Reconnaissance Soil Survey of the Willamette Basin, Oregon

Segment III: Uplands Outside National Forests

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RECONNAISSANCE SOIL SURVEY OF THE WILLAMETTE BASIN, OREGON

SEGMENT III: UPLANDS OUTSIDE NATIONAL FORESTS

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I. Introduction

This report consists of general soil maps, acreage data, and supporting descriptive and interpretive information for Segment III of the Willamette River Basin (Fig. 1).

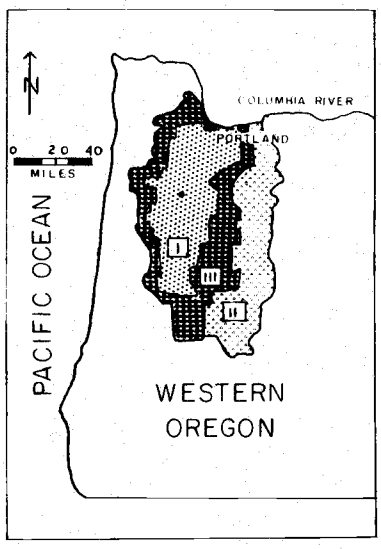

Fig. 1. Location of Segment III of the Willamette Basin General Soil Map.

Segment III comprises the forested uplands extending around the periphery of the lowlands and foothills (Segment I) of the basin, but excluding the National Forests (Segment II). The area includes about two million acres consisting primarily of commercial timber lands in private ownership or public ownership under federal and state control.

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The compilation of this report was undertaken to obtain an initial broad inventory and description of the soil resources. Detailed soil survey information is presently available only for small parts of the forested uplands in the Willamette Basin. This report, while quite general and brief, constitutes the first systematic examination of the soils throughout this important timber-producing area. The map provides soil information basic to a general natural resource inventory and is useful for broad planning of resource management. It shows the general extent and geographic distribution of soils in Segment III. This information facilitates planning of research on important soils and the extrapolation of research and management data throughout the area.

The report describes the methods used in map compilation and explains how to use the map and report. A general section on the nature and distribution of soils is included to give a broad perspective of the different soils and their landscape relationships. Each kind of soil and mapping unit is further described in a later section of the report. Other sections give soil acreages and certain forestry-oriented interpretations of the soils. One interpretation is the relative stability of the regolith once the soil mantle and landscape is disturbed by roads. Another is the relative timber productivity of the soils, based on a summary of available site-index data.

Information in the report is based on reconnaissance field observations, and unpublished data from detailed soil survey work of the cooperative soil survey in Oregon, (4) (7) (13) (19). The report was compiled by the Oregon Agricultural Experiment Station with the assistance of the United States Soil Conservation Service. Financial support for the project was through the Bureau of Land Management, United States Department of the Interior.

II. Nature and Distribution of the Soils

This section relates some of the major differences and similarities among the soils to the major soil forming factors and processes. It supplements the soils map, which shows the location and extent of the soils. Other portions of this report contain the soil use interpretations and more detailed descriptions for individual soils. This section is an attempt to give a broad perspective of all the soils in the survey area.

The nature and distribution of soils is closely related to the natural environmental and physical soil-forming factors; namely, climate, living organisms (primarily vegetation), geologic parent material, topography, and time or age of landform. A fundamental principle of soil classification and the related applied art of soil survey is that soils are natural three-dimensional bodies on the earth's surface, each of which possesses a unique set of characteristics that result from interactions among soil-forming factors (11). If all conditions are similar, as they are in the vicinities of Sweet Home and Cottage Grove, then the soils will be similar in their characteristics. If one or more soil-forming factors are different, as is the case with climate, topography, age, and parent material between Sweet Home and the 4,500 foot high Green Mountain, then the soils will be different in many respects, including their suitabilities and limitations for applied use objectives.

Discussion of genetic relationships of the soils is organized under three soil moisture-soil temperature zones. These are: xeric-mesic, moist-mesic, and moist-frigid. Note that these terms refer to soil characteristics rather than climate. However, these zones are closely related to seasonal precipitation and air temperature. Soils within any one zone may have many properties in common; however, it should be emphasized that there are also great differences between individual soils of a zone, and management practices suited for one may not be the best for the others.

The zones are defined, for soil classification purposes, by precise, quantitative limits (12). Obviously the limits between zones in nature will be more gradational than the written definitions imply. Also, empirical data on soil moisture and soil temperature is too limited to firmly fix the boundaries between zones in the field, so users of the map should consider the plotted boundaries between xeric-mesic soils and between moist-mesic and moist-frigid soils as approximations only.

Soils of the xeric-mesic zone have a prolonged moisture deficit during the dry summer period. In precise terms, the moisture content of the soil between depths of 7 and 20 inches is below the permanent wilting point for at least 60 consecutive days in at least 7 out of 10 years if the soil is typically xeric, and at least 4 or 5 out of 10 years if the soil is an intergrade between the xeric and moist or non-xeric zone. Most of the soils in this zone occur in areas receiving less than 55 inches of rainfall per year and some near the Columbia River are only considered xeric if they receive less than 45 inches annually. Generally, the xeric-mesic soils are located on foothills and in valleys with elevations below 1,000 feet, and in some

areas (again, near the Columbia River) below 500 feet. Most of the area covered in this survey is moist or non-xeric.

The term mesic refers to the soil temperature and means temperate, with winter soil temperatures significantly colder than the summer soil temperatures. Quantitatively, mesic means that the mean annual soil temperature is between 47°F and 59°F and that the winter soil temperature is at least 9°F colder than the summer soil temperature. Except for the ridges and peaks at elevations above 3,000 to 4,000 feet, most of this survey area is considered moist-mesic.

Moist-frigid soils have mean annual soil temperatures that are less than 47°F and the winter temperatures are at least 9°F colder than the summer temperatures. Moist-frigid soils are found on the higher mountains in this survey.

The three climatic-soil zones are discussed separately below. The general environment and physiography of the zone are described first, followed by brief mention of the nature and occurrence of each soil in the zone. Table 2 presents a summary of the soil groupings and their main characteristics.

Xeric-Mesic Zone

The xeric-mesic zone seldom occurs at elevations higher than 1,500 feet and is usually at elevations below 1,000 feet. A few side slopes facing south or southwest are in this zone at elevations in excess of 2,000 feet. This zone occurs in foothills at the margins of the Willamette Valley Lowlands physiographic province (17) and up to 1,500 feet in the southern portion of Lane County.

Most soils in this zone receive less than 55 inches of precipitation per year. In Columbia County, the upper limit for the xeric-mesic zone appears to be about 45 inches of precipitation. The zone has the wet winters and dry summers characteristic of the Pacific Northwest (16). Mean temperatures of 38-40°F in January, about 65°F in July, and about 54°F for the year are typical.

The native vegetation has been referred to as that of the "valley zone" (6) and represents the driest and warmest climate in the Willamette Basin. Douglas-fir occupies much of the area. Some areas support stands of Oregon white oak intermingled with Douglas-fir (14). Poison oak, madrone, and incense cedar were used as indicator plants for separating this zone from the moist-mesic zone. Other common shrubs include ocean spray, serviceberry, hazel, wild cherry, wild rose and dewberry.

Soils of this zone occurring in the uplands of the Western Cascade Mountains are developed almost exclusively in material from basic volcanic rocks. The bedrock formations are basalt and andesite flow rocks and pyroclastic tuffs, breccias, and agglomerates, all of the Miocene Epoch (17).

In the Coast Range, sedimentary rocks occupy a large portion of the area in association with basic rocks of volcanic and intrusive origin. Much of the sedimentary rock is tuffaceous sandstone and siltstone of Eocene Age. The major areas of igneous rocks are also mainly of Eocene Age. In the northern part of the Coast Range, there are areas of Oligocene and Miocene sedimentary and basic igneous rocks (17). A mantle of wind-deposited silt, of Pleistocene Age, covers ridges and footslopes in Columbia, Multnomah, and Washington counties (9).

Uplands of the xeric-mesic zone have relatively low relief and moderate slopes compared to the moist-mesic portions of the survey area. Surfaces on which many of the soils have formed are quite old and stable. Degree of soil development, as evidenced by intensity of weathering and extent of horizon differentiation is generally greater than it is in the moist-mesic and moist-frigid zones. The pronounced wet-dry seasonal precipitation pattern, characteristic of the xeric zone, apparently has enhanced horizon differentiation in these soils (12). Soils on steeper side slopes of the foothills commonly show only moderate horizon differentiation because erosional losses are more nearly keeping pace with weathering. In general, the soils of the xeric-mesic zone are less acid than those of the moist-mesic zones due to less intense leaching of bases. Some of the soils developed under grass or the open type oak vegetation tend to be very dark brown to considerable depths, whereas those developed under Dougals-fir frequently have lighter colored and thinner surface horizons.

A brief account of occurrence of the major soils of this zone follows. The survey area excludes the valley lowlands and parts of the foothills. Additional information about soils of the lowlands and foothills of the Willamette Basin and surrounding areas is presented in other reports (8, 10, 14, 15).

The dominant soils of the gently to moderately steep foothills are Jory, Nekia, and Willakenzie. Jory soils are deeper than 40 inches to hard rock; Nekia soils are less than 40 inches deep and generally more stony. Soils of both series are reddish, clayey, strongly developed and moderately to strongly acid. The Willakenzie soils are moderately deep and not as clayey as the Jory and Nekia soils. Some ridges and steep slopes are occupied by Witzel soils which are shallow, skeletal (over 35% coarse fragments by volume) and moderately fine textured. They typically have a cover of grasses with scattered oak trees. Associated with Witzel soils are finer-textured Dixonville soils on the lower, less sloping areas of the grass-oak openings.

Steeper side slopes below areas of Nekia and Jory soils often have weakly developed Hullt or Ritner soils. Hullt soils are less clayey and less red than Nekia soils. Ritner soils are more stony than Hullt or Nekia soils, but as clayey as Nekia.

Steiwer soils commonly occur on the lowest foothills adjacent to the valley floor. Steiwer soils are formed under oak-grass vegetation and are dark brown, moderately deep, slightly to moderately acid, and well drained.

The wind-deposited silty mantles on the Tualatin Hills and other ridges and footslopes in Columbia and Washington counties give rise to silty textured soils. These include the well-drained Laurelwood, the moderately well-drained Kinton and somewhat poorly drained 256 (unnamed) series. 256 soils have a very firm, brittle subsoil.

Soils of the Cazadero series occur on dissected terraces along the Sandy and Bull Run River in Clackamas County. These soils are deep, well drained, red, moderately fine textured and strongly developed.

Moist-Mesic Zone

The moist-mesic zone encompasses most of the area in this survey. It occurs between the xeric-mesic zone and the moist-frigid zone. Lower elevations generally range from 600 to 1,200 feet and the upper elevations range from 3,000 to 4,000 feet. In general, the zone is at lower elevations near the Columbia River and gradually rises towards the south.

The mean annual precipitation is generally over 45 inches in the vicinity of the Tualatin Hills and over 55 inches in other parts of the Basin. The annual precipitation increases with elevation, approaching 200 inches in the Coast Range and 140 inches in the western Cascade Mountains (6, 16). About 60 percent of the precipitation falls in the period between November and February, and 10 percent in the period between June and September. Snow amounts to less than 10 percent of the precipitation at lower elevations, but nearly 50 percent at elevations of 4,000 feet in the Cascade Mountains. Snow accumulations are small in the Coast Range (17).

Air temperatures become colder with increasing elevation. Average January temperatures are 34 to 36°F and average July temperatures are 62 to 64°F. Mean annual air temperatures range from almost 46 to 54°F.

The Douglas-fir vegetation zone (6, 13) encompasses this climatic region. Douglas-fir is the most abundant single species and occurs in pure stands over wide areas. On the more moist sites and at higher elevations, western redcedar, grand fir, and mountain hemlock are mixed with Douglas-fir. The understory includes vine maple and alder. The ground cover includes salal, red huckleberry, salmon berry, sword fern, and brackenfern.

The topography is mountainous with steep or very steep side slopes and irregular peaks and ridges. Relief and length of slope are generally greater at higher elevations (17). Broad ridges with moderate slopes and relief are common in eastern Multnomah and Clackamas counties.

Parent materials in the western Cascade Mountains are dominantly from basic rocks of volcanic origin as described for the xeric-mesic zone. Glacial deposits are apparently extensive but differ little from associated colluvial materials. The aeolian silt mantle extends into this zone in Multnomah and northern Clackamas counties.

The Coast Range is composed largely of weakly consolidated sedimentary bedrock with lesser amounts of basic volcanic and intrusive rocks (9, 17). Slopes are often unstable and mass movement is common, especially in areas with sedimentary rocks. In the northern part of the Coast Range, aeolian silt mantles the ridges and some side slopes.

Distribution of the major soils of the moist-mesic zone is discussed in the following paragraphs. Several of the soils were not known prior to this reconnaissance survey and are unnamed. They are identified by field numbers in the discussion.

The more stable landscape positions in lower portions of this zone have soils with strongly developed horizons. These include deep, red, clayey Honeygrove soils and moderately deep clayey Peavine soils. Apt soils are brown but otherwise are similar to the Honeygrove series. Olyic soils are brown, with moderately fine texture and strong profile differentiation. The following series, associated with Honeygrove and Apt soils on steeper side slopes, are less strongly developed and moderately deep. Digger soils are brown and have light colored surface layers. The unnamed 69S soils are brown and are very gravelly or cobbly. Klickitat soils are reddish and are very gravelly or cobbly.

Areas capped with loess in the Coast Range contain moderately well-drained Goble and Cascade soils. Cascade soils have very firm, brittle subsoils below 18 inches. Bull Run soils occur in the loess mantled portion of the moist-mesic zone in the northern Cascade Mountains.

Red clayey soils without strong horizon differentiation and with dark surface layers are the McCully series in the Cascade Mountains and the Blachly series in the Coast Range. Deep, red soils less clayey than McCully or Blachly are the Hembre series if the surface soils are dark, or the Marty series if the surface soils are light colored. Unnamed soils of the 21 series are red, moderately deep, and moderately fine textured with light colored surface layers. Associated with the red soils on the steep to very steep side slopes and canyon walls are soils of the very gravelly or cobbly, moderately deep, Klickitat and shallow Kilchis series.

Vast areas of brown or yellowish brown soils occur in the moist-mesic zone. These are commonly associated with sedimentary rocks in the Coast Range and with high rainfall in both mountain ranges. Fine textured brownish soils are Astoria, Melby, and Ead. Astoria soils are deep and have a dark surface. Melby soils are deep and have a light surface. Ead soils are moderately deep and have a very thick dark surface layer. Medium to moderately fine textured, brownish soils include Bohannon, Horeb, Kinney, Preacher, and Slickrock. Bohannon soils are moderately deep to rock. The others are deep. The Slickrock series has a very thick dark surface layer. Horeb soils are medium textured. Preacher and Kinney soils are moderately fine textured.

Brownish or yellowish-brown skeletal soils (with over 35% coarse fragments) include the Aschoff, 69S, 175S, 53S and 70S series. Those with dark surfaces include the deep Damsite, the moderately deep 69S, and the shallow 175S series. Skeletal soils with light colored surfaces are the moderately

deep 53S and shallow 70S series. Generally, skeletal and shallow soils are found on very steep slopes and canyon walls where the rate of geologic erosion is almost equal to the rate of soil formation.

Moist-Frigid Zone

The moist-frigid zone makes up a minor portion of the survey and is restricted to higher ridges and peaks of the Cascade Mountains and Coast Range. The lower limit of the zone ranges from about 3,000 feet in the northern part of the basin to nearly 4,000 feet at the Calapooya Divide. Most of this zone is in the Cascade Mountains. Rocky Top Mountain, located in Marion County, is the highest point in the survey and has an elevation of 5,015 feet. The tallest mountain in the Coast Range is Marys Peak with an elevation of 4,097 feet.

Very little meteorological data is available for the more mountainous parts of Oregon, but it is estimated that the mean air temperatures are about 32°F in January, 62°F in July, and 45°F for the year (16). The mean annual precipitation ranges from 80 to 140 inches in the Cascade Mountains and from 100 to nearly 200 inches in the Coast Range. Nearly half of the precipitation occurs as snow in the Cascade Mountains, but winter accumulations of snow are small in the Coast Range.

The dominant tree species in this zone is western hemlock. Other species are noble fir, silver fir, Douglas-fir, western white pine, and western redcedar. Ground cover vegetation includes rhododendron, beargrass, and blue huckleberry (6, 13).

Most areas of this zone are located on narrow ridges with very steep slopes. Some saddles and ridges are only moderately sloping.

The soils are generally developed in materials derived from basic igenous rocks (17). The underlying rocks in the Cascade Mountains are mainly volcanic flows and associated pyroclastics. The highest peaks in the Coast Range are generally capped with intrusive, medium to coarse grained basic igneous rocks.

Most soils of the moist-frigid zone are brownish or yellowish skeletal soils. In the Cascade Mountains, the deep, loamy skeletal Goodlow soils and moderately deep Henline soils occupy most of the ridges and steep sideslopes. Associated with the Henline soils are smaller areas of shallow 75S soils. The craggy peaks and crests that are dominantly barren rock outcrop were mapped as the miscellaneous land type rockland. In Marion County, the moderately coarse textured, highly leached Whetstone soils are associated with Henline soils. In Linn County, the moderately deep, nonskeletal Keel[2/] soils occupy some ridges.

Reddish soils occurring in the moist-frigid zone are the moderately fine textured, moderately deep Cruiser[2/] series.

[2/] Proposed soil series.

III. Methods and Use of the Report

This section is intended to aid the reader in making use of the soil map and the related information about the soils. It provides an explanation of what the map shows and how the descriptive and interpretive information is related to it. Limitations inherent in any small scale portrayal of soil landscapes are also indicated.

The map shows the location and extent of the important soil series and the dominant slopes within each delineation. It does not identify the soil series or slope at any particular spot in the landscape. Detailed soil surveys made at scales of four inches per mile are customarily used for this purpose. Generalization of the soil pattern to the scale of one inch per mile on topographic maps was accomplished by delineating associations of intermingled soil series and slope classes.

Map Preparation

The map was made by a reconnaissance soil survey and by generalizing from existing detailed soil surveys.

Those portions of Polk, Washington, Columbia, Multnomah, Clackamas, Linn and Lane Counties[3/] within the Segment III area were mapped by field inspection during a reconnaissance soil survey. The map delineations were made on small scale aerial photographs (1:60,000) and transferred to USGS topographic quadrangle sheets (15 minute series), or made directly on the quadrangle sheets. The individual quadrangle sheets were reduced one-half to page size maps for inclusion in the back of this report.

Those portions of Yamhill, Marion and Benton Counties within the Segment III area were generalized from unpublished, detailed soil survey field sheets compiled by the Soil Conservation Service. The detailed patterns of soils on the detailed soil maps were abstracted to a level of detail suitable for the general map and transferred to the 15 guadrangle sheets. Areas of forested upland that were mapped as part of Segment I of the Willamette Basin (10) are included on the quadrangle maps, although shown as outside of the Segment III area.

Map Areas and Soil Symbols

The general soil map shows the location and extent of many soil areas. Each delineated area is identified by a map symbol and is called a mapping unit. The symbol includes one or a combination of numbers (14-20). The mapping unit identifies the one, two, or three dominant soil series, or miscellaneous land types, that occur within the delineated area. The soil series are indicated in order of their dominance. For example, a delineation with the symbol, 14-20, has 14 (Honeygrove series) as the primary soil and 20 (Peavine series) as the secondary soil. The approximate percentage of each

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[3/] A portion of western Lane County was mapped by Joel A. Norgren, Oregon State Agricultural Experiment Station.

soil in a mapping unit is given in the mapping unit descriptions found in the report under the soil description of the primary series. Soil series that comprise less than 20 percent of a delineation are not included in the symbol.[4/]

Slope Phases

The mapping unit symbol also contains capital letters V, W, X, or Y at the end which designates the slope phase or phases. For example, the symbol (14-20 W) indicates an area of Honeygrove and Peavine soils with slopes dominantly ranging from 10 to 35 percent. The symbol (14-20 X) indicates an area of Honeygrove and Peavine soils with slopes dominantly ranging from 35 to 60 percent. The symbol (14-20 WX) indicates an area of Honeygrove and Peavine soils with about seventy percent of the delineation having slopes in the W slope range (10 to 35 percent) and about thirty percent of the area in the X slope range (35 to 60 percent). The usual range in slope for the delineation for 14-20 WX would be 10-60 percent but small areas of other slopes may be included.

Detailed soil maps have separate delineations for each slope range of significance for soil use and management.

The five slope phases and their respective symbols used on the general soil map are given below, and also in the map legend.

Slope phase symbol	Dominant slope range	
no symbol	nearly level	0- 3 percent
V	gently sloping to sloping	0-10 percent
W	sloping to steep	10-35 percent
X	steep	35-60 percent
Y	very steep	60-90+ percent

The nearly level (0-3%) slope phase is used with soil series of the few narrow stream valleys that extend into the forested uplands. The V, W, X and Y slope phases are similar in range of slope gradient to slope phases mapped in detailed surveys of forested uplands. However, they are used on the general map for a broader and less exact stratification of the soil landscapes where significant proportions of both slope phases occur in a pattern too small to delineate. The phase symbol which is listed first indicates that about seventy percent of the landscape has slope gradients defined by that symbol.

[4/] It is important to note that other soils not recognized in the map symbol could comprise a minor but significant acreage within a delineation of contrasting soils with different management requirements. The more important likely inclusions of other soils are mentioned in the mapping unit descriptions. Detailed soil surveys or on the spot identification of soils are needed for appropriate soil information about specific areas within map delineations.

Descriptions of Soil Series

Map areas of this survey identify soils in terms of slope phases of soil series. Soil series are in the lowest category (most narrowly defined) of the national system of soil classification. Each series consists of soils essentially uniform in characteristics, including texture, structure, arrangement of horizons, and color. A map delineation may include two or three soil series with contrasting properties and subsequently, with contrasting suitabilities and management requirements. Meaningful interpretations of the soils information must therefore be made for the individual soil series, (or slope phase subdivisions of them) and not for the entire mapping unit of the general soil map.

Section VIII contains a description for each soil series and miscellaneous land type. Mapping units are listed and described under the dominant series in the unit. The soil series descriptions give a brief account of the setting, major soil profile features, topography, and limitations for timber production.

Soil series are named and defined in a National Cooperative Soil Survey program. Some of the series used in this report are established within this program. Established series are fairly stable, but some refinements in definitions may result from more detailed study. Other series are recognized in the national system but have only tentative status. They are more likely to be changed or dropped. Proposed series that are not yet recognized in the national system are treated in this report as unnamed series and referred to by map symbol. Classification of the soil series into higher categories of the national system is indicated in Table 3.

Descriptions of Mapping Units

All map delineations with identical symbols contain the same major soils and have similar relationships in the landscape. These delineations with identical symbols are called mapping units. Each mapping unit is described under its dominant soil in Section VIII. For example, the mapping unit 27-29S-35S Y is described under the Hembre series (27). The mapping unit description states the soils included, gives their average proportions and major slope gradients, and indicates the typical inclusions of other soils. The setting and typical landscape occurrence of the primary series of the mapping unit (first named in symbol) is given beneath the series descriptions and is not repeated for each mapping unit. The mapping unit descriptions do describe the landscape occurrence of the secondary associated soils.

Acreage Figures

The acreage of each delineation on the map was determined by means of a calibrated grid device. The acreage of each soil series was calculated on the basis of the average proportions of the components in the delineations as given in the mapping unit descriptions. Areas mapped in terms of one series were credited entirely to that series.

The acreage for each series, subdivided by slope phase, is listed in Table 1 by county and three subbasins for Segment III lands. Acreage figures in this report are only approximations because only the major soils in each delineation were accounted for. Inclusions of other soils amounting to less than 20 percent of a delineation were tabulated with the major soils. Moreover, the proportions of the major soils used in the calculation only approximate the real proportions.

Interpretations

After the soils were classified, mapped and characterized according to standard procedures (11, 12) they were interpreted for various forest land use objectives. One interpretation presented for each soil series and slope phase is the relative stability of the disturbed regolith. Engineering behavior of each soil is evaluated and relative productivity by site index class is summarized. The soils are also rated or put into groupings for certain qualities such as erosion hazard, available water-holding capacity, permeability and effective rooting depth. The interpretative information is given in Section VII. Additional soil data relative to reforestation success are currently being developed and summarized. These interpretations will be made available in a supplementary report. For arable land, the agricultural interpretations given in the report for Segment I of the Willamette Basin (10), apply for corresponding soils.

How to Use the Map

The map is useful to learn about the major soils of an area and where they generally occur with respect to each other in the landscape. An alphabetical index to series is on page 58.

For any particular map delineation, the soil series symbolized in order of dominance and the slope range can be quickly identified by using the map legend. Those already familiar with the nature and properties of the soil series will immediately know a great deal about the capabilities, limitations, and forest management requirements of the soils in that area. Those unfamiliar with the soils can learn about the general characteristics of each soil by reading the descriptions of the series in Section VIII. The estimated acreage of each series occurring within the boundaries of the map or within a particular county or subbasin can be found in Table 1. Interpretive ratings and selected soil properties and qualities are summarized in Table 5. The engineering behavior of each series is estimated in Table 6. These descriptions and Tables 1, 5, and 6 are arranged numerically by soil map symbol in the same order as the map legend (Table 9). Tables 3, 4, 7, and 8 are arranged alphabetically by soil series. The numerical map symbol for each series is included in Table 3 to provide a quick cross-reference to the symbol for each named series.

An evaluation of individual map delineations for a specific purpose can be made by consideration of the distribution, properties, and qualities of each soil within the delineation. Generally, the characteristics of the pri-

mary soil of the mapping unit are the most important. Sometimes the secondary soils will be similar enough to have the same interpretations as the primary soil. More often, they will differ in their behavior and management requirements. Each soil has particular capabilities and requirements and should be treated accordingly.

This general map and report shows the general distribution and predominance of the kinds of soils. The information about the landscape occurrence permits some prediction of where the individual soils might be found within delineations. Detailed soil surveys are needed to stratify the soil landscape into individual soil areas with particular management requirements. It should be noted that some associated soils have intricately intermingled patterns of distribution, and use of one soil may be influenced by characteristics of another soil. Detailed soil surveys or on-site examinations are needed to evaluate this situation in any particular area. Reference is made in the soil series descriptions to the soils that generally occur in areas too small to be managed separately.

In summary, the soil association map will serve as a tool for general planning and educational purposes. It should prove helpful in extending research results and knowledge of soils to portions of Segment III without soil surveys. The map is not designed or intended to substitute for detailed soil surveys, which are required for planning at the more intensive management level.

IV. Estimated Acreage of Each Soil Series and Slope Phase

Table 1 shows the estimated acreage of each soil series, rockland, and mixed alluvial land. Acreages are tabulated by slope phases of the series. The acreages are given by subbasin and county for the entire area of Segment III. Figures are listed in thousands of acres.

Acreage figures for Segment I soil areas shown on the soils maps, but outside the Segment III survey area boundary, are not included in this report. The acreage for these lands are included in the Segment I report (10).

Figure 2 shows the location of the counties and subbasins within the Willamette Basin.

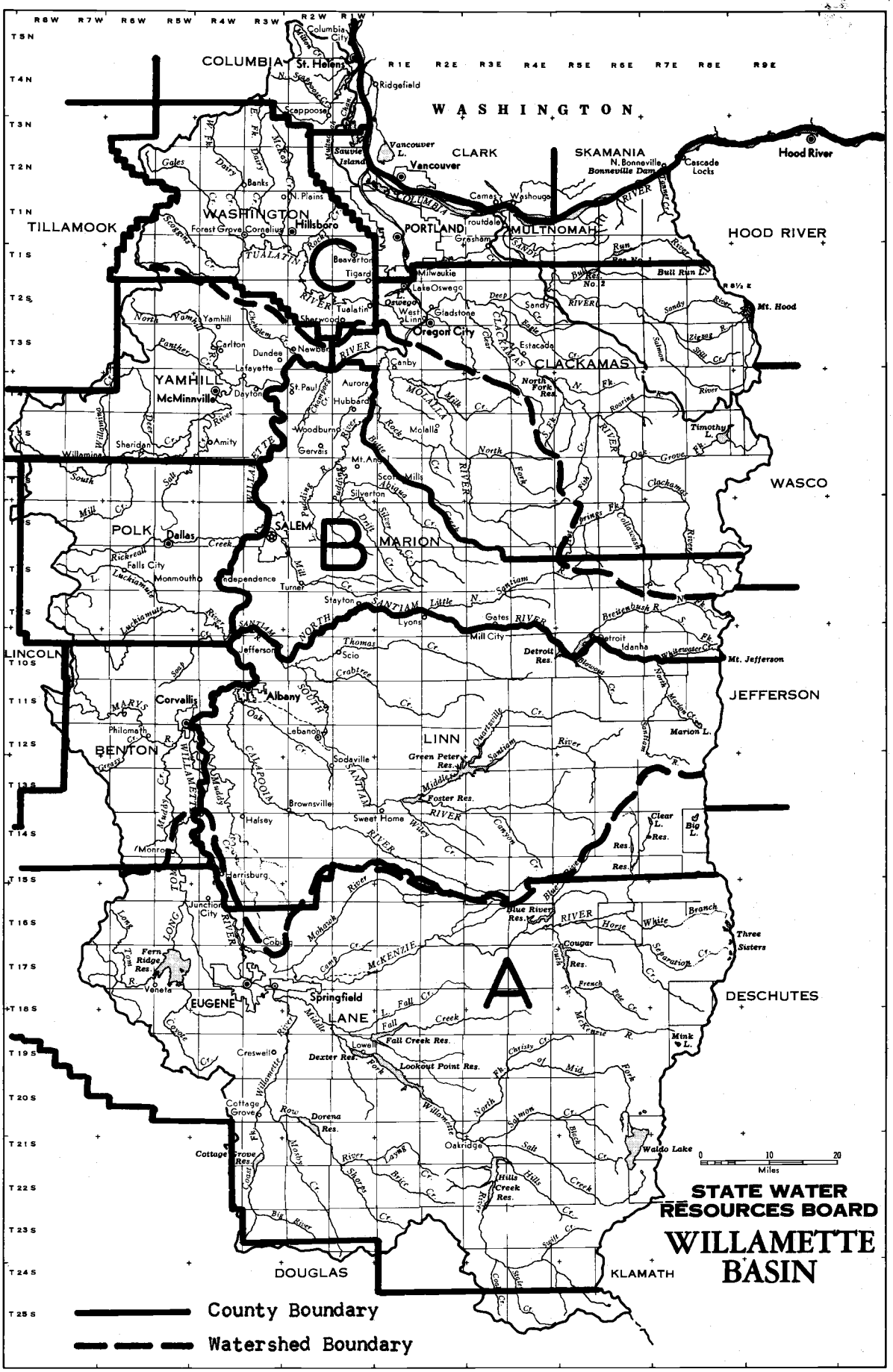

Fig. 2 Location of the Counties and Subbasins within the Willamette Basin

Table 1

Segment III

Acreage of Each Soil Series and Phase

by Subbasin and County

(in Thousands of Acres)

Phase Symbol	Soil Series or Land Type	SUBBASIN A					SUBBASIN B			
		Douglas	Benton	Lane	Linn	TOTAL	Lincoln	Benton	Lane	Linn
1	Mixed alluvial land	.1		8.4		8.5	.7	.5		2.7
10 V	Blachly									
10 W								1.1		
10 X								.7		
10 Y										
11 V	Marty									
11 W								2.6		
11 X								1.0		
11 Y								.4		.8
12	Jory			1.0		1.0				
12 V				8.3		8.3				13.0
12 W				36.7		36.7		.8	.2	23.7
12 X				6.9	.2	7.1		.3		1.2
12 Y										
12x V	Jory							1.2		
12x W	(sedimentary			2.0		2.0		1.6		
12x X	bedrock			.6		.6				
12x Y	phase)									

SUBBASIN C													
Clackamas	Marion	Polk	Yamhill	Tillamook	TOTAL	Washington	Columbia	Clackamas	Multnomah	Yamhill	Tillamook	TOTAL	Segment III TOTAL
.5		2.1	1.6		8.1	2.4	2.2		.3			4.9	21.5
		3.0			3.0								3.0
		5.5			6.6								6.6
		3.5	.3		4.5								4.5
		.6			.6								.6
						1.1	.2					1.3	1.3
		.9			3.5	9.6	.4					10.0	13.5
		.1			1.1	5.7						5.7	6.8
					1.2								1.2
													1.0
					13.0	.6	.8					1.4	22.7
.8					25.5	2.6	3.3			1.6		7.5	69.7
		.7			2.2	2.6	.8			.2		3.6	12.9
		.6			1.8								1.8
		2.0	.4		4.0	.7						.7	6.7
			.5		.5	1.5				.1		1.6	2.7
						.2						.2	1.2

TABLE 1 con't

Phase Symbol	Soil Series or Land Type	SUBBASIN A					SUBBASIN B			
		Douglas	Benton	Lane	Linn	TOTAL	Lincoln	Benton	Lane	Linn
14 V	Honeygrove			3.4		3.4				6.9
14 W				70.5	.8	71.3		3.4		32.4
14 X				7.1		7.1	1.8	3.9		12.2
14 Y										
14x V	Honeygrove									
14x W	(sedimentary			8.1		8.1		.7	.4	
14x X	bedrock			6.7		6.7		2.7	.3	
14x Y	phase			.7		.7				
15 V	Hullt			.3		.3				
15 W				1.9		1.9				
15 X				1.2		1.2				
15 Y				.1		.1				
16 W	Olyic									
16 X										
16 Y										
17 V	Cazadero									
17 W										
17 X										
19 V	Cruiser			.1		.1				.4
19 W	(proposed									1.3
19 X	name)									1.6
20 V	Peavine			1.9		1.9				3.9
20 W		1.2		64.0	.5	65.7		.7		23.4
20 X		.7		70.5	.1	71.3				23.2
20 Y		.1		9.4		9.5				4.9
20x W	Peavine			.6		.6			.1	
20x X	(sedimentary			1.4		1.4		.5	.1	
20x Y	bedrock phase)									
21 W	Unnamed									
21 X										
21 Y										
23	Nekia			2.4		2.4				
23 V				2.1		2.1			6.5	
23 W				16.8		16.8		.7	3.0	19.6
23 X				22.3	.6	22.9		.2		3.3
23 Y				.1		.1			1.3	.3

SUBBASIN C													
Clackamas	Marion	Polk	Yamhill	Tillamook	TOTAL	Washington	Columbia	Clackamas	Multnomah	Yamhill	Tillamook	TOTAL	Segment III TOTAL
		.3			7.2	1.6	2.2					3.8	14.4
		.7	.5		37.0	10.1	6.7					16.8	125.1
			.7		18.6	8.0	.7					8.7	34.4
						.2						.2	.2
		.1			.1								.1
		3.8	1.9		6.8	1.2						1.2	16.1
		.9	1.4		5.3	2.7						2.7	14.7
		.5			.5								1.2
													.3
													1.9
1.3					1.3								2.5
.6	.1				.7								.8
			9.0		9.0	4.4				.2		4.6	13.6
			14.6		14.6	11.3						11.3	25.9
			4.4		4.4	1.6						1.6	6.0
										.4		.4	.4
								.1				.1	.1
										3.8		3.8	3.8
		1.7			2.1								2.2
		.8			2.1								2.1
		1.3			2.9								2.9
					3.9		1.0					1.0	6.8
		.3	.9		25.3	1.1	4.1					5.2	96.2
			1.4		24.6	1.7	1.7					3.4	99.3
					4.9								14.4
		1.3	2.9		4.3								4.9
		.3	2.8		3.7								5.1
		.2			.2								.2
		.8			.8								.8
		7.1			7.1		1.2					1.2	8.3
		.9			.9		.2					.2	1.1
													2.4
					6.5	.4						.4	9.0
.5				.1	23.9	.8	.2			2.5		3.5	44.2
.2		.4			4.1	1.2	1.2		.1	.3		2.8	29.8
					1.6								1.7

TABLE 1 con't

Phase Symbol	Soil Series or Land Type	SUBBASIN A					SUBBASIN B			
		Douglas	Benton	Lane	Linn	TOTAL	Lincoln	Benton	Lane	Linn
23x V	Nekia			.2		.2		.8		
23x W	(sedimentary			2.1		2.1		.3		
23x X	bedrock			1.0		1.0				
23x Y	phase)									
24 W	Ritner			1.0		1.0				
24 X				1.6	.3	1.9				.1
25 W	Whetstone									
25 X										
25 Y										
26	Dixonville			.6		.6				.2
26 V				.3		.3				1.3
26 W				3.6		3.6			.9	3.9
26 X				.4		.4				1.3
26 Y				.1		.1			.1	
27 V	Hembre									.3
27 W	(basalt									6.9
27 X	bedrock									3.7
27 Y	phase)									1.4
27n W	Hembre						.2			
27n X	(diorite						1.2			.7
27n Y	bedrock						.1			.1
	phase)									
29S W	Klickitat	.9		5.3	.3	6.5			.2	.8
29S X		1.6		62.0	1.2	64.8		7.2		10.9
29S Y		3.8		44.7	.1	48.6		2.8		29.3
35S W	Kilchis							.2		
35S X				.4		.4				.2
35S Y		2.8		23.2	.1	26.1	.1			10.9
36S V	Witzel			.5		.5				.6
36S W				4.8		4.8			.8	4.1
36S X				4.0		4.0				1.7
36S Y				1.4		1.4			2.3	.4
50 V	Apt									
50 W				5.6		5.6		1.0	.4	
50 X				8.7		8.7		2.6	.4	
50 Y				1.8		1.8				

SUBBASIN C													
Clackamas	Marion	Polk	Yamhill	Tillamook	TOTAL	Washington	Columbia	Clackamas	Multnomah	Yamhill	Tillamook	TOTAL	Segment III TOTAL
		.4			1.2								1.4
		1.3	.3		1.9								4.0
			.3		.3	.1				.1		.2	1.5
						.1						.1	.1
													1.0
					.1								2.0
.1	.7				.8								.8
	9.0				9.0								9.0
	4.5				4.5								4.5
					.2								.8
					1.3								1.6
					4.8								8.4
					1.3				.1			.1	1.8
					.1								.2
					.3								.3
		.2			7.1								7.1
					3.7	1.3						1.3	5.0
		12.8			14.2	.5						.5	14.7
		6.3	6.3	1.3	14.1	1.9					.1	1.9	16.0
		25.2	13.8	1.4	42.3	15.0					.4	15.4	57.7
		4.2	2.6	1.2	8.2	.7						.7	8.9
.4					1.4		.1					.1	8.0
.6			.4		19.1		.9					.9	84.8
.2		9.0	4.4		45.7	1.3		1.1	.8			3.2	97.5
					.2								.2
					.2	.4						.4	1.0
		9.2	.1		20.3	2.0			1.3			3.3	49.7
					.6								1.1
					4.9								9.7
					1.7								5.7
					2.7								4.1
					1.4								7.0
		.4			3.4	.3						.3	12.4
													1.8

TABLE 1 con't

Phase Symbol	Soil Series or Land Type	SUBBASIN A					SUBBASIN B			
		Douglas	Benton	Lane	Linn	TOTAL	Lincoln	Benton	Lane	Linn
51 W	Astoria									
51 X										
52 W	Fendall									
52 X										
53S Y	Unnamed			9.8		9.8				15.4
54 X	Slickrock							.5		
55 V	Laurelwood									
55 W										
55 X										
56 V	Cascade									
56 W										
57 W	Preacher									
57 X							.5	4.6		
57 Y										
58 V	Kinton									
58 W										
58 X										
60 V	Melby									
60 W										
60 X										
60 Y										.4
61 W	Ead									
61 X										
62 W	Keel									1.3
62 X	(proposed name)			.1		.1				3.9
65 V	Steiwer			.7		.7				
65 W				1.4		1.4				
65 X				.1		.1				.1
65 Y				.3		.3				
66 W	Digger			1.8		1.8	.3	.3		
66 X				11.9		11.9	4.2	.7	.3	
66 Y				2.6		2.6				

SUBBASIN C													
Clackamas	Marion	Polk	Yamhill	Tillamook	TOTAL	Washington	Columbia	Clackamas	Multnomah	Yamhill	Tillamook	TOTAL	Segment III TOTAL
		4.5	9.3		13.8								13.8
		3.1	7.4		10.5								10.5
			.8		.8								.8
			4.2		4.2								4.2
					15.4								25.2
					.5								.5
						.7						.7	.7
						1.0						1.0	1.0
						1.3						1.3	1.3
						.6						.6	.6
						.3						.3	.3
		1.4			1.4	1.1	1.4					2.5	3.9
		.3			5.4	1.7	1.4					3.1	8.5
		.1			.1								.1
	.2				.2	.5	3.1					3.6	3.8
						1.4	8.6					10.0	10.0
						3.0	1.9					4.9	4.9
						.1						.1	.1
		.2	.2		.4	.7				.1		.8	1.2
		1.3	.9		2.2	.5						.5	2.7
		.9	.2		1.5								1.5
			1.0		1.0								1.0
			2.3		2.3								2.3
					1.3								1.3
					3.9								4.0
													.7
													1.4
					.1								.2
													.3
		.2			.8								2.6
		.1			5.3								17.2
													2.6

TABLE 1 con't

Phase Symbol	Soil Series or Land Type	SUBBASIN A					SUBBASIN B			
		Douglas	Benton	Lane	Linn	TOTAL	Lincoln	Benton	Lane	Linn
67	Willakenzie			.2		.2				
67 V				1.9		1.9				
67 W				13.3		13.3				
67 X				4.2		4.2				.1
67 Y				.4		.4				
69S V	Unnamed									.1
69S W				5.8	.2	6.0		.5	.1	10.4
69S X		.3		9.4	.4	10.1	.2	4.6		15.0
69S Y				10.0		10.0		1.2		7.5
70S X	Unnamed									
70S Y				11.7		11.7				14.6
75S W	Unnamed									
75S X		.3		.1		.4				
75S Y		.1		.1		.2				2.1
111	McCully			2.1		2.1				.2
111 V				1.3		1.3				1.5
111 W				22.3	3.3	25.6			.5	37.2
111 X		.4		5.7		6.1				15.5
111 Y										1.2
156	Horeb									
156 W										
156 X										
157	Kinney									.9
157 V										.8
157 W				11.6	.4	12.0			.2	21.3
157 X		.3		12.5	1.7	14.5				28.4
157 Y				5.3		5.3				4.2
158 V	Bull Run									
158 W										
158 X										
159S W	Aschoff									
159S X										.1
159S Y				.4		.4				

SUBBASIN C													
Clackamas	Marion	Polk	Yamhill	Tillamook	TOTAL	Washington	Columbia	Clackamas	Multnomah	Yamhill	Tillamook	TOTAL	Segment III TOTAL
													.2
													1.9
						3.4						3.4	16.7
					.1	2.0						2.0	6.3
													.4
					.1								.1
.2		.5			11.7	.7	.6					1.3	19.0
1.2		.2			21.2	1.1	.9	.4				2.4	33.7
1.0	.2				9.9			.9				.9	20.8
					14.6								26.3
.3					.3								.3
1.0					1.0								1.4
3.6	.5				6.2								6.4
.1	.1				.4								2.5
3.7	3.5				8.7			4.2	9.7			13.9	23.9
17.6	11.3				66.6			15.2	4.2			19.4	111.6
9.6	2.4				27.5			2.7	1.4			4.1	37.7
.2	.7				2.1								2.1
	.7				.7								.7
	4.7				4.7		.6					.6	5.3
1.8	.9				2.7								2.7
					.9								.9
2.0	4.8				7.6								7.6
21.7	9.1				32.3			6.3				6.3	70.6
12.9	6.0				47.3			1.3				1.3	63.1
1.1	.2				5.5			1.3				1.3	12.1
								2.2	2.1			4.3	4.3
								1.9	1.9			3.8	3.8
								.3	1.4			1.7	1.7
.3					.3								.3
11.3	.5				11.9								11.9
9.7	.1				9.8								10.2

TABLE 1 con't

Phase Symbol	Soil Series or Land Type	SUBBASIN A Douglas	Benton	Lane	Linn	TOTAL	SUBBASIN B Lincoln	Benton	Lane	Linn
169S W	Henline			1.2		1.2				1.2
169S X		.5		.3		.8				5.0
169S Y		.2		.7		.9				2.4
175S X	Unnamed									
175S Y										
256 V	Unnamed									
256 W										
256 X										
258 V	Goble									
258 W										
258 X										
258 Y										
259S W	Goodlow	.1		.5		.6				2.0
259S X										5.3
259S Y										3.1
R	Rockland			4.9	.1	5.0				3.5
TOTAL		14.9		682.4	10.3	707.6	9.3	50.3	18.1	460.3

SUBBASIN C													
Clackamas	Marion	Polk	Yamhill	Tillamook	TOTAL	Washington	Columbia	Clackamas	Multnomah	Yamhill	Tillamook	TOTAL	Segment III TOTAL
.5	1.3				3.0								4.2
6.3	2.0				13.3								14.1
1.5	6.0				9.9								10.8
7.5	.3				7.8								7.8
21.5	.3				21.8								21.8
							1.2					1.2	1.2
							1.2					1.2	1.2
							.2					.2	.2
						4.5	2.7					7.2	7.2
						18.7	4.1					22.8	22.8
						9.6	.3					9.9	9.9
						.8						.8	.8
1.4					3.4								4.0
2.3	.5				8.1			1.0				1.0	9.1
					3.1								3.1
.5	.7				4.7		2.1					2.1	11.8
144.0	71.5	122.0	97.8	4.0	977.3	152.1	58.2	38.9	23.1	9.3	.5	282.1	1967.0

Segment III Total

1,967,000 acres

V. Key to the Soil Series

The key shown in Table 2 was prepared so the major soil series may be quickly identified in the field. Seven steps are required to place a soil into the proper series. They are as follows:

1. Climatic zone: The observer must determine if the location is in the xeric-mesic zone, the moist-mesic zone, or the moist-frigid zone. These three zones are discussed in Section II, nature and distribution of the soils.

2. Color of the subsoil: Two general colors are listed, brown and red. Brown soils have hues of 10 YR, sometimes grading to 7.5 YR. Red soils have hues of 2.5 YR or 5 YR, sometimes grading to 7.5 YR. (Refers to Munsell color chart notations.) The moderately well drained soils have reddish, yellowish or grayish colored mottles in the lower portion of the subsoil. The somewhat poorly drained soils have reddish, yellowish, grayish or bluish colored mottles in the upper portion of the subsoil.

3. Soil depth: Depth of soil.

Very shallow and shallow	Less than 20"
Moderately deep	20 to 40"
Deep and very deep	40 to 60"+

4. Stone content: Soils which contain an average of over 35 percent gravel and stones in the subsoil by volume are classified as skeletal. The observer must determine if the soil is skeletal or non-skeletal.

5. Texture: The texture of the subsoil must be determined. The texture falls into a fine-silty, fine-loamy, coarse-silty, loamy skeletal, fine, coarse-loamy or clayey classification. These are defined by proportions of sand, silt, clay and coarse fragment content.

6. Surface soil color. The surface soil is either light colored or dark colored. A light colored surface soil is lighter than a value of 3.5 moist, or 5.5 dry, or a chroma higher than 3.5 when moist. A dark colored surface soil has a value of 2 to 3.5 moist and less than 5.5 dry and a chroma of 1 to 3.5 moist. Soils with over 20 inches of dark surface are referred to as pachic.

7. Clay skins: The presence of numerous clay skins on the ped surfaces in the subsoil affects classification. The observer must determine if the peds in the subsoil are or are not coated with clay skins.

The characteristics listed in the key are observable. Other characteristics which are not observable also affect classification. The Suborders, by definition, indicate some of these unobservable characteristics (12). The key is not intended to indicate all the criteria or to place soils into a Suborder; however, some Suborder criteria are used in the key to place a soil into the proper series.

TABLE 2

Key to the Soil Series

Suborder	Subsoil Color	Family Texture (subsoil zone)	Very Shallow and Shallow 0-20"	Moderately Deep 20-40"	Deep and Very Deep 40-60"+	Deep Moderately Well Drained	Deep Somewhat Poorly Drained
Soil Series of the Xeric-Mesic Zone							
Ochrepts	brown	fine-silty				Kinton	256
Umbrepts	red	fine-loamy			Hullt		
Xerolls	red	loamy-skeletal	Witzel				
Xerolls	brown	fine-loamy		Steiwer			
Xerolls	brown	fine		Dixonville			
Xeralfs	brown	fine-silty			Laurelwood		
Xeralfs	red	fine-loamy		Willakenzie			
Xeralfs	red	fine			Cazadero		
Humults	red	clayey		Nekia	Jory		
Ochrepts	red	clayey-skeletal			Ritner		
Soil Series of the Moist-Mesic Zone							
Ochrepts (Light colored surface, no clay skins)	brown	loamy-skeletal	70S	53S			
	brown	coarse-silty			Bull Run		
	brown	fine-loamy		Digger			
	brown	fine			Melby		
	red	fine-loamy		21			
	red	fine-loamy			Marty		
Umbrepts (Dark colored surface, no clay skins)	brown	loamy-skeletal	175S	69S	Aschoff (pachic)*		
	brown	fine-loamy			Horeb		
	brown	fine-loamy			Kinney		
	brown	fine-loamy		Bohannon	Preacher		
	brown	fine-loamy			Slickrock (pachic)*		
	brown	fine		Ead (pachic)*	Astoria		
				Fendall			
	brown	fine-silty				Goble	Cascade
	red	loamy-skeletal	Kilchis	Klickitat			
	red	fine-loamy			Hembre		
	red	fine			McCully, Blachly		
Humults (Clay skins)	brown	clayey			Apt		
	red	fine-loamy			Olyic		
	red	clayey		Peavine	Honeygrove		
Soil Series of the Moist-Frigid Zone							
Umbrepts (Dark colored surface, no clay skins)	brown	loamy-skeletal	75S	Henline	Goodlow		
	brown	coarse-loamy			Keel (proposed name)		
	red	fine			Cruiser (proposed name)		
Orthods		coarse-loamy		Whetstone			

* Over 20 inches of dark soil surface.

VI. Soil Classification

Soil series are at the lowest level in the national system of soil classification (11). The system was adopted to help soil scientists and others remember and understand the many characteristics and relationships of the wide range of soils in the United States. The placement of established and tentative series as of January 30, 1968, is presented in Table 3 along with proposed placement of the unnamed series and the two locally proposed, named series. The other named series have tentative status except for Astoria, Cascade and Kilchis which are established series. Proposed and tentative series are subject to possible modification of concept or change of name before they are established in the system of classification. The status of each named series is indicated in the series description in Section VIII.

TABLE 3

Placement of Soil Series in Classification System

Soil Series	Mapping Symbol	Subgroup	Family
Apt	50	Typic Haplohumults	clayey, mixed, mesic
Aschoff	159S	Andic Haplumbrepts	loamy-skeletal, mixed, mesic
Astoria	51	Andic Haplumbrepts	fine, mixed, mesic
Blachly	10	Typic Haplumbrepts	fine, mixed, mesic
Bull Run	158	Andic Dystrochrepts	coarse-silty, mixed, mesic
Cascade	56	Aquic Fragiumbrepts	fine-silty, mixed, mesic
Cazadero	17	Ultic Haploxeralfs	fine, mixed, mesic
Cruiser[1]	19	Typic Cryumbrepts	fine-loamy, mixed
Digger	66	Dystric Eutrochrepts	fine-loamy, mixed, mesic
Dixonville	26	Pachic Ultic Argixerolls	fine, mixed, mesic
Ead	61	Pachic Haplumbrepts	fine, mixed, mesic
Fendall	52	Typic Haplumbrepts	fine, mixed, mesic
Goble	258	Andic Fragiumbrepts	fine-silty, mixed, mesic
Goodlow	259S	Typic Cryumbrepts	loamy-skeletal, mixed
Hembre	27 & 27n	Typic Haplumbrepts	fine-loamy, mixed, mesic
Henline	169S	Entic Cryumbrepts	loamy-skeletal, mixed
Honeygrove	14 & 14x	Typic Haplohumults	clayey, mixed, mesic
Horeb	156	Typic Haplumbrepts	fine-loamy, mixed, mesic
Hullt	15	Typic Xerumbrepts	fine-loamy, mixed, mesic
Jory	12 & 12x	Xeric Haplohumults	clayey, mixed, mesic
Keel[1]	62	Typic Cryumbrepts	coarse-loamy, mixed
Kilchis	35S	Lithic Haplumbrepts	loamy-skeletal, mixed, mesic
Kinney	157	Andic Haplumbrepts	fine-loamy, mixed, mesic
Kinton	58	Typic Fragiochrepts	fine-silty, mixed, mesic
Klickitat	29S	Typic Haplumbrepts	loamy-skeletal, mixed, mesic
Laurelwood	55	Ultic Haploxeralfs	fine-silty, mixed, mesic
Marty	11	Andic Dystrochrepts	fine-loamy, mixed, mesic
McCully	111	Typic Haplumbrepts	fine, mixed, mesic
Melby	60	Typic Dystrochrepts	fine, mixed, mesic
Nekia	23 & 23x	Xeric Haplohumults	clayey, mixed, mesic
Olyic	16	Typic Haplohumults	fine-loamy, mixed, mesic
Peavine	20 & 20x	Typic Haplohumults	clayey, mixed, mesic
Preacher	57	Typic Haplumbrepts	fine-loamy, mixed, mesic
Ritner	24	Dystric Xerochrepts	clayey-skeletal, mixed, mesic
Slickrock	54	Pachic Haplumbrepts	fine-loamy, mixed, mesic
Steiwer	65	Ultic Haploxerolls	fine-loamy, mixed, mesic
Unnamed	21	Typic Dystrochrepts	fine-loamy, mixed, mesic
Unnamed	53S	Typic Dystrochrepts	loamy-skeletal, mixed
Unnamed	69S	Typic Haplumbrepts	loamy-skeletal, mixed, mesic
Unnamed	70S	Lithic Dystrochrepts	loamy-skeletal, mixed
Unnamed	75S	Lithic Cryumbrepts	loamy-skeletal, mixed
Unnamed	175S	Lithic Haplumbrepts	loamy-skeletal, mixed
Unnamed	256	Xeric Fragiochrepts	fine-silty, mixed, mesic
Whetstone	25	Typic Cryorthod	coarse-loamy, mixed, orstein
Willakenzie	67	Ultic Haploxeralfs	fine-loamy, mixed, mesic
Witzel	36S	Lithic Ultic Haploxerolls	loamy-skeletal, mixed, mesic

[1] Proposed name

VII. Interpretations

Interpretative Groups for Selected Objectives

Interpretive groups comprise soils that are similar with respect to a set of properties or qualities, or degree of limitations, that are important for some specific objective, usually some aspect of use and management. Properties not pertinent to the objective of the grouping may deviate widely among the soils in any particular group.

Interpretive groupings are useful for the stated objective. This can be misleading if used for a different objective. It is advisable to consider the differences that exist between soils in each group as well as the similarities that are the basis for the groups.

Stability of the Disturbed Regolith

Stability of the disturbed regolith is comparable to the United States Forest Service's Cutbank Stability rating (1, 2). There is a distinction between the Forest Service's stability classes and the stability classes for this report. The Forest Service defines each of the five stability classes as to the number of cutbank failures per mile for a geological unit. For this survey, three relative stability classes were made by comparing the frequency of cutbank failures for each soil phase. The stability classes used in this report are somewhat less quantitative than those of the Forest Service although they were derived in essentially the same manner. That is, the soils were rated by soils specialists who based their opinions on recorded and general field observations as to the tendency of the soils to slump or slide after being disturbed by roads. The soils specialists also correlated soil and bedrock characteristics (such as soil texture, degree of rock weathering, and degree of rock fracturing) with stability of the disturbed regolith.

The following guide can be used to correlate the two systems:

Forest Service Cutbank Stability classes	Segment III Disturbed Regolith Stability classes
Very Stable Stable	Stable
Moderately Stable	Moderately Stable
Unstable Very Unstable	Unstable

Table 4 gives the stability ratings for each slope phase of each upland soil type.

TABLE 4

Disturbed Regolith Relative Stability Classes

Soil Series	0-10% slope V	10-35% slope W	35-60% slope X	60-90%+ slope Y
Apt	Stable	Mod. Stable	Unstable	Unstable
Aschoff	Stable	Stable	Stable	Mod. Stable
Astoria	Stable	Mod. Stable	Unstable	
Blachly	Stable	Stable	Mod. Stable	Unstable
Bull Run	Stable	Stable	Mod. Stable	
Cascade	Stable	Stable	Mod. Stable	
Cazadero	Stable	Stable		
Cruiser	Stable	Stable	Stable	Mo. Stable
Digger	Stable	Mod. Stable	Unstable	Unstable
Dixonville	Stable	Stable	Mod. Stable	Unstable
Ead	Stable	Mod. Stable	Unstable	
Goble	Stable	Stable	Mod. Stable	
Goodlow	Stable	Stable	Stable	Mod. Stable
Fendall	Stable	Mod. Stable	Unstable	Unstable
Hembre (basalt) (bedrock)	Stable	Stable	Stable	Mod. Stable
Hembre (diorite) (bedrock)	Stable	Stable	Stable	Mod. Stable
Henline	Stable	Stable	Stable	Mod. Stable
Honeygrove	Stable	Stable	Mod. Stable	Unstable
Honeygrove (sedimentary bedrock)	Stable	Mod. Stable	Unstable	Unstable
Horeb	Stable	Stable	Mod. Stable	Mod. Stable
Hullt	Stable	Stable	Stable	Mod. Stable
Jory	Stable	Stable	Mod. Stable	Unstable
Jory (sedimentary bedrock)	Stable	Mod. Stable	Unstable	Unstable
Keel	Stable	Stable	Mod. Stable	Unstable
Kilchis	Stable	Stable	Stable	Mod. Stable
Kinney	Stable	Stable	Mod. Stable	Mod. Stable
Kinton	Stable	Stable	Mod. Stable	
Klickitat	Stable	Stable	Stable	Mod. Stable
Laurelwood	Stable	Stable	Mod. Stable	
Marty	Stable	Stable	Stable	Mod. Stable
McCully	Stable	Stable	Mod. Stable	Unstable
Melby	Stable	Mod. Stable	Unstable	Unstable
Nekia	Stable	Stable	Mod. Stable	Unstable
Nekia (sedimentary bedrock)	Stable	Mod. Stable	Unstable	Unstable
Olyic	Stable	Stable	Mod. Stable	Unstable
Peavine	Stable	Stable	Mod. Stable	Unstable
Peavine (sedimentary bedrock)	Stable	Mod. Stable	Unstable	Unstable
Preacher	Stable	Mod. Stable	Unstable	Unstable
Slickrock	Stable	Stable	Mod. Stable	Mod. Stable
Steiwer	Stable	Stable	Stable	Mod. Stable

Soil Series	0-10% slope	10-35% slope	35-60% slope	60-90%+ slope
Whetstone	Stable	Stable	Stable	Mod. Stable
Willakenzie	Stable	Stable	Mod. Stable	Unstable
Witzel	Stable	Stable	Stable	Mod. Stable
21	Stable	Mod. Stable	Unstable	Unstable
53S			Unstable	Unstable
69S	Stable	Stable	Mod. Stable	Unstable
70S			Unstable	Unstable
75S	Stable	Stable	Stable	Mod. Stable
175S	Stable	Stable	Stable	Mod. Stable
256	Stable	Stable	Mod. Stable	

Soil Properties, Qualities, and Interpretations

Table 5 is a numerical listing of the soils with a summary of certain properties and qualities considered important for the use and management of the soils. Most of the properties and qualities are given as relative ratings such as good, fair, and poor; or slow, medium, and rapid. These ratings represent ranges with quantitative limits for the soil properties, such as infiltration rate and available water holding capacity; but are only qualitative relative ratings for the soil qualities such as drainage class and workability for tilth. The qualities are inferred from observable or measurable properties. Most of the ratings for soil properties appearing in Table 6, however, are only estimations. They have been arrived at by comparing the observable properties of the soils in the survey area with the properties of selected bench mark soils for which such things as infiltration rate and water holding capacity have been determined. The ratings are described in the following paragraphs.

Drainage

Four classes of drainage were used. Drainage classes are influenced by run-off, permeability, and internal soil drainage. Definitions of the four classes are as follows:

Somewhat poor: Water is removed from the soil slowly enough to keep it wet for significant periods but not all the time.

Moderately good: Water is removed from the soil somewhat slowly, so that the profile is wet for a small but significant part of the time.

Good: Water is removed from the soil readily but not rapidly.

Excessive: Water is removed from the soil very rapidly.

Run-off

Five classes of run-off are recognized on the basis of the relative rate at which water is removed from the soil by flow over the surface. Run-off rates are dependent upon soil slope, texture, infiltration rate, plant cover, and intensity of rainfall. Definitions of the five classes are as follows:

Very slow: Surface water flows away very slowly and free water either covers the surface for long periods of time or enters almost immediately into the soil. Most of the water either passes through the soil or evaporates from the surface. Soils with very slow run-off rates are usually nearly level to slightly concave or have rapid infiltration rates.

Slow: Surface water flows away so slowly that free water covers the surface for a significant period of time or enters quite rapidly into the soil. Much of the water either passes through the soil or evaporates from the surface. Soils with slow rates of surface run-off are usually nearly level or have moderate to rapid infiltration rates.

Medium: Surface water flows away at such a rate that a moderate amount of the water falling on the surface enters the soil profile and free water covers the soil surface only for short periods. Sufficient water enters the profile to saturate it.

Rapid: Surface water flows rapidly over the soil surface and a small amount enters the soil and moves through the profile. Soils with rapid rates of run-off are usually moderately steep or have moderate to slow infiltration rates.

Very rapid: Surface water flows over the soil surface and only a very small amount enters and moves through the soil. Surface water runs off as fast as it falls on the soil. Soils with very rapid rates of run-off are either very steep or have slow to very slow infiltration rates or both.

Infiltration

The ratings for infiltration indicate the comparative rates at which water will enter the soil surface when the profile is unsaturated. In general, infiltration is a function of soil texture, soil structure, compaction, slope and vegetation cover. Under saturated conditions the infiltration rate is limited by the rate that water moves through the least permeable layer of soil. Infiltration ratings are very slow, slow, moderately slow, moderate, moderately rapid and rapid. Quantitative limits for the classes are essentially the same as those for the permeability classes which are discussed below.

Permeability

Soil permeability is that quality of soil that enables it to transmit water or air. It is measured in terms of rate of movement of water through a unit cross-section of saturated soil per unit of time. Six classes of permeability are recognized. Permeability for the whole soil is determined by the least permeable layer.

Descriptive term	Rate in inches per hour
Very slow	Less than 0.06
Slow	0.06 to 0.20
Moderately slow	0.20 to 0.63
Moderate	0.63 to 2.00
Moderately rapid	2.00 to 6.30
Rapid	6.30 to 10.00 +

Available Water Holding Capacity (A.W.H.C.)

Available water holding capacity refers to the total quantity of water available for plant growth that is stored in the effective root zone or the upper 60 inches of the soil profile at field capacity. It is largely dependent upon the effective depth, texture, structure, porosity, organic matter content, and coarse fragment content. In general, profiles that contain 50 percent coarse fragments by volume will only have one-half the moisture holding capacity of a comparable soil that is free of coarse fragments. The following four classes are recognized.

Descriptive term	Available water in inches
High	9 or more
Moderate	6 to 9
Low	3 to 6
Very low	Less than 3

Effective Root Zone

The effective root zone consists of either the upper 60 inches of soil or the usable soil above a layer that restricts root growth and water movement that is less than 60 inches deep. It is the part of the soil that is favorable for root growth because it retains moisture, is well aerated and does not mechanically restrict root development. The effective root zone may be thinner than the soil profile and should not be confused with depth of the soil profile as used in the soil series descriptions. A soil profile can be described as being very deep and having an effective root zone of 24 inches because of a dense clay pan occurring at that depth. A layer of gravel may restrict root growth because of lack of available water. Some of the common kinds of limiting layers that occur in soil profiles are consolidated bedrock, fractured bedrock, very slowly permeable clay layers, rapidly permeable sand and gravel layers, and hard pans. Effective root zone is expressed in inches in Table 12. Recognized class names for segments of the depth range are as follows:

Descriptive term	Depth in inches
Shallow	0 to 20
Moderately deep	20 to 40
Deep	40 to 60

Shrink-Swell Potential

The ratings for shrink-swell potential indicate in relative terms the soil volume change to be expected with changes in moisture content of the soil. Ratings are low, medium, and high. In general, soils that contain large amounts of sand and silt and small amounts of plastic clay have a low shrink-swell potential. Shrink-swell potential is an important consideration when using the soil for construction sites and as fill material (5). A single rating is given for the whole soil.

Hydrologic Groups

Soils are placed in hydrologic groups according to their potential to yield run-off. This information is used in watershed planning. Various hydrologic groups range from (A), that shed almost no precipitation to (D), that shed nearly all the precipitation.

The four hydrologic groups are defined as follows:

A: Very deep, coarse and moderately coarse textured soils that transmit water through their profile and substratum at a high rate. These soils have the lowest run-off potential.

B: Medium to fine-textured, moderately deep to very deep soils having a moderate rate of water transmission through the profile.

C: Fine-textured, deep and very deep soils that have a slow rate of water transmission through the subsoil.

D: Fine-textured, deep soils, and impervious material exposed or covered by a thin mantle of soil. These soils have the highest run-off potential.

TABLE 5

Interpretive Ratings for Selected Soil Properties and Qualities

Phase Symbol		Soil Series or Land Type	Slope Percent	Drainage	Run-off	Infiltration
10	W	Blachly	10-35	Good	Slow	Moderate
	X		35-60	Good	Slow	Moderate
11	V	Marty	0-10	Good	Slow	Mod. Rapid
	W		10-35	Good	Slow	Mod. Rapid
	X		35-60	Good	Slow	Mod. Rapid
	Y		60-90+	Good	Slow	Mod. Rapid
12	V	Jory	0-10	Good	Slow	Moderate
	W		10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
12x	V	Jory (sedimentary	0-10	Mod. Good	Medium	Moderate
	W	bedrock)	10-35	Mod. Good	Medium	Moderate
14	V	Honeygrove	0-10	Good	Slow	Moderate
	W		10-35	Good	Slow	Moderate
	X		35-60	Good	Rapid	Moderate
14x	W	Honeygrove (sedi-	10-35	Mod. Good	Slow	Moderate
	X	mentary bedrock)	35-60	Mod. Good	Medium	Moderate
	Y		60-90+	Mod. Good	Rapid	Moderate
15	X	Hullt	35-60	Good	Medium	Moderate
	Y		60-90+	Good	Rapid	Moderate
16	W	Olyic	10-35	Good	Slow	Mod. Rapid
	X		35-60	Good	Slow	Mod. Rapid
	Y		60-90+	Good	Medium	Mod. Rapid
17	V	Cazadero	0-10	Good	Slow	Mod. Rapid
	W		10-35	Good	Medium	Mod. Rapid
19	V	Cruiser	0-10	Good	Slow	Mod. Rapid
	W		10-35	Good	Slow	Mod. Rapid
	X		35-60	Good	Medium	Mod. Rapid
20	V	Peavine	0-10	Good	Slow	Moderate
	W		10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
	Y		60-90+	Good	Very Rapid	Moderate
20x	W	Peavine (sedi-	10-35	Good	Medium	Moderate
	X	mentary bedrock)	35-60	Good	Rapid	Moderate
21	W	Unnamed	10-35	Good	Slow	Moderate
	X		35-60	Good	Medium	Moderate
	Y		60-90+	Good	Rapid	Moderate
23	V	Nekia (basalt	0-10	Good	Slow	Moderate
	W	bedrock)	10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
23x	W	Nekia (sedimentary	10-35	Good	Medium	Moderate
	X	bedrock)	35-60	Good	Rapid	Moderate
25	W	Whetstone	10-35	Good	Slow	Mod. Rapid
	X		35-60	Good	Medium	Mod. Rapid
	Y		60-90+	Good	Rapid	Mod. Rapid
26	V	Dixonville	0-10	Good	Slow	Moderate
	W		10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
	Y		60-90+	Good	Very Rapid	Moderate

Permeability	A.W.H.C.	Effective Root Zone (inches)	Shrink-swell Potential	Erosion Hazard (Bare Soil Surface)	Hydrologic Group
Moderate	High	40-60+	Medium	Medium	C
Moderate	High	40-60+	Medium	High	C
Moderate	Mod. to High	40-60	Low	Low	B
Moderate	Mod. to High	40-60	Low	Low	B
Moderate	Mod. to High	40-60	Low	Medium	B
Moderate	Mod. to High	40-60	Low	High	B
Mod. Slow	High	40-60+	Medium	Low	C
Mod. Slow	High	40-60+	Medium	Medium	C
Mod. Slow	High	40-60+	Medium	High	C
Mod. Slow	High	40-60+	Medium	Low	C
Mod. Slow	High	40-60+	Medium	Medium	C
Mod. Slow	High	40-60+	Medium	Low	C
Mod. Slow	High	40-60+	Medium	Low	C
Mod. Slow	High	40-60+	Medium	Medium	C
Mod. Slow	High	40-60+	Medium	Low	C
Mod. Slow	High	40-60+	Medium	Medium	C
Mod. Slow	High	40-60+	Medium	High	C
Moderate	Moderate	40-60+	Low	Medium	B
Moderate	Moderate	40-60+	Low	High	B
Moderate	High	40-60+	Low	High	C
Moderate	High	40-60+	Low	High	C
Moderate	High	40-60+	Low	High	C
Moderate	High	40-60+	Low	Low	B
Moderate	High	40-60+	Low	Medium	B
Moderate	Moderate	40-60	Low	Low	B
Moderate	Moderate	40-60	Low	Low	B
Moderate	Moderate	40-60	Low	Medium	B
Mod. Slow	Moderate	20-40	Medium	Low	C
Mod. Slow	Moderate	20-40	Medium	Medium	C
Mod. Slow	Moderate	20-40	Medium	High	C
Mod. Slow	Moderate	20-40	Medium	High	C
Mod. Slow	Moderate	20-40	Medium	Medium	C
Mod. Slow	Moderate	20-40	Medium	High	C
Moderate	Moderate	20-40	Low	Medium	B
Moderate	Moderate	20-40	Low	Medium	B
Moderate	Moderate	20-40	Low	High	B
Mod. Slow	Moderate	20-40	Medium	Low	B
Mod. Slow	Moderate	20-40	Medium	Medium	C
Mod. Slow	Moderate	20-40	Medium	High	C
Mod. Slow	Moderate	20-40	Medium	Medium	C
Mod. Slow	Moderate	20-40	Medium	High	C
Moderate	Moderate	20-40	Low	Low	C
Moderate	Moderate	20-40	Low	Medium	C
Moderate	Moderate	20-40	Low	Medium	C
Mod. Slow	Moderate	20-40	Medium	Low	C
Mod. Slow	Moderate	20-40	Medium	Medium	C
Mod. Slow	Moderate	20-40	Medium	High	C
Mod. Slow	Moderate	20-40	Medium	High	C

TABLE 5 con't

Phase Symbol		Soil Series or Land Type	Slope Percent	Drainage	Run-off	Infiltration
27	V	Hembre (basalt	0-10	Good	Slow	Mod. Rapid
	W	bedrock)	10-35	Good	Slow	Mod. Rapid
	X		35-60	Good	Medium	Mod. Rapid
	Y		60-90+	Good	Rapid	Mod. Rapid
27n	W	Hembre (diorite	10-35	Good	Slow	Mod. Rapid
	X	bedrock)	35-60	Good	Medium	Mod. Rapid
	Y		60-90+	Good	Rapid	Mod. Rapid
29	W	Klickitat	10-35	Good	Slow	Mod. Rapid
	X		35-60	Good	Medium	Mod. Rapid
	Y		60-90+	Good	Rapid	Mod. Rapid
35S	W	Kilchis	10-35	Excessive	Medium	Mod. Rapid
	X		35-60	Excessive	Rapid	Mod. Rapid
	Y		60-90+	Excessive	Very Rapid	Mod. Rapid
36S	V	Witzel	0-10	Good	Medium	Moderate
	W		10-35	Good	Rapid	Moderate
	X		35-60	Good	Very Rapid	Moderate
	Y		60-90+	Good	Very Rapid	Moderate
50	W	Apt	10-35	Good	Slow	Moderate
	X		35-60	Good	Rapid	Moderate
51	W	Astoria	10-35	Good	Slow	Moderate
	X		35-60	Good	Medium	Moderate
52	W	Fendall	10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
53S	Y	Unnamed	60-90+	Excessive	Rapid	Mod. Rapid
54	X	Slickrock	35-60	Good	Medium	Moderate
55	V	Laurelwood	0-10	Good	Slow	Moderate
	W		10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
56	V	Cascade	0-10	Smwht Poor	Slow	Moderate
	W		10-35	Smwht Poor	Medium	Moderate
	X		35-60	Smwht Poor	Rapid	Moderate
57	W	Preacher	10-35	Good	Slow	Moderate
	X		35-60	Good	Medium	Moderate
	Y		60-90+	Good	Rapid	Moderate
58	V	Kinton	0-10	Mod. Good	Slow	Moderate
	W		10-35	Mod. Good	Medium	Moderate
	X		35-60	Mod. Good	Rapid	Moderate
60	V	Melby	0-10	Good	Slow	Moderate
	W		10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
	Y		60-90+	Good	Very Rapid	Moderate
61	W	Ead	10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
62	W	Keel	10-35	Good	Slow	Mod. Rapid
	X		35-60	Good	Medium	Mod. Rapid
R		Rockland	35+	Excessive	Very Rapid	Slow to Rapid

Permeability	A.W.H.C.	Effective Root Zone (inches)	Shrink-swell Potential	Erosion Hazard (Bare Soil Surface)	Hydrologic Group
Moderate	High	40-60	Low	Low	B
Moderate	High	40-60	Low	Low	B
Moderate	High	40-60	Low	Medium	B
Moderate	High	40-60	Low	High	B
Mod. Rapid	High	40-60	Low	Low	B
Mod. Rapid	High	40-60	Low	Medium	B
Mod. Rapid	High	40-60	Low	High	B
Mod. Rapid	Moderate	20-40	Low	Low	B
Mod. Rapid	Moderate	20-40	Low	Low	B
Mod. Rapid	Moderate	20-40	Low	High	B
Mod. Rapid	Very Low	10-20	Low	Low	D
Mod. Rapid	Very Low	10-20	Low	Low	D
Mod. Rapid	Very Low	10-20	Low	High	D
Moderate	Very Low	10-20	Low	Low	D
Moderate	Very Low	10-20	Low	Medium	D
Moderate	Very Low	10-20	Low	High	D
Moderate	Very Low	10-20	Low	High	D
Mod. Slow	Moderate	40-60+	Medium	Medium	C
Mod. Slow	Moderate	40-60+	Medium	High	C
Moderate	High	60+	Medium	High	B
Moderate	High	60+	Medium	Very High	B
Moderate	Moderate	20-40	Medium	Low	C
Moderate	Moderate	20-40	Medium	Medium	C
Rapid	Low	20-40	Low	High	B
Moderate	Moderate	40-60	Low	Medium	B
Moderate	High	60+	Low	Medium	B
Moderate	High	60+	Low	High	B
Moderate	High	60+	Low	Very High	B
Mod. Slow	High	60+	Low	Low	C
Mod. Slow	High	60+	Low	Low	C
Mod. Slow	High	60+	Low	Medium	C
Moderate	Low	40-60	Low	Low	B
Moderate	Low	40-60	Low	Medium	B
Moderate	Low	40-60	Low	High	B
Mod. Slow	High	40-60	Low	Low	C
Mod. Slow	High	40-60	Low	Medium	C
Mod. Slow	High	40-60	Low	High	C
Moderate	Moderate	40-60	Medium	Low	C
Moderate	Moderate	40-60	Medium	Medium	C
Moderate	Moderate	40-60	Medium	High	C
Moderate	Moderate	40-60	Medium	Very High	C
Moderate	Moderate	20-40	Medium	Medium	C
Moderate	Moderate	20-40	Medium	High	C
Mod. Rapid	Moderate	40-60	Low	Medium	B
Mod. Rapid	Moderate	40-60	Low	High	B
Slow to Rapid	Very Low	0-20	Low	Low to High	D

TABLE 5 con't

Phase Symbol		Soil Series or Land Type	Slope Percent	Drainage	Run-off	Infiltration
65	W	Steiwer	10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
66	W	Digger	10-35	Good	Slow	Mod. Rapid
	X		35-60	Good	Medium	Mod. Rapid
	Y		60-90+	Good	Rapid	Mod. Rapid
67	V	Willakenzie	0-10	Good	Slow	Moderate
	W		10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
	Y		60-90+	Good	Very Rapid	Moderate
69S	V	Unnamed	0-10	Good	Slow	Mod. Rapid
	W		10-35	Good	Slow	Mod. Rapid
	X		35-60	Good	Medium	Mod. Rapid
	Y		60-90+	Good	Rapid	Mod. Rapid
70S	Y	Unnamed	60-90+	Good	Very Rapid	Mod. Rapid
75S	X	Unnamed	35-60	Good	Rapid	Mod. Rapid
	Y		60-90+	Good	Very Rapid	Mod. Rapid
111	V	McCully	0-10	Good	Slow	Moderate
	W		10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
	Y		60-90+	Good	Rapid	Moderate
156	V	Horeb	0-10	Good	Slow	Moderate
	W		10-35	Good	Slow	Moderate
	X		35-60	Good	Medium	Moderate
	Y		60-90+	Good	Rapid	Moderate
157	V	Kinney	0-10	Good	Slow	Moderate
	W		10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
	Y		60-90+	Good	Rapid	Moderate
158	V	Bull Run	0-10	Good	Slow	Moderate
	W		10-35	Good	Medium	Moderate
	X		35-60	Good	Rapid	Moderate
159S	X	Aschoff	35-60	Good	Medium	Mod. Rapid
	Y		60-90+	Good	Rapid	Mod. Rapid
169S	W	Henline	10-35	Excessive	Slow	Mod. Rapid
	X		35-60	Excessive	Medium	Mod. Rapid
	Y		60-90+	Excessive	Rapid	Mod. Rapid
175S	X	Unnamed	35-60	Good	Rapid	Mod. Rapid
	Y		60-90+	Good	Very Rapid	Mod. Rapid
256	V	Unnamed	0-10	Smwht Poor	Slow	Moderate
	W		10-35	Smwht Poor	Medium	Moderate
	X		35-60	Smwht Poor	Rapid	Moderate
258	V	Goble	0-10	Mod. Good	Slow	Moderate
	W		10-35	Mod. Good	Medium	Moderate
	X		35-60	Mod. Good	Rapid	Moderate
259S	V	Goodlow	0-10	Good	Slow	Moderate
	W		10-35	Good	Slow	Moderate
	X		35-60	Good	Medium	Moderate

Permeability	A.W.H.C.	Effective Root Zone (inches)	Shrink-swell Potential	Erosion Hazard (Bare Soil Surface)	Hydrologic Group
Moderate	Low	20-40	Low	High	C
Moderate	Low	20-40	Low	Very High	C
Mod. Rapid	Low	20-40	Low	Low	B
Mod. Rapid	Low	20-40	Low	Medium	B
Mod. Rapid	Low	20-40	Low	High	B
Mod. Slow	Moderate	20-40	Low	Medium	C
Mod. Slow	Moderate	20-40	Low	High	C
Mod. Slow	Moderate	20-40	Low	Very High	C
Mod. Slow	Moderate	20-40	Low	Very High	C
Mod. Rapid	Low	20-40	Low	Low	B
Mod. Rapid	Low	20-40	Low	Low	B
Mod. Rapid	Low	20-40	Low	Medium	B
Mod. Rapid	Low	20-40	Low	High	B
Mod. Rapid	Very Low	10-20	Low	High	D
Mod. Rapid	Very Low	10-20	Low	Medium	D
Mod. Rapid	Very Low	10-20	Low	High	D
Moderate	Moderate	40-60+	Medium	Medium	B
Moderate	Moderate	40-60+	Medium	High	B
Moderate	Moderate	40-60+	Medium	Very High	B
Moderate	Moderate	40-60+	Medium	Very High	B
Moderate	Moderate	40-60	Low	Low	B
Moderate	Moderate	40-60	Low	Medium	B
Moderate	Moderate	40-60	Low	Medium	B
Moderate	Moderate	40-60	Low	High	B
Moderate	Moderate	40-60	Low	Low	B
Moderate	Moderate	40-60	L w	Medium	B
Moderate	Moderate	40-60	Low	High	B
Moderate	Moderate	40-60	Low	High	B
Moderate	High	60+	Low	Low	B
Moderate	High	60+	Low	Low	B
Moderate	High	60+	Low	Medium	B
Moderate	Moderate	40-60	Low	Medium	B
Moderate	Moderate	40-60	Low	High	B
Mod. Rapid	Moderate	20-40	Low	Low	B
Mod. Rapid	Moderate	20-40	Low	Medium	B
Mod. Rapid	Moderate	20-40	Low	High	B
Mod. Rapid	Very Low	10-20	Low	Medium	D
Mod. Rapid	Very Low	10-20	Low	High	D
Mod. Slow	High	60+	Low	Low	C
Mod. Slow	High	60+	Low	Low	C
Mod. Slow	High	60+	Low	Medium	C
Mod. Slow	High	40-60	Low	Low	C
Mod. Slow	High	40-60	Low	Medium	C
Mod. Slow	High	40-60	Low	High	C
Moderate	Moderate	40-60	Low	Low	B
Moderate	Moderate	40-60	Low	Low	B
Moderate	Moderate	40-60	Low	Medium	B

Engineering Interpretations

Engineering interpretations and estimated classification are shown in Table 6. They are listed in order of their map symbol. For the hydrological soil properties see Table 5.

Workability

The ratings for workability indicate the comparative ease of performing tillage operations on the soil without respect to soil slope. The terms used are good, fair, and poor. Workability depends primarily upon the amount and nature of the clay portions of soil and upon the coarse fragment content. Soils very high in plastic clay are rated as having poor workability. They can only be effectively tilled over a narrow range of soil moisture conditions and tend to become hard when too dry and very sticky when too wet.

Suitability for Wearing Surfaces, (Untreated) (5)

Ratings are for wearing surfaces on unsurfaced roads. The ratings are good, fair, and poor. The good rating is for roads that can withstand traffic during wet periods with a minimum of damage. The fair rating is for roads that are damaged by traffic during wet periods but are usually passable. The poor rating is for roads that are excessively damaged by traffic during wet periods and are usually unpassable.

Suitability for Compacted Earth Lining for Water Storage (5)

Ratings are good, fair or poor. Ratings are based on permeability and resistance to erosion. A good rating is the most stable and least permeable. A fair rating is either unstable or is permeable. A poor rating is for soils which are unstable and permeable. One may use a combination for effective linings. A soil which is impermeable and erosive could be covered by a soil which is permeable but not erosive.

Suitability for Drain Fields (5)

Ratings are good, fair, or poor. Soils listed with good ratings have high permeabilities. They present no problems for drainfields. Soils rated fair have moderate permeabilities. Soils rated poor are fine textured and have slow permeabilities or are shallow. Ratings apply for low slopes. Steeper slopes would be rated more severely. Slopes over 12 percent generally have severe limitations.

Classification

The AASHO classification is listed only for those soils which have had laboratory analysis. The soils under the unified classification marked with an asterisk were classified from the laboratory analysis. Those not marked with

an asterisk were classified by using soil descriptions and Table 1 in the "Guide for Interpreting Engineering Uses of Soils" (18).

Expected Road Construction Method

The expected methods are blade, rip or blast. The ratings are based on the depth to bedrock, slope and whether the bedrock is fractured, partially decomposed, or solid. A road may be built entirely with a blade on deep soils overlying decomposed or very soft rock. A ripper is required on shallow soils overlying fractured bedrock. Extensive blasting is required on shallow soils overlying solid bedrock, or deep soils on steeper slopes overlying solid bedrock. There may be local intrusions of hard diorite rock in areas which could otherwise be excavated with a blade.

Compaction Hazard for Winter Tractor Logging

Ratings are based on soil texture and coarse fragment content. Fine textured soils with few coarse fragments have the highest hazard. Medium and moderately fine textured soils without appreciable coarse fragments have a medium hazard. Loam textured soils with a high percentage of coarse fragments have a low hazard.

TABLE 6

Engineering Interpretations and Estimated Classification

Symbol	Soil Series	Workability (Surface Soil)	Suitability for: Wearing Surface (Untreated)	Suitability for: Compacted Earth Lining for Water Storage (subsoil)
10	Blachly	Poor	Poor	Poor
11	Marty	Good	Fair	Fair
12	Jory	Fair	Poor	Poor
12x	Jory (sedimentary rock phase)	Fair	Poor	Poor
14	Honeygrove	Fair	Poor	Poor
14x	Honeygrove (sedimentary rock phase)	Fair	Poor	Poor
15	Hullt	Fair	Poor	Fair
16	Olyic	Good	Poor	Fair
17	Cazadero	Good	Poor	Poor
19	Cruiser	Good	Fair	Fair
20	Peavine	Fair	Poor	Poor
20x	Peavine (sedimentary rock phase)	Fair	Poor	Poor
21	Unnamed	Fair	Poor	Fair
23	Nekia	Fair	Poor	Poor
23x	Nekia (sedimentary rock phase)	Fair	Poor	Poor
24	Ritner	Fair	Fair	Good
25	Whetstone	Fair	Fair	Fair
26	Dixonville	Fair	Low	Poor
27	Hembre (basalt rock phase)	Good	Fair	Fair
27n	Hembre (diorite rock phase)	Fair	Fair	Fair
29S	Klickitat	Poor	Good	Fair
35S	Kilchis	Poor	Good	Fair
36S	Witzel	Poor	Good	Good
50	Apt	Fair	Poor	Fair
51	Astoria	Good	Poor	Poor
52	Fendall	Good	Poor	Good
53S	Unnamed	Poor	Good	Fair
54	Slickrock	Fair	Poor	Fair
55	Laurelwood	Good	Poor	Fair
56	Cascade	Good	Poor	Fair
57	Preacher	Fair	Fair	Poor
58	Kinton	Good	Poor	Fair
60	Melby	Good	Poor	Poor
61	Ead	Poor	Poor	Fair
62	Keel	Good	Fair	Fair
65	Steiwer	Fair	Poor	Fair
66	Digger	Fair	Fair	Fair
67	Willakenzie	Fair	Poor	Fair
69S	Unnamed	Poor	Good	Fair

Suitability for: Drain Fields	AASHO Classification (Subsoil)	Unified Classification (Subsoil)	Expected Road Construction Method	Compaction Hazard for Winter Tractor Logging
Fair	A-5 (8) *	MH *	Blade	High
Good		ML	Blade	Medium
Poor	A-7-6 (10) *	ML-MH *	Blade	High
Poor		MH	Blade	High
Poor		MH	Blade	High
Poor	A-5 (10) *	MH *	Blade	High
Fair	A-5	ML	Blade	Medium
Fair	A-5 (8) *	ML *	Blade	Medium
Fair		MH	Blade	High
Good		ML	Rip-Blade	Low to Medium
Poor		MH	Rip-Blade	High
Poor	A-7-6 (20) *	MH *	Blade	High
Fair		ML	Blade	Low
Poor	A-5 (8) *	ML *	Rip-Blade	High
Poor		MH	Rip-Blade	High
Poor		GC	Blade	High
Fair	A-2-4	GM	Rip-Blade	Low
Poor		MH	Blade	High
Good	A-1-6 (0) *	ML	Blade-Blast	Low to Medium
Good	A-1-6 (0)	ML	Blade-Blast	Low to Medium
Good		SM	Blade-Blast	Low
Poor		GM	Blast	Low
Poor		GC	Blade-Blast	Low
Poor	A-5 (3) *	SM *	Blade	High
Fair	A-7-5 (11) *	MH *	Blade	High
Poor		CL	Blade	High
Good		SM	Rip-Blast	Low
Fair	A-5 (1)	SM	Blade	Medium
Fair	A-7-6 (11) *	ML-CL *	Blade	Medium to High
Poor		ML-CL	Blade	Medium to High
Good	A-7-5 (7) *	MH	Blade-Blast	Medium
Poor		ML-CL	Blade	Medium to High
Fair		MH	Blade	High
Poor		ML	Blade	High
Good		SM	Blade	Low
Fair	A-7	ML	Blade	Medium
Fair	A-4 (2) *	SM *	Blade	Medium
Fair	A-7-5 (10) *	ML *	Blade	Medium
Fair		GM	Rip-Blade-Blast	Medium

TABLE 6 con't

Symbol	Soil Series	Workability (Surface Soil)	Suitability for: Wearing Surface (Untreated)	Suitability for: Compacted Earth Lining for Water Storage (Subsoil)
70S	Unnamed	Poor	Good	Fair
75S	Unnamed	Poor	Good	Fair
111	McCully	Fair	Poor	Fair
156	Horeb	Fair	Fair	Good
157	Kinney	Fair	Fair	Fair
158	Bull Run	Good	Poor	Fair
159S	Aschoff	Poor	Fair	Fair
169S	Henline	Poor	Fair	Fair
175S	Unnamed	Poor	Good	Fair
256	Unnamed	Good	Poor	Fair
258	Goble	Good	Poor	Fair
259S	Goodlow	Poor	Fair	Fair

Suitibility for: Drain Fields	AASHO Classification (Subsoil)	Unified Classification (Subsoil)	Expected Road Construction Method	Compaction Hazard for Winter Tractor Logging
Poor		GM (oversize)	Blast	Low
Poor		GM (oversize)	Blast	Low
Fair	A-5 (7) *	ML *	Blade	High
Good	A-2-5 *	SC *	Blade	Low
Good	A-5 (4) *	SM *	Blade	Low to Medium
Fair	A-4 (0) *	SM *	Blade	Medium
Good	A-2-5 (0) *	GM (oversize)*	Blade-Blast	Low
Good	A-1 (6)	GM	Blade-Blast	Low
Poor		GM (oversize)	Blast	Low
Poor		ML-CL	Blade	Medium to High
Poor		ML-CL	Blade	Medium to High
Good		GM	Blade-Blast	Low

* Classification obtained from laboratory tests. See Table 7.

Engineering Laboratory Data

Table 7 shows the engineering laboratory data for selected soil series.

The soil series selected for engineering analysis have extensive coverage in the soil survey area from which they were collected. The soils listed in Table 7 were compiled from the Tillamook Soil Survey Report (3) and unpublished manuscripts from the Alsea (4), Yamhill (7), Marion (19), and Bull Run-Sandy (13) areas. The samples were collected by the Soil Conservation Service or the U.S. Forest Service in cooperation with the Oregon Agricultural Experiment Station. The samples were run by the Engineering Experiment Station, Oregon State University.

TABLE 7 con't

Soil Name and Location	Lab No.	Depth Inches	Moisture - Density: Maximum dry density lb. per cu. ft.	Moisture - Density: Optimum moisture per cu. ft.	Large Stones Percent	Percen 3"	1½"	3/4"	3/8"
Jory	240-138	0-5	89	30	0	-	-	-	-
SW¼ SW¼ Sec.25	240-139	28-35	99	24	0	-	-	-	-
T.8S,R.3W	240-140	50-78/	95	28	0	-	-	-	-
Kinney									
NW¼ SE¼ NE¼	240-105	0-4	66	44	0	-	-	100	99
Sec.35,T.8S	240-106	18-28	77	33	0	-	-	100	98
R.1E	240-107	49/	68	16	0	-	100	99	97
Laurelwood									
SW¼ NW¼ SE¼	240-48	0-11	98	22	0	-	-	-	100
Sec.27,T.1S	240-49R	32-43	103	20	0	-	-	-	-
R.3W	240-50	62-72/	95	20	0	-	-	-	-
McCully									
SW¼ NE¼ NW¼	240-108	0-7	68	14	0	-	-	-	-
Sec.26,T.8S	240-109	22-40	90	28	0	-	-	-	-
R.1E	240-110	82-108/	81	10	0	-	-	-	100
Nekia									
NW¼ SW¼ NW¼	240-120	0-6	89	29	0	-	-	-	-
Sec.17,T.8S	240-121	26-47	92	28	0	-	-	-	-
R.1W	240-122	56-74/	86	34	0	-	-	-	-
Olyic									
NE¼ SE¼	240-46	0-11	93	25	0	-	-	-	-
Sec.9,T.5N,R.3W	240-47	38-53	100	23	0	-	-	-	-
Preacher									
N½ NW¼ NW¼ SW¼	1667	6-14	79	36	0	-	100	99	99
Sec.24,T.15S,R.10W	1669	28-42	83	33	5	-	-	100	99
Peavine									
on Sediments	240-229	4-10	87	29	0	-	-	-	-
SW¼ SW¼ SE¼	240-230	15-26	75	36	0	-	-	-	-
Sec.10,T.3S,R.5W	240-231	64-84	76	41	0	-	-	-	-
Slickrock									
W½ SW¼ NW¼ NW¼	1711	7-14	82	34	0	-	100	99	97
Sec.4,T.15S,R.9W	1725	23-47	94	26	30	100	98	93	91
Willakenzie									
SE¼ NW¼ SW¼	240-226	4-12	90	28	0	-	-	-	-
Sec.24,T.3S	240-227	18-26	93	27	0	-	-	-	-
R.5W	240-228	36-54/	71	52	0	-	-	-	-

Mechanical Analysis												
tage Passing Sieve					Percentage Smaller Than				Liquid Limit	Plasticity Index	Classification	
#4	#10	#40	#60	#200	0.05	0.02	0.005	0.002			AASHO	Unified
-	100	69	62	52	39	24	10	6	49	15	A-7-5(6)	ML
-	100	90	84	76	72	60	44	37	42	13	A-7-6(10)	ML
-	100	81	75	68	66	56	44	33	46	12	A-7-5(8)	ML
97	90	63	55	41	38	25	8	2	63	3	A-5(2)	SM
98	97	82	76	53	46	30	12	6	49	NP	A-5(4)	ML
97	95	69	61	45	41	26	5	1	54	NP	A-5(3)	SM
99	97	91	89	86	74	44	23	12	34	2	A-4(8)	ML
-	100	98	97	94	91	60	37	27	41	16	A-7-6(11)	ML-Cl
-	100	97	96	95	91	88	58	50	47	11	A-7-5(10)	ML
100	89	56	46	32	26	16	7	2	65	NP	A-2-5(0)	SM
100	99	85	78	63	59	50	36	26	48	6	A-5(7)	ML
99	92	61	54	42	39	30	12	7	46	NP	A-5(2)	SM
-	100	93	90	80	76	63	30	19	40	12	A-6(9)	ML
-	100	90	85	73	68	57	39	29	41	8	A-5(8)	ML
100	99	84	78	66	42	51	34	27	53	77	A-5(8)	MH
100	99	81	76	69	66	46	18	14	39	2	A-4(7)	ML
-	100	96	94	88	82	63	38	28	42	8	A-5(8)	ML
99	99	82	72	47	42	32	17	13	52	7	A-5(3)	SM
99	99	95	87	60	51	35	20	13	51	12	A-7-5(7)	MH
-	100	87	83	78	74	58	34	21	49	18	A-7-5(13)	ML
-	100	86	81	76	73	63	45	33	84	42	A-7-6(20)	MH
-	100	64	55	39	37	32	17	11	67	16	A-7-5(3)	SM
95	91	79	67	37	28	18	8	5	48	8	A-5(1)	SM
91	89	81	72	46	42	34	22	15	42	10	A-5(1)	SM
-	100	90	85	76	69	56	29	13	41	10	A-5(8)	ML
-	100	98	96	89	85	71	44	27	42	14	A-7-5(10)	ML
-	100	67	57	42	42	38	24	16	68	16	A-7-5(4)	MH

Productivity

Productivity ratings for the various soil series are listed in Table 8. These data were made available by the Soil Conservation Service, U.S. Forest Service, and Oregon State University. Table 8 was prepared by compiling site data from soil survey areas in Lane, Lincoln, Benton, Yamhill, Marion, Multnomah, Clackamas, Linn, and Washington Counties.

Site data for each soil series from each survey area were averaged together and placed in the appropriate site class. Soil aspect phases were used only in the Lane County area. Site data on soils from the counties lying north of Lane County do not seem to show differences due to aspect.

Site class is defined by the range in site indices* as follows:

Site Class	Range in Site Indices
I	Higher than 185
II	156 to 185
III	126 to 155
IV	96 to 125
V	Less than 96

A + or - sign indicates the average of the site indices is at the upper or lower limits of that class respectively. A site class without a + or - sign indicates the average of the site indices is in about the middle of the class range.

* Site indices based on curves from Technical Bulletin No. 201, U. S. Department of Agriculture, 1949.

TABLE 8

Site Class Ratings by Soil Series for Various Areas

Soil Series	Mapping Unit Number	Lane County Area		Alsea Area	Yamhill County	Marion County	Benton County	Bull Run Sandy Area	Linn County	Washington County	Multnomah County
		South Slopes	North Slopes	Lincoln-Benton Counties				Multnomah-Clackamas Counties			
Apt	50.			II.			II				
Aschoff	159S							II			
Astoria	51.				II.						
Blachly	10.			II.							
Bohannon		III		III.							
Cascade	56.										
Cazadero	17.										
Cruiser	19.								III.		
Digger	66.			III.							
Dixonville	26.		IV.				IV				
Ead	61.				II.						
Fendall	52.			III.							
Goble	258.									III.	III
Goodlow	259S							IV			
Hembre	27 & 27n				II.						
Henline	169S	III Est.				III					
Honeygrove	14 & 14x	II		II.			II		II.		
Horeb	156.					II			I.		
Hullt	15	III				III					
Jory	12 & 12x		II-		III.	III	III+		II.		
Keel	62.								II.		
Kilchis	35S			IV.	IV.						
Kinney	157	III	II-			III			II.		
Kinton	58.										
Klickitat	29S	IV+	III.	III.	III.				III.		
Laurelwood	55.				II.						
Marty	11.						III				
McCully	111	III	III+			II			II.		
Melby	60.				II-					III+	
Nekia	23 & 23x		III.			III			III.		
Olyic	16.				II.						
Peavine	20 & 20x	II	II.		II.				II.		
Preacher	57.			II.							
Ritner	24	III Est.	III.				III		III.		
Slickrock	54.			II.							
Steiwer	65.				III.						
Unnamed	21										
Unnamed	53S										
Unnamed	69S										
Unnamed	70S										
Unnamed	75S										
Unnamed	175S										
Unnamed	256										
Whetstone	25.					III					
Willakenzie	67.		II-		II.						
Witzel	36S										

VIII. Description of the Soil Series and Mapping Units

A brief, general profile description is given for each soil series. The soil depth, drainage, acidity, parent material, use, and limitations for Douglas-fir production are indicated.

Detailed profile descriptions of the unnamed series follow the general descriptions. These unnamed soils have not been mapped prior to this reconnaissance survey. Detailed descriptions of the other series are on file with the Soil Conservation Service or the Oregon Agricultural Experiment Station.

The pH ranges for acidity classes are defined as follows:

Extremely acid	Less than 4.5
Very strongly acid	4.5 - 5.0
Strongly acid	5.1 - 5.5
Medium acid	5.6 - 6.0
Slightly acid	6.1 - 6.5
Neutral	6.6 - 7.3

The setting includes the topography as it appears when viewed on aerial photographs with a stereoscope, the geographic occurrence, and average precipitation.

Soils are listed in mapping units alone, as an association, or as an undifferentiated unit. A soil association is two or more soil series which are geographically associated and are not mappable separately at the scale used. The different soil series generally occur in a predictable pattern and their position on the landscape is given. Undifferentiated units in this report contain two or more soil series which are geographically associated but do not occur on the landscape in a predictable pattern. Their position on the landscape is not given. The total acreage of each mapping unit is given.

The symbols for soil series and slope phases in the mapping units are shown in order of their dominance in map delineations. The average proportions of the series are indicated in the description. In mapping units with two slope symbols, the first slope symbol indicates the dominant slope phase in the delineated areas. The second symbol indicates the slope phase in the remaining twenty to forty percent of each delineation. The slope range and dominant slope phase are given in the mapping unit descriptions.

Alphabetical Index to Descriptions of the Soil Series and Mapping Units

[1] Soil Series are tentative except as indicated.
[2] Proposed name.
[3] Established series.

Map Legend

Table 9 relates the map symbols to soil series and slope ranges. The soil series symbols are given in numerical order.

An alphabetical listing of soil series with their corresponding numerical symbols is given in Table 3.

Series and slope symbols in map delineations are shown in order of dominance. The mapping units are described in the report under the dominant series.

Using the legend, one can identify the major and secondary series and slope phases in the mapping units. The series are described in numerical order of map symbols in Section VIII and the characteristics, properties, and qualities of each series and phase are summarized in Table 5. The acreage of each soil can be obtained in Table 1, and estimates of engineering behavior for each soil are listed in Table 6. All of the above tables are arranged numerically by symbol.

The key to soil series (Table 2), classification of the soils (Table 3), relative stability of the disturbed regolith (Table 4), engineering laboratory data, and timber site-class rating (Table 8) are arranged alphabetically.

TABLE 9

Map Symbol Identification Legend Shown in Numerical Order

Map Symbol	Soil Series[1]	Map Symbol	Soil Series
1	Mixed alluvial land	50	Apt
10	Blachly	51	Astoria[3]
11	Marty	52	Fendall
12	Jory	53S	Unnamed soil
12x	Jory (sedimentary bedrock phase)	54	Slickrock
		55	Laurelwood
14	Honeygrove	56	Cascade[3]
14x	Honeygrove (sedimentary bedrock phase)	57	Preacher
		58	Kinton
15	Hullt	60	Melby
16	Olyic	61	Ead
17	Cazadero	62	Keel[2]
19	Cruiser[2]	65	Steiwer
20	Peavine	66	Digger
20x	Peavine (sedimentary bedrock phase)	67	Willakenzie
		69S	Unnamed soil
21	Unnamed soil	70S	Unnamed soil
23	Nekia	75S	Unnamed soil
23x	Nekia (sedimentary bedrock phase)	111	McCully
		156	Horeb
24	Ritner	157	Kinney
25	Whetstone	158	Bull Run
26	Dixonville	159S	Aschoff
27	Hembre (basalt bedrock phase)	169S	Henline
		175S	Unnamed soil
27n	Hembre (diorite bedrock phase)	256	Unnamed soil
		258	Goble
29S	Klickitat	259S	Goodlow
35S	Kilchis[3]	R	Rockland
36S	Witzel		

Slope Symbol	Dominant Slope Range
No Symbol	0 to 3% slopes
V	0 to 10% slopes
W	10 to 35% slopes
X	35 to 60% slopes
Y	60 to 90+% slopes

1/ Soil Series are tentative except as indicated.
2/ Proposed name.
3/ Established series.

Mixed Alluvial Land (1)

This mapping unit includes all the floodplains within the mapping area. For soils information in these areas consult the Willamette Basin General Soil Association Map and Report. Segment I (10).

Blachly (10) (tentative series)

The Blachly series consists of deep, well drained soils formed in colluvium and/or residuum. The Blachly soils occur on gently sloping to steep mountainous topography.

The Blachly soils are used for timber production and some gently sloping areas are used for pasture. These soils have a high erosion hazard if the surface cover is destroyed. They are very good for timber production.

Profile Description: Blachly clay loam

Surface soil:	0-10"	Dark brown clay loam, friable, medium acid. Ten to 12 inches thick.
Subsoil:	10-94"	Dark red clay, friable, medium acid. Fifty-three to 108 inches thick.
Substrata:	94"+	Bedrock.

Setting:

The topography on which the Blachly soils occur is represented by broad ridges, long uniform slopes, and a low density dissection pattern lacking sharp draws and ridges. Many areas are relatively smooth, gently sloping to sloping and occur at the same elevation (800-1200 ft.). These "old surfaces" are adjacent to the bottomlands or are on the lower 1/3 of the mountain slopes. Some areas of these soils almost resemble the Astoria soil series. These areas are easily separated from adjacent, steeper areas that have sharper ridges and a more dense dissection pattern. These soils are located in the Coast Range portion of the survey area. Annual precipitation ranges from 80 to 100 inches.

Mapping Units:

10 W	4,700 acres, 10 to 35% slopes.
10 X	3,600 acres, 35 to 60% slopes.
10 VW	4,600 acres, 0 to 35% slopes. Mostly 0 to 10% slopes. Predominantly deep Blachly soils. Minor inclusions of moderately deep Peavine soils occur at random. Small areas of Hembre soils are found on some of the ridges. About ten percent inclusions of deep, fine textured Honeygrove soils occur at random.

Marty (11) (tentative series)

The Marty series consists of deep, well drained soils formed in colluvium. The Marty soils are on gently sloping to steep ridges and smooth slopes.

The Marty soils are used for timber production and have no serious limitations.

Profile Description: Marty gravelly loam

Surface soil:	0-11"	Dark brown gravelly loam, friable, strongly acid.
Subsoil:	11-42"	Dark brown clay loam, friable, very strongly acid.
Substrata:	42-60"+	Dark brown loam.

Setting:

The topography on which the Marty soil occurs is represented by broad ridges, long uniform slopes, and a sparse dissection pattern which lacks sharp draws and ridges. Many areas are relatively smooth, gently sloping to sloping. Annual precipitation ranges from 60 to 100 inches. The Marty soils occur in the Coast Range portion of the survey area.

Mapping Units:

11 W	5,200 acres, 10 to 35% slopes.
11 X	4,900 acres, 35 to 60% slopes.
11 WV	4,100 acres, 0 to 35% slopes. Mostly 10 to 35% slopes.
11 WX	4,900 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. Predominantly deep Marty soils. Minor inclusions of deep Blachly or Honeygrove soils occur on the rounded ridges running parallel to the dissections. Inclusions of Hembre soils occur on the dissection escarpments.

Jory (12) Over basic igneous rock (tentative series)
Jory (12x) Over sedimentary rock

The Jory series consists of very deep, well drained soils formed in colluvium from basic igneous and sedimentary rocks. The Jory soils are on sloping to steep foothills.

The Jory soils are used for orchards and timber production. The main limitation for timber production is the dry summer period.

Profile Descriptions: Jory silty clay

Surface soil:	0-19"	Dark reddish brown silty clay, friable, medium acid. Sixteen to 26 inches thick.
Subsoil:	19-100"+	Dark reddish brown clay, very firm, strongly acid.

Setting:

The topography on which the Jory soils occur is represented by broad ridge tops, rounded ridge noses and long sideslopes having a moderately dense dissection pattern. Jory soils occur on the footslopes of the Coast Range and Cascade Mountains. Annual precipitation ranges from 40 to 60 inches. These soils are distributed throughout the survey area.

Mapping Units:

12-23 W	76,800 acres, 10 to 35% slopes.
12-23 X	3,100 acres, 35 to 60% slopes.
12-23 VW	29,800 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.
12-23 XW	3,900 acres, 10 to 60% slopes. Mostly 35 to 60% slopes. Associations of about sixty percent deep Jory soils with about forty percent moderately deep Nekia soils. Nekia soils occur on the ridge tops and the ridge noses. Inclusions of the deep skeletal Ritner soils occur at random. Inclusions of moderately deep Dixonville soils are located on the slopes at lower elevations.
12-58 W	1,400 acres, 10 to 35% slopes. 2,300 acres, 0 to 35% slopes. Mostly 10 to 35% slopes. Undifferentiated units containing about sixty percent deep Jory soils and about forty percent deep Kinton soils. These soils are intermingled and have no predictable pattern. Inclusions are of the Laurelwood and Nekia soils.
12-23-15 W	5,700 acres, 10 to 35% slopes.
12-23-15 XW	1,700 acres, 10 to 60% slopes. Mostly 35 to 60% slopes. Associations containing about forty percent deep Jory soils, about thirty percent moderately deep Nekia soils and about thirty percent deep Hullt soils. The Nekia soils occur on the rounded ridge noses. The Hullt soils occur in slumps on the broad ridge tops. Inclusions of Steiwer and Willakenzie may be expected in the unit. The Steiwer and Willakenzie soils occur on low rolling hills adjacent to the valley terraces.

12-23-55 VW — 2,000 acres, 0 to 35% slopes. Mostly 0 to 10% slopes. An association of about fifty percent deep Jory soils, about thirty percent moderately deep Nekia soils and about twenty percent deep Laurelwood soils. Nekia soils occur on the ridge tops and on the ridge noses and on the short, steep escarpments. The Laurelwood soils occur on long convex slopes. The complex slope pattern consists of low mounds with about twenty feet of relief and covers 3 to 10 acres.

12-23-26 W — 2,500 acres, 10 to 35% slopes. An association of about forty percent deep Jory soils, about thirty percent moderately deep Nekia soils and about thirty percent moderately deep Dixonville soils. Nekia soils occur on the ridge tops and the ridge noses and on the steeper sideslopes. The Dixonville soils occur on the broad convex slopes at lower elevations. Inclusions of Ritner soils occur on steep escarpments.

12-24-23 W — 900 acres, 10 to 35% slopes. An association of about forty percent deep Jory soils, about thirty percent deep skeletal Ritner soils and about thirty percent moderately deep Nekia soils. Ritner soils occur on the short, steep escarpment slopes and in areas with large slumps. The Nekia soils occur on the broad ridge noses and ridge tops.

12x W — 1,100 acres, 10 to 35% slopes. Predominantly deep Jory soils derived from sedimentary rocks. Inclusions of moderately deep Nekia soils are intermingled.

12x-23x W — 4,800 acres, 35 to 60% slopes.

12x-23x X — 1,700 acres, 35 to 60% slopes.

12x-23x VW — 3,000 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.

12x-23x WV — 3,000 acres, 0 to 35% slopes. Mostly 10 to 35% slopes. Associations of about sixty percent deep Jory soils with about forty percent moderately deep Nekia soils. Nekia soils occur on the ridge tops and the ridge noses. Both soils were derived from sedimentary rocks. Small inclusions of skeletal Ritner soils may occur on the steep, short sideslopes adjacent to the drainages.

12x-23x-67 W — 800 acres, 10 to 35% slopes. An association containing about forty percent deep Jory soils, about thirty percent moderately deep Nekia soils and about thirty percent moderately deep Willakenzie soils. Nekia soils occur predominantly on the ridge tops and the ridge noses. The Willakenzie soils occur on rolling hills adjacent to the valley terraces.

Honeygrove (14) Over basic igneous rock (tentative series)
Honeygrove (14x) Over sedimentary rock

The Honeygrove series consists of deep, well drained soils formed in colluvium from basic igneous and sedimentary rock. The Honeygrove soils are on sloping to very steep mountainous slopes.

The Honeygrove soils are used for timber and orchards. The Honeygrove soils have no serious limitations except in local areas which have a dense subsoil that limits root penetration.

Profile Description: Honeygrove clay (14x)

Surface soil: 0-12" Dark reddish brown clay, friable, slightly acid.
Subsoil: 12-105"Dark red clay, friable, strongly acid.
Substrata: 105"+ Variegated brown and yellow shale fragments.

Setting:

The topography on which the Honeygrove soils occur is represented by broad ridges, rounded ridge noses and sideslopes with a moderately dense dissection pattern. The Honeygrove series occur higher in elevation than the Jory soils and are distributed throughout the survey area. Annual precipitation ranges from 60 to 90 inches.

Mapping Units:

14 W	4,800 acres, 10 to 35% slopes.
14 X	6,800 acres, 35 to 60% slopes.
14 VW	4,000 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.
14 WV	1,800 acres, 0 to 35% slopes. Mostly 10 to 35% slopes. Predominantly deep Honeygrove soils. Minor inclusions of moderately deep Peavine soils occur throughout the unit.
14-20 W	152,700 acres, 10 to 35% slopes.
14-20 X	5,600 acres, 35 to 60% slopes.
14-20 VW	18,600 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.
14-20 WV	7,100 acres, 0 to 35% slopes. Mostly 10 to 35% slopes.
14-20 WX	9,300 acres, 10 to 60% slopes. Mostly 10 to 35% slopes.
14-20 XW	4,000 acres, 10 to 60% slopes. Mostly 35 to 60% slopes. Associations of about seventy percent deep Honeygrove soils with about thirty percent moderately deep Peavine soils. The Peavine soils occur at the crests of the rolling hills and at random. Inclusions of Jory and Nekia soils may be expected at lower elevations.
14-50 X	700 acres, 35 to 60% slopes. An undifferentiated unit containing about seventy percent deep Honeygrove soils and about thirty percent deep Apt soils. The overall topography of the mapping unit is gently sloping to steep. A few areas have very steep escarpments. Minor inclusions of deep Hullt soils occur at random. Inclusions of Marty or Hembre soils occur on the ridge noses and the very steep escarpments. Small areas of moderately deep Peavine soils occur at random.

14-258 WV	6,100 acres, 0 to 35% slopes.
14-258 WX	1,100 acres, 10 to 60% slopes. Associations of about sixty percent deep Honeygrove soils with about forty percent deep Kinton soils. The Kinton soils occur on the rounded ridges.
14x W	2,800 acres, 10 to 35% slopes.
14x X	2,900 acres, 35 to 60% slopes. Predominantly deep Honeygrove soils which were derived from sedimentary rocks. Minor inclusions of moderately deep Peavine soils occur on some of the ridge noses.
14x-20x W	4,300 acres, 10 to 35% slopes.
14x-20x X	1,200 acres, 35 to 60% slopes. Associations of about sixty percent deep Honeygrove soils, which were derived from sedimentary rocks, with about forty percent moderately deep Peavine soils, which were derived from sedimentary rocks. The Peavine soils occur on the ridge tops and the ridge noses. Also, areas of Peavine soils may be found on the steeper sideslopes. Inclusions of the McCully soils may occur at higher elevations.
14x-50 W	10,000 acres, 10 to 35% slopes. An undifferentiated unit containing about sixty percent deep Honeygrove soils, which were derived from sedimentary rocks, and about forty percent deep Apt soils. Inclusions of deep Marty soils may be expected on the long convex ridge noses.
14x-50-66 W	1,400 acres, 10 to 35% slopes. An undifferentiated unit containing about forty percent deep Honeygrove soils which were derived from sedimentary rocks, about thirty percent deep Apt soils, and about thirty percent deep Digger soils.

Hullt (15) (tentative series)

The Hullt series consists of deep well drained soils formed in colluvium from basic igneous and sedimentary rocks. The Hullt soils are on sloping to very steep mountainous slopes.

The Hullt soils are used for timber production. The dry summer period is the most serious limitation.

Profile Description: Hullt clay loam

Surface soil:	0-15"	Dark brown clay loam, friable, medium acid. Twelve to 18 inches thick.
Subsoil:	15-55"	Reddish brown silty clay loam, firm, very strongly acid. Forty to 58 inches thick.
Substrata:	55-65"	Variegated strong brown and pinkish gray weathered sandstone.

Setting:

The topography upon which the Hullt series occur is represented by moderately sharp ridges and ridge noses with a dense, shallow dissection pattern. Annual precipitation ranges from 45 to 60 inches.

Mapping Units:

15 X 1,000 acres, 35 to 60% slopes.

15 Y 600 acres, 60 to 90%+ slopes. Predominantly deep Hullt soils. Inclusions of deep Jory soils and moderately deep Nekia soils occur at random.

15-23 X 900 acres, 35 to 60% slopes. An association of about seventy percent deep Hullt soils with about thirty percent moderately deep Nekia soils. Nekia soils occur on the ridge noses at lower elevations.

15-23-12XY 2,700 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. An undifferentiated unit containing about forty percent deep Hullt soils, about thirty percent moderately deep Nekia soils, and about thirty percent deep Jory soils. Inclusions of Klickitat soils may be expected on the steep escarpments.

15-67 Y 1,300 acres, 60 to 90% slopes. An undifferentiated unit containing about 70 percent deep Hullt soils with about thirty percent moderately deep Willakenzie soils.

Olyic (16) (tentative series)

The Olyic series consists of deep, well-drained soils formed in colluvium. The Olyic soils are on sloping to very steep mountainous slopes.

The Olyic soils are used for timber with the more gentle slopes adjacent to bottomlands used for pasture and orchards. The Olyic soils have no serious limitations for timber production.

Profile Description: Olyic silt loam.

Surface soil:	0-15"	Dark reddish brown silt loam, friable, medium acid. Eleven to 15 inches thick.
Subsoil:	15-44"	Reddish brown silty clay loam, firm, very strongly acid. Twenty-four to 33 inches thick.
Substrata:	44-59"	Dark brown gravelly clay loam, very firm, very strongly acid.

Setting:

The topography on which the Olyic soils occur is represented by rolling hills with rounded ridge tops and strongly sloping to steep sideslopes. Annual precipitation ranges from 60 to 80 inches. The distribution of the Olyic series is confined to the north portion of the Coast Range.

Mapping Units:

16 W 9,800 acres, 10 to 35% slopes.
16 X 13,300 acres, 35 to 60% slopes.
16 Y 5,200 acres, 60 to 90%+ slopes. Predominantly deep Olyic soils. Inclusions of Honeygrove soils occur at random.

16-14 W 700 acres, 10 to 35% slopes.
16-14 X 4,800 acres, 35 to 60% slopes. Associations of about sixty percent deep Olyic soils with about forty percent deep Honeygrove soils. Honeygrove soils occur on the steep sideslopes adjacent to the deep dissections. Inclusions of Peavine soils occur on the ridge tops and the ridge noses. Inclusions of Klickitat soils occur on the steep sideslopes.

16-14x W 3,000 acres, 10 to 35% slopes.
16-14x X 6,700 acres, 35 to 60% slopes. Associations of about sixty percent deep Olyic soils with about forty percent deep Honeygrove soils which were derived from sedimentary rocks. Inclusions of Apt soils occur on the slumps. Inclusions of Klickitat soils occur on the steeper sideslopes.

16-60 W — 2,700 acres, 10 to 35% slopes.

16-60 X — 3,300 acres, 35 to 60% slopes. Association of about seventy percent deep Olyic soils with about thirty percent moderately deep Melby soils. The Melby soils are on the lower sloping footslopes. Inclusions of Honeygrove soils occur on the steeper dissected sideslopes.

16-258 XY — 5,400 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. An association of about sixty percent deep Olyic soils with about forty percent deep Goble soils. The Goble soils occur on long broad gentle ridges and and on ridge noses. Inclusions of Marty soils occur at random.

Cazadero (17) (tentative series)

The Cazadero series consists of deep, well drained soils formed in old alluvium.

The Cazadero soils are used for timber production and cropland. Dry summers are the limiting factor for tree growth.

Profile Description: Cazadero silt loam

Surface soil:	0-8"	Dark brown silt loam, friable, medium acid.
Subsoil:	8-75"	Dark red silty clay loam, firm, strongly acid.
Substrata:	75"+	Variegated brown, red, and yellow silt loam, firm, strongly acid.

Setting:

The topography on which the Cazadero soils occur is represented by gently sloping terraces and rolling hills. Annual precipitation ranges from 60 to 80 inches. These soils occur in the northern portion of the Willamette Valley.

Mapping Units:

Soils of the Cazadero series are not dominant in any of the mapping units and occur as secondary soils in units of the Bull Run Series.

Cruiser (19) (proposed series)

The Cruiser series consists of deep, well drained soils formed in colluvium from basic igneous rock. The Cruiser soils are on moderately steep mountain slopes.

The Cruiser soils are used for timber production. The limiting factor for timber production is cold temperatures at high elevations.

Profile Description: Cruiser stony loam

Surface soil:	0-16"	Dark reddish brown stony loam, friable, very strongly acid. Eight to 16 inches thick.
Subsoil:	16-43"	Dark reddish brown stony clay loam, friable, very strongly acid. Fourteen to 22 inches thick.
Substrata:	43"+	Partially weathered rock.

Setting:

The topography on which Cruiser soils occur is represented by broad undulating ridges with steep sideslopes. The mean annual precipitation ranges from 100 to 120 inches. The distribution is mainly on the Cascade Mountains with a small portion occurring on the Laurel Mountain area.

Mapping Units:

19 VW	3,700 acres, 0 to 35% slopes.
19 X	1,300 acres, 35 to 60% slopes.
19 XW	2,000 acres, 10 to 60% slopes. Mostly 35 to 60% slopes. Predominantly deep, stony Cruiser soils. Inclusions of 75S soils occur on the steeper sideslopes.

Peavine (20) Over basic igneous rock (tentative series)
Peavine (20x) Over sedimentary rock

The Peavine series consists of moderately deep well drained soils formed in colluvium from basic igneous and sedimentary rocks. The Peavine soils are on sloping to very steep mountainous uplands.

The Peavine soils are used for timber, orchards, small grain, and pasture production. The only limitation for timber production is depth to bedrock.

Profile Description: Peavine silty clay loam

Surface soil:	0-10"	Dark brown silty clay loam, friable, medium acid. Six to 15 inches thick.
Subsoil:	10-36"	Yellowish red silty clay, firm, very strongly acid. Twelve to 23 inches thick.
Substrata:	36-64"	Yellowish red and light yellowish brown silty clay loam, firm, very strongly acid, 80% shale fragments.

Setting:

The topography upon which the Peavine soils occur is represented by broad, rounded ridge tops and ridge noses and on short, steep sideslopes. The dissection pattern is moderately dense. These soils are usually on the moderately steep areas between the sloping Jory and Nekia soil associations and the steep topography which occurs at higher elevations. Mean annual precipitation ranges from 55 to 70 inches. These soils are distributed throughout the survey area.

Mapping Units:

20 W	800 acres, 10 to 35% slopes.
20 X	600 acres, 35 to 60% slopes. Predominantly moderately deep Peavine soils. Inclusions of Honeygrove soils occur in concave positions.
20-14 W	30,500 acres, 10 to 35% slopes.
20-14 WX	1,100 acres, 10 to 60% slopes. Mostly 10 to 35% slopes.
20-14 X	38,100 acres, 35 to 60% slopes.
20-14 XW	1,300 acres, 10 to 60% slopes. Mostly 35 to 10% slopes. Associations of about sixty percent moderately deep Peavine soils with about forty percent deep Honeygrove soils. Honeygrove soils occur on the uniform sideslopes. Inclusions of the McCully soils occur at higher elevations. Inclusions of the Klickitat soils occur on the steeper sideslopes and the escarpments.
20-15 X	2,000acres, 35 to 60% slopes. An association containing about seventy percent moderately deep Peavine soils with about thirty percent deep Hullt soils. The Hullt soils occur at higher elevations on the uniform or concave sideslopes. Inclusions of Klickitat soils occur on the steeper sideslopes and the escarpments.

20-57 W — 1,400 acres, 10 to 35% slopes. An association of about seventy percent moderately deep Peavine soils with about thirty percent deep Preacher soils. Preacher soils occur on the slump escarpments and on the gently sloping convex ridges. Inclusions of 69S soils occur at random.

20-29S W — 4,400 acres, 10 to 35% slopes.

20-29S X — 77,700 acres, 35 to 60% slopes.

20-29S WX — 2,300 acres, 10 to 60% slopes. Mostly 10 to 35% slopes.

20-29S XY — 15,700 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes.

20-29S Y — 5,800 acres, 60 to 90%+ slopes. Associations of about sixty percent moderately deep Peavine soils with about forty percent moderately deep Klickitat soils. Klickitat soils occur on the steeper sideslopes, on some ridge noses and on the escarpments. Inclusions of the Honeygrove soils occur on the concave sideslopes.

20x-14x W — 5,300 acres, 10 to 35% slopes.

20x-14x X — 7,700 acres, 35 to 60% slopes. Associations containing about seventy percent moderately deep Peavine soils, which were derived from sedimentary rock, with about thirty percent deep Honeygrove soils which were derived from sedimentary rock. Honeygrove soils occur on the uniform sideslopes. Inclusions of Jory and Nekia soils occur at lower elevations and inclusions of the Blachly soils occur at higher elevations.

Unnamed (21)

This series consists of moderately deep, well drained soils formed in colluvium. These soils are on sloping to very steep mountain slopes.

These soils are used for timber production. The main limitation for timber production is depth of rock.

Profile Description:

Surface soil:	0-11"	Dark brown silt loam, friable.
Subsoil:	11-31"	Reddish brown silty clay loam, firm.
Substrata:	31-39"	Reddish brown very shaley clay loam grading to bedrock.

Setting:

The topography on which unit 21 soils occur is represented by sharp ridges, sharp finger ridges, moderately dense dissection pattern, and numerous slumps. Areas of unit 21 soils occur adjacent to Hembre soils. Unit 21 soils are distinguished from Hembre (basalt bedrock) soils by having numerous slumps. They are distinguished from Hembre (diorite bedrock) soils by having sharp ridges and finger ridges. Annual precipitation ranges from 60 to 100 inches. The distribution is limited to Polk County.

Mapping Units:

21 X	6,600 acres, 35 to 60% slopes.
21 Y	800 acres, 60 to 90%+ slopes. Predominantly moderately deep unit 21 soils. Inclusions of Kilchis soils occur on the ridge noses and steep sideslopes.
21-14x Y	500 acres, 60 to 90%+ slopes. An association of about sixty percent moderately deep unit 21 soils with about forty percent deep Honeygrove soils which were derived from sedimentary rock. Honeygrove soils occur on the steep uniform sideslopes. Inclusions of Klickitat and Kilchis soils occur on the ridge noses and the very steep excarpments.
21-27n XW	3,200 acres, 10 to 60% slopes. Mostly 35 to 60% slopes. An undifferentiated unit containing about fifty percent moderately deep unit 21 soils and about fifty percent deep Hembre soils. Inclusions of the Kilchis and Klickitat soils occur on the ridge tops, the ridge noses, and the steeper sideslopes.

Nekia (23) Over basic igneous rock (tentative series)
Nekia (23x) Over sedimentary rock

The Nekia series consists of moderately deep, well drained soils formed in colluvium. The Nekia soils are on sloping to very steep mountainous slopes.

The Nekia soils are used for timber, orchards, and grass seed production. Bare Nekia soils have a high erosion hazard. The limiting factors for timber production are the dry summer months and depth to bedrock.

Profile Description:

Surface soil:	0-18"	Dark reddish brown clay, friable, strongly acid. Twelve to 18 inches thick.
Subsoil:	18-36"	Dark reddish brown clay, firm, strongly acid. Seventeen to 25 inches thick.
Substrata:	36-45"	Yellowish red very stony clay, firm strongly acid.

Setting:

The topography upon which the Nekia soils occur is represented by gently sloping long, broad ridges and finger ridge noses with a sparse dissection pattern. On the steeper slopes the ridge noses are rounded and drainages are very steep. Annual precipitation ranges from 40 to 60 inches. These soils are distributed throughout the survey area.

Mapping Units:

23 W	1,400 acres, 10 to 35% slope.
23 X	1,100 acres, 35 to 60% slope. Predominantly moderately deep Nekia soils. Inclusions of Jory soils occur on the concave sideslopes.
23-12 W	23,700 acres, 10 to 35% slope.
23-12 X	20,600 acres, 35 to 60% slope. Associations containing about sixty percent moderately deep Nekia soils with about forty percent deep Jory soils. Jory soils occur on the concave sideslopes. Inclusions of Ritner soils occur on the ridge noses and ridge tops. Inclusions of the Willakenzie soils occur at random.
23-36S W	3,400 acres, 10 to 35% slopes.
23-36S X	1,100 acres, 35 to 60% slopes.
23-36S WX	1,800 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. Associations containing about seventy percent moderately deep Nekia soils with about thirty percent shallow Witzel soils. Witzel soils occur on the rige tops, the ridge noses, and adjacent to the drainages. Inclusions of the Jory soils occur on the concave sideslopes. Inclusions of the Ritner soils occur at random.

23-36S-26 W — 1,100 acres, 10 to 35% slopes. An association containing about forty percent moderately deep Nekia soils, about thirty percent shallow Witzel soils and about thirty percent moderately deep Dixonville soils. Witzel soils occur on the ridge tops and the ridge noses. The Dixonville soils occur on the lower, rounded footslopes. Inclusions of Willakenzie occur at random.

23-26 W — 1,200 acres, 10 to 35% slopes.

23-26 X — 1,200 acres, 35 to 60% slopes. Associations containing about sixty percent moderately deep Nekia soils with about forty percent moderately deep Dixonville soils. Dixonville soils occur at lower elevations on the rounded footslopes.

23-24 W — 1,400 acres, 10 to 35% slopes.

23-24 X — 5,200 acres, 35 to 60% slopes. Undifferentiated units containing approximately sixty percent moderately deep Nekia soils with about forty percent deep skeletal Ritner soils. Inclusions of Jory occur on the concave sideslopes.

23-29S WX — 600 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. An association containing about sixty percent moderately deep Nekia soils with about forty percent moderately deep Klickitat soils. Klickitat soils occur on the steeper moist slopes. This unit occurs on the steepest slopes adjacent to the head of streams and tributaries cutting up into large areas of Jory and Nekia soils which occur above. Inclusions of Kinton and Cascade soils are located adjacent to the large areas of Kinton and Cascade soils.

23x-12x-67 X — 2,000 acres, 35 to 60% slopes. An undifferentiated unit containing approximately forty percent moderately deep Nekia soils; approximately thirty percent deep Jory soils, and approximately thirty percent moderately deep Willakenzie soils.

Ritner (24) (tentative series)

The Ritner series consists of deep soils derived from colluvium. Ritner soils are on moderately steep or very steep slopes.

The Ritner soils are used for timber production. The limiting factors for timber production are the stone content and low summer precipitation.

Profile Description: Ritner gravelly silty clay loam

Surface soil:	0-12"	Dark reddish brown gravelly silty clay, friable, medium acid. Nine to 17 inches thick.
Subsoil:	12-42"	Dark reddish brown very gravelly clay, firm, 60 percent gravel and rocks, strongly acid. Twenty to 36 inches deep.
Substrata:		Bedrock.

Setting:

The topography on which the Ritner soils occur is represented by steep sideslopes. Annual precipitation ranges from 40 to 60 inches.

Mapping Units:

Soils of the Ritner series are not dominant in any of the mapping units and occur as secondary soils in mapping units of the Jory and Nekia series.

Whetstone (25) (tentative series)

The Whetstone series consists of moderately deep soils derived from colluvium. The Whetstone soils are on moderately steep to very steep slopes.

The Whetstone soils are used for timber production. Cold climate is the main limitation for timber production.

Profile Description: Whetstone stony loam

Surface soil:	1-5"	Dark reddish brown loam, firm, weakly cemented, extremely acid. Three to 6 inches thick.
Subsoil:	5-19"	Dark brown stony loam, friable, very strongly acid. Twelve to 16 inches thick.
Substrata:	19-48"+	Dark yellowish brown stony loam, friable, very strongly acid. Several feet thick.

Setting:

The topography upon which the Whetstone soils occur is represented by even, steep sideslopes. Annual precipitation ranges from 70 to 90 inches. These soils are located in Marion County.

Mapping Units:

25 W	800 acres, 10 to 35% slopes.
25 X	9,000 acres, 35 to 60% slopes.
25 Y	4,500 acres, 60 to 90%+ slopes. Predominantly moderately deep Whetstone soils.

Dixonville (26) (tentative series)

The Dixonville series consists of moderately deep, well drained soils derived from Colluvium.

The Dixonville soils are used for pasture and timber production. Dry summers and a firm subsoil limits these soils for timber production.

Profile Description: Dixonville silty clay loam

Surface soil:	4-12"	Very dark brown silty clay loam, friable, medium acid. Ten to 16 inches thick.
Subsoil:	12-34"	Dark reddish brown clay, very firm, slightly acid. Fourteen to 30 inches thick.
Substrata:	24-40"+	Decomposed rock.

Setting:

The topography upon which the Dixonville soils occur is represented by steep foothills, rounded ridge noses and rounded hill tops. Annual precipitation ranges from 35 to 60 inches. These soils are distributed throughout the survey area at lower elevations.

Mapping Units:

Soils of the Dixonville series are not dominant in any mapping unit and occur as secondary soils in mapping units of the Jory, Nekia, Witzel and Steiwer series.

Hembre (27) (tentative series)
Hembre (27n)

The Hembre series consists of deep, well drained soils derived from colluvium. The Hembre soils are on sloping to very steep mountainous slopes.

The Hembre soils are used for timber production. They have no serious limitations for timber production.

Profile Description: Hembre loam

Surface soil:	0-12"	Dark brown loam, friable, strongly acid. Ten to 14 inches thick.
Subsoil:	12-44"	Reddish brown clay loam, friable, very strongly acid. Thirty-two to 42 inches thick.
Substrata:	44"+	Basalt bedrock.

Setting: (27n)

A. The Hembre soils designated (27n) are formed on igneous intrusive rocks. These intrusive rocks occur as broad caps with varying degrees of thickness over sedimentary rocks, as stringers along ridges or as vertical columns penetrating through the sedimentary rocks. In all cases, the underlying sedimentary materials weather, slump, and erode away leaving the more resistant intrusive rocks to shape the main ridges and mountains.

The topography on which the Hembre (27n) soils occur is represented by broad, rounded ridges and rounded finger ridges with a noticeable number of large slumps on the sideslopes. The overall landscape is generally unstable due to the sedimentary rock eroding away from under the intrusive cap. The dissection pattern is sparse. Hembre (27n) soils occur mainly in the Coast Range portion of the survey area.

Setting: (27)

B. The Hembre soils designated (27) are formed on basic igneous extrusive rocks. The topography on which the Hembre (27) soils occur is represented by sharp ridges, numerous sharp finger ridges and numerous sharp draws which are perpendicular to the stream valleys and steep sideslopes. The area is almost entirely free of slumps. The overall landscape is quite stable.

Mapping Units;

27 W	7,700 acres, 10 to 35% slopes.
27 X	2,600 acres, 35 to 60% slopes. Predominantly deep Hembre soils. Inclusions of Klickitat soils occur on the ridge tops and the ridge noses.
27-35S X	1,000 acres, 35 to 60% slopes.
27-35S Y	1,400 acres, 60 to 90%+ slopes. Associations containing about sixty percent deep Hembre soils with about thirty percent shallow Kilchis soils. Kilchis soils occur on the ridge tops and ridge noses. Inclusions of Klickitat soils

occur adjacent to the Kilchis soils and at random on the sideslopes.

27n Y — 8,500 acres, 60 to 90%+ slopes.

27n XW — 8,400 acres, 10 to 60% slopes. Mostly 35 to 60% slopes. Predominantly deep Hembre soils. Inclusions of the Klickitat and Kilchis soils occur on the ridge tops and ridge noses.

27n-35S Y — 1,700 acres, 60 to 90%+ slopes. An association of about sixty percent deep Hembre soils with about forty percent shallow Kilchis soils. The Kilchis soils occur on the ridge noses. Inclusions of Klickitat soils occur at random.

27-29S X — 3,000 acres, 35 to 60% slopes. An undifferentiated unit containing about sixty percent deep Hembre soils with about forty percent moderately deep Klickitat soils. Inclusions of the Kilchis soils occur mostly on the ridge tops and the ridge noses.

27-29S-35S Y — 30,200 acres, 60 to 90%+ slopes. An association containing thirty-five percent deep Hembre soils, thirty percent moderately deep Klickitat soils, twenty-five percent shallow Kilchis soils, and ten percent rock outcrop. Hembre soils dominantly occur on the lower 1/3 of the slope. Small bodies of Hembre soils my be expected to to occur at random on the upper 2/3 of the slope. The moderately deep Klickitat soil dominantly occurs on the upper 2/3 of the slope. The Kilchis soil dominantly occurs on the upper 1/3 of the slope, the ridge noses, and the ridge tops.

27n Y — 13, 000 acres, 10 to 35% slopes.

27n X — 50,000 acres, 35 to 60% slopes. This mapping unit is composed of deep Hembre soils. Inclusions of Klickitat and Kilchis soils occur on the ridge tops and the ridge noses.

Klickitat (29S) (tentative series)

The Klickitat series consists of moderately deep, well drained soils formed in colluvium. The Klickitat soils are on moderately steep to very steep mountainous slopes.

The Klickitat soils are used for timber production. The limiting features for timber production are depth to bedrock and high stone content.

Profile Description: Klickitat gravelly clay loam

Surface soil:	0-15"	Dark reddish brown very gravelly clay loam, friable, strongly acid. Eleven to 22 inches thick.
Subsoil:	29-47"	Dark brown very gravelly loam, very friable, very strongly acid, 70% coarse fragments. Fifteen to 20 inches thick.

Setting:

The topography upon which the Klickitat soils occur is represented by sharp ridge tops and ridge noses and on steep or very steep sideslopes adjacent to the drainages. The dissection pattern is moderately sparse. There are few slumps. Annual precipitation ranges from 80 to 120 inches. These soils are distributed throughout the survey area.

Mapping Units:

29S X	17,500 acres, 35 to 60% slopes.
29S Y	22,700 acres, 60 to 90%+ slopes.
29S WX	1,600 acres, 10 to 60% slopes. Mostly 10 to 35% slopes.
29S XY	2,400 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. Predominantly moderately deep Klickitat soils. Inclusions of Hembre soils occur on the uniform sideslopes. Inclusions of the Kilchis soils occur on the ridge tops and the ridge noses.
29S-20 X	21,800 acres, 35 to 60% slopes.
29S-20 Y	4,200 acres, 60 to 90%+ slopes.
29S-20 XY	18,900 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. Associations containing about sixty percent moderately deep Klickitat soils with about forty percent moderately deep Peavine soils. Peavine soils occur on the broad rounded ridge noses at lower elevations. Inclusions of the Kilchis soils occur at random.
29S-27 Y	3,200 acres, 60 to 90%+ slopes. An association containing approximately seventy percent moderately deep Klickitat soils with about thirty percent deep Hembre soils. Hembre soils occur on the sideslopes between the ridge noses and the draws. Inclusions of the Kilchis soils occur on the ridge tops and the ridge noses.

29S-27n X — 1,000 acres, 35 to 60% slopes. An association containing about fifty percent moderately deep Klickitat soils with about forty percent deep Hembre soils. Hembre soils occur on the uniform or concave sideslopes. Inclusions of the Kilchis soils occur on the ridge tops and the ridge noses. Inclusions of the moderately deep Hembre variant soils occur at random.

29S-35S X — 1,600 acres, 35 to 60% slopes.

29S-35S Y — 69,800 acres, 60 to 90%+ slopes. Undifferentiated units containing approximately sixty percent moderately deep Klickitat soils with about forty percent shallow Kilchis soils. Inclusions of rock outcrop occur on ridge noses.

29S-60 Y — 1,000 acres, 60 to 90%+ slopes. An association containing approximately sixty percent moderately deep Klickitat soils, with about forty percent deep Melby soils. Melby soils occur on the rounded or convex sideslopes. Inclusions of the Kilchis soils occur on the ridge tops.

29S-69S Y — 1,000 acres, 60 to 90%+ slopes. An association containing approximately sixty percent moderately deep Klickitat soils, with about forty percent moderately deep unit 69S soils. Unit 69S soils occur on the escarpments and at random.

29S-111 W — 500 acres, 10 to 35% slopes.

29S-111 X — 6,100 acres, 35 to 60% slopes. Associations of about sixty percent moderately deep Klickitat soils with about forty percent deep McCully soils. McCully soils occur on the broad smooth sideslopes while the Klickitat soils occur on the steeper escarpments. Inclusions of the Kilchis soils occur on the steeper escarpments. Inclusions of the Kilchis soils occur on convex sideslopes and the sharper ridge noses.

29S-157 X — 1,100 acres, 35 to 60% slopes.

29S-157 Y — 6,800 acres, 60 to 90%+ slopes. Undifferentiated units containing about sixty percent moderately deep Klickitat soils with about forty percent deep Kinney soils. Inclusions of Kilchis soils occur on ridge tops, ridge noses, and at random on the sideslopes.

29S-69S-157 X — 2,100 acres, 35 to 60% slopes.

29S-69S-157 WX — 3,200 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. Associations containing about forty percent moderately deep unit 69S soils, about thirty percent deep Kinney soils. Unit 69S soils occur on escarpments. Kinney soils occur on the broad, rounded ridge noses and on the concave sideslopes. Inclusions of Kilchis soils occur on ridge tops.

Kilchis (35S) (established series)

The Kilchis series consists of stony, shallow, well drained soils formed in colluvium. The Kilchis soils are on steep to very steep mountainous slopes.

The Kilchis soils are used for timber production. The shallow depth and stone content are serious limitations for timber production.

Profile Description: Kilchis stony loam

Surface soil:	0-5"	Dark reddish brown stony loam, friable, strongly, acid. Four to 8 inches thick.
Subsoil:	5-12"	Dark reddish brown, very gravelly silt loam, friable, very strongly acid, 65% coarse fragments. Five to 9 inches thick.
Substrata:	12-20"	Dark reddish brown very gravelly silt loam, friable, very strongly acid, 85% coarse fragments. Three to 10 inches thick.

Setting:

A. Associated with intrusive bedrock. The topography on which the Kilchis soils occur is represented by broad ridge tops and rounded ridge noses. The dissection pattern is relatively sparse. The Kilchis soils occur on the apex of the ridges and ridge noses, adjacent to rock outcroppings and on very steep escarpments.

B. Associated with extrusive bedrock. The topography on which the Kilchis soils occur is represented by sharp ridge tops, numerous sharp bottoms, and plentiful rock outcroppings. The Kilchis soil is dominant on the upper 1/3 of the slope, especially on, and adjacent to, the ridge tops. Annual precipitation ranges from 80 to 120 inches. These soils are distributed throughout the survey area.

Mapping Units:

35S-39S Y	6,400 acres, 60 to 90%+ slopes. An undifferentiated unit containing approximately sixty percent shallow Kilchis soils with about forty percent moderately deep Klickitat soils. Inclusions of rock outcrop occur on the ridge tops and the ridge noses and at random on the sideslopes. Inclusions of Hembre soils occur on small concave positions on sideslopes. This unit generally occurs on drainage escarpments.
35S-69S Y	2,900 acres, 60 to 90%+ slopes. An undifferentiated unit containing about sixty percent shallow Kilchis soil with about forty percent moderately deep unit 69S soils. Inclusions of Klickitat soils occur at random.
35S-R Y	10,400 acres, 60 to 90%+ slopes. An undifferentiated unit containing about fifty percent shallow Kilchis soils with about fifty percent rock outcrop. Major inclusions of the moderately deep Klickitat soils occur intermingled with shallow Kilchis soils.

Witzel (36S) (tentative series)

The Witzel series consists of shallow, stony, well drained soils formed in colluvium. The Witzel soils are on gently sloping, to steep foothills.

The Witzel soils are used for pasture. Dry summers, shallow depth and stone content are serious limitations for timber production.

Profile Description: Witzel very stony silty clay loam

Surface soil:	0-4"	Dark brown very stony silty clay loam, friable, medium acid. Two to 6 inches thick.
Subsoil:	4-19"	Dark reddish brown very stony silty clay loam, firm, medium acid. Eleven to 19 inches thick.
Substrata:	19"+	Bedrock.

Setting:

The topography upon which the Witzel soils occur is represented by low rolling foothills with rounded ridge noses. Annual precipitation ranges from 40 to 60 inches. These soils occur throughout the survey area.

Mapping Units:

36S W	500 acres, 10 to 35% slopes.
36S X	1,200 acres, 35 to 60% slopes.
36S WX	1,100 acres, 10 to 60% slopes. Mostly 10 to 35% slopes.
36S XY	1,900 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. Predominantly shallow Witzel soils.
36S-26 W	5,200 acres, 10 to 35% slopes.
36S-26 X	1,700 acres, 35 to 60% slopes.
36S-26 Y	600 acres, 60 to 90%+ slopes.
36S-26 VW	1,200 acres, 0 to 35% slopes. Mostly 0 to 10% slopes. Associations containing about sixty percent shallow Witzel soils with about forty percent moderately deep Dixonville soils. Dixonville soils occur on the uniform sideslopes and the broad rounded ridge noses. Inclusions of rock outcrop occur at random.
36S-23 W	1,300 acres, 10 to 35% slopes.
36S-23 X	1,000 acres, 35 to 60% slopes.
36S-23 Y	4,000 acres, 60 to 90%+ slopes. Undifferentiated units containing about fifty percent Nekia soils. Inclusions of rock outcrop occur intermingled with Witzel soils.
36S-26-23 W	6,300 acres, 10 to 35% slopes. An undifferentiated unit containing approximately forty percent shallow Witzel soils, about thirty percent moderately deep Dixonville soils and about thirty percent moderately deep Nekia soils.

36S-23x X — 600 acres, 35 to 60% slopes. An undifferentiated unit containing about sixty percent shallow Witzel soils with about forty percent moderately deep Nekia soils, which were derived from sedimentary rocks. Inclusions of rock outcrop occur at random.

36S-23-26 X — 1,400 acres, 35 to 60% slopes. An undifferentiated unit containing about forty percent shallow Witzel soils, about thirty percent moderately deep Nekia soils, and about thirty percent moderately deep Dixonville soils. Inclusions of rock outcrop occur at random.

Apt (50) (tentative series)

The Apt series consists of deep, well and moderately well drained soils formed in colluvium. The Apt soils are on gently sloping to steep mountain sideslopes.

The Apt soils are used for timber production. The dense subsoil and unstable topography are limiting factors for timber production.

Profile Description: Apt clay

Surface soil:	0-8"	Dark brown clay, friable, strongly acid. Seven to 12 inches thick.
Subsoil:	8-49"	Brown silty clay, firm, very strongly acid. Thirty-four to 50 inches thick.
Substrata:	49-63"+	Yellowish brown silty clay loam, slightly firm, very strongly acid.

Setting:

The topography on which the Apt soils occur is represented by broad ridges, rounded ridge noses and a dense dissection pattern. Annual precipitation ranges from 60 to 80 inches. These soils are confined to the Coast Range portion of the survey area.

Mapping Units:

50 W	1,000 acres, 10 to 35% slopes.
50 X	3,000 acres, 35 to 60% slopes. Predominantly deep Apt soils. Inclusions of Honeygrove and Peavine soils occur at random.
50-14x W	1,100 acres, 10 to 35% slopes. An undifferentiated unit containing approximately sixty percent deep Apt soils with about forty percent deep Honeygrove soils which were derived from sedimentary rocks. Inclusions of Peavine soils occur at random.
50-66-14x X	1,000 acres, 35 to 60% slopes. An undifferentiated unit containing about forty percent deep Apt soils, about thirty percent deep Digger soils and about thirty percent deep Honeygrove soils which were derived from sedimentary rock.

Astoria (51) (established series)

The Astoria series consists of deep, well drained soils formed in colluvium. The Astoria soils are on gently sloping to very steep mountainous slopes.

The Astoria soils are used for timber production and pasture on the more gently sloping areas. There are no limiting features for timber production.

Profile Description: Astoria silt loam

Surface soil:	0-19"	Very dark grayish brown silt loam, friable, very strongly acid. Ten to 22 inches thick.
Subsoil:	19-50"	Dark yellowish brown silty clay, firm, very strongly acid. Twenty-six to 42 inches thick.
Substrata:	50-68"	Yellowish brown silty clay loam, firm very strongly acid. Fourteen to 22 inches thick.

Setting:

The topography on which the Astoria soils occur is represented by broad ridges, rounded ridge noses, and uniform sideslopes with a moderate amount of dissection. Contrasting, adjacent soils derived from basalt are differentiated by steeper slopes, sharper ridges, and a less dense dissection pattern. Annual precipitation ranges from 80 to 120 inches. These soils are located in the Coast Range portion of the survey area.

Mapping Units:

51 W	14,700 acres, 10 to 35% slopes.
51 X	14,600 acres, 35 to 60% slopes. Predominantly deep Astoria soils. Minor inclusions of Ead soils occur on ridge noses. Inclusions of Hembre, Klickitat or Kilchis soils occur where intrusive rocks protrude.

Fendall (52) (tentatives series)

The Fendall series consists of moderately deep, well drained soils formed in colluvium. The Fendall soils are on sloping to steep mountainous slopes.

The Fendall soils are used for timber production. A dense subsoil limits Douglas-fir growth by restricting rooting depth.

Profile Description: Fendall gravelly clay loam

Surface soil:	0-13"	Black very gravelly clay loam, friable, very strongly acid. Eleven to 17 inches thick.
Subsoil:	13-31"	Yellowish brown clay, firm, extremely acid.
Substrata:	31"+	Fractured and weathered shale.

Setting:

The topography on which the Fendall soils occur is represented by rounded ridges and ridge noses and deep dissections. These soils occur in the Coast Range portion of the survey area. Average annual precipitation ranges from 80 to 120 inches.

Mapping Units:

52 W	800 acres, 10 to 35% slopes.
52 X	4,200 acres, 35 to 60% slopes. Predominantly moderately deep Fendall gravelly clay loam soils.

Unnamed (53S)

Unit 53S soils consists of moderately deep, stony soils formed in colluvium. Unit 53S soils are on very steep mountain slopes.

Unit 53S soils are used for timber production. Depth to bedrock and stone content are limiting factors for timber production.

Profile Description: Unit 53S very gravelly loam

Surface soil:	0-13"	Dark yellowish brown very gravelly loam, very friable, very strongly acid.
Subsoil:	13-39"	Dark brown very gravelly clay loam, friable, very strongly acid.
Substrata:	39"+	Bedrock.

Setting:

The topography on which unit 53S soils occur is represented by sharp ridges, sharp draws, sharp finger ridges, and a dense dissection pattern. The slopes are long and very steep. Annual precipitation ranges from 60 to 90 inches. These soils are located on the Cascade Mountains.

Mapping Units:

53S-70S Y — 13,500 acres, 60 to 90%+ slopes. An association containing about fifty-five percent moderately deep unit 53S soils with about forty-five percent shallow unit 70S soils. Unit 70S soils occur on the sharp ridge tops and the sharp ridge noses and at random on the steep sideslopes. There are large major inclusions of the Marty soils occurring on the lower 1/3 of the slope on the rounded ridge noses. Overall topography of this unit has very sharp ridges, sharp ridge noses and sharp V bottoms. The drainage pattern is moderately dense. There is an absence of large landslide or mass flows. However, there are numerous shallow slips which are small. Roads and lack of vegetation accelerate these shallow slips which usually terminate at the bottom of the draws. Bedrock is quite fractured and often falls from the cut slopes on the road.

53S-70S-20 Y — 22,200 acres, 60 to 90%+ slopes. An association containing about fifty percent moderately deep unit 53S soils, about thirty percent shallow unit 70S soils and about twenty percent moderately deep Peavine soils. Unit 70S soils occur predominantly on the ridge tops and the ridge noses and adjacent to the drainages. Peavine soils occur on the lower 1/3 of the slope on the rounded ridge noses. The overall topography resembles the unit listed above.

Slickrock (54) (tentative series)

The Slickrock series consists of deep, well drained soils formed in colluvium. The Slickrock soils are on sloping to very steep uneven mountainous slopes.

The Slickrock soils are used for timber production. Sometimes drainage is a limiting factor for timber production.

Profile Description: Slickrock gravelly loam

Surface soil:	0-7"	Very dark brown gravelly loam, friable, very strongly acid. Six to 13 inches thick.
Subsoil:	7-55"	Dark brown stony clay loam, friable, very strongly acid, 45% coarse fragments. Thirty-seven to 55 inches thick.
Substrata:	55"+	Weathered sandstone.

Setting:

The topography upon which the Slickrock soils occur is represented by uneven, dissected slumps or sideslopes. Annual precipitation ranges from 80 to 120 inches. These soils occur in the Coast Range portion of the survey area.

Mapping Units:

54 X	506 acres, 35 to 60% slopes. Predominantly deep Slickrock soils.

Laurelwood (55) (tentative series)

The Laurelwood series consists of deep, well drained soils formed in loess. The Laurelwood soils occur on the low lying uplands on long, convex slopes that are gently sloping to steep.

The Laurelwood soils are used for orchard, berry, grain, pasture and timber production. The dry summer season is the limiting factor in the soils.

Profile Description: Laurelwood silt loam

Surface soil:	0-23"	Dark brown silt loam, friable, medium acid. Twenty to 26 inches thick.
Subsoil:	23-52"	Yellowish brown silty clay loam, firm, medium acid. Twenty-five to 38 inches thick.
Substrata:	52-72"+	Reddish brown silty clay, black mottles, strongly acid.

Setting:

The Laurelwood soils occur on long, convex slopes that are gently sloping to steep. Annual precipitation ranges from 45 to 50 inches. These soils are limited to the northern portion of the survey area.

Mapping Units:

55-58-12 W	700 acres, 10 to 35% slopes. An undifferentiated unit containing about forty percent deep Laurelwood soils, about thirty percent deep Kinton soils, and about thirty percent deep Jory soils. The Jory soils usually occur adjacent to the drainage ways.

Cascade (56) (established series)

The Cascade series consists of very deep, somewhat poorly drained soils derived from loess over old, red clayey materials. The Cascade soils are on 0 to 35 percent slopes and occur on smooth to rolling broad ridges.

The Cascade soils are used for timber, small grain, orchards, and some rowcrops, such as strawberries. Drainage and a fragipan are the limiting factors for timber production.

Profile Description: Cascade silt loam

Surface soil:	0-8"	Very dark grayish brown silt loam, friable.
Subsoil:	8-94"	Dark yellowish brown clay loam, mixed brown and white soil materials, very firm, many coarse distinct yellowish brown mottles.
Substrata:	94"+	Weathered basalt or old, red clayey materials.

Setting:

The topography on which the Cascade soils occur is represented by gently sloping to sloping, broad ridge tops, and finger ridges on low rolling hills. Annual precipitation ranges from 50 to 70 inches. These soils are restricted to the northern portion of the survey area.

Mapping Units:

Soils of the Cascade series are not dominant in any mapping unit and occur as secondary soils or inclusions in mapping of the Goble series.

Preacher (57) (tentatives series)

The Preacher series consists of deep, well drained soils formed in colluvium. The Preacher soils are on nearly level to steep slopes in mountainous terrain.

The Preacher soils are used for timber production.

Profile Description: Preacher clay loam

Surface soil:	0-14"	Dark brown clay loam, friable, very strongly acid. Nine to 18 inches thick.
Subsoil:	14-42"	Dark yellowish brown clay loam, friable, very strongly acid.
Substrata:	42-70"+	Yellowish brown clay loam grading into weathered sandstone.

Setting:

The topography on which the Preacher soils occur is represented by slumps, slump escarpments, and gently sloping convex ridges and smooth sideslopes. Annual precipitation ranges from 80 to 120 inches. These soils occur mainly on the Coast Range.

Mapping Units:

57 X	4,200 acres, 35 to 60% slopes. Predominantly deep Preacher soils. Inclusions of unit 69S soils occur on the ridge tops and the ridge noses.
57-69S W	1,100 acres, 10 to 35% slopes.
57-69S X	3,900 acres, 35 to 60% slopes.
57-69S WX	3,800 acres, 10 to 60% slopes. Mostly 10 to 35% slopes.
57-69S XW	2,900 acres, 10 to 60% slopes. Mostly 35 to 60% slopes. Associations containing about sixty percent deep Preacher soils with about forty percent moderately deep unit 69S soils. Unit 69S soils occur on the ridge noses, the slump escarpments, and adjacent to the drainage ways. Inclusions of 175S soils occur on the ridge tops and the ridge noses.

Kinton (58) (tentative series)

The Kinton series consists of deep, moderately well drained soils derived from loess. The Kinton soils are on 3 to 20% slopes and occur on rolling uplands having long interfluvial slopes.

The Kinton soils are used for cultivated row crops, orchards, and timber production. A fragipan at 24 inches and dry summers are the limiting factors for timber production.

Profile Description: Kinton silt loam

Surface soil:	0-17"	Dark brown silt loam, friable, medium acid. Ten to 26 inches thick.
Subsoil:	17-30"	Dark yellowish brown silty clay loam, few faint mottles, firm. Nineteen to 42 inches thick.
Substrata:	30"+	Dark yellowish brown silt loam, cemented layer at top. Common reddish brown mottles, strongly acid.

Setting: (Columbia County)

The topography on which the Kinton soils occur is represented by long, broad, gentle ridges and finger ridge noses. These soils are on rolling hills which occur in northern Washington County and central Columbia County. Annual precipitation ranges from 42 to 46 inches. The distribution of these soils is limited to the northern portion of the survey area.

Mapping Units.

58 W	1,500 acres, 10 to 35% slopes.
58 X	1,900 acres, 35 to 60% slopes.
58 VW	1,300 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.
58 WX	700 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. Predominantly deep Kinton soils. Inclusions of Cascade soils occur at random. Inclusions of alluvium undifferentiated soils occur in the vally bottoms.
58-12 W	3,900 acres, 10 to 35% slopes.
58-12 WV	2,300 acres, 0 to 35% slopes. Mostly 10 to 35% slopes. Associations containing about seventy percent deep Kinton soils with about thirty percent deep Jory soils. Jory soils occur on the sideslopes. Inclusions of 25 soils occur at random.
58-23 X	1,200 acres, 35 to 60% slopes. An association of about sixty percent deep Kinton soils with about forty percent moderately deep Nekia soils. Nekia soils occur on the steeper sideslopes adjacent to the drainage ways. Inclusions of Cascade and Jory soils occur at random.
58-55 V	800 acres, 0 to 10% slopes.
58-55 WX	1,200 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. Associations containing about seventy percent deep Kinton soils. Laurelwood soils occur on the sideslopes, especially at the lower one-third of the slope. Inclusions

of Cascade soils occur at random.

58-55-12 W — 1,300 acres, 10 to 35% slopes.

58-55-12 X — 3,800 acres, 35 to 60% slopes. Associations containing about forty percent deep Kinton soils with about thirty percent deep Laurelwood soils and about thirty percent deep Jory soils. Laurelwood soils occur on the sideslopes and Jory soils occur on the steeper slopes adjacent to the drainages.

58-256 VW — 3,000 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.

58-256 WV — 1,700 acres, 0 to 35% slopes. Mostly 10 to 35% slopes.

58-256 WX — 1,400 acres, 10 to 60% slopes. Mostly 35 to 60% slopes. Associations of about sixty percent deep Kinton soils with about forty percent deep unit 256 soils. Unit 256 soils occur mostly on the gentle sloping ridge tops. Kinton soils occur mainly on the sideslopes. Inclusions of Nekia soils occur on the steepest slopes along the stream inclusions. Minor inclusions of undifferentiated alluvium occur on the floodplains.

Melby (60) (tentative series)

The Melby series consists of deep, well drained soils formed in colluvium. The Melby soils are on sloping to steep footslopes.

The Melby soils are used for timber and small grain production. The dense subsoil is the limiting factor for root growth.

Profile Description: Melby silty clay loam

Surface soil:	0-13"	Dark brown silty clay loam, friable, medium acid. Eleven to 15 inches thick.
Subsoil:	13-34"	Dark brown silty clay, firm, strongly acid. Eighteen to 26 inches thick.
Substrata:	34-63"	Yellowish brown silty clay, firm, strongly acid.

Setting:

The topography upon which the Melby soils occur is represented by rolling hills that are gently sloping to steep. Annual precipitation ranges from 60 to 70 inches. These soils occur on the Coast Range portion of the survey area.

Mapping Units:

60-10 W	400 acres, 10 to 35% slopes.
60-10 X	2,100 acres, 35 to 60% slopes.
60-10 Y	1,500 acres, 60 to 90%+ slopes. Undifferentiated units containing about sixty percent deep Melby soils with about forty percent deep Blachly soils.

Ead (61) (tentative series)

The Ead series consists of moderately deep, well drained soils formed in colluvium. The Ead soils are on gently sloping to steep, convex mountainous slopes.

The Ead soils are used for timber production.

Profile Description: Ead silty clay loam

Surface soil:	0-7"	Very dark brown silty clay loam, friable, very strongly acid (pH 5.0). Six to 7 inches thick.
Subsoil:	7-22"	Dark brown silty clay, firm, very strongly acid (pH 4.6). Thirteen to 19 inches thick.
Substrata:	22-33"	Strong brown silty clay, firm, extremely acid (pH 4.4). Nine to 16 inches thick.

Setting:

The topography upon which the Ead soils occur is represented by smooth, convex sideslopes. Annual precipitation ranges from 60 to 70 inches. The distribution of these soils is limited to the Coast Range area.

Mapping Units:

61 W	1,000 acres, 10 to 35% slopes.
61 X	2,300 acres, 35 to 60% slopes. Predominantly moderately deep Ead soils.

Keel (62) (proposed series)

The Keel series consists of deep, well drained soils formed in colluvium. The Keel are on hilly to very steep slopes.

The Keel soils are used for timber production. Cold temperatures and stone content are the limiting factors for tree growth.

Profile Description: Keel loam

Surface soil:	0-15"	Dark brown loam, friable, very strongly acid. Ten to 17 inches thick.
Subsoil:	15-55"	Dark yellowish brown clay loam, friable, very strongly acid. Nineteen to 36 inches thick.
Substrata:	55"+	Bedrock.

Setting:

The topography on which the Keel soils occur is represented by broad, rounded ridges and uneven sideslopes at higher elevations. Annual precipitation ranges from 80 to 120 inches. The distribution of these soils is limited to the Cascade Mountains.

Mapping Units:

62 W	1,300 acres, 10 to 35% slopes.
62 X	3,200 acres, 35 to 60% slopes. Predominantly deep Keel soils.
62-19 X	600 acres, 35 to 60% slopes. An association containing about sixty percent deep Keel soils with about forty percent deep Cruiser soils. Cruiser soils occur on the broad ridge noses.

Steiwer (65) (tentative series)

The Steiwer series consists of moderately deep, well drained soils formed in colluvium. The Steiwer soils are on 0 to 30 percent slopes.

The Steiwer soils are used for general crop production. Dry summer conditions are the limiting factor for tree growth.

Profile Description: Steiwer silty clay loam

Surface soil:	0-19"	Dark brown silty clay loam, friable, medium acid. Thirteen to 31 inches thick.
Subsoil:	19-27"	Dark yellowish brown silty clay loam, firm, medium acid. Six to 12 inches thick.
Substrata:	27-40"+	Bedrock.

Setting:

The Steiwer soils occur on low rolling hills that are adjacent to the valley terraces. They are usually on the steeper slopes with southerly aspects. Annual precipitation ranges from 42 to 45 inches. These soils are distributed throughout the survey area at low elevations.

Mapping Units:

65-67 Wx	1,100 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. An association containing about forty percent moderately deep Willakenzie soils. Willakenzie soils occur on slumpy topography and on slopes with a northerly aspect.
65-23x-67 W	600 acres, 10 to 35% slopes. An association containing about forty percent moderately deep Steiwer soils, about thirty percent moderately deep Peavine soils, which were derived from sedimentary rocks, and about thirty percent moderately deep Willakenzie soils. Peavine soils occur in the lower foot slopes adjacent to the valley floor. Willakenzie soils occur on the hummocky topography and on gently sloping northerly slopes.
65-26 VW	600 acres, 0 to 35% slopes. Mostly 0 to 10% slopes. An association containing about seventy percent Steiwer soils with about thirty percent moderately deep Dixonville soils.

Digger (66) (tentative series)

The Digger series consists of moderately deep, well drained soils formed in colluvium. The Digger soils are on sloping to very steep mountainous slopes.

The Digger soils are used for timber production. Depth to bedrock and stone content are limiting factors for timber production.

Profile Description: Digger gravelly loam

Surface soil:	0-4"	Dark grayish brown gravelly loam, friable, strongly acid. Four to 7 inches thick.
Subsoil:	4-30"	Brown gravelly loam, friable, very strongly acid. Twenty-two to 29 inches thick.
Substrata:	30"+	Fractured sandstone.

Setting:

The topography on which the Digger soils occur is represented by convex sideslopes and ridge noses. In high areas, Digger soils occur on recent slump escarpments. Annual precipitation ranges from 60 to 80 inches. Distribution of the Digger soils is limited to the Coast Range portion of the survey area.

Mapping Units:

66 W	800 acres, 10 to 35% slopes.
66 X	2,400 acres, 35 to 60% slopes. Predominantly moderately deep Digger soils. Inclusions of an unnamed shallow soil occur on the ridge tops and the ridge noses. Small inclusions of Melby soils occur on colluvial footslopes.
66-14 X	4,500 acres, 35 to 60% slopes. An association of about sixty percent moderately deep Digger soils with about forty forty percent deep Honeygrove soils. Honeygrove soils occur on the concave sideslopes. Minor inclusions of Apt soils occur on the slumps.
66-50 W	700 acres, 10 to 35% slopes.
66-50 X	1,900 acres, 35 to 60% slopes.
66-50 XY	9,600 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. Associations of about sixty percent moderately deep Digger soils with about forty percent deep Apt soils. Apt soils occur on the rounded ridge noses and the concave sideslopes. Inclusions of Honeygrove and Peavine soils occur at random.
66-50-14x W	2,300 acres, 10 to 35% slopes.
66-50-14x X	10,600 acres, 35 to 60% slopes.
66-50-14x XW	1,000 acres, 10 to 60% slopes. Mostly 35 to 60% slopes.
66-50-14x XY	7,300 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. Undifferentiated units containing about forty percent moderately deep Digger soils, about thirty percent deep Apt soils, and about thirty percent deep Honeygrove soils which were derived from sedimentary rocks. Inclusions of Peavine soils occur intermingled with the Honeygrove soils.

Willakenzie (67) (tentative series)

The Willakenzie series consists of moderately deep well drained soils formed in colluvium. The Willakenzie soils are on gently sloping to steep foothills.

The Willakenzie soils are used for orchard, small grain, pasture and timber production. Dry summer conditions are the limiting factor for tree production.

Profile Description: Willakenzie silty clay loam

Surface soil:	0-12"	Dark brown silty clay loam, friable, medium acid. Ten to 19 inches thick.
Subsoil:	12-32"	Dark brown silty clay loam, firm, medium acid. Sixteen to 27 inches thick.
Substrata:	32-54"+	Yellowish red silty clay loam with 80% coarse fragments grading into bedrock.

Setting:

The Willakenzie soils occur on smooth, convex uplands that may be slightly hummocky due to slumps. These soils are usually on the gentle slopes with a northerly aspect. Annual precipitation ranges from 40 to 50 inches.

Mapping Units:

67 V	1,300 acres, 0 to 10% slopes.
67 W	13,400 acres, 10 to 35% slopes.
67 X	3,600 acres, 35 to 60% slopes. Predominantly moderately deep Willakenzie soils. Inclusions of Steiwer soils occur on the southerly slopes. Inclusions of Nekia soils occur on the steeper lower sideslopes.
67-12x W	2,200 acres, 10 to 35% slopes.
67-12x X	3,300 acres, 35 to 60% slopes. Associations containing about sixty percent moderately deep Willakenzie soils with about forty percent deep Jory soils, which were derived from sedimentary rocks. Jory soils occur on the lower slopes and on the broad ridge noses.
67-23x W	1,300 acres, 10 to 35% slopes. An association of about sixty percent moderately deep Willakenzie soils with about forty percent moderately deep Nekia soils which were derived from sedimentary rocks. Nekia soils occur on the ridge noses and the steeper slopes adjacent to the drainage ways. Inclusions of Steiwer and Jory soils occur at random.
67-65 VW	1,200 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.
67-65 Y	900 acres, 60 to 90%+ slopes. Associations containing about sixty percent moderately deep Willakenzie soils with about forty percent moderately deep Steiwer soils. Steiwer soils occur on slopes with a

southerly aspect. Inclusions of Witzel and Nekia soils occur at random.

67-65-23x VW — 900 acres, 0 to 35% slopes. Mostly 0 to 10% slopes. An association containing about forty percent moderately deep Willakenzie soils, about thirty percent moderately deep Steiwer soils, and about thirty percent moderately deep Nekia soils, which were derived from sedimentary rocks. Steiwer soils occur on the steeper slopes with a southerly aspect. Nekia soils occur on the lower slopes adjacent to the valley floor. Inclusions of Witzel soils occur on the ridge noses.

Unnamed (69S)

Unit 69S soils consist of moderately deep, stony, well drained soils formed in colluvium. Unit 69S soils are on sloping to very steep mountainous slopes.

Unit 69S soils are used for timber production. Depth and stone content are limiting factors for tree growth.

Profile Description: Unit 69S gravelly loam

Surface soil:	0-11"	Dark brown gravelly loam, friable, strongly acid. Nine to 12 inches thick.
Subsoil:	11-24"	Dark brown gravelly loam, friable, extremely acid. Nine to 14 inches thick.
Substrata:	24-58"	Dark yellowish brown, very stony loam, friable, extremely acid.

Setting:

The topography on which the unit 69S soils occur is represented by rounded ridges and ridge noses, smooth sideslopes with a moderate dissection pattern and on steep to very steep headwalls above slumps. These soils are distributed throughout the survey area.

Mapping Units:

69S W	1,200 acres, 10 to 35% slopes.
69S X	5,200 acres, 35 to 60% slopes.
69S Y	9,400 acres, 60 to 90%+ slopes. Predominantly moderately deep unit 69S soils. Inclusions of Kinney soils occur on the sideslopes. Inclusions of Preacher soils occur at random.
69S-157 W	1,700 acres, 10 to 35% slopes.
69S-157 X	14,400 acres, 35 to 60% slopes.
69S-157 Y	4,400 acres, 60 to 90%+ slopes.
69S-157 XY	7,900 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. Associations containing about sixty percent moderately deep unit 69S soils with about forty percent deep Kinney soils. Kinney soils occur predominantly on the smooth sideslopes. Inclusions of unit 75S occur on the ridge tops at the higher elevations. Inclusions of Kilchis soils occur on the steep sideslopes adjacent to the drainages.
69S-159S Y	1,300 acres, 60 to 90%+ slopes. An undifferentiated unit containing about sixty percent moderately deep unit 69S soils with about forty percent Aschoff soils. Aschoff soils occur on the more rounded ridge noses and on the uniform sideslopes.

Unnamed (70S)

Unit 70S consists of shallow, stony, well drained soils formed in colluvium. Unit 70S soils are on ridges and very steep sideslopes.

Unit 70S soils are used for timber production. The shallow depth and stone content are serious limitations for timber production.

Profile Description: Unit 70S gravelly sand loam

Surface soil:	0-9"	Dark yellowish brown gravelly sand loam, very friable, very strongly acid.
Subsoil:	9-18"	Dark yellowish brown very gravelly loam, friable, very strongly acid.
Substrata:	18"+	Bedrock.

Setting:

The topography on which unit 70S soils occur is represented by sharp ridges, sharp draws, sharp finger ridges, and a dense dissection pattern. The slopes are long and very steep. Unit 70S soils occur on the ridge tops, the ridge noses, and the convex sideslopes. Annual precipitation ranges from 60 to 90 inches. These soils are confined to the Cascade Mountains.

Mapping Units:

70S-53S Y — 19,300 acres, 60 to 90%+ slopes. An association of about seventy percent shallow unit 70S soils with about thirty percent moderately deep unit 53S soils. Unit 53S soils occur on the concave sideslopes. This unit occurs on topography that has sharp ridges and sharp draws and sharp ridge noses. There is an absence of large land slide or large slips; however, there are numerous shallow small slips. A very dense dissection pattern distinguishes this unit from the unit 53S-70S which has a moderately dense dissection pattern.

70S-53S-111 Y — 2,600 acres, 60 to 90%+ slopes. An association of about forty percent shallow unit 70S soils, about thirty percent moderately deep unit 53S soils and about thirty percent deep McCully soils. Unit 53S soils usually occur on the rounded ridge noses on the lower 1/3 of the slopes. McCully soils occur on the toeslopes. Overall topography for this unit has sharp ridges and sharp draws. There is an absence of large land slides; however, there are numerous shallow small slips. These areas have a very dense drainage pattern. Dense drainage patterns distinguish this unit from 53S-70S which has a moderately dense dissection pattern.

Unnamed (75S)

Unit 75S consists of shallow, stony, well drained soils formed in colluvium. Unit 75S soils are on ridges, ridge noses and very steep sideslopes.

Unit 75S soils are used for timber production. Shallow depths, stone content, and cold climate are very serious limitations for timber production.

Profile Description: Unit 75S very gravelly loam

Surface soil:	0-7"	Black very gravelly loam, friable, strongly acid.
Subsoil:	7-15"	Very dark grayish brown very gravelly loam, friable, strongly acid.
Substrata:	15"+	Fractured bedrock.

Setting:

The topography on which unit 75S soils occur is represented by sharp to slightly rounded tops and ridge noses, and very steep sideslopes at higher elevations. The dissection pattern is dense in areas that are primarily 75S soils. Annual precipitation ranges from 70 to 100 inches. These soils occur at higher elevations in the Cascade Mountains.

Mapping Units:

75S-169S Y	5,600 acres, 60 to 90%+ slopes. An association containing about seventy percent shallow unit 75S soils with about thirty percent moderately deep Henline soils. Henline soils dominantly occur at higher elevations. Inclusions of Preacher soils occur on the higher ridge tops and ridge noses.

McCully (111) (tentative series)

The McCully series consists of deep well drained soils formed in colluvium. The McCully soils are on gently sloping to very steep uplands.

The McCully soils are used for timber production. The McCully soils have no serious limitations for timber production.

Profile Description: McCully clay

Surface soil:	0-12"	Dark reddish brown clay, friable, strongly acid. Ten to 14 inches thick.
Subsoil:	12-58"	Reddish brown clay, firm, very strongly acid. Thirty-eight to 51 inches thick.
Substrata:	58-108"+	Variegated dark yellowish brown, dark brown and very dark gray brown gravelly loam, very strongly acid.

Setting:

The topography on which the McCully soils occur is represented by rolling and/or moderately steep slopes. The dissection pattern is sparse but the drainages are usually deep with very steep sideslopes. The overall topography is quite gentle compared to the steep adjacent areas. Annual precipitation ranges from 60 to 80 inches. These soils are located in the Cascade Mountains.

Mapping Units:

111 V	10,200 acres, 0 to 10% slopes.
111 W	94,700 acres, 10 to 35% slopes.
111 X	27,500 acres, 35 to 60% slopes.
111 VW	23,900 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.
111 WX	4,000 acres, 10 to 60% slopes. Mostly 10 to 35% slopes.
111 XY	1,400 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. Predominantly deep McCully soils. Inclusions of Honeygrove soils occur at lower elevations. Inclusions of Kinney soils occur at higher elevations.
111-29S W	6,200 acres, 10 to 35% slopes.
111-29S X	6,300 acres, 35 to 60% slopes.
111-29S Y	2,000 acres, 60 to 90%+ slopes.
111-29S WX	2,400 acres, 10 to 60% slopes. Mostly 35 to 60% slopes. Associations containing about sixty percent deep McCully soils with about forty percent moderately deep Klickitat soils. Klickitat soils occur on the sideslopes adjacent to the drainage ways and on the sharper ridge noses. Inclusions of Kilchis soils occur intermingled with the Klickitat soils.

111-157 W	3,600 acres, 10 to 35% slopes.
111-157 X	3,000 acres, 35 to 60% slopes. Associations containing about sixty percent deep McCully soils with about forty percent deep Kinney soils. Kinney soils occur on the steeper sideslopes and the sharper ridge noses. Inclusions of Klickitat soils occur on the steeper slopes adjacent to the drainage ways and intermingled with Kinney soils on the sharper ridge noses.

Horeb (156) (tentative series)

The Horeb series consists of deep well drained soils formed in colluvium. The Horeb soils are on gently to moderately sloping footslopes.

The Horeb soils are used for timber production. These soils have no serious limitations for timber production.

Profile Description: Horeb loam

Surface soil:	0-14"	Very dark brown loam, friable, strongly acid. Ten to 19 inches thick.
Subsoil:	14-36"	Dark yellowish brown gravelly loam, friable, very strongly acid.
Substrata:	36-60"+	Dark grayish brown cobbly loam firm, very strongly acid.

Setting:

The topography on which the Horeb soils occur is represented by gently to moderately sloping footslopes. Annual precipitation ranges from 70 to 90 inches. The distribution for these soils is limited to the Cascade Mountains.

Mapping Units:

156 V	700 acres,	0 to 10% slopes.
156 W	5,300 acres,	10 to 35% slopes.
156 X	2,700 acres,	35 to 60% slopes. Predominantly deep Horeb soils.

Kinney (157) (tentative series)

The Kinney series consists of deep, well drained soils formed in colluvium. The Kinney soils are on gently sloping to steep sideslopes.

The Kinney soils are used for timber production. The Kinney soils have no serious limitations for timber production.

Profile Description: Kinney cobbly loam

Surface soil:	0-10"	Very dark brown cobbly loam, friable, strongly acid. Eight to 12 inches thick.
Subsoil:	10-53"	Dark brown cobbly clay loam, friable, very strongly acid. Twenty-seven to 40 inches thick.
Substrata:	53"+	Weathered bedrock.

Setting:

The topography on which the Kinney soils occur is represented by hilly to steep slopes that have broad, rounded ridge tops and broad finger ridge noses. The sideslopes are relatively smooth and free from numerous, deep dissections. The annual precipitation ranges from 60 to 90 inches. These soils are distributed in the Cascade Mountains.

Mapping Units:

157 V	6,100 acres, 0 to 10% slopes.
157 W	38,300 acres, 10 to 35% slopes.
157 X	24,000 acres, 35 to 60% slopes.
157 VW	3,500 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.
157 WX	7,600 acres, 10 to 60% slopes. Mostly 10 to 35% slopes.
157 XY	5,900 acres, 35 to 90%+ slopes. Mostly 35 to 69% slopes. Predominantly deep Kinney soils. Inclusions of Unit 60S soils occur on the ridge noses and on the steep sideslopes adjacent to the drainages. Inclusions of 175S soils occur on high ridges. Small areas of rock outcrop mainly occur on the ridge tops.
157-69S W	30,800 acres, 10 to 35% slopes.
157-69S X	27,800 acres, 35 to 60% slopes.
157-69S Y	6,800 acres, 60 to 90%+ slopes.
157-69S WX	8,800 acres, 10 to 60% slopes. Mostly 10 to 35% slopes.
157-69S XY	3,300 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. Associations containing about sixty percent deep Kinney soils with about forty percent moderately deep unit 69S soils. Unit 69S soils occur on the steeper sideslopes, adjacent to the drainages, and on some ridge noses. Inclusions of 175S soils occur on the ridge tops. Small inclusions of the Aschoff soils occur on the concave sideslopes.
157-29S X	3,900 acres, 35 to 60% slopes.
157-29S WX	1,200 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. Associations containing about seventy percent deep Kinney

soils with about thirty percent moderately deep Klickitat soils. Klickitat soils occur on the steeper slopes adjacent to the drainage ways, on the ridge tops, and on the ridge noses. Inclusions of the Kilchis soils occur intermingled with the Klickitat soils. Inclusions of the McCully soils occur on the rounded ridge noses at lower elevations. Small areas of unit 69S soils occur at random.

157-159 S — 900 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. An undifferentiated unit of about sixty percent deep Kinney soils with about forty percent deep Aschoff soils. Inclusions of unit 69S soils occur at random. Inclusions of unit 175S soils occur on higher ridge tops.

Bull Run (158) (tentative series)

The Bull Run series consists of deep, well drained soils formed in loess. The Bull Run soils are on sloping or rolling to steep slopes in the lower valleys and footslopes of the northern Oregon Cascade Mountains.

Bull Run soils are used for timber, pasture, and grain production. These soils have no limitations for timber production.

Profile Description: Bull Run silt loam

Surface soil:	0-7"	Very dark brown silt loam, friable, medium acid. Four to 18 inches thick.
Subsoil:	7-54"	Dark yellowish brown silt loam, friable, medium acid. Ten to 72 inches thick.
Substrata:	54"+	Dark yellowish brown silt loam, friable, medium acid. One foot to many feet thick.

Setting:

The topography on which the Bull Run soils occur is represented by broad, nearly level "Plateaus" surrounded by steep sideslopes. The primary drainage pattern is represented by sparse, deep drainage ways. Annual precipitation ranges from 65 to 105 inches. The distribution of these soils is limited to the northeast portion of the survey area.

Mapping Units:

158 V	2,500 acres, 0 to 10% slopes.
158 W	1,900 acres, 10 to 35% slopes.
158 X	1,300 acres, 35 to 60% slopes.
158 Vw	2,700 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.
158 WX	1,500 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. Predominantly deep Bull Run soils. Inclusions of Cazadero soils occur at lower elevations.

Aschoff (159S) (tentative series)

The Aschoff series consists of deep, well drained soils formed in colluvium. The Aschoff soils are on sloping to very steep mountain slopes.

Aschoff soils are used for timber production. Stone content is a limiting factor for timber production.

Profile Description: Aschoff gravelly loam

Surface soil:	0-12"	Very dark brown gravelly loam, friable, medium acid. Three to 21 inches thick.
Subsoil:	12-34"	Dark brown stony heavy loam, friable, medium acid. Twelve to 36 inches thick.
Substrata:	34"+	Brown stony silt loam, friable, slightly acid. Three to many feet thick.

Setting:

The topography on which the Aschoff soils occur is represented by rounded ridges, rounded finger ridge noses, uniform steep sideslopes, and a moderately dense dissection pattern. Annual precipitation ranges from 85 to 115 inches. The distribution of these soils is limited to the Cascade Mountains.

Mapping Units:

159S-175S X	19,600 acres, 35 to 60% slopes. An association of about sixty percent deep Aschoff soils with about forty percent shallow unit 175S soils. The 175S soils occur on the ridge tops, the ridge noses, and on the steeper sideslopes. Inclusions of rock outcrop occur on the ridge noses.

Henline (169S) (tentative series)

The Henline series consists of moderately deep, stony, well drained soils formed in colluvium. Henline soils are on steep to very steep mountainous slopes and ridges.

The Henline soils are used for timber production. Stone content, depth, and cold temperatures are limiting factors for timber production.

Profile Description: Henline very stony sandy loam

Surface soil:	0-10"	Very dark brown very stony loam, very friable, slightly acid. Five to 15 inches thick.
Subsoil:	10-30"	Dark brown very stony sandy loam, very friable, slightly acid. Eighteen to 22 inches thick.
Substrata:	30"+	Fractured bedrock.

Setting:

The topography on which the Henline soils occur is represented by rounded ridges, rounded finger ridge noses, uniform steep sideslopes and a moderately dense dissection pattern. Annual precipitation ranges from 70 to 90 inches. Distribution of these soils is limited to the Cascade Mountains.

Mapping Units:

169S W	2,000 acres, 10 to 35% slopes.
169S X	4,100 acres, 35 to 60% slopes.
169S Y	7,400 acres, 60 to 90%+ slopes. Predominantly moderately deep Henline soils. Inclusions of 75S soils occur on the ridge tops and the ridge noses. Inclusions of Goodlow soils occur on the uniform sideslopes.
169S-75S X	2,800 acres, 35 to 60% slopes.
169S-75S WX	1,200 acres, 10 to 60% slopes. Mostly 10 to 35% slopes.
169S-75S XY	1,600 acres, 35 to 90%+ slopes. Mostly 35 to 60% slopes. Associations of about sixty percent moderately deep Henline soils with about forty percent shallow unit 75S soils. The 75S soils occur on the ridge tops and on the ridge noses and on the steep sideslopes adjacent to the drainages. Inclusions of rock outcrops occur on the ridge tops and ridge noses. Inclusions of Goodlow soils occur on the concave sideslopes.
169S-159S Y	1,100 acres. An association containing about seventy percent moderately deep Henline soils with about forty percent deep Aschoff soils, 60%+ slopes. The Aschoff soils occur on the lower 1/3 of the uniform sideslopes. Inclusions of 75S soils occur on the high ridge tops.

169S-259S W	1,900 acres, 10 to 35% slopes.
169S-259S X	11,400 acres, 35 to 60% slopes.
169S-259S WX	2,000 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. Associations of about sixty percent moderately deep Henline soils with about forty percent deep Goodlow soils. Goodlow soils occur on the uniform sideslopes. Inclusions of 75S soils occur on the ridge tops and on the ridge noses.

Unnamed (175S)

Unit 175S consists of shallow, stony, well drained soils formed in colluvium. Unit 175S soils are on ridges, ridge noses, and very steep sideslopes.

Unit 175S soils are used for timber production. Shallow depth and stone content are serious limitations for timber production.

Profile Description: Unit 175S very gravelly loam

Surface soil:	0-7"	Black very gravelly loam, friable, strongly acid.
Subsoil:	7-15"	Very dark grayish brown very gravelly loam, friable, strongly acid.
Substrata:	15"+	Fractured bedrock.

Setting:

The topography on which unit 175S soils occur is represented by sharp to slightly rounded ridge tops and ridge noses and very steep sideslopes. The dissection pattern is dense in areas that are primarily 175S soils. The dissection pattern is sparse in areas where 175S is the secondary soils (see 159S). Annual precipitation ranges from 70 to 90 inches. The distribution of these soils is limited to the Cascade Mountains.

Mapping Units:

175S-159S Y	31,000 acres, 60 to 90%+ slopes. An association containing about seventy percent shallow unit 175S soils with about thirty percent deep Aschoff soils. Aschoff soils occur on the uniform sideslopes. Inclusions of 69S soils occur on the ridge noses. Inclusions of rock outcrop occur on the ridge tops. Areas that are predominantly Aschoff soils have a moderately dense dissection pattern. Areas that are predominantly 175S soils have a dense dissection pattern.

Unnamed (256)

Unit 256 consists of very deep, somewhat poorly drained soils formed in loess over old, red clayey materials. Unit 256 soils are sloping to moderately steep areas.

Unit 256 soils are used for timber, small grain, orchards, and some rowcrops, such as strawberries. The long, dry summer periods are a limiting factor for timber production.

Profile Description: Unit 256 silt loam

Surface soil:	0-8"	Very dark grayish brown silt loam, friable.
Subsoil:	8-94"	Dark yellowish brown clay loam, mixed brown and white soil materials, very firm, many coarse distinct yellowish brown mottles.
Substrata:	94"+	Weathered basalt or old red clayey materials.

Setting:

The topography on which the 256 soils occur is represented by gently sloping to sloping, broad ridge tops and rounded finger ridge noses. Annual precipitation ranges from 45 to 50 inches. The distribution of these soils is limited to the north portion of the survey area.

Mapping Units:

Soils of the 256 unit are not dominant in any of the mapping units and occur as secondary soils or inclusions in mapping units of the Kinton series.

Goble (258) (tentative series)

The Goble series consists of deep, moderately well drained soils derived from loess. The Goble soils are on rolling to moderately steep hills.

The Goble soils are used for cultivated row crops, orchards, and timber production. Goble series is equivalent to a non-xeric Kinton series. These soils have no serious limitations for timber productions.

Profile Description: Goble silt loam

Surface soil:	0-17"	Dark brown silty loam, friable, medium acid. Ten to 26 inches thick.
Subsoil:	17-30"	Dark yellowish brown silty clay loam, firm, few faint mottles. Nineteen to 42 inches thick.
Substrata:	30"+	Dark yellowish brown silt loam, cemented layer at top, common reddish brown mottles, strongly acid.

Setting:

The topography on which the Goble soils occur is represented by long, broad, gentle ridges and finger ridge noses. These soils are on rolling hills. Annual precipitation ranges from 60 to 75 inches. Distribution of these soils is limited to the north portion of the survey area.

Mapping Units:

258 W	7,000 acres, 10 to 35% slopes.
258 X	3,900 acres, 35 to 60% slopes.
258 VW	5,600 acres, 0 to 35% slopes. Mostly 0 to 10% slopes.
258 WV	1,600 acres, 0 to 35% slopes. Mostly 10 to 35% slopes.
258 WX	6,800 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. Predominantly deep Goble soils. Inclusions of Cascade soils occur at random. Inclusions of Honeygrove or Peavine soils occur on the sideslopes adjacent to the drainages.
258-14 W	2,700 acres, 10 to 35% slopes.
258-14 X	2,100 acres, 35 to 60% slopes.
258-14 WV	6,800 acres, 0 to 35% slopes. Mostly 10 to 35% slopes.
258-14 WX	3,200 acres, 10 to 60% slopes. Mostly 10 to 35% slopes. Associations of about sixty percent deep Goble soils with forty percent deep Honeygrove soils. Honeygrove soils occur on the sideslopes. Inclusions of Peavine soils occur on the steeper slopes adjacent to the drainages. Inclusions of Cascade soils occur intermingled with the Goble soils.
258-20 X	1,000 acres, 35 to 60% slopes. An association containing about seventy percent deep Goble soils with about thirty percent moderately deep Peavine soils. Peavine soils occur on ridge noses and on steeper sideslopes adjacent to the drainage ways. Inclusions of Honeygrove soils occur on the uniform sideslopes.

258-56 VW 2,000 acres, 0 to 35% slopes. Mostly 0 to 10% slopes. An undifferentiated unit containing about sixty percent deep Goble soils with about forty percent deep Cascade soils. Inclusions of Peavine soils occur on slopes adjacent to the drainages.

Goodlow (259S) (tentative series)

The Goodlow series consists of deep, stony, well drained soils formed in colluvium. The Goodlow soils are sloping to very steep mountain slopes.

The Goodlow soils are used for timber production. Stone content and cold temperatures are limiting factors for timber production.

Profile Description: Goodlow gravelly silt loam

Surface soil:	0-10"	Dark brown gravelly silt loam, friable, strongly acid. Six to 19 inches thick.
Subsoil:	10-40"+	Brown to dark brown stony clay loam, friable, strongly acid.
Substrata:		Fractured bedrock.

Setting:

The topography on which the Goodlow soils occur is represented by hilly to very steep sideslopes, sloping to steep rounded ridge tops and a moderately dense shallow dissection pattern. Annual precipitation ranges from 70 to 90 inches. These soils are distributed at higher elevations in the Cascade Mountains.

Mapping Units:

259S W	2,600 acres, 10 to 35% slopes.
259S X	3,600 acres, 35 to 60% slopes.
259S Y	1,900 acres, 60 to 90%+ slopes. Predominantly deep Goodlow soils. Inclusions of Henline soils occur on the sideslopes adjacent to the drainages. Inclusions of 75S soils occur on the ridge tops and the ridge noses.
259S-62 X	1,200 acres, 35 to 60% slopes. An undifferentiated unit containing about sixty percent deep Goodlow soils with about forty percent deep Keel soils. Inclusions of Henline soils occur at random.
259S-169S Y	2,100 acres, 60 to 90%+ slopes. An association containing about sixty percent deep Goodlow soils with about forty percent Henline soils. The Henline soils occur on ridge noses and on sideslopes adjacent to the drainages. Inclusions of unit 75S soils and rock outcrop occur on ridge tops and on ridge noses.

Rockland (R)

A miscellaneous land type that contains about fifty percent rock outcrop and about fifty percent shallow, stony, or moderately deep soils which are associated with the adjacent soil types.

Mapping Units:

R	4,900 acres. A miscellaneous land type that contains about fifty percent solid rock outcrop and about fifty percent shallow soils which are associated with the surrounding soil types.
R-75S-169S Y	7,200 acres, 60 to 90%+ slopes. An undifferentiated unit containing about forty percent rock outcrop, about thirty percent shallow 75S, soils with about thirty percent moderately deep Henline soils. There are inclusions of Kinney occurring on the concave sideslopes.
R-36S Y	1,000 acres, 60 to 90%+ slopes. An undifferentiated unit containing about sixty percent Rockland with about forty percent shallow Witzel soils.

Detailed Descriptions of the Unnamed Soil Series 1/

Unit 21

O1	0-1"	Leaves, twigs and mosses.
A1	0-7"	Dark brown (7.5 YR 4/2) gravelly loam, pinkish gray (7.5 YR 6/2) dry; strong fine and medium granular structure; slightly hard, friable; abundant fine and medium roots; abrupt smooth boundary.
A3	7-11"	Dark brown (7.5 YR 4/3) gravelly clay loam, pinkish gray (7.5 YR 6/3) dry; weak fine subangular blocky structure; slightly hard; friable, slightly sticky, slightly plastic; plentiful roots; few fine concretions; clear smooth boundary.
B1	11-19"	Brown (7.5 YR 4/4) heavy clay loam, light brown (7.5 YR 6/4) dry; weak medium and coarse, subangular blocky structure; slightly hard, friable, sticky, plastic; 13% gravel; plentiful roots; clear wavy boundary.
B2	19-31"	Reddish brown (5 YR 4/4) silty clay loam, light brown (7.5 YR 6/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky, plastic; 13% gravel; few roots; clear wavy boundary.
C1	31-39"	Reddish brown (5 YR 4/4) very shaly, clay loam; weak fine subangular blocky structure, hard, firm, sticky, plastic; 65% shale fragments; few roots.
R	39"+	Weathered shale.

Location: Polk County. On Columbia River Paper Co. road between Pedee and Valsetz. NE¼, Sec. 27, T.9S, R7W

Vegetation: Salal, ocean spray, vine maple, alder, Oregon grape and brackenfern with a Douglas-fir overstory.

1/ Colors are for moist soils unless stated otherwise.

Unit 53S

O1 & O2	2-0"	Leaves, twigs, and partially decomposed organic material.
A1	0-4"	Dark yellowish brown (10 YR 3/4) very gravelly loam; weak fine granular structure; very friable; 55% gravel; very strongly acid; clear smooth boundary.
A3	4-13"	Dark yellowish brown (10 YR 3/4) very gravelly loam, moderate medium and coarse granular structure; friable; 55% gravel; plentiful roots; strongly acid (pH 5.4); clear wavy boundary.
B1	13-22"	Brown (10 YR 4/3) very gravelly clay loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; 55% gravel, plentiful roots; strongly acid (pH 5.4); clear smooth boundary.
B2	22-33"	Dark yellowish brown (10 YR 4/4) very gravelly clay loam; weak fine and medium subangular blocky structure; friable, slightly sticky, slightly plastic; 75% gravel, few roots; very strongly acid (pH 5.0); clear smooth boundary.
B3	33-39"	Yellowish brown (10 YR 5/6) very gravelly loam; weak fine subangular blocky structure; friable; 80% gravel; few roots; strongly acid (pH 5.5).
R	39"+	Paralithic contact.

Location: Linn County
SE¼ SE¼, S.17, T.11S, R.4E

Vegetation: Salal, sword fern, Oregon grape, and rhododendron with an overstory of Douglas-fir and hemlock.

Unit 69S

O1 & O2	1-0"	Moss, needles, leaves, twigs, and decomposed organic material.
A11	0-5"	Very dark grayish brown (10 YR 3/2) gravelly loam; weak fine granular structure; very friable; 30% gravel and stone, abundant roots; very strongly acid (pH 5.0); clear smooth boundary.
A12	5-12"	Dark brown (10 YR 3/3) gravelly loam, moderate fine and medium granular structure; friable, slightly sticky, slightly plastic; 25% gravel and stone; plentiful roots; very strongly acid (pH 5.0); clear smooth boundary.
B2	12-23"	Dark yellowish brown (10 YR 4/4) gravelly loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; 40% gravel and stone; few roots; very strongly acid; clear smooth boundary.
B3	23-33"	Yellowish brown (10 YR 5/4); very gravelly loam; massive; 80% gravel and stone; few roots; extremely acid (pH 4.4); abrupt wavy boundary.
R	33"+	Fractured andesite.

Location: Clackamas County.
NE¼ SW¼, S.12, T.6S, R.3E

Vegetation: Huckleberry, Oregon grape, and beargrass with a Douglas-fir overstory.

Unit 70S

O1 & O2	2-0"	Needles, leaves, twigs and partially decomposed organic material.
A1	0-1½"	Dark yellowish brown (10 YR 3/4); very gravelly sandy loam; yellowish brown (10 YR 5/6) dry; weak fine granular structure; loose, very friable; 60% gravel and stone; abundant roots; very strongly acid (pH 4.6); abrupt wavy boundary.
B1	1½-9"	Dark yellowish brown (10 YR 4/4) very gravelly sandy loam; weak fine granular structure; loose, very friable; 65% gravel and stone; abundant roots; very strongly acid (pH 4.7); clear smooth boundary.
B2	9-18"	Dark yellowish brown (10 YR 3/4) very gravelly loam; weak fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; 70% gravel and stone; very strongly acid (pH 4.9); abrupt wavy boundary.
R	18"+	Hard andesite.

Location: Linn County
NW ¼ SW ¼, S. 16, T.11S, R.4E

Vegetation: Red Huckleberry, vine maple, and sword fern with a hemlock overstory.

Unit 75S

O1	4-3"	Leaves and branches.
O2	3-0"	Partially decomposed organic material.
A11	0-7"	Black (10 YR 2/1) very gravelly loam; moderate fine and medium granular structure; friable, slightly sticky; 55% gravel and stone; abundant roots; strongly acid (pH 5.1); clear smooth boundary.
A12	7-15"	Very dark brown (10 YR 3/2) very gravelly loam; weak fine and medium granular structure, friable; 65% gravel and stone; abundant roots; strongly acid (pH 5.5).
R	15"+	Fractured andesite.

Location: NE corner of SE¼ of NW¼, Sec. 35, T.6S, R.4E

Vegetation: Huckleberry, vine maple, rhododendron, twin flower, and thimble berry with an overstory of hemlock, Douglas-fir and noble fir.

Unit 175S

Same type of soil as Unit 75S soil except it occurs in the moist-mesic zone instead of the moist-frigid zone.

Unit 256

Same type of soil as the Cascade series except it occurs in the xeric-mesic zone instead of the moist-mesic zone.

IX. Bibliography

1. Alvis, Richard J. Cutbank Stability Reconnaissance Survey Information, Siskiyou National Forest. USDA, Forest Service, "In Service" Report. Portland, Oregon.

2. Alvis, Richard J., and Herman, L.D. Cutbank Stability Reconnaissance Survey Information, Willamette National Forest. USDA, Forest Service, "In Service" Report. Portland, Oregon.

3. Bowlsby, Clyde C. and Swanson, Richard C. 1964. Soil Survey Tillamook Area, Oregon. USDA, Soil Conservation Service. US Government Printing Office, Wash., D.C.

4. Corliss, John F. Soil and Vegetation Survey, Alsea Area, Oregon. USDA, Forest Service, Unpublished manuscript, 730 pp.

5. Federal Housing Administration. Revised 1961. Engineering Soil Classification for Residential Development. FHA No. 373. U.S. Government Printing Office, Wash., D.C.

6. Highsmith, Richard M., Jr. Atlas of the Pacific Northwest. Resources and Development. 1962. 3rd Edition. Oregon State Univ. Press, Corvallis 168 pp.

7. Otte, George E. Soil Survey of Yamhill Area, Oregon. USDA, Soil Conservation Service. Unpublished manuscript.

8. Pomerening, J.H., Paeth, R. C., Knox, E.G. and Simonson, G.H.. Umpqua Drainage Basin General Soil Map Report with Irrigable Areas. Oregon Agricultural Experiment Station. Unpublished manuscript.

9. Schlicker, H. G. and Deacon, Robert J. 1967. Engineering Geology of the Tualatin Valley Region, Oregon. Oregon Department of Geology and Mineral Industrial Bull. 60. Portland, Oregon. 103 pp.

10. Simonson, G.H., Norgren J.A., Paeth, R.C. and Knox E.G., Willamette Drainage Basin, Segment I: Lowlands and Foothills, General Soil Map Report. Oregon Agricultural Experiment Station. Unpublished manuscript.

11. Soil Survey Staff. 1960. Soil Classification—A comprehensive system: 7th Approximation. U.S. Government Printing Office, Wash., D.C.

12. Soil Survey Staff. March 1967. Supplement to Soil Classification—A comprehensive system: 7th Approximation. U.S. Government Printing Office, Wash., D.C.

13. Stephens, F. R. Soil Survey, Bull Run-Sandy Area, Oregon. USDA, Forest Service. Unpublished manuscript. 447 pp.

14. Thilenius, John F. 1963. Synecology of the White Oak (Quercus Garryana Douglas) Woodlands of the Willamette Valley, Oregon State University, Corvallis, Ph.D. thesis.

15. Thomas, Byron R. and Simonson, G.H. North, Mid, and South Coast Drainage Basin General Soil Map Report with Irrigable Areas. Oregon Agricultural Experiment Station. Unpublished manuscript.

Bibliography con't

16. USDA. 1941. Climate and Man, Yearbook of Agriculture. U.S. Government Printing Office, Wash., D.C.

17. USDA. 1964. Interim Report. Willamette River Basin, Oregon. Prepared by Economic Research Service. U.S. Forest Service, Soil Conservation Service.

18. USDA. 1967. Guide for Interpreting Engineering Uses of Soils. USDA, Soil Conservation Service.

19. Williams, Lynn H. Soil Survey of Marion Area, Oregon. USDA, Soil Conservation Service. Unpublished manuscript. 545 pp.