES IN SPRING AND FALL--Continued

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Recorded in the period 1953-77 at Detroit, OR			
Last freezing temperature in spring:			
1 year in 10 later than--	March 4	April 3	May 1
2 years in 10 later than--	February 21	March 21	April 23
5 years in 10 later than--	January 28	February 24	April 9
First freezing temperature in fall:			
1 year in 10 earlier than--	November 29	November 15	October 27
2 years in 10 earlier than--	December 8	November 26	November 4
5 years in 10 earlier than--	December 27	December 18	November 18

TABLE 3.--GROWING SEASON

Probability	Length of growing season if daily minimum temperature exceeds--		
	24 °F	28 °F	32 °F
Recorded in the period 1951-74 at Albany, OR			
	Days	Days	Days
9 years in 10	267	232	156
8 years in 10	285	242	168
5 years in 10	321	262	192
2 years in 10	365	281	216
1 year in 10	365	291	228
Recorded in the period 1951-79 at Cascadia, OR			
	Days	Days	Days
9 years in 10	237	172	117
8 years in 10	252	186	126
5 years in 10	281	213	143
2 years in 10	321	239	159
1 year in 10	365	253	168
Recorded in the period 1953-77 at Detroit, OR			
	Days	Days	Days
9 years in 10	282	245	188
8 years in 10	300	268	200
5 years in 10	345	291	222
2 years in 10	365	342	244
1 year in 10	365	365	255

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1A	Abiqua silty clay loam, 0 to 3 percent slopes	1,610	0.2
1B	Abiqua silty clay loam, 3 to 5 percent slopes	340	*
2D	Acanod silt loam, 2 to 25 percent slopes	1,800	0.2
3	Amity silt loam	26,700	2.8
4D	Apt silty clay loam, 2 to 25 percent slopes	8,205	0.9
5F	Apt silty clay loam, 25 to 50 percent north slopes	3,485	0.4
6F	Apt silty clay loam, 25 to 50 percent south slopes	1,560	0.2
7	Awbrig silty clay loam	9,985	1.0
8	Bashaw silty clay	25,635	2.7
9C	Bellpine silty clay loam, 3 to 12 percent slopes	6,735	0.7
9D	Bellpine silty clay loam, 12 to 20 percent slopes	9,120	1.0
9E	Bellpine silty clay loam, 20 to 30 percent slopes	4,695	0.5
9F	Bellpine silty clay loam, 30 to 50 percent slopes	1,810	0.2
10E	Bensley stony loam, 2 to 30 percent slopes	1,915	0.2
11F	Bensley-Valsetz stony loams, 30 to 50 percent slopes	4,470	0.5
11G	Bensley-Valsetz stony loams, 50 to 75 percent slopes	6,855	0.7
12E	Blachly clay loam, 3 to 30 percent slopes	12,410	1.3
13F	Blachly clay loam, 30 to 50 percent north slopes	6,335	0.7
13G	Blachly clay loam, 50 to 75 percent north slopes	3,800	0.4
14F	Blachly clay loam, 30 to 50 percent south slopes	8,880	0.9
14G	Blachly clay loam, 50 to 75 percent south slopes	3,580	0.4
15D	Bohannon cobbly loam, 3 to 25 percent slopes	220	*
16B	Briedwell silt loam, 0 to 7 percent slopes	2,495	0.3
17C	Bull Run silt loam, 3 to 15 percent slopes	1,675	0.2
17E	Bull Run silt loam, 15 to 30 percent slopes	1,040	0.1
18	Camas gravelly sandy loam	2,185	0.2
19	Chapman loam	7,000	0.7
20C	Chehalem silt loam, 3 to 12 percent slopes	675	0.1
21	Chehalis silty clay loam	10,895	1.1
22C	Chehulpum silt loam, 3 to 12 percent slopes	1,215	0.1
22E	Chehulpum silt loam, 12 to 35 percent slopes	740	0.1
23	Clackamas gravelly silt loam	10,300	1.1
24	Clackamas Variant silt loam	2,075	0.2
25	Cloquato silt loam	8,350	0.9
26	Coburg silty clay loam	16,165	1.7
27	Concord silt loam	10,835	1.1
28	Conser silty clay loam	9,955	1.0
29	Courtney gravelly silty clay loam	8,500	0.9
30D	Crabtree stony loam, 2 to 25 percent slopes	415	*
30F	Crabtree stony loam, 25 to 45 percent slopes	2,070	0.2
30G	Crabtree stony loam, 45 to 75 percent slopes	4,190	0.4
31D	Cruiser gravelly loam, 3 to 25 percent slopes	2,925	0.3
31F	Cruiser gravelly loam, 25 to 50 percent slopes	2,725	0.3
31G	Cruiser gravelly loam, 50 to 70 percent slopes	1,830	0.2
32D	Cumley silty clay loam, 2 to 20 percent slopes	3,005	0.3
33	Dayton silt loam	59,075	6.1
34C	Dixonville silty clay loam, 3 to 12 percent slopes	3,360	0.4
34E	Dixonville silty clay loam, 12 to 30 percent slopes	4,910	0.5
34F	Dixonville silty clay loam, 30 to 50 percent slopes	2,535	0.3
35C	Dixonville-Philomath-Hazelair complex, 3 to 12 percent slopes	3,935	0.4
35E	Dixonville-Philomath-Hazelair complex, 12 to 35 percent slopes	5,215	0.5
36D	Dupee silt loam, 3 to 20 percent slopes	4,100	0.4
37D	Flane gravelly loam, 3 to 25 percent slopes	1,795	0.2
37F	Flane gravelly loam, 25 to 50 percent slopes	2,920	0.3
37G	Flane gravelly loam, 50 to 75 percent slopes	1,875	0.2
38F	Flane-Moe gravelly loams, 25 to 50 percent slopes	3,765	0.4
38G	Flane-Moe gravelly loams, 50 to 75 percent slopes	2,690	0.3
39	Fluvents-Fluvaquents complex, nearly level	10,100	1.1
40G	Harrington-Klickitat complex, 50 to 75 percent north slopes	18,290	1.9
41G	Harrington-Klickitat complex, 50 to 75 percent south slopes	31,595	3.3
42H	Harrington-Rock outcrop complex, 50 to 90 percent slopes	2,980	0.3
43B	Hazelair silty clay loam, 2 to 7 percent slopes	8,000	0.8
43D	Hazelair silty clay loam, 7 to 20 percent slopes	5,715	0.6
44E	Henline very stony sandy loam, 6 to 30 percent slopes	585	0.1
44F	Henline very stony sandy loam, 30 to 55 percent slopes	2,165	0.2
44G	Henline very stony sandy loam, 55 to 80 percent slopes	2,800	0.3
45F	Henline-Yellowstone-Rock outcrop complex, 25 to 50 percent slopes	5,495	0.6

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
45H	Henline-Yellowstone-Rock outcrop complex, 50 to 90 percent slopes	9,395	1.0
46	Holcomb silt loam	17,530	1.8
47C	Honeygrove silty clay loam, 3 to 12 percent slopes	2,585	0.3
47D	Honeygrove silty clay loam, 12 to 25 percent slopes	33,470	3.5
48F	Honeygrove silty clay loam, 25 to 50 percent north slopes	8,170	0.9
49F	Honeygrove silty clay loam, 25 to 50 percent south slopes	16,580	1.7
50D	Hummington very gravelly loam, 5 to 25 percent slopes	1,315	0.1
50F	Hummington very gravelly loam, 25 to 50 percent slopes	4,300	0.4
50G	Hummington very gravelly loam, 50 to 75 percent slopes	7,565	0.8
51C	Jory silty clay loam, 2 to 12 percent slopes	9,415	1.0
51D	Jory silty clay loam, 12 to 20 percent slopes	6,025	0.6
51E	Jory silty clay loam, 20 to 30 percent slopes	2,205	0.2
51F	Jory silty clay loam, 30 to 50 percent slopes	695	0.1
52D	Keel gravelly silt loam, 2 to 25 percent slopes	5,230	0.5
52F	Keel gravelly silt loam, 25 to 45 percent slopes	11,350	1.2
52G	Keel gravelly silt loam, 45 to 75 percent slopes	17,645	1.8
53G	Kilchis-Harrington complex, 30 to 60 percent slopes	600	0.1
53H	Kilchis-Harrington complex, 60 to 90 percent slopes	6,310	0.7
54D	Kinney cobbly loam, 3 to 20 percent slopes	8,630	0.9
55F	Kinney cobbly loam, 20 to 50 percent north slopes	9,795	1.0
55G	Kinney cobbly loam, 50 to 70 percent north slopes	9,585	1.0
56F	Kinney cobbly loam, 20 to 50 percent south slopes	9,200	1.0
56G	Kinney cobbly loam, 50 to 70 percent south slopes	3,005	0.3
57E	Kinney cobbly loam, slump, 3 to 30 percent slopes	2,300	0.2
58F	Kinney-Klickitat complex, 20 to 50 percent north slopes	1,795	0.2
58G	Kinney-Klickitat complex, 50 to 70 percent north slopes	6,885	0.7
59F	Kinney-Klickitat complex, 20 to 50 percent south slopes	1,690	0.2
59G	Kinney-Klickitat complex, 50 to 70 percent south slopes	10,655	1.1
60E	Klickitat-Harrington complex, 3 to 30 percent slopes	2,595	0.3
61F	Klickitat-Harrington complex, 30 to 50 percent north slopes	2,215	0.2
62F	Klickitat-Harrington complex, 30 to 50 percent south slopes	6,560	0.7
63	Malabon silty clay loam	12,350	1.3
64	Malabon Variant loam	1,095	0.1
65B	Marcola cobbly silty clay loam, 2 to 7 percent slopes	1,760	0.2
66B	McAlpin silty clay loam, 3 to 6 percent slopes	7,605	0.8
67	McBee silty clay loam	7,930	0.8
68F	McDuff silty clay loam, 25 to 50 percent slopes	875	0.1
68G	McDuff silty clay loam, 50 to 75 percent slopes	410	*
69B	Minniece silty clay loam, 0 to 8 percent slopes	445	*
70D	Moe gravelly loam, 3 to 25 percent slopes	9,715	1.0
70F	Moe gravelly loam, 25 to 50 percent slopes	4,725	0.5
71F	Mulkey loam, 25 to 50 percent slopes	855	0.1
72C	Nekia silty clay loam, 2 to 12 percent slopes	11,110	1.2
72D	Nekia silty clay loam, 12 to 20 percent slopes	9,840	1.0
72E	Nekia silty clay loam, 20 to 30 percent slopes	7,710	0.8
72F	Nekia silty clay loam, 30 to 50 percent slopes	6,440	0.7
73	Newberg fine sandy loam	14,185	1.5
74H	Ochrepts, very steep	4,005	0.4
75C	Panther silty clay loam, 2 to 12 percent slopes	2,640	0.3
76E	Peavine silty clay loam, 3 to 30 percent slopes	6,215	0.6
76G	Peavine silty clay loam, 30 to 60 percent slopes	8,285	0.9
77A	Pengra silt loam, 1 to 4 percent slopes	2,125	0.2
78C	Philomath silty clay, 3 to 12 percent slopes	1,205	0.1
79C	Philomath cobbly silty clay, 3 to 12 percent slopes	2,940	0.3
79F	Philomath cobbly silty clay, 12 to 45 percent slopes	6,600	0.7
80	Pits	770	0.1
81D	Quartzville silt loam, 2 to 25 percent slopes	3,660	0.4
82F	Quartzville silt loam, 25 to 50 percent north slopes	1,480	0.2
82G	Quartzville silt loam, 50 to 75 percent north slopes	810	0.1
83F	Quartzville silt loam, 25 to 50 percent south slopes	2,225	0.2
84E	Ritner cobbly silty clay loam, 2 to 30 percent slopes	9,465	1.0
84G	Ritner cobbly silty clay loam, 30 to 60 percent slopes	7,165	0.7
85	Riverwash	2,275	0.2
86G	Rock outcrop-Orthents complex, steep	4,430	0.5
87	Salem gravelly silt loam	5,010	0.5
88B	Salkum silty clay loam, 2 to 8 percent slopes	6,540	0.7
88C	Salkum silty clay loam, 8 to 15 percent slopes	2,165	0.2

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
89B	Santiam silt loam, 3 to 6 percent slopes	3,240	0.3
90B	Saturn clay loam, 0 to 5 percent slopes	1,615	0.2
91	Saturn Variant silt loam	610	0.1
92	Sifton Variant gravelly loam	1,480	0.2
93C	Silverton silt loam, 3 to 12 percent slopes	290	*
94B	Stayton silt loam, 0 to 7 percent slopes	915	0.1
95C	Steiwer silt loam, 3 to 12 percent slopes	795	0.1
95D	Steiwer silt loam, 12 to 20 percent slopes	850	0.1
95F	Steiwer silt loam, 20 to 50 percent slopes	635	0.1
96E	Valsetz stony loam, 3 to 30 percent slopes	615	0.1
97E	Valsetz-Yellowstone stony loams, 3 to 30 percent slopes	925	0.1
97H	Valsetz-Yellowstone stony loams, 30 to 90 percent slopes	3,465	0.4
98	Waldo silty clay loam	6,800	0.7
99	Wapato silty clay loam	4,920	0.5
100	Whiteson silt loam	3,010	0.3
101C	Willakenzie clay loam, 2 to 12 percent slopes	2,025	0.2
101D	Willakenzie clay loam, 12 to 20 percent slopes	1,060	0.1
101E	Willakenzie clay loam, 20 to 30 percent slopes	480	0.1
101F	Willakenzie clay loam, 30 to 50 percent slopes	500	0.1
102	Willamette silt loam	7,125	0.7
103C	Witham silty clay, 2 to 12 percent slopes	1,275	0.1
104E	Witzel very cobbly loam, 3 to 30 percent slopes	5,600	0.6
104G	Witzel very cobbly loam, 30 to 70 percent slopes	2,620	0.3
105C	Witzel Variant very cobbly silt loam, 0 to 12 percent slopes	1,545	0.2
106A	Woodburn silt loam, 0 to 3 percent slopes	30,490	3.2
106C	Woodburn silt loam, 3 to 12 percent slopes	1,040	0.1
107E	Yellowstone stony loam, 3 to 30 percent slopes	265	*
107H	Yellowstone stony loam, 30 to 90 percent slopes	3,795	0.4
108H	Zango-Dobbins gravelly loams, 60 to 90 percent slopes	5,250	0.5
	Water	5,665	0.6
	Total	956,560	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. Only the soils suited to crops and pasture are listed]

Soil name and map symbol	Perennial ryegrass seed		Annual ryegrass seed		Winter wheat		Sweet corn		Snap beans		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Lbs	Lbs	Lbs	Lbs	Bu	Bu	Tons	Tons	Tons	Tons	AUM*	AUM*
1A----------------------- Abiqua	900	---	---	---	100	---	---	9	---	6	12	18
1B----------------------- Abiqua	900	---	---	---	100	---	---	9	---	6	12	18
3**---------------------- Amity	900	---	1,800	---	100	---	---	9	---	6	10	16
7**---------------------- Awbrig	650	---	1,800	---	50	---	---	5	---	3	8	12
8**---------------------- Bashaw	---	---	1,600	---	40	---	---	3	---	---	8	12
9C----------------------- Bellpine	---	---	---	---	70	---	---	7	---	4.5	6	---
9D----------------------- Bellpine	---	---	---	---	65	---	---	---	---	---	6	---
9E----------------------- Bellpine	---	---	---	---	---	---	---	---	---	---	6	---
9F----------------------- Bellpine	---	---	---	---	---	---	---	---	---	---	4	---
16B---------------------- Briedwell	---	---	---	---	60	---	---	7	---	4.5	8	14
17C, 17E----------------- Bull Run	---	---	---	---	---	---	---	---	---	---	7.5	---
18----------------------- Camas	---	---	---	---	20	---	---	5	---	3	5	12
19----------------------- Chapman	900	---	---	---	100	---	---	9	---	6	12	18
20C---------------------- Chehalem	700	---	1,600	---	60	---	---	7	---	4.5	8.5	16
21----------------------- Chehalis	900	---	---	---	100	---	---	9	---	6	12	18
22C---------------------- Chehulpum	---	---	---	---	---	---	---	---	---	---	4	---
22E---------------------- Chehulpum	---	---	---	---	---	---	---	---	---	---	3	---
23**--------------------- Clackamas	850	---	1,600	---	50	---	---	7	---	4.5	8	12
24**--------------------- Clackamas Variant	850	---	1,600	---	50	---	---	7	---	4.5	8	12
25----------------------- Cloquato	900	---	---	---	100	---	---	9	---	6	12	18

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Perennial ryegrass seed		Annual ryegrass seed		Winter wheat		Sweet corn		Snap beans		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Lbs	Lbs	Lbs	Lbs	Bu	Bu	Tons	Tons	Tons	Tons	AUM*	AUM*
26** Coburg	900	---	---	---	95	---	---	9	---	6	12	18
27** Concord	700	---	1,800	---	50	---	---	6.5	---	4	8.5	12
28** Conser	650	---	1,800	---	50	---	---	6.5	---	4	8.5	12
29** Courtney	700	---	1,400	---	40	---	---	5	---	3.5	8	12
33** Dayton	700	---	1,800	---	50	---	---	6.5	---	4	8	12
34C Dixonville	---	---	---	---	50	---	---	6	---	3.5	6	---
34E Dixonville	---	---	---	---	40	---	---	---	---	---	6	---
34F Dixonville	---	---	---	---	---	---	---	---	---	---	4	---
35C Dixonville-Philomath-Hazelair	---	---	---	---	---	---	---	---	---	---	5	---
35E Dixonville-Philomath-Hazelair	---	---	---	---	---	---	---	---	---	---	5	---
36D** Dupee	---	---	1,000	---	50	---	---	---	---	---	7	---
43B** Hazelair	---	---	---	---	40	---	---	---	---	---	7	---
43D** Hazelair	---	---	---	---	40	---	---	---	---	---	7	---
46** Holcomb	900	---	1,800	---	65	---	---	8	---	6	10	16
51C Jory	---	---	---	---	80	---	---	8	---	5	8	---
51D Jory	---	---	---	---	75	---	---	---	---	---	8	---
51E Jory	---	---	---	---	---	---	---	---	---	---	8	---
63 Malabon	900	---	---	---	100	---	---	9	---	6	12	18
64 Malabon Variant	900	---	---	---	80	---	---	7	---	4.5	10	15
65B** Marcola	---	---	---	---	40	---	---	---	---	---	6	12
66B** McAlpin	900	---	---	---	95	---	---	9	---	6	10	16

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Perennial ryegrass seed		Annual ryegrass seed		Winter wheat		Sweet corn		Snap beans		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Lbs	Lbs	Lbs	Lbs	Bu	Bu	Tons	Tons	Tons	Tons	AUM*	AUM*
67** McBee	900	---	---	---	95	---	---	9	---	6	10	16
72C, 72D Nekia	---	---	---	---	70	---	---	7	---	4.5	6	---
72E Nekia	---	---	---	---	---	---	---	---	---	---	6	---
72F Nekia	---	---	---	---	---	---	---	---	---	---	4	---
73 Newberg	900	---	---	---	55	---	---	9	---	6	12	18
75C Panther	---	---	---	---	---	---	---	---	---	---	4	---
77A** Pengra	800	---	1,800	---	60	---	---	7	---	4.5	9	15
78C Philomath	---	---	---	---	---	---	---	---	---	---	3	---
84E Ritner	---	---	---	---	45	---	---	---	---	---	5	---
84G Ritner	---	---	---	---	---	---	---	---	---	---	5	---
87 Salem	900	---	---	---	80	---	---	9	---	6	10	18
88B Salkum	900	---	---	---	75	---	---	8	---	5.5	8	---
88C Salkum	900	---	---	---	70	---	---	---	---	---	8	---
89B Santiam	900	---	---	---	75	---	---	8	---	6	10	18
90B Saturn	---	---	---	---	---	---	---	---	---	---	9	15
91** Saturn Variant	850	---	---	---	55	---	---	8	---	6	8	12
92 Sifton Variant	---	---	---	---	25	---	---	5	---	3	5	12
93C Silverton	750	---	---	---	65	---	---	---	---	---	8	13
94B Stayton	---	---	---	---	---	---	---	---	---	---	4	---
95C Steiwer	---	---	---	---	45	---	---	---	---	---	6	---
95D Steiwer	---	---	---	---	40	---	---	---	---	---	5	---
95F Steiwer	---	---	---	---	---	---	---	---	---	---	5	---

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Perennial ryegrass seed		Annual ryegrass seed		Winter wheat		Sweet corn		Snap beans		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Lbs	Lbs	Lbs	Lbs	Bu	Bu	Tons	Tons	Tons	Tons	AUM*	AUM*
98**: Waldo	---	---	1,800	---	40	---	---	5	---	3	8	14
99**: Wapato	800	---	1,800	---	50	---	---	6	---	4	8	15
100**: Whiteson	800	---	1,800	---	50	---	---	6	---	4	8	15
101C, 101D: Willakenzie	---	---	---	---	75	---	---	7	---	5	7	---
101E: Willakenzie	---	---	---	---	---	---	---	---	---	---	7	---
101F: Willakenzie	---	---	---	---	---	---	---	---	---	---	6	---
102: Willamette	900	---	---	---	110	---	---	9	---	6	12	18
103C**: Witham	---	---	---	---	40	---	---	---	---	---	5	---
104E, 104G: Witzel	---	---	---	---	---	---	---	---	---	---	2	---
105C: Witzel Variant	---	---	---	---	---	---	---	---	---	---	2	---
106A**: Woodburn	900	---	---	---	100	---	---	9	---	6	12	18
106C**: Woodburn	900	---	---	---	100	---	---	9	---	6	12	18

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** Drainage is needed for winter wheat, sweet corn, and snap beans.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Management concerns				Potential productivity		Trees to plant
	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
2D----- Acanod	Moderate	Slight	Slight	Moderate	Douglas-fir----- Western hemlock----- Western redcedar---- Bigleaf maple------- Red alder-----------	160 --- --- --- ---	Douglas-fir, western hemlock, western redcedar.
4D----- Apt	Moderate	Slight	Slight	Moderate	Douglas-fir----- Western hemlock----- Western redcedar---- Bigleaf maple------- Red alder-----------	175 130 --- --- ---	Douglas-fir, western hemlock.
5F----- Apt	Severe	Slight	Slight	Moderate	Douglas-fir----- Western hemlock----- Western redcedar---- Bigleaf maple------- Red alder-----------	175 130 --- --- ---	Douglas-fir, western hemlock.
6F----- Apt	Severe	Moderate	Slight	Moderate	Douglas-fir----- Western hemlock----- Bigleaf maple------- Red alder-----------	135 --- --- ---	Douglas-fir.
9C----- Bellpine	Moderate	Slight	Moderate	Slight	Douglas-fir----- Grand fir----------- Bigleaf maple------- Oregon white oak----	155 --- --- ---	Douglas-fir.
9D, 9E----- Bellpine	Moderate	Slight	Moderate	Slight	Douglas-fir----- Grand fir----------- Bigleaf maple------- Oregon white oak----	155 --- --- ---	Douglas-fir.
9F----- Bellpine	Severe	Slight	Moderate	Slight	Douglas-fir----- Grand fir----------- Bigleaf maple------- Oregon white oak----	155 --- --- ---	Douglas-fir.
10E*----- Bensley	Moderate	Slight	Slight	Slight	Douglas-fir----- Western redcedar---- Mountain hemlock---- Noble fir-----------	110 --- --- ---	Douglas-fir, mountain hemlock, noble fir, western redcedar.
11F*:							
Bensley-----	Moderate	Slight	Slight	Slight	Douglas-fir----- Western redcedar---- Mountain hemlock---- Noble fir-----------	110 --- --- ---	Douglas-fir, mountain hemlock, noble fir, western redcedar.
Valsetz-----	Moderate	Moderate	Moderate	Moderate	Douglas-fir----- Mountain hemlock---- Noble fir-----------	115 --- ---	Douglas-fir, mountain hemlock, noble fir.
11G*:							
Bensley-----	Severe	Slight	Moderate	Slight	Douglas-fir----- Western redcedar---- Mountain hemlock---- Noble fir-----------	110 --- --- ---	Douglas-fir, mountain hemlock, noble fir, western redcedar.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns				Potential productivity		Trees to plant
	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
11G*:							
Valsetz	Severe	Moderate	Moderate	Moderate	Douglas-fir Mountain hemlock Noble fir	115 --- ---	Douglas-fir, mountain hemlock, noble fir.
12E Blachly	Moderate	Slight	Slight	Moderate	Douglas-fir Bigleaf maple Western hemlock Red alder	150 --- --- ---	Douglas-fir.
13F Blachly	Moderate	Slight	Slight	Severe	Douglas-fir Bigleaf maple Western hemlock Red alder	165 --- --- ---	Douglas-fir, western hemlock.
13G Blachly	Severe	Slight	Slight	Severe	Douglas-fir Bigleaf maple Western hemlock Red alder	165 --- --- ---	Douglas-fir, western hemlock.
14F Blachly	Moderate	Moderate	Slight	Moderate	Douglas-fir Bigleaf maple Western hemlock Red alder	150 --- --- ---	Douglas-fir.
14G Blachly	Severe	Moderate	Slight	Moderate	Douglas-fir Bigleaf maple Western hemlock Red alder	150 --- --- ---	Douglas-fir.
15D Bohannon	Moderate	Moderate	Moderate	Moderate	Douglas-fir Western hemlock Bigleaf maple Red alder	150 --- --- ---	Douglas-fir, western hemlock, grand fir, western redcedar.
17C, 17E Bull Run	Slight	Slight	Slight	Moderate	Douglas-fir Bigleaf maple Red alder	170 --- ---	Douglas-fir.
30D*, 30F* Crabtree	Moderate	Slight	Moderate	Slight	Douglas-fir Noble fir Western hemlock Pacific silver fir Western redcedar	105 105 --- --- ---	Douglas-fir, noble fir, western hemlock, western redcedar.
30G* Crabtree	Severe	Slight	Moderate	Slight	Douglas-fir Noble fir Western hemlock Pacific silver fir Western redcedar	105 105 --- --- ---	Douglas-fir, noble fir, western hemlock, western redcedar.
31D* Cruiser	Moderate	Slight	Slight	Slight	Douglas-fir Noble fir Western hemlock Western redcedar	140 120 120 ---	Douglas-fir, western hemlock, Pacific silver fir, noble fir.
31F* Cruiser	Moderate	Slight	Slight	Slight	Douglas-fir Noble fir Western hemlock Western redcedar	140 120 120 ---	Douglas-fir, western hemlock, Pacific silver fir, noble fir.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
31G*: Cruiser	Severe	Slight	Slight	Slight	Douglas-fir Noble fir Western hemlock Western redcedar	140 120 120 ---	Douglas-fir, western hemlock, Pacific silver fir, noble fir.
32D: Cumley	Severe	Slight	Severe	Severe	Douglas-fir Western hemlock Western redcedar Red alder Bigleaf maple	155 --- --- --- ---	Douglas-fir, western redcedar, western hemlock.
34C, 34E: Dixonville	Moderate	Moderate	Slight	Severe	Douglas-fir Grand fir Oregon white oak	120 --- ---	Douglas-fir, ponderosa pine.
34F: Dixonville	Severe	Moderate	Slight	Severe	Douglas-fir Grand fir Oregon white oak	120 --- ---	Douglas-fir, ponderosa pine.
35C, 35E:							
Dixonville	Moderate	Moderate	Slight	Severe	Douglas-fir Grand fir Oregon white oak	120 --- ---	Douglas-fir, ponderosa pine.
Philomath.							
Hazelair.							
37D: Flane	Moderate	Slight	Slight	Slight	Douglas-fir Western hemlock Western redcedar	130 --- ---	Douglas-fir, western hemlock.
37F: Flane	Moderate	Slight	Slight	Slight	Douglas-fir Western hemlock Western redcedar	130 --- ---	Douglas-fir, western hemlock.
37G: Flane	Severe	Slight	Slight	Slight	Douglas-fir Western hemlock Western redcedar	130 --- ---	Douglas-fir, western hemlock.
38F:							
Flane	Moderate	Slight	Slight	Slight	Douglas-fir Western hemlock Western redcedar	130 --- ---	Douglas-fir, western hemlock.
Moe	Moderate	Slight	Slight	Moderate	Douglas-fir Western hemlock Western redcedar	145 --- ---	Douglas-fir, western hemlock.
38G:							
Flane	Severe	Slight	Slight	Slight	Douglas-fir Western hemlock Western redcedar	130 --- ---	Douglas-fir, western hemlock.
Moe	Moderate	Slight	Slight	Moderate	Douglas-fir Western hemlock Western redcedar	145 --- ---	Douglas-fir, western hemlock.
40G:							
Harrington	Severe	Moderate	Moderate	Moderate	Douglas-fir Grand fir	140 ---	Douglas-fir, grand fir.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
40G:							
Klickitat	Severe	Slight	Slight	Moderate	Douglas-fir Western hemlock	160 ---	Douglas-fir, western hemlock.
41G:							
Harrington	Severe	Severe	Moderate	Moderate	Douglas-fir Grand fir	140 ---	Douglas-fir, grand fir.
Klickitat	Severe	Moderate	Slight	Moderate	Douglas-fir	145	Douglas-fir.
42H:							
Harrington	Severe	Severe	Moderate	Moderate	Douglas-fir Grand fir	140 ---	Douglas-fir, grand fir.
Rock outcrop.							
44E* Henline	Moderate	Moderate	Moderate	Slight	Douglas-fir Noble fir Western hemlock	135 --- ---	Douglas-fir, noble fir, western hemlock.
44F* Henline	Severe	Moderate	Moderate	Slight	Douglas-fir Noble fir Western hemlock	135 --- ---	Douglas-fir, noble fir, western hemlock.
44G* Henline	Severe	Moderate	Moderate	Slight	Douglas-fir Noble fir Western hemlock	135 --- ---	Douglas-fir, noble fir, western hemlock.
45F*:							
Henline	Severe	Moderate	Moderate	Slight	Douglas-fir Noble fir Western hemlock	135 --- ---	Douglas-fir, noble fir, western hemlock.
Yellowstone	Moderate	Severe	Severe	Slight	Douglas-fir Mountain hemlock Noble fir Western white pine	80 --- --- ---	Douglas-fir, mountain hemlock, noble fir.
Rock outcrop.							
45H*:							
Henline	Severe	Moderate	Moderate	Slight	Douglas-fir Noble fir Western hemlock	135 --- ---	Douglas-fir, noble fir, western hemlock.
Yellowstone	Severe	Severe	Severe	Slight	Douglas-fir Mountain hemlock Noble fir Western white pine	80 --- --- ---	Douglas-fir, mountain hemlock, noble fir.
Rock outcrop.							
47C, 47D Honeygrove	Slight	Slight	Slight	Moderate	Douglas-fir Western hemlock Western redcedar	165 --- ---	Douglas-fir, western hemlock.
48F Honeygrove	Moderate	Slight	Slight	Moderate	Douglas-fir Western hemlock Western redcedar	165 --- ---	Douglas-fir, western hemlock.
49F Honeygrove	Moderate	Moderate	Slight	Moderate	Douglas-fir Western hemlock	155 ---	Douglas-fir, western hemlock.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns				Potential productivity		Trees to plant
	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
50D*, 50F*------------- Hummington	Moderate	Moderate	Moderate	Moderate	Douglas-fir--------- Western hemlock----- Noble fir-----------	145 --- ---	Douglas-fir, western hemlock, noble fir, Pacific silver fir.
50G*------------------- Hummington	Severe	Moderate	Moderate	Moderate	Douglas-fir--------- Western hemlock----- Noble fir-----------	145 --- ---	Douglas-fir, western hemlock, noble fir, Pacific silver fir.
51C, 51D--------------- Jory	Slight	Slight	Slight	Moderate	Douglas-fir--------- Oregon white oak---- Bigleaf maple-------	155 --- ---	Douglas-fir, grand fir.
51E-------------------- Jory	Slight	Slight	Slight	Moderate	Douglas-fir--------- Oregon white oak---- Bigleaf maple-------	155 --- ---	Douglas-fir, grand fir.
51F-------------------- Jory	Moderate	Slight	Slight	Moderate	Douglas-fir--------- Oregon white oak---- Bigleaf maple-------	155 --- ---	Douglas-fir, grand fir.
52D*------------------- Keel	Moderate	Slight	Moderate	Slight	Douglas-fir--------- Western hemlock----- Noble fir-----------	130 120 140	Douglas-fir, western hemlock, noble fir, Pacific silver fir.
52F*------------------- Keel	Moderate	Slight	Moderate	Slight	Douglas-fir--------- Western hemlock----- Noble fir-----------	130 120 140	Douglas-fir, western hemlock, noble fir, Pacific silver fir.
52G*------------------- Keel	Severe	Slight	Moderate	Slight	Douglas-fir--------- Western hemlock----- Noble fir-----------	130 120 140	Douglas-fir, western hemlock, noble fir, Pacific silver fir.
53G:							
Kilchis----------------	Severe	Severe	Severe	Moderate	Douglas-fir--------- Western hemlock----- Red alder-----------	120 --- ---	Douglas-fir.
Harrington-------------	Severe	Moderate	Moderate	Moderate	Douglas-fir--------- Grand fir-----------	140 ---	Douglas-fir, grand fir.
53H:							
Kilchis----------------	Severe	Severe	Severe	Moderate	Douglas-fir--------- Western hemlock----- Red alder-----------	120 --- ---	Douglas-fir.
Harrington-------------	Severe	Moderate	Moderate	Moderate	Douglas-fir--------- Grand fir-----------	140 ---	Douglas-fir, grand fir.
54D-------------------- Kinney	Moderate	Moderate	Slight	Moderate	Douglas-fir--------- Western hemlock----- Bigleaf maple------- Grand fir-----------	180 140 --- ---	Douglas-fir, western hemlock, grand fir.
55F-------------------- Kinney	Moderate	Slight	Slight	Moderate	Douglas-fir--------- Western hemlock----- Bigleaf maple------- Grand fir-----------	180 140 --- ---	Douglas-fir, western hemlock, grand fir.
55G-------------------- Kinney	Severe	Slight	Slight	Moderate	Douglas-fir--------- Western hemlock----- Bigleaf maple------- Grand fir-----------	180 140 --- ---	Douglas-fir, western hemlock, grand fir.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns				Potential productivity		Trees to plant
	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
56F------------------- Kinney	Moderate	Moderate	Slight	Moderate	Douglas-fir--------- Western hemlock----- Bigleaf maple------- Grand fir-----------	180 140 --- ---	Douglas-fir, western hemlock, grand fir.
56G------------------- Kinney	Severe	Moderate	Slight	Moderate	Douglas-fir--------- Western hemlock----- Bigleaf maple------- Grand fir-----------	180 140 --- ---	Douglas-fir, western hemlock, grand fir.
57E------------------- Kinney	Moderate	Slight	Slight	Moderate	Douglas-fir--------- Western hemlock----- Bigleaf maple------- Grand fir-----------	180 140 --- ---	Douglas-fir, western hemlock, grand fir.
58F: Kinney-----------------	Moderate	Slight	Slight	Moderate	Douglas-fir--------- Western hemlock----- Bigleaf maple------- Grand fir-----------	180 140 --- ---	Douglas-fir, western hemlock, grand fir.
Klickitat-------------	Moderate	Slight	Slight	Moderate	Douglas-fir--------- Western hemlock-----	160 ---	Douglas-fir, western hemlock.
58G: Kinney-----------------	Severe	Slight	Slight	Moderate	Douglas-fir--------- Western hemlock----- Bigleaf maple------- Grand fir-----------	180 140 --- ---	Douglas-fir, western hemlock, grand fir.
Klickitat-------------	Severe	Slight	Slight	Moderate	Douglas-fir--------- Western hemlock-----	160 ---	Douglas-fir, western hemlock.
59F: Kinney-----------------	Moderate	Moderate	Slight	Moderate	Douglas-fir--------- Western hemlock----- Bigleaf maple------- Grand fir-----------	180 140 --- ---	Douglas-fir, western hemlock, grand fir.
Klickitat-------------	Moderate	Moderate	Slight	Moderate	Douglas-fir---------	145	Douglas-fir.
59G: Kinney-----------------	Severe	Moderate	Slight	Moderate	Douglas-fir--------- Western hemlock----- Bigleaf maple------- Grand fir-----------	180 140 --- ---	Douglas-fir, western hemlock, grand fir.
Klickitat-------------	Severe	Moderate	Slight	Moderate	Douglas-fir---------	145	Douglas-fir.
60E: Klickitat-------------	Moderate	Slight	Slight	Moderate	Douglas-fir--------- Western hemlock-----	145 ---	Douglas-fir, western hemlock.
Harrington------------	Slight	Moderate	Moderate	Moderate	Douglas-fir--------- Grand fir-----------	140 ---	Douglas-fir, grand fir.
61F: Klickitat-------------	Moderate	Slight	Slight	Moderate	Douglas-fir--------- Western hemlock-----	160 ---	Douglas-fir, western hemlock.
Harrington------------	Severe	Moderate	Moderate	Moderate	Douglas-fir--------- Grand fir-----------	140 ---	Douglas-fir, grand fir.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
62F:							
Klickitat	Moderate	Moderate	Slight	Moderate	Douglas-fir	145	Douglas-fir.
Harrington	Severe	Severe	Moderate	Moderate	Douglas-fir	140	Douglas-fir, grand fir.
					Grand fir	---	
68F McDuff	Moderate	Slight	Slight	Moderate	Douglas-fir	145	Douglas-fir.
					Bigleaf maple	---	
					Red alder	---	
					Western hemlock	---	
68G McDuff	Severe	Slight	Slight	Moderate	Douglas-fir	145	Douglas-fir.
					Bigleaf maple	---	
					Red alder	---	
					Western hemlock	---	
69B Minniece	Severe	Severe	Severe	Severe	Douglas-fir	140	Douglas-fir, western hemlock, western redcedar.
					Western redcedar	---	
					Western hemlock	---	
					Red alder	---	
					Bigleaf maple	---	
					Oregon ash	---	
70D Moe	Moderate	Slight	Slight	Moderate	Douglas-fir	145	Douglas-fir, western hemlock.
					Western hemlock	---	
					Western redcedar	---	
70F Moe	Moderate	Slight	Slight	Moderate	Douglas-fir	145	Douglas-fir, western hemlock.
					Western hemlock	---	
					Western redcedar	---	
71F* Mulkey	Moderate	Moderate	Moderate	Moderate	Douglas-fir	110	Douglas-fir, noble fir.
					Noble fir	130	
					Western hemlock	---	
72C Nekia	Moderate	Moderate	Moderate	Moderate	Douglas-fir	150	Douglas-fir, grand fir.
					Grand fir	---	
					Bigleaf maple	---	
					Oregon white oak	---	
72D Nekia	Moderate	Moderate	Moderate	Moderate	Douglas-fir	150	Douglas-fir, grand fir.
					Grand fir	---	
					Bigleaf maple	---	
					Oregon white oak	---	
72E Nekia	Moderate	Moderate	Moderate	Moderate	Douglas-fir	150	Douglas-fir, grand fir.
					Grand fir	---	
					Bigleaf maple	---	
					Oregon white oak	---	
72F Nekia	Severe	Moderate	Moderate	Moderate	Douglas-fir	145	Douglas-fir, grand fir.
					Grand fir	---	
					Bigleaf maple	---	
					Oregon white oak	---	
76E Peavine	Moderate	Slight	Moderate	Moderate	Douglas-fir	160	Douglas-fir, western hemlock.
					Grand fir	---	
					Western redcedar	---	
					Red alder	---	
					Bigleaf maple	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
76G Peavine	Severe	Moderate	Moderate	Moderate	Douglas-fir Grand fir Western redcedar Red alder Bigleaf maple	160 --- --- --- ---	Douglas-fir, western hemlock.
81D Quartzville	Moderate	Slight	Slight	Moderate	Douglas-fir Western hemlock Western redcedar Red alder Bigleaf maple	190 --- --- --- ---	Douglas-fir, western hemlock, western redcedar.
82F Quartzville	Severe	Slight	Slight	Severe	Douglas-fir Western hemlock Western redcedar Red alder Bigleaf maple	190 --- --- --- ---	Douglas-fir, western hemlock, western redcedar.
82G Quartzville	Severe	Slight	Slight	Severe	Douglas-fir Western hemlock Western redcedar Red alder Bigleaf maple	190 --- --- --- ---	Douglas-fir, western hemlock, western redcedar.
83F Quartzville	Severe	Moderate	Slight	Moderate	Douglas-fir Western hemlock Western redcedar Red alder Bigleaf maple	190 --- --- --- ---	Douglas-fir, western hemlock, western redcedar.
84E Ritner	Moderate	Moderate	Moderate	Moderate	Douglas-fir Ponderosa pine Bigleaf maple Oregon white oak	130 120 --- ---	Douglas-fir, ponderosa pine.
84G Ritner	Severe	Moderate	Slight	Moderate	Douglas-fir Ponderosa pine Bigleaf maple Oregon white oak	130 120 --- ---	Douglas-fir, ponderosa pine.
90B Saturn	Moderate	Moderate	Slight	Moderate	Douglas-fir Western hemlock Grand fir Bigleaf maple Red alder Black cottonwood	140 --- --- --- --- ---	Douglas-fir, western hemlock.
96E* Valsetz	Moderate	Moderate	Moderate	Moderate	Douglas-fir Mountain hemlock Noble fir	115 --- ---	Douglas-fir, mountain hemlock, noble fir.
97E*:							
Valsetz	Moderate	Moderate	Moderate	Moderate	Douglas-fir Mountain hemlock Noble fir	115 --- ---	Douglas-fir, mountain hemlock, noble fir.
Yellowstone	Moderate	Severe	Severe	Slight	Douglas-fir Mountain hemlock Noble fir Western white pine	80 --- --- ---	Douglas-fir, mountain hemlock, noble fir.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns				Potential productivity		Trees to plant
	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
97H*:							
Valsetz	Severe	Moderate	Moderate	Moderate	Douglas-fir	115	Douglas-fir, mountain hemlock, noble fir.
					Mountain hemlock	---	
					Noble fir	---	
Yellowstone	Severe	Severe	Severe	Slight	Douglas-fir	80	Douglas-fir, mountain hemlock, noble fir.
					Mountain hemlock	---	
					Noble fir	---	
					Western white pine	---	
101C, 101D Willakenzie	Slight	Slight	Moderate	Moderate	Douglas-fir	140	Douglas-fir.
					Oregon white oak	---	
					Bigleaf maple	---	
101E Willakenzie	Slight	Slight	Moderate	Moderate	Douglas-fir	140	Douglas-fir.
					Oregon white oak	---	
					Bigleaf maple	---	
101F Willakenzie	Moderate	Slight	Moderate	Moderate	Douglas-fir	140	Douglas-fir.
					Oregon white oak	---	
					Bigleaf maple	---	
104E, 104G Witzel	Moderate	Severe	Severe	Slight	Douglas-fir	115	Ponderosa pine, Douglas-fir.
					Oregon white oak	---	
					Ponderosa pine	---	
107E* Yellowstone	Moderate	Severe	Severe	Slight	Douglas-fir	80	Douglas-fir, mountain hemlock, noble fir.
					Mountain hemlock	---	
					Noble fir	---	
					Western white pine	---	
107H* Yellowstone	Severe	Severe	Severe	Slight	Douglas-fir	80	Douglas-fir, mountain hemlock, noble fir.
					Mountain hemlock	---	
					Noble fir	---	
					Western white pine	---	
108H:							
Zango	Severe	Severe	Severe	Slight	Douglas-fir	110	Douglas-fir, western hemlock.
					Western hemlock	---	
					Western redcedar	---	
Dobbins	Severe	Moderate	Moderate	Slight	Douglas-fir	140	Douglas-fir.
					Western hemlock	---	
					Bigleaf maple	---	

* "Height Growth and Site Index for Douglas-fir in High Elevation Forests of the Oregon-Washington Cascades" ($T3$T1) was used to determine the site index for Douglas-fir.

TABLE 7.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1A Abiqua	Slight	Slight	Slight	Slight	Slight.
1B Abiqua	Slight	Slight	Moderate: slope.	Slight	Slight.
2D Acanod	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: large stones, wetness, slope.
3 Amity	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
4D Apt	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
5F, 6F Apt	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
7 Awbrig	Severe: flooding, ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
8 Bashaw	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding, too clayey.
9C Bellpine	Slight	Slight	Severe: slope.	Slight	Moderate: large stones, thin layer.
9D Bellpine	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
9E, 9F Bellpine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
10E Bensley	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
11F*, 11G*:					
Bensley	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Valsetz	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: large stones, slope.
12E Blachly	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
13F, 13G, 14F, 14G Blachly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
15D------------------- Bohannon	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: large stones, slope.	Moderate: large stones.	Moderate: large stones, slope, thin layer.
16B------------------- Briedwell	Moderate: small stones, dusty.	Moderate: small stones, dusty.	Severe: small stones.	Moderate: dusty.	Moderate: small stones, large stones.
17C------------------- Bull Run	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
17E------------------- Bull Run	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
18-------------------- Camas	Severe: flooding.	Moderate: small stones.	Severe: small stones.	Slight----------	Severe: droughty.
19-------------------- Chapman	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
20C------------------- Chehalem	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness.
21-------------------- Chehalis	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
22C------------------- Chehulpum	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: dusty.	Severe: thin layer.
22E------------------- Chehulpum	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope, dusty.	Severe: slope, thin layer.
23-------------------- Clackamas	Severe: wetness.	Severe: wetness.	Severe: small stones, wetness.	Severe: wetness.	Severe: wetness.
24-------------------- Clackamas Variant	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: small stones, wetness.	Slight----------	Slight.
25-------------------- Cloquato	Severe: flooding.	Moderate: dusty.	Moderate: flooding, dusty.	Moderate: dusty.	Moderate: flooding.
26-------------------- Coburg	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
27-------------------- Concord	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
28-------------------- Conser	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, erodes easily.	Severe: ponding.
29-------------------- Courtney	Severe: flooding, ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: small stones, ponding, percs slowly.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
30D------------------- Crabtree	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Moderate: large stones.	Severe: small stones, large stones.
30F, 30G-------------- Crabtree	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, large stones, slope.
31D------------------- Cruiser	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight----------	Moderate: small stones, slope.
31F, 31G-------------- Cruiser	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
32D------------------- Cumley	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
33-------------------- Dayton	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, erodes easily.	Severe: ponding.
34C------------------- Dixonville	Slight----------	Slight----------	Severe: slope.	Slight----------	Moderate: large stones, thin layer.
34E------------------- Dixonville	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
34F------------------- Dixonville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
35C*:					
Dixonville------------	Slight----------	Slight----------	Severe: slope.	Slight----------	Moderate: large stones, thin layer.
Philomath-------------	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: too clayey.	Severe: thin layer, too clayey.
Hazelair--------------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, thin layer.
35E*:					
Dixonville------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Philomath-------------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: too clayey, slope.	Severe: slope, thin layer, too clayey.
Hazelair--------------	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Moderate: wetness, slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
36D----------------- Dupee	Moderate: slope, wetness, dusty.	Moderate: slope, wetness, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.
37D----------------- Flane	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight---------	Moderate: small stones, large stones, slope.
37F, 37G------------ Flane	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
38F*, 38G*:					
Flane---------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Moe-----------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
39*:					
Fluvents.					
Fluvaquents.					
40G*, 41G*:					
Harrington----------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Klickitat-----------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
42H*:					
Harrington----------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Rock outcrop.					
43B----------------- Hazelair	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, thin layer.
43D----------------- Hazelair	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope, thin layer.
44E----------------- Henline	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: small stones.	Severe: small stones, large stones, slope.
44F, 44G------------ Henline	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope, small stones.	Severe: small stones, large stones, slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
45F*, 45H*:					
Henline	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope, small stones.	Severe: small stones, large stones, slope.
Yellowstone	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones.	Severe: slope.	Severe: slope, thin layer.
Rock outcrop.					
46 Holcomb	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
47C Honeygrove	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
47D Honeygrove	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
48F, 49F Honeygrove	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
50D Hummington	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope.	Severe: small stones, slope.
50F, 50G Hummington	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
51C Jory	Slight	Slight	Severe: slope.	Slight	Slight.
51D Jory	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
51E, 51F Jory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
52D Keel	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, large stones, slope.
52F, 52G Keel	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
53G*, 53H*:					
Kilchis	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
Harrington	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
54D Kinney	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: large stones, slope.	Slight	Moderate: large stones, slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
55F, 55G, 56F, 56G---- Kinney	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: slope.	Severe: slope.
57E------------------- Kinney	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: slope.	Severe: slope.
58F*, 58G*, 59F*, 59G*:					
Kinney---------------	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: slope.	Severe: slope.
Klickitat------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
60E*:					
Klickitat------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: large stones, slope.	Severe: slope.
Harrington-----------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
61F*, 62F*:					
Klickitat------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Harrington-----------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
63-------------------- Malabon	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
64-------------------- Malabon Variant	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Slight.
65B------------------- Marcola	Moderate: large stones, small stones.	Moderate: large stones, small stones.	Severe: large stones, small stones.	Moderate: large stones.	Severe: large stones.
66B------------------- McAlpin	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight----------	Slight.
67-------------------- McBee	Severe: flooding.	Moderate: wetness.	Moderate wetness, flooding.	Slight----------	Moderate: flooding.
68F, 68G-------------- McDuff	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
69B------------------- Minniece	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
70D------------------- Moe	Moderate: slope, small stones, percs slowly.	Moderate: slope, small stones, percs slowly.	Severe: slope, small stones.	Slight----------	Moderate: small stones, slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
70F Moe	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
71F Mulkey	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
72C Nekia	Slight	Slight	Severe: slope.	Slight	Moderate: large stones, thin layer.
72D Nekia	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
72E, 72F Nekia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
73 Newberg	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
74H*. Ochrepts					
75C Panther	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: slope, wetness, percs slowly.	Severe: wetness.	Severe: wetness.
76E Peavine	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
76G Peavine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
77A Pengra	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: wetness.	Moderate: wetness.
78C Philomath	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: too clayey.	Severe: thin layer, too clayey.
79C Philomath	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, slope, depth to rock.	Moderate: large stones, too clayey.	Severe: thin layer, too clayey.
79F Philomath	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: slope.	Severe: slope, thin layer, too clayey.
80*. Pits					
81D Quartzville	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: large stones, slope.
82F, 82G, 83F Quartzville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
84E Ritner	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.	Severe: large stones, slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
84G------------------- Ritner	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: large stones, slope.
85*. Riverwash					
86G*: Rock outcrop.					
Orthents.					
87-------------------- Salem	Moderate: small stones, dusty.	Moderate: small stones, dusty.	Severe: small stones.	Moderate: dusty.	Moderate: small stones, droughty.
88B------------------- Salkum	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
88C------------------- Salkum	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
89B------------------- Santiam	Moderate: wetness, dusty.	Moderate: wetness, dusty.	Moderate: slope, wetness, dusty.	Severe: erodes easily.	Slight.
90B------------------- Saturn	Severe: flooding.	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: droughty.
91-------------------- Saturn Variant	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: small stones, wetness.	Slight----------	Slight.
92-------------------- Sifton Variant	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Moderate: small stones, large stones, droughty.
93C------------------- Silverton	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.	Moderate: thin layer.
94B------------------- Stayton	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: erodes easily.	Severe: thin layer.
95C------------------- Steiwer	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.	Moderate: thin layer.
95D------------------- Steiwer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: dusty, slope.	Severe: slope.
95F------------------- Steiwer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
96E------------------- Valsetz	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: large stones, slope.	Severe: large stones, slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
97E*:					
Valsetz	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: large stones, slope.	Severe: large stones, slope.
Yellowstone	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones.	Moderate: large stones, slope.	Severe: slope, thin layer.
97H*:					
Valsetz	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: large stones, slope.
Yellowstone	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones.	Severe: slope.	Severe: slope, thin layer.
98 Waldo	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
99 Wapato	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
100 Whiteson	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness, erodes easily.	Severe: wetness, flooding.
101C Willakenzie	Slight	Slight	Severe: slope.	Slight	Moderate: thin layer.
101D Willakenzie	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
101E, 101F Willakenzie	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
102 Willamette	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
103C Witham	Moderate: wetness, percs slowly.	Moderate: wetness, too clayey.	Severe: slope.	Moderate: wetness, too clayey.	Severe: too clayey.
104E Witzel	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: small stones.	Severe: small stones, large stones, slope.
104G Witzel	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: slope, small stones.	Severe: small stones, large stones, slope.
105C Witzel Variant	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, slope, small stones.	Moderate: large stones.	Severe: large stones, thin layer.
106A Woodburn	Moderate: wetness, dusty.	Moderate: wetness, dusty.	Moderate: wetness, dusty.	Moderate: dusty.	Slight.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
106C-------------------- Woodburn	Moderate: wetness, dusty.	Moderate: wetness, dusty.	Severe: slope.	Moderate: dusty.	Slight.
107E-------------------- Yellowstone	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones.	Moderate: large stones, slope.	Severe: slope, thin layer.
107H-------------------- Yellowstone	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones.	Severe: slope.	Severe: slope, thin layer.
108H*:					
Zango-------------------	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, droughty, slope.
Dobbins-----------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1A, 1B------------ Abiqua	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
2D---------------- Acanod	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: large stones, wetness, slope.
3----------------- Amity	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness.
4D---------------- Apt	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, shrink-swell.	Moderate: slope.
5F, 6F------------ Apt	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
7----------------- Awbrig	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
8----------------- Bashaw	Severe: cutbanks cave, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding, too clayey.
9C---------------- Bellpine	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: large stones, thin layer.
9D, 9E, 9F-------- Bellpine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
10E--------------- Bensley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
11F*, 11G*:						
Bensley-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Valsetz-----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.
12E, 13F, 13G, 14F, 14G--------- Blachly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
15D--------------- Bohannon	Moderate: depth to rock, large stones, slope.	Moderate: slope, large stones.	Moderate: depth to rock, slope, large stones.	Severe: slope.	Moderate: slope, large stones.	Moderate: large stones, slope, thin layer.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
16B Briedwell	Slight	Slight	Slight	Slight	Slight	Moderate: small stones, large stones.
17C Bull Run	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.	Moderate: slope.
17E Bull Run	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
18 Camas	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty.
19 Chapman	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, low strength, shrink-swell.	Slight.
20C Chehalem	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
21 Chehalis	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
22C Chehulpum	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: thin layer.
22E Chehulpum	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
23 Clackamas	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
24 Clackamas Variant	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Severe: low strength.	Slight.
25 Cloquato	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
26 Coburg	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
27 Concord	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
28 Conser	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
29 Courtney	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
30D--------------- Crabtree	Severe: wetness.	Moderate: wetness, slope, large stones.	Severe: wetness.	Severe: slope.	Moderate: wetness, slope, frost action.	Severe: small stones, large stones.
30F, 30G---------- Crabtree	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.
31D--------------- Cruiser	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: small stones, slope.
31F, 31G---------- Cruiser	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
32D--------------- Cumley	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
33---------------- Dayton	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
34C--------------- Dixonville	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: large stones, thin layer.
34E, 34F---------- Dixonville	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
35C*:						
Dixonville--------	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: large stones, thin layer.
Philomath---------	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: thin layer, too clayey.
Hazelair----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness, thin layer.
35E*:						
Dixonville--------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Philomath---------	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope, thin layer, too clayey.
Hazelair----------	Severe: wetness, slope.	Severe: wetness, shrink-swell, slope.	Severe: wetness, slope, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
36D: Dupee	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: wetness, slope.
37D: Flane	Moderate: too clayey, large stones, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Severe: low strength.	Moderate: small stones, large stones, slope.
37F, 37G: Flane	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
38F*, 38G*:						
Flane	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Moe	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
39*:						
Fluvents.						
Fluvaquents.						
40G*, 41G*:						
Harrington	Severe: depth to rock, large stones, slope.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Klickitat	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
42H*:						
Harrington	Severe: depth to rock, large stones, slope.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Rock outcrop.						
43B: Hazelair	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness, thin layer.
43D: Hazelair	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: wetness, slope, thin layer.
44E, 44F, 44G: Henline	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.
45F*, 45H*:						
Henline	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
45F*, 45H*:						
Yellowstone	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, thin layer.
Rock outcrop.						
46 Holcomb	Severe: too clayey, wetness.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: low strength, wetness, shrink-swell.	Moderate: wetness.
47C Honeygrove	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
47D, 48F, 49F Honeygrove	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
50D, 50F, 50G Hummington	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
51C Jory	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
51D, 51E, 51F Jory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
52D Keel	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Severe: frost action.	Moderate: small stones, large stones, slope.
52F, 52G Keel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
53G*, 53H*:						
Kilchis	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: droughty, slope.
Harrington	Severe: depth to rock, large stones, slope.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
54D Kinney	Moderate: large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Severe: low strength.	Moderate: large stones, slope.
55F, 55G, 56F, 56G, 57E Kinney	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
58F*, 58G*, 59F*, 59G*:						
Kinney	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
58F*, 58G*, 59F*, 59G*:						
Klickitat	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
60E*, 61F*, 62F*:						
Klickitat	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Harrington	Severe: depth to rock, large stones, slope.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
63 Malabon	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
64 Malabon Variant	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
65B Marcola	Severe: large stones.	Severe: shrink-swell, large stones.	Severe: shrink-swell, large stones.	Severe: shrink-swell, large stones.	Severe: shrink-swell, large stones.	Severe: large stones.
66B McAlpin	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
67 McBee	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength flooding.	Moderate: flooding.
68F, 68G McDuff	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
69B Minniece	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
70D Moe	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: small stones, slope.
70F Moe	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
71F Mulkey	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
72C Nekia	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength.	Moderate: large stones, thin layer.
72D, 72E, 72F Nekia	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
73 Newberg	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
74H*. Ochrepts						
75C---------------- Panther	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness.	Severe: wetness.
76E, 76G---------- Peavine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
77A---------------- Pengra	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
78C, 79C---------- Philomath	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: thin layer, too clayey.
79F---------------- Philomath	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope, thin layer, too clayey.
80*. Pits						
81D---------------- Quartzville	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: large stones, slope.
82F, 82C, 83F------ Quartzville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
84E, 84G---------- Ritner	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.
85*. Riverwash						
86G*: Rock outcrop.						
Orthents.						
87----------------- Salem	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: small stones, droughty.
88B---------------- Salkum	Moderate: too clayey.	Slight----------	Slight----------	Moderate: slope.	Severe: low strength.	Slight.
88C---------------- Salkum	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
89B---------------- Santiam	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Slight.
90B---------------- Saturn	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
91----------------- Saturn Variant	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Slight.
92----------------- Sifton Variant	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: small stones, large stones, droughty.
93C---------------- Silverton	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength.	Moderate: thin layer.
94B---------------- Stayton	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
95C---------------- Steiwer	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: thin layer.
95D, 95F----------- Steiwer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
96E---------------- Valsetz	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.
97E*, 97H*:						
Valsetz-----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.
Yellowstone-------	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, thin layer.
98----------------- Waldo	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness.
99----------------- Wapato	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.
100---------------- Whiteson	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
101C--------------- Willakenzie	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: thin layer.
101D, 101E, 101F-- Willakenzie	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
102---------------- Willamette	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
103C-------------- Witham	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
104E, 104G-------- Witzel	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: small stones, large stones, slope.
105C-------------- Witzel Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, thin layer.
106A-------------- Woodburn	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Slight.
106C-------------- Woodburn	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, slope, shrink-swell.	Severe: low strength.	Slight.
107E, 107H-------- Yellowstone	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, thin layer.
108H*:						
Zango------------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, droughty, slope.
Dobbins----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1A------------------ Abiqua	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
1B------------------ Abiqua	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
2D------------------ Acanod	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Poor: too clayey.
3------------------- Amity	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
4D------------------ Apt	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack, small stones.
5F, 6F-------------- Apt	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, small stones.
7------------------- Awbrig	Severe: ponding, percs slowly.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Poor: hard to pack, ponding.
8------------------- Bashaw	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
9C------------------ Bellpine	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
9D, 9E, 9F---------- Bellpine	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
10E----------------- Bensley	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
11F*, 11G*:					
Bensley-------------	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Valsetz-------------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
12E, 13F, 13G, 14F, 14G Blachly	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
15D Bohannon	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, small stones.
16B Briedwell	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey, large stones.	Slight	Poor: small stones.
17C Bull Run	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
17E Bull Run	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
18 Camas	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
19 Chapman	Moderate: flooding, percs slowly.	Severe: flooding, seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
20C Chehalem	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
21 Chehalis	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
22C Chehulpum	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
22E Chehulpum	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
23 Clackamas	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
24 Clackamas Variant	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, small stones.
25 Cloquato	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: thin layer.
26 Coburg	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness, too clayey.	Severe: wetness.	Poor: too clayey.
27 Concord	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
28------------------ Conser	Severe: ponding, percs slowly.	Severe: flooding, ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
29------------------ Courtney	Severe: ponding, percs slowly.	Severe: seepage, flooding, ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: small stones, ponding.
30D----------------- Crabtree	Severe: wetness, percs slowly.	Severe: slope, wetness, large stones.	Severe: large stones.	Moderate: wetness, slope.	Poor: small stones.
30F, 30G------------ Crabtree	Severe: wetness, percs slowly, slope.	Severe: slope, wetness, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
31D----------------- Cruiser	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey, large stones.	Moderate: slope.	Poor: small stones.
31F, 31G------------ Cruiser	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
32D----------------- Cumley	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
33------------------ Dayton	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
34C----------------- Dixonville	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
34E, 34F------------ Dixonville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
35C*:					
Dixonville----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Philomath-----------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Hazelair------------	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Poor: area reclaim, too clayey, hard to pack.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
35E*:					
Dixonville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Philomath	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Hazelair	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, wetness, slope.	Severe: depth to rock, wetness, slope.	Poor: area reclaim, too clayey, hard to pack.
36D Dupee	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
37D Flane	Moderate: percs slowly, slope, large stones.	Severe: slope.	Severe: too clayey, large stones.	Moderate: slope.	Poor: too clayey, large stones.
37F, 37G Flane	Severe: slope.	Severe: slope.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, large stones, slope.
38F*, 38G*:					
Flane	Severe: slope.	Severe: slope.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, large stones, slope.
Moe	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
39*:					
Fluvents.					
Fluvaquents.					
40G*, 41G*:					
Harrington	Severe: depth to rock, slope, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
Klickitat	Severe: slope.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope.	Poor: small stones, slope.
42H*:					
Harrington	Severe: depth to rock, slope, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
Rock outcrop.					

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
43B------------------ Hazelair	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Poor: area reclaim, too clayey, hard to pack.
43D------------------ Hazelair	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Poor: area reclaim, too clayey, hard to pack.
44E, 44F, 44G------- Henline	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
45F*, 45H*:					
Henline------------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
Yellowstone--------	Severe: depth to rock, slope, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, large stones, slope.
Rock outcrop.					
46------------------ Holcomb	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness, too clayey.	Severe: seepage, wetness.	Poor: wetness.
47C------------------ Honeygrove	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
47D, 48F, 49F------- Honeygrove	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
50D, 50F, 50G------- Hummington	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, seepage, small stones.
51C------------------ Jory	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey.
51D, 51E, 51F------- Jory	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, slope.
52D------------------ Keel	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack, large stones.
52F, 52G------------ Keel	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, large stones.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
53G*, 53H*:					
Kilchis	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
Harrington	Severe: depth to rock, slope, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
54D Kinney	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Poor: hard to pack.
55F, 55G, 56F, 56G, 57E Kinney	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: hard to pack, slope.
58F*, 58G*, 59F*, 59G*:					
Kinney	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: hard to pack, slope.
Klickitat	Severe: slope.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope.	Poor: small stones, slope.
60E*, 61F*, 62F*:					
Klickitat	Severe: slope.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope.	Poor: small stones, slope.
Harrington	Severe: depth to rock, slope, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
63 Malabon	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
64 Malabon Variant	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
65B Marcola	Severe: wetness, percs slowly, large stones.	Severe: large stones.	Severe: wetness, too clayey, large stones.	Moderate: wetness.	Poor: too clayey, hard to pack, small stones.
66B McAlpin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.
67 McBee	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness, thin layer.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
68F, 68G----------- McDuff	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
69B---------------- Minniece	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
70D---------------- Moe	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
70F---------------- Moe	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
71F---------------- Mulkey	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, slope.
72C---------------- Nekia	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, small stones.
72D, 72E, 72F------- Nekia	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, small stones.
73----------------- Newberg	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: too sandy.
74H*. Ochrepts					
75C---------------- Panther	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: depth to rock, wetness.	Severe: wetness.	Poor: too clayey, hard to pack.
76E, 76G----------- Peavine	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
77A---------------- Pengra	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
78C, 79C----------- Philomath	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
79F---------------- Philomath	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
80*. Pits					
81D----------------- Quartzville	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
82F, 82G, 83F------- Quartzville	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, slope.
84E, 84G------------ Ritner	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, small stones.
85*. Riverwash					
86G*: Rock outcrop.					
Orthents.					
87------------------ Salem	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
88B----------------- Salkum	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey, hard to pack.
88C----------------- Salkum	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, hard to pack, slope.
89B----------------- Santiam	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
90B----------------- Saturn	Severe: wetness, poor filter.	Severe: seepage, flooding.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
91------------------ Saturn Variant	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Poor: small stones.
92------------------ Sifton Variant	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
93C----------------- Silverton	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Poor: area reclaim, too clayey, hard to pack.
94B----------------- Stayton	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
95C----------------- Steiwer	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
95D, 95F------------ Steiwer	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
96E----------------- Valsetz	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
97E*, 97H*:					
Valsetz------------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
Yellowstone--------	Severe: depth to rock, slope, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, large stones, slope.
98------------------ Waldo	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, seepage, wetness.	Poor: too clayey, hard to pack, wetness.
99------------------ Wapato	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
100----------------- Whiteson	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
101C---------------- Willakenzie	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
101D, 101E, 101F---- Willakenzie	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
102----------------- Willamette	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
103C---------------- Witham	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
104E, 104G---------- Witzel	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
105C---------------- Witzel Variant	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, small stones.
106A---------------- Woodburn	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
106C----------------- Woodburn	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
107E, 107H---------- Yellowstone	Severe: depth to rock, slope, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, large stones, slope.
108H*:					
Zango---------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Dobbins-------------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1A, 1B Abiqua	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, large stones, area reclaim.
2D Acanod	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.
3 Amity	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
4D Apt	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
5F, 6F Apt	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
7 Awbrig	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
8 Bashaw	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
9C Bellpine	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, large stones.
9D Bellpine	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
9E, 9F Bellpine	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
10E Bensley	Fair: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
11F*, 11G*:				
Bensley	Poor: slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Valsetz	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
12E------------------- Blachly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
13F, 13G, 14F, 14G---- Blachly	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
15D------------------- Bohannon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
16B------------------- Briedwell	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
17C------------------- Bull Run	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
17E------------------- Bull Run	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
18-------------------- Camas	Good-----------------	Probable-------------	Probable-------------	Poor: small stones, area reclaim.
19-------------------- Chapman	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
20C------------------- Chehalem	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
21-------------------- Chehalis	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
22C------------------- Chehulpum	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
22E------------------- Chehulpum	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
23-------------------- Clackamas	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, wetness.
24-------------------- Clackamas Variant	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
25-------------------- Cloquato	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
26-------------------- Coburg	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
27-------------------- Concord	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
28 Conser	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
29 Courtney	Poor: wetness.	Probable	Probable	Poor: small stones, area reclaim, wetness.
30D Crabtree	Fair: large stones, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
30F, 30G Crabtree	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
31D Cruiser	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
31F, 31G Cruiser	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
32D Cumley	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
33 Dayton	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
34C Dixonville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
34E Dixonville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
34F Dixonville	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
35C*:				
Dixonville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
Philomath	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, large stones.
Hazelair	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
35E*:				
Dixonville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
Philomath	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, large stones.
Hazelair	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
36D Dupee	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
37D Flane	Fair: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones.
37F, 37G Flane	Poor: slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones, slope.
38F*, 38G*:				
Flane	Poor: slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones, slope.
Moe	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
39*:				
Fluvents.				
Fluvaquents.				
40G*, 41G*:				
Harrington	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
Klickitat	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
42H*:				
Harrington	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
Rock outcrop.				
43B, 43D Hazelair	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
44E: Henline	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
44F, 44G: Henline	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
45F*, 45H*:				
Henline	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Yellowstone	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
Rock outcrop.				
46: Holcomb	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
47C: Honeygrove	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
47D: Honeygrove	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
48F, 49F: Honeygrove	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
50D: Hummington	Poor: area reclaim.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, slope.
50F, 50G: Hummington	Poor: area reclaim, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, slope.
51C: Jory	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
51D: Jory	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
51E, 51F: Jory	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
52D: Keel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
52F, 52G: Keel	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
53G*, 53H*:				
Kilchis	Poor: area reclaim, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones, slope.
Harrington	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
54D Kinney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.
55F, 55G, 56F, 56G Kinney	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim, slope.
57E Kinney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim, slope.
58F*, 58G*, 59F*, 59G*:				
Kinney	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim, slope.
Klickitat	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
60E*:				
Klickitat	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Harrington	Poor: area reclaim, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
61F*, 62F*:				
Klickitat	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Harrington	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
63 Malabon	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
64 Malabon Variant	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
65B------------------- Marcola	Poor: large stones, shrink-swell.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim.
66B------------------- McAlpin	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
67-------------------- McBee	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
68F, 68G-------------- McDuff	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
69B------------------- Minniece	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
70D------------------- Moe	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer, slope.
70F------------------- Moe	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
71F------------------- Mulkey	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
72C------------------- Nekia	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
72D------------------- Nekia	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
72E, 72F-------------- Nekia	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
73-------------------- Newberg	Good------------------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, thin layer.
74H*. Ochrepts				
75C------------------- Panther	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
76E------------------- Peavine	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
76G Peavine	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
77A Pengra	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
78C, 79C Philomath	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, large stones.
79F Philomath	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, large stones.
80*. Pits				
81D Quartzville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
82F, 82G, 83F Quartzville	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
84E Ritner	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
84G Ritner	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
85*. Riverwash				
86G*: Rock outcrop.				
Orthents.				
87 Salem	Good	Probable	Probable	Poor: small stones, area reclaim.
88B, 88C Salkum	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
89B Santiam	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
90B Saturn	Good	Probable	Probable	Poor: small stones, area reclaim.
91 Saturn Variant	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
92 Sifton Variant	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
93C Silverton	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
94B Stayton	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
95C Steiwer	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
95D Steiwer	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
95F Steiwer	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
96E Valsetz	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
97E*:				
Valsetz	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Yellowstone	Poor: area reclaim, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
97H*:				
Valsetz	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Yellowstone	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
98 Waldo	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
99 Wapato	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
100 Whiteson	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
101C Willakenzie	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
101D------------------ Willakenzie	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
101E, 101F------------ Willakenzie	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
102------------------- Willamette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
103C------------------ Witham	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
104E------------------ Witzel	Poor: area reclaim, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones, slope.
104G------------------ Witzel	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones, slope.
105C------------------ Witzel Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
106A, 106C------------ Woodburn	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
107E------------------ Yellowstone	Poor: area reclaim, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
107H------------------ Yellowstone	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
108H*:				
Zango-----------------	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Dobbins---------------	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1A------ Abiqua	Moderate: seepage.	Severe: hard to pack.	Deep to water	Favorable------	Favorable------	Favorable.
1B------ Abiqua	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope------	Favorable------	Favorable.
2D------ Acanod	Severe: slope.	Moderate: large stones, wetness.	Percs slowly, slope.	Wetness, percs slowly, slope.	Slope, large stones, wetness.	Large stones, slope, percs slowly.
3------ Amity	Moderate: seepage.	Severe: piping, wetness.	Favorable------	Wetness------	Erodes easily, wetness.	Wetness, erodes easily.
4D, 5F, 6F------ Apt	Severe: slope.	Severe: hard to pack.	Deep to water	Slope------	Slope------	Slope.
7------ Awbrig	Slight------	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, droughty, percs slowly.	Erodes easily, ponding.	Wetness, erodes easily, droughty.
8------ Bashaw	Slight------	Severe: hard to pack, ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
9C------ Bellpine	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock	Depth to rock.
9D, 9E, 9F------ Bellpine	Severe: slope.	Severe: hard to pack.	Deep to water	Percs slowly, depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
10E------ Bensley	Severe: slope.	Severe: large stones.	Deep to water	Large stones, slope.	Slope, large stones.	Large stones, slope.
11F*, 11G*:						
Bensley------	Severe: slope.	Severe: large stones.	Deep to water	Large stones, slope.	Slope, large stones.	Large stones, slope.
Valsetz------	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
12E, 13F, 13G, 14F, 14G------ Blachly	Severe: slope.	Severe: hard to pack.	Deep to water	Slope------	Slope------	Slope.
15D------ Bohannon	Severe: seepage, slope.	Severe: piping.	Deep to water	Large stones, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
16B------ Briedwell	Moderate: seepage, slope.	Moderate: large stones.	Deep to water	Slope------	Large stones---	Large stones.
17C, 17E------ Bull Run	Severe: slope.	Severe: piping.	Deep to water	Slope------	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
18----------------- Camas	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, flooding.	Large stones, too sandy.	Large stones, droughty.
19----------------- Chapman	Moderate: seepage.	Severe: piping.	Favorable------	Favorable------	Favorable------	Favorable.
20C---------------- Chehalem	Moderate: slope.	Severe: hard to pack.	Percs slowly, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
21----------------- Chehalis	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Favorable------	Favorable.
22C---------------- Chehulpum	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
22E---------------- Chehulpum	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
23----------------- Clackamas	Slight---------	Severe: wetness.	Favorable------	Wetness, droughty.	Wetness--------	Wetness, droughty.
24----------------- Clackamas Variant	Slight---------	Moderate: seepage, piping, wetness.	Percs slowly---	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly.
25----------------- Cloquato	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Favorable------	Favorable.
26----------------- Coburg	Moderate: seepage.	Severe: wetness.	Favorable------	Wetness--------	Erodes easily, wetness.	Erodes easily.
27----------------- Concord	Slight---------	Severe: piping, ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
28----------------- Conser	Moderate: seepage.	Severe: ponding.	Ponding, percs slowly.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
29----------------- Courtney	Moderate: seepage.	Severe: seepage, ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding--------	Wetness, percs slowly.
30D, 30F, 30G------ Crabtree	Severe: slope.	Severe: large stones.	Large stones, slope.	Large stones, wetness, droughty.	Slope, large stones, wetness.	Large stones, slope, droughty.
31D, 31F, 31G------ Cruiser	Severe: slope.	Moderate: piping.	Deep to water	Slope----------	Slope, large stones.	Slope.
32D---------------- Cumley	Severe: slope.	Severe: hard to pack.	Slope----------	Wetness, slope.	Slope, wetness.	Slope.
33----------------- Dayton	Moderate: seepage.	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, droughty, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, droughty.
34C---------------- Dixonville	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Large stones, percs slowly, depth to rock.	Large stones, depth to rock.	Large stones, depth to rock.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
34E, 34F----------Dixonville	Severe: slope.	Severe: hard to pack.	Deep to water	Large stones, percs slowly, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
35C*:						
Dixonville-------	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Large stones, percs slowly, depth to rock.	Large stones, depth to rock.	Large stones, depth to rock.
Philomath--------	Severe: depth to rock.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Depth to rock	Depth to rock.
Hazelair---------	Moderate: depth to rock, slope.	Severe: hard to pack.	Percs slowly, depth to rock, slope.	Wetness, percs slowly, depth to rock.	Depth to rock, wetness.	Wetness, depth to rock.
35E*:						
Dixonville-------	Severe: slope.	Severe: hard to pack.	Deep to water	Large stones, percs slowly, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Philomath--------	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Slope, depth to rock.	Slope, depth to rock.
Hazelair---------	Severe: slope.	Severe: hard to pack.	Percs slowly, depth to rock, slope.	Wetness, percs slowly, depth to rock.	Slope, depth to rock, wetness.	Wetness, slope, depth to rock.
36D--------------Dupee	Severe: slope.	Severe: hard to pack.	Slope----------	Wetness, slope, erodes easily.	Slope, erodes easily, wetness.	Slope, erodes easily.
37D, 37F, 37G-----Flane	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
38F*, 38G*:						
Flane------------	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Moe--------------	Severe: slope.	Severe: hard to pack.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
39*:						
Fluvents.						
Fluvaquents.						
40G*, 41G*:						
Harrington-------	Severe: seepage, slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.
Klickitat--------	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
42H*:						
Harrington-------	Severe: seepage, slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
42H*: Rock outcrop.						
43B------------- Hazelair	Moderate: depth to rock, slope.	Severe: hard to pack.	Percs slowly, depth to rock, slope.	Wetness, percs slowly, depth to rock.	Depth to rock, wetness.	Wetness, depth to rock.
43D------------- Hazelair	Severe: slope.	Severe: hard to pack.	Percs slowly, depth to rock, slope.	Wetness, percs slowly, depth to rock.	Slope, depth to rock, wetness.	Wetness, slope, depth to rock.
44E, 44F, 44G----- Henline	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
45F*, 45H*:						
Henline----------	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Yellowstone------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
46--------------- Holcomb	Severe: seepage.	Severe: hard to pack.	Percs slowly---	Wetness, slow intake, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
47C-------------- Honeygrove	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope----------	Favorable------	Favorable.
47D, 48F, 49F----- Honeygrove	Severe: slope.	Severe: hard to pack.	Deep to water	Slope----------	Slope----------	Slope.
50D, 50F, 50G----- Hummington	Severe: seepage, slope.	Severe: seepage.	Deep to water	Large stones, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
51C-------------- Jory	Moderate: slope.	Slight---------	Deep to water	Slope----------	Favorable------	Favorable.
51D, 51E, 51F----- Jory	Severe: slope.	Slight---------	Deep to water	Slope----------	Slope----------	Slope.
52D, 52F, 52G----- Keel	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
53G*, 53H*:						
Kilchis----------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Harrington-------	Severe: seepage, slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.
54D, 55F, 55G, 56F, 56G, 57E---- Kinney	Severe: slope.	Severe: hard to pack.	Deep to water	Large stones, slope.	Slope, large stones.	Large stones, slope.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
58F*, 58G*, 59F*, 59G*:						
Kinney	Severe: slope.	Severe: hard to pack.	Deep to water	Large stones, slope.	Slope, large stones.	Large stones, slope.
Klickitat	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
60E*, 61F*, 62F*:						
Klickitat	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Harrington	Severe: seepage, slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.
63 Malabon	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
64 Malabon Variant	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
65B Marcola	Moderate: slope.	Severe: large stones.	Deep to water	Large stones, percs slowly, slope.	Large stones, percs slowly.	Large stones, percs slowly.
66B McAlpin	Moderate: seepage, slope.	Moderate: wetness.	Slope	Wetness, slope.	Wetness	Favorable.
67 McBee	Moderate: seepage.	Moderate: piping, Wetness.	Flooding	Wetness, flooding.	Wetness	Favorable.
68F, 68G McDuff	Severe: slope.	Severe: hard to pack.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
69B Minniece	Moderate: slope.	Severe: hard to pack, wetness.	Percs slowly, slope.	Wetness, percs slowly, slope.	Wetness, percs slowly.	Wetness, percs slowly.
70D, 70F Moe	Severe: slope.	Severe: hard to pack.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
71F Mulkey	Severe: seepage, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
72C Nekia	Moderate: depth to rock, slope.	Moderate: thin layer, large stones.	Deep to water	Large stones, depth to rock, slope.	Large stones, depth to rock.	Large stones, depth to rock.
72D, 72E, 72F Nekia	Severe: slope.	Moderate: thin layer, large stones.	Deep to water	Large stones, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
73 Newberg	Severe: seepage.	Severe: seepage, piping.	Deep to water	Flooding	Too sandy	Favorable.
74H*. Ochrepts						

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
75C Panther	Moderate: depth to rock, slope.	Severe: hard to pack, wetness.	Percs slowly, slope.	Wetness, percs slowly, slope.	Wetness, percs slowly.	Wetness, percs slowly.
76E, 76G Peavine	Severe: slope.	Severe: hard to pack.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
77A Pengra	Slight	Severe: hard to pack.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly.
78C Philomath	Severe: depth to rock.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Depth to rock	Depth to rock.
79C Philomath	Severe: depth to rock.	Severe: hard to pack.	Deep to water	Large stones, slow intake, percs slowly.	Large stones, depth to rock.	Large stones, depth to rock.
79F Philomath	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Large stones, slow intake, percs slowly.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
80*. Pits						
81D, 82F, 82G, 83F Quartzville	Severe: slope.	Slight	Deep to water	Slope	Slope, large stones.	Slope.
84E, 84G Ritner	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
85*. Riverwash						
86G*: Rock outcrop.						
Orthents.						
87 Salem	Severe: seepage.	Severe: seepage.	Deep to water	Droughty	Too sandy	Droughty.
88B Salkum	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope	Favorable	Favorable.
88C Salkum	Severe: slope.	Severe: hard to pack.	Deep to water	Slope	Slope	Slope.
89B Santiam	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
90B Saturn	Severe: seepage.	Severe: seepage.	Deep to water	Droughty	Large stones, too sandy.	Droughty.
91 Saturn Variant	Moderate: seepage.	Moderate: wetness.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly.
92 Sifton Variant	Severe: seepage.	Severe: seepage.	Deep to water	Droughty	Large stones, too sandy.	Large stones, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
93C--------------- Silverton	Moderate: depth to rock, slope.	Moderate: hard to pack, wetness.	Percs slowly, depth to rock, slope.	Wetness, percs slowly, depth to rock.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
94B--------------- Stayton	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
95C--------------- Steiwer	Moderate: depth to rock, slope.	Moderate: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
95D, 95F---------- Steiwer	Severe: slope.	Moderate: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
96E--------------- Valsetz	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
97E*, 97H*:						
Valsetz-----------	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Yellowstone-------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
98---------------- Waldo	Slight----------	Severe: hard to pack, wetness.	Flooding, percs slowly.	Wetness, flooding, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
99---------------- Wapato	Slight----------	Severe: hard to pack, ponding.	Ponding, flooding.	Ponding, flooding.	Ponding---------	Wetness.
100--------------- Whiteson	Slight----------	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
101C-------------- Willakenzie	Moderate: depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
101D, 101E, 101F-- Willakenzie	Severe: slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
102--------------- Willamette	Moderate: seepage.	Slight----------	Deep to water	Favorable------	Erodes easily	Erodes easily.
103C-------------- Witham	Moderate: slope.	Severe: hard to pack.	Percs slowly, slope.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Percs slowly.
104E, 104G-------- Witzel	Severe: depth to rock, slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
105C-------------- Witzel Variant	Severe: depth to rock.	Severe: piping, large stones.	Deep to water	Large stones, droughty, depth to rock.	Large stones, depth to rock.	Large stones, droughty.
106A-------------- Woodburn	Moderate: seepage.	Severe: piping.	Percs slowly---	Wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
106C-------------- Woodburn	Moderate: seepage, slope.	Severe: piping.	Percs slowly, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
107E, 107H-------- Yellowstone	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
108H*:						
Zango------------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Dobbins----------	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1A, 1B----------- Abiqua	0-7	Silty clay loam	ML	A-6	0-5	100	95-100	95-100	85-95	35-40	10-15
	7-60	Silty clay, silty clay loam, clay.	MH, ML	A-7	0-10	100	90-100	90-100	85-100	40-55	15-30
2D--------------- Acanod	0-9	Silt loam--------	CL	A-6	0-20	95-100	90-95	85-90	80-85	25-35	10-15
	9-14	Silty clay loam, clay loam.	CL	A-6, A-7	0-20	95-100	90-95	85-90	85-90	35-45	15-20
	14-52	Silty clay loam, silty clay, clay.	CL	A-7	0-20	95-100	90-95	85-90	85-90	40-50	15-25
	52-68	Stony silty clay, stony silty clay loam, stony clay loam.	CL	A-7	25-45	95-100	90-95	85-90	85-90	40-50	15-25
3---------------- Amity	0-22	Silt loam--------	ML	A-4	0	100	100	95-100	90-95	30-40	5-10
	22-35	Silty clay loam	CL	A-7	0	100	100	95-100	95-100	40-45	15-20
	35-72	Silt loam--------	ML	A-4	0	100	100	95-100	90-95	30-40	5-10
4D, 5F, 6F------- Apt	0-13	Silty clay loam	ML, MH	A-7	0	95-100	90-100	75-100	60-95	40-60	10-20
	13-38	Clay, silty clay	MH	A-7	0	95-100	80-90	75-90	60-70	50-60	10-20
	38-66	Gravelly silty clay, clay, very gravelly silty clay loam.	GM, MH	A-7	0-20	55-90	45-90	45-90	40-70	50-60	10-20
7---------------- Awbrig	0-11	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	85-95	35-45	15-25
	11-31	Clay, silty clay	CH, MH	A-7	0	100	90-100	90-100	80-95	55-75	25-45
	31-60	Silty clay loam, clay loam.	CH, MH	A-7	0	100	90-100	90-100	75-95	50-65	20-35
8---------------- Bashaw	0-4	Silty clay-------	CH	A-7	0	100	95-100	95-100	85-95	60-70	35-40
	4-60	Clay-------------	CH	A-7	0	100	95-100	95-100	85-95	70-90	40-60
	60-70	Silty clay, clay, sandy clay.	CH	A-7	0	100	90-100	90-100	55-95	60-90	35-60
9C, 9D, 9E, 9F--- Bellpine	0-7	Silty clay loam	CL	A-6, A-7	0-10	100	100	95-100	85-95	35-45	15-20
	7-32	Silty clay, clay	MH	A-7	0-15	100	90-100	80-100	70-95	50-60	20-25
	32	Weathered bedrock	---	---	---	---	---	---	---	---	---
10E-------------- Bensley	0-11	Stony loam-------	GM-GC, SM-SC	A-4	15-25	70-80	65-75	55-70	40-50	20-30	5-10
	11-62	Very cobbly clay loam, very cobbly loam, very gravelly clay loam.	GC	A-6	25-55	55-70	50-65	40-60	35-50	25-35	10-15
11F*, 11G*:											
Bensley---------	0-11	Stony loam-------	GM-GC, SM-SC	A-4	15-25	70-80	65-75	55-70	40-50	20-30	5-10
	11-62	Very cobbly clay loam, very cobbly loam, very gravelly clay loam.	GC	A-6	25-55	55-70	50-65	40-60	35-50	25-35	10-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
11F*, 11G*:											
Valsetz	0-3	Stony loam	GM, ML, SM	A-4	25-45	60-85	55-80	45-75	35-60	30-35	NP-5
	3-36	Very gravelly loam, very gravelly clay loam, extremely gravelly loam.	GM	A-2	30-45	40-60	25-45	20-40	15-35	30-40	NP-10
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
12E, 13F, 13G, 14F, 14G	0-25	Clay loam	MH	A-5, A-7	0	100	100	95-100	85-95	50-65	5-15
Blachly	25-53	Silty clay, clay	MH	A-7	0	85-100	75-100	65-100	50-90	50-65	10-20
	53-60	Silty clay, clay, silty clay loam.	MH	A-7	0	85-100	75-100	65-100	50-90	50-65	10-20
15D	0-14	Cobbly loam	SM, ML	A-4	10-30	75-95	75-90	60-85	40-60	---	NP
Bohannon	14-38	Gravelly loam, cobbly loam, cobbly clay loam.	SM	A-4	0-30	70-95	60-90	50-85	35-50	25-35	NP-10
	38	Weathered bedrock	---	---	---	---	---	---	---	---	---
16B	0-21	Silt loam	ML, GM	A-4	0-10	80-100	75-100	50-95	40-85	25-35	NP-10
Briedwell	21-36	Gravelly silty clay loam, gravelly clay loam, very gravelly clay loam.	CL, GC	A-6	0-10	45-85	40-75	35-70	35-65	30-40	10-15
	36-60	Very gravelly clay loam, extremely gravelly clay loam.	GC	A-2	0-40	25-40	20-35	20-35	15-25	30-35	10-15
17C, 17E	0-12	Silt loam	ML	A-5	0	90-100	75-100	70-100	55-90	40-50	NP-5
Bull Run	12-66	Silt loam	ML	A-5	0	100	95-100	85-100	85-95	40-50	NP-5
18	0-13	Gravelly sandy loam.	GM, SM	A-1	0-15	60-70	50-70	25-50	15-25	---	NP
Camas	13-60	Extremely gravelly coarse sand, very gravelly sand, very gravelly loamy sand.	GP	A-1	5-25	25-50	15-40	10-20	0-5	---	NP
19	0-13	Loam	ML	A-4	0	95-100	95-100	80-95	60-75	30-40	5-10
Chapman	13-52	Loam, clay loam	ML	A-4, A-6	0	90-100	85-100	75-100	55-80	30-40	5-15
	52-60	Gravelly sandy loam, gravelly loam.	SM	A-1, A-2, A-4	0	70-80	60-70	35-55	20-40	20-25	NP-5
20C	0-14	Silt loam	ML	A-4	0	100	95-100	90-100	80-90	25-35	5-10
Chehalem	14-60	Silty clay, clay, silty clay loam.	MH	A-7	0	100	95-100	90-100	85-95	50-60	15-25
21	0-16	Silty clay loam	CL	A-7	0	100	100	95-100	85-95	40-50	20-30
Chehalis	16-60	Silt loam, silty clay loam.	ML	A-4, A-6, A-7	0	100	100	95-100	85-95	35-45	5-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
22C, 22E--------- Chehulpum	0-2	Silt loam---------	ML	A-4	0	95-100	90-100	85-95	60-90	25-35	NP-10
	2-16	Silt loam, clay loam, gravelly silt loam.	ML	A-4	0-10	80-100	60-100	55-95	50-90	30-40	5-10
	16	Weathered bedrock	---	---	---	---	---	---	---	---	---
23--------------- Clackamas	0-12	Gravelly silt loam.	GM, ML, SM	A-4	0-5	55-80	50-75	45-70	40-65	25-35	NP-5
	12-21	Gravelly clay loam, gravelly silty clay loam, silty clay loam.	CL, GC	A-6	0-5	60-85	60-85	45-80	40-75	35-40	15-20
	21-60	Extremely gravelly clay loam, extremely gravelly silty clay loam, extremely gravelly loam.	GC	A-2	5-15	20-35	15-30	10-30	10-30	35-40	15-20
24--------------- Clackamas Variant	0-13	Silt loam---------	ML	A-4	0	80-100	75-100	70-100	65-90	25-35	NP-5
	13-27	Silty clay loam, gravelly silty clay loam.	CL	A-6	0-5	75-100	70-100	65-100	60-90	35-40	15-20
	27-60	Very gravelly clay.	GC	A-7, A-2	5-10	35-50	30-45	25-45	25-45	45-55	20-30
25--------------- Cloquato	0-21	Silt loam---------	ML	A-4	0	100	100	95-100	80-95	20-30	NP-5
	21-60	Silt loam---------	ML	A-4	0	100	100	95-100	75-90	20-30	NP-5
26--------------- Coburg	0-17	Silty clay loam	CL	A-6	0	95-100	90-100	85-100	80-95	30-40	10-15
	17-62	Silty clay loam, silty clay.	CL	A-7	0	95-100	90-100	85-100	80-95	40-50	15-25
27--------------- Concord	0-20	Silt loam---------	ML	A-4	0	100	100	95-100	85-95	30-40	5-10
	20-40	Silty clay, silty clay loam, clay.	CL	A-7	0	100	100	95-100	80-90	40-50	15-25
	40-72	Silt loam, silty clay loam.	ML	A-4	0	100	100	95-100	80-90	30-40	5-10
28--------------- Conser	0-17	Silty clay loam	CL	A-6	0	100	95-100	95-100	85-95	35-40	15-20
	17-64	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	95-100	95-100	90-95	45-55	20-30
29--------------- Courtney	0-17	Gravelly silty clay loam.	ML, CL	A-6	0-10	65-80	60-75	55-70	50-60	35-40	10-15
	17-33	Gravelly clay, gravelly silty clay.	CH	A-7	0-5	60-80	55-75	50-70	50-65	60-80	35-50
	33-48	Very gravelly clay loam, extremely gravelly clay loam.	GM, GC	A-2	5-10	20-40	15-35	15-35	10-25	35-40	10-15
	48-60	Very gravelly sand, extremely gravelly sand.	GP, GW	A-1	5-15	20-40	15-35	10-30	0-5	---	NP
30D, 30F, 30G---- Crabtree	0-8	Stony loam--------	GM, SM	A-2, A-4	30-45	50-80	45-80	40-75	30-50	25-35	NP-5
	8-55	Very gravelly loam, extremely gravelly loam.	GM	A-2, A-4	30-40	35-60	30-55	25-50	20-40	25-35	NP-5
	55-60	Very stony loam	GM, SM	A-2, A-4	30-55	45-85	35-80	30-70	25-50	25-35	NP-5

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
31D, 31F, 31G---- Cruiser	0-14	Gravelly loam----	SM	A-1, A-2	0-5	70-85	60-75	35-55	15-35	---	NP
	14-45	Gravelly clay loam, gravelly loam.	SM, GM	A-5	0-15	65-85	60-75	50-70	35-50	50-60	5-10
	45-60	Very cobbly clay loam, cobbly loam, gravelly loam.	SM, GM	A-5, A-2	15-50	60-85	50-70	35-65	30-45	50-60	5-10
32D-------------- Cumley	0-18	Silty clay loam	CL, ML	A-6	0-5	95-100	90-95	85-95	75-90	35-40	10-15
	18-60	Silty clay, clay	MH	A-7	0-5	95-100	85-100	75-90	65-85	50-60	15-25
33--------------- Dayton	0-9	Silt loam--------	ML	A-4	0	100	95-100	90-100	85-100	30-35	5-10
	9-15	Silt loam, silty clay loam.	ML	A-4, A-6	0	100	95-100	90-100	90-100	30-40	5-15
	15-40	Silty clay, clay	CH	A-7	0	100	95-100	90-100	90-100	55-70	35-45
	40-76	Silt loam, silty clay loam.	ML	A-4, A-6	0	100	95-100	90-100	85-95	30-40	5-15
34C, 34E, 34F---- Dixonville	0-12	Silty clay loam	CL	A-6	0-10	90-100	90-100	85-100	75-95	35-40	15-20
	12-26	Clay, cobbly clay, silty clay.	CH	A-7	0-30	75-100	70-100	65-100	50-95	50-80	30-50
	26	Weathered bedrock	---	---	---	---	---	---	---	---	---
35C*, 35E*:											
Dixonville------	0-12	Silty clay loam	CL	A-6	0-10	90-100	90-100	85-100	75-95	35-40	15-20
	12-26	Clay, cobbly clay, silty clay.	CH	A-7	0-30	75-100	70-100	65-100	50-95	50-80	30-50
	26	Weathered bedrock	---	---	---	---	---	---	---	---	---
Philomath-------	0-4	Silty clay-------	CH, CL	A-7	0	100	90-100	75-100	70-95	50-60	35-45
	4-19	Clay, cobbly silty clay, cobbly clay.	CH	A-7	0-30	90-100	70-95	60-90	60-85	60-80	40-50
	19	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hazelair--------	0-5	Silty clay loam	CL	A-6	0	95-100	90-95	85-95	80-90	30-40	10-20
	5-15	Silty clay, silty clay loam.	CL	A-7	0	95-100	90-95	85-95	80-95	40-50	20-25
	15-34	Clay-------------	CH	A-7	0	95-100	85-95	75-90	70-90	60-80	40-50
	34	Weathered bedrock	---	---	---	---	---	---	---	---	---
36D-------------- Dupee	0-4	Silt loam--------	ML	A-4	0	100	95-100	85-100	65-90	30-40	5-10
	4-65	Silty clay loam, silty clay, clay.	MH	A-7	0	100	90-100	85-95	75-90	50-60	20-25
37D, 37F, 37G---- Flane	0-13	Gravelly loam----	GM, SM	A-4	0-15	55-80	55-65	50-60	35-50	25-30	NP-5
	13-37	Very cobbly silty clay loam, very cobbly silty clay.	GC, CL	A-7	40-65	50-80	40-75	40-75	35-70	40-50	20-25
	37-60	Very cobbly clay loam, extremely cobbly clay loam.	GM, SM, ML	A-2, A-6	40-65	50-80	40-75	35-70	30-55	35-40	10-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
38F*, 38G*:											
Flane-----------	0-13	Gravelly loam----	GM, SM	A-4	0-15	55-80	55-65	50-60	35-50	25-30	NP-5
	13-37	Very cobbly silty clay loam, very cobbly silty clay.	GC, CL	A-7	40-65	50-80	40-75	40-75	35-70	40-50	20-25
	37-60	Very cobbly clay loam, extremely cobbly clay loam.	GM, SM, ML	A-2, A-6	40-65	50-80	40-75	35-70	30-55	35-40	10-15
Moe-------------	0-15	Gravelly loam----	SM	A-4	0	70-85	50-75	45-70	35-50	30-40	NP-10
	15-24	Silty clay loam	CL	A-7	0	100	100	90-100	80-95	40-50	15-25
	24-61	Silty clay, silty clay loam, clay loam.	MH	A-7	0	100	95-100	95-100	80-95	50-60	20-30
39*:											
Fluvents.											
Fluvaquents.											
40G*, 41G*:											
Harrington------	0-4	Gravelly loam----	GM	A-4	0-15	65-80	60-75	55-70	35-50	20-30	NP-5
	4-34	Very gravelly clay loam, extremely gravelly loam, very cobbly loam.	GM, GM-GC	A-1, A-2, A-4	25-60	30-70	25-65	25-60	20-45	20-30	NP-10
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Klickitat-------	0-9	Stony loam-------	GM, ML	A-2, A-4	15-30	50-75	50-70	40-65	30-55	25-35	5-10
	9-20	Very gravelly clay loam, very cobbly clay loam, extremely cobbly clay loam.	GC	A-2, A-6	20-55	45-65	35-60	30-60	25-50	30-40	10-15
	20-56	Very cobbly loam, extremely cobbly loam.	GM, SM, GC, SC	A-2, A-4, A-1	30-55	35-70	30-60	25-60	20-50	25-35	5-10
	56	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
42H*:											
Harrington------	0-4	Gravelly loam----	GM	A-4	0-15	65-80	60-75	55-70	35-50	20-30	NP-5
	4-34	Very gravelly clay loam, extremely gravelly loam, very cobbly loam.	GM, GM-GC	A-1, A-2, A-4	25-60	30-70	25-65	25-60	20-45	20-30	NP-10
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
43B, 43D--------- Hazelair	0-5	Silty clay loam	CL	A-6	0	95-100	90-95	85-95	80-90	30-40	10-20
	5-15	Silty clay, silty clay loam.	CL	A-7	0	95-100	90-95	85-95	80-95	40-50	20-25
	15-34	Clay-------------	CH	A-7	0	95-100	85-95	75-90	70-90	60-80	40-50
	34	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
44E, 44F, 44G---- Henline	0-5	Very stony sandy loam.	GM	A-1, A-2	15-50	20-50	15-45	10-40	10-30	15-25	NP-5
	5-28	Very cobbly sandy loam, very gravelly sandy loam, very gravelly fine sandy loam.	GM	A-1	15-55	40-60	35-55	25-40	15-25	15-25	NP-5
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
45F*, 45H*:											
Henline---------	0-5	Very stony sandy loam.	GM	A-1, A-2	15-50	20-50	15-45	10-40	10-30	15-25	NP-5
	5-28	Very cobbly sandy loam, very gravelly sandy loam, very gravelly fine sandy loam.	GM	A-1	15-55	40-60	35-55	25-40	15-25	15-25	NP-5
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Yellowstone-----	0-5	Stony loam-------	GM, SM	A-4	15-30	65-85	60-80	50-70	35-50	20-30	NP-5
	5-18	Extremely stony sandy loam, very stony sandy loam, extremely cobbly loam.	GM, SM	A-1, A-2, A-4	45-75	40-80	35-75	25-55	15-40	15-25	NP-5
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
46--------------- Holcomb	0-7	Silt loam--------	ML	A-4	0	100	95-100	90-95	90-95	30-35	5-10
	7-27	Silty clay loam, silt loam.	ML, CL	A-6, A-4	0	100	100	95-100	90-95	30-40	5-15
	27-47	Clay, silty clay	CH	A-7	0	80-100	75-100	70-100	65-100	60-80	40-50
	47-60	Silt loam, silty clay loam, clay loam.	ML	A-4, A-6, A-7	0	85-100	80-100	75-95	70-95	30-50	5-20
47C, 47D, 48F, 49F------------- Honeygrove	0-13	Silty clay loam	ML	A-4	0	100	100	95-100	85-95	30-40	5-10
	13-75	Clay, silty clay	MH	A-7	0-15	85-100	75-100	70-100	50-95	55-70	10-20
50D, 50F, 50G---- Hummington	0-8	Very gravelly loam.	GM	A-1, A-2	5-15	40-55	35-50	30-45	20-35	---	NP
	8-36	Very cobbly loam, very gravelly loam, extremely cobbly loam.	GM, SM, GP-GM, SP-SM	A-4, A-1, A-2	10-60	40-75	35-70	30-60	20-45	---	NP
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
51C, 51D, 51E, 51F------------- Jory	0-6	Silty clay loam	ML	A-7	0	100	95-100	80-95	65-90	40-50	10-15
	6-60	Clay, silty clay	CL	A-7	0	100	95-100	85-100	75-90	40-50	15-25

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
52D, 52F, 52G---- Keel	0-5	Gravelly silt loam.	MH, GM	A-5	5-10	60-80	55-75	50-70	40-65	70-90	NP-10
	5-15	Silt loam, clay loam.	MH	A-5	0-5	90-100	85-95	80-90	70-80	70-90	NP-10
	15-24	Gravelly loam, cobbly loam, clay loam.	ML, SM, MH	A-5, A-7	10-30	75-95	70-95	60-90	45-80	40-55	NP-15
	24	Weathered bedrock	---	---	---	---	---	---	---	---	---
53G*, 53H*: Kilchis----------	0-4	Stony loam-------	SM, ML	A-4	15-30	75-95	70-95	60-90	40-65	20-30	NP-5
	4-12	Extremely gravelly silt loam, very cobbly loam, very stony loam.	GM	A-1, A-2, A-4	25-55	30-65	25-60	20-55	15-45	20-30	NP-5
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Harrington------	0-4	Gravelly loam----	GM	A-4	0-15	65-80	60-75	55-70	35-50	20-30	NP-5
	4-34	Very gravelly clay loam, extremely gravelly loam, very cobbly loam.	GM, GM-GC	A-1, A-2, A-4	25-60	30-70	25-65	25-60	20-45	20-30	NP-10
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
54D, 55F, 55G, 56F, 56G, 57E--- Kinney	0-15	Cobbly loam------	MH	A-7	15-25	85-95	80-90	70-85	55-80	60-70	10-20
	15-35	Cobbly clay loam, cobbly loam.	MH	A-7	20-30	90-95	85-90	75-85	55-75	55-65	10-20
	35-55	Cobbly loam, very cobbly loam.	MH	A-7	15-40	85-95	80-90	65-80	50-75	50-65	10-20
	55	Weathered bedrock	---	---	---	---	---	---	---	---	---
58F*, 58G*, 59F*, 59G*: Kinney----------	0-15	Cobbly loam------	MH	A-7	15-25	85-95	80-90	70-85	55-80	60-70	10-20
	15-35	Cobbly clay loam, cobbly loam.	MH	A-7	20-30	90-95	85-90	75-85	55-75	55-65	10-20
	35-55	Cobbly loam, very cobbly loam.	MH	A-7	15-40	85-95	80-90	65-80	50-75	50-65	10-20
	55	Weathered bedrock	---	---	---	---	---	---	---	---	---
Klickitat------	0-9	Stony loam-------	GM, ML	A-2, A-4	15-30	50-75	50-70	40-65	30-55	25-35	5-10
	9-20	Very gravelly clay loam, very cobbly clay loam, extremely cobbly clay loam.	GC	A-2, A-6	20-55	45-65	35-60	30-60	25-50	30-40	10-15
	20-56	Very cobbly loam, extremely cobbly loam.	GM, SM, GC, SC	A-2, A-4, A-1	30-55	35-70	30-60	25-60	20-50	25-35	5-10
	56	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
60E*, 61F*, 62F*:											
Klickitat-------	0-9	Stony loam-------	GM, ML	A-2, A-4	15-30	50-75	50-70	40-65	30-55	25-35	5-10
	9-20	Very gravelly clay loam, very cobbly clay loam, extremely cobbly clay loam.	GC	A-2, A-6	20-55	45-65	35-60	30-60	25-50	30-40	10-15
	20-56	Very cobbly loam, extremely cobbly loam.	GM, SM, GC, SC	A-2, A-4, A-1	30-55	35-70	30-60	25-60	20-50	25-35	5-10
	56	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Harrington------	0-4	Gravelly loam----	GM	A-4	0-15	65-80	60-75	55-70	35-50	20-30	NP-5
	4-34	Very gravelly clay loam, extremely gravelly loam, very cobbly loam.	GM, GM-GC	A-1, A-2, A-4	25-60	30-70	25-65	25-60	20-45	20-30	NP-10
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
63--------------- Malabon	0-17	Silty clay loam	ML	A-6	0	95-100	90-100	80-100	75-95	35-40	10-15
	17-60	Silty clay, silty clay loam.	CL	A-7	0	95-100	90-100	85-100	80-95	45-50	20-25
64--------------- Malabon Variant	0-14	Loam-------------	ML	A-4	0	90-100	85-100	65-80	50-65	---	NP
	14-55	Sandy loam-------	SM	A-4	0	90-100	85-100	65-80	40-50	---	NP
	55-60	Very gravelly sandy loam, extremely gravelly sandy loam, extremely gravelly loamy sand.	GM, GP-GM	A-1	15-30	30-55	25-50	15-35	5-20	---	NP
65B-------------- Marcola	0-12	Cobbly silty clay loam.	CL	A-7, A-6	20-40	75-85	70-80	70-80	60-75	35-45	15-20
	12-60	Very cobbly clay, very gravelly clay, extremely cobbly clay.	GC, CH	A-2, A-7	30-60	30-75	20-70	20-70	15-65	50-60	25-35
66B-------------- McAlpin	0-25	Silty clay loam	ML, CL	A-6	0	100	95-100	90-95	80-90	35-40	10-15
	25-60	Silty clay, clay	CL	A-7	0	100	95-100	90-100	85-95	40-50	15-25
67--------------- McBee	0-19	Silty clay loam	ML	A-6	0	100	100	95-100	85-95	35-40	10-15
	19-60	Silty clay loam, clay loam, silt loam.	ML, CL	A-6	0	100	100	95-100	80-95	34-40	10-15
68F, 68G--------- McDuff	0-7	Silty clay loam	ML	A-6	0-5	90-100	90-100	85-100	75-95	35-40	10-15
	7-36	Silty clay, clay	MH	A-7	0	100	90-100	85-100	80-95	50-60	20-25
	36	Weathered bedrock	---	---	---	---	---	---	---	---	---
69B-------------- Minniece	0-10	Silty clay loam	ML	A-6	0-5	100	95-100	95-100	85-95	35-40	10-15
	10-36	Clay, silty clay	MH	A-7	0-5	100	90-100	85-95	75-85	50-60	15-25
	36-65	Clay, silty clay loam, clay loam.	MH	A-7	0-5	100	90-100	85-95	65-90	50-60	15-25

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
70D, 70F--------- Moe	0-15	Gravelly loam----	SM	A-4	0	70-85	50-75	45-70	35-50	30-40	NP-10
	15-24	Silty clay loam	CL	A-7	0	100	100	90-100	80-95	40-50	15-25
	24-61	Silty clay, silty clay loam, clay loam.	MH	A-7	0	100	95-100	95-100	80-95	50-60	20-30
71F-------------- Mulkey	0-8	Loam-------------	ML	A-4	0-5	95-100	90-100	75-95	55-75	30-40	5-10
	8-19	Gravelly loam----	ML, SM, GM	A-4	0-15	70-80	65-75	55-70	40-55	30-40	5-10
	19-31	Cobbly loam, cobbly sandy loam.	ML	A-4	20-40	85-95	80-90	70-85	50-70	30-40	NP-5
	31	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
72C, 72D, 72E, 72F------------- Nekia	0-10	Silty clay loam	ML	A-6	0-15	100	85-100	85-95	70-90	35-40	10-15
	10-29	Clay, gravelly clay, silty clay.	CL, GC	A-7	0-30	70-100	50-100	50-95	40-85	40-50	15-25
	29	Weathered bedrock	---	---	---	---	---	---	---	---	---
73--------------- Newberg	0-19	Fine sandy loam	SM	A-4, A-2	0	100	100	60-85	30-50	20-25	NP-5
	19-28	Sandy loam, fine sandy loam, coarse sandy loam.	SM	A-2, A-4	0	75-100	75-100	40-85	25-50	20-25	NP-5
	28-64	Loamy sand, loamy fine sand, fine sand.	SM	A-1, A-2, A-4	0-10	80-100	80-100	45-85	15-40	---	NP
74H*. Ochrepts											
75C-------------- Panther	0-7	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	30-40	10-20
	7-48	Clay-------------	CH	A-7	0	100	100	90-100	80-100	60-85	35-50
	48	Weathered bedrock	---	---	---	---	---	---	---	---	---
76E, 76G--------- Peavine	0-10	Silty clay loam	ML, MH	A-7	0	100	100	90-100	80-90	45-55	10-20
	10-37	Silty clay, clay	MH	A-7	0	100	100	90-100	80-95	60-85	25-45
	37	Weathered bedrock	---	---	---	---	---	---	---	---	---
77A-------------- Pengra	0-10	Silt loam--------	ML	A-4	0	100	100	95-100	80-90	30-40	NP-10
	10-29	Silty clay loam	ML	A-6	0	100	100	95-100	85-95	35-40	10-15
	29-60	Clay-------------	CH	A-7	0	100	100	90-100	75-95	60-80	40-50
78C-------------- Philomath	0-4	Silty clay-------	CH, CL	A-7	0	100	90-100	75-100	70-95	50-60	35-45
	4-19	Clay, cobbly silty clay, cobbly clay.	CH	A-7	0-30	90-100	70-95	60-90	60-85	60-80	40-50
	19	Weathered bedrock	---	---	---	---	---	---	---	---	---
79C, 79F--------- Philomath	0-4	Cobbly silty clay	CL, CH	A-7	15-30	85-100	75-90	70-85	60-80	50-60	35-45
	4-19	Clay, cobbly silty clay, cobbly clay.	CH	A-7	0-30	90-100	70-95	60-90	60-85	60-80	40-50
	19	Weathered bedrock	---	---	---	---	---	---	---	---	---
80*. Pits											

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
81D, 82F, 82G, 83F: Quartzville	0-9	Silt loam	CL	A-6	0-15	85-100	80-100	80-100	70-90	25-35	10-15
	9-58	Silty clay loam, silty clay, clay loam.	CL	A-7	0-15	85-100	80-100	80-100	70-85	40-50	15-25
	58-65	Clay loam, silty clay loam.	CL	A-6, A-7	0-25	85-100	80-100	80-100	65-85	35-45	15-20
84E, 84G: Ritner	0-15	Cobbly silty clay loam.	ML, CL	A-6	25-35	90-100	85-100	80-95	70-90	35-40	10-15
	15-34	Very cobbly silty clay, extremely cobbly silty clay loam.	CL, GC	A-7	30-55	35-75	30-60	25-60	25-55	40-50	15-25
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
85*. Riverwash											
86G*: Rock outcrop.											
Orthents.											
87: Salem	0-9	Gravelly silt loam.	ML, GM, CL-ML, GM-GC	A-4	0-5	55-80	50-75	45-75	40-70	25-35	5-10
	9-35	Gravelly clay loam, gravelly silty clay loam, gravelly sandy clay loam.	GM, SM, ML, CL	A-2, A-6, A-7	0-5	55-80	50-75	40-70	20-65	35-45	10-20
	35-60	Very gravelly sand, very gravelly loamy sand, extremely gravelly sand.	GP, SP, GP-GM, SP-SM	A-1	10-15	25-55	15-50	10-35	0-10	---	NP
88B, 88C: Salkum	0-19	Silty clay loam	CL	A-7	0	100	100	95-100	85-95	40-45	15-20
	19-27	Silty clay, clay	MH	A-7	0	100	85-100	80-95	65-90	50-65	15-25
	27-60	Silty clay, silty clay loam, clay.	ML, MH	A-7	0	100	90-100	80-95	65-90	45-60	15-25
89B: Santiam	0-14	Silt loam	ML	A-4	0	100	100	90-100	70-90	30-40	5-10
	14-34	Silty clay loam, silty clay, clay.	CL	A-6	0	100	100	95-100	85-95	30-50	10-30
	34-60	Clay, silty clay	CH	A-7	0	100	95-100	90-100	90-100	50-60	30-40
90B: Saturn	0-10	Clay loam	ML	A-6	0-5	85-95	85-90	75-85	55-75	35-40	10-15
	10-36	Clay loam, gravelly clay loam, gravelly loam.	CL, GC, SC	A-6	0-10	60-85	55-85	45-80	35-65	30-40	10-15
	36-60	Very gravelly sand, very gravelly loamy sand, extremely gravelly loamy sand.	GP, GP-GM	A-1	20-35	30-50	25-45	10-30	0-10	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
91---------------- Saturn Variant	0-10	Silt loam--------	CL, CL-ML	A-4	0	90-100	85-100	80-95	70-85	20-30	5-10
	10-24	Silty clay loam, clay loam.	CL	A-6	0	90-100	85-100	70-85	65-80	30-40	10-15
	24-60	Very gravelly clay loam.	GC	A-2	10-15	35-50	30-45	25-40	20-35	30-40	10-15
92---------------- Sifton Variant	0-9	Gravelly loam----	SM, GM	A-4	10-15	65-80	60-75	55-65	40-50	---	NP
	9-15	Very gravelly loam.	GM	A-1, A-2	10-15	40-55	35-50	30-45	20-30	---	NP
	15-60	Extremely gravelly loamy sand, extremely gravelly coarse sand.	GP, GP-GM	A-1	15-25	20-35	15-30	5-15	0-10	---	NP
93C--------------- Silverton	0-11	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	70-90	25-35	5-10
	11-22	Silty clay loam	CL	A-6, A-7	0	100	95-100	85-95	70-85	35-45	15-20
	22-37	Gravelly silty clay, gravelly clay.	CL, CH	A-7	0-15	80-90	60-75	60-75	55-70	45-60	20-30
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
94B--------------- Stayton	0-13	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	30-40	5-10
	13	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
95C, 95D, 95F---- Steiwer	0-14	Silt loam--------	ML	A-4	0	100	95-100	85-95	65-90	30-40	5-10
	14-32	Clay loam, silty clay loam.	ML	A-7	0-5	95-100	85-100	80-100	60-95	40-50	5-15
	32	Weathered bedrock	---	---	---	---	---	---	---	---	---
96E--------------- Valsetz	0-3	Stony loam-------	GM, ML, SM	A-4	25-45	60-85	55-80	45-75	35-60	30-35	NP-5
	3-36	Very gravelly loam, very gravelly clay loam, extremely gravelly loam.	GM	A-2	30-45	40-60	25-45	20-40	15-35	30-40	NP-10
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
97E*, 97H*:											
Valsetz---------	0-3	Stony loam-------	GM, ML, SM	A-4	25-45	60-85	55-80	45-75	35-60	30-35	NP-5
	3-36	Very gravelly loam, very gravelly clay loam, extremely gravelly loam.	GM	A-2	30-45	40-60	25-45	20-40	15-35	30-40	NP-10
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Yellowstone-----	0-5	Stony loam-------	GM, SM	A-4	15-30	65-85	60-80	50-70	35-50	20-30	NP-5
	5-18	Extremely stony sandy loam, very stony sandy loam, extremely cobbly loam.	GM, SM	A-1, A-2, A-4	45-75	40-80	35-75	25-55	15-40	15-25	NP-5
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
98---------------- Waldo	0-20	Silty clay loam	ML, CL	A-6	0	100	95-100	90-100	85-95	35-40	10-15
	20-72	Silty clay, clay	MH, CH	A-7	0	100	95-100	90-100	85-95	50-60	20-30

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
99---------------- Wapato	0-17	Silty clay loam	ML	A-6	0	100	100	95-100	85-95	35-40	10-15
	17-48	Silty clay loam, silt loam.	ML	A-6	0	100	100	95-100	80-95	30-40	5-15
	48-60	Silty clay-------	MH	A-7	0	100	100	95-100	90-95	50-60	10-20
100-------------- Whiteson	0-11	Silt loam--------	ML	A-4, A-6	0	100	95-100	90-100	80-100	30-40	5-15
	11-15	Clay loam, silty clay loam.	CL	A-6	0	100	95-100	90-100	80-100	30-40	10-15
	15-43	Silty clay, clay	MH	A-7	0	100	95-100	90-100	85-95	50-70	20-35
	43-60	Gravelly sandy clay loam.	GC	A-6	0	55-70	50-70	45-55	35-50	30-40	15-20
101C, 101D, 101E, 101F------------ Willakenzie	0-6	Clay loam--------	ML	A-4, A-5	0	100	100	90-100	75-95	35-45	5-10
	6-22	Silty clay loam, clay loam.	ML	A-6, A-7	0	100	100	95-100	80-95	35-45	10-15
	22	Weathered bedrock	---	---	---	---	---	---	---	---	---
102-------------- Willamette	0-24	Silt loam--------	ML	A-4	0	100	95-100	95-100	95-100	35-40	5-10
	24-53	Silty clay loam, silt loam.	CL	A-7	0	100	95-100	95-100	95-100	40-50	15-25
	53-60	Silty clay loam, silt loam.	ML	A-6	0	100	95-100	95-100	95-100	35-40	10-15
103C------------- Witham	0-11	Silty clay-------	CH	A-7	0	100	100	95-100	90-95	55-75	35-50
	11-60	Clay, silty clay.	CH	A-7	0	100	100	90-100	75-95	60-80	40-60
104E, 104G------- Witzel	0-5	Very cobbly loam	GM	A-4, A-2	30-45	50-75	40-70	30-70	25-50	25-30	NP-5
	5-16	Very stony silty clay loam, very cobbly clay loam.	GC	A-6	50-60	45-75	30-65	30-60	25-50	35-40	15-20
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
105C------------- Witzel Variant	0-6	Very cobbly silt loam.	GM, ML, SM	A-4	35-45	60-75	55-75	55-70	45-60	30-40	NP-10
	6-18	Very cobbly silt loam.	GM	A-4	40-45	55-65	50-60	50-60	40-50	25-35	NP-10
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
106A, 106C------- Woodburn	0-19	Silt loam--------	ML	A-4	0	100	95-100	85-95	70-85	25-30	NP-5
	19-54	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-95	30-40	10-20
	54-60	Silt loam, silty clay loam.	ML, CL-ML	A-4	0	100	100	95-100	80-90	25-35	5-10
107E, 107H------- Yellowstone	0-5	Stony loam-------	GM, SM	A-4	15-30	65-85	60-80	50-70	35-50	20-30	NP-5
	5-18	Extremely stony sandy loam, very stony sandy loam, extremely cobbly loam.	GM, SM	A-1, A-2, A-4	45-75	40-80	35-75	25-55	15-40	15-25	NP-5
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
108H*:											
Zango-----------	0-5	Gravelly loam----	GM, SM, GM-GC, SM-SC	A-2, A-4	0-15	50-75	45-70	40-60	30-50	20-30	NP-10
	5-13	Very gravelly loam, very gravelly clay loam, very cobbly loam.	GC, GM-GC	A-2	0-35	45-60	40-55	35-50	25-35	25-40	5-15
	13	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Dobbins---------	0-4	Gravelly loam----	SM, GM	A-4	0-15	65-80	60-75	55-70	40-50	25-30	NP-5
	4-34	Very gravelly silty clay loam, very cobbly silty clay.	CL, GC	A-7	25-50	50-75	45-65	45-60	40-55	40-50	15-25
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cm	In/hr	In/in	pH				Pct
1A, 1B-----------	0-7	27-40	1.20-1.30	0.6-2.0	0.19-0.21	5.1-6.5	Moderate-----	0.24	5	3-6
Abiqua	7-60	35-50	1.20-1.30	0.2-0.6	0.12-0.21	5.1-6.0	High---------	0.28		
2D---------------	0-9	18-27	0.85-0.95	0.6-2.0	0.19-0.21	4.5-5.0	Low----------	0.28	5	4-8
Acanod	9-14	27-40	0.95-1.20	0.2-0.6	0.19-0.21	4.5-5.0	Moderate-----	0.32		
	14-52	35-45	0.95-1.20	0.06-0.2	0.15-0.17	4.5-5.0	Moderate-----	0.32		
	52-68	35-45	0.95-1.20	0.06-0.2	0.12-0.14	4.5-5.0	Moderate-----	0.32		
3----------------	0-22	15-25	1.20-1.45	0.6-2.0	0.19-0.21	5.6-6.0	Low----------	0.32	5	3-5
Amity	22-35	27-35	1.20-1.40	0.2-0.6	0.19-0.21	5.6-6.5	Moderate-----	0.49		
	35-72	10-25	1.20-1.45	0.6-2.0	0.19-0.21	6.1-6.5	Low----------	0.55		
4D, 5F, 6F-------	0-13	30-45	1.10-1.30	0.6-2.0	0.14-0.21	4.5-5.5	Moderate-----	0.28	5	4-8
Apt	13-38	45-60	1.10-1.30	0.2-0.6	0.14-0.16	4.5-5.5	Moderate-----	0.32		
	38-66	30-45	1.10-1.30	0.2-0.6	0.11-0.16	4.5-5.5	Moderate-----	0.28		
7----------------	0-11	27-30	1.30-1.40	0.6-2.0	0.18-0.22	5.1-6.5	Moderate-----	0.32	5	2-5
Awbrig	11-31	50-60	1.30-1.40	<0.06	0.03-0.05	6.1-6.5	High---------	0.37		
	31-60	27-40	1.30-1.40	0.2-0.6	0.17-0.20	6.6-7.3	Moderate-----	0.32		
8----------------	0-4	50-60	1.10-1.30	<0.06	0.16-0.19	5.6-7.3	High---------	0.20	5	4-8
Bashaw	4-60	55-70	1.10-1.30	<0.06	0.14-0.16	5.6-7.3	High---------	0.17		
	60-70	50-70	1.10-1.30	<0.06	0.14-0.16	6.1-7.3	High---------	0.20		
9C, 9D, 9E, 9F---	0-7	27-35	1.20-1.40	0.6-2.0	0.18-0.21	5.1-6.0	Low----------	0.28	3	3-6
Bellpine	7-32	40-55	1.10-1.40	0.06-0.2	0.13-0.16	4.5-6.0	Moderate-----	0.32		
	32	---	---	---	---	---	-------------	----		
10E--------------	0-11	15-25	0.95-1.10	0.6-2.0	0.11-0.13	4.5-5.0	Low----------	0.10	5	2-4
Bensley	11-62	18-30	1.10-1.20	0.6-2.0	0.10-0.12	4.5-5.0	Low----------	0.15		
11F*, 11G*:										
Bensley----------	0-11	15-25	0.95-1.10	0.6-2.0	0.11-0.13	4.5-5.0	Low----------	0.10	5	2-4
	11-62	18-30	1.10-1.20	0.6-2.0	0.10-0.12	4.5-5.0	Low----------	0.15		
Valsetz----------	0-3	20-25	1.00-1.30	2.0-6.0	0.08-0.10	4.5-5.0	Low----------	0.15	3	4-8
	3-36	20-30	1.00-1.30	2.0-6.0	0.06-0.08	4.5-5.0	Low----------	0.15		
	36	---	---	---	---	---	-------------	----		
12E, 13F, 13G, 14F, 14G--------	0-25	27-40	1.10-1.20	0.6-2.0	0.17-0.21	4.5-6.0	Low----------	0.17	5	3-6
Blachly	25-53	40-50	1.10-1.30	0.2-0.6	0.11-0.13	4.5-6.0	Moderate-----	0.24		
	53-60	35-45	1.10-1.30	0.2-0.6	0.14-0.20	4.5-6.0	Moderate-----	0.24		
15D--------------	0-14	15-25	0.90-1.20	2.0-6.0	0.12-0.15	4.5-6.0	Low----------	0.10	3	4-6
Bohannon	14-38	18-30	1.00-1.30	2.0-6.0	0.09-0.15	4.5-6.0	Low----------	0.17		
	38	---	---	---	---	---	-------------	----		
16B--------------	0-21	15-25	1.10-1.30	0.6-2.0	0.15-0.20	5.1-6.5	Low----------	0.28	4	3-5
Briedwell	21-36	27-35	1.20-1.30	0.6-2.0	0.13-0.19	5.6-6.5	Moderate-----	0.24		
	36-60	27-30	1.20-1.30	0.6-2.0	0.04-0.06	5.6-6.5	Low----------	0.20		
17C, 17E---------	0-12	12-20	0.70-0.75	0.6-2.0	0.18-0.24	5.1-6.0	Low----------	0.32	5	6-10
Bull Run	12-66	12-18	0.70-0.85	0.6-2.0	0.24-0.26	5.1-6.0	Low----------	0.49		
18---------------	0-13	5-10	1.30-1.50	2.0-6.0	0.07-0.09	5.6-7.3	Low----------	0.10	2	1-3
Camas	13-60	0-5	1.40-1.60	>20	0.03-0.05	5.6-6.5	Low----------	0.10		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm	In/hr	In/in	pH				Pct
19---------------	0-13	18-27	1.20-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Low-----------	0.28	4	3-5
Chapman	13-52	20-35	1.20-1.40	0.6-2.0	0.13-0.16	5.6-6.5	Moderate-----	0.32		
	52-60	5-20	1.30-1.50	2.0-6.0	0.07-0.10	6.1-7.3	Low-----------	0.20		
20C--------------	0-14	20-27	1.20-1.40	0.2-0.6	0.16-0.19	5.6-6.0	Low-----------	0.37	5	2-5
Chehalem	14-60	35-45	1.20-1.40	0.06-0.2	0.15-0.17	5.6-6.0	High----------	0.32		
21---------------	0-16	30-40	1.20-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Moderate-----	0.24	5	5-10
Chehalis	16-60	25-35	1.20-1.40	0.6-2.0	0.17-0.21	5.6-7.3	Moderate-----	0.28		
22C, 22E---------	0-2	18-27	1.30-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Low-----------	0.28	2	3-5
Chehulpum	2-16	20-30	1.30-1.40	0.6-2.0	0.18-0.22	5.6-6.5	Low-----------	0.28		
	16	---	---	---	---	---	-------------	----		
23---------------	0-12	15-25	1.20-1.40	0.6-2.0	0.13-0.18	5.6-6.0	Low-----------	0.15	5	3-4
Clackamas	12-21	27-35	1.30-1.50	0.2-0.6	0.14-0.18	5.6-6.0	Low-----------	0.15		
	21-60	27-35	1.30-1.50	0.2-0.6	0.03-0.05	5.1-5.5	Low-----------	0.05		
24---------------	0-13	18-25	1.20-1.40	0.6-2.0	0.16-0.21	5.6-6.0	Low-----------	0.32	5	3-5
Clackamas	13-27	27-35	1.30-1.40	0.2-0.6	0.14-0.21	5.1-6.0	Moderate-----	0.28		
Variant	27-60	40-55	1.30-1.40	0.06-0.2	0.04-0.11	5.1-5.5	High----------	0.10		
25---------------	0-21	5-15	1.20-1.40	0.6-2.0	0.20-0.22	5.6-6.5	Low-----------	0.32	5	5-10
Cloquato	21-60	5-15	1.20-1.40	0.6-2.0	0.19-0.21	6.1-7.3	Low-----------	0.32		
26---------------	0-17	27-35	1.20-1.40	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.32	5	4-6
Coburg	17-62	35-45	1.20-1.40	0.2-0.6	0.18-0.20	6.1-7.3	Moderate-----	0.37		
27---------------	0-20	20-25	1.40-1.60	0.6-2.0	0.19-0.21	5.6-6.5	Low-----------	0.28	5	2-4
Concord	20-40	35-50	1.30-1.50	0.06-0.2	0.15-0.17	6.1-7.3	High----------	0.32		
	40-72	20-35	1.40-1.60	0.2-0.6	0.19-0.21	6.1-7.3	Low-----------	0.49		
28---------------	0-17	27-35	1.20-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Moderate-----	0.37	5	4-8
Conser	17-64	35-60	1.20-1.40	0.06-0.2	0.14-0.16	5.6-6.5	High----------	0.37		
29---------------	0-17	27-35	1.30-1.40	0.2-0.6	0.16-0.19	5.1-6.0	Moderate-----	0.20	2	3-5
Courtney	17-33	50-60	1.30-1.40	<0.06	0.11-0.14	5.6-6.5	High----------	0.15		
	33-48	27-35	1.30-1.40	0.2-0.6	0.07-0.13	5.6-6.5	Moderate-----	0.15		
	48-60	0-5	1.30-1.40	6.0-20	0.03-0.05	5.6-7.3	Low-----------	0.02		
30D, 30F, 30G----	0-8	15-25	0.95-1.30	0.6-2.0	0.06-0.09	6.1-6.5	Low-----------	0.10	3	.5-1
Crabtree	8-55	15-25	0.95-1.30	0.6-2.0	0.05-0.08	5.6-6.0	Low-----------	0.10		
	55-60	15-20	0.95-1.30	0.06-0.2	0.02-0.05	5.6-6.0	Low-----------	0.02		
31D, 31F, 31G----	0-14	---	0.85-0.95	0.6-2.0	0.20-0.25	4.5-6.0	Low-----------	0.17	5	4-6
Cruiser	14-45	---	0.90-1.00	0.6-2.0	0.17-0.20	4.5-6.0	Low-----------	0.24		
	45-60	---	1.10-1.30	0.6-2.0	0.10-0.16	4.5-6.0	Low-----------	0.24		
32D--------------	0-18	27-35	1.20-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.24	5	4-6
Cumley	18-60	40-55	1.30-1.40	0.2-0.6	0.14-0.16	5.1-6.0	High----------	0.24		
33---------------	0-9	15-20	1.30-1.40	0.6-2.0	0.18-0.25	5.1-6.0	Low-----------	0.43	5	1-4
Dayton	9-15	15-30	1.25-1.40	0.6-2.0	0.18-0.24	5.1-6.0	Low-----------	0.49		
	15-40	40-50	1.25-1.40	<0.06	0.03-0.05	5.1-6.5	High----------	0.32		
	40-76	15-30	1.30-1.40	0.2-2.0	0.15-0.20	6.1-7.3	Low-----------	0.49		
34C, 34E, 34F----	0-12	27-40	1.30-1.50	0.6-2.0	0.18-0.21	5.6-6.5	Moderate-----	0.32	3	3-6
Dixonville	12-26	40-60	1.30-1.60	0.06-0.2	0.12-0.17	5.6-6.5	High----------	0.24		
	26	---	---	---	---	---	-------------	----		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cm	In/hr	In/in	pH				Pct
35C*, 35E*:										
Dixonville------	0-12	27-40	1.30-1.50	0.6-2.0	0.18-0.21	5.6-6.5	Moderate-----	0.32	3	3-6
	12-26	40-60	1.30-1.60	0.06-0.2	0.12-0.17	5.6-6.5	High---------	0.24		
	26	---	---	---	---	---	-------------	----		
Philomath-------	0-4	40-55	1.30-1.40	0.6-2.0	0.18-0.21	5.6-6.5	High---------	0.32	1	2-4
	4-19	40-60	1.30-1.40	0.06-0.2	0.14-0.16	5.6-7.3	High---------	0.24		
	19	---	---	---	---	---	-------------	----		
Hazelair--------	0-5	27-40	1.20-1.40	0.6-2.0	0.16-0.18	5.6-6.5	Moderate-----	0.32	2	2-4
	5-15	35-50	1.05-1.20	0.2-0.6	0.13-0.19	5.1-6.5	High---------	0.28		
	15-34	60-70	1.00-1.20	<0.06	0.09-0.12	5.1-6.5	High---------	0.24		
	34	---	---	---	---	---	-------------	----		
36D-------------- Dupee	0-4	15-27	1.10-1.30	0.6-2.0	0.19-0.23	5.1-6.0	Low----------	0.43	5	2-3
	4-65	35-50	1.25-1.35	0.2-0.6	0.16-0.21	4.5-5.5	Moderate-----	0.37		
37D, 37F, 37G---- Flane	0-13	15-18	0.90-1.00	0.6-2.0	0.09-0.13	4.5-5.0	Low----------	0.15	5	8-10
	13-37	35-45	1.00-1.20	0.6-2.0	0.04-0.08	4.5-5.0	Moderate-----	0.24		
	37-60	27-35	1.00-1.20	0.6-2.0	0.04-0.10	4.5-5.0	Low----------	0.24		
38F*, 38G*:										
Flane-----------	0-13	15-18	0.90-1.00	0.6-2.0	0.09-0.13	4.5-5.0	Low----------	0.15	5	8-10
	13-37	35-45	1.00-1.20	0.6-2.0	0.04-0.08	4.5-5.0	Moderate-----	0.24		
	37-60	27-35	1.00-1.20	0.6-2.0	0.04-0.10	4.5-5.0	Low----------	0.24		
Moe-------------	0-15	18-27	0.85-0.95	0.6-2.0	0.16-0.20	4.5-5.0	Low----------	0.17	5	10-12
	15-24	27-40	0.85-0.95	0.6-2.0	0.21-0.23	4.5-5.0	Moderate-----	0.28		
	24-61	35-45	0.85-1.20	0.2-0.6	0.17-0.20	4.5-5.0	Moderate-----	0.37		
39*:										
Fluvents.										
Fluvaquents.										
40G*, 41G*:										
Harrington------	0-4	18-25	1.30-1.40	2.0-6.0	0.14-0.16	5.6-6.5	Low----------	0.20	3	3-4
	4-34	25-35	1.30-1.40	2.0-6.0	0.05-0.14	5.1-6.0	Low----------	0.10		
	34	---	---	---	---	---	-------------	----		
Klickitat-------	0-9	20-27	1.20-1.40	0.6-2.0	0.08-0.10	4.5-6.0	Low----------	0.10	3	3-6
	9-20	27-33	1.20-1.40	0.6-2.0	0.06-0.10	4.5-5.5	Low----------	0.15		
	20-56	20-27	1.20-1.40	0.6-2.0	0.05-0.08	4.5-5.5	Low----------	0.10		
	56	---	---	---	---	---	-------------	----		
42H*:										
Harrington------	0-4	18-25	1.30-1.40	2.0-6.0	0.14-0.16	5.6-6.5	Low----------	0.20	3	3-4
	4-34	25-35	1.30-1.40	2.0-6.0	0.05-0.14	5.1-6.0	Low----------	0.10		
	34	---	---	---	---	---	-------------	----		
Rock outcrop.										
43B, 43D--------- Hazelair	0-5	27-40	1.20-1.40	0.6-2.0	0.16-0.18	5.6-6.5	Moderate-----	0.32	2	2-4
	5-15	35-50	1.05-1.20	0.2-0.6	0.13-0.19	5.1-6.5	High---------	0.28		
	15-34	60-70	1.00-1.20	<0.06	0.09-0.12	5.1-6.5	High---------	0.24		
	34	---	---	---	---	---	-------------	----		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cm	In/hr	In/in	pH				Pct
44E, 44F, 44G---- Henline	0-5	7-15	1.20-1.40	2.0-6.0	0.05-0.08	5.1-6.5	Low----------	0.10	2	2-4
	5-28	7-15	1.20-1.40	2.0-6.0	0.05-0.08	5.1-6.5	Low----------	0.10		
	28	---	---	---	---	---	-------------	----		
45F*, 45H*:										
Henline----------	0-5	7-15	1.20-1.40	2.0-6.0	0.05-0.08	5.1-6.5	Low----------	0.10	2	2-4
	5-28	7-15	1.20-1.40	2.0-6.0	0.05-0.08	5.1-6.5	Low----------	0.10		
	28	---	---	---	---	---	-------------	----		
Yellowstone-----	0-5	10-20	1.10-1.40	2.0-6.0	0.09-0.11	4.5-5.5	Low----------	0.10	1	4-8
	5-18	5-15	1.30-1.50	6.0-20	0.04-0.06	4.5-5.5	Low----------	0.10		
	18	---	---	---	---	---	-------------	----		
Rock outcrop.										
46--------------- Holcomb	0-7	20-25	1.30-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.28	5	3-5
	7-27	25-30	1.30-1.40	0.6-2.0	0.18-0.20	5.6-6.5	Moderate-----	0.32		
	27-47	40-50	1.30-1.40	<0.06	0.03-0.05	6.1-7.3	High---------	0.32		
	47-60	25-40	1.30-1.40	0.06-0.2	0.05-0.15	6.1-7.3	Moderate-----	0.49		
47C, 47D, 48F, 49F------------- Honeygrove	0-13	30-40	1.20-1.40	0.2-0.6	0.14-0.16	4.5-6.5	Low----------	0.17	5	5-8
	13-75	50-60	1.20-1.40	0.2-0.6	0.14-0.16	4.5-5.5	Moderate-----	0.24		
50D, 50F, 50G---- Hummington	0-8	7-18	0.50-0.85	2.0-6.0	0.20-0.30	5.1-5.5	Low----------	0.10	2	5-10
	8-36	7-18	0.50-0.85	2.0-6.0	0.20-0.30	5.1-5.5	Low----------	0.10		
	36	---	---	---	---	---	-------------	----		
51C, 51D, 51E, 51F------------- Jory	0-6	27-40	1.20-1.30	0.6-2.0	0.18-0.21	4.5-6.5	Low----------	0.17	5	3-6
	6-60	45-60	1.30-1.50	0.2-0.6	0.15-0.17	4.5-5.5	Moderate-----	0.24		
52D, 52F, 52G---- Keel	0-5	---	0.40-0.85	0.6-2.0	0.22-0.25	4.5-6.0	Low----------	0.20	3	5-10
	5-15	---	0.40-0.85	0.6-2.0	0.30-0.50	4.5-6.0	Low----------	0.32		
	15-24	---	0.75-0.90	0.6-2.0	0.15-0.20	4.5-6.0	Low----------	0.28		
	24	---	---	---	---	---	-------------	----		
53G*, 53H*:										
Kilchis----------	0-4	18-27	1.10-1.30	2.0-6.0	0.06-0.08	4.5-5.5	Low----------	0.15	1	4-8
	4-12	18-27	1.20-1.40	2.0-6.0	0.04-0.06	4.5-5.5	Low----------	0.10		
	12	---	---	---	---	---	-------------	----		
Harrington------	0-4	18-25	1.30-1.40	2.0-6.0	0.14-0.16	5.6-6.5	Low----------	0.20	3	3-4
	4-34	25-35	1.30-1.40	2.0-6.0	0.05-0.14	5.1-6.0	Low----------	0.10		
	34	---	---	---	---	---	-------------	----		
54D, 55F, 55G, 56F, 56G, 57E--- Kinney	0-15	18-27	0.85-0.95	0.6-2.0	0.16-0.22	5.1-6.5	Low----------	0.10	4	4-8
	15-35	22-30	0.90-1.20	0.6-2.0	0.15-0.20	4.5-5.5	Low----------	0.17		
	35-55	15-27	0.90-1.20	0.6-2.0	0.13-0.20	3.6-5.5	Low----------	0.15		
	55	---	---	---	---	---	-------------	----		
58F*, 58G*, 59F*, 59G*:										
Kinney----------	0-15	18-27	0.85-0.95	0.6-2.0	0.16-0.22	5.1-6.5	Low----------	0.10	4	4-8
	15-35	22-30	0.90-1.20	0.6-2.0	0.15-0.20	4.5-5.5	Low----------	0.17		
	35-55	15-27	0.90-1.20	0.6-2.0	0.13-0.20	3.6-5.5	Low----------	0.15		
	55	---	---	---	---	---	-------------	----		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cm	In/hr	In/in	pH				Pct
58F*, 58G*, 59F*, 59G*:										
Klickitat------	0-9	20-27	1.20-1.40	0.6-2.0	0.08-0.10	4.5-6.0	Low----------	0.10	3	3-6
	9-20	27-33	1.20-1.40	0.6-2.0	0.06-0.10	4.5-5.5	Low----------	0.15		
	20-56	20-27	1.20-1.40	0.6-2.0	0.05-0.08	4.5-5.5	Low----------	0.10		
	56	---	---	---	---	---	-------------	----		
60E*, 61F*, 62F*:										
Klickitat-------	0-9	20-27	1.20-1.40	0.6-2.0	0.08-0.10	4.5-6.0	Low----------	0.10	3	3-6
	9-20	27-33	1.20-1.40	0.6-2.0	0.06-0.10	4.5-5.5	Low----------	0.15		
	20-56	20-27	1.20-1.40	0.6-2.0	0.05-0.08	4.5-5.5	Low----------	0.10		
	56	---	---	---	---	---	-------------	----		
Harrington------	0-4	18-25	1.30-1.40	2.0-6.0	0.14-0.16	5.6-6.5	Low----------	0.20	3	3-4
	4-34	25-35	1.30-1.40	2.0-6.0	0.05-0.14	5.1-6.0	Low----------	0.10		
	34	---	---	---	---	---	-------------	----		
63--------------- Malabon	0-17	27-35	1.20-1.40	0.6-2.0	0.18-0.20	5.6-6.0	Moderate-----	0.15	5	4-6
	17-60	35-45	1.20-1.40	0.2-0.6	0.18-0.20	5.1-7.3	Moderate-----	0.28		
64--------------- Malabon Variant	0-14	10-15	0.85-0.95	2.0-6.0	0.15-0.18	5.6-6.0	Low----------	0.24	5	4-8
	14-55	10-15	0.85-0.95	6.0-20	0.10-0.13	5.1-6.0	Low----------	0.20		
	55-60	5-10	1.20-1.40	>20	0.05-0.09	5.1-5.5	Low----------	0.05		
65B-------------- Marcola	0-12	27-35	1.30-1.40	0.6-2.0	0.14-0.18	5.6-6.5	Moderate-----	0.20	5	4-6
	12-60	40-50	1.30-1.50	0.06-0.2	0.12-0.16	6.1-7.3	High---------	0.20		
66B-------------- McAlpin	0-25	30-40	1.20-1.40	0.6-2.0	0.19-0.21	5.1-6.0	Moderate-----	0.24	5	3-6
	25-60	40-50	1.20-1.40	0.2-0.6	0.15-0.17	5.1-6.0	High---------	0.28		
67--------------- McBee	0-19	27-35	1.20-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Moderate-----	0.28	5	4-6
	19-60	25-35	1.20-1.40	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28		
68F, 68G--------- McDuff	0-7	27-35	0.95-1.10	0.6-2.0	0.19-0.21	4.5-5.5	Moderate-----	0.24	3	4-6
	7-36	40-60	0.95-1.10	0.2-0.6	0.11-0.13	3.6-5.0	Moderate-----	0.28		
	36	---	---	---	---	---	-------------	----		
69B-------------- Minniece	0-10	27-35	1.10-1.30	0.2-0.6	0.19-0.21	5.6-6.5	Moderate-----	0.32	5	6-10
	10-36	40-55	1.10-1.30	<0.06	0.06-0.08	5.6-6.5	High---------	0.32		
	36-65	35-55	1.10-1.30	0.06-0.2	0.06-0.10	5.6-6.5	High---------	0.32		
70D, 70F--------- Moe	0-15	18-27	0.85-0.95	0.6-2.0	0.16-0.20	4.5-5.0	Low----------	0.17	5	10-12
	15-24	27-40	0.85-0.95	0.6-2.0	0.21-0.23	4.5-5.0	Moderate-----	0.28		
	24-61	35-45	0.85-1.20	0.2-0.6	0.17-0.20	4.5-5.0	Moderate-----	0.37		
71F-------------- Mulkey	0-8	10-20	0.50-0.85	2.0-6.0	0.16-0.18	3.6-5.0	Low----------	0.17	2	3-10
	8-19	10-20	0.50-0.85	2.0-6.0	0.14-0.16	4.5-5.0	Low----------	0.15		
	19-31	10-20	0.50-0.85	2.0-6.0	0.12-0.15	4.5-5.5	Low----------	0.15		
	31	---	---	---	---	---	-------------	----		
72C, 72D, 72E, 72F-------------- Nekia	0-10	30-40	1.10-1.30	0.2-0.6	0.17-0.21	5.1-6.0	Low----------	0.24	3	3-8
	10-29	40-50	1.10-1.30	0.2-0.6	0.09-0.16	4.5-5.5	Moderate-----	0.20		
	29	---	---	---	---	---	-------------	----		
73--------------- Newberg	0-19	7-15	1.20-1.40	2.0-6.0	0.12-0.15	5.6-6.5	Low----------	0.28	5	2-4
	19-28	5-15	1.20-1.40	2.0-6.0	0.12-0.15	5.6-6.5	Low----------	0.24		
	28-64	2-10	1.20-1.40	6.0-20	0.09-0.13	5.6-7.3	Low----------	0.17		
74H*. Ochrepts										

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm	In/hr	In/in	pH				Pct
75C-------------- Panther	0-7	25-35	1.20-1.30	0.2-0.6	0.19-0.21	5.6-6.5	Moderate-----	0.24	3	3-5
	7-48	60-70	1.30-1.50	<0.06	0.13-0.16	3.6-6.5	High---------	0.24		
	48	---	---	---	---	---	-------------	----		
76E, 76G---------- Peavine	0-10	30-40	1.10-1.30	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.28	3	4-8
	10-37	45-60	1.10-1.30	0.2-0.6	0.13-0.16	4.5-5.5	Moderate-----	0.28		
	37	---	---	---	---	---	-------------	----		
77A-------------- Pengra	0-10	20-27	1.30-1.40	0.2-0.6	0.19-0.21	5.6-6.5	Low----------	0.28	5	4-6
	10-29	27-35	1.30-1.40	0.2-0.6	0.19-0.21	5.6-6.5	Moderate-----	0.28		
	29-60	60-70	1.40-1.60	<0.06	0.10-0.12	6.1-7.3	High---------	0.24		
78C-------------- Philomath	0-4	40-55	1.30-1.40	0.6-2.0	0.18-0.21	5.6-6.5	High---------	0.32	1	2-4
	4-19	40-60	1.30-1.40	0.06-0.2	0.14-0.16	5.6-7.3	High---------	0.24		
	19	---	---	---	---	---	-------------	----		
79C, 79F--------- Philomath	0-4	40-55	1.30-1.40	0.6-2.0	0.14-0.17	5.6-6.5	High---------	0.28	1	2-4
	4-19	40-60	1.30-1.40	0.06-0.2	0.14-0.16	5.6-7.3	High---------	0.24		
	19	---	---	---	---	---	-------------	----		
80*. Pits										
81D, 82F, 82G, 83F------------- Quartzville	0-9	18-27	0.85-0.95	0.6-2.0	0.19-0.21	5.1-6.0	Low----------	0.28	5	4-8
	9-58	35-45	0.90-1.20	0.2-0.6	0.17-0.21	5.1-6.0	Moderate-----	0.32		
	58-65	27-40	0.90-1.20	0.2-0.6	0.17-0.21	5.1-6.0	Moderate-----	0.32		
84E, 84G--------- Ritner	0-15	30-40	1.20-1.40	0.6-2.0	0.12-0.19	5.6-6.0	Low----------	0.24	3	2-4
	15-34	35-50	1.30-1.50	0.2-0.6	0.06-0.13	5.1-6.0	Moderate-----	0.10		
	34	---	---	---	---	---	-------------	----		
85*. Riverwash										
86G*: Rock outcrop.										
Orthents.										
87--------------- Salem	0-9	15-20	1.20-1.50	0.6-2.0	0.11-0.17	5.6-6.5	Low----------	0.20	3	4-6
	9-35	25-35	1.20-1.50	0.6-2.0	0.09-0.17	6.1-7.3	Moderate-----	0.20		
	35-60	0-15	1.30-1.60	>20	0.03-0.05	6.1-6.5	Low----------	0.02		
88B, 88C--------- Salkum	0-19	27-35	---	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.28	5	2-6
	19-27	40-55	---	0.6-2.0	0.15-0.17	4.5-6.0	Low----------	0.24		
	27-60	35-50	---	0.2-0.6	0.15-0.17	4.5-6.0	Low----------	0.24		
89B-------------- Santiam	0-14	18-27	1.20-1.40	0.6-2.0	0.19-0.21	5.1-6.0	Low----------	0.43	5	2-3
	14-34	35-45	1.20-1.40	0.2-0.6	0.17-0.19	5.1-6.0	Moderate-----	0.43		
	34-60	40-50	1.40-1.50	0.06-0.2	0.14-0.16	5.1-6.0	High---------	0.28		
90B-------------- Saturn	0-10	27-35	1.00-1.20	0.6-2.0	0.15-0.20	5.1-6.0	Low----------	0.17	3	6-8
	10-36	25-35	1.10-1.30	0.6-2.0	0.10-0.16	4.5-5.5	Low----------	0.32		
	36-60	0-5	1.20-1.40	6.0-20	0.03-0.05	4.5-5.5	Low----------	0.10		
91--------------- Saturn Variant	0-10	18-25	0.85-0.95	0.6-2.0	0.16-0.21	5.1-5.5	Low----------	0.24	3	1-3
	10-24	27-35	0.90-1.20	0.6-2.0	0.16-0.21	5.6-6.0	Low----------	0.20		
	24-60	27-35	1.30-1.50	0.06-0.2	0.09-0.12	5.6-6.0	Low----------	0.10		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	G/cm	In/hr	In/in	pH				Pct
92---------------- Sifton Variant	0-9	10-15	0.85-0.95	2.0-6.0	0.11-0.15	5.6-6.0	Low-----------	0.17	2	2-4
	9-15	10-15	0.90-1.20	6.0-20	0.08-0.12	5.6-6.0	Low-----------	0.10		
	15-60	0-5	1.20-1.40	>20	0.03-0.05	5.6-6.5	Low-----------	0.05		
93C--------------- Silverton	0-11	18-25	1.20-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Low-----------	0.43	3	2-4
	11-22	25-35	1.20-1.40	0.2-0.6	0.19-0.21	5.6-6.5	Moderate------	0.32		
	22-37	40-55	1.40-1.50	0.06-0.2	0.15-0.17	5.6-6.5	Moderate------	0.15		
	37	---	---	---	---	---	--------------	----		
94B--------------- Stayton	0-13	10-18	0.70-0.85	0.6-2.0	0.19-0.21	5.1-6.0	Low-----------	0.37	1	5-8
	13	---	---	---	---	---	--------------	----		
95C, 95D, 95F---- Steiwer	0-14	20-27	1.30-1.40	0.6-2.0	0.17-0.21	5.1-6.5	Low-----------	0.32	3	2-5
	14-32	27-35	1.30-1.40	0.2-0.6	0.17-0.20	5.1-6.0	Moderate------	0.32		
	32	---	---	---	---	---	--------------	----		
96E--------------- Valsetz	0-3	20-25	1.00-1.30	2.0-6.0	0.08-0.10	4.5-5.0	Low-----------	0.15	3	4-8
	3-36	20-30	1.00-1.30	2.0-6.0	0.06-0.08	4.5-5.0	Low-----------	0.15		
	36	---	---	---	---	---	--------------	----		
97E*, 97H*:										
Valsetz----------	0-3	20-25	1.00-1.30	2.0-6.0	0.08-0.10	4.5-5.0	Low-----------	0.15	3	4-8
	3-36	20-30	1.00-1.30	2.0-6.0	0.06-0.08	4.5-5.0	Low-----------	0.15		
	36	---	---	---	---	---	--------------	----		
Yellowstone------	0-5	10-20	1.10-1.40	2.0-6.0	0.09-0.11	4.5-5.5	Low-----------	0.10	1	4-8
	5-18	5-15	1.30-1.50	6.0-20	0.04-0.06	4.5-5.5	Low-----------	0.10		
	18	---	---	---	---	---	--------------	----		
98---------------- Waldo	0-20	27-40	1.10-1.30	0.6-2.0	0.18-0.21	5.1-6.5	Moderate------	0.24	5	4-8
	20-72	40-55	1.10-1.30	0.06-0.2	0.14-0.17	5.1-6.0	High----------	0.28		
99---------------- Wapato	0-17	27-35	1.20-1.40	0.2-2.0	0.19-0.21	5.1-7.3	Moderate------	0.32	5	4-8
	17-48	20-35	1.20-1.40	0.2-0.6	0.15-0.17	5.1-6.5	Moderate------	0.32		
	48-60	40-50	1.20-1.40	0.2-0.6	0.15-0.17	5.6-6.5	Moderate------	0.28		
100--------------- Whiteson	0-11	20-27	1.20-1.40	0.6-2.0	0.18-0.20	5.6-6.5	Low-----------	0.43	2	4-8
	11-15	27-35	1.20-1.40	0.2-0.6	0.18-0.20	5.6-6.5	Moderate------	0.32		
	15-43	55-65	1.20-1.40	<0.06	0.05-0.07	6.1-7.3	High----------	0.32		
	43-60	25-35	1.20-1.40	0.2-0.6	0.10-0.11	6.6-7.8	Moderate------	0.28		
101C, 101D, 101E, 101F------------ Willakenzie	0-6	27-30	1.15-1.25	0.2-0.6	0.19-0.21	5.6-6.5	Low-----------	0.24	2	3-6
	6-22	30-35	1.15-1.30	0.2-0.6	0.15-0.18	4.5-6.0	Moderate------	0.32		
	22	---	---	---	---	---	--------------	----		
102--------------- Willamette	0-24	20-27	1.20-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Low-----------	0.32	5	3-5
	24-53	25-35	1.20-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Moderate------	0.43		
	53-60	20-30	1.20-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Low-----------	0.43		
103C-------------- Witham	0-11	40-60	1.30-1.40	0.06-0.2	0.15-0.17	5.1-6.5	High----------	0.28	3	4-6
	11-60	50-70	1.30-1.40	<0.06	0.13-0.15	5.6-6.5	High----------	0.24		
104E, 104G-------- Witzel	0-5	18-25	1.35-1.50	0.6-2.0	0.07-0.10	5.6-6.5	Low-----------	0.15	1	1-4
	5-16	27-35	1.30-1.40	0.2-0.6	0.10-0.15	5.6-6.5	Moderate------	0.15		
	16	---	---	---	---	---	--------------	----		

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm	In/hr	In/in	pH				Pct
105C-------------- Witzel Variant	0-6	12-15	0.50-0.85	0.6-2.0	0.09-0.13	5.6-6.0	Low----------	0.15	1	1-4
	6-18	15-18	0.50-0.85	0.6-2.0	0.08-0.11	5.6-6.0	Low----------	0.15		
	18	---	---	---	---	---	-------------	----		
106A, 106C------- Woodburn	0-19	10-20	1.20-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.32	5	3-5
	19-54	20-35	1.20-1.40	0.6-2.0	0.19-0.21	5.6-6.5	Moderate-----	0.43		
	54-60	15-30	1.30-1.50	0.06-0.2	0.19-0.21	5.6-6.5	Low----------	0.55		
107E, 107H------- Yellowstone	0-5	10-20	1.10-1.40	2.0-6.0	0.09-0.11	4.5-5.5	Low----------	0.10	1	4-8
	5-18	5-15	1.30-1.50	6.0-20	0.04-0.06	4.5-5.5	Low----------	0.10		
	18	---	---	---	---	---	-------------	----		
108H*:										
Zango-----------	0-5	10-20	1.25-1.40	2.0-6.0	0.06-0.10	5.1-6.0	Low----------	0.15	1	1-2
	5-13	18-30	1.30-1.50	0.6-2.0	0.03-0.06	5.1-5.5	Low----------	0.17		
	13	---	---	---	---	---	-------------	----		
Dobbins---------	0-4	15-18	0.90-1.00	0.6-2.0	0.10-0.15	4.5-5.5	Low----------	0.15	2	8-10
	4-34	35-45	1.00-1.20	0.2-0.6	0.03-0.08	5.1-5.5	Moderate-----	0.24		
	34	---	---	---	---	---	-------------	----		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1A, 1B------------ Abiqua	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
2D---------------- Acanod	C	None---------	---	---	1.5-3.0	Perched	Nov-Mar	>60	---	---	High------	High.
3----------------- Amity	D	None---------	---	---	0.5-1.5	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
4D, 5F, 6F-------- Apt	B	None---------	---	---	>6.0	---	---	>60	---	---	High------	High.
7----------------- Awbrig	D	Rare---------	---	---	+.5-1.0	Perched	Nov-May	>60	---	---	Moderate	Moderate.
8----------------- Bashaw	D	Frequent----	Long------	Dec-Apr	+1-0.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
9C, 9D, 9E, 9F---- Bellpine	C	None---------	---	---	>6.0	---	---	20-40	Soft	---	High------	High.
10E--------------- Bensley	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	High.
11F*, 11G*:												
Bensley-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	High.
Valsetz-----------	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High------	High.
12E, 13F, 13G, 14F, 14G--------- Blachly	B	None---------	---	---	>6.0	---	---	>60	---	---	High------	High.
15D--------------- Bohannon	C	None---------	---	---	>6.0	---	---	20-40	Soft	---	High------	High.
16B--------------- Briedwell	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
17C, 17E---------- Bull Run	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
18---------------- Camas	A	Occasional	Brief-----	Nov-May	>6.0	---	---	>60	---	---	Moderate	Moderate.
19---------------- Chapman	B	Rare--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
20C--------------- Chehalem	C	None--------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	---	Moderate	Moderate.
21---------------- Chehalis	B	Occasional	Brief-----	Nov-Mar	>6.0	---	---	>60	---	---	Moderate	Moderate.
22C, 22E---------- Chehulpum	C	None--------	---	---	>6.0	---	---	10-20	Soft	---	Moderate	Moderate.
23---------------- Clackamas	D	None--------	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
24---------------- Clackamas Variant	C	None--------	---	---	2.0-3.0	Perched	Nov-May	>60	---	---	Moderate	Moderate.
25---------------- Cloquato	B	Occasional	Brief-----	Nov-Mar	>6.0	---	---	>60	---	---	Moderate	Moderate.
26---------------- Coburg	C	None--------	---	---	1.5-2.5	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
27---------------- Concord	D	None--------	---	---	+.5-0.5	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
28---------------- Conser	D	Rare--------	---	---	+.5-1.5	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
29---------------- Courtney	D	Rare--------	---	---	+.5-1.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
30D, 30F, 30G----- Crabtree	C	None--------	---	---	2.0-3.0	Perched	Nov-Jun	>60	---	High-----	Moderate	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth**	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
31D, 31F, 31G----- Cruiser	B	None--------	---	---	>6.0	---	---	>60	---	High-----	High-----	High.
32D--------------- Cumley	C	None--------	---	---	2.0-3.0	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
33---------------- Dayton	D	None--------	---	---	+.5-1.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
34C, 34E, 34F----- Dixonville	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Low.
35C*, 35E*:												
Dixonville-------	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Low.
Philomath--------	D	None--------	---	---	>6.0	---	---	12-20	Soft	---	Moderate	Moderate.
Hazelair---------	D	None--------	---	---	1.0-2.0	Perched	Dec-Apr	20-40	Soft	---	Moderate	Moderate.
36D--------------- Dupee	C	None--------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	---	High-----	High.
37D, 37F, 37G----- Flane	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	High.
38F*, 38G*:												
Flane------------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	High.
Moe--------------	B	None--------	---	---	>6.0	---	---	>60	---	High-----	High-----	High.
39*:												
Fluvents.												
Fluvaquents.												
40G*, 41G*:												
Harrington-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate.
Klickitat--------	B	None--------	---	---	>6.0	---	---	40-60	Hard	---	High-----	High.
42H*:												
Harrington-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate.
Rock outcrop.												

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
43B, 43D---------- Hazelair	D	None--------	---	---	1.0-2.0	Perched	Dec-Apr	20-40	Soft	---	Moderate	Moderate.
44E, 44F, 44G----- Henline	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
45F*, 45H*:												
Henline-----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
Yellowstone------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	High.
Rock outcrop.												
46---------------- Holcomb	D	None--------	---	---	1.0-1.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
47C, 47D, 48F, 49F--------------- Honeygrove	B	None--------	---	---	>6.0	---	---	>60	---	---	High-----	High.
50D, 50F, 50G----- Hummington	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
51C, 51D, 51E, 51F--------------- Jory	B	None--------	---	---	>6.0	---	---	>60	---	---	High-----	High.
52D, 52F, 52G----- Keel	C	None--------	---	---	>6.0	---	---	20-40	Soft	High-----	High-----	High.
53G*, 53H*:												
Kilchis-----------	D	None--------	---	---	>6.0	---	---	12-20	Hard	---	High-----	High.
Harrington--------	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate.
54D, 55F, 55G, 56F, 56G, 57E---- Kinney	B	None--------	---	---	>6.0	---	---	40-60	Soft	---	High-----	High.
58F*, 58G*, 59F*, 59G*:												
Kinney------------	B	None--------	---	---	>6.0	---	---	40-60	Soft	---	High-----	High.
Klickitat--------	B	None--------	---	---	>6.0	---	---	40-60	Hard	---	High-----	High.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
60E*, 61F*, 62F*:												
Klickitat--------	B	None--------	---	---	>6.0	---	---	40-60	Hard	---	High-----	High.
Harrington-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate.
63---------------- Malabon	C	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
64---------------- Malabon Variant	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
65B--------------- Marcola	C	None--------	---	---	3.5-4.5	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
66B--------------- McAlpin	C	None--------	---	---	2.0-3.0	Apparent	Nov-Mar	>60	---	---	Moderate	Moderate.
67---------------- McBee	C	Occasional	Brief-----	Nov-May	2.0-3.0	Apparent	Nov-Apr	>60	---	---	Moderate	Moderate.
68F, 68G---------- McDuff	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	High-----	High.
69B--------------- Minniece	D	None--------	---	---	0-2.0	Perched	Nov-May	>60	---	---	Moderate	Moderate.
70D, 70F---------- Moe	B	None--------	---	---	>6.0	---	---	>60	---	High-----	High-----	High.
71F--------------- Mulkey	C	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	High-----	High.
72C, 72D, 72E, 72F-------------- Nekia	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	High-----	High.
73---------------- Newberg	B	Occasional	Brief-----	Dec-Mar	>6.0	---	---	>60	---	---	Moderate	Moderate.
74H*. Ochrepts												

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
75C--------------- Panther	D	None--------	---	---	0-1.0	Perched	Dec-Apr	40-60	Soft	---	High-----	High.
76E, 76G---------- Peavine	C	None--------	---	---	>6.0	---	---	20-40	Soft	---	High-----	High.
77A--------------- Pengra	C	None--------	---	---	1.5-2.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
78C, 79C, 79F----- Philomath	D	None--------	---	---	>6.0	---	---	12-20	Soft	---	Moderate	Moderate.
80*. Pits												
81D, 82F, 82G, 83F--------------- Quartzville	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
84E, 84G---------- Ritner	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate.
85*. Riverwash												
86G*: Rock outcrop.												
Orthents.												
87---------------- Salem	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
88B, 88C---------- Salkum	B	None--------	---	---	>6.0	---	---	>60	---	---	High-----	High.
89B--------------- Santiam	C	None--------	---	---	2.0-3.0	Perched	Dec-Mar	>60	---	---	Moderate	Moderate.
90B--------------- Saturn	B	Rare--------	---	---	3.5-5.0	Apparent	Dec-Mar	>60	---	---	High-----	High.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
91: Saturn Variant	C	None	---	---	2.0-3.0	Perched	Nov-May	>60	---	---	Moderate	Moderate.
92: Sifton Variant	A	None	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
93C: Silverton	C	None	---	---	2.5-5.0	Apparent	Nov-May	20-40	Hard	---	Moderate	Moderate.
94B: Stayton	D	None	---	---	>6.0	---	---	12-20	Hard	---	Moderate	Moderate.
95C, 95D, 95F: Steiwer	C	None	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Moderate.
96E: Valsetz	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High	High.
97E*, 97H*:												
Valsetz	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High	High.
Yellowstone	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	High.
98: Waldo	D	Occasional	Brief	Jan-Apr	0-0.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.
99: Wapato	D	Frequent	Brief	Dec-Apr	+1-1.0	Apparent	Nov-May	>60	---	---	Moderate	Moderate.
100: Whiteson	D	Frequent	Brief to long.	Dec-Apr	0-1.0	Perched	Nov-May	>60	---	---	Moderate	Moderate.
101C, 101D, 101E, 101F: Willakenzie	C	None	---	---	>6.0	---	---	20-40	Soft	---	High	High.
102: Willamette	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
103C: Witham	D	None	---	---	1.5-2.5	Perched	Nov-May	>60	---	---	Moderate	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth**	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
104E, 104G--------- Witzel	D	None---------	---	---	>6.0	---	---	12-20	Hard	---	Moderate	Moderate.
105C--------------- Witzel Variant	D	None---------	---	---	>6.0	---	---	12-20	Hard	---	Moderate	Moderate.
106A, 106C--------- Woodburn	C	None---------	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	---	Moderate	Moderate.
107E, 107H--------- Yellowstone	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	High------	High.
108H*:												
Zango-------------	D	None---------	---	---	>6.0	---	---	10-20	Hard	---	Moderate	Moderate.
Dobbins-----------	C	None---------	---	---	>6.0	---	---	20-40	Hard	---	High------	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

** A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

TABLE 15.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Abiqua	Fine, mixed, mesic Cumulic Ultic Haploxerolls
Acanod	Fine, mixed, mesic Pachic Haplumbrepts
Amity	Fine-silty, mixed, mesic Argiaquic Xeric Argialbolls
Apt	Clayey, mixed, mesic Typic Haplohumults
Awbrig	Fine, montmorillonitic, mesic Vertic Albaqualfs
Bashaw	Very-fine, montmorillonitic, mesic Typic Pelloxererts
Bellpine	Clayey, mixed, mesic Xeric Haplohumults
Bensley	Loamy-skeletal, mixed Dystric Cryochrepts
Blachly	Fine, mixed, mesic Umbric Dystrochrepts
Bohannon	Fine-loamy, mixed, mesic Typic Haplumbrepts
Briedwell	Loamy-skeletal, mixed, mesic Ultic Haploxerolls
Bull Run	Medial, mesic Umbric Vitrandepts
Camas	Sandy-skeletal, mixed, mesic Fluventic Haploxerolls
Chapman	Fine-loamy, mixed, mesic Cumulic Ultic Haploxerolls
Chehalem	Fine, mixed, mesic Cumulic Haplaquolls
Chehalis	Fine-silty, mixed, mesic Cumulic Ultic Haploxerolls
Chehulpum	Loamy, mixed, mesic, shallow Ultic Haploxerolls
Clackamas	Fine-loamy, mixed, mesic Typic Argiaquolls
Clackamas Variant	Fine, mixed, mesic Aquultic Haploxerolls
Cloquato	Coarse-silty, mixed, mesic Cumulic Ultic Haploxerolls
Coburg	Fine, mixed, mesic Pachic Ultic Argixerolls
Concord	Fine, montmorillonitic, mesic Typic Ochraqualfs
Conser	Fine, mixed, mesic Typic Argiaquolls
Courtney	Fine, montmorillonitic, mesic Abruptic Argiaquolls
Crabtree	Loamy-skeletal, mixed Aquic Cryochrepts
Cruiser	Medial Andic Cryochrepts
Cumley	Clayey, mixed, mesic Typic Haplohumults
Dayton	Fine, montmorillonitic, mesic Typic Albaqualfs
Dixonville	Fine, mixed, mesic Pachic Ultic Argixerolls
Dobbins	Clayey-skeletal, mixed, mesic Umbric Dystrochrepts
Dupee	Fine, mixed, mesic Aquultic Haploxeralfs
Flane	Clayey-skeletal, mixed, frigid Umbric Dystrochrepts
Fluvaquents	Fluvaquents
Fluvents	Fluvents
Harrington	Loamy-skeletal, mixed, mesic Typic Haplumbrepts
Hazelair	Very-fine, mixed, mesic Aquultic Haploxerolls
Henline	Loamy-skeletal, mixed Entic Cryumbrepts
Holcomb	Fine, montmorillonitic, mesic Mollic Albaqualfs
Honeygrove	Clayey, mixed, mesic Typic Haplohumults
Hummington	Medial-skeletal Dystric Cryandepts
Jory	Clayey, mixed, mesic Xeric Haplohumults
Keel	Medial Dystric Cryandepts
Kilchis	Loamy-skeletal, mixed, mesic Lithic Haplumbrepts
Kinney	Medial, mesic Andic Haplumbrepts
Klickitat	Loamy-skeletal, mixed, mesic Typic Haplumbrepts
Malabon	Fine, mixed, mesic Pachic Ultic Argixerolls
Malabon Variant	Medial, mesic Typic Dystrandepts
Marcola	Clayey-skeletal, mixed, mesic Pachic Ultic Argixerolls
McAlpin	Fine, mixed, mesic Cumulic Ultic Haploxerolls
McBee	Fine-silty, mixed, mesic Cumulic Ultic Haploxerolls
McDuff	Clayey, mixed, mesic Typic Haplohumults
Minniece	Fine, mixed, mesic Typic Umbraqualfs
Moe	Medial, frigid Andic Haplumbrepts
Mulkey	Medial Dystric Cryandepts
Nekia	Clayey, mixed, mesic Xeric Haplohumults
Newberg	Coarse-loamy, mixed, mesic Fluventic Haploxerolls
Ochrepts	Ochrepts
Orthents	Orthents
Panther	Very-fine, montmorillonitic, mesic Typic Haplaquolls
Peavine	Clayey, mixed, mesic Typic Haplohumults
Pengra	Fine-silty over clayey, mixed, mesic Typic Haplaquolls
Philomath	Clayey, montmorillonitic, mesic, shallow Vertic Haploxerolls
Quartzville	Fine, mixed, mesic Andic Haplumbrepts
Ritner	Clayey-skeletal, mixed, mesic Dystric Xerochrepts
Salem	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Ultic Argixerolls
Salkum	Clayey, kaolinitic, mesic Xeric Haplohumults
Santiam	Fine, mixed, mesic Aquultic Haploxeralfs
Saturn	Fine-loamy over fragmental, mixed, mesic Fluventic Haplumbrepts
Saturn Variant	Fine-loamy, mixed, mesic Andic Xerumbrepts

Soil name	Family or higher taxonomic class
Sifton Variant	Sandy-skeletal, mixed, mesic Andic Xerumbrepts
Silverton	Fine, mixed, mesic Pachic Ultic Argixerolls
Stayton	Medial, mesic Lithic Umbric Vitrandepts
Steiwer	Fine-loamy, mixed, mesic Ultic Haploxerolls
Valsetz	Loamy-skeletal, mixed Dystric Cryochrepts
Waldo	Fine, mixed, mesic Fluvaquentic Haplaquolls
Wapato	Fine-silty, mixed, mesic Fluvaquentic Haplaquolls
Whiteson	Fine-loamy over clayey, mixed, mesic Fluvaquentic Haplaquolls
Willakenzie	Fine-silty, mixed, mesic Ultic Haploxeralfs
Willamette	Fine-silty, mixed, mesic Pachic Ultic Argixerolls
Witham	Fine, montmorillonitic, mesic Vertic Haploxerolls
Witzel	Loamy-skeletal, mixed, mesic Lithic Ultic Haploxerolls
Witzel Variant	Medial-skeletal, mesic Lithic Dystrandepts
Woodburn	Fine-silty, mixed, mesic Aquultic Argixerolls
Yellowstone	Loamy-skeletal, mixed Lithic Cryumbrepts
Zango	Loamy-skeletal, mixed, mesic Lithic Dystrochrepts

☆U S GOVERNMENT PRINTING OFFICE 1987—482-710/40060

Accessibility Statement

This document is not accessible by screen-reader software. The U.S. Department of Agriculture is committed to making its electronic and information technologies accessible to individuals with disabilities by meeting or exceeding the requirements of Section 508 of the Rehabilitation Act (29 U.S.C. 794d), as amended in 1998. Section 508 is a federal law that requires agencies to provide individuals with disabilities equal access to electronic information and data comparable to those who do not have disabilities, unless an undue burden would be imposed on the agency. The Section 508 standards are the technical requirements and criteria that are used to measure conformance within this law. More information on Section 508 and the technical standards can be found at www.section508.gov.

If you require assistance or wish to report an issue related to the accessibility of any content on this website, please email Section508@oc.usda.gov. If applicable, please include the web address or URL and the specific problems you have encountered. You may also contact a representative from the USDA Section 508 Coordination Team.

Nondiscrimination Statement

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by:

(1) mail: U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410;

(2) fax: (202) 690-7442; or

(3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.