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SOIL SURVEY

Skagit County Washington

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
Washington Agricultural Experiment Station

HOW TO USE THE SOIL SURVEY REPORT

THIS SURVEY of the soils of Skagit County, Washington, will help you plan the kind of agriculture that will protect your soils and provide good yields. The fieldwork was completed in 1951. Unless otherwise specified, the information in this report refers to conditions at that time.

Find your farm on the map

In using this survey, start with the soil map that is at the back of this report. This is a large map of the county, on which you can see roads, rivers, towns, important buildings, and other landmarks.

To find your farm on the large map, use the index to map sheets. This is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located.

Each kind of soil mapped in the county is identified on the soil map by a symbol. Suppose you have found on your farm an area marked with the symbol Af. The legend for the detailed soil map shows that this symbol identifies Alderwood gravelly sandy loam, 0 to 3 percent slopes.

Learn about your soils

Alderwood gravelly sandy loam, 0 to 3 percent slopes, and all other soils mapped in this county are described in the section Descriptions of Soils. Table 3, in the section Management of Soils, tells what crops and cropping systems are suitable for each soil in the county, and table 4 tells how much you can expect to harvest from each soil.

Make a farm plan

Compare the yields you are getting with those shown in table 4 for the soils on your farm. Look at your fields for signs of runoff and erosion. Then decide whether you need to change your farming methods. This survey will help you plan new methods, but it is not a plan of management for any particular farm.

If you want help in planning, consult the county agent or the local representative of the Soil Conservation Service. Members of the staff of your State agricultural experiment station will also be glad to help you.

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SOIL SURVEY OF SKAGIT COUNTY, WASHINGTON

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General Nature of the Area

Skagit County is in the northwestern part of the State of Washington. Roughly rectangular in shape, the county extends from Puget Sound on the west to the crest of the Cascade Mountains on the east (fig. 1). On the east, it borders Okanogan County and Chelan County; on the north, Whatcom County; and on the south, Snohomish County. It is 24 miles wide from north to south and 95 miles long from east to west. The eastern part, which is in Mount Baker National Forest, was not surveyed. About 54 percent of the county—approximately 935 square miles, including several islands in Puget Sound—was surveyed.

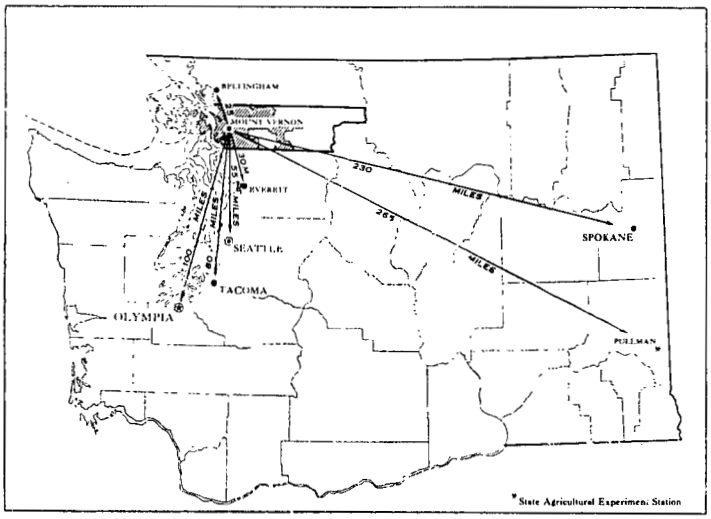

Figure 1.—Location of Skagit County in Washington.

Physiography

Most of Skagit County, including the part not surveyed, is in the Northern Cascade Mountains of the Sierra-Cascade Province. The Cascade Mountains (fig. 2) consist of ancient sediments, strongly folded, generally metamorphosed, and intruded by granite batholiths (*4*). The summit level of the Cascade peneplain ranges from 6,000 to 8,000 feet above sea level; west of the national forest, the elevation ranges from 3,000 to 4,000 feet.

The western part of the county is in the Puget Trough of the Pacific Border Province. This section includes most of the agricultural areas. It consists of an extensive delta plain (fig. 3), alluvial flats, low glacial outwash plains, and a few lateral or frontal moraines. Except for many monadnocks, the elevation ranges from sea level to 300 or 400 feet.

This section of the county was covered by a lobe of the Cordilleran Glacier Complex, but, compared to most of

Figure 2.—The Cascade Mountains, where most of the virgin timber stands. The soils are generally shallow. Rock outcrops are numerous. Peaks in background are bare of vegetation and are snow covered most of the year.

Figure 3.—The delta plain and part of the uplands.

the other northwestern Washington counties, the total area of glacial deposits is small. Most of the deposits occur in scattered areas as high moraines skirting foothills and as outwash terraces bordering the Skagit River. Most of the glacial material in the mountain valleys of the eastern part of the county was deposited by glaciers formed in the Cascade Mountains.

The Skagit River, the largest river in that part of the State north of the Columbia River, drains much of the county. Its main tributaries are the Sauk, Suiattle, Cascade, and Baker Rivers, all of which are in the eastern half of the county. The Skagit River empties into Puget Sound at the southwestern corner of the county. An extensive delta plain has formed north of the mouth of the river.

The Samish River drains the northwestern corner of the county. The Nooksack River drains a mountainous section in the north-central part. The southern edge is drained by Pilchuck Creek and Deer Creek and the North Fork of the Stillaguamish River.

In the mountainous areas, the Skagit River and its tributaries are fast flowing and have cut deeply into the bedrock, but the Skagit becomes sluggish and meandering in the broad, flat, alluvial bottoms and delta of its lower reaches. The bottom lands and many of the adjacent terraces are imperfectly to poorly drained. In the delta plain, dikes have been built to keep the river in its course when the water is high. Dikes at the extremity of the delta keep out salt water.

On the delta plain, the water table is high during the rainy season but low enough during the growing season so that many crops can be grown. The alluvial flood plains, although subject to flooding, are better drained than the delta. The bordering glacial moraines are not well drained because they lack well-developed drainage channels. Many soils have very slow internal drainage and underdrainage because they are underlain by fine-textured or cemented till. The glacial outwash terraces that have free underdrainage are typically somewhat excessively drained. Ponded or poorly drained small basins or depressions are scattered throughout these glaciated areas.

Climate

The climate of Skagit County is mild because of the modifying effects of the prevailing westerly winds from the Pacific Ocean. It is characterized by fairly cool, dry summers and mild, moist winters. The county is sheltered by the Cascade Mountains from the extremes of temperatures and the strong winds of the continental interior. Table 1 presents data on temperature and precipitation at two weather stations, one at Anacortes in the western part of the county and the other at Concrete in the north-central part. Because of the tremendous differences in relief, the temperature varies from place to place. The amount of precipitation in the Cascade Mountains is far greater than in the lowlands to the west. The average rainfall at Anacortes Station is 26.60 inches a year, and the average yearly snowfall is 6.2 inches. In contrast, the average yearly rainfall at Concrete Station is 60.79 inches, and the snowfall is 33.4 inches. At high altitudes, as much as 90 inches of rain falls annually.

About 70 percent of the precipitation falls between October 1 and April 1. June, July, and August are dry months. The precipitation is in the form of gentle rains, showers, fog, or mist. At elevations of more than 2,000 feet, snow accumulates to considerable depths. At lower elevations, snow falls occasionally but remains on the ground only a short time. In the foothills and mountain valleys above Concrete, however, snow sometimes remains for several weeks. There are few windy days, thunderstorms, cloudbursts, or hailstorms. The prevailing winds from the west are usually gentle.

According to the data gathered at the Anacortes Station, the average frost-free growing season in that part of the county is from March 28 to November 10, or 227 days; in the area around Concrete, it is from April 16 to October 27, or 194 days.

Vegetation

Except for some small scattered groves of deciduous trees that occupy depressions, the virgin vegetation is a dense growth of very large conifers. Differences in precipitation and temperature, resulting from a wide range in altitude and relief, influence the rate and type of growth.

The dominant and most valuable tree in the virgin forest is the Douglas-fir (*Pseudotsuga menziesii*). It grows throughout the county. Other conifers thrive in many areas. Western hemlock (*Tsuga heterophylla*) and Sitka spruce (*Picea sitchensis*) grow throughout the county, most extensively in the mountain sections. At some of the highest elevations, balsam fir (*Abies balsamea*) and mountain hemlock (*Tsuga mertensiana*) are dominant. Western redcedar (*Thuja plicata*) grows under various conditions but attains a large size only in the moister places. It normally does not grow on droughty soils. At low elevations it grows mostly on the moderately well drained to poorly drained soils. It predominates, however, in many areas in the mountains where rainfall is heavy. A little lodgepole pine (*Pinus contorta*) and Rocky Mountain juniper (*Juniperus scopulorum*) grow on arid sites.

Many different deciduous trees and shrubs are associated with the conifers. They predominate in only a few areas and are unimportant commercially. Red alder (*Alnus rubra*) and bigleaf maple (*Acer macrophyllum*) spread rapidly over cutover lands. They are crowded out by conifers in a few years, provided the areas have not been excessively burned and provided there is a source of conifer seed. Willow (*Salix* spp.), vine maple (*Acer circinatum*), and alder are dominant in low moist areas and in other less favorable cutover areas. Other, but less common, trees of the moist areas are western paper birch (*Betula papyrifera*), black cottonwood (*Populus trichocarpa*) and quaking aspen (*Populus tremuloides*).

Other common trees and shrubs include Pacific dogwood (*Cornus nuttallii*), cascara buckthorn (*Rhamnus purshiana*), elderberry (*Sambucus glauca*), hazelnut (*Corylus cornuta*), and oceanspray, or ironwood, (*Holodiscus discolor*). These are thinly scattered among the conifers and do best in moist places. In the original forest, deciduous trees were most common on the alluvial flood plains, along the borders of foothills and low mountain streams, and in depressions.

TABLE 1.—*Temperature and precipitation at two weather stations in Skagit County, Wash.*

[Anacortes, elevation, 30 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1929)	Wettest year (1917)	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	41.2	62	9	4.00	4.08	12.46	0.8
January	39.1	65	6	3.47	1.89	4.19	2.6
February	41.5	69	9	2.48	1.27	3.00	1.7
Winter	40.6	69	6	9.95	7.24	19.65	5.1
March	45.1	73	21	2.36	2.09	3.03	.6
April	49.6	83	28	1.89	1.47	4.00	[3]
May	54.3	90	31	1.60	1.20	.94	0
Spring	49.7	90	21	5.85	4.76	7.97	.6
June	58.6	95	33	1.31	.74	4.29	0
July	61.4	92	35	.67	.09	.34	0
August	61.6	95	37	.88	.40	.34	0
Summer	60.5	95	33	2.86	1.23	4.97	0
September	57.8	88	37	1.58	.20	1.70	0
October	51.9	82	25	2.57	.90	1.24	[3]
November	45.4	69	23	3.79	1.56	2.29	.5
Fall	51.7	88	23	7.94	2.66	5.23	.5
Year	50.6	95	6	26.60	15.89	37.82	6.2

[Concrete, elevation, 270 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1930)	Wettest year (1910)	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	38.2	63	9	9.32	3.72	13.40	6.6
January	35.2	63	−1	8.50	4.18	8.53	13.6
February	39.6	66	1	6.22	8.96	5.48	8.4
Winter	37.7	66	−1	24.04	16.86	27.41	28.6
March	44.9	82	15	5.96	5.12	4.49	2.5
April	51.3	93	25	3.53	2.87	4.43	.2
May	56.2	94	29	3.11	2.84	2.41	0
Spring	50.8	94	15	12.60	10.83	11.33	2.7
June	60.8	106	35	2.51	1.97	.64	0
July	65.0	102	39	1.13	[3]	1.24	0
August	64.9	102	31	1.42	[3]	1.81	0
Summer	63.6	106	31	5.06	1.97	3.69	0
September	60.0	102	30	3.36	3.30	11.70	0
October	52.4	87	10	6.49	6.55	14.66	[3]
November	42.8	69	10	9.24	3.94	11.66	2.1
Fall	51.7	102	10	19.09	13.79	38.02	2.1
Year	50.9	106	−1	60.79	43.45	80.45	33.4

[1] *Anacortes:* Average temperature based on a 46-year record, through 1955; highest and lowest temperatures based on a 45-year record, through 1952. *Concrete:* Average temperature based on a 35-year record, through 1955; highest and lowest temperatures based on a 35-year record, through 1952.

[2] *Anacortes:* Average precipitation based on a 63-year record, through 1955; wettest and driest years based on a 62-year record, in the period 1893–1955; snowfall based on a 54-year record, through 1952. *Concrete:* Average precipitation based on a 38-year record, through 1955; wettest and driest years based on a 38-year record, in the period 1906–55; snowfall based on a 36-year record, through 1952.

[3] Trace.

The understory is generally a luxuriant and dense tangle of many different plants. It most commonly includes the following: Salal (*Gaultheria shallon*), Oregon grape (*Berberis Odostemon aquifolium*) salmonberry (*Rubus spectabilis*), western thimbleberry (*Rubus parviflorus*), trailing blackberry (*Rubus macropetalus*), evergreen blackberry (*Rubus laciniatus*), snowberry (*Symphoricarpos albus*), red huckleberry (*Vaccinium parvifolium*), and wild rose (*Rosa nutkana*). These are associated with many kinds of ferns and mosses. The western swordfern (*Polystichum munitum*) is most common under dense virgin timber and does best in moist shady places. The western bracken (*Pteridium acquilinum*), now the most common fern, grows throughout a wide range of conditions. It spreads rapidly after logging, burning, or partial clearing. In many places it forms a dense cover that excludes nearly all other vegetation.

In some peat bogs and wet basins, Douglas spirea (*Spirae douglasii*), also called hardhack, is common. It completely covers some areas of sedimentary and sedge peat. Water-tolerant grasses, sedges (*Carex* spp.), tules (*Scirpus acutus*), skunkcabbage (*Symplocarpus* sp.), rushes (*Juncus* spp.) and cattails (*Typha* spp.) also grow in these positions. Acid peat bogs of sphagnum support Labrador-tea (*Ledum groenlandicum*), cranberry (*Vaccinium oxycoccus*), and other acid-tolerant plants.

Most of the merchantable timber has been removed in the western part of the county and from the lower elevations in the central part. Some extensive areas of virgin timber remain in the eastern part. The remaining virgin forests consist mainly of western hemlock, mountain hemlock, and balsam fir. Most of the logged areas not in farms are restocking to the same kinds of trees as were in the original stands. However, the deciduous trees, including alder, maple, and willow, are rapidly growing up in these areas and are retarding or preventing the growth of more desirable trees. This is particularly true of areas that were carelessly logged or severely burned or that lack sufficient conifers for seed.

In 1945, the volume of sawtimber available in the whole county, measured in thousand (M) board-feet log scale, Scribner rule, was reported to be as follows (*6*):

	Thousands of board-feet
Douglas-fir	2,130,223
Pines, western larch, and miscellaneous softwoods	110,947
Spruces, hemlocks, and true firs	6,672,681
Cedars	1,525,126
Hardwoods	105,817

These estimates include hardwoods and pines exceeding 11 inches DBH and other conifers exceeding 15 inches. Slightly less than half was in national forests or on Indian land.

Water

Water for domestic use is obtained from shallow wells, springs, and mountain streams. The supply is adequate and the quality good. Most of the towns get their water supply from mountain streams. Mount Vernon and other towns in the western part of the county have gravity water systems fed by streams in the Cultus Mountains. A standby pumping system supplements the gravity system during summer. Water for irrigation is obtained from nearby streams or wells. At present, irrigation is used only on a small acreage of alluvial soils.

Soil Survey Methods and Definitions

The scientist who makes a soil survey examines soils in the field and, according to his observations, maps the boundaries of each soil on an aerial photograph or other map.

FIELD STUDY.—The soil surveyor bores or digs many holes to see what the soils are like. The holes are spaced irregularly, depending on the lay of the land. Usually they are not more than a quarter of a mile apart; in many areas they are much closer together. In most soils each boring, hole, or pit reveals several layers, called horizons, which collectively are known as the soil profile. The profile is studied to see how the horizons differ from one another and to learn the things about the soil that influence its capacity to support plants.

Color is usually related to the amount of organic matter. The darker the surface soil, as a rule, the more organic matter it contains. Color is also a clue to the natural drainage conditions. A bright brown subsoil is evidence of good drainage and aeration. Streaks and spots of gray, yellow, and brown show that the soil has a high water table for much of the year and has poor drainage and aeration. A bluish-gray subsoil is characteristic of soils that are waterlogged or covered by water most of the year.

Texture, or the content of sand, silt, and clay, is determined by the way the soil feels when rubbed between the fingers and by laboratory analysis. Texture determines how well the soil retains moisture, plant nutrients, and fertilizer and whether it is easy or difficult to cultivate.

Structure, which is the way the individual soil particles are arranged in aggregates and the amount of pore space between aggregates, gives clues to the ease or difficulty with which the soil is penetrated by plant roots and by moisture. The aggregates may be prismatic, columnar, blocky, platy, or granular. As a rule, soil particles are not evenly distributed. Channels have been formed by roots and earthworms, and cracks appear when the soils shrink and swell upon drying and wetting. Thus, the soils are a network of channels filled with air, roots, and water, bounded by the irregular surfaces of the soil particles.

Consistence, or the tendency of the soil to crumble or to stick together, indicates whether it is easy or difficult to keep the soil open and porous under cultivation.

Other characteristics observed in the course of the field survey and considered in correlating the soil include the following: The depth of the soil over bedrock or compact layers, the presence of gravel or stones in amounts that will interfere with cultivation, the steepness and pattern of slopes, the degree of erosion, the nature of the parent material, and the acidity or alkalinity of the soil as measured by chemical tests.

CORRELATION.—On the basis of the characteristics observed by the soil scientists or determined by laboratory tests, soils are correlated by series, types, and phases.

As an example of correlation, consider how the Kline series of Skagit County is separated into types and phases:

Series	*Type*	*Phase*
Kline	Gravelly loam	1 to 3 percent slopes.
		3 to 8 percent slopes.
	Loam	1 to 3 percent slopes.
		3 to 8 percent slopes.
	Sandy loam	1 to 3 percent slopes.
	Silt loam	1 to 3 percent slopes.

Soil series.—Soils similar in kind, thickness, and arrangement of layers are normally designated as a soil series. In a given area, a soil series may be represented by only one soil.

Soil type.—Within a series, there may be one soil type or several types. The types are differentiated by the texture of the surface layer.

Soil phase.—Soil types are divided into phases because of differences in slope, number of rock outcrops, degree of erosion, or depth.

The phase (or the type, if it has not been subdivided) is the unit shown on the soil map. It is the unit that has the narrowest range of characteristics. It can be described more specifically than the series or the broader groups that contain more variation.

Miscellaneous land types.—Certain mapping units that have little true soil are not classified by series and types but are identified by descriptive names. Examples of such units in Skagit County are Riverwash and Rough rocky land.

The Soils of Skagit County

The soils of Skagit County are of two main groups: (1) alluvial, or bottom-land, soils and (2) upland soils. Most of the soils of the bottom lands are fertile and highly productive and have many different agricultural uses; the upland soils in general are much less fertile and less productive and have fewer uses. Erosion is not a problem in Skagit County, although considerable stream cutting has occurred in some sections along the Skagit River.

Soils of the bottom lands.—These soils occur mostly in the valley and on the delta of the Skagit River. There are wide variations in color, texture, and thickness of the surface layer and in the character of the subsoil and substratum. The poorly drained Puget soils, for example, have a gray, mottled surface soil and a gray, clayey subsoil, whereas the better drained Puyallup soils have a brownish surface soil and a friable, sandy subsoil. The surface soil and upper subsoil of the Puyallup and Sultan soils are similar in color, but the underlying materials are different. The Puyallup is underlain by sandy material and the Sultan by friable, silty material. The Sultan soil

is more drought resistant and more productive of most crops than the Puyallup. It is one of the few soils well suited to alfalfa.

Many of the bottom-land soils are nearly uniform to depths of 30 to 40 inches. The Puget and Sumas soils, for example, differ mainly in the substratum. The Puget soil is underlain by clayey material, and the Sumas by sand. Both soils are highly productive if properly drained, but the Sumas soil is more easily and rapidly drained.

Soils of the uplands.—The profiles of the Alderwood and Everett soils are somewhat similar to a depth of about 30 inches. The Alderwood is underlain by a strongly cemented hardpan, and the Everett by loose, porous, gravelly and sandy materials. The cemented hardpan aids considerably in conserving moisture in the dry summer season; consequently, the Alderwood soils can be used to a limited extent for agriculture, whereas the Everett soils are generally unsuited to agriculture. The character and depth of the underlying material are important in many of the upland soils. The Bow soils are shallower than the Alderwood and are underlain by compact clayey material. The Squalicum soils, like the Alderwood, are underlain by a strongly cemented hardpan.

The soils on slopes of more than 15 percent are not well suited to cultivation. They are better suited to forestry. If cleared and farmed, they would be erodible; more water would run off and less would be absorbed.

A unique area occurs in the vicinity of the town of Concrete. Dust from the cement plant has changed the reaction of the soils from acid to alkaline over a period of approximately 25 years. The dust has had the greatest effect to the west of the plant; it has had very little effect to the north and south. Within 1 mile of the plant, the reaction of the soil to a depth of 3 inches has changed from strongly acid to alkaline. The area outlined on the soil map by black dots has calcareous surface soils. The larger area outlined with black dashes has neutral or mildly alkaline surface soils. The lime dust appears to benefit crops.

Descriptions of Soils

In the following pages, the soils and miscellaneous land types of Skagit County are described, and their use and management are discussed. Their location and distribution are shown on the soil map in the back of this report. Their acreage and proportionate extent are given in table 2.

TABLE 2.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Alderwood gravelly sandy loam, 0 to 3 percent slopes	1, 895	0. 3	Bow gravelly loam, 0 to 3 percent slopes	8, 400	1. 4
Alderwood gravelly sandy loam, 3 to 8 percent slopes	5, 005	. 8	Bow gravelly loam, 3 to 8 percent slopes	5, 350	. 9
Alderwood gravelly sandy loam, 8 to 15 percent slopes	2, 990	. 5	Bow gravelly loam, 8 to 15 percent slopes	1, 345	. 2
Alderwood gravelly sandy loam, 15 to 30 percent slopes	2, 290	. 4	Bow gravelly loam, 15 to 30 percent slopes	225	(1)
Alderwood gravelly sandy loam, 30 to 45 percent slopes	1, 310	. 2	Bow gravelly loam, 30 to 45 percent slopes	115	(1)
Alderwood gravelly sandy loam, shallow, 0 to 3 percent slopes	200	(1)	Bow loam, 0 to 3 percent slopes	525	. 1
Alderwood gravelly sandy loam, shallow, 3 to 8 percent slopes	165	(1)	Bow loam, 3 to 8 percent slopes	520	. 1
Alderwood gravelly sandy loam, shallow, 8 to 15 percent slopes	540	. 1	Bow loam, 15 to 30 percent slopes	90	(1)
Alderwood gravelly sandy loam, shallow, 15 to 30 percent slopes	300	. 1	Bow loam, shallow, 0 to 3 percent slopes	1, 600	. 3
Alderwood gravelly loam, 0 to 3 percent slopes	575	. 1	Cagey gravelly fine sandy loam, 0 to 3 percent slopes	130	(1)
Alderwood gravelly loam, 3 to 8 percent slopes	3, 975	. 7	Cagey gravelly fine sandy loam, 3 to 8 percent slopes	150	(1)
Alderwood gravelly loam, 8 to 15 percent slopes	2, 715	. 5	Cagey gravelly sandy loam, moderately shallow, 0 to 3 percent slopes	120	(1)
Alderwood gravelly loam, 15 to 30 percent slopes	3, 680	. 6	Cagey gravelly sandy loam, moderately shallow, 3 to 8 percent slopes	345	. 1
Alderwood gravelly loam, 30 to 45 percent slopes	325	. 1	Cagey gravelly sandy loam, moderately shallow, 8 to 15 percent slopes	165	(1)
Belfast silt loam, 0 to 3 percent slopes	940	. 2	Carbondale muck, 0 to 1 percent slopes	80	(1)
Bellingham silt loam, 0 to 2 percent slopes	1, 605	. 3	Carbondale muck, shallow, 0 to 1 percent slopes	245	(1)
Bellingham silt loam, 2 to 5 percent slopes	235	(1)	Cathcart loam, 3 to 8 percent slopes	1, 165	. 2
Bellingham silt loam, light colored variant, 0 to 3 percent slopes	130	(1)	Cathcart loam, 8 to 15 percent slopes	1, 105	. 2
Bellingham silty clay loam, 0 to 2 percent slopes	1, 135	. 2	Cathcart loam, 15 to 30 percent slopes	1, 475	. 2
Bellingham silty clay loam, 2 to 5 percent slopes	95	(1)	Cathcart loam, 30 to 60 percent slopes	2, 635	. 4
Bellingham clay, 0 to 2 percent slopes	40	(1)	Cathcart clay loam, 3 to 8 percent slopes	225	(1)
Bellingham clay loam, light colored variant, 0 to 3 percent slopes	140	(1)	Cathcart gravelly loam, 3 to 8 percent slopes	600	. 1
Bow silt loam, 0 to 3 percent slopes	4, 200	. 7	Cathcart gravelly loam, 8 to 15 percent slopes	550	. 1
Bow silt loam, 3 to 8 percent slopes	5, 875	1. 0	Cathcart gravelly loam, 15 to 30 percent slopes	1, 310	. 2
Bow silt loam, 8 to 15 percent slopes	1, 040	. 2	Cathcart stony loam, 8 to 15 percent slopes	160	(1)
Bow silt loam, 15 to 30 percent slopes	715	. 1	Cathcart stony loam, 15 to 30 percent slopes	180	(1)
Bow silt loam, 30 to 45 percent slopes	875	. 1	Cathcart stony loam, 30 to 60 percent slopes	1, 105	. 2
Bow silt loam, shallow, 0 to 3 percent slopes	335	. 1	Coastal beach, 0 to 3 percent slopes	405	. 1
Bow silt loam, shallow, 3 to 8 percent slopes	55	(1)	Cokedale silt loam, 0 to 3 percent slopes	1, 205	. 2
			Cokedale silt loam over Puyallup soil material, 0 to 3 percent slopes	320	. 1
			Cokedale loam, 0 to 3 percent slopes	490	. 1
			Cokedale sandy loam, 0 to 3 percent slopes	310	1
			Cokedale silty clay loam, 0 to 3 percent slopes	65	(1)
			Cokedale silty clay loam over Puyallup soil material, 0 to 3 percent slopes	130	(1)
			Corkindale loam, 0 to 3 percent slopes	170	(1)

See footnote at end of table.

TABLE 2.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Corkindale loam, 3 to 8 percent slopes	365	0. 1	Lummi silt loam, 0 to 1 percent slopes	1, 020	0. 2
Corkindale loam, 8 to 15 percent slopes	80	(1)	Lummi silty clay loam, 0 to 1 percent slopes	870	. 1
Corkindale loam, 15 to 30 percent slopes	95	(1)	Lynden sandy loam, 0 to 3 percent slopes	1, 345	. 2
Corkindale loam, 30 to 45 percent slopes	55	(1)	Lynden sandy loam; 3 to 8 percent slopes	255	(1)
Coveland gravelly loam, 0 to 3 percent slopes	435	1	Lynden loamy sand, 0 to 3 percent slopes	955	. 2
Coveland gravelly loam, 3 to 8 percent slopes	175	(1)	Lynden loamy sand, 3 to 8 percent slopes	70	(1)
Coveland silt loam, 0 to 3 percent slopes	120	(1)	Lynden loamy sand, 8 to 15 percent slopes	95	(1)
Coveland silt loam, moderately well drained variant, 0 to 3 percent slopes	100	(1)	Lynden loam, 0 to 3 percent slopes	825	. 1
			Lynden loam, 3 to 8 percent slopes	160	(1)
			Lynden gravelly loam, 0 to 3 percent slopes	185	(1)
Coveland gravelly silt loam, 3 to 8 percent slopes	470	. 1	Lynden gravelly loam, 3 to 8 percent slopes	150	(1)
Everett gravelly sandy loam, 0 to 3 percent slopes	2, 290	. 4	Made land	630	. 1
			Marblemount stony loam, 15 to 30 percent slopes	70	(1)
Everett gravelly sandy loam, 3 to 8 percent slopes	2, 845	. 5	Mukilteo peat, 0 to 1 percent slopes	480	. 1
			Mukilteo peat, shallow, 0 to 1 percent slopes	65	(1)
Everett gravelly sandy loam, 8 to 15 percent slopes	2, 265	. 4	Neptune sandy loam, 0 to 3 percent slopes	15	(1)
Everett gravelly sandy loam, 15 to 30 percent slopes	845	. 1	Nookachamps silty clay loam, 0 to 2 percent slopes	800	. 1
			Nookachamps silt loam, 0 to 2 percent slopes	720	. 1
Everett gravelly sandy loam, 30 to 45 percent slopes	370	. 1	Norma silt loam, 0 to 2 percent slopes	660	. 1
			Norma silt loam, 2 to 5 percent slopes	50	(1)
Everett cobbly sandy loam, 0 to 3 percent slopes	295	(1)	Norma loam, 0 to 2 percent slopes	390	. 1
Fidalgo rocky loam, 8 to 15 percent slopes	390	. 1	Norma silty clay loam, 0 to 2 percent slopes	45	(1)
Fidalgo rocky loam, 15 to 30 percent slopes	2, 105	. 4	Oso loam, 15 to 30 percent slopes	3, 525	. 6
Fidalgo rocky loam, 30 to 45 percent slopes	2, 490	. 4	Oso loam, 30 to 60 percent slopes	385	. 1
Giles silt loam, 0 to 3 percent slopes	920	. 2	Oso loam, 3 to 8 percent slopes	1, 030	. 2
Giles silt loam, 8 to 15 percent slopes	45	(1)	Oso loam, 8 to 15 percent slopes	955	. 2
Giles loam, 0 to 3 percent slopes	890	. 1	Pilchuck fine sand, 0 to 3 percent slopes	3, 410	. 6
Giles loam, 3 to 8 percent slopes	190	(1)	Pilchuck loamy sand, 0 to 3 percent slopes	1, 475	. 2
Gilligan silt loam, 0 to 3 percent slopes	1, 630	. 3	Pilchuck sandy loam, 0 to 3 percent slopes	215	(1)
			Pilchuck gravelly sand, 0 to 3 percent slopes	620	. 1
Gilligan silt loam, moderately shallow, 0 to 3 percent slopes	55	(1)	Puget silt loam, 0 to 1 percent slopes	20, 295	3. 4
Gilligan loam, 0 to 3 percent slopes	440	. 1	Puget silty clay loam, 0 to 1 percent slopes	4, 640	. 8
			Puget loam, 0 to 1 percent slopes	90	(1)
Gilligan gravelly loam, moderately shallow, 0 to 3 percent slopes	230	(1)	Puget fine sandy loam, 0 to 3 percent slopes	1, 990	. 3
Greenwater loamy sand, 0 to 3 percent slopes	3, 910	. 7	Puyallup fine sandy loam, 0 to 3 percent slopes	20, 385	3. 4
Greenwater loamy sand, 3 to 8 percent slopes	215	(1)	Puyallup loamy sand over Puget soil material, 0 to 3 percent slopes	220	(1)
Greenwater loamy sand, 8 to 15 percent slopes	50	(1)			
Greenwater sandy loam, 0 to 3 percent slopes	135	(1)	Puyallup loam, 0 to 3 percent slopes	11, 360	2. 0
Greenwood peat, 0 to 1 percent slopes	80	(1)	Puyallup silt loam, 0 to 3 percent slopes	11, 270	2. 0
Heisler stony loam, 15 to 30 percent slopes	475	. 1	Rifle peat, 0 to 1 percent slopes	905	. 2
Heisler stony loam, 30 to 45 percent slopes	385	. 1	Rifle peat, shallow, 0 to 1 percent slopes	775	. 1
Heisler gravelly loam, 3 to 8 percent slopes	335	. 1	Riverwash, 0 to 3 percent slopes	2, 765	. 5
Heisler gravelly loam, 8 to 15 percent slopes	210	(1)	Rough broken land	22, 540	3. 8
Heisler gravelly loam, 15 to 30 percent slopes	325	. 1	Rough mountainous land, Cathcart soil material	52, 474	8. 8
Hovde loamy sand, 0 to 1 percent slopes	40	(1)	Rough mountainous land, Heisler soil material	148, 498	25. 0
Indianola loamy sand, 3 to 8 percent slopes	300	. 1	Rough mountainous land, Marblemount soil material	13, 155	2. 2
Indianola loamy sand, 8 to 15 percent slopes	420	. 1			
Indianola loamy sand, 15 to 30 percent slopes	195	(1)	Rough mountainous land, Oso soil material	57, 628	9. 6
Indianola loamy sand, 30 to 45 percent slopes	120	(1)	Rough rocky land	12, 185	2. 0
Indianola sandy loam, 3 to 8 percent slopes	675	. 1	Samish silty clay loam, 0 to 1 percent slopes	1, 020	. 2
Klaus gravelly sandy loam, 0 to 3 percent slopes	490	. 1	Samish silt loam, 0 to 1 percent slopes	980	. 2
Klaus gravelly sandy loam, 3 to 8 percent slopes	1, 590	. 3	Sauk loam, 0 to 3 percent slopes	360	. 1
Klaus gravelly sandy loam, 8 to 15 percent slopes	1, 125	. 2	Sauk loam, 3 to 8 percent slopes	85	(1)
			Saxon silt loam, 3 to 8 percent slopes	685	. 1
Klaus gravelly sandy loam, 15 to 30 percent slopes	730	. 1	Saxon silt loam, 8 to 15 percent slopes	330	. 1
			Saxon silt loam, 15 to 30 percent slopes	115	(1)
Klaus gravelly loam, 0 to 3 percent slopes	175	(1)	Semiahmoo muck, 0 to 1 percent slopes	230	(1)
Klaus gravelly loam, 3 to 8 percent slopes	115	(1)	Semiahmoo muck, shallow, 0 to 1 percent slopes	945	. 2
Klaus gravelly loam, 8 to 15 percent slopes	145	(1)	Skiyou gravelly loam, 3 to 8 percent slopes	2, 280	. 4
Klaus gravelly loam, 15 to 30 percent slopes	180	(1)	Skiyou gravelly loam, 8 to 15 percent slopes	1, 830	. 3
Klaus sandy loam, 0 to 3 percent slopes	885	. 1	Skiyou gravelly loam, 15 to 30 percent slopes	2, 420	. 4
Klaus sandy loam, 3 to 8 percent slopes	460	. 1	Skiyou gravelly loam, 30 to 45 percent slopes	605	. 1
Klaus sandy loam, 8 to 15 percent slopes	465	. 1	Skykomish gravelly sandy loam, 3 to 8 percent slopes	545	. 1
Klaus sandy loam, 15 to 30 percent slopes	2, 090	. 3			
Kline silt loam, 1 to 3 percent slopes	500	. 1	Skykomish gravelly sandy loam, 8 to 15 percent slopes	205	(1)
Kline loam, 1 to 3 percent slopes	680	. 1			
Kline loam, 3 to 8 percent slopes	135	(1)	Skykomish gravelly sandy loam, 15 to 30 percent slopes	940	. 2
Kline gravelly loam, 1 to 3 percent slopes	330	. 1			
Kline gravelly loam, 3 to 8 percent slopes	220	(1)	Skykomish cobbly sandy loam, 0 to 3 percent slopes	325	. 1
Kline sandy loam, 1 to 3 percent slopes	180	(1)			

See footnote at end of table.

TABLE 2.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Skykomish cobbly sandy loam, 3 to 8 percent slopes	845	0. 1	Thornton silty clay loam, 0 to 2 percent slopes	120	(1)
Skykomish cobbly sandy loam, 8 to 15 percent slopes	75	(1)	Thornwood gravelly loam, 0 to 3 percent slopes	715	0. 1
Skykomish cobbly sandy loam, 15 to 30 percent slopes	65	(1)	Thornwood gravelly loam, 3 to 8 percent slopes	2, 115	. 4
Snohomish silt loam, 0 to 1 percent slopes	1, 110	. 2	Thornwood gravelly loam, 8 to 15 percent slopes	1, 970	. 3
Snohomish silty clay loam, 0 to 1 percent slopes	100	(1)	Thornwood gravelly loam, 15 to 30 percent slopes	1, 585	. 3
Squalicum gravelly silt loam, 0 to 3 percent slopes	405	. 1	Thornwood gravelly sandy loam, 0 to 3 percent slopes	1, 230	. 2
Squalicum gravelly silt loam, 3 to 8 percent slopes	3, 290	. 5	Thornwood gravelly sandy loam, 3 to 8 percent slopes	1, 815	. 3
Squalicum gravelly silt loam, 8 to 15 percent slopes	3, 675	. 6	Thornwood gravelly sandy loam, 8 to 15 percent slopes	875	. 1
Squalicum gravelly silt loam, 15 to 30 percent slopes	2, 780	. 5	Thornwood gravelly sandy loam, 15 to 30 percent slopes	2, 185	. 4
Squalicum gravelly silt loam, 30 to 45 percent slopes	555	. 1	Thornwood gravelly sandy loam, 30 to 45 percent slopes	2, 715	. 5
Sultan silt loam, 0 to 3 percent slopes	1, 970	. 3	Tidal marsh, 0 to 1 percent slopes	3, 860	. 6
Sultan loam, 0 to 3 percent slopes	350	. 1	Tisch silty clay loam, 0 to 1 percent slopes	230	(1)
Sultan fine sandy loam, 0 to 3 percent slopes	370	. 1	Wickersham shaly loam, 0 to 3 percent slopes	1, 325	. 2
Sultan loamy sand, 0 to 3 percent slopes	20	(1)	Wickersham shaly loam, 3 to 8 percent slopes	815	. 1
Sumas silt loam, 0 to 1 percent slopes	12, 410	2. 1	Wickersham shaly silt loam, 0 to 3 percent slopes	980	. 2
Sumas silt loam, shallow, 0 to 1 percent slopes	1, 045	. 2	Wickersham shaly silt loam, 3 to 8 percent slopes	240	(1)
Sumas silt loam, deep, 0 to 1 percent slopes	295	(1)	Woodinville silt loam, 0 to 1 percent slopes	235	(1)
Sumas silty clay loam, 0 to 1 percent slopes	2, 325	. 4	Fresh water	10, 880	1. 8
Tanwax peat, 0 to 1 percent slopes	205	(1)			
Tanwax peat, shallow, 0 to 1 percent slopes	35	(1)	Total	598, 494	100. 0
Thornton clay, 0 to 2 percent slopes	1, 190	. 2			

[1] Less than 0.1 percent.

Alderwood gravelly sandy loam, 0 to 3 percent slopes (Af).—This brown, well-drained soil of the uplands has developed under forest from sandy and gravelly glacial materials of varied origin. This soil and other Alderwood soils resemble the Squalicum soils except in having a considerably coarser textured substratum. The native forest was mainly a dense growth of Douglas-fir. It also contained some western hemlock, western redcedar, alder, vine maple, and willow.

Most of this soil is on Guemes Island and in a few small, scattered areas in the western half of the county. It is associated with Bow and Squalicum soils and with other Alderwood soils. The acreage is small compared to that of the undulating and rolling Alderwood soils.

Profile description:

Surface soil—
Dark-brown [1] or dark yellowish-brown friable gravelly sandy loam; brown to pale brown when dry; medium to strongly acid; contains many shot pellets (small rounded concretions); layer is 6 to 8 inches thick.

Subsurface layer—
Yellowish-brown to brown gravelly sandy loam; resembles surface layer except for being slightly lighter colored and slightly less acid.

Subsoil—
Dark yellowish-brown very friable gravelly sandy loam; contains shot; amount of shot decreases with depth; top of subsoil at depths of 10 to 14 inches.

Lower part, just above substratum, is generally a finer textured layer 2 to 6 inches thick, faintly mottled with yellow, brown, and gray, and not so friable as the rest of subsoil; abrupt boundary between subsoil and substratum.

Substratum—
Hardpan of indurated or strongly cemented sandy and gravelly till; many feet thick; depth to substratum is 30 to 40 inches.

Some stones and cobblestones occur throughout the profile.

The surface soil and subsoil are permeable. Moisture seeps through the hardpan very slowly or not at all. Roots do not penetrate the hardpan but form a mat on top of it. Runoff is slow, and internal drainage is medium down to the hardpan. Lateral movement of water may be more rapid.

Included with this mapping unit are areas where the substratum is only weakly cemented. In areas where this soil is adjacent to Bow or Squalicum soils, the substratum is finer textured than typical. In a few places, the depth to the cemented substratum is only 24 inches; in others, it is as much as 48 inches.

Use and management.—Less than 10 percent of this soil has been cleared for farming. The rest is in second-growth timber. All the virgin timber has been logged off. Most of the cleared acreage and a small part of the wooded area are used for pasture (fig. 4). Some of the pastures produce one crop of hay each season and are used for grazing the rest of the season. Only a little of this soil is used for cultivated crops. Red clover and alsike clover mixed with grasses are the common hay and pasture crops. Pastures and meadows are generally not tilled for 2 to 5 years or even longer. When tilled, they are seeded to oats or to oats with legumes and grasses. Oats is grown principally for hay rather than for grain.

[1] Colors are for moist soil unless otherwise specified.

Figure 4.—Stump pasture on Alderwood gravelly sandy loam.

Fruits and vegetables are grown largely for home use. When properly managed, strawberries grow fairly well. Although this soil is coarse and gravelly, it usually holds enough moisture for plants because water does not drain through the hardpan.

Commercial fertilizers are not ordinarily used. Barnyard manure is the fertilizer most commonly applied. This soil is in management group 1.

Alderwood gravelly sandy loam, 3 to 8 percent slopes (Ag).—Because of the steeper slopes, runoff is slightly more rapid on this soil than on Alderwood gravelly sandy loam, 0 to 3 percent slopes. This soil occurs mainly in the western half of the county, in association with the Everett gravelly sandy loams and with other Alderwood gravelly sandy loams. It is generally in slightly higher positions and on more uneven topography than the Everett soils.

Use and management.—This soil can be used and managed in the same way as Alderwood gravelly sandy loam, 0 to 3 percent slopes. It is in management group 1.

Alderwood gravelly sandy loam, 8 to 15 percent slopes (Ah).—In places this soil shows more variation in the thickness of layers than does Alderwood gravelly sandy loam, 0 to 3 percent slopes.

Use and management.—This soil absorbs water readily and normally has some vegetative cover during the rainy winter season. Therefore, runoff is not a problem. Conserving moisture, however, is a problem.

Except that a larger proportion is used for pasture, this soil has the same uses as Alderwood gravelly sandy loam, 3 to 8 percent slopes. It is managed in the same way as Alderwood gravelly sandy loam, 0 to 3 percent slopes. It is in management group 1.

Alderwood gravelly sandy loam, 15 to 30 percent slopes (Ak).—This soil is similar to Alderwood gravelly sandy loam, 8 to 15 percent slopes, but is generally a little lighter colored. In many places the texture is gravelly loamy sand. The depth to the cemented till and the hardness of this layer vary within short distances. It occurs in the western half of the county in association with other Alderwood soils.

Use and management.—Because it is hilly and droughty, this soil is more valuable for producing timber than for farming. Some areas on slopes as strong as 25 percent can be used for permanent pasture under careful management. This soil is in management group 12.

Alderwood gravelly sandy loam, 30 to 45 percent slopes (Am).—This soil occupies steep moraines adjacent to mountainous areas and, to a lesser extent, steep drainage areas and terracelike breaks. It is commonly associated with other Alderwood soils. Although the profile is similar to that of Alderwood gravelly sandy loam, 0 to 3 percent slopes, it varies from place to place in color, texture, and thickness of layers.

Use and management.—Because of the steep slopes, this soil is suited only to forest. It is in management group 12.

Alderwood gravelly sandy loam, shallow, 0 to 3 percent slopes (An).—This soil is only 12 to 20 inches deep over the cemented substratum, or hardpan. The hardpan is generally strongly cemented, but the degree of cementation is more variable than in the deeper Alderwood soils. In places the upper part is weakly cemented. Except in these spots, roots generally do not penetrate the hardpan but form a mat on top of it. Moisture seeps through the hardpan very slowly. This soil is not so well drained as the deeper Alderwood soils. The color ranges from grayish brown to brown. The native vegetation was the same as that on Alderwood gravelly sandy loam, 0 to 3 percent slopes.

This soil occurs in scattered areas on the western half of Samish Island.

Use and management.—Present use and management are similar to those described for Alderwood gravelly sandy loam, 0 to 3 percent slopes. Most of the profile is saturated throughout the rainy winter season and then becomes very droughty during the dry summer months. Consequently, this soil is not very productive. The profile, particularly the subsoil, becomes compact and difficult to penetrate when dry. Open ditches should be used to drain off excess moisture early in spring. This soil is in management group 1.

Alderwood gravelly sandy loam, shallow, 3 to 8 percent slopes (Ao).—This soil resembles and is closely associated with Alderwood gravelly sandy loam, shallow, 0 to 3 percent slopes. Runoff is more rapid; consequently, drainage is slightly better.

Use and management.—This soil can be used and managed in the same way as Alderwood gravelly sandy loam, shallow, 0 to 3 percent slopes. It is in management group 1.

Alderwood gravelly sandy loam, shallow, 8 to 15 percent slopes (Ap).—This soil has more rapid runoff and better drainage than Alderwood gravelly sandy loam, shallow, 0 to 3 percent slopes.

Use and management.—Only a very small part of the total acreage of this soil is cleared of trees and brush. This soil is even less suitable for crops than the more gently sloping phases. Conservation of moisture is more of a problem, and erosion would also be more likely to occur if fields were bare during the rainy season. This soil is in management group 1.

Alderwood gravelly sandy loam, shallow, 15 to 30 percent slopes (Ar).—This soil occupies morainic hills. It is adjacent to the Fidalgo soils and other Alderwood soils. In a few places, the slope gradient is more than 30 percent. Although the profile is generally similar to that of Alderwood gravelly sandy loam, shallow, 0 to 3 percent slopes, it varies more from place to place in color, texture, and thickness of layers.

Use and management.—Generally, this soil can be used and managed in the same way as Alderwood gravelly

sandy loam, 15 to 30 percent slopes. It is in management group 12.

Alderwood gravelly loam, 0 to 3 percent slopes (Aa).—This soil is similar to Alderwood gravelly sandy loam, 0 to 3 percent slopes, but is finer textured. Generally, the depth to the hardpan is 30 to 40 inches. In a few areas it is 24 to 48 inches.

This soil occurs throughout the county. It is most extensive in the southwestern corner, where it is closely associated with other Alderwood soils and with Bow, Everett, Indianola, and Squalicum soils. Varying amounts of fine-textured material occur in spots, especially where the soil is closely associated with Bow and Squalicum soils.

Included with this mapping unit are areas where the substratum is only weakly cemented. The degree of cementation varies within short distances.

Use and management.—This soil can be used and managed in the same way as Alderwood gravelly sandy loam, 0 to 3 percent slopes, but it is slightly better suited to the general crops of the area. Its finer textured surface soil has a slightly higher moisture-holding capacity. More of it is used for grains, especially oats, and for strawberries and raspberries for home use. Most of the cleared areas, however, are used for hay and pasture in conjunction with dairy farming.

Stones in the plow layer should be removed before this soil is cultivated. This soil is in management group 1.

Alderwood gravelly loam, 3 to 8 percent slopes (Ab).—This soil has slightly more rapid runoff than Alderwood gravelly loam, 0 to 3 percent slopes. It occurs in association with other Alderwood soils.

Use and management.—This soil can be used and managed in the same way as Alderwood gravelly loam, 0 to 3 percent slopes. It is in management group 1.

Alderwood gravelly loam, 8 to 15 percent slopes (Ac).—This soil resembles Alderwood gravelly loam, 3 to 8 percent slopes, but in places has more variation in its profile characteristics. In an area north of Concrete, this soil is more strongly acid.

Use and management.—This soil can be used and managed in the same way as Alderwood gravelly sandy loam, 8 to 15 percent slopes. It is in management group 1.

Alderwood gravelly loam, 15 to 30 percent slopes (Ad).—Most characteristics of this soil are similar to those of Alderwood gravelly sandy loam, 15 to 30 percent slopes. The texture of the surface soil, however, ranges from gravelly loam to fine gravelly sandy loam. The latter texture occurs in areas too small to be delineated on the map. A very small acreage north of Concrete has a more strongly acid surface soil.

Use and management.—As a rule, this soil can be used and managed in the same way as Alderwood gravelly sandy loam, 15 to 30 percent slopes. This soil, however, has slightly less moisture-holding capacity and is not so good for pasture. Its best and principal use is forestry. This soil is in management group 12.

Alderwood gravelly loam, 30 to 45 percent slopes (Ae).—Except for the texture of the surface soil, this soil is similar to Alderwood gravelly sandy loam, 30 to 45 percent slopes.

Use and management.—Because of the steep slopes, this soil is suited only to the production of timber. It is in management group 12.

Belfast silt loam, 0 to 3 percent slopes (Ba).—This soil occurs in fairly narrow drainageways, largely in the small valleys in the western half of the county. It has formed in recent alluvium washed from glacial uplands and mountainous areas. The alluvium is composed of mixed sediments, mostly glacial materials.

This soil is well drained to moderately well drained or, in places, somewhat imperfectly drained. In some areas, water stands near the surface at least part of the rainy winter season. The original vegetation was a mixture of coniferous and deciduous trees.

Profile description:

Surface soil—
Brown to dark-brown friable granular silt loam; pale brown when dry; 6 to 8 inches thick.

Subsurface layer—
Pale-brown friable to firm loam or silt loam; 14 to 18 inches thick.

Subsoil—
Brown or grayish-brown stratified coarse- and medium-textured materials, generally faintly mottled with yellow and brown; when dry, light brownish gray, light yellowish brown, or light gray; firm in place but crumbles readily to fine aggregates when removed; texture below 3 feet highly variable but commonly coarse; some lenses of finer material; embedded gravel generally below depths of 3 or 4 feet.

In an area north of Birdsview, Belfast silt loam is closely associated with the Wickersham soils and with Gilligan silt loam. The associated soils are strongly influenced by mica-schist, and Belfast silt loam is also somewhat influenced by it.

This soil is moderately high in natural fertility. It is easily tilled. Its productivity and moisture-holding capacity are moderately high.

Use and management.—Approximately 80 percent of this soil has been cleared. Most of the cleared area is used for pasture and meadow. A very small part is used for strawberries. Dairying is the chief source of farm income.

In winter, cultivated areas benefit by some artificial drainage. Some areas of this soil are too small to be used or managed independently of other soils. This soil is in management group 8.

Bellingham silt loam, 0 to 2 percent slopes (Bd).—This dark-colored soil occurs in poorly drained flats or in basins in the glaciated uplands. Its parent material is of glacial or marine origin and consists of deep strata of fine-textured materials. The natural drainage is poor. Water stands on the surface for long periods during the rainy season, and it drains very slowly through the soil because of the dense clay in the substratum. The native vegetation consisted of a mixture of shrubs and vines and deciduous and coniferous trees, mainly cedar, hemlock, Douglas-fir, alder, maple, willow, and ash. The present vegetation in uncleared areas is largely deciduous trees.

This soil occurs in widely scattered small areas, in association with the better drained Alderwood, Bow, and Squalicum soils and other upland soils derived from glacial materials.

Profile description:

Surface soil—
Black, very dark-gray, and dark grayish-brown silt loam; some areas grayish brown when dry; friable; moderately granular; high in organic matter; strongly acid; 6 to 10 inches thick; abrupt boundary between this layer and the subsoil.

Subsoil—
Gray to dark-gray firm silt loam or sandy clay loam; distinct mottles of yellowish brown and brown; hard to very hard in place when dry but crumbles readily when removed; contains scattered gravel and pebbles; layer is 3 to 12 inches thick; gradual transition, at depths of 12 to 18 inches, to gray, dense, plastic clay or silty clay distinctly mottled with yellowish brown and brown; degree of mottling decreases with depth.
Substratum—
Gray dense clay; very faintly mottled; strong coarse blocky or subangular blocky; very hard when dry; contains a little gravel.

In places the dark-colored surface soil is immediately over the plastic clay. In some of the areas where this soil is associated with the Alderwood and Squalicum soils, gravelly, fine-textured, cemented till occurs at a depth of about 3 feet.

Use and management.—Many areas of Bellingham silt loam are too isolated and too small to be managed separately, or are adjacent to areas unsuited to agriculture. Consequently, only about half of this soil has been cleared for farming. The rest is in shrubs, vines, and second-growth deciduous trees. The cleared areas are principally in pasture.

Some of this mapping unit is used for hay, oats, and other grains. Many areas are very small and, consequently, are generally used in the same way as the surrounding areas.

This soil is best suited to pasture and meadow. If properly drained and well managed, it will produce high yields of pasture plants and moderate yields of hay, oats, and other crops. Surface ditches will remove most of the excess water so that the soil can be used fairly early in spring. This soil is in management group 7.

Bellingham silt loam, 2 to 5 percent slopes (Be).—This soil is a little less poorly drained than Bellingham silt loam, 0 to 2 percent slopes, and it generally has a thinner surface layer. Its color is more varied and spotty, and the profile contains a little more gravel. It is associated with the Bow soils and, less commonly, with other glaciated soils of the uplands. This soil receives considerable water by runoff and seepage from higher areas. It has very slow internal drainage.

Use and management.—This soil can be used and managed in the same way as Bellingham silt loam, 0 to 2 percent slopes. It is in management group 7.

Bellingham silt loam, light colored variant, 0 to 3 percent slopes (Bf).—This variant occurs in association with Bellingham clay loam, light colored variant, 0 to 3 percent slopes. It differs from that soil not only in the texture of its surface soil but also in having a slightly coarser textured and generally lighter colored subsoil.

Use and management.—Except for a few acres, this soil has been cleared and is in farms. It is easier to till and is better suited to grains than Bellingham clay loam, light colored variant, 0 to 3 percent slopes. This soil can be used and managed in the same way as Bellingham silt loam, 0 to 2 percent slopes. It is in management group 7.

Bellingham silty clay loam, 0 to 2 percent slopes (Bg).—Except for its finer surface texture, this soil is similar to Bellingham silt loam, 0 to 2 percent slopes.

Use and management.—About half of the acreage has been cleared for agriculture. Because of its finer texture, this soil is not so easily tilled as the Bellingham silt loams. It can be used and managed in the same way as Bellingham silt loam, 0 to 2 percent slopes. It is in management group 7.

Bellingham silty clay loam, 2 to 5 percent slopes (Bh).—Runoff is more rapid on this soil than on Bellingham silty clay loam, 0 to 2 percent slopes, but the profile remains saturated for many months.

Use and management.—This soil is not suitable for agriculture unless it is artificially drained. It is more easily drained than Bellingham silty clay loam, 0 to 2 percent slopes. It can be used and managed the same as that soil. It is in management group 7.

Bellingham clay, 0 to 2 percent slopes (Bb).—The texture of the surface layer of this soil ranges from heavy silty clay to clay. In most areas, the surface soil lies directly above the dense, plastic, gray clay.

Use and management.—Because of its fine texture, this soil is difficult to till and to drain. About 75 percent of the acreage is cleared and in permanent pasture. This soil is best suited to pasture. It is in management group 7.

Bellingham clay loam, light colored variant, 0 to 3 percent slopes (Bc).—This soil has developed from mixed, fine-textured, old alluvial and glacial-lake material that includes considerable micaceous material. It is poorly drained. After rains, water often stands on the surface. The water table is near the surface during the rainy season. The native vegetation in this area was largely deciduous trees, shrubs, and vines, but there was some hemlock, western redcedar, and Douglas-fir.

This soil occurs in valleys that were once glacial drainageways and through which small streams now flow. Most of it lies in the valley of Friday Creek.

Profile description:

Surface soil—
Dark grayish-brown friable clay loam; grayish brown when dry; moderate granular structure; moderately high in organic matter; 4 to 8 inches thick.
Subsoil—
Light-gray or gray, very plastic, tough silty clay loam or clay loam moderately mottled with yellow and brown; contains some mica-schist; extends to a depth of about 18 inches.
Light-gray stratified medium-textured materials mottled with yellow and brown; layer ranges up to 10 inches in thickness but is lacking in some places.
Bluish-gray, very plastic, tough clay or silty clay; contains considerable mica-schist.

No schist fragments are found in the substratum or in any part of the profile.

Use and management.—All of this soil has been cleared. It is now used mainly for meadow and permanent pasture in conjunction with dairying. This soil remains in sod for several years before being replowed. During most of the summer, the pastures are good. This soil can be used and managed in the same way as Bellingham silt loam, 0 to 2 percent slopes. It is in management group 7.

Bow silt loam, 0 to 3 percent slopes (Bv).—This imperfectly drained soil generally occurs in large bodies on plateaulike glacial uplands (fig. 5). It has developed from compact, fine-textured glacial till, partly composed of sediments from glacial lakes. It is closely associated with Bow silt loam, 3 to 8 percent slopes, with other Bow soils, and, to a lesser extent, with the Squalicum and other glacial soils. The Squalicum soils are deeper, and they developed from coarser textured, strongly cemented parent materials. The substratum of Bow silt loam, 0 to 3 percent slopes, although very hard when dry, is not cemented.

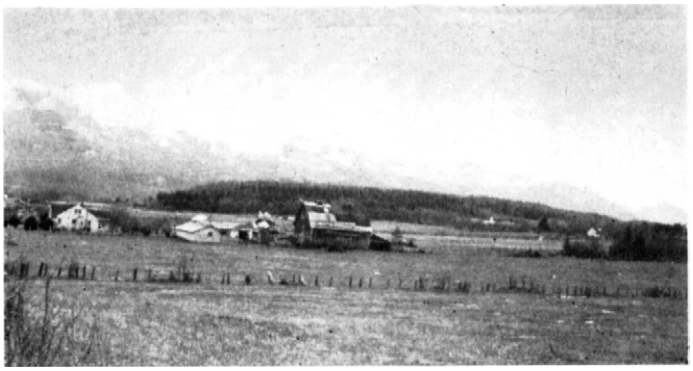

Figure 5.—**Bow soils in the glaciated uplands. The wooded areas below the mountains are occupied by Alderwood and Squalicum soils.**

The native vegetation consisted largely of Douglas-fir, but some western hemlock, western redcedar, and such deciduous trees as alder, vine maple, and willow were in the stands. Deciduous trees now predominate in most areas.

Profile description:

Surface soil—
Dark-brown to dark grayish-brown, friable, moderately granular silt loam; brown when dry; contains many small shot pellets; medium to strongly acid; 6 to 10 inches thick.

Subsoil—
Brown to grayish-brown firm silt loam; contains shot, which decrease in number with depth; 10 to 14 inches thick.
Dark olive-gray or brownish-gray firm loam to light sandy clay loam; mottled; very hard when dry; breaks into subangular blocky aggregates; less acid than surface soil; 2 to 10 inches thick; abrupt transition to substratum.

Substratum—
Dark-olive, olive, or dark olive-gray very plastic clay; moderately mottled; very hard when dry; breaks to subangular blocky aggregates; olive, pale olive, dark olive gray, or light gray when dry; contains a little embedded gravel; slightly acid; many feet thick.

In small low spots where the surface drainage is very slow, the surface soil is grayer. In places the uppermost layer of the subsoil is very thin and the layer below is much thicker. The depth to the substratum ranges from 18 to 30 inches.

The moisture-supplying capacity of this soil is moderately high. Runoff is very slow, and water stands on the surface for short periods after heavy rains. The surface soil and subsoil are moderately permeable, but the dense clay substratum is slowly permeable.

Use and management.—Only a very small acreage of this fairly extensive soil has been cleared for cultivation. All of the virgin timber has been logged, and the uncleared areas are restocking with native species. Because of the high cost of removing the stumps and brush, the size of most individual clearings is less than 40 acres.

Of the upland soils of the county, this is one of the best for agriculture. It is not suited to high-value crops but is moderately productive of pasture plants, hay, and oats. Most of the cleared acreage is in pasture. The pasture stands consist of grasses mixed with some clover. Normally, an area is left in pasture for at least 4 years before it is plowed and planted to oats. Grass and clover may either be seeded with the oats or be seeded the following year. Usually, only one hay crop is cut from a meadow each year. The meadow may be pastured either before or after the hay crop is cut.

Barnyard manure is the principal fertilizer used. On some farms it is supplemented with phosphate. Lime is used occasionally. These amendments are generally applied at the time of seeding. Pasture management is limited to occasional clipping to control weeds and tall grasses. This soil is in management group 5.

Bow silt loam, 3 to 8 percent slopes (Bw).—Except for slightly more rapid runoff and less variable surface color, this soil is similar to Bow silt loam, 0 to 3 percent slopes.

Use and management.—This soil can be used and managed in about the same way as Bow silt loam, 0 to 3 percent slopes. It is in management group 5.

Bow silt loam, 8 to 15 percent slopes (Bx).—This soil is similar to Bow silt loam, 3 to 8 percent slopes, but it has more rapid runoff.

Use and management.—Only a very small percentage of this soil has been cleared. The cleared areas are small and are used with the adjacent soils. Although this soil absorbs water fairly readily, it would probably erode if left bare during the rainy season. This soil is less suitable for cultivation than the Bow silt loams on milder slopes. It is in management group 5.

Bow silt loam, 15 to 30 percent slopes (By).—This soil is similar to Bow silt loam, 0 to 3 percent slopes. The color varies more and usually is a little lighter. The depth to the clay substratum is generally no less, but it varies more. This soil is closely associated with other Bow soils.

Use and management.—Because this soil is hilly and may erode if cultivated, it should be left in timber. Some areas on slopes of no more than 25 percent might possibly be used for permanent pasture under careful management. At present, all of the acreage is in second-growth timber and brush. This soil is in management group 12.

Bow silt loam, 30 to 45 percent slopes (Bz).—This soil occupies terracelike breaks and the sides of stream gullies. It is associated with other Bow silt loams. Some of it is on slopes of more than 45 percent.

Use and management.—This soil is suited only to forest. It is in management group 12.

Bow silt loam, shallow, 0 to 3 percent slopes (B2).—This soil occurs mainly east of Mount Vernon. It is associated with Bellingham soils and other Bow soils. It has a considerably thinner subsoil than Bow silt loam, 0 to 3 percent slopes, and is less well drained. The depth to the clay substratum is only 10 to 18 inches.

The surface soil is 4 to 10 inches thick. Its color ranges, within short distances, from dark brown to dark grayish brown or very dark grayish brown. On slight elevations the soil is browner and generally a little deeper than in other places. The surface soil grades to firm to very firm, dark-gray to dark olive-gray or brown loam or sandy clay loam, which is underlain by very plastic clay.

Use and management.—Most of this soil has been cleared or partly cleared. The cleared acreage is in grass and is used for pasture. Farms on this soil are very small, and many are operated part time by persons employed in Mount Vernon.

This soil can be used and managed in the same way as Bow silt loam, 0 to 3 percent slopes. It needs artificial drainage to remove excess water after heavy rains. It is in management group 5.

Bow silt loam, shallow, 3 to 8 percent slopes (B3).—This soil is similar to Bow silt loam, shallow, 0 to 3 percent slopes. It occurs only in two general areas, one near Clear Lake and the other on Fidalgo Island.

Use and management.—Almost all of this soil is cleared and used with adjoining soils for pasture. It can be used and managed in the same way as Bow silt loam, 0 to 3 percent slopes. It is in management group 5.

Bow gravelly loam, 0 to 3 percent slopes (Bk).—This soil is associated with other Bow soils, principally Bow gravelly loam, 3 to 8 percent slopes. Most of it occurs in fairly large areas near Bay View. This is the most extensive of the Bow soils.

In places some stones and cobblestones occur on the surface and in the profile. In old cutover areas where the ground surface is uneven, the profile is extremely variable in depth and color. In the higher spots the soil is deep and brown, and in the swales it is shallow and grayish brown to dark grayish brown. When these areas are cleared, leveled, and cultivated, the soil becomes more uniform. Included are some small areas in which the profile, down to the clay substratum, is looser, deeper, and more gravelly than the normal profile.

Use and management.—This soil can be used and managed in the same way as Bow silt loam, 0 to 3 percent slopes, but a slightly larger proportion of this soil is cleared because it is in areas that have more roads and utilities. Approximately 2,000 acres is in a naval reservation and an airport. This soil is in management group 5.

Bow gravelly loam, 3 to 8 percent slopes (Bm).—This soil occurs in association with other Bow gravelly loams and with other soils of the glacial uplands. The largest area occurs on Pleasant Ridge near La Conner. A few spots in this area are stony and cobbly.

This soil is like Bow gravelly loam, 0 to 3 percent slopes, except that runoff is slightly more rapid and the color of the surface soil is less variable.

Use and management.—This soil can be used and managed in the same way as Bow silt loam, 0 to 3 percent slopes. It is in management group 5.

Bow gravelly loam, 8 to 15 percent slopes (Bn).—This soil occurs in widely scattered areas in association with other soils of the glacial uplands. Mostly, however, it is in association with other Bow soils. It is similar to Bow gravelly loam, 3 to 8 percent slopes, but it has more rapid runoff and dries out faster and is consequently more droughty in summer.

Use and management.—Because of the stronger slopes, this soil is less suitable for general agriculture than Bow gravelly loams on milder slopes. Although the soil absorbs water readily, it would probably erode if left without a vegetative cover during the rainy season. The areas cleared are small and are used with adjacent soils. This soil can be used and managed in the same way as Bow silt loam, 0 to 3 percent slopes. It is in management group 5.

Bow gravelly loam, 15 to 30 percent slopes (Bo).—This soil is associated with other Bow soils. Generally, it occupies slopes between the less strongly sloping Bow soils and the bottom lands. It also occurs on slopes along drainage channels. It is more variable in color than Bow gravelly loam, 8 to 15 percent slopes, and generally lighter colored. It is also more variable in depth to the substratum but generally is no shallower.

Use and management.—All of this soil is now in second-growth trees and brush. It can best be used to produce timber. It is in management group 12.

Bow gravelly loam, 30 to 45 percent slopes (Bp).—Most of this soil is on steep single slopes where the uplands adjoin the bottom lands.

Use and management.—This soil is suitable only for the production of timber. It is in management group 12.

Bow loam, 0 to 3 percent slopes (Br).—This is an inextensive soil that occurs in relatively small, scattered areas in association with Bow gravelly loam, 0 to 3 percent slopes. In areas east and southeast of Milltown, this mapping unit has a more friable subsoil and a substratum that is not so fine textured.

Use and management.—Approximately half of this soil has been cleared. The cleared acreage is used principally for pasture, but some is used for hay and grains. This soil can be used and managed in the same way as Bow silt loam, 0 to 3 percent slopes. It is in management group 5.

Bow loam, 3 to 8 percent slopes (Bs).—This soil is similar to Bow loam, 0 to 3 percent slopes. Runoff is more rapid on this soil, and the surface soil color is less variable. This soil occurs largely east of Mount Vernon, in association with other Bow soils.

Use and management.—About one-third of this soil has been cleared of stumps and brush and is used for pasture and meadow. This soil can be used and managed in the same way as Bow silt loam, 0 to 3 percent slopes. It is in management group 5.

Bow loam, 15 to 30 percent slopes (Bt).—This soil has more variable characteristics than Bow loam, 3 to 8 percent slopes. Most of it occurs east of Milltown, on narrow slopes adjacent to drainage channels.

Use and management.—This soil is all in second-growth trees and brush. It is best suited to forests. It is in management group 12.

Bow loam, shallow, 0 to 3 percent slopes (Bu).—This soil occurs largely in two areas, one east of Mount Vernon and the other on the peninsula north of Summit Park. It is associated with the other Bow soils, mainly with the Bow gravelly loams and with Bow loam, 3 to 8 percent slopes. The profile is more variable than that of Bow loam, 0 to 3 percent slopes. The thickness of the layers, especially the subsoil, differs from place to place. The depth to the clay substratum ranges from 10 to 18 inches.

Use and management.—About half of this soil has been cleared of most of the stumps and brush and is used mainly for pasture. Most of the farms are small, and the operators depend upon outside jobs for a large part of their incomes. This soil can be used and managed in the same way as Bow silt loam, 0 to 3 percent slopes. Some artificial drainage is beneficial during the winter season. This soil is in management group 5.

Cagey gravelly fine sandy loam, 0 to 3 percent slopes (Ca).—This soil has a very friable to loose, very coarse textured subsoil. The parent material consists of glacial outwash of mixed origin over strongly cemented glacial till. This soil occurs on glacial outwash terraces, in association mainly with Cagey gravelly fine sandy loam, 3 to 8 percent slopes, but also with the Bow and Alderwood soils. The native vegetation consisted of Douglas-fir, some western hemlock and western redcedar, and deciduous trees, including alder, willow, maple, and dogwood. The ground cover now consists of salal, Oregon grape, oceanspray, and various ferns, vines, and mosses.

The drainage is moderately good. During the rainy season the cemented till holds water in the porous lower

subsoil, and yellow and reddish-brown iron compounds are formed in the saturated zone.

This soil occurs in widely scattered small areas in the western part of the county, largely on Samish Island.

Profile description:

Surface soil—
Brown to reddish-brown friable gravelly fine sandy loam; light reddish brown to pale brown when dry; contains scattering of shot; 8 to 14 inches thick.
Subsoil—
Yellowish-brown loose gravelly sand to gravelly loamy sand; extends to depth of about 30 inches.
Yellowish-brown, loose, porous gravelly sand; stained with yellow and reddish brown; extends to depth of about 54 inches.
Substratum—
Dark-gray cemented till, distinctly mottled in upper part; texture ranges from gravelly sandy loam to gravelly sandy clay loam; many feet thick.

In places the lower subsoil is pale brown to brownish gray and highly stained with yellow and brown. The depth to the cemented till ranges from 36 to 60 inches. In some areas the till is not very strongly cemented. Water drains rapidly through the soil to the cemented till. The till is only very slowly permeable.

Use and management.—Less than one-third of this soil has been cleared. Cleared areas are used chiefly for pasture and meadow. Uncleared areas have a dense second-growth forest of alder, willow, and maple, in which there is a scattering of Douglas-fir and hemlock. A fairly large acreage has been planted recently to filbert trees, which appear to be doing fairly well. Most of the pastures now consist largely of native plants and a scattering of clover. This soil is in management group 1.

Cagey gravelly fine sandy loam, 3 to 8 percent slopes (Cb).—This soil is closely associated with Cagey gravelly fine sandy loam, 0 to 3 percent slopes. It differs from that soil in having a thinner, slightly lighter colored, and more variable surface soil. Furthermore, the depth to the substratum is not so uniform.

Use and management.—About one-third of this soil has been cleared. It is used in about the same way as Cagey gravelly fine sandy loam, 0 to 3 percent slopes, but is less productive. This soil is in management group 1.

Cagey gravelly sandy loam, moderately shallow, 0 to 3 percent slopes (Cc).—This soil differs from Cagey gravelly fine sandy loam, 0 to 3 percent slopes, mainly in the depth to the cemented till. The depth to till in this soil ranges from 24 to 36 inches; in the deeper soil, it ranges from 36 to 60 inches.

Runoff is very slow. Internal drainage is rapid down to the underlying till, which is very slowly permeable to moisture and almost impenetrable to roots.

This soil occurs in the far western part of the county. It is associated with the Bow and Alderwood soils. It is deeper and coarser textured than the Bow soils and has a less compact subsoil. It differs from the Alderwood in having a finer textured underlying till.

Use and management.—Most of this soil is in deciduous trees, brush, and scattered conifers. The cleared areas are used mainly for pasture. This soil can be used and managed in the same way as Alderwood gravelly sandy loam, 0 to 3 percent slopes. It is in management group 1.

Cagey gravelly sandy loam, moderately shallow, 3 to 8 percent slopes (Cd).—This soil resembles Cagey gravelly sandy loam, moderately shallow, 0 to 3 percent slopes. Runoff is slightly more rapid, although this soil takes in water rapidly. Most of this soil is on Fidalgo Island.

Use and management.—This soil is mainly in second-growth timber consisting of deciduous trees, brush, and a few conifers. It can be used and managed in the same way as Alderwood gravelly sandy loam, 3 to 8 percent slopes. It is in management group 1.

Cagey gravelly sandy loam, moderately shallow, 8 to 15 percent slopes (Ce).—This soil resembles Cagey gravelly fine sandy loam, 3 to 8 percent slopes, but the depth to its underlying cemented substratum is only 20 to 36 inches. The degree of cementation is variable. Most of this soil is in one area, which is north of Lake Campbell on Fidalgo Island. In this area the surface soil is slightly darker colored than in other areas. In places it has been modified slightly by material washed down from the steep, rough, rocky land adjacent to it.

Use and management.—About half of the acreage has been cleared and is used for pasture and meadow. A small part is used for oats grown for grain. This soil does not retain moisture for so long a period as the other moderately shallow Cagey soils; consequently, crop yields are lower. This soil is in management group 1.

Carbondale muck, 0 to 1 percent slopes (Cf).—This is a very poorly drained organic soil that occurs in widely scattered areas in wet basins and depressions in the uplands, on terraces, and on bottom lands. It was derived from accumulations of organic matter, dominantly woody in the upper part and fibrous and sedimentary in the lower part. The native vegetation consisted of hemlock, western redcedar, alder, willow, a little Douglas-fir and spruce, and an understory of shrubs and vines. This soil is associated with other organic soils or highly organic mineral soils. It differs from Rifle peat mainly in the degree to which the organic matter is decomposed. The woody material in Rifle peat is easily recognizable and not well decomposed.

Profile description:

Surface soil—
Very dark brown or nearly black, granular, friable muck; well decomposed; contains only a few recognizable wood fragments; 6 to 12 inches thick.
Subsoil—
Accumulations of woody and fibrous material in various stages of decomposition to depths of 24 to 30 inches; below this, to a depth of at least 60 inches, dominantly sedge peat that becomes more finely fibrous with depth.

In some areas the organic soil is underlain by colloidal or sedimentary deposits. The organic soil generally is more than 5 feet deep. Where the depth to mineral soil is less than 2 feet, the soil is mapped as a shallow phase.

Use and management.—Nearly all of this soil has been cleared. It is used mainly for hay, pasture, and oats and other grains. As most areas of this soil are small, their use depends largely upon the use of the adjoining soil. Unless this soil is artificially drained, water stands on the surface for many months of the year. Most areas have few or no outlets for draining off excess water. If outlets are available, this soil can be drained effectively by interception ditches and central drainage ditches.

This soil is highly productive if it is properly drained and if the water table can be stabilized so that a supply of moisture is available during the growing season. An excellent seedbed can be prepared. The well-decomposed organic materials provide sufficient nitrogen for growing

plants. Crops, especially vegetables, respond well to applications of phosphate and potash fertilizers. This soil is in management group 11.

Carbondale muck, shallow, 0 to 1 percent slopes (Cg).—This soil is more extensive than Carbondale muck, 0 to 1 percent slopes, and has a larger proportion of mineral material in the surface soil. The depth to the mineral soil ranges from 8 to 24 inches. The underlying material is variable but generally is similar to that of adjacent soils.

This soil occurs in small widely scattered areas in very poorly drained basins and depressions. Most of it is in back-bottom positions on the alluvial flood plains, where the underlying soil is sandy. Included with this mapping unit are areas where the underlying material is fine textured. In the valley of Friday Creek is an area in which the soil is very shallow, has considerable mineral soil in its surface layer, and is underlain by medium-textured gravelly material.

Use and management.—About three-quarters of this soil has been cleared of stumps and brush. Crops and plants similar to those that grow on Carbondale muck, 0 to 1 percent slopes, grow on this soil. The two soils are about equally productive if properly drained. This soil is in management group 11.

Cathcart loam, 3 to 8 percent slopes (Co).—This well-drained soil occupies gentle slopes in areas that are predominantly hilly and steep. It occurs on glacially scoured ridges bordering lower glaciated areas; it is also on gentle slopes on mountain foothills in the interior. The parent material consists of a mixture of glacial material of varied origin and of sedimentary material derived from sandstone and some shale. The amount of glacial material varies, but in most areas a thin glacial mantle overlies the weathered sedimentary materials. This soil originally supported a dense cover of Douglas-fir, hemlock, cedar, and associated trees and shrubs. The forest is now mostly a dense second-growth stand, similar to the virgin stand but with a larger proportion of deciduous trees. Alder, willow, and maple are dominant in many areas. The internal drainage is medium, and the water-holding capacity is moderate.

This soil occurs in two general areas, one west of Big Lake and the other west of McMurray Lake. It is associated with other Cathcart soils and is adjacent to Rough mountainous land.

Profile description:

Surface soil—
Dark-brown to brown, friable, weakly granular loam to fine sandy loam; pale brown to brown when dry; contains a scattering of shot and gravel; moderately high in organic matter; about 6 inches thick.

Subsurface soil—
Yellowish-brown to brown gritty or gravelly fine sandy loam to loam; extends to depths of 12 to 14 inches.

Subsoil—
Yellowish-brown, firm, gritty or gravelly fine sandy loam.
Yellowish-brown, firm, gritty or gravelly fine sandy loam, lighter colored than layer above; some reddish-brown to grayish-brown streaks; contains a few soft sandstone fragments that crush readily to single grains; layer extends to depths of 40 to 50 inches.

Substratum—
Varicolored mixture of partially disintegrated soft sandstone and fine sandy loam; in many places the fine sandy loam consists of glacial and weathered sandstone, but in other places the amount of sandstone is small.

The profile is moderately permeable and strongly acid. In some areas, the texture of the subsoil is finer than that described. Throughout the profile, in some areas, considerable glacial gravel and cobblestones occur. This soil is in management group 2.

Cathcart loam, 8 to 15 percent slopes (Cp).—This soil is closely associated with other Cathcart soils. It is similar to Cathcart loam, 3 to 8 percent slopes, but water runs off it more rapidly. Profile characteristics are more variable, especially the depth to disintegrated sandstone.

Use and management.—Less than 10 percent of this soil has been cleared of trees and brush. Most of the cleared areas are used for hay and pasture. So far, erosion has not been a problem, because the soil has had a vegetative cover during the rainy season. More careful management is required to conserve moisture and to prevent erosion than on Cathcart loam, 3 to 8 percent slopes. This soil is in management group 2.

Cathcart loam, 15 to 30 percent slopes (Cr).—This soil occupies hilly or strongly sloping areas along drainageways and on the sides of ridges and hills. It is closely associated with other Cathcart soils. The profile is variable. In some areas sandstone fragments occur throughout the profile. In places, gravel and cobblestones are on the surface and in the upper part of the profile.

Use and management.—All areas of this soil have been logged, and a second growth of Douglas-fir, hemlock, and cedar is becoming established. None of this soil is used for farming. Because the relief makes it unsuitable for farming, this soil is best left in forest. It is in management group 12.

Cathcart loam, 30 to 60 percent slopes (Cs).—This soil is closely associated with other Cathcart soils. In a few areas slopes are steeper than 60 percent. The profile characteristics are extremely variable. This soil is less affected by glacial material than Cathcart loam, 15 to 30 percent slopes. There are numerous sandstone outcrops in some areas.

Use and management.—This soil is all in timber, the use to which it is best suited. It is in management group 12.

Cathcart clay loam, 3 to 8 percent slopes (Ch).—This well-drained soil is closely associated with the Cathcart loams. It occupies the tops of ridges, where the mantle of glacial material is thin. It occurs at high altitudes and in fairly inaccessible areas where snow falls frequently in winter. The parent material contained more soft shale than that of the Cathcart loams, which consisted largely of sandstone. Internal drainage is medium. The native vegetation was Douglas-fir, hemlock, cedar, and associated trees and shrubs. This soil occurs only in two small areas, which are southwest of McMurray Lake.

Profile description:

Surface soil—
Dark-brown clay loam; granular; friable; strongly acid.

Subsoil—
Yellowish-brown, firm, heavy clay loam or sandy clay loam faintly streaked with reddish brown and yellow; extends to depths of 24 to 30 inches.
Light yellowish-brown to olive-yellow, firm, heavy clay loam or sandy clay loam; color becomes more variegated with depth; contains fragments of soft shale and sandstone; extends to depths of 36 to 60 inches.

Substratum—
Dominantly soft shale fragments with fine-textured interstitial material.

Varying amounts of glacial gravel occur in the upper part of the profile. The soil is strongly acid.

Use and management.—About half of this soil has been cleared or partly cleared of stumps and brush. The cleared acreage is in pasture, which is grazed chiefly by beef cattle. The pasture stands consist of mixed clovers and grasses. They provide moderately high amounts of forage during most of the dry summer. This soil is in management group 2.

Cathcart gravelly loam, 3 to 8 percent slopes (Ck).—This soil occurs in association with other Cathcart soils. Its profile characteristics are variable, but less so than those of the rolling phases of Cathcart gravelly loam. Less water runs off, and water drains through the soil fast enough to keep the soil well drained.

Use and management.—Other than a few acres used for homesites, all of this soil is in second-growth Douglas-fir, hemlock, and deciduous trees. This soil is in management group 2.

Cathcart gravelly loam, 8 to 15 percent slopes (Cm).—This soil occurs in association with Cathcart gravelly loam, 15 to 30 percent slopes. It resembles the associated soil, except that its profile characteristics are not quite so variable and rock outcrops are not very common.

Use and management.—Most of this soil is in second-growth timber. A small acreage is partially cleared and used for pasture. All of the virgin stand has been removed.

This soil is suited to pasture, hay, and small grains, but, as most of it occurs in remote areas, it cannot economically be used for farming. It needs more careful management than Cathcart soils on milder slopes, if erosion is to be prevented and water conserved. This soil is in management group 2.

Cathcart gravelly loam, 15 to 30 percent slopes (Cn).—This is a well-drained soil that occurs on hilly moraines or mountain foot slopes that have been scoured by glaciers. It generally lies just below large areas of Rough mountainous land, Cathcart soil material, a mapping unit composed of shallow soils that have ill-defined profiles consisting of a thin mantle of glacial debris over arkose sandstone.

The parent material of this soil is unassorted glacial drift and talus rubble. Most of the glacial material was deposited by continental glaciers, but some may have been deposited by local alpine glaciers.

There is much variation in the color, texture, thickness of layers, and depth to bedrock. Outcrops of sandstone occur here and there. The native vegetation consisted mainly of Douglas-fir, hemlock, and western redcedar. The dense forest has protected the soil from accelerated erosion.

Use and management.—All of this soil is in second-growth timber, mainly Douglas-fir and hemlock. Alder, willow, and maple trees have invaded some areas. Because of its remoteness and hilly relief, this soil is unsuitable for farming. It is best left in trees. This soil is in management group 12.

Cathcart stony loam, 8 to 15 percent slopes (Ct).—This soil occurs in a few scattered areas in the northwestern corner of the county and in a small area south of Hamilton. It resembles the steeper phases of Cathcart stony loam.

Use and management.—This soil is too stony to be suited to farm crops. All of it is in second-growth forest. It is in management group 12.

Cathcart stony loam, 15 to 30 percent slopes (Cu).—Most of this soil occurs south of Hamilton. Runoff is not quite so rapid as on Cathcart stony loam, 30 to 60 percent slopes.

Use and management.—All of this soil is in second-growth Douglas-fir, hemlock, and deciduous trees, mainly alder. Because it is hilly and stony, this soil is suited only to forest. It is in management group 12.

Cathcart stony loam, 30 to 60 percent slopes (Cv).—This soil occupies mountain foot slopes or steeply sloping moraines. It resembles Cathcart gravelly loam, 15 to 30 percent slopes, but has been less affected by glacial material and is considerably shallower. Rock outcrops and sandstone boulders and stones are numerous. Runoff is rapid, but in most places the dense vegetation limits accelerated erosion. The native vegetation consisted mainly of Douglas-fir, hemlock, and some western redcedar. The largest area of this soil is a few miles southeast of Big Lake.

Use and management.—All of the merchantable timber has been removed. A dense growth of deciduous trees is replacing the virgin stand. The species are those that are normally dominant after excessive burning and careless logging. Except where it is very shallow, this soil is as good for timber as the Cathcart soils on milder slopes. It is in management group 12.

Coastal beach, 0 to 3 percent slopes (Cw).—This miscellaneous land type consists of elongated narrow beaches of wave-washed sand, gravel, and stone. These beaches are about 100 feet to about 660 feet wide. They may be under water during storms. They are often covered with driftwood and other debris. The beaches are normally barren, but short-lived grasses or shrubs grow in some places along the inner margins. Included in the mapping unit are small areas that have more vegetation and, consequently, a darker colored surface layer. One such area is on the west coast of Guemes Island, and another is on the northeast coast of Samish Island.

This miscellaneous land type is nonagricultural. It is a possible source of road and construction material and may be used for homesites and recreation. It is in management group 12.

Cokedale silt loam, 0 to 3 percent slopes (Cz).—This is an imperfectly drained alluvial soil that overlies sandy material. It occurs mostly in the eastern part of the county, in widely scattered areas on nearly level to gently undulating first bottoms.

This soil developed from medium- and coarse-textured material washed from uplands and deposited near streams. The uplands were underlain largely by mica-schist, talc, and argillite. The parent material of this soil was largely dark-gray mica-schist.

The native vegetation was a mixture of Douglas-fir, cedar, hemlock, willow, and maple trees and various shrubs, vines, and ferns. Drainage through the soil is medium when the water table is low, but during the heavy winter rains the water table is at or near the surface. Overflow from streams occasionally floods this soil.

This soil occurs in close association with other Cokedale soils and with Samish soils. The Samish soils developed from the same kind of parent material but are more poorly drained and have a finer textured subsoil and substratum. The Wickersham soils were also derived from similar materials, but they occur on alluvial fans and are underlain by gravel and fragments of mica-schist.

Profile description:

Surface soil—
Dark gray to very dark gray friable silt loam; appears silvery or steel gray; gray to light olive gray when dry; 6 to 12 inches thick; faint mottles of yellow and brown are common in lower part; medium acid to slightly acid; extends to depths of 18 to 36 inches.
Subsoil—
Stratified medium- and coarse-textured materials; color similar to color of surface soil; faintly mottled with brown and yellowish brown; smooth or greasy when moist; medium acid to strongly acid; extends to depths of 18 to 36 inches.
Substratum—
Gray, light-gray, and dark-gray stratified sand, fine sand, and fine sandy loam; lenses of silty clay loam in a few places; medium acid.

In places there are enough mixed glacial materials in the profile to give the soil a browner color than the typical soil.

Use and management—Because many of the areas of this soil are small, isolated, and fairly inaccessible, only a very small part of it has been cleared for farming. Some of the areas are too small to farm as a unit and are surrounded by soils that are unsuited to agriculture. The areas used for farming are largely in pasture, but some are used for hay and grain. This soil is suited to peas, strawberries, vegetables, and other crops. It is in management group 10.

Cokedale silt loam over Puyallup soil material, 0 to 3 percent slopes (C2).—This soil occurs mainly in association with Puyallup and Sumas soils and other Cokedale soils. The parent materials washed from nearby uplands that are underlain by mica-schist. The materials are carried down by minor streams and deposited over the Puyallup soils laid down by the Skagit River.

This soil is subject to overflow and deposition when there are heavy rainstorms, and when snow thaws rapidly in the adjacent mountainous areas.

Profile description:

Surface soil and subsoil—
Dark gray to very dark gray silt loam, commonly mottled with brown and yellow below depths of 6 to 8 inches; friable; depth ranges from 8 to 24 inches and is commonly more than 12 inches.
Substratum—
Yellowish-brown, brown, or brownish-gray stratified fine sandy loam, loamy fine sand, and fine sand; in places where the upper layer is shallow, the upper part of the substratum is silt loam or very fine sandy loam.

Use and management.—Most of this soil is cleared. It is used principally for hay, grain, and pasture, in conjunction with dairying. Because the individual areas are small and are part of an intricate soil pattern, they are generally farmed with adjacent soils. Cultivated crops will not grow well on this soil without artificial drainage.

Red clover, alsike clover, and grasses are the common mixture for hay and pasture. Small grains are frequently used as nurse crops. Oats grown with vetch for hay gives high yields. Pastures and meadows usually remain in sod for several years, or until native grasses invade and yields decline. This soil is in management group 10.

Cokedale loam, 0 to 3 percent slopes (Cx).—This soil occurs on narrow stream bottoms in two general areas in the eastern half of the county. One area is in the valley of Finney Creek, and the other is along Day Creek. The parent materials were washed from the adjoining rough uplands. The soils of the uplands are underlain by mica-schist, talc, and argillite, but considerable glacial material overlies the parent rocks.

The surface soil is grayish brown, dark-gray, or gray. It is more variable in color than the surface soil of Cokedale silt loam, 0 to 3 percent slopes. This soil is often flooded by fairly fast moving waters, and therefore the texture of the surface soil varies from place to place.

Use and management.—Except for a few acres, this soil has not been cleared and farmed. It occurs in small areas in remote locations and is associated with nonagricultural soils. It is in management group 10.

Cokedale sandy loam, 0 to 3 percent slopes (Cy).—This soil is variable in color. Generally, it is grayish, and in the higher lying areas it has brownish spots. It is slightly better drained than Cokedale loam, 0 to 3 percent slopes. When the water table is low, internal drainage is more rapid. This soil occurs only along the Nooksack River, which may overflow during the rainy season. Many areas along the river are complexes of various textures. Included are spots that are much browner in color than the typical soil.

Use and management.—None of this soil is farmed. All of it is in second-growth timber and probably will remain in timber, as the areas are remote and fairly difficult to reach. This soil is in management group 10.

Cokedale silty clay loam, 0 to 3 percent slopes (C3).—This soil is associated with Samish silty clay loam, 0 to 1 percent slopes. Most of it occurs in one area, which is in the valley of the Samish River southwest of Thornwood. The entire profile is silvery in color and feels smooth and greasy. Drainage is slightly slower in this soil than in Cokedale silt loam, 0 to 3 percent slopes.

Profile description:

Surface soil—
Very dark gray, friable but greasy silty clay loam; gray when dry; 6 to 10 inches thick.
Subsoil—
Very dark gray firm silty clay loam or silt loam mottled with brown and yellow; some lenses of fine sandy loam.
Substratum—
Light-gray, gray, and dark-gray stratified fine sandy loam, very fine sand, and fine sand; contains a few lenses of fine-textured material.

Use and management.—About two-thirds of this soil has been cleared and is used for hay and pasture in conjunction with dairying. Drainage, generally by open drains, is required for cultivated crops. Summer pastures are very good, as the soil remains moist enough that plants grow well. This soil is in management group 10.

Cokedale silty clay loam over Puyallup soil material, 0 to 3 percent slopes (C4).—This soil occurs in the same localities as Cokedale silt loam over Puyallup soil material, 0 to 3 percent slopes. Generally, it occupies slightly lower levels or slight depressions in the flood plain. Hence, it is more difficult to drain.

Use and management.—Statements about the use and management of Cokedale silt loam over Puyallup soil material, 0 to 3 percent slopes, apply to this soil. This soil is in management group 10.

Corkindale loam, 0 to 3 percent slopes (C5).—This reddish-brown soil overlies loose gravelly material. It is well drained to somewhat excessively drained; drainage is rapid through the soil and the porous, coarse-textured substratum. It occurs in the valley of the Skagit River, on high terraces west of Rockport. It is associated with

undulating to steep phases of Corkindale loam. The parent material was loose gravelly outwash or till of varied origin. The soil developed under a dense coniferous forest in an area of heavy rainfall. The vegetation is mostly Douglas-fir and western hemlock. Except for those in rough mountainous areas, one of the few remaining accessible stands of virgin timber in the county is on the Corkindale soils.

Profile description:

Surface soil—
In virgin areas, dark reddish-brown to yellowish-red loam; reddish brown when dry; contains small, hard shot; contains firm spots that are generally darker reddish brown than surrounding material; strongly acid to very strongly acid; 0 to 3 inches thick.
Subsurface layer—
Yellowish-red friable loam; contains as much shot as the surface layer or, in places, more; weakly granular; medium to strongly acid; extends to depths of 8 to 12 inches.
Subsoil—
Reddish-brown to dark yellowish-brown friable gravelly loam; contains a little shot; coarser and not so red with depth; medium to strongly acid; 6 to 18 inches thick.
Substratum—
Yellowish-brown, loose, gravelly sand or sandy gravel; more gravelly with increasing depth.

The depth to the substratum is generally 20 to 24 inches; in a few areas it is 36 inches.

Use and management.—Except for a few acres cleared and used for homesites and small pastures, this soil is in timber, much of which is the virgin stand. It is not well suited to crops because the moisture-supplying capacity is moderately low and the fertility is low. However, it is moderately well suited to pasture, oats for hay, other hay crops, and strawberries. It is in management group 6.

Corkindale loam, 3 to 8 percent slopes (C6).—Except for being shallower, this soil resembles Corkindale loam, 0 to 3 percent slopes. It is closely associated with that soil, as well as with the steeper phases of Corkindale loams. The depth to the gravelly substratum ranges from 15 to 20 inches.

Use and management.—Statements about the use and management of Corkindale loam, 0 to 3 percent slopes, apply to this soil. This soil is in management group 6.

Corkindale loam, 8 to 15 percent slopes (C7).—This is an inextensive soil occurring in association with other Corkindale soils. It resembles Corkindale loam, 3 to 8 percent slopes.

Use and management.—None of this soil has been cleared. A small acreage is used for stump pasture. Because this soil is droughty, it is best suited to pasture, meadow, and forest. It is in management group 6.

Corkindale loam, 15 to 30 percent slopes (C8).—This soil is closely associated with other Corkindale loams. It is more variable in color, in texture of the subsoil, and in depth to the gravelly substratum.

Use and management.—None of this soil is used for farming. Because it is steep and droughty, it is suited only to forests. It is in management group 12.

Corkindale loam, 30 to 45 percent slopes (C9).—This soil occupies steep gullies and terrace breaks in association with the other Corkindale soils. The profile varies a great deal from place to place. Some gravel occurs throughout the profile, and the depth to the gravelly substratum is generally less than 15 inches.

Use and management.—This soil is not suited to cultivation and is all in second-growth or virgin timber. It is best suited to forest. It is in management group 12.

Coveland gravelly loam, 0 to 3 percent slopes (C12).—This is a shallow, imperfectly drained soil that has a moderately coarse textured subsoil and a compact clayey substratum. The fine-textured parent material was probably glacial in origin. It was reworked and deposited in marine waters and glacial lakes. The native vegetation was grass and a scattering of Douglas-fir, oak, and brush. The predominance of grass accounts for the dark color of the surface soil. Internal drainage is slow. During the rainy season, the subsoil becomes saturated unless artificially drained.

This soil is adjacent to Puget Sound on Fidalgo and Guemes Islands. It is associated with Bow soils and other Coveland soils.

Profile description:

Surface soil—
Nearly black friable gravelly loam; high in organic matter; finely granular; extends to depths of 6 to 14 inches; abrupt boundary between this layer and the subsoil.
Subsoil—
Grayish-brown, gray, or brown firm gravelly sandy loam or gravelly loamy sand; very hard when dry; moderately mottled with brown and yellow; abrupt boundary at a depth of about 18 inches.
Substratum—
Olive-gray to gray, plastic, compact clay loam, sandy clay loam, or clay; highly mottled with brown and yellow; pebbles and gravel embedded in layer; mottling decreases with depth.

Some gravel occurs throughout the profile. The entire profile is medium acid to slightly acid. The surface soil and subsoil are moderately permeable. The substratum is slowly permeable.

Use and management.—This is one of the most fertile of the upland soils. It is well supplied with organic matter and retains plenty of moisture during the growing season. All of it is in farms, and most of it is used for hay, pasture, and grains in conjunction with dairying. When properly drained, this soil is suited to clovers, grasses, peas, and other vegetables. Some drainage is beneficial to early seeded hay and pasture plants. Pastures and meadows usually are seeded to mixtures of clover and grass. Generally, hay is cut once a year, and the soil is used for pasture the remainder of the season. Oats, which is the principal grain grown, is often cut green for hay. Yields are fairly high. This soil is in management group 5.

Coveland gravelly loam, 3 to 8 percent slopes (C13).—This soil is closely associated with other Coveland soils. Runoff is slightly more rapid than on Coveland gravelly loam, 0 to 3 percent slopes, but generally there is sufficient seepage from adjacent higher areas to keep this soil moist during the growing season. Included are areas that have a lighter colored surface soil.

Use and management.—Most of this soil is in the residential section of Anacortes. Small areas are used along with the associated soils. This soil is in management group 5.

Coveland silt loam, 0 to 3 percent slopes (C15).—This soil is similar to Coveland gravelly loam, 0 to 3 percent slopes, except that there is little or no gravel in the surface soil. This soil occurs in only one area, which is north of Summit Park on Fidalgo Island.

Use and management.—All of this soil is in farms and is used for hay, pasture, and small grains in conjunction with dairying. Some drainage is needed for farm crops, especially early seeded crops. This soil is slightly more

productive than Coveland gravelly loam, 0 to 3 percent slopes. It can be used and managed in the same way as Coveland gravelly loam, 0 to 3 percent slopes. It is in management group 5.

Coveland silt loam, moderately well drained variant, 0 to 3 percent slopes (C16).—This soil has a very dark colored surface soil, a lighter colored subsoil, and a compact, gravelly substratum. It occupies nearly level bottom lands. The parent material was a mixture of old alluvium and outwash, but it was mostly outwash. This soil resembles the typical Coveland silt loam except that its substratum is not so fine textured and its drainage is better. Runoff is very slow, but internal drainage is restricted only when the water table is fairly high during the rainy season or just after heavy rains.

This soil occurs in only one area, which is east of Belfast in the valley of the Samish River. The total area is only about 100 acres. Associated soils are the Bellingham silt loams and Belfast silt loam.

Profile description:

Surface soil—
Very dark brown to very dark grayish-brown friable silt loam; dark grayish brown when dry; moderately granular; 6 to 8 inches thick; abrupt boundary between this layer and the subsoil.

Subsoil—
Dark yellowish-brown, friable, heavy silt loam; breaks into irregularly shaped aggregates; lower part faintly mottled; extends to depths of 14 to 20 inches. Abrupt boundary between this layer and substratum.

Substratum—
Dark yellowish-brown, compact, very gravelly sandy loam; very difficult to penetrate; many feet thick; pebbles are coated and stained.

This soil is strongly to very strongly acid. The acidity decreases gradually with depth.

Use and management.—This soil is moderately high in natural fertility. It has a fairly large supply of organic matter; nevertheless, it responds to applications of fertilizer that contains phosphates and some nitrogen. Crop yields are good.

This soil is all in farms. Most of it is used for permanent pasture. Some is used for hay. The pasture stands consist mainly of a mixture of grasses and such legumes as red clover and alsike clover. Hay is usually a mixture of legumes and grasses. Generally, only one crop of hay is cut each year, and then the soil is used for pasture. This soil is in management group 8.

Coveland gravelly silt loam, 3 to 8 percent slopes (C14).—This soil resembles Coveland silt loam, 0 to 3 percent slopes, but has a gravelly surface layer and a deeper profile. The depth to the clayey substratum ranges from 18 to 24 inches. When moist, the surface soil is dark grayish brown to black. All except a few acres of this soil occurs in one large area within the city limits of Anacortes.

Use and management.—Except for a few acres, this soil is used for gardens and building sites within the city of Anacortes. The small areas used for farming are used in about the same way as other Coveland soils. This soil is in management group 5.

Everett gravelly sandy loam, 0 to 3 percent slopes (Eb).—This coarse-textured glacial soil of the uplands has a brown to dark-brown surface soil and a dark yellowish-brown subsoil. The subsoil overlies a loose, porous, gravelly substratum.

The soil occupies nearly level areas on glacial outwash terraces and glacial moraines and is associated with undulating and rolling areas of Everett gravelly sandy loam. The parent material was gravelly glacial outwash or drift. The gravel, cobblestones, and rocks are of mixed origin. They are dominantly dark colored. The native vegetation consisted of Douglas-fir, western hemlock, some western redcedar, an understory of salal, and a ground cover of Oregon grape, ferns, and moss. Alder, vine maple, willow, and other deciduous trees are common in some areas, especially in second-growth stands or in areas recently cut over. This soil is somewhat excessively drained. Runoff is slow, and internal drainage is rapid.

This soil occurs in widely scattered areas throughout the county but mostly in the western half. It is associated with the Alderwood soils but generally occupies lower, more nearly level positions.

Profile description:

Surface soil—
Brown to dark-brown very friable gravelly sandy loam; pale brown to brown when dry; contains a little shot; medium strongly acid; 4 to 8 inches thick.

Subsoil—
Dark yellowish-brown to brown, loose, very gravelly sandy loam to very gravelly loamy sand; contains a little shot; less acid than surface soil; extends to depths of 20 to 30 inches.

Substratum—
Light yellowish-brown, pale-olive, and gray, loose, poorly assorted gravelly loamy sand, sandy gravel, and gravelly sand; many stones and cobblestones in some places, and streaks of compact slightly stained sand and gravel in others; less acid than subsoil; many feet thick.

Some stones and cobblestones occur throughout the profile.

Included are small areas in which the surface soil is gravelly loamy sand. In these areas, the soil is generally shallower.

Use and management.—All of the virgin timber has been logged. The second growth consists of the same species as the original forest but includes a larger proportion of deciduous trees, shrubs, and vines. Trees grow very slowly, and roots penetrate to only moderate depths.

This soil is droughty and low in fertility; therefore, it is not generally suited to crops. Except for a few small pastures, gardens, and homesites, it has not been cleared. Some partially cleared areas are used in spring for woodland pasture. The grazing period is limited by droughtiness. This soil is best used for forests. It is in management group 3.

Everett gravelly sandy loam, 3 to 8 percent slopes (Ec).—This soil occurs in close association with Everett gravelly sandy loam, 0 to 3 percent slopes.

Use and management.—Because of its low fertility and poor moisture-holding capacity, this soil is generally unsuited to farm crops. It is as droughty as the nearly level areas of Everett gravelly sandy loam, or possibly more so. It should be used and managed in the same way. It is in management group 3.

Everett gravelly sandy loam, 8 to 15 percent slopes (Ed).—This soil normally occupies rolling glacial moraines and slopes between terraces. It is associated largely with the Alderwood soils. Its characteristics, particularly the depth to the substratum, vary more than those of Everett gravelly sandy loam, 3 to 8 percent slopes.

Use and management.—This soil is more droughty than the more gently sloping Everett soils. The natural

fertility is low. Except for some wooded pastures and homesites, this soil is in forest, the use to which it is best suited. It is in management group 3.

Everett gravelly sandy loam, 15 to 30 percent slopes (Ee).—This soil occupies slope breaks and kames. It is associated with other glacial soils of the upland. Its profile characteristics are, as a rule, similar to those of the other Everett soils, but in most areas they are much more variable. The color is generally a little lighter. The texture of the surface layer varies from gravelly sandy loam to gravelly loamy sand.

Use and management.—In addition to being droughty and infertile, this soil is too hilly to be used for agriculture. It remains in second-growth timber, the use to which it is best suited. It is in management group 12.

Everett gravelly sandy loam, 30 to 45 percent slopes (Ef).—This soil occupies steep terrace escarpments and steep glacial moraines. It is associated with the Alderwood soils and with other Everett soils. From place to place, the profile is extremely variable in color, texture, and thickness of horizons.

Use and management.—This soil is best suited to forests. It is a source of sand and gravel for road building and other construction. It is in management group 12.

Everett cobbly sandy loam, 0 to 3 percent slopes (Ea).—This soil occupies topography similar to that occupied by Everett gravelly sandy loam, 0 to 3 percent slopes. Cobblestones are scattered throughout the profile and on the surface. In places there are also some larger stones.

Use and management.—Because it is cobbly or stony, droughty, and infertile, this soil is suited only to forest. At present, a small part of it is used for wooded pasture. This soil is in management group 3.

Fidalgo rocky loam, 8 to 15 percent slopes (Fa).—This is a well drained to moderately well drained, moderately permeable, shallow soil. Essentially, it consists of a thin mantle of glacial drift over serpentine bedrock or unconsolidated stony material. Rock outcrops are common. The depth to the underlying material is extremely variable. The native vegetation consists of Douglas-fir, western hemlock, some western redcedar, and associated deciduous trees, shrubs, and vines.

This soil occurs only on the coastal islands. It is associated with the steeper areas of Fidalgo rocky loam and with Rough rocky land.

Profile description:

Surface soil—
Dark-brown or dark reddish-brown friable rocky loam; contains rounded pebbles and angular fragments; strongly acid; 3 to 8 inches thick.

Subsoil—
Brown to dark-brown rocky, gravelly, or shaly loam to sandy loam; slightly less acid than surface soil; extends to depths of as much as 24 inches; lower part is friable to partially cemented glacial till mixed with serpentinite.

Substratum—
Olive to brown rocky sandy loam; contains many fragments of serpentine rock; hard in place; gradual transition to bedrock; layer ranges from extremely thin to more than 24 inches in thickness.

All of the characteristics are extremely variable. The acidity decreases slightly with depth.

Use and management.—None of this soil has been cleared for farming, but a number of homesites have been cleared. Most of the virgin timber has been logged, and the soil is now reforesting naturally with the native species. This rocky soil is best suited to forest. It is in management group 12.

Fidalgo rocky loam, 15 to 30 percent slopes (Fb).—Although similar to Fidalgo rocky loam, 8 to 15 percent slopes, this soil is shallower and has more rock outcrops. It occurs in association with other Fidalgo soils and with Rough rocky land.

Use and management.—Except for a few homesites, this soil is used for forestry, the use to which it is best suited. It is in management group 12.

Fidalgo rocky loam, 30 to 45 percent slopes (Fc).—This soil is like Fidalgo rocky loam, 8 to 15 percent slopes, except that the mantle of glacial material is thinner and the outcrops of rocks are more numerous. This soil occupies the steep sides of ridges and hills. It is associated with the other phases of Fidalgo rocky loam and with Rough rocky land.

Use and management.—Because it is steep and rocky, this soil is suited only to forests. It is in management group 12.

Giles silt loam, 0 to 3 percent slopes (Gc).—This is a well-drained soil that occurs in widely scattered areas on terraces in the glacial uplands. The areas are smoother and slightly lower than the areas of undulating and nearly level Lynden and Everett soils with which this soil is associated. The underlying material consists of stratified sands similar to those under the Lynden soils. The parent material consisted of clayey or silty sediments, deeper and less sandy than the parent material of the Lynden soils. The native vegetation consisted of dense stands of Douglas-fir, hemlock, cedar, scattered deciduous trees, and an understory of brush, ferns, and herbaceous plants.

Profile description:

Surface soil—
Strong-brown to reddish-brown, friable silt loam; pale brown to brown when dry; contains scattered shot; 6 to 10 inches thick.

Subsoil—
Brown or dark yellowish-brown, friable to firm silt loam; contains a little shot; weak fine subangular blocky structure; lenses of olive-gray silt loam in places; extends to a depth of about 20 inches.
Yellowish-brown to olive-gray, firm, stratified silt loam, very fine sandy loam, or loam; faintly mottled in most places; contains some lenses of silty clay loam; extends to depths of 30 to 50 inches; abrupt lower boundary.

Substratum—
Olive-gray, gray, and yellowish-brown loose sands; contains lenses of medium-textured materials; faintly mottled with brown and yellow.

This soil is strongly acid to medium acid. It is moderately permeable. The moisture-holding capacity is good, and internal drainage is adequate. In a few areas a scattering of gravel occurs, generally in the substratum.

Use and management.—A large proportion of this soil is in second-growth forest. Like the virgin forest, the present stands are a mixture of conifers and deciduous trees. Many areas support an almost pure stand of alder and an understory of vines and shrubs.

This soil is excellent for farming. It is suited to many crops but is used largely for hay, permanent pasture, and small grains. The most common mixture for hay and pasture consists of red clover and alsike clover sown with ryegrass or timothy. Small grains, principally oats, are usually cut green for hay and used as a nurse crop for legumes. Berries do fairly well, and strawberries will grow well.

This soil is deficient in organic matter and nitrogen. It responds well to applications of phosphate. The deficiencies are partly made up by applying manure and by including legumes in the hay and pasture mixtures. Little commercial fertilizer is used. This soil is in management group 6.

Giles silt loam, 8 to 15 percent slopes (Gd).—This soil is associated with other Giles soils and with Lynden and Everett soils. It resembles Giles silt loam, 0 to 3 percent slopes, but it is slightly shallower and contains some gravel. Although runoff is more rapid, erosion is not a problem because the soil is moderately permeable and is protected by vegetation.

Use and management.—The areas of this soil are very small. Most of them are in second-growth forest. The cleared areas are used principally with the adjacent soils for hay and pasture.

This soil can be used and managed in the same way as Giles silt loam, 0 to 3 percent slopes. It is in management group 6.

Giles loam, 0 to 3 percent slopes (Ga).—This soil occurs in widely scattered small areas, largely on terraces in the valley of the Skagit River. It is associated with Giles silt loam, 0 to 3 percent slopes, and with the Lynden and Everett soils. Internal drainage is medium. Runoff is very slow. The surface soil and subsoil absorb moisture readily and hold it available for plants.

Included in this mapping unit are areas in which the surface soil is fine sandy loam. Where this soil is associated with the Everett soils, some gravel is scattered through the profile.

Use and management.—Less than a quarter of the acreage has been cleared and is used for farm crops. The virgin timber, which was largely Douglas-fir, hemlock, and cedar, has been logged. The second growth consists mostly of the same kinds of trees. Deciduous trees, however, are dominant in many areas. Most of the cleared areas are used for permanent pasture, hay, and small grains, principally oats.

This soil is excellent for farming, because it retains moisture during the growing season. Because of its coarser texture, it is slightly more droughty and slightly less productive than the Giles silt loams. This soil can be used and managed in the same way as Giles silt loam, 0 to 3 percent slopes. It is in management group 6.

Giles loam, 3 to 8 percent slopes (Gb).—This soil is associated with the more nearly level Giles, Lynden, and Everett soils. It is generally shallower and more variable in depth to the sandy substratum than Giles loam, 0 to 3 percent slopes.

Use and management.—Except for a few acres, this soil is in second-growth forest. It can be used and managed in the same way as Giles silt loam, 0 to 3 percent slopes. It is in management group 6.

Gilligan silt loam, 0 to 3 percent slopes (Gg).—This soil resembles Giles silt loam, 0 to 3 percent slopes, but it is more uniformly olive colored in the subsoil and it contains talc and mica-schist. It occurs in widely scattered areas on nearly level glacial outwash terraces in the valley of the Skagit River. It is associated with the Thornwood soils and with Gilligan loam. The original vegetation was largely Douglas-fir and western hemlock. Western redcedar, shrubs, vines, and ferns were also native.

This soil is deep and friable. It is moderately well drained and has good moisture-holding capacity. Drainage is adequate through the coarse-textured underlying material.

Profile description:

Surface soil—
Dark-brown to brown friable silt loam; light brown to brown when dry; contains a little shot; weakly granular; medium to strongly acid; 6 to 10 inches thick.

Subsoil—
Olive or brown silt loam; in places variegated with olive gray; friable to firm; medium acid to strongly acid; extends to depths of about 20 inches.
Pale-olive to olive-gray firm silt loam, faintly mottled with yellow and brown; feels very smooth and slightly greasy; medium acid to strongly acid; extends to depths of 30 to 40 inches.

Substratum—
Olive stratified sand, silt, and fine sandy loam; contains some talc, gravel, and mica-schist; slightly acid.

The depth to the sandy substratum ranges from 24 to 48 inches. Areas are included where lenses of fine sandy loam and silty clay loam occur in the subsoil. In a few places, the color in the upper part of the profile has been affected by the mica-schist or talc. The amount of these materials varies considerably.

Use and management.—Most of this soil is in second-growth forest. The trees are generally of the same kinds as were in the virgin stand. In many areas, however, the forest is mostly deciduous trees, mainly alder, maple, and willow, and includes only a little Douglas-fir, hemlock, and cedar.

The cleared acreage is used mostly for hay, small grains, and permanent pasture. Strawberries will do fairly well if fertilized. The pasture and meadow stands consist chiefly of alsike, red, or white clovers mixed with grasses. After 3 or 4 years, the stands will contain a high proportion of the less desirable native grasses. Generally, hay is cut only once a year, and the soil is used for pasture the rest of the season. Oats, the chief grain crop, is commonly cut green for hay. When harvested for grain, it is used as feed on the farm. Manure is the principal amendment used.

This is one of the better soils of the uplands, but, because it is a long way from markets, only a small part has been cleared for farming. The farms are small, and many farmers get part of their income from logging or other outside employment. This soil is in management group 6.

Gilligan silt loam, moderately shallow, 0 to 3 percent slopes (Gh).—This soil is associated with Giles loams and Lynden loams. Essentially, the characteristics of this soil are like those of Giles silt loam, 0 to 3 percent slopes, but this soil is shallower to the sandy substratum. The average depth is 24 inches. The material below is gravelly and contains considerable mica-schist. The surface soil and subsoil contain little or no shale or gravel.

Use and management.—Except for a few acres, this soil has been cleared. It is used primarily for hay, pasture, and small grains. It does not retain moisture so well as Gilligan silt loam, 0 to 3 percent slopes; consequently, it is slightly less productive.

This soil can be used and managed in the same way as Gilligan silt loam, 0 to 3 percent slopes. It is in management group 6.

Gilligan loam, 0 to 3 percent slopes (Gf).—This soil occurs on terraces, largely in association with Giles silt loam, 0 to 3 percent slopes. Except for the texture of the surface soil, the two soils have similar profiles. The texture of the subsoil varies from loam to silt loam. Included are areas in which the surface soil is fine sandy loam.

Use and management.—Most of this soil is in areas fairly difficult to reach. Except for a few acres, it is in second-growth forest consisting of deciduous trees and conifers of the same species as the original stock.

Although one of the better upland soils, this soil is not so productive as Gilligan silt loam, 0 to 3 percent slopes. It can be used and managed in the same way as that soil. It is in management group 6.

Gilligan gravelly loam, moderately shallow, 0 to 3 percent slopes (Ge).—This soil is associated with other Gilligan soils and with Lynden and Thornwood soils. It is 24 to 30 inches deep over gravelly sand or sandy gravel. The profile is gravelly throughout. Much of the coarse material is mica-schist.

Use and management.—Approximately half of this soil has been cleared for farming. Most of the farms consist of a few acres used for pasture for a small herd of dairy cattle. The farmers obtain a major portion of their income from the lumbering industry. This soil is more droughty than the other Gilligan soils and yields are slightly lower. It can be used and managed in the same way as Gilligan silt loam, 0 to 3 percent slopes. It is in management group 6.

Greenwater loamy sand, 0 to 3 percent slopes (Gk).—This soil occurs on river terraces above the present flood plains. It is associated with other Greenwater soils. It has developed from gray and dark-gray coarse sands with which fragments of light-colored pumice were mixed. This material apparently was washed from the flanks of volcanic peaks in the Cascade Range and deposited in the valleys of the Sauk and Suiattle Rivers. The presence of a few erratics—rounded stones, cobblestones, and pebbles—in some places suggests that the material was moved by swift, turbulent water, possibly glacial rivers.

The native vegetation consists of a light stand of Douglas-fir and other slow-growing conifers. The ground cover is mostly moss.

This soil is somewhat excessively drained. Internal drainage is very rapid.

Profile in a forested area:

Organic litter—
Partly decomposed leaves, needles, and moss.
Surface soil—
Gray loamy sand; ½ inch to 2 inches thick; abrupt lower boundary.
Brown or brownish-gray loose loamy sand; contains a high proportion of pumice; medium acid to strongly acid; extends to depths of 4 to 6 inches.
Subsoil—
Yellowish-brown or olive coarse loamy sand, mottled with iron stains; slightly acid to medium acid; contains many pumice fragments; extends to depths of 18 to 24 inches.
Substratum—
Gray, light-gray, dark-gray, and olive, loose, coarse sand that has stains of yellowish brown and reddish brown; less mottled below a depth of 36 inches; pumice content less than that of layer above and decreases with depth; slightly acid to medium acid.

In a few small scattered areas, the subsoil is very hard or cemented. An area near the Snohomish County line on the west side of the Sauk River has a surface layer of coarse sand or gravelly sand.[2]

The pumice fragments are yellow on the outside and light gray or white on the inside. Most of them are less than one-eighth inch in diameter, but a few are up to 6 inches in diameter. Unbroken pumice stone occurs in places. In some small areas, the amount of pumice is negligible.

Use and management.—None of this soil is cleared for farming. Most of the virgin timber has been logged, and the areas are slowly restocking with the same kinds of trees. Much of the acreage now has little vegetation except for moss and a scattering of brush, deciduous trees, and ferns.

This soil is very droughty and unproductive. Most of it is in fairly remote areas. It is in management group 4.

Greenwater loamy sand, 3 to 8 percent slopes (Gm).—This soil is similar to and occurs in association with Greenwater loamy sand, 0 to 3 percent slopes.

Use and management.—This soil is all in forest, the use to which it is best suited. It is in management group 4.

Greenwater loamy sand, 8 to 15 percent slopes (Gn).—This soil occurs in association with other Greenwater soils. It generally occupies slopes between nearly level areas and rough broken or mountainous areas. The profile resembles that of Greenwater loamy sand, 0 to 3 percent slopes.

Use and management.—This soil is all in second-growth forest. It is unsuitable for farming and should remain in trees. It is in management group 4.

Greenwater sandy loam, 0 to 3 percent slopes (Go).—This soil occurs in small, inaccessible areas in association with Greenwater loamy sand, 0 to 3 percent slopes. It occupies slightly lower positions than that soil. It contains less pumice than the associated soil, has a somewhat finer textured subsoil, and is less droughty. Internal drainage is rapid.

Use and management.—All of this soil is in second-growth forest consisting of deciduous trees and scattered Douglas-firs and western hemlocks. It should be left in forest. It is in management group 4.

Greenwood peat, 0 to 1 percent slopes (Gp).—Greenwood peat is an organic soil derived mainly from sphagnum. It occupies very poorly drained basinlike areas in the glacial uplands. The water table is at or near the surface most of the year. The vegetation consists largely of Labrador-tea and some spirea, wild cranberry, and ferns. Some areas have a scattering of white pine.

Profile description:

Dark yellowish-brown or brown spongy mixture of live and dead sphagnum and roots of growing plants; 6 to 12 inches deep. Yellowish-brown moss peat; extends to depths of about 36 inches; underlain in many areas by brown, dark-brown, or dark grayish-brown mixture of sedimentary and sedgy peat, normally many feet thick.

The entire profile is extremely acid. Included is about 10 acres in which the deposit of moss peat is only about 12 inches deep.

Use and management.—This mapping unit can be used for growing cranberries, but at present it is not used for

[2] Greenwater soils were not recognized or mapped in the 1937 survey of Snohomish County, Washington. Areas that are mapped as Greenwater soils in Skagit County adjoin areas mapped as Skykomish soils in Snohomish County.

agriculture. The peat moss has commercial value. This soil is in management group 11.

Heisler stony loam, 15 to 30 percent slopes (Hd).—This is a well-drained soil that developed from mixed glacial till containing mica-schist, shale, and argillite. It occupies hilly moraines on mountain foothills. These glacially scoured areas generally border lower lying glaciated areas on one side and, on the other, large areas of Rough mountainous land, Heisler soil material, which has shallow, ill-defined horizons composed largely of mica-schist and shale.

This soil absorbs and holds a good supply of moisture. Internal drainage is medium. Runoff is medium but the dense forest cover prevents accelerated erosion.

The forest consists largely of Douglas-fir, cedar, and western hemlock. The second growth includes deciduous trees.

Profile description:

Surface soil—
Brown or dark-brown friable stony loam; light brown to brown when dry; contains varying amounts of rounded pebbles and shaly fragments; strongly acid; 6 to 10 inches thick.

Subsoil—
Dark yellowish-brown to yellowish-brown firm to friable gravelly loam or clay loam; medium acid; contains numerous stones and schist fragments; extends to depths of 24 to 30 inches.

Substratum—
Heterogeneous mixture of stony till, principally schist and argillite; compact and in places softly cemented; slightly acid; depth to bedrock is at least 4 feet; in most places the depth is more than 4 feet.

Glacial stones and boulders are scattered on the surface. In undisturbed timbered areas, there is a thin, gray, strongly acid layer just below the organic litter of fir needles that covers the surface. The depth to bedrock is highly variable.

Use and management.—Most of the original timber has been removed, and the areas are rapidly restocking. Most of the areas recently logged are covered with alders, willows, maples, and other deciduous trees.

The areas are rather hard to reach and are too hilly and stony for agriculture. This soil is very good for timber. It is in management group 12.

Heisler stony loam, 30 to 45 percent slopes (He).—This soil occurs on steep mountainsides and along deeply incised streams. It is associated with rough mountainous land and with glaciated soils of the upland. There are rock outcrops in some places. The glacial mantle is thinner, as a rule, than on Heisler stony loam, 15 to 30 percent slopes.

Use and management.—Practically all of the merchantable timber has been logged. In most places, a thick stand of deciduous trees grows up immediately after logging. This soil is in management group 12.

Heisler gravelly loam, 3 to 8 percent slopes (Ha).—This soil is associated with Rough mountainous land, Heisler soil material. The profile contains considerable mica-schist, and the substratum is compact till and mica-schist. Included are areas in which the surface soil is gravelly silt loam.

Use and management.—The present use of this soil is forestry. The trees are mainly conifers of different species. Recently logged areas are chiefly covered with deciduous trees. This soil is in management group 2.

Heisler gravelly loam, 8 to 15 percent slopes (Hb).—This soil occurs in small, remote, scattered areas on rolling moraines. Generally, it is adjacent to mountainous land or more strongly sloping Heisler soils.

Use and management.—All of this soil is in dense second-growth forest. The stand consists largely of Douglas-fir, western hemlock, and western redcedar but includes alder, willow, maple, and other deciduous trees. This soil is in management group 2.

Heisler gravelly loam, 15 to 30 percent slopes (Hc).—This soil is closely associated with rough mountainous lands, and with Skiyou and Thornwood soils. It occupies sharply rising moraines and hilly areas near the mountains.

Use and management.—All of the native timber has been removed, and a second growth of the same kinds of trees is becoming established. This soil is excellent for timber. The irregular hilly relief precludes the use of this soil for cultivation, and none of it is in farm crops. This soil is in management group 12.

Hovde loamy sand, 0 to 1 percent slopes (Hf).—This is an inextensive soil occupying wet basins behind ridges on the coastal beach. Most of it is in one area, which is on Samish Island. It consists of coastal beach material and a few lenses of gravelly material and finer textured sediments. It is poorly drained. The water table is near the surface most of the year, and salt water seeps into the lower part of the profile. The vegetation is mostly sedges, reeds, and water-tolerant grasses. Saltgrass grows in spots.

Profile description:

0 to 6 inches—
Dark grayish-brown loose loamy sand; bound with many plant roots; medium acid.

6 to 12 inches—
Loose loamy sand; slightly lighter colored than layer above; fewer roots than layer above.

12 inches +—
Gray, dark-gray, and light-gray, loose, coarse sand; generally strongly alkaline.

There is little differentiation in the profile from the surface down to depths of many feet. In some spots the surface soil is finer textured than the typical soil, and in others it is coarser textured.

Use and management.—This soil provides some native pasture. Other than that, it is not suited to farming. It has poor drainage and is difficult to drain artificially because it lacks suitable outlets. The fertility is very low. This soil is in management group 10.

Indianola loamy sand, 3 to 8 percent slopes (Ia).—This somewhat excessively drained soil occurs in widely scattered areas in the glacial uplands, largely in the western part of the county. It occupies undulating areas on glacial moraines. It is associated with rolling and hilly areas of Indianola soils and other glacial soils. The parent material was sandy glacial drift of mixed origin. The native vegetation was Douglas-fir, other conifers, deciduous trees, brush, and vines. This soil has rapid internal drainage and a low moisture-holding capacity.

Profile description:

Surface soil—
Brown or dark yellowish-brown very friable loamy sand; contains a little shot; pale brown or yellowish brown when dry; medium acid; 6 to 10 inches thick. (In undisturbed areas, the uppermost few inches is generally a little darker colored and contains a scattering of weakly cemented aggregates.)

Subsoil—
Yellowish-brown to olive, loose loamy sand; a few firm or slightly hard spots or lenses; a little shot in upper part; medium acid; extends to depths of 18 to 24 inches.
Substratum—
Pale-olive, olive-yellow, or brownish-yellow loose sand; firm in place but readily crumbles to individual grains; slightly acid.

In some areas scattered gravel or lenses of gravel occur below depths of 3 or 4 feet. An area of about 65 acres, east of Marblemount, is brighter colored and more strongly acid in the surface layer than the typical soil.

Permeability is very rapid. The sandy substratum is low in fertility. Plant roots generally do not penetrate to depths of more than 2 feet.

Use and management.—About one-third of this soil has been cleared. The cleared areas are used mostly for homesites and gardens. The areas that are not cleared support a second growth of deciduous trees with a scattering of Douglas-fir and western hemlock.

Forestry is the best use for this soil. Low moisture-holding capacity and low natural fertility limit its agricultural value. Under careful management, it can be used for early pasture or for strawberries or other small fruits. Yields are low. This soil is in management group 3.

Indianola loamy sand, 8 to 15 percent slopes (Ib).—This soil occupies rolling moraines. It is closely associated with Indianola loamy sand, 3 to 8 percent slopes, and other glacial soils of the uplands. It occurs in the western part of the county and also east of Cavanaugh Lake in the vicinity of Deer Creek. In the area east of the lake, the rainfall is heavier than in other areas of this soil, and the soil is more strongly acid and brighter colored. Included in the mapping unit is a small area that has a slightly finer textured surface soil.

Use and management.—Except for a few acres, this soil is in timber. The cleared areas are used for homesites, gardens, and pastures. This soil can be used and managed in the same way as Indianola loamy sand, 3 to 8 percent slopes. It is in management group 3.

Indianola loamy sand, 15 to 30 percent slopes (Ic).—This soil occurs in scattered areas throughout the county. It occupies hilly moraines in association with other glacial soils of the uplands. Although runoff is not rapid, it is faster than on the rolling and undulating areas of Indianola loamy sand. The loose, porous soil absorbs water readily, and the internal drainage is very rapid. A few areas in the valley of the Sauk River are more acid and have a more reddish surface soil than the rest of this mapping unit. The texture is also more variable, and in some places the surface soil is sandy loam.

Use and management.—All of this soil is in second-growth Douglas-fir and deciduous trees. Deciduous trees are dominant in some areas. This soil is best suited to forestry. It is in management group 12.

Indianola loamy sand, 30 to 45 percent slopes (Id).—This soil occurs in only one area, which is north of Concrete. The slopes are irregular, and some are steeper than 45 percent. The thickness of the layers is extremely variable. In most places, the profile resembles that of Indianola loamy sand, 3 to 8 percent slopes.

Runoff is held in check on this soil by the thick cover of second-growth Douglas-fir, hemlock, cedar, and deciduous trees. The dust from the cement plant in Concrete has made the surface soil moderately alkaline in places.

Use and management.—Because this soil is steep and droughty, it is suited only to forestry. It is in management group 12.

Indianola sandy loam, 3 to 8 percent slopes (Ie).—This soil occurs in widely scattered areas, mainly in the western half of the county. It is associated with glacial soils of the uplands. Its sandy loam surface layer is about 8 inches deep. Its subsoil is slightly finer textured than that of Indianola loamy sand, 3 to 8 percent slopes. Two areas about 3 miles west of Rockport have a reddish surface soil. Although this soil is somewhat excessively drained, it is not so droughty as the Indianola loamy sands.

Use and management.—Only a very small part of this soil has been cleared for farming. The areas not cleared are in second-growth timber. Most of the trees are deciduous, but the stands include Douglas-fir and western hemlock. The small cleared areas are used along with adjacent soils, principally for pasture. Some partially cleared areas are used for grazing in spring and early in summer.

This soil is low in organic matter and essential plant nutrients, but it responds well to applications of nitrogen and phosphate fertilizer. The most serious limiting factor is insufficient moisture; consequently, early seeded and early maturing crops will do best. Under careful management, this soil is suited to hay and early pasture. Strawberries do fairly well. This soil is in management group 3.

Klaus gravelly sandy loam, 0 to 3 percent slopes (Ke).—This strongly acid soil occupies glacial terraces along the Sauk and Skagit Rivers. It is associated with areas of undulating to hilly Klaus gravelly sandy loam. The parent material was mixed, coarse-textured glacial drift derived from basic and acidic igneous rocks and sedimentary rocks. The drift was probably deposited by local mountain glaciers. The native vegetation consisted of a dense stand of Douglas-fir, western hemlock, associated deciduous trees, and an understory of shrubs, ferns, and vines.

This soil occurs in the eastern half of the county, where the rainfall is heavy. The natural drainage is somewhat excessive. Runoff is very slow, but internal drainage is very rapid.

The Klaus soils resemble the Skykomish and Everett soils. They are much less gravelly and cobbly than the Skykomish and have redder profiles. The Everett soils are brown to yellowish brown. They are less acid than the Klaus soils, and they developed from material deposited by continental glaciers.

Profile description:

Organic litter—
Partially decomposed needles and leaves; extremely acid; up to 2 inches deep.
Surface soil—
Gray sandy loam or loamy sand; extremely acid; 1 inch thick. (In many places, this layer has been disturbed by logging operations.)
Subsurface soil—
Dark reddish-brown gravelly sandy loam; very friable; reddish brown when dry; contains some shot; the uppermost 3 or 4 inches contains some irregular firm aggregates, iron stained and dark reddish brown; medium acid to strongly acid; extends to depths of 6 to 10 inches.
Subsoil—
Yellowish-red or reddish-brown gravelly sandy loam; very friable; contains less shot than surface soil; medium to strongly acid; extends to depths of 20 to 24 inches; abrupt lower boundary.

Substratum—
Olive and brownish-yellow, loose, very gravelly sand or sandy gravel; amount of gravel increases below depths of 36 to 48 inches; slightly acid.

In some disturbed areas, the color of the surface soil ranges from red to brown. The amount of gravel in the soil varies. Generally, the surface soil contains only a little gravel.

Use and management.—All of the merchantable timber has been removed, and this soil is now restocking to Douglas-fir, western hemlock, and deciduous trees. Recently logged areas have a preponderance of deciduous trees, such as alder, vine maple, and willow. Hardly any of this soil is farmed. Small acreages have been cleared and are used for homesites and gardens.

Because this soil is very droughty and infertile, and is located in remote and inaccessible areas, it is not suitable for cultivation. It is fairly good for timber because it is in an area where rainfall is heavy. It is in management group 3.

Klaus gravelly sandy loam, 3 to 8 percent slopes (Kf).—This soil is associated with Klaus gravelly sandy loam, 0 to 3 percent slopes, and with other Klaus soils. It occurs on high terraces fronting the Sauk, Skagit, and Cascade Rivers and Pilchuck and Deer Creeks.

Use and management.—Except for a few areas used for homesites, this soil is in second-growth forest. It is a fairly good soil for timber. It is in management group 3.

Klaus gravelly sandy loam, 8 to 15 percent slopes (Kg).—This soil is closely associated with other Klaus soils. It commonly occurs at the base of rough mountainous areas. Runoff is more rapid than on Klaus gravelly sandy loam, 0 to 3 percent slopes.

Use and management.—This soil is more droughty than the less strongly sloping Klaus gravelly sandy loams. It is best suited to forestry. All of it is now in timber. This soil is in management group 3.

Klaus gravelly sandy loam, 15 to 30 percent slopes (Kh).—This soil occupies hilly moraines and breaks or escarpments. It is associated with other Klaus soils and with other glacial soils of the uplands. It resembles Klaus gravelly sandy loam, 8 to 15 percent slopes, but varies more in color and thickness of layers and is more droughty because runoff is more rapid.

Use and management.—In addition to being droughty, hilly, and low in fertility, most areas of this soil are remote and inaccessible. Forestry is the best use for this soil. All of it is in second-growth timber. It is in management group 12.

Klaus gravelly loam, 0 to 3 percent slopes (Ka).—This soil occupies glacial terraces, mainly in the upper valley of the Skagit River. It is associated with other Klaus soils. It retains more moisture than Klaus gravelly sandy loam, 0 to 3 percent slopes. Nevertheless, internal drainage is rapid.

Use and management.—Only a small part of this soil has been cleared. The cleared areas are used largely for homesites and pasture. All of the native merchantable timber has been removed. This soil is now restocking with Douglas-fir, hemlock, a little cedar, deciduous trees, shrubs, vines, and ferns.

Although more productive than Klaus gravelly sandy loam, 0 to 3 percent slopes, this soil is not well suited to farm crops. It is in management group 3.

Klaus gravelly loam, 3 to 8 percent slopes (Kb).—This soil is similar to Klaus gravelly loam, 0 to 3 percent slopes. The parent material in some areas included a small amount of schist and argillite.

Use and management.—This soil is all in second-growth timber consisting of deciduous trees and a scattering of young hemlock and Douglas-fir. Because this soil is in a remote area and is droughty, it is of little value for crops. It is, however, a good forest soil. It is in management group 3.

Klaus gravelly loam, 8 to 15 percent slopes (Kc).—This soil is closely associated with other Klaus soils. It commonly occurs at the foot of rough mountains. Runoff is more rapid than on the more nearly level areas of Klaus gravelly loam.

Use and management.—Except for a small acreage used for farm-building sites, this soil has not been cleared. It is in second-growth timber consisting largely of hemlock and Douglas-fir.

Forestry is the best use for this soil. The high cost of clearing and the small returns from crops make cultivation impractical. Early pastures, however, will be fairly good if properly managed. This soil is in management group 3.

Klaus gravelly loam, 15 to 30 percent slopes (Kd).—This soil occupies hilly moraines or strongly sloping areas adjacent to rough mountains. It is associated with other Klaus soils. It is similar to Klaus gravelly loam, 8 to 15 percent slopes, but it varies more in color, texture, and thickness of layers and is more droughty because runoff is more rapid. Accelerated erosion is minimized by the dense vegetation and the permeability of the soil.

Use and management.—This soil is all in Douglas-fir, hemlock, and associated deciduous trees. Because of its hilly relief, this soil is suitable only for forest. It is in management group 12.

Klaus sandy loam, 0 to 3 percent slopes (Kk).—This soil occurs mostly on high glacial terraces along the Sauk River. It is associated with other Klaus soils. It is similar to Klaus gravelly sandy loam, 0 to 3 percent slopes, but is less porous and less rapidly permeable. Scarcely any gravel occurs in the upper part of the profile.

Use and management.—This soil is best suited to forest. It is droughty and low in fertility, and it occurs in remote areas. None of it has been cleared for farming. All of the native vegetation has been cut. The second growth consists of the same kinds of trees as the original forest. This soil is in management group 3.

Klaus sandy loam, 3 to 8 percent slopes (Km).—This soil is closely associated with Klaus sandy loam, 0 to 3 percent slopes, and with other Klaus soils. It resembles Klaus sandy loam, 0 to 3 percent slopes.

Use and management.—This soil is as droughty as, or slightly more droughty than, Klaus sandy loam, 0 to 3 percent slopes. It is in second-growth forest consisting largely of Douglas-fir, western hemlock, and associated deciduous trees. Forestry is the best use for it. It is in management group 3.

Klaus sandy loam, 8 to 15 percent slopes (Kn).—This soil generally occupies rolling glacial moraines and sloping areas next to rough mountainous land. Runoff is greater than on the undulating and nearly level Klaus sandy loams.

Use and management.—This soil occurs in remote and rather inaccessible areas. It is droughty and infertile, and these factors limit its use to forestry. It is in management group 3.

Klaus sandy loam, 15 to 30 percent slopes (Ko).—This soil occurs on kames and hilly moraines. Many of the areas are on foot slopes next to rough mountainous areas. In a few places, the slopes are slightly greater than 30 percent. The profile is similar to that of Klaus sandy loam, 8 to 15 percent slopes, but it varies more in color, texture, and thickness of layers. Runoff is more rapid, but accelerated erosion is prevented by the dense vegetation.

Use and management.—All of this soil is in second-growth timber. It is too low in fertility and too hilly to be used for farming. Forestry is the best use for it. It is in management group 12.

Kline silt loam, 1 to 3 percent slopes (Kv).—This deep, well-drained soil is scattered throughout the county. About two thirds of it is in the eastern part of the surveyed area. It occurs on alluvial fans at the mouths of tributary streams that flow from outlying low hills and precipitous mountains into the valleys of the major streams. The fans range in size from a few acres to about 20 acres.

This soil is associated with various soils of the bottom lands and terraces. It has developed from material washed from the uplands. The material is mixed but is dominantly of glacial origin. In many parts of the uplands a thin mantle of glacial material overlies bedrock of argillite, sandstone, shale, or schist. The original vegetation was a mixture of conifers and deciduous trees.

This soil is moderately permeable. Runoff and internal drainage are normally rapid enough to remove the excess water that accumulates in spots from uneven seepage and runoff from adjacent slopes. Streams occasionally overflow, deposit sediments, and cause some erosion.

Profile description:

Surface soil—
Dark-brown to dark grayish-brown friable silt loam; grayish brown to brown when dry; weakly granular; strongly acid; 6 inches thick.

Subsoil—
Yellowish-brown to brown friable loam to silt loam; extends to depth of 12 inches.
Yellowish-brown to olive, firm, stratified, medium-textured materials; faintly mottled with yellow and brown; contains some lenses of finer and coarser textured materials; strongly acid; extends to depth of 24 inches or more.

Substratum—
Yellowish-brown to olive, firm, stratified sandy loam or loamy fine sand mottled with yellow, brown, and gray; contains lenses of finer textured material; medium acid below depth of 30 inches.

In some places gravel and pebbles are scattered through the profile. East of Belfast is an area of about 65 acres that appears to consist of a gravelly alluvial deposit overlying reworked glacial outwash mixed with finer materials. In this area the profile is gravelly and cobbly throughout and the substratum is very gravelly, cobbly, or stony. Gravel symbols identify this area on the soil map.

The color of the surface soil is highly variable in some areas. There are a few small wet spots in which the subsoil is grayer and more mottled than is typical. In some areas the material below a depth of 4 feet is similar to the material underlying the adjacent alluvial or terrace soils. In places there is an almost imperceptible transition to the soils of the valley floor.

Use and management.—In the eastern half of the county, only a little of this soil has been cleared for farming. Most of the areas in the western half have been cleared. They are generally too small to be managed separately and are used with the adjacent soils for hay, small grains, and permanent pasture. This soil is moderately high in fertility. The principal management problem is maintaining the fertility. Interception drains at the base of steep slopes will help to remove excess water during heavy rains. This soil is in management group 8.

Kline loam, 1 to 3 percent slopes (Ks).—This soil occurs in widely scattered areas throughout the county but mainly in the eastern part at the upper end of the valley of the Skagit River. It is similar to Kline silt loam, 1 to 3 percent slopes. Scattered gravel is fairly common in the profile. Other variations that occur in Kline silt loam also occur in this soil. Internal drainage is slightly more rapid. The underlying material is coarser textured.

Use and management.—Less than one-fourth of this soil has been cleared for farming. Its remote location limits its use for agriculture. It can be used and managed in the same way as Kline silt loam, 1 to 3 percent slopes. It is in management group 8.

Kline loam, 3 to 8 percent slopes (Kt).—All of this soil is in the eastern half of the county, in the valley of the Skagit River. Although runoff is more rapid than on Kline loam, 1 to 3 percent slopes, this soil is not eroded because it absorbs water readily and is protected by vegetation. Most of it is on slopes of between 3 and 5 percent.

Use and management.—About half of this soil has been cleared or partially cleared and is used for permanent pasture. This soil can be used and managed in the same way as Kline silt loam, 1 to 3 percent slopes. It is in management group 8.

Kline gravelly loam, 1 to 3 percent slopes (Kp).—This soil occurs on alluvial fans at the mouths of swiftly flowing streams. The parent materials were similar to those of other Kline soils, but they included considerable coarser textured material. This soil is more droughty than other Kline soils, and has more rapid internal drainage. The amount of gravel is considerable below depths of 2 or 3 feet.

Use and management.—Except for a few acres, this soil is in second-growth timber. The cleared areas are used mainly for building sites and for permanent pasture. This soil can be used and managed in the same way as Kline silt loam, 1 to 3 percent slopes. Crop yields are lower, however. This soil is in management group 8.

Kline gravelly loam, 3 to 8 percent slopes (Kr).—This soil developed from materials deposited by swift-flowing streams. Most of it is on slopes of 3 to 5 percent. The amount of gravel varies considerably. Included are areas in which stones and cobblestones are scattered on the surface and through the profile. These areas are generally adjacent to present streams or abandoned stream beds.

Use and management.—Only a few acres of this soil has been cleared for farming. Most of it is in second-growth timber. Some areas are used for building sites and gardens. Much of this soil is in remote areas and is associated with soils unsuitable for agriculture; consequently, it has little value for agriculture. This soil is in management group 8.

Kline sandy loam, 1 to 3 percent slopes (Ku).—Much of this soil occurs in one area, which is southwest of Marblemount at the mouth of Illabot Creek. This soil is closely associated with other Kline soils. The subsoil is variable and is somewhat coarser textured than that of the Kline loams. Internal drainage is rapid; consequently, this soil is much more droughty than other Kline soils.

Use and management.—As most of it occurs in a remote area, this soil is not used for farming. It is now in second-growth alder, maple, willow, and other trees. It is in management group 8.

Lummi silt loam, 0 to 1 percent slopes (La).—This soil occurs on the delta of the Skagit River, in low, wet areas adjacent to tidal flats or the waters of Puget Sound. It occupies flats that were, until recently, periodically inundated by salt water. The parent material consists of delta deposits washed down by the Skagit River and its tributaries.

Before it was artificially drained, this soil was poorly drained and was often ponded with salt water. Now it is protected from salt water by dikes and drained by an extensive system of open drains and tide gates. Nevertheless, the water table is at or near the surface during the rainy season. Although the ground water to depths of 3 or 4 feet is free of salt, the water farther down remains salty. The native vegetation consisted largely of reeds, sedges, and water-tolerant grasses. Alders, willows, cottonwoods, and other deciduous trees have become established in some of the better drained areas.

This soil is associated with the Puget and Sumas soils but occupies lower and more poorly drained positions. It is more mottled and more strongly acid than the associated soils and contains numerous flattened remnants of sedges.

Profile description:

Surface soil—
Grayish-brown or dark grayish-brown friable silt loam mottled with yellow and brown; strongly acid to extremely acid; 4 to 8 inches thick.

Subsoil—
Gray or olive-gray very plastic silty clay loam, silty clay, or clay mottled with brown or reddish brown; extends to depths of 20 to 24 inches.
Material similar to layer above but not so prominently mottled; numerous interbedded flattened remains of sedge in various stages of decomposition; most of the mottles are along root channels and sedge remains; subsoil strongly acid to extremely acid; extends to depths of 36 to 48 inches.

Substratum—
Gray to dark-gray laminated clays, silts, and fine sands; little or no mottling; strongly alkaline; below 3 feet, dominantly coarse textured material in some areas.

Use and management.—The fertility of this soil is high, but because the soil is so difficult to drain, its use is limited. Although all of it has been reclaimed by the use of dikes, tide gates, and open ditches, it remains poorly drained. Most of it is in permanent grass pasture. The pastures have a high carrying capacity throughout the dry summer season. Mixtures of legumes and grasses for hay and pasture do very well, especially on the better drained areas. Oats grown for grain produce high yields in most years, but the fields are spotty in appearance. This soil is in management group 10.

Lummi silty clay loam, 0 to 1 percent slopes (Lb).—Generally, this soil occurs in slightly lower positions and nearer the lower edge of the delta than Lummi silt loam, 0 to 1 percent slopes. It is more difficult to drain and, even when diked, is under water much of the time during the rainy season. The mottling is generally more pronounced in the surface soil and less so in the subsoil. Nevertheless, the mottles in the subsoil, which commonly occur only along old root channels, are very conspicuous.

Use and management.—Most of this soil is protected from salt water by dikes, and the drainage has been improved somewhat by open ditches and tide gates. About half of the acreage has not been cultivated, but the native grasses and sedges provide considerable forage for livestock. The better drained areas are used primarily for hay, pasture, and oats for grain or hay. Yields are slightly lower than on Lummi silt loam, 0 to 1 percent slopes. This soil is in management group 10.

Lynden sandy loam, 0 to 3 percent slopes (Lm).—This soil occupies widely scattered areas on glacial outwash plains. Much of it is on terraces. It was derived from sandy glacial outwash, most of which was free of gravel. It is closely associated with the Giles and Everett soils and with other Lynden soils. The Lynden soils differ from the Giles in being shallower to sand, and from the Everett in being relatively free of gravel throughout the profile.

This soil is somewhat excessively drained. Runoff is very slow, but internal drainage is rapid. The native vegetation consisted of Douglas-fir, western hemlock, some cedar, and associated deciduous trees, shrubs, and vines.

Profile description:

Surface soil—
Brown, dark-brown, or yellowish-brown very friable sandy loam; pale brown to yellowish brown when dry; contains a little shot and coarse sand; medium acid; 8 to 10 inches thick.

Subsoil—
Yellowish-brown loose loamy sand; contains a very little shot; less acid than surface layer; 8 to 12 inches thick.

Substratum—
Dark-gray, olive, and light-gray, medium and coarse, loose sands; a few thin, wavy, stained, compact bands in upper part; scattered gravel in some areas; less acid than subsoil; many feet thick.

Use and management.—All of the merchantable timber has been cut, and in some areas a second growth of Douglas-fir and western hemlock is established. Many areas have a dense stand of alders, maples, and willows. The cleared areas are used primarily for pasture, but some are used for hay. If suitable grass-and-legume mixtures are used, grazing is good throughout the spring. A small part of this soil is only partially cleared and is used for woodland pasture. Usually these pastures are good following flash burns, provided weeds and trees are kept under control.

Although this porous soil absorbs moisture rapidly, it becomes droughty in the latter part of the growing season. The fertility is low, and the soil is in remote areas; consequently, only a few acres have been cleared for cultivation.

To provide nutrients for pasture plants, barnyard manure should be applied and legumes should be grown. Legumes respond well to applications of phosphate fertilizer. Green-manure crops should be grown occasionally. This soil is in management group 4.

Lynden sandy loam, 3 to 8 percent slopes (Ln).—This soil occurs on terraces and outwash plains. It is associated with other Lynden soils and with the Giles and Everett soils. It is slightly more droughty than Lynden sandy loam, 0 to 3 percent slopes.

Use and management.—Only a very small part of this soil has been cleared for farming. This soil can be used and managed in the same way as Lynden sandy loam, 0 to 3 percent slopes. It is in management group 4.

Lynden loamy sand, 0 to 3 percent slopes (Lg).—This soil occurs on terraces, mostly in the vicinity of Birdsview and Concrete. It is associated with other Lynden soils and other soils derived from glacial outwash. It has a lower moisture-holding capacity and more rapid internal drainage than Lynden sandy loam, 0 to 3 percent slopes. The surface layer is slightly thinner. In most areas the lower part of the profile contains some gravel. Areas are included in which the substratum is gravelly sand. The gravel occurs sporadically.

Use and management.—Except for a few acres in homesites, small clearings, and woodland pasture, this soil remains in timber. The original Douglas-firs and associated trees have been removed. Second-growth conifers, alders, willows, and maples are now becoming established.

This soil is droughty and low in fertility. Forestry is the best use for it. If cleared, it can be used and managed in the same way as Lynden sandy loam, 0 to 3 percent slopes, but it will not respond so well to amendments and will not give as good yields. This soil is in management group 4.

Lynden loamy sand, 3 to 8 percent slopes (Lh).—This soil occurs in only two areas, one along Finney Creek and the other 1 mile south of Thornwood. It is more gravelly and has a shallower surface soil than Lynden loamy sand, 0 to 3 percent slopes. In some places the parent material contains some fragments of mica-schist.

Use and management.—A second growth of Douglas-fir, alder, maple, and willow occupies most of the soil. The proportion of deciduous trees is greater than it was in the virgin forest. Only 10 to 15 acres has been cleared. The cleared acreage is used for hay and pasture.

Because of its low moisture-holding capacity, this soil is less suitable for farm crops than Lynden loamy sand, 0 to 3 percent slopes. It is, however, equally well suited to trees, and forestry is a good use for it. This soil is in management group 4.

Lynden loamy sand, 8 to 15 percent slopes (Lk).—This soil is more droughty than other Lynden soils. Its characteristics are more variable than those of Lynden loamy sand, 0 to 3 percent slopes, which it most nearly resembles. The texture of the surface soil ranges from loamy sand to sandy loam.

Use and management.—Forestry is the best use for this soil. The virgin timber has been cut. The second growth of native conifers is being crowded by deciduous trees and brush. This soil is in management group 4.

Lynden loam, 0 to 3 percent slopes (Le).—This soil is associated with the Giles and Everett soils and with other Lynden soils. The profile is essentially the same as that of Lynden sandy loam, 0 to 3 percent slopes. Because the profile is not so coarse-textured, however, the moisture-holding capacity is slightly better. Included are areas in which the underlying material is a gravelly sand or sandy gravel.

Use and management.—Because this soil is more fertile and less droughty than other Lynden soils, more of it has been cleared for farming. The cleared areas are used mainly for hay and pasture.

This soil can be used and managed in the same way as Lynden sandy loam, 0 to 3 percent slopes. It is in management group 4.

Lynden loam, 3 to 8 percent slopes (Lf).—This soil is associated with Lynden loam, 0 to 3 percent slopes. It is slightly more droughty than that soil and is more variable in color of the surface soil. In a few areas, gravel occurs in the lower part of the profile.

Use and management.—This soil can be used and managed in the same way as Lynden loam, 0 to 3 percent slopes. Only a few acres of it has been cleared for farming. It is in management group 4.

Lynden gravelly loam, 0 to 3 percent slopes (Lc).—This soil resembles Lynden loam, 0 to 3 percent slopes, but it is slightly more droughty. It has a scattering of gravel throughout the surface soil, and more gravel in the subsoil and the substratum. It is not nearly so gravelly as the Everett soils. Included, however, are areas in which the substratum contains considerable gravel.

Use and management.—Little of this soil has been cleared and used for cultivated crops or pasture. Most of it is in second-growth timber. Deciduous trees and brush are crowding the Douglas-fir. Crop yields are slightly lower than on Lynden loam, 0 to 3 percent slopes. This soil is in management group 4.

Lynden gravelly loam, 3 to 8 percent slopes (Ld).—This soil is associated with Everett gravelly sandy loams and the Giles soils. Most of it is north of Sedro-Woolley. It is more gravelly than Lynden gravelly loam, 0 to 3 percent slopes, and has a slightly shallower surface soil.

Use and management.—Except for a few acres used for homesites and small pastures, this soil is in second-growth timber. It can be used and managed in the same way as Lynden sandy loam, 0 to 3 percent slopes. It is in management group 4.

Made land (Ma).—This is a miscellaneous land type. The largest area occurs along Swinomish Slough. It consists of sandy material dredged from the slough. Airfields and some building sites are on Made land. This land type is of no agricultural importance. It is in management group 12.

Marblemount stony loam, 15 to 30 percent slopes (Mb).—This soil occupies mountain foot slopes in the eastern part of the county. It is close to large areas of granitic rough mountainous land composed of shallow soils that have ill-defined profiles. Most of this soil has developed from local granitic colluvium. The native vegetation consisted of a dense stand of Douglas-fir, western hemlock, and other conifers. As rainfall is heavy in this region, the trees grow fairly rapidly.

This soil is well drained. Runoff is medium. Erosion is checked by the dense vegetation and the moderate permeability of the soil.

Profile description:

Surface soil—
Brown to dark-brown friable loam; contains small shot and angular and subangular blocky fragments; moderate granular structure; medium acid to strongly acid; 6 to 12 inches thick.

Subsoil—
Dark yellowish-brown stony loam; friable to firm; contains less shot than surface soil; extends to depth of 24 inches.

Substratum—
Olive, olive-gray, or grayish-brown, firm, somewhat weathered granitic material composed mostly of stones and sandy loam interstitial material; number of granite stones and boulders increases with depth.

The profile is extremely variable, though the one described is most common. Stones and boulders are generally scattered on the surface. In undisturbed wooded areas, the surface soil is overlain by a very strongly acid gray layer that is ½ to 1 inch thick. This is covered with organic litter, mostly fir needles and leaves. The reaction ranges from strongly acid at the surface to slightly acid in the lower part of the profile. The depth to bedrock varies. Outcrops occur in places.

Use and management.—All of the merchantable timber has been removed. This soil is now restocking with the same species as those in the native forest. It is a good soil for timber but is of no value for agriculture because of its stoniness and hilly relief. It is in management group 12.

Mukilteo peat, 0 to 1 percent slopes (Mc).—This organic soil occurs throughout the county in small depressions or basins that have no natural drainage outlets. The areas that are not drained artificially are inundated for many months of the year. This soil is composed of recognizable remains of sedges and water-tolerant grasses, mixed with sedimentary material. The native vegetation consists chiefly of sedges, reeds, and tules. Trees and brush, including spirea and lodgepole pine, commonly grow along the outer margins. The remains of these are incorporated in the peat in some places.

In this mapping unit, the peat deposit is at least 2 feet deep. Deposits less than 2 feet deep are mapped as Mukilteo peat, shallow, 0 to 1 percent slopes.

This soil is commonly associated with Semiahmoo muck, 0 to 1 percent slopes, which was derived from organic materials similar to those from which this soil was derived.

Profile description:

Surface soil—
Dark-brown partially decomposed sedge peat, matted with roots and fibers; contains some woody fragments; extremely acid; 6 to 12 inches thick.

Subsoil—
Dark yellowish-brown fibrous sedge peat; contains embedded flattened remains of sedges, reeds, and coarse grasses; lower part contains considerable sedimentary and colloidal material; slightly less acid than surface soil; extends to depth of 36 inches.

Substratum—
Fibrous or sedimentary material; contains some woody fragments; very strongly acid; extends to depths of more than 72 inches.

Use and management.—Only a small part of this soil has been cleared, drained, and cultivated. In some areas, the coarse fibers interfere with cultivation. Many areas are too small to farm as separate units and are adjacent to soils unsuitable for agriculture. Draining this soil is difficult because of its location in basins and depressions. If adequately drained and cultivated for a few years, however, it is very productive. The areas now farmed are used for hay and permanent pasture. They provide good pasture during the dry summer season, when the pastures on the associated soils of the upland are poor. This soil is in management group 11.

Mukilteo peat, shallow, 0 to 1 percent slopes (Md).—Much of this soil occurs in small shallow basins or depressions and on the outer margins of areas of deeper deposits of peat. In this mapping unit, the organic deposit is less than 24 inches deep. It overlies mineral soil of variable characteristics.

Use and management.—This soil can be used and managed in much the same way as Mukilteo peat, 0 to 1 percent slopes. It is in management group 11.

Neptune sandy loam, 0 to 3 percent slopes (Na).—This soil occurs in a few scattered areas on the Skagit River delta. It occupies old beach ridges above high tide. It is chiefly associated with the Puget soils. The parent materials were coastal beach deposits thickly embedded with marine shells. This soil is normally droughty, although in winter the water table is high.

Profile description:

Surface soil—
Brown to dark-brown very friable sandy loam; contains scattered marine shells in places; pale brown to light brownish gray when dry; generally mildly alkaline but slightly acid in places; 6 inches thick.

Subsoil—
Dark grayish-brown to grayish-brown loose loamy sand; contains fragments of gray, blue, or white marine shells; mildly alkaline; extends to depth of about 24 inches.

Substratum—
Shell fragments mixed with dark-gray and gray coarse sand; mildly alkaline; 18 to 24 inches thick.
Gray mottled clay loam or clay similar to that underlying the Puget soils.

Use and management.—Each area of this soil is about 4 or 5 acres in size. This soil is used in conjunction with the adjacent Puget soils. It is in management group 8.

Nookachamps silty clay loam, 0 to 2 percent slopes (Nc).—This soil occupies flood plains in rather narrow valleys in the western part of the county. Two of the major areas are in the valleys of Nookachamps and Walker Creeks. The parent material was mostly alluvium derived from argillite, shale, mica-schist, and glacial materials. The material was washed from hilly, steep, and mountainous areas, most of which have a thin mantle of glacial material overlying the bedrock.

In some areas this soil is associated with the Belfast silt loam, 0 to 3 percent slopes. The Belfast soil is much better drained. It was derived principally from glacial materials. The Nookachamps soil differs from most other soils derived from alluvium in having many prominent mottles throughout the profile.

This soil is poorly drained. The water table is high for many months of the year. During most of the growing season, however, the water table is low enough for crops to grow well. Occasionally, this soil is flooded by heavy runoff from the surrounding hills. The floodwaters of the Skagit River frequently back into the valley of Nookachamps Creek and raise the water table or flood the entire area.

The native vegetation consisted of mixed conifers, deciduous trees, shrubs, vines, and ferns. The trees were chiefly cedar, hemlock, Douglas-fir, willow, alder, and maple.

Profile description:

Surface soil—
Grayish-brown to dark grayish-brown friable silty clay loam; light brownish gray to grayish brown when dry; medium, prominent, yellowish-brown and gray mottles; slightly acid to medium acid; 6 to 10 inches thick.

Subsoil—
Gray, very plastic silty clay loam; coarse, prominent, brown and reddish-brown mottles; slightly acid to medium acid; extends to depths of 18 to 24 inches.
Mottled brownish-gray, yellowish-brown, reddish-brown, and gray stratified silty clay loam, silt loam, sandy loam, and sands; many coarse, distinct mottles; slightly acid; extends to a depth of 30 inches; in some areas, stratified clay and silty clay, commonly neutral or mildly alkaline.

Substratum—
Gray, very plastic silty clay or clay; many fine, distinct mottles in upper few inches; mottling decreases with depth; few mottles below 48 inches; slightly acid.

The color of the surface soil is highly variable in some places. In some areas it is dark brown or brown. These areas normally occur on swells or low narrow ridges and are slightly better drained than the rest of the mapping unit. The texture of the stratified lower subsoil varies greatly in some places. In some areas in the valley of Walker Creek the material below a depth of 4 feet is dominantly sandy.

Use and management.—A little more than half of this soil has been cleared. The rest is mostly in second-growth deciduous trees; a few conifers are becoming established. The cleared areas are used chiefly for hay and pasture. A few acres is used for oats. Most of the farms on this soil are dairies.

This soil is difficult to drain and to protect from floods. Although dikes have been built along Nookachamps Creek and open ditches have been dug to drain off excess water, flooding and poor drainage remain serious problems in most areas.

This soil is moderately high in fertility. Hay and pasture plants grow well. Pastures are excellent throughout the summer. Pasture stands generally consist of a mixture of grasses and alsike clover. Normally, one crop of hay is cut each year, and then the meadow is used for pasture the rest of the season. Barnyard manure is the principal amendment used. Occasionally some phosphate is used at the time of seeding. This soil is in management group 10.

Nookachamps silt loam, 0 to 2 percent slopes (Nb).—This soil is closely associated with Nookachamps silty clay loam, 0 to 2 percent slopes. It occupies slightly higher positions than the associated soil; consequently, it is somewhat better drained and is less often flooded. South of Big Lake are some included areas that have a surface soil of brown or grayish-brown loam or silt loam, less mottled than the rest of the mapping unit. The subsoil and underlying material are clay loam or silty clay loam.

Use and management.—About half of this soil has been cleared. It can be used and managed in the same way as Nookachamps silty clay loam, 0 to 2 percent slopes. It is in management group 10.

Norma silt loam, 0 to 2 percent slopes (Ne).—This soil occurs in widely scattered areas throughout the glacial uplands and terraces. It occupies poorly drained flats, depressions, or basins, and narrow, intermittent drainageways. It occurs in the same general area as the Alderwood, Everett, Indianola, and Bow soils. The parent material was sandy glacial drift, slightly modified by erosion and deposition. Runoff is very slow, and a high water table is common during the rainy season. The native vegetation was alder, willow, and maple and some cedar and hemlock.

This soil resembles the Bellingham soils, but the Bellingham soils are underlain by very fine-textured, less permeable material, typically free of gravel.

Profile description:

Surface soil—
Dark gray to very dark gray or almost black, friable, granular silt loam; dark gray to gray when dry; large amount of organic matter; medium acid to strongly acid; about 6 inches thick.
Olive-gray firm silt loam or very fine sandy loam; fine or medium, distinct, yellowish-brown mottles; about 6 inches thick.
Subsoil—
Olive-gray or olive firm sandy loam; contains lenses of finer material; some fine to coarse, distinct mottles of reddish brown, yellow, and brown; in places, incipient development of ortstein; slightly acid; extends to a depth of 36 inches.
Substratum—
Olive-gray, gray, and dark-gray coarse-textured material; contains varying amounts of gravel; below depths of 48 to 60 inches, cemented glacial till; slightly acid.

Here and there, gravel occurs in different parts of the profile. In some areas, the surface soil is dark grayish brown; in others, there are layers of clay loam in the subsoil.

Use and management.—The use of this soil is dependent upon the size of individual areas, the character of the associated soils, and the ease with which the soil can be drained. All of the original timber has been removed, but only a small acreage of the second growth has been cleared and used for farming. Many of the areas are too small to farm as separate units, and in some places the adjacent soils are poor for agriculture. If properly drained, this soil is moderately permeable and is moderately productive of many crops. It is especially good for hay and summer pasture.

This soil is suited to grasses and legumes for hay and pasture and to oats for grain or hay. Many of the old pastures, originally seeded to clover and grasses, are now grown up to a mixture of wild and tame grasses, sedges, and weeds. Other areas are plowed every 3 to 5 years and reseeded to a grass-legume mixture with oats as a companion crop.

Most of the farms that include some of this soil are small. The farmers keep some poultry and a few dairy cows and supplement their incomes by working in the lumber industry or in business in nearby towns. This soil is in management group 7.

Norma silt loam, 2 to 5 percent slopes (Nf).—This soil lies between Norma silt loam, 0 to 2 percent slopes, and a well-drained soil on stronger slopes. Seepage and runoff from the stronger slopes keep it saturated most of the time, and the underlying cemented glacial till prevents the excess water from draining away internally. The till is at depths of 30 to 36 inches.

Use and management.—Except for a few acres, this soil has not been cleared of its second-growth trees and brush. Interception drains at the base of the stronger slopes improve the drainage. This soil can be used and managed in the same way as Norma silt loam, 0 to 2 percent slopes, but it is easier to drain. It is in management group 7.

Norma loam, 0 to 2 percent slopes (Nd).—A scattering of gravel throughout the profile is more common in this soil than in Norma silt loam, 0 to 2 percent slopes.

Use and management.—This soil can be used and managed in the same way as Norma silt loam, 0 to 2 percent slopes. It is in management group 7.

Norma silty clay loam, 0 to 2 percent slopes (Ng).—This soil occurs in widely scattered small areas, mostly along narrow drainageways. The texture of the surface soil ranges from silty clay loam to clay loam. The subsoil is mottled firm sandy clay loam to heavy loam. Underlying it is coarse-textured glacial material. There

is a gradual transition to cemented glacial till at depths of 3 or 4 feet.

Use and management.—All of this soil is in second-growth trees and brush. It can be used and managed in the same way as Norma silt loam, 0 to 2 percent slopes. It is in management group 7.

Oso loam, 15 to 30 percent slopes (Oc).—This soil has developed from a mixture of glacial material mixed with material weathered from argillite and other metamorphic rocks. It consists of a thin mantle of glacial drift over bedrock or weathered sedimentary rock. There are many rock outcrops. The native vegetation was mainly a coniferous forest of Douglas-fir, hemlock, cedar, and associated trees, shrubs, and ferns. The present dense vegetation prevents accelerated erosion. Both runoff and internal drainage are medium.

This soil is closely associated with large areas of Rough mountainous land, Oso soil material, which has a shallow, ill-defined soil profile that developed from argillite.

Profile description:

Surface soil—
Reddish-brown to brown or dark-brown friable loam; light reddish brown to light brown when dry; contains a little shot and a few angular and round pebbles; strongly acid; 6 inches thick.

Subsurface soil—
Strong-brown to yellowish-red friable loam; contains much shot and some gravel; 6 inches thick.

Subsoil—
Yellowish-brown or yellowish-red firm loam or silt loam; contains variable amounts of gravel and weathered fragments of bedrock; lower part has faint reddish-brown and brown mottles; medium acid; extends to depth of 36 inches.

Substratum—
Grayish-brown cemented till; gravel and fragments of argillite embedded in till; layer extends to depth of 60 inches.

The profile is variable in texture, thickness of layers, and depth to bedrock. Included with this mapping unit are areas having a surface soil of silt loam and sandy loam. Angular stones are scattered on the surface in many areas. In some areas the profile is gravelly. In undisturbed forest areas, a very strongly acid, thin, gray layer lies between a layer of organic forest litter and the reddish-brown surface soil.

Use and management.—All of the virgin timber has been removed from this soil, which is rapidly restocking with Douglas-fir and western hemlock. Willow, alder, and maple trees are crowding the conifers.

The hilly topography and inaccessibility of this soil limits its use to forestry, to which it is well suited. This soil is in management group 12.

Oso loam, 30 to 60 percent slopes (Od).—This soil occupies steep slopes below areas of Rough mountainous land, Oso soil material. Because of the steep slopes, runoff is rapid, but accelerated erosion is held in check by the dense vegetation. The characteristics of this soil are more variable than those of Oso loam, 15 to 30 percent slopes, and rock outcrops are more common. Stones occur throughout the profile in many areas. This soil is inextensive.

Use and management.—All of the merchantable timber has been logged, and this soil is now restocking with trees and brush. Because of the excessively rough relief, this soil is suitable only for forestry. It is in management group 12.

Oso loam, 3 to 8 percent slopes (Oa).—This soil occupies smooth areas on mountain slopes below steeper phases of Oso loam and Rough mountainous land, Oso soil material. Runoff is slow, and internal drainage is medium. The soil characteristics are not so variable as those of Oso loam, 15 to 30 percent slopes. Generally, the layer of glacial material is thicker.

Use and management.—All of the virgin timber has been removed. Some areas are now restocking, principally with Douglas-fir and hemlock. The most recently logged areas have dense stands of alder, willow, and maple.

This soil occurs in remote and inaccessible areas; consequently, none is under cultivation. It is in management group 2.

Oso loam, 8 to 15 percent slopes (Ob).—This soil is closely associated with other Oso soils and resembles them except for degree of slope.

Use and management.—This soil is located in remote and inaccessible areas, and none of it is in cultivation. All of it is in second-growth timber. It is well suited to forest. This soil is in management group 2.

Pilchuck fine sand, 0 to 3 percent slopes (Pa).—This soil occupies alluvial bottom lands that are hummocky in places. It is generally adjacent to streams. Most of it is next to or near the Skagit River or other streams and is only a few feet above the normal level of the water. This soil is developing from sandy sediments that were deposited very recently by rivers and streams. The materials are of mixed origin. They contain less glacial flour than the parent materials of the Puget, Sultan, Puyallup, and other associated alluvial soils.

This soil is frequently flooded. Runoff is very slow, and internal drainage is very rapid. Permeability is very rapid. The vegetation consists of alder, maple, willow, cottonwood, cascara, some cedar, and shrubs, vines, and grasses.

Profile description:

Surface soil—
Brownish-gray or olive-gray loose fine sand, well matted with roots; small amount of organic matter; in some areas, stratified with thin lenses of fine sandy loam or silt; slightly acid to medium acid; 2 to 8 inches thick.

Subsoil—
Dark-gray, olive-gray, gray, and light-gray medium and fine sand; loose; porous; in a few places, stratified with finer textured materials; slightly acid to medium acid; extends to depths of 36 to 48 inches.

Substratum—
Coarse sand; slightly acid to medium acid.

Variations occur mainly in the thickness and the occurrence of stratified materials. During floods, the texture of the surface soil is likely to be changed by either erosion or deposition.

Use and management.—As this soil is very droughty during the summer months and at other times is frequently flooded, it is not generally cleared for farming. Some is used for wild pasture. It is in management group 8.

Pilchuck loamy sand, 0 to 3 percent slopes (Pc).—This soil is closely associated with Pilchuck fine sand, 0 to 3 percent slopes. Except for the difference in the texture of the surface soil, the profiles of the two soils are about the same. Like Pilchuck fine sand, 0 to 3 percent slopes, this soil is frequently flooded. It is also very droughty.

Use and management.—Most of this soil has been left in its native state. Occasionally a few acres are used with adjacent soils. This soil is in management group 8.

Pilchuck sandy loam, 0 to 3 percent slopes (Pd).—Except for the texture of the surface soil, the characteristics of this soil are the same as those of Pilchuck fine sand, 0 to 3 percent slopes. The surface soil is 4 to 8 inches thick. Included in the mapping unit are areas that have a surface layer of fine sandy loam to silt loam.

Use and management.—Except for a few acres in abandoned stream channels southwest of Allen and a few other small scattered areas, this soil has not been farmed. It provides some wild pasture. Unless it is irrigated, it is not suitable for other uses because it is shallow and droughty. It is in management group 8.

Pilchuck gravelly sand, 0 to 3 percent slopes (Pb).—Most of this soil is in abandoned channels once occupied by swiftly flowing streams. It is closely associated with other Pilchuck soils and with Riverwash, 0 to 3 percent slopes. Except for having a considerable amount of gravel in the profile, it resembles Pilchuck fine sand, 0 to 3 percent slopes.

Use and management.—Although not so densely wooded as other Pilchuck soils, this soil supports a fair stand of young alder and willow. None of it has been cleared. Its only value is as a possible source of material for roads and other construction. This soil is in management group 8.

Puget silt loam, 0 to 1 percent slopes (Pg).—This is one of the most extensive and productive soils of the county. Most of it is in the delta plain of the Skagit River. Much of the delta plain is only slightly above high tide. It has developed from fine-textured recent alluvium that accumulated in ponded areas and in stagnant water along sluggish streams and in their deltas. The sediments were derived from many types of rocks.

This soil has poor natural drainage and, unless it is protected by dikes, it is flooded when the water is high in the streams. Dikes, tide gates, and open ditches now keep most of this soil adequately drained. The water table is high during the rainy season, and the soil is occasionally flooded when extremely high water overflows or breaks the dikes.

The native vegetation on the lower areas and on the extremity of the delta consisted mostly of marsh grasses, sedges, cattails, tules, and spirea. A scattering of cedar trees and shrubs also grew there. On slightly better drained sites, stands of cedar, hemlock, willow, alder, and Douglas-fir were fairly common.

This soil is associated with Puget silty clay loam, 0 to 1 percent slopes, and with the Sumas soils. The Sumas soils are much like the Puget except that they are underlain by sand.

Profile description:

Surface soil—
Grayish-brown to olive-gray friable silt loam; light brownish gray, light olive gray, or light gray when dry; a few faint fine yellowish-brown and brown mottles; weak granular structure; 6 to 8 inches thick.

Subsoil—
Gray to olive-gray, very plastic, stratified silty clay loam, silt loam, and silty clay; many medium, distinct, reddish-brown and brown mottles; extends to a depth of about 18 inches.

Gray to olive-gray, very plastic silty clay, clay, or silty clay loam; less mottled than upper part of subsoil; extends to depths of 36 to 48 inches.

Substratum—
Gray to light olive-gray, stratified, very plastic, fine-textured materials; faintly mottled; lenses of sandy material in places.

As a rule, the profile is strongly to very strongly acid, but the reaction varies somewhat, depending on the distance to salt water. In areas next to tidal marshes or salt water, the soil is generally more acid than in other places. Some areas near La Conner are very strongly acid to extremely acid 6 to 10 inches below the surface. The acidity increases with depth. Nevertheless, in many areas near salt water the substratum is alkaline below depths of 4 or 5 feet.

The color of the surface soil varies. It is brown in the slightly better drained areas. These areas, however, are small and spotty. Included are areas that have a few sandy lenses in the subsoil and in the substratum below a depth of 4 feet. In places flattened sedge remains are embedded in the lower subsoil and substratum.

Use and management.—Almost all of this soil is under cultivation. If properly drained and protected from overflow, this is one of the most productive soils in the county. It is used principally for hay, pasture, and small grains grown in conjunction with dairying (fig. 6). Among the important cash crops are green peas, strawberries, potatoes, and vegetable-seed crops (fig. 7). The chief seed crops are cabbage, turnip, beet, spinach, and rutabaga. A small but increasing acreage is used for bulbs, mainly iris, tulip, and daffodil.

***Figure 6.*—Oats growing on Puget silt loam.**

Mixtures of grasses and legumes remain in sod for 4 or 5 years. Unless well managed, the legumes die out after 2 or 3 years and are replaced by grasses and weeds. Generally, hay is cut only once a year, either in the last week in June or in the first week in July. The meadows are then used for pasture the rest of the season. Some are pastured in spring and then left for hay, which is cut late in July when the weather is drier than earlier in the season. The meadows are then grazed until late in fall.

Alsike and red clovers are the legumes most commonly used. Timothy, ryegrass, and orchardgrass are the common grasses. In the better drained sites, alfalfa is grown for hay, but the acreage in alfalfa is small compared to

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Figure 7.—**Strawberries and cabbage for seed on Puget and Sumas soils.**

that in red and alsike clovers. Generally, alfalfa is seeded without a grass mixture. It might be advantageous to seed it with orchardgrass.

A fairly large and increasing acreage is used to grow mixtures of clover and grasses for dehydration. As many as 3 to 6 cuttings are made each season. Areas used for this purpose need heavier applications of fertilizer than those used for cured hay.

Oats is the most important grain crop. It is normally seeded in spring. Some winter wheat is raised. Both oats and wheat are used principally as feed for dairy cattle. Yields are very high.

This soil is used chiefly for hay and pasture so, generally, crops are not rotated systematically. On dairy farms, rotations consist principally of several years of hay and pasture followed by peas, oats, vegetables for seed, or some other cash crop. Often a green-manure crop is plowed under before a cash crop is planted. Peas, strawberries, and vegetables for seed are fertilized heavily. Fertilizer should be used in amounts and kinds recommended by the county agent. This soil is in management group 10.

Puget silty clay loam, 0 to 1 percent slopes (Ph).—This soil generally occupies positions that are slightly lower and nearer tidal marshes and salt water than those occupied by Puget silt loam, 0 to 1 percent slopes. It is also associated with the Lummi soils. This soil is more difficult to drain than Puget silt loam, 0 to 1 percent slopes, and it is ponded more often during the rainy season. It is protected by dikes and is flooded only when the water is extremely high in the streams.

The surface soil is more distinctly mottled than that of Puget silt loam, 0 to 1 percent slopes, and the subsoil and substratum are more strongly acid. As in the Lummi soils, embedded organic fibers in the lower subsoil are common in some areas.

Included are areas in which the texture of the surface soil is finer than that of the typical soil. In a 200-acre area 2 or 3 miles southwest of Clear Lake, the texture of the surface soil is variable. Much of this area is under water for many months of the year.

Use and management.—This soil is used for hay, pasture, small grains, and many other crops. Although it is about as fertile as Puget silt loam, 0 to 1 percent slopes, it produces smaller yields of strawberries and vegetable-seed crops because of the slightly poorer drainage. Crops sown in spring do better than fall-sown crops. This soil can be used and managed in much the same way as Puget silt loam, 0 to 1 percent slopes. It is in management group 10.

Puget loam, 0 to 1 percent slopes (Pf).—Most of this soil occurs in one area, which is northwest of Conway, on Fir Island. It is closely associated with Puget silt loam, 0 to 1 percent slopes, but occupies a slightly higher position and has slightly better drainage. The water table is not so high during the rainy season, and the surface soil has been more recently modified by deposition of coarser textured material. The surface soil is 4 to 8 inches thick. It is medium acid to strongly acid. It is grayish brown to brown and generally is not mottled except in the lower part. The subsoil and underlying material are similar to those of Puget silt loam, 0 to 1 percent slopes.

Use and management.—All of this soil has been cleared and used for farming in conjunction with the adjoining soils. This soil can be worked earlier in spring than Puget silt loam, 0 to 1 percent slopes. It is used for the same crops and is about equally productive. It can be managed in the same way. It is in management group 10.

Puget fine sandy loam, 0 to 3 percent slopes (Pe).—This soil is associated with other Puget soils and with Puyallup soils. It occupies small areas adjacent to streams. These areas are slightly higher than those occupied by the associated Puget silt loam, 0 to 1 percent slopes, and slightly lower than those occupied by the associated Puyallup soils. Essentially, this soil consists of recent sandy alluvial deposits. It overlies fine-textured materials similar to those underlying Puget silt loam, 0 to 1 percent slopes.

This soil is imperfectly drained. Runoff is very slow, and internal drainage is restricted in the lower part of the profile. The fine-textured underlying material aids in conserving moisture. In winter, the water table is intermittently high in most places. Occasionally the soil is flooded when the water in the streams is extremely high. Artificial drainage helps to remove excess water.

Profile description:

Surface soil—
Brown to grayish-brown very friable fine sandy loam; pale brown or light brownish gray when dry; 6 to 10 inches thick.
Subsoil—
Grayish-brown stratified loamy fine sand; firm in place; loose when crushed; many medium, faint and distinct mottles, especially in lower part; extends to depths of 24 to 36 inches; abrupt boundary.
Substratum—
Gray stratified silt and clay; many coarse, distinct, brown and yellow mottles, especially along old root channels.

The profile is medium acid to slightly acid. In most areas, acidity decreases with depth. The main variation within this mapping unit is the depth to the underlying material. In some places the depth is less than 24 inches, and in others it is more than 36 inches.

Use and management.—This soil is well suited to many different crops. As most of the areas are small, its use is similar to that of the associated soils. A small acreage is used for raspberries. This soil gives slightly better yields of some crops because it has a better supply of moisture during the dry summer months. It can be used and managed in much the same way as Puyallup fine sandy loam, 0 to 3 percent slopes. It is in management group 9.

Puyallup fine sandy loam, 0 to 3 percent slopes (Pk).—This soil occurs on alluvial bottom lands. Some areas are hummocky or very gently undulating. Most of this soil

is in the valley of the Skagit River, in association with other Puyallup soils and with the Sultan soils. It differs from the Sultan soils in overlying loose sands rather than medium-textured materials. It has developed from recently deposited alluvium derived from many different kinds of rocks. The alluvium was deposited by streams that rise in active glaciers of the Cascade Mountains. The original vegetation was Douglas-fir, cedar, hemlock, and associated trees, brush, vines, and ferns.

This soil occupies slightly higher positions than the Puget and Pilchuck soils. It is well drained. Water generally runs off the surface rapidly enough, and internal drainage is rapid through the sandy substratum. This soil is permeable. The lower lying areas adjacent to streams are occasionally flooded during the rainy season and during periods when water is high in streams. During winter and spring the water table rises, but generally only the lower areas become waterlogged. These areas can be drained adequately by open drains.

This soil is inherently fertile. It contains medium amounts of organic matter, is well supplied with moisture, and is easily tilled.

Profile description:

Surface soil—
Brown to dark-brown or grayish-brown fine sandy loam; very friable; pale brown to light brownish gray when dry; slightly acid to medium acid; 6 to 12 inches thick.

Subsoil—
Grayish-brown to olive-gray, stratified loamy fine sand and fine sand; a few fine, faint, brown and yellow mottles; very friable; slightly acid to medium acid; extends to depths of 18 to 30 inches.

Substratum—
Olive-gray, stratified, loose, fine and medium sand; also considerable amounts of dark and light-gray sand; slightly acid to nearly neutral.

Included with this mapping unit are areas in which the subsoil is fine sandy loam at a depth of 24 inches. The texture of the surface soil ranges, in some areas, from loamy fine sand to sandy loam. In some small areas, just southwest of Allen, the texture of the surface soil is loamy fine sand or sandy loam. Included are areas where the color of the surface soil is dark grayish brown.

Use and management.—Much of this soil is under cultivation. Most of it is used for hay, pasture, and small grains in conjunction with dairy farming. It is well suited to strawberries, raspberries, and other row crops. Most of the uncleared areas are on the very low bottom lands within the braided pattern of the Skagit River. These areas are mostly in deciduous trees, are periodically flooded, and are fairly difficult to reach because they are surrounded by streams.

Pasture and hay stands ordinarily consist of mixtures of red and white clovers (with or without alsike clovers) and various grasses, mainly ryegrass, orchardgrass, and timothy. Generally, hay fields are pastured after one cutting of hay. Alfalfa for hay does moderately well, but it is grown on only a small acreage. Oats, used as a companion crop for a legume-and-grass mixture, is commonly cut for hay. A mixture of oats and vetch produces good yields. Pastures are fairly good. They provide grazing for a long period because moisture is available throughout the summer. However, if pastures are irrigated during the dry months, their yields can be increased by about 50 percent. The use of overhead sprinkling systems is increasing steadily. Water for irrigation is obtained either from wells or from nearby streams.

This soil can be cultivated throughout a wide range of moisture content; therefore, it is suitable for strawberries, potatoes, and other row crops. Strawberries are an important commercial crop. They are grown extensively on this soil, and yields are moderately high. Peas, for canning and freezing, also do fairly well but not so well as on the fine-textured alluvial soils (fig. 8). Supplemental irrigation is used with good results by some growers of fruits and vegetables.

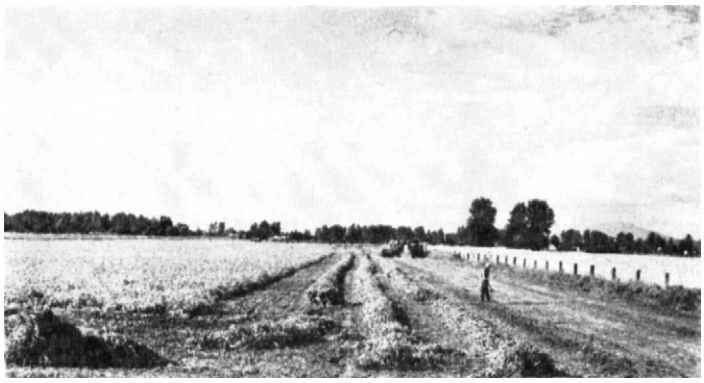

***Figure 8.*—Pea vines grown on Puyallup soil being loaded on trucks that will take them to a nearby viner.**

The supply of organic matter and nitrogen can be maintained by systematic rotations that include legumes. Grasses and legumes respond well to yearly applications of superphosphate, and the phosphate not used by the sod crop is normally enough for the grain crop that may follow. Generally, all available manure is applied to pastures. It is plowed under in areas that are to be used for special crops the following year.

A fairly heavy application of complete fertilizer is ordinarily used for strawberries. Peas respond best to applications of phosphate and potash fertilizers. The county agent will advise on the kinds and amounts of amendments needed. This soil is in management group 8.

Puyallup loamy sand over Puget soil material, 0 to 3 percent slopes (Pn).—This is an inextensive soil that occupies areas adjacent to stream channels in the delta of the Skagit River. It is associated with Puget silt loam, 0 to 1 percent slopes, and with the Puyallup soils. It consists of recently deposited alluvium overlying fine-textured Puget soil materials. Except for the texture of the surface soil, the profile is similar to that of Puget fine sandy loam, 0 to 3 percent slopes. The depth to the Puget soil material ranges from 24 to 40 inches but is generally not more than 30 inches.

This soil is well drained. Internal drainage is very rapid down to the underlying fine-textured material. This material aids considerably in conserving moisture. The surface soil dries out quickly, and shallow-rooted crops may lack moisture during the dry summer.

Use and management.—All of this soil has been cleared. It contains less organic matter and nitrogen than other Puyallup soils. These deficiencies can be corrected by growing legumes frequently in the rotation, applying manure, and plowing under green-manure crops. This soil is in management group 9.

Puyallup loam, 0 to 3 percent slopes (Pm).—Although much less extensive than Puyallup fine sandy loam, 0 to 3 percent slopes, this soil is important agriculturally. It is closely associated with other Puyallup soils. Most of it is on natural levees along the Skagit River. Except for the finer texture of the surface soil, this soil resembles Puyallup fine sandy loam, 0 to 3 percent slopes. Included are areas that have a surface soil of very fine sandy loam.

Use and management.—Nearly all of this soil is under cultivation. It is used for the same crops and can be managed in the same way as Puyallup fine sandy loam, 0 to 3 percent slopes. Yields are slightly better, though somewhat lower than on Puyallup silt loam, 0 to 3 percent slopes. This soil is in management group 8.

Puyallup silt loam, 0 to 3 percent slopes (Po).—This soil is widely distributed in the bottom lands of the Skagit River. It is associated with other Puyallup soils. Generally it is a little farther from the stream channels than the associated soils; consequently, it has less rapid internal drainage. Sags and swells are common in some areas, although generally the relief is smoother than in areas of Puyallup fine sandy loam, 0 to 3 percent slopes. A few flat or depressed spots stay wet longer than adjoining areas. A few low areas next to stream channels are subject to flooding. Open drains and tile drains help to remove excess water after heavy rains and floods.

The subsoil and surface soil are finer textured than those of Puyallup loam, 0 to 3 percent slopes. The lower part of the subsoil, as a rule, has a few faint, small to medium mottles of brown and yellow.

Use and management.—Most of this soil has been cleared and farmed. The moisture-holding capacity is higher than that of other Puyallup soils; consequently, crop yields are higher, especially in dry years. The crops grown are the same as those grown on Puyallup fine sandy loam, 0 to 3 percent slopes, but a greater part of this soil is used for peas, strawberries, and potatoes. The areas that are often flooded have not been cleared but remain in deciduous trees.

This soil can be used and managed in the same way as Puyallup fine sandy loam, 0 to 3 percent slopes. It is in management group 8.

Rifle peat, 0 to 1 percent slopes (Ra).—This organic soil occurs in widely scattered areas in wet basins and depressions on the uplands, terraces, and bottom lands. Most commonly, it occupies the marginal or better drained parts of the depressions. In most areas it is associated with other organic soils. It consists of decomposing woody plant remains, which are readily recognizable to a depth of about 12 inches. In most places the underlying layer is sedge peat over sedimentary peat or mineral material. The organic deposit is at least 2 feet deep and is commonly more than 4 or 5 feet deep. This soil was derived from organic materials similar to those from which Carbondale muck, 0 to 1 percent slopes, was derived. It is less decomposed than that soil, especially in the uppermost 6 to 12 inches.

The natural drainage is very poor. The water table is high for many months of the year. It is lowest in the summer. Most areas have no natural outlets for draining off excess water.

The native vegetation consists of hemlock, willow, alder, and western redcedar. The forests also contain a little Douglas-fir and spruce and an undercover of shrubs and vines.

Profile description:

Surface soil—
Very dark brown to nearly black woody peat; matted with plant roots; contains wood fragments; 4 to 8 inches thick.

Subsoil—
Dark-brown to very dark grayish-brown woody peat; bound with roots, fibrous material, and woody fragments; contains some sedge and colloidal peaty material; extends to depths of 18 to 24 inches.

Dark-brown sedge peat; contains some woody peat and many coarse fibers; fibers become finer with depth; commonly extends to depths of more than 4 or 5 feet; in many areas, overlies colloidal or sedimentary peat at various depths.

The peaty layers vary considerably in thickness, as does the total depth of the organic deposit.

Use and management.—All of the original timber has been cut. The second growth is mostly deciduous trees. Only about one-fourth of this soil has been cleared and drained for agricultural use. This is partly because much of it is associated with soils unsuited to agriculture and because the individual areas of peat are small and difficult to drain.

If this soil is properly drained and otherwise well managed, it is highly productive of pasture, hay, oats, truck crops, and garden crops. It is used mainly for hay and pasture. The plants most commonly grown are grasses mixed with some alsike clover. They respond well to phosphate and potash fertilizers.

Tillage improves this soil; it cuts up the fibrous material and causes the surface soil to become more compacted and to decompose more rapidly. This results in a better seedbed. This soil is in management group 11.

Rifle peat, shallow, 0 to 1 percent slopes (Rb).—This soil occurs in widely scattered areas in very poorly drained basins and depressions. It is similar to Rifle peat, 0 to 1 percent slopes. In the shallowest areas the organic deposit consists mostly of woody peat, mixed with some sedge peat in the lower part. The depth to mineral soil ranges from 8 to 24 inches. Though variable, the underlying mineral soil generally is fine textured and slowly permeable.

Use and management.—All of the original timber has been removed from this soil, which is now in second-growth trees and shrubs. This soil is suitable for the same crops as Rifle peat, 0 to 1 percent slopes. It is in management group 11.

Riverwash, 0 to 3 percent slopes (Rc).—This miscellaneous land type consists of gravel, boulders, and reworked sand. It occupies abandoned river channels and areas adjacent to active streams, mostly in the braided pattern of the Skagit River. Frequent floods result in erosion and deposition. The boundaries change in times of high water.

These areas have no agricultural value. They are barren for the most part, but in places some young willow and alder trees, brush, shrubs, and grasses grow. Accessible areas of Riverwash are sources of material for road building and other construction. This miscellaneous land type is in management group 12.

Rough broken land (Rd).—This miscellaneous land type occurs in widely scattered small bodies throughout the glaciated part of the county. It consists of areas of steep soils so variable and so weakly developed that they are not readily classified as recognized soils. It occupies narrow, elongated areas on steep breaks or in stream gullies, or larger areas on steep terminal and

ground moraines. It is not very stony, and it contains no rock outcrops. The slope range is 45 to 60 percent.

The parent material was deposited by glaciers and was commonly coarse textured and porous. This material is exceedingly variable within short distances, but it commonly resembles the parent material of the adjacent soils on milder slopes.

Use and management.—Most of this land type is forested, but some areas are bare of vegetation because of erosion and landslides. In most areas, erosion is checked by dense second-growth vegetation.

This land type is not suited to agriculture; it is too droughty and steep. It is in management group 12.

Rough mountainous land, Cathcart soil material (Re).—This miscellaneous land type occurs in areas that are not so mountainous nor so rough as the other land types mapped as Rough mountainous land. It generally occurs at lower elevations or on foot slopes. A fairly thin mantle of glacial material covers the area. The depth, texture, and color vary within short distances. The bedrock is mostly arkose sandstone. Small areas are underlain by softer sandstone, shale, argillite, and other sedimentary and metamorphic rocks. Rock outcrops, boulders, and stones abound in many areas. In general, this land type closely resembles the Cathcart soils, but it is much more variable. The drainage and vegetation are the same as in other areas of rough mountainous land.

Use and management.—Most of the original Douglas-fir, hemlock, and cedar has been removed. The logged areas are restocking with the same species. The areas that have been carelessly logged or severely burned are largely covered with alder, maple, willow, and brush.

This mapping unit can be used and managed in the same way as Rough mountainous land, Heisler soil material. It is in management group 12.

Rough mountainous land, Heisler soil material (Rf).—This miscellaneous land type occupies about one-fourth of the area surveyed. It includes fairly smooth hills mantled with glacial debris, low mountain spurs, and rugged mountains. The elevations range from about 500 to 5,000 feet or more. The slopes are mostly between 30 and 50 percent, but steep canyon walls have slopes of as much as 100 percent. Extensive areas, especially those at higher elevations, are very steep and stony and have outcrops of bedrock. Runoff is rapid, but erosion is prevented by the dense forest cover.

The dominant bedrock is mica-schist. In a few areas the bedrock is argillite, shale, sandstone, or limestone. Considerable glacial material mantles the slopes at the lower elevations, but the higher the elevation, the thinner the mantle. There is scarcely any mantle above 3,000 to 4,000 feet.

The profile, though variable, resembles that of the Heisler soils, especially at the lower elevations. In all these mountainous areas, the soil material varies exceedingly in color and texture within short distances.

Use and management.—This land type is not suited to agriculture, but it is well suited to forestry. The high rainfall—generally more than 50 or 60 inches a year—and the cool environment promote the growth of valuable timber trees, principally Douglas-fir, western hemlock, Sitka spruce, and cedar. Some of the logged areas are restocking to the same kinds of trees, but in areas that were carelessly logged or severely burned, alders and other deciduous trees are crowding the conifers.

Because of the steep slopes and high rainfall, many areas will deteriorate unless their use is restricted. Good management that will help to insure continuous production of timber includes slash disposal, suitable logging methods, reforestation, and protection from fire, insects, and diseases. This miscellaneous land type is in management group 12.

Rough mountainous land, Marblemount soil material (Rg).—This miscellaneous land type occurs in the mountainous areas east of Marblemount. The relief, vegetation, and drainage are similar to those described for Rough mountainous land, Heisler soil material. The texture, color, and thickness of the profile are more variable than in Marblemount stony loam, 15 to 30 percent slopes. Rock outcrops, boulders, and stones occur in many places. The rock is mainly granite or granodiorite. Except in some of the higher areas that have been modified by alpine glaciation, there is little glacial material.

Use and management.—Much of this land type remains in native timber, mainly Douglas-fir, hemlock, and cedar. The logged areas are restocking to the same kinds of trees. This land type can be used and managed in the same way as Rough mountainous land, Heisler soil material. It is in management group 12.

Rough mountainous land, Oso soil material (Rh).—Considerable glacial material mantles this miscellaneous land type, especially at the lower elevations. The profile is exceedingly variable in texture, consistence, color, and depth. It resembles that of the Oso soils. Rock outcrops are prevalent at the higher elevations, where the soil material is very shallow. Argillite is the dominant parent rock. In some areas, the parent rock is slate, schist, or other metamorphic rock—in others, it is basic or acidic igneous rocks.

Use and management.—A large proportion of this land type remains in valuable virgin timber. Douglas-fir, hemlock, Sitka spruce, and cedar are the dominant kinds of trees. This land type is in management group 12.

Rough rocky land (Rk).—This miscellaneous land type is steep and droughty. It has many loose stones, boulders, and outcrops of bedrock. The outcrops and boulders occupy between 15 and 50 percent of the surface area. Areas where there are many rock outcrops are identified on the soil map by symbols. The bedrock is serpentinite, argillite, mica-schist, shale, sandstone, and sandstone conglomerate. These rocks have weathered only to shallow depths. Only shallow soils or thin layers of soil materials have formed. They are commonly mixed with glacial material. The areas are glacially scoured and, in most places, mantled with glacial material. This land type is most common in the western part of the county. It is associated with the Fidalgo soils.

Use and management.—This land type is too stony and too steep for agriculture. It is suitable only for forestry. It is in management group 12.

Samish silty clay loam, 0 to 1 percent slopes (Sb).—This soil is in back bottoms on alluvial flood plains, mostly in the valley of the Samish River. It is associated with the Cokedale and Wickersham soils. Streams flowing from the mountains deposited the moderately fine textured parent material, which was derived from mica-schist, talc, and argillite. The native vegetation consisted chiefly of willow, alder, and maple, and shrubs, vines, sedges, and reeds. Cedar, hemlock, and Douglas-fir were also common in some areas.

This soil is poorly drained. It is periodically flooded. Some areas are ponded for many months each year unless artificially drained. The water table is high during the rainy season, and internal drainage is very slow.

The associated Cokedale soils have a sandy substratum and are slightly better drained than this soil. The Wickersham soils occupy alluvial fans. Although they developed from some of the same parent materials as this soil, they contain considerable shaly material. All of these soils have a characteristic silvery gray color.

Profile description:

Surface soil—
Dark-gray to very dark-gray friable silty clay loam; gray, light gray, or light olive gray when dry; fine to medium, distinct, brown and yellow mottles; moderate granular structure; strongly acid; 6 to 12 inches thick.

Subsoil—
Firm, stratified silty clay loam, silt loam, and very fine sandy loam; plastic when wet; color similar to that of surface soil; fine to medium, distinct, brown and yellow mottles; strongly acid; extends to depths of 24 to 36 inches.

Substratum—
Gray, plastic silty clay loam, clay loam, or silty clay loam; a few lenses of coarser textured materials; a few medium to coarse, brown and yellow mottles; strongly acid.

The entire profile has a silvery color and feels somewhat greasy. The fine texture of the substratum keeps plant roots from penetrating deeper than 36 inches.

The color of the soil varies, depending on the amount of dark-colored mica-schist in the parent material. Included are areas in which the texture of the subsoil is dominantly silty clay, clay, or silty clay loam. Other areas are included where coarser textured materials are more common.

Use and management.—About 75 percent of this soil is in deciduous vegetation consisting mainly of willow, alder, and maple trees and shrubs, vines, and water-loving plants. Much of the acreage has not been drained and is wet for many months of the year. The areas that have been cleared and adequately drained are used primarily for hay, pasture, and oats. The hay and pasture plants are similar to those grown on the Puget silty clay loam and other poorly drained soils. This soil is less fertile than the Puget soils. It is difficult and expensive to drain. This soil is in management group 10.

Samish silt loam, 0 to 1 percent slopes (Sa).—Most of this soil occurs in the valley of the Samish River. It is similar to Samish silty clay loam, 0 to 1 percent slopes, and is closely associated with it. It occupies higher, slightly more undulating positions on the alluvial flood plain and has better surface drainage. It is occasionally flooded, and internal drainage is slow. The texture of the subsoil varies considerably in some areas.

Use and management.—About 80 percent of this soil has been cleared. It is used mainly for hay, oats, and pasture. A small acreage is used for raising green peas and vegetables for seed. The uncleared areas are in deciduous trees.

This soil is not so hard to drain as Samish silty clay loam, 0 to 1 percent slopes. It is easier to till and slightly more productive. It can be used and managed in the same way as Puget silt loam, 0 to 1 percent slopes. It is in management group 10.

Sauk loam, 0 to 3 percent slopes (Sc).—Most of this soil occurs on terraces in the valley of the Skagit River near Marblemount, where the annual rainfall is very heavy. It occupies smoother and slightly lower areas than the nearly level or undulating Klaus soils with which it is associated. The parent material was glacial outwash of varied origin. It was probably deposited by local glaciers of the Cascade Mountains, not by continental glaciers. This soil most nearly resembles the Giles soils but is redder and has a more acid surface soil.

This soil is moderately permeable. It is deep, friable, and moderately fertile. Drainage is good. Runoff is very slow, and internal drainage is medium. A dense stand of Douglas-fir, hemlock, and cedar was the original vegetation.

Profile description:

Organic litter—
Litter generally underlain by one-fourth inch of gray sandy loam or loam.

Surface soil—
Dark reddish-brown or yellowish-red friable loam; contains firm to hard dusky-red spots or lumps and a little shot; strongly acid to very strongly acid; 2 to 4 inches thick.
Yellowish-red friable loam; moderate amount of shot; strongly to very strongly acid; extends to a depth of about 8 inches.

Subsurface soil—
Similar to overlying layers but is slightly lighter in color and contains less shot; less acid than surface soil; extends to a depth of about 18 inches.

Subsoil—
Yellowish-brown to dark yellowish-brown firm fine sandy loam; very little shot; crumbles readily to single grains when removed.

Substratum—
Yellowish-brown or brown loose sand, loamy fine sand, and fine sandy loam; gravelly in some areas; amount of gravel increases with depth; slightly acid to medium acid.

In one small area a mile west of Rockport, the surface soil is less acid than the typical soil.

Use and management.—Most of the original timber has been removed from this soil. It is restocking with the same kinds of trees, but they are being crowded by alder, willow, maple, and other deciduous trees and brush. Only a small part of this soil has been cleared for farming. The cleared areas are used mainly for pasture. The farms are small, and the farmers depend on outside work for most of their income.

This soil is excellent for trees and good for agriculture. Its inaccessibility, however, limits its use. It can be used and managed in the same way as the Giles soils, and it is about as productive. It responds more to applications of lime and fertilizer than the Giles soils. This soil is in management group 6.

Sauk loam, 3 to 8 percent slopes (Sd).—This soil occurs about 1 mile west of Rockport. It is associated with the Corkindale soils. The profile is similar to that of Sauk loam, 0 to 3 percent slopes, but the surface soil is not so strongly acid and there is no thin gray layer immediately below the organic litter in timbered areas. Possibly the reaction of the surface soil has been affected by lime dust from the cement plant at Concrete. Included in the mapping unit are some areas on slopes of 8 to 15 percent.

Use and management.—All of this soil remains in native timber, largely Douglas-fir and hemlock (fig. 9). Some trees are 4 feet in diameter, and most are more than 2 feet in diameter. The thin underbrush is mostly vine maple, dogwood, and swordfern. This soil is in management group 6.

Saxon silt loam, 3 to 8 percent slopes (Se).—This deep, medium-textured soil occurs in the uplands west of Cavanaugh Lake. The lake was probably much larger

Figure 9.—**Virgin stand of Douglas-fir and western hemlock on Sauk soil. Ground cover is largely swordfern.**

in the glacial period. The silt in this soil was derived from glacial lake sediments.

This soil is well drained. Runoff is slow, and internal drainage is medium. The moisture-holding capacity is moderately high; it is higher than that of the well-drained soils of the uplands and terraces. Permeability is moderate. The native vegetation was chiefly Douglas-fir.

Profile description:

Surface soil—
Dark-brown to brown friable silt loam; brown or light brown when dry; contains a few rounded or subangular concretions; moderate coarse granular structure; strongly acid; 6 inches thick.

Subsurface soil—
Similar to layer above; weak medium granular; slightly variegated; strongly acid; extends to depths of 12 to 14 inches.

Subsoil—
Yellowish-brown to dark yellowish-brown, firm, heavy silt loam or light silty clay loam; pale brown to very pale brown when dry; faintly streaked or mottled with grayish brown or brown; subangular blocky structure.

Substratum—
Pale-brown or grayish-brown to gray laminated silt loam and silty clay loam; seams or strata of fine sand and silt; a few faint mottles of yellow and brown; massive in place but breaks into subangular blocky aggregates.

The acidity decreases with depth. Included are some areas where the surface soil is reddish brown or dark reddish brown, as well as some areas where the silty clay loam subsoil is mottled with browns and yellows. About 1½ to 2 miles west of Birdsview are two areas that are nearly level. In these areas, the substratum contains more seams of coarse-textured material than in the typical profile. Gravel or boulders are rare.

Use and management.—Only a few acres has been cleared for farming. Most of this soil occurs in remote areas. The original timber has been removed, and a second-growth of the same kinds of trees is becoming established.

This soil is well suited to crops but is deficient in organic matter and nitrogen. The deficiency can be corrected by applying phosphate and including legumes in the rotation. This soil is in management group 5.

Saxon silt loam, 8 to 15 percent slopes (Sf).—This soil is associated with Saxon silt loam, 3 to 8 percent slopes. Runoff is slightly more rapid than on that soil.

Use and management.—All of this soil is in second-growth timber consisting of a mixture of deciduous trees, Douglas-fir, hemlock, and a little cedar. This soil can be used and managed in about the same way as Saxon silt loam, 3 to 8 percent slopes. It is in management group 5.

Saxon silt loam, 15 to 30 percent slopes (Sg).—This soil occurs mainly along drainageways and terrace fronts. Runoff is more rapid than on the more gently sloping areas of Saxon silt loam, but erosion is prevented by the dense vegetation. Except for stronger relief and greater variation in characteristics, this soil resembles Saxon silt loam, 8 to 15 percent slopes. Some areas are adjacent to the Oso soils and have some characteristics in common with them.

Use and management.—All of this soil is in second-growth timber consisting largely of Douglas-fir, hemlock, alder, willow, and maple. Because of the hilly relief, this soil is best suited to forestry. It is in management group 12.

Semiahmoo muck, 0 to 1 percent slopes (Sh).—This soil is widely scattered in small, low, wet basins or depressions in the uplands, on terraces, or in stream valleys. A few areas are next to small lakes or ponds. The natural drainage is very poor, and the soil is ponded for at least a part of the year. Unless this soil is artificially drained, the water table is always high.

Like Mukilteo peat, this soil is composed of the remains of sedges and coarse, water-tolerant grasses. The peaty materials, especially those in the uppermost 6 to 12 inches, are more highly decomposed than in Mukilteo peat. The individual sedge fibers are not discernible.

Profile description:

Surface soil—
Dark brown to very dark brown or almost black sedge muck; brown to dark brown when dry; strongly acid to very strongly acid; 6 to 12 inches thick.

Subsoil—
Brown to dark yellowish-brown fibrous sedge peat consisting of embedded, flattened remains of sedges, reeds, and coarse grasses; lower part generally contains sedimentary or colloidal peaty material and is darker colored than upper part; extends to depths of 24 to 30 inches.

Substratum—
Fibrous or sedimentary peat; less fibrous with depth; depth to mineral soil generally more than 6 feet.

The profile becomes slightly less acid with depth. The depth to mineral soil is variable. Areas that have organic deposits less than 2 feet deep are mapped as Semiahmoo muck, shallow.

Use and management.—This soil must be artificially drained before it can be used successfully for agriculture.

Slightly more than half of it has been cropped. It is used mainly for pasture, hay, and oats. If drained and properly managed, it is highly productive of truck crops and other crops. Most areas are managed in the same manner as Carbondale muck, 0 to 1 percent slopes, but are slightly less productive. This soil is in management group 11.

Semiahmoo muck, shallow, 0 to 1 percent slopes (Sk).—This soil is more extensive than Semiahmoo muck, 0 to 1 percent slopes. Except that this soil is shallower, the two soils are much alike. The depth to mineral soil ranges from 8 to 24 inches in this mapping unit. One area of about 350 acres about 1½ miles northwest of Burlington, as well as a few small areas, are associated with soils derived from poorly drained alluvium. In these areas the sedge muck is 8 to 12 inches thick and is underlain by gray, mottled, fine-textured material similar to that underlying the Puget soils. In other areas the underlying mineral soil is variable, but generally it is compact or dense, medium to fine textured, and slowly permeable.

Use and management.—A large proportion of this soil has been cleared, drained, and used for farming. The areas that are on the delta of the Skagit River are suitable for the same uses as the Puget soils. However, they are not ordinarily used for vegetable-seed crops or fall-seeded crops.

This soil is used principally for oats, hay, and pasture. Yields are about the same as on Semiahmoo muck, 0 to 1 percent slopes. This soil is in management group 11.

Skiyou gravelly loam, 3 to 8 percent slopes (Sm).—This well-drained soil occupies undulating moraines near foot slopes or rough mountainous areas where the Heisler soils are dominant. The parent material was glacial till containing appreciable amounts of mica-schist, talc, and argillite. These materials distinguish this soil from the Alderwood and Squalicum soils. In many places this soil is associated with the Thornwood soils, which have loose, porous, gravelly substrata.

Runoff is slow. Internal drainage is medium to the cemented hardpan. The native vegetation was chiefly a dense growth of Douglas-fir and hemlock. It also included western redcedar and an understory of deciduous trees and shrubs.

Profile description:

Surface soil—
Brown, dark-brown, or reddish-brown friable gravelly loam; light brown to pale brown when dry; contains a little shot and some schistose material; 6 to 10 inches thick.

Subsoil—
Yellowish-brown friable gravelly loam to gravelly sandy loam; contains a little shot and a few fragments of schist; extends to depth of about 24 inches.
Olive-gray or olive friable gravelly loam or gravelly sandy loam; many faint to distinct yellow and brown mottles; contains many fragments of schist; many matted plant roots immediately above substratum; extends to depth of about 30 inches.

Substratum—
Dark-gray to olive-gray strongly cemented gravelly sandy loam (glacial till); many stones and fragments of schist and argillite; uppermost 6 to 12 inches generally mottled with yellow and brown; many feet thick.

The profile contains variable amounts of mica-schist, talc, and argillite. Included are areas in which these materials are recognizable only in the cemented substratum. The texture of the substratum varies considerably; in some areas it is sandy clay loam.

Use and management.—Only a very small part of this soil has been cleared of timber and stumps. Most of it is in second-growth timber consisting mainly of Douglas-fir, hemlock, and deciduous trees. The areas cleared are small. They are used mainly for pasture and hay for small dairy herds. Farmers receive most of their income from outside employment.

This soil is suited to hay, pasture, and small grains. It can be used and managed in about the same way as Alderwood gravelly loam, 0 to 3 percent slopes. Crop yields on the two soils are about the same. This soil is in management group 1.

Skiyou gravelly loam, 8 to 15 percent slopes (Sn).—This soil resembles Skiyou gravelly loam, 3 to 8 percent slopes, but has slightly more rapid runoff. It is associated with other Skiyou gravelly loams.

Use and management.—This soil can be used and managed in the same way as Skiyou gravelly loam, 3 to 8 percent slopes. It is in management group 1.

Skiyou gravelly loam, 15 to 30 percent slopes (So).—This soil generally occupies hilly moraines or slopes adjacent to mountainous areas. Runoff is more rapid than on the less sloping areas, but the dense vegetation checks erosion. The color, texture, and thickness of layers vary more than in the undulating or rolling areas of Skiyou gravelly loams.

Use and management.—Because this soil is droughty and hilly it is best suited to forestry. All of it is in second-growth timber. It is in management group 12.

Skiyou gravelly loam, 30 to 45 percent slopes (Sp).—This soil occupies steep glacial moraines or steep foot slopes near mountainous areas. Slopes are steeper than 45 percent in a few areas. Although the profile is extremely variable in color, texture, and thickness of layers, it generally resembles that of Skiyou gravelly loam, 3 to 8 percent slopes.

Use and management.—The original timber has been logged, and this soil is now restocking. The dominant vegetation in some areas consists of alder, willow, and maple trees.

This soil is suited only to forestry. It is not much more droughty than the Skiyou soils on milder slopes because it absorbs water readily and the vegetation is dense. It is in management group 12.

Skykomish gravelly sandy loam, 3 to 8 percent slopes (Sv).—This somewhat excessively drained soil is in the eastern part of the county. It occurs on the smoother parts of glacial outwash terraces. The outwash materials, most of which were deposited by local glaciers, were derived from acidic and basic igneous rocks, sedimentary rocks, and metamorphic rocks. Runoff is very slow, and internal drainage is very rapid. The native vegetation was Douglas-fir, hemlock, and associated deciduous trees, shrubs, vines, and ferns.

This soil resembles the Everett soils. The drift from which it developed was cobbly and more stratified. It is less acid and much more cobbly and gravelly than the Klaus soils.

Profile description:

Surface soil—
Brown to dark-brown very friable sandy loam; pale brown to brown when dry; contains a little shot; medium acid; 4 to 10 inches thick.

Subsoil—
Yellowish-brown very friable to loose cobbly or gravelly sandy loam to cobbly loamy sand; contains less shot than surface soil; in places, firm or coherent; slightly acid; extends to depths of 18 to 24 inches.
Substratum—
Yellowish-brown, gray, and olive irregularly stratified cobblestones, gravel, and sand; gravel predominates; slightly acid.

The coarse-textured materials contain only a small amount of plant nutrients, if any, and little moisture. The root zone is moderately shallow. In some areas, stones and boulders are common in the soil and on the surface.

Use and management.—All of this soil has been logged and is now restocking with the original species, but alders and other deciduous trees and shrubs are now dominant. Some Douglas-fir has been planted. As the soil is very droughty and low in fertility, the trees grow slowly and are not large at maturity.

Only a few small areas have been cleared. They are used for pastures or homesites. Some partially cleared areas are used for wooded pasture. Much of this soil is located in remote areas. It is best suited to forestry. It is in management group 4.

Skykomish gravelly sandy loam, 8 to 15 percent slopes (Sw).—This soil is similar to Skykomish gravelly sandy loam, 3 to 8 percent slopes, with which it is closely associated.

Use and management.—This soil is all in second-growth timber and brush. It is best suited to forestry. It is in management group 4.

Skykomish gravelly sandy loam, 15 to 30 percent slopes (Sx).—This soil occupies kamelike moraines, terrace breaks, and escarpments. It is associated with other Skykomish soils. It varies more in color, texture, and thickness of layers than Skykomish gravelly sandy loam, 3 to 8 percent slopes. Included are areas in which the profile is shallower and this surface soil is gravelly loamy sand or gravelly coarse sandy loam that is lighter colored than the typical surface soil.

Use and management.—All of this soil is in second-growth timber. It is too rough to farm. It is best suited to forestry. It is in management group 12.

Skykomish cobbly sandy loam, 0 to 3 percent slopes (Sr).—This soil absorbs moisture readily, so little water runs off. Internal drainage is very rapid. The cobblestones in the soil range from 3 to 6 inches in diameter. Some stones are as much as 10 or 12 inches in diameter. The native vegetation was Douglas-fir, some deciduous trees, and shrubs, vines, ferns, and moss.

Use and management.—Most of the original vegetation has been removed. Few of the present trees grow to more than 18 to 24 inches in diameter. This soil is too droughty and stony to be cultivated. It is best suited to forestry. It is in management group 12.

Skykomish cobbly sandy loam, 3 to 8 percent slopes (Ss).—Except for stronger slopes, this soil is like Skykomish cobbly sandy loam, 0 to 3 percent slopes.

Use and management.—This soil has been cleared of all merchantable timber. It is best suited to forestry. It is in management group 12.

Skykomish cobbly sandy loam, 8 to 15 percent slopes (St).—This inextensive soil is associated with other Skykomish cobbly sandy loams. Except for the stronger slopes, this soil is similar to Skykomish cobbly sandy loam, 3 to 8 percent slopes.

Use and management.—This soil is used only for forestry and is not suited to cultivation. It is in management group 12.

Skykomish cobbly sandy loam, 15 to 30 percent slopes (Su).—This soil occurs on terrace fronts and other strong slopes. Its profile characteristics are more variable than those of Skykomish cobbly sandy loam, 8 to 15 percent slopes.

Use and management.—This soil is in second-growth Douglas-fir and hemlock. It is best suited to forestry. It is in management group 12.

Snohomish silt loam, 0 to 1 percent slopes (Sy).—This soil consists of mixed alluvial materials overlying deposits of sedge peat or woody peat, or both. It occurs in slight depressions or back bottoms in the delta of the Skagit River, mainly in association with Puget silt loam. The natural vegetation consisted of a mixture of deciduous trees and conifers.

This soil is poorly drained. Runoff is very slow, and internal drainage is slow. The surface soil is moderately high in organic matter.

Profile description:

Surface soil—
Very dark grayish-brown to dark grayish-brown friable silt loam; grayish brown to light brownish gray when dry; moderately granular structure; slightly acid; lower part generally contains a few faint to distinct yellow and brown mottles; 6 to 12 inches thick.
Subsoil—
Gray, plastic, stratified silt loam and silty clay loam; many fine to medium, distinct, yellow and brown mottles; many flattened sedge remains; medium acid; extends to depths of 18 to 24 inches; abrupt boundary.
Substratum—
Yellowish-brown to dark-brown stratified peaty materials, dominantly sedge peat but also some sedimentary peat, and, in places, woody peat; very strongly acid.

Use and management.—Except for a few acres, this soil has been cleared, adequately drained, and used for many different crops. It is used for pasture, hay, small grains, peas, and potatoes. Crop yields are about the same as for Puget silt loam, 0 to 1 percent slopes. This soil is in management group 10.

Snohomish silty clay loam, 0 to 1 percent slopes (Sz).—Most of this soil resembles Snohomish silt loam, 0 to 1 percent slope. In the valley of Walker Creek is one area that is associated with Nookachamps silty clay loam, 0 to 2 percent slopes. The soil in this area developed from the same kind of parent material as the Nookachamps soil. Its subsoil is more distinctly mottled than that of Snohomish silt loam, 0 to 1 percent slopes. In an area about 2 miles northeast of Conway, the subsoil contains thin sandy lenses. This area is flooded many months of the year. It is difficult to drain.

Use and management.—Only a few acres of this soil has been cleared and adequately drained for farming. These areas are used mainly for hay and pasture. This soil can be used and managed in the same way as Snohomish silt loam, 0 to 1 percent slopes. Crop yields are slightly lower. This soil is in management group 10.

Squalicum gravelly silt loam, 0 to 3 percent slopes (S2).—This well-drained soil occurs on high plains, mostly in one area east of Mount Vernon. It is similar to the Alderwood soils, but it has a finer textured substratum

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containing some sandstone and shale. It resembles the Skiyou soils, except that it has not been modified by mica-schist. Glacial till of varied origin was the parent material.

Runoff is very slow. Internal drainage is medium down to the cemented till, which is very slowly permeable. The moisture-holding capacity is fairly good. The original vegetation was a thick forest of Douglas-fir and associated trees and shrubs.

Profile description:

Surface soil—
Brown to dark-brown friable gravelly silt loam; pale brown to brown when dry; contains shot; 8 to 12 inches thick.
Subsoil—
Dark yellowish-brown gravelly silt loam; firm to friable; contains some shot; extends to depths of 24 to 30 inches; lower part is olive-brown, firm, gravelly silt loam to gravelly sandy clay loam; many faint to distinct yellow and brown mottles; mat formed by many roots just above abrupt lower boundary.
Substratum—
Olive, olive-gray, or gray gravelly sandy clay loam to gravelly loam; strongly cemented; upper part mottled; somewhat platy; embedded stones and cobblestones in places.

In some places the surface soil is gravelly loam. In others there is little gravel in either the surface soil or the subsoil. Within short distances, the underlying till varies from weakly cemented to indurated.

Use and management.—Only small clearings have been made. They are used for homesites and for pastures for small dairy herds. Most of the area is in second-growth timber consisting of young Douglas-fir and hemlock. In some areas the second growth is mostly alder. The vegetation is dense and grows rapidly.

This soil is suitable for pasture, hay, and oats. Yields may be slightly higher than on Alderwood gravelly sandy loam, 0 to 3 percent slopes. This soil is in management group 1.

Squalicum gravelly silt loam, 3 to 8 percent slopes (S3).—This soil occurs in widely scattered areas in the western half of the county. It occupies the tops of high glacial moraines. Most of it is in mountain valleys or next to foot slopes. Runoff is more rapid than on Squalicum gravelly silt loam, 0 to 3 percent slopes.

Use and management.—Only a very small part of this soil has been cleared. All the merchantable timber has been removed. Most of the cutover areas are restocking with Douglas-fir and hemlock. In some the second growth consists of alder and a little willow and maple. Because of its remote location, most of this soil will continue to be used for forestry. The cleared areas are used mostly for hay and pasture. This soil is in management group 1.

Squalicum gravelly silt loam, 8 to 15 percent slopes (S4).—This soil is closely associated with the Alderwood and Bow soils and with other Squalicum soils. Runoff is more rapid than on Squalicum gravelly silt loam, 3 to 8 percent slopes. Nevertheless, this soil remains moist most of the year. The color, texture, and thickness of layers are slightly more variable. In a few places the sandstone and shale bedrock is only a few feet below the surface.

Use and management.—This soil has the same uses as Squalicum gravelly silt loam, 3 to 8 percent slopes. If it is farmed, yields are slightly lower. This soil is in management group 1.

Squalicum gravelly silt loam, 15 to 30 percent slopes (S5).—Most of this soil is next to areas of Rough mountainous land or Rough rocky land that are underlain by shale, arkose sandstone, or argillite. Although the profile is similar to that of Squalicum gravelly silt loam, 8 to 15 percent slopes, it is more variable, particularly in color, texture, and thickness of layers. Included are areas in which the texture is coarser or finer than gravelly silt loam and in which the color is slightly lighter or more yellowish. The depth to bedrock is generally several feet, but a few outcrops occur. The substratum is weakly to strongly cemented.

Use and management.—All of the merchantable timber has been logged. The soil is now restocking to the same species of conifers as were in the original forest, but these are being crowded by native deciduous trees.

Because of the hilly relief, this soil is best suited to forestry. The small acreages that have been cleared are used for building sites and wooded pasture. This soil is in management group 12.

Squalicum gravelly silt loam, 30 to 45 percent slopes (S6).—This soil occupies steep glacial moraines or steep mountain foot slopes. It is closely associated with the Cathcart soils and with Rough mountainous land, Cathcart soil material. In general, its profile is similar to that of Squalicum gravelly silt loam, 15 to 30 percent slopes, but the color, texture, and thickness of layers are extremely variable from place to place. Runoff is rapid.

Use and management.—Because of the steep slopes, this soil is suited only to forestry. The dense vegetation prevents erosion. Enough moisture for trees is retained. This soil is in management group 12.

Sultan silt loam, 0 to 3 percent slopes (S12).—This moderately well drained alluvial soil is widely distributed on the flood plain of the Skagit River. It is associated with the Puyallup soils. It has a medium-textured subsoil and substratum, whereas the subsoil and substratum of the Puyallup are coarse textured. The parent material and the native vegetation are like those of the Puyallup soils.

This soil is permeable to water, air, and roots. Runoff is very slow, and internal drainage is medium. Floods are infrequent.

Profile description:

Surface soil—
Brown, dark-brown, or grayish-brown friable silt loam; pale brown to light brownish gray when dry; moderate granular structure; medium acid to slightly acid; 6 to 12 inches thick.
Subsoil—
Brown, olive, or grayish-brown friable silt loam; contains a few lenses of very fine sandy loam; a few faint yellow and brown mottles; slightly acid; extends to a depth of 36 inches.
Substratum—
Similar to subsoil but more stratified with very fine sandy loam and loam; nearly neutral in reaction.

Included are a few areas where the material below a depth of 36 inches is fine textured. In some areas the subsoil is pale brown or light brownish gray.

Use and management.—This soil is highly productive and is suited to many different crops. It is one of the best soils for alfalfa and other deep-rooted crops. Nearly all of it has been cleared. Many of the areas are small and are used with the adjacent Puyallup soils. As this soil retains more moisture in summer, it is better suited to pasture plants and small grains than the Puyallup soils.

Artificial drainage benefits early seeded crops and helps remove excess water after heavy rains. This soil is in management group 9.

Sultan loam, 0 to 3 percent slopes (S8).—This inextensive soil is closely associated with other Sultan soils and with Puyallup soils. Except for the texture of the surface soil, the profile is the same as that of Sultan silt loam.

Use and management.—Most of this soil is cleared for cultivation and has uses similar to those of Puyallup fine sandy loam. Yields are slightly higher than on the Puyallup soil but are lower than on Sultan silt loam, 0 to 3 percent slopes. This soil is in management group 9.

Sultan fine sandy loam, 0 to 3 percent slopes (S7).—This soil occurs in widely scattered small areas. It is associated with other alluvial soils, chiefly with other Sultan soils and Puyallup soils. It is more undulating than Sultan silt loam, 0 to 3 percent slopes. Runoff is slightly more rapid. The profile consists of 6 to 18 inches of recently deposited fine sandy loam underlain by silty material like that of Sultan silt loam.

Use and management.—Nearly all of this soil has been cleared for farming. Because most areas are small, they are used with the associated soils. Crop yields are slightly higher than on Puyallup fine sandy loam, 0 to 3 percent slopes, as this soil has a higher moisture-holding capacity. This soil is in management group 9.

Sultan loamy sand, 0 to 3 percent slopes (S9).—This soil occurs in only one area, which is approximately 1 mile northwest of Mount Vernon. It is closely associated with Sultan fine sandy loam, 0 to 3 percent slopes, which it resembles except for having a loamy sand or loamy fine sand surface soil. The relief is very gently undulating.

This soil is well drained. It dries out quickly in spring and may be somewhat droughty for shallow-rooted or late-seeded crops.

Use and management.—All of this soil is under cultivation. Yields are lower than on Sultan fine sandy loam, 0 to 3 percent slopes, because of the droughtiness of the surface soil. This soil is in management group 9.

Sumas silt loam, 0 to 1 percent slopes (S13).—This soil is not quite so extensive as Puget silt loam, 0 to 1 percent slopes, but it is an equally important and productive soil. It is closely associated with the Puget soils on the nearly level delta of the Skagit River. The parent material consisted of alluvial sediments derived from many different kinds of rocks. Much of it was glacial rock flour deposited by melt water from active glaciers. Originally, this soil was heavily forested with cedar, hemlock, Douglas-fir, and other trees. Some of the lower areas at the extremity of the delta were covered with sedges, reeds, tules, cattails, and coarse grasses.

This soil differs from the Puget silt loam mainly in having, below depths of 30 to 36 inches, a coarse sandy substratum. When the water table is low, water drains readily through the substratum. However, this soil is poorly drained because the subsoil is fine textured and the water table is high during the rainy season. Dikes protect the Sumas soils from floods.

Profile description:

Surface soil—
Dark-gray or grayish-brown friable silt loam; light brownish gray, light olive gray, or light gray when dry; a few faint mottles of yellowish brown and reddish brown; strongly acid to very strongly acid; 6 to 8 inches thick.

Subsoil—
Gray to olive-gray stratified silty clay loam, silty clay, or clay; some sandy or silty lenses; very plastic; very strongly acid; upper part has many medium and coarse reddish-brown and brown mottles; extends to depths of 30 to 36 inches.

Substratum—
Stratified gray, olive, light-gray, and dark-gray loose sands stained or mottled with reddish brown and brown.

The depth to the substratum ranges from 18 to 48 inches. Near tidal marshes or salt water, the substratum is alkaline. The color and size of the sand particles vary. In some places the substratum is mainly light-gray or gray fine sand, and in others it is mostly dark-gray coarse sand.

Included are areas in which the surface soil is brown. In some areas the texture of the surface soil ranges to silty clay loam.

Use and management.—Artificial drainage improves the productivity of this soil. Open drains carry off enough water so that crops can be planted early in the spring. Use and management are the same as for Puget silt loam, 0 to 1 percent slopes, but because this soil drains more readily, more of it is used for small grains, peas, strawberries, potatoes, and vegetable-seed crops. This soil is in management group 10.

Sumas silt loam, shallow, 0 to 1 percent slopes (S15).—About 75 percent of this soil is in a low back bottom south of Mount Vernon. It is associated with Snohomish soils, Carbondale muck, and other organic soils. The depth to the sandy substratum ranges from 10 to 20 inches. The reaction ranges from strongly acid to medium acid.

The water table is high for several months of the year. However, open ditches drain the soil well enough to allow using it for crops. In abandoned stream channels, the soil is wet most of the year and the profile characteristics are extremely variable. There is a gradual transition from this soil to the better drained Puyallup soils, which are also underlain by sandy material.

Use and management.—Except for about 100 acres, this soil is cultivated. It yields a little less than Sumas silt loam, 0 to 1 percent slopes, and a larger proportion of it is used for hay, pasture, and small grains. This soil is in management group 10.

Sumas silt loam, deep, 0 to 1 percent slopes (S14).—This soil is associated with Puget silt loam, 0 to 1 percent slopes, and with other Sumas soils. It occurs in an area about 2 miles north of La Conner. It is like Sumas silt loam, 0 to 1 percent slopes, but is more than 48 inches deep. Its internal drainage is slightly slower.

Use and management.—All of this soil has been cleared for farming. It is suited to the same crops as the Puget silt loam and other Sumas silt loams. It can be managed in the same way as those soils. It is in management group 10.

Sumas silty clay loam, 0 to 1 percent slopes (S16).—This soil is closely associated with the Sumas silt loams. It generally occupies slightly lower positions, near or next to salt water, tidal marshes, or areas of Lummi soils. The texture of the surface layer ranges from silty clay loam to clay loam. The surface soil is grayer and more distinctly mottled than that of the Sumas silt loams, and the subsoil is more strongly acid. The substratum is alkaline in most places and particularly so in areas next to tidal marshes or salt water. Organic fibers are embedded in the lower subsoil.

This soil is more difficult to drain than the associated silt loams because the water table is high for many months each year. Excess water that accumulates on the surface in the rainy season can be quickly removed by artificial drainage. Dikes protect most of this soil from flooding, except when the water is exceptionally high.

Use and management.—This soil is about as fertile as Sumas silt loam, 0 to 1 percent slopes, but is harder to till because of its finer texture. It is used for as many different crops as the silt loam, but a larger proportion is in grain, hay, or pasture. Because of the high water table, it is less well suited to deep-rooted crops than the silt loam and is better suited to spring-sown crops than to fall-sown crops. This soil is in management group 10.

Tanwax peat, 0 to 1 percent slopes (Ta).—This soil occurs in widely scattered small depressions in the glaciated uplands and terraces. It generally occupies the entire depression, but in some places it is associated with sedge peat, muck, or marsh. This soil consists of colloidal sediments and the remains of microscopic plants. The material accumulated under water in deep glacial-lake depressions or basins. These areas have poorer drainage than other organic soils. Except for a short time in summer, they remain saturated or flooded. The vegetation is mainly spirea. There is also a little Labrador-tea, huckleberry, sedge, and moss.

Profile description:

Very dark gray or very dark grayish-brown sedimentary peat; very smooth and slightly plastic when wet, very hard when dry; contains plant roots and some fibrous or woody material; 6 to 8 inches thick.

Similar to overlying layer but without plant roots; contains a few embedded, flattened sedge remains; extends to a depth of about 24 inches.

Sedimentary peat containing fine fibers or sedimentary peat mixed with mineral material; extends to depths of 2 to more than 6 feet.

The underlying material is compact, cemented glacial drift of variable texture.

The amount of fibrous material varies. There is not enough to permit classifying any areas as sedge peat, but in some places the upper few inches is highly fibrous, and in other places sedge peat is mixed with the sedimentary peat or occurs in layers.

Use and management.—All of this soil remains in its original state. It is more difficult to drain and would be less productive than organic soils developed from sedge or woody materials. If this soil were properly drained and managed, it would probably be productive of pasture and hay. It is in management group 11.

Tanwax peat, shallow, 0 to 1 percent slopes (Tb).—This soil occurs in widely scattered small depressions or basins. The depth of the peat accumulation ranges from about 12 to 24 inches. The peat contains the roots of the present vegetation and varying amounts of fine fibers.

Use and management.—None of this soil has been cleared for agriculture. Many of the areas are only about 5 acres in size and are in remote areas. The associated soils are poor for agriculture. This soil is in management group 11.

Thornton clay, 0 to 2 percent slopes (Tc).—This poorly drained soil occupies terraces near Day Creek. It lies considerably above the flood stage. Its fine-textured parent material was washed from mountainous areas where talc and mica-schist are dominant. Apparently, the parent material was deposited in very quiet waters, possibly in glacial lakes. Runoff and internal drainage are very slow. The water table is high for many months of the year. Because the subsoil is dense and fine textured, this soil is hard to drain.

The original vegetation was mostly Douglas-fir, cedar, western hemlock, and shrubs, vines, and ferns. Alder, vine maple, willow, and other deciduous trees and brush predominate on some of the wetter sites.

Profile description:

Surface soil—
Gray, olive-gray, and olive firm clay or silty clay; pale olive, light olive gray, or light gray when dry; many medium and coarse, distinct, yellowish-brown and brown mottles; greasy and smooth when rubbed; strongly acid; 8 inches thick.

Subsoil—
Gray, firm clay; massive; very finely laminated; tough and extremely greasy when wet; some mottles, mainly along old root channels and fractures; less acid than surface soil; extends to a depth of 24 inches.

Substratum—
Gray, fine-textured material similar to that of the subsoil; contains lenses of coarse and medium texture that were derived mainly from talc and mica; below depths of 4 feet, some shaly fragments and considerable coarse-textured material; nearly neutral.

Included are small areas where there are peaty layers in the surface soil. In undisturbed areas, the topmost 2 or 3 inches is variable in texture. The material below a depth of 3 feet, in some areas, is dominantly shaly and coarse textured.

Use and management.—Only a little of this soil has been cleared. Most of it is in a second growth of deciduous trees and scattered cedars, Douglas-firs, and hemlocks. Some of these areas are used as wooded pasture for beef and dairy cattle. Permanent pasture is the principal use for the cleared areas. This is the best agricultural use for this soil. A small acreage is used for grass and clover hay. Reed canarygrass does well on this swampy soil. It can be grown for either hay or pasture.

This soil is very hard to cultivate and to drain. It is in management group 10.

Thornton silty clay loam, 0 to 2 percent slopes (Td).—This is an inextensive soil associated with Thornton clay, 0 to 2 percent slopes. It occupies slightly higher positions than the associated soil and, consequently, is somewhat better drained and less difficult to drain artificially. Except for the topmost 6 inches, the profile is similar to that of Thornton clay, 0 to 2 percent slopes. The surface soil of grayish-brown, dark grayish-brown, or olive-gray friable silty clay loam is moderately high in organic matter. Talc and mica are found in large quantities throughout the profile. The material below a depth of 3 feet is generally shaly and coarse textured.

Use and management.—About half of this soil has been cleared and used for pasture and hay. This soil is better suited to these crops than Thornton clay, 0 to 2 percent slopes. It is in management group 10.

Thornwood gravelly loam, 0 to 3 percent slopes (Te).—This soil occupies glacial outwash plains and glacial moraines. It is associated with the undulating and rolling Thornwood soils. The parent material was a mixture of gravel, stones, and cobblestones and considerable, though variable, amounts of mica-schist, talc, and argillite. The inclusion of mica-schist, talc, and argillite

in the parent material differentiates the Thornwood soils from the Everett soils.

This soil is somewhat excessively drained. Runoff is very slow, but internal drainage is rapid. The original vegetation was a coniferous forest consisting of Douglas-fir, hemlock, a little western redcedar, and a dense undergrowth of shrubs, vines, and ferns.

Profile description:

Surface soil—
Brown or dark-brown friable gravelly loam; slightly lighter colored in the lower part; pale brown to brown when dry; contains a little shot and scattered fragments of mica-schist; strongly acid; 8 to 12 inches thick.

Subsoil—
Olive or yellowish-brown gravelly sandy loam; loose to very friable; contains a little shot and scattered fragments of mica-schist; medium acid; extends to depths of 20 to 24 inches.

Substratum—
Poorly sorted, loose, porous sandy gravel; contains variable amounts of schist fragments and other angular and subangular pebbles of varied origin; slightly acid.

Stones and cobblestones occur throughout the profile in some areas. The mica-schist is mostly in coarse fragments, but in some places it is very fine. It is more common in the substratum than in the surface soil and subsoil. In many areas the subsoil is light yellowish brown when dry and yellowish brown or dark yellowish brown when moist.

Use and management.—Most of the merchantable timber has been logged, and most areas are now restocking with the same kinds of trees. Only small clearings have been made. They are used primarily for homesites or for pastures. Some partially cleared areas are used for wooded pasture.

This soil is droughty and low in fertility. It is not well suited to farm crops. The lower lying areas and those at the base of long steep slopes remain moist longer in the growing season and can be used more successfully for hay and pasture than the higher areas. Early pastures of grass and legume mixtures do fairly well. Alta fescue is drought resistant and should be used in a mixture with other grasses and red clover. Yields are lower than on the Alderwood soils and other glacial upland soils that have a cemented substratum.

Much of this soil occurs in remote or inaccessible areas. The best use for these areas is forestry. This soil is in management group 3.

Thornwood gravelly loam, 3 to 8 percent slopes (Tf).—This soil is closely associated with Thornwood gravelly loam, 0 to 3 percent slopes.

Use and management.—This soil is suitable for the same uses as Thornwood gravelly loam, 0 to 3 percent slopes, and it can be managed in the same way. It is in management group 3.

Thornwood gravelly loam, 8 to 15 percent slopes (Tg).—This soil occupies rolling areas, mostly near the mountains. It is associated with other Thornwood soils and with the Skiyou and Heisler soils. The profile characteristics are more varied than those of the more gently sloping Thornwood soils. Generally, this soil is more strongly influenced by mica-schist, talc, and argillite.

Use and management.—Most of this soil is in second-growth timber. The stands consist mostly of conifers, but alders, willows, and maples are encroaching. This soil is less well suited to farming than the more gently sloping Thornwood gravelly loams. Many of the areas are fairly remote and hard to reach. This soil is in management group 3.

Thornwood gravelly loam, 15 to 30 percent slopes (Th).—This soil occupies hilly glacial moraines and strong slopes adjacent to steeper Heisler soils. Runoff is more rapid than on Thornwood gravelly loam, 8 to 15 percent slopes, but erosion is controlled by the dense vegetation and the soil's ability to absorb moisture rapidly. The color, texture, thickness of layers, and amount of mica-schist are exceedingly variable.

Use and management.—All of the merchantable timber has been removed, and this soil is now restocking to the same kinds of trees as were in the original forests. In many areas the second growth consists mostly of deciduous trees. Because of hilly relief, droughtiness, and low fertility, this soil is best suited to forest. It is in management group 12.

Thornwood gravelly sandy loam, 0 to 3 percent slopes (Tk).—This soil occurs on high glacial terraces in the valley of the Skagit River. Except for the texture of the surface soil, this soil is very similar to Thornwood gravelly loam, 0 to 3 percent slopes. The surface soil and subsoil contain considerable mica-schist. Argillite and talc are common in some areas. Runoff is very slow, but internal drainage is very rapid. The moisture-holding capacity is low. This soil dries out early in summer and becomes very droughty.

Use and management.—Except for a few acres used for homesites and small pastures, this soil remains in timber. Most of the merchantable timber has been logged. In the second growth, deciduous trees are competing with the conifers. Because of low fertility and droughtiness, this soil is generally not suitable for farm crops. It occurs in remote areas. It is best suited to forest. It is in management group 3.

Thornwood gravelly sandy loam, 3 to 8 percent slopes (Tm).—Except for stronger slopes, this soil is like Thornwood gravelly sandy loam, 0 to 3 percent slopes.

Use and management.—Remarks made about use and management of Thornwood gravelly sandy loam, 0 to 3 percent slopes, apply to this soil as well. This soil is in management group 3.

Thornwood gravelly sandy loam, 8 to 15 percent slopes (Tn).—This is the least extensive of the Thornwood gravelly sandy loams. It is closely associated with other Thornwood soils.

Use and management.—Remarks made about use and management of Thornwood gravelly sandy loam, 0 to 3 percent slopes, apply to this soil as well. This soil is in management group 3.

Thornwood gravelly sandy loam, 15 to 30 percent slopes (To).—This glacial soil occupies moraines, breaks, escarpments, or the sides of stream gullies. The profile characteristics are more variable than those of Thornwood gravelly sandy loam, 8 to 15 percent slopes. Included are areas where the texture of the surface soil is gravelly loamy sand. The amount of mica-schist varies from place to place. The gravel and stones are of varied origin and are more angular than in many other glacial soils. Runoff is more rapid, and the soil is more droughty where it is not heavily forested.

Use and management.—Most of the merchantable timber has been removed. The soil is now restocking with the same kinds of trees as were in the original stand,

but these are being crowded by deciduous trees and brush. Because of strong slopes, low fertility, and droughtiness, this soil should be kept in forest. It is in management group 12.

Thornwood gravelly sandy loam, 30 to 45 percent slopes (Tp).—This soil occupies steep glacial moraines near mountains, steep foot slopes, and steep gully sides. Some slopes of more than 45 percent are included. From place to place, the profile varies exceedingly in color, texture, and thickness of layers. Mica-schist outcrops in some places. Runoff is more rapid than on Thornwood gravelly loam, 15 to 30 percent slopes. However, the dense vegetation and the very rapid permeability of the soil prevent erosion.

Use and management.—Most of the original timber has been removed, and the soil is now restocking to the same kinds of trees. The trees appear to be growing nearly as well as on Thornwood gravelly sandy loams that have milder slopes. This soil is suited only to forests. It is in management group 12.

Tidal marsh, 0 to 1 percent slopes (Tr).—This miscellaneous land type borders salty or brackish water. At high tide it is almost completely submerged. Large areas of it occur at the outer edge of the Skagit River delta, beyond the dikes.

The alluvial or marine deposits that make up this mapping unit are like the parent material of the Lummi, Puget, and Sumas soils. They consist of gray, mottled, medium- and fine-textured material that contains flattened sedge remains. There is no appreciable differentiation with depth. The vegetation consists mainly of salt-tolerant plants.

Use and management.—This land type is generally nonagricultural because it is regularly saturated with salt water. Some of the higher areas are better drained and can be used for pasture, but the pasture is poor. Probably some of these areas can be diked and drained. If drained, this land type will be similar to the Lummi soils. It is in management group 12.

Tisch silty clay loam, 0 to 1 percent slopes (Ts).—This poorly drained soil is characterized by a shallow, highly organic surface soil overlying deep layers of diatomaceous earth. It is mainly in a depressed area in the valley of Nookachamps Creek. It was derived chiefly from diatomaceous earth. Most of it is ponded for many months of the year. The vegetation consists of groves of willows, alders, other deciduous trees, brush, and vines.

Profile description:

Surface soil—
Very dark gray to dark grayish-brown friable silty clay loam; faint brown and yellow mottles; grayish brown to light gray when dry; contains fragments or streaks of diatomaceous earth; moderate granular structure; medium acid; 4 to 10 inches thick.

Subsoil—
White diatomaceous earth; many faint yellow mottles in the upper part; very smooth when rubbed between the fingers; nearly neutral; extends to depths of 48 to 60 inches.

A mixture of diatomaceous earth and sedimentary peat; more peat with depth; slightly acid; extends to depths of more than 6 feet.

The amount of diatomaceous earth in the surface soil varies. Included are a few areas that have a silt loam surface soil.

Use and management.—Except for a few acres used for pasture, this soil remains in deciduous trees. It needs artificial drainage to make it suitable for agriculture, but it is difficult to drain. Diatomaceous earth, in itself, contains a very small supply of plant nutrients, if any; consequently, plant growth depends upon the surface soil, which is generally quite shallow. However, this soil is fairly productive of hay and pasture if adequately drained and fertilized occasionally with phosphate, potash, and manure. It is in management group 7.

Wickersham shaly loam, 0 to 3 percent slopes (Wa).—This soil occurs in widely scattered areas in the valleys of major streams. It occupies alluvial fans at the mouths of tributary streams. Most of the fans are small. This soil is associated with the Cokedale and Samish soils and with other soils of the bottom lands and terraces. It has developed mainly from Heisler soil material that washed from hills and mountains. The material is predominantly mica-schist, mixed with varying amounts of argillite and shale.

This soil is well drained. Runoff and internal drainage are adequate to remove excess water, but small seep spots are common in many areas. The streams overflow occasionally, causing deposition and erosion. The vegetation consists of conifers and deciduous trees.

Profile description:

Surface soil—
Very dark gray friable shaly loam; dark gray or gray when dry; weak fine granular structure; 6 to 10 inches thick.

Subsoil—
Dark gray or very dark gray shaly loam or shaly sandy loam; very friable; extends to depths of 15 to 24 inches.

Substratum—
Gray or dark-gray shaly loamy sand or shaly sand.

Coarse angular or subangular fragments of mica-schist and argillite occur throughout the profile. The reaction is medium acid to strongly acid. The acidity decreases with depth.

The color varies; it may be dark gray, very dark gray, dark olive gray, or dark grayish brown. Included are areas in which a greater variety of rock fragments occur than in the typical profile. In the upper end of the valley of the Skagit River, there are more fragments of argillite and shale. The color in this area is gray, grayish brown, or olive gray.

Use and management.—Only a little of this soil has been cleared and cultivated. Most of the cleared areas are in the western half of the county; the acreage in the eastern half remains in second-growth timber. The moisture-holding capacity is low, and the supply of organic matter and nitrogen is deficient. The cleared acreage is used mainly for hay and pasture. Some is used for small grains. This soil is in management group 8.

Wickersham shaly loam, 3 to 8 percent slopes (Wb).—This soil resembles Wickersham shaly loam, 0 to 3 percent slopes, but it has more rapid runoff. As this soil absorbs water readily, cultivated areas do not erode.

Use and management.—This soil can be used and managed in about the same way as Wickersham shaly loam, 0 to 3 percent slopes. It is in management group 8.

Wickersham shaly silt loam, 0 to 3 percent slopes (Wc).—This soil occupies alluvial fans, mainly in the valley of the Samish River. It is associated with other Wickersham soils. The parent material was derived mostly from mica-schist but partly from argillite and shale. This soil retains more moisture than the Wickersham shaly loams. In some areas much of the parent

material is glacial. The texture of the subsoil and substratum is extremely variable. The amount of shaly or gravelly material varies within short distances. Included are areas in which there are very few shaly fragments in the surface soil.

Use and management.—Slightly more than half of this soil has been cleared for farming. It is used principally for hay, oats, and pasture. Yields are slightly higher than on Wickersham shaly loam, 0 to 3 percent slopes. This soil is in management group 8.

Wickersham shaly silt loam, 3 to 8 percent slopes (Wd).—This soil is closely associated with other Wickersham soils. The texture of the subsoil and substratum vary more than in Wickersham shaly silt loam, 0 to 3 percent slopes. Runoff is slightly more rapid on this soil, but enough moisture to meet the needs of most crops is retained.

Use and management.—About 75 percent of this soil has been cleared. It is used mainly for hay, oats, and pasture. Yields are slightly lower than on Wickersham shaly silt loam, 0 to 3 percent slopes. This soil is in management group 8.

Woodinville silt loam, 0 to 1 percent slopes (We).—This poorly drained soil occurs on the delta of the Samish River. It is associated with the Puget and Sumas soils. It is like Puget silt loam, 0 to 1 percent slopes, but has a few peaty lenses in the upper part of the profile. The parent material is similar to that of the Sumas soils.

This soil occupies slight depressions and shallow basins in the flood plain; consequently, it is slightly more poorly drained than the associated soils. It is sometimes flooded. Runoff and internal drainage are very slow, and the water table is high. The native vegetation consisted mostly of marsh grasses, sedges, reeds, shrubs, and alder, vine maple, willow, and other deciduous trees.

Profile description:

Surface soil—
Dark grayish-brown or dark-gray friable silt loam; granular structure; contains lenses of sedge peat; in cultivated fields, sedge peat is mixed with the topmost 6 to 8 inches of soil; light brownish gray or light gray when dry, depending upon the amount of peaty material; 6 to 10 inches thick.

Subsoil—
Gray, very plastic, stratified silty clay, clay, or silty clay loam; contains a few thin peaty lenses; many distinct fine or medium reddish-brown and brown mottles; extends to a depth of about 24 inches.

Substratum—
Gray, firm, very plastic, stratified and laminated silty clay and clay; a few coarser textured lenses and embedded flattened sedge remains; a few distinct brown and yellow mottles.

This soil is strongly acid to medium acid. It becomes less acid with depth; below depths of 4 feet, it is slightly acid to nearly neutral. The amount of peaty material in the upper part of the profile varies. Cultivation has mixed the peaty lenses with the silt loam, and the resulting surface layer is a highly organic mineral soil. Included are areas in which there is considerable coarse-textured material below depths of 36 to 48 inches.

Use and management.—All of this soil has been cleared for farming. It is used mostly for hay, pasture, and small grains. Yields are about the same as on Puget silt loam, 0 to 1 percent slopes. The two soils can be used in about the same way. This soil is in management group 10.

Capability Groups

Capability grouping is a system of classification used to show the relative suitability of soils for crops, grazing, forestry, and wildlife. It is a practical grouping based on the needs and limitations of the soils, the risks of damage to them, and also their response to management.

There are 8 broad classes in the capability system but not all of these occur in Skagit County. Each soil is placed in one of the 8 classes according to the degree of its limitations or suitability for use.

In classes I, II, and III are soils that are suitable for annual or periodic cultivation of annual or short-lived crops.

Class I soils are those that have the widest range of use and the least risk of damage. They are level or nearly level, productive, well drained, and easy to work. They can be cultivated with almost no risk of erosion and will remain productive if managed with normal care.

Class II soils can be cultivated regularly, but do not have quite so wide a range of suitability as class I soils. Some class II soils are gently sloping; consequently, they need moderate care to prevent erosion. Other soils in class II may be slightly droughty, slightly wet, or somewhat limited in depth.

Class III soils can be cropped regularly but have a narrower range of use. These need even more careful management.

In class IV are soils that should be cultivated only occasionally or only under very careful management.

In classes V, VI, and VII are soils that normally should not be cultivated for annual or short-lived crops, but that can be used for pasture or range, for woodland, or for wildlife. Class V does not occur in Skagit County.

Class V soils are nearly level and gently sloping but are droughty, wet, low in fertility, or otherwise unsuitable for cultivation.

Class VI soils are not suitable for crops, because they are steep or droughty or have characteristics that limit their use, but they give fair yields of forage or forest products. Some soils in class VI can, without damage, be cultivated enough so that fruit trees or forest trees can be set out or pasture crops seeded.

Class VII soils can be used to produce forage or forest products, but they have characteristics that limit them to only poor or fair yields.

In class VIII are soils that have practically no agricultural use. Some of them have value as watersheds or wildlife habitats, or for scenery.

Subclasses.—Although the soils within a single capability class have similar limitations and, therefore, use and management problems of about the same degree, the kinds of problems may differ greatly. These problems and limitations may result from the effects or the risk of erosion, designated by the symbol (e), excess water (w), shallow soil, low fertility, or low capacity for available moisture (s), or unfavorable climate (c). Climate is not used as a limiting factor in classifying the soils of the county, and the symbol (c) is not used.

The following pages give the capability classes and subclasses in Skagit County and the mapping units in each class and subclass.

The capability classes and subclasses in Skagit County are defined below.

Class I.—Deep, nearly level, fertile silt loams and loams; suitable for tilled crops and other uses; few or no permanent limitations.

Class II.—Soils that have moderate limitations if tilled; suitable for crops, pasture, and trees.

Subclass IIw: Nearly level, fertile soils that are moderately limited by floods, excess water from seepage, or high water table.

Subclass IIs: Deep soils that are limited by moderate fertility and moderate capacity for holding moisture available.

Class III.—Soils that have moderately serious limitations and require careful management if tilled; suitable for crops, pasture, and trees.

Subclass IIIw: Slowly permeable soils that require improved drainage if used for tilled crops.

Subclass IIIs: Soils that are limited in use because of shallowness, low fertility, or little capacity for holding moisture available.

Class IV.—Soils that are suited to pasture or trees. They have serious limitations and should be tilled only occasionally.

Subclass IVe: Slowly or very slowly permeable sloping soils that are erodible if cultivated.

Subclass IVw: Shallow soils that are seriously limited in use because of excess water.

Subclass IVs: Soils that have limited use because of low fertility, shallowness, slow permeability, or little capacity for holding moisture available.

Class V.—No soils were grouped in this class in Skagit County.

Class VI.—Soils generally suited to pasture or trees, but not suited to tilled crops.

Subclass VIe: Moderately steep soils that are generally suited to pasture or trees; erodible if cover is not maintained.

Subclass VIs: Soils that are only moderately well suited to pasture and trees because of low fertility and little capacity for holding moisture available.

Class VII.—Soils that may be used for pasture or trees but have severe hazards; not suited to tilled crops.

Subclass VIIe: Soils on steep slopes that are erodible if good cover is not maintained.

Subclass VIIs: Soils in steep, shallow, rocky areas having many limitations and suited only to trees.

Class VIII.—Soils that will not produce vegetation of any kind in commercial quantities.

The capability class and subclass for each soil in the county is shown in the following list.

	Capability class and subclass
Alderwood gravelly sandy loam, 0 to 3 percent slopes (Af)	IVs
Alderwood gravelly sandy loam, 3 to 8 percent slopes (Ag)	IVs
Alderwood gravelly sandy loam, 8 to 15 percent slopes (Ah)	IVs
Alderwood gravelly sandy loam, 15 to 30 percent slopes (Ak)	VIe
Alderwood gravelly sandy loam, 30 to 45 percent slopes (Am)	VIIe
Alderwood gravelly sandy loam, shallow, 0 to 3 percent slopes (An)	IVs
Alderwood gravelly sandy loam, shallow, 3 to 8 percent slopes (Ao)	IVs
Alderwood gravelly sandy loam, shallow, 8 to 15 percent slopes (Ap)	IVs
Alderwood gravelly sandy loam, shallow, 15 to 30 percent slopes (Ar)	VIe
Alderwood gravelly loam, 0 to 3 percent slopes (Aa)	IVs
Alderwood gravelly loam, 3 to 8 percent slopes (Ab)	IVs
Alderwood gravelly loam, 8 to 15 percent slopes (Ac)	IVs
Alderwood gravelly loam, 15 to 30 percent slopes (Ad)	VIe
Alderwood gravelly loam, 30 to 45 percent slopes (Ae)	VIIe
Belfast silt loam, 0 to 3 percent slopes (Ba)	IIs
Bellingham silt loam, 0 to 2 percent slopes (Bd)	IIIw
Bellingham silt loam, 2 to 5 percent slopes (Be)	IIIw
Bellingham silt loam, light colored variant, 0 to 3 percent slopes (Bf)	IIIw
Bellingham silty clay loam, 0 to 2 percent slopes (Bg)	IIIw
Bellingham silty clay loam, 2 to 5 percent slopes (Bh)	IIIw
Bellingham clay, 0 to 2 percent slopes (Bb)	IVw
Bellingham clay loam, light colored variant, 0 to 3 percent slopes (Bc)	IIIw
Bow silt loam, 0 to 3 percent slopes (Bv)	IVs
Bow silt loam, 3 to 8 percent slopes (Bw)	IVs
Bow silt loam, 8 to 15 percent slopes (Bx)	IVe
Bow silt loam, 15 to 30 percent slopes (By)	VIe
Bow silt loam, 30 to 45 percent slopes (Bz)	VIIe
Bow silt loam, shallow, 0 to 3 percent slopes (B2)	IVw
Bow silt loam, shallow, 3 to 8 percent slopes (B3)	IVw
Bow gravelly loam, 0 to 3 percent slopes (Bk)	IVs
Bow gravelly loam, 3 to 8 percent slopes (Bm)	IVs
Bow gravelly loam, 8 to 15 percent slopes (Bn)	IVs
Bow gravelly loam, 15 to 30 percent slopes (Bo)	VIe
Bow gravelly loam, 30 to 45 percent slopes (Bp)	VIIe
Bow loam, 0 to 3 percent slopes (Br)	IVs
Bow loam, 3 to 8 percent slopes (Bs)	IVs
Bow loam, 15 to 30 percent slopes (Bt)	VIe
Bow loam, shallow, 0 to 3 percent slopes (Bu)	IVw
Cagey gravelly fine sandy loam, 0 to 3 percent slopes (Ca)	IIIs
Cagey gravelly fine sandy loam, 3 to 8 percent slopes (Cb)	IIIs
Cagey gravelly sandy loam, moderately shallow, 0 to 3 percent slopes (Cc)	IVs
Cagey gravelly sandy loam, moderately shallow, 3 to 8 percent slopes (Cd)	IVs
Cagey gravelly sandy loam, moderately shallow, 8 to 15 percent slopes (Ce)	IVs
Carbondale muck, 0 to 1 percent slopes (Cf)	IIw
Carbondale muck, shallow, 0 to 1 percent slopes (Cg)	IIIw
Cathcart loam, 3 to 8 percent slopes (Co)	IIIs
Cathcart loam, 8 to 15 percent slopes (Cp)	IVs
Cathcart loam, 15 to 30 percent slopes (Cr)	VIe
Cathcart loam, 30 to 60 percent slopes (Cs)	VIIe
Cathcart clay loam, 3 to 8 percent slopes (Ch)	IIIs
Cathcart gravelly loam, 3 to 8 percent slopes (Ck)	IIIs
Cathcart gravelly loam, 8 to 15 percent slopes (Cm)	IVs
Cathcart gravelly loam, 15 to 30 percent slopes (Cn)	VIe
Cathcart stony loam, 8 to 15 percent slopes (Ct)	VIe
Cathcart stony loam, 15 to 30 percent slopes (Cu)	VIe
Cathcart stony loam, 30 to 60 percent slopes (Cv)	VIIe
Coastal beach, 0 to 3 percent slopes (Cw)	VIII
Cokedale silt loam, 0 to 3 percent slopes (Cz)	IIw
Cokedale silt loam over Puyallup soil material, 0 to 3 percent slopes (C2)	IIw
Cokedale loam, 0 to 3 percent slopes (Cx)	IIw
Cokedale sandy loam, 0 to 3 percent slopes (Cy)	IIIw
Cokedale silty clay loam, 0 to 3 percent slopes (C3)	IIIw
Cokedale silty clay loam over Puyallup soil material, 0 to 3 percent slopes (C4)	IIIw
Corkindale loam, 0 to 3 percent slopes (C5)	IVs
Corkindale loam, 3 to 8 percent slopes (C6)	IVs
Corkindale loam, 8 to 15 percent slopes (C7)	IVs
Corkindale loam, 15 to 30 percent slopes (C8)	VIe
Corkindale loam, 30 to 45 percent slopes (C9)	VIIe
Coveland gravelly loam, 0 to 3 percent slopes (C12)	IIIw
Coveland gravelly loam, 3 to 8 percent slopes (C13)	IIIw
Coveland silt loam, 0 to 3 percent slopes (C15)	IIIw
Coveland silt loam, moderately well drained variant, 0 to 3 percent slopes (C16)	IIIs
Coveland gravelly silt loam, 3 to 8 percent slopes (C14)	IIIw
Everett gravelly sandy loam, 0 to 3 percent slopes (Eb)	VIs
Everett gravelly sandy loam, 3 to 8 percent slopes (Ec)	VIs
Everett gravelly sandy loam, 8 to 15 percent slopes (Ed)	VIs
Everett gravelly sandy loam, 15 to 30 percent slopes (Ee)	VIs
Everett gravelly sandy loam, 30 to 45 percent slopes (Ef)	VIIe

	Capability class and subclass
Everett cobbly sandy loam, 0 to 3 percent slopes (Ea)	VIs
Fidalgo rocky loam, 8 to 15 percent slopes (Fa)	VIs
Fidalgo rocky loam, 15 to 30 percent slopes (Fb)	VIs
Fidalgo rocky loam, 30 to 45 percent slopes (Fc)	VIIe
Giles silt loam, 0 to 3 percent slopes (Gc)	IIIs
Giles silt loam, 8 to 15 percent slopes (Gd)	IVs
Giles loam, 0 to 3 percent slopes (Ga)	IIIs
Giles loam, 3 to 8 percent slopes (Gb)	IIIs
Gilligan silt loam, 0 to 3 percent slopes (Gg)	IIIs
Gilligan silt loam, moderately shallow, 0 to 3 percent slopes (Gh)	IIIs
Gilligan loam, 0 to 3 percent slopes (Gf)	IIIs
Gilligan gravelly loam, moderately shallow, 0 to 3 percent slopes (Ge)	IIIs
Greenwater loamy sand, 0 to 3 percent slopes (Gk)	VIs
Greenwater loamy sand, 3 to 8 percent slopes (Gm)	VIs
Greenwater loamy sand, 8 to 15 percent slopes (Gn)	VIs
Greenwater sandy loam, 0 to 3 percent slopes (Go)	VIs
Greenwood peat, 0 to 1 percent slopes (Gp)	VIII
Heisler stony loam, 15 to 30 percent slopes (Hd)	VIe
Heisler stony loam, 30 to 45 percent slopes (He)	VIIe
Heisler gravelly loam, 3 to 8 percent slopes (Ha)	IVs
Heisler gravelly loam, 8 to 15 percent slopes (Hb)	IVs
Heisler gravelly loam, 15 to 30 percent slopes (Hc)	VIe
Hovde loamy sand, 0 to 1 percent slopes (Hf)	IVs
Indianola loamy sand, 3 to 8 percent slopes (Ia)	VIs
Indianola loamy sand, 8 to 15 percent slopes (Ib)	VIs
Indianola loamy sand, 15 to 30 percent slopes (Ic)	VIs
Indianola loamy sand, 30 to 45 percent slopes (Id)	VIIe
Indianola sandy loam, 3 to 8 percent slopes (Ie)	IVs
Klaus gravelly sandy loam, 0 to 3 percent slopes (Ke)	VIs
Klaus gravelly sandy loam, 3 to 8 percent slopes (Kf)	VIs
Klaus gravelly sandy loam, 8 to 15 percent slopes (Kg)	VIs
Klaus gravelly sandy loam, 15 to 30 percent slopes (Kh)	VIs
Klaus gravelly loam, 0 to 3 percent slopes (Ka)	VIs
Klaus gravelly loam, 3 to 8 percent slopes (Kb)	VIs
Klaus gravelly loam, 8 to 15 percent slopes (Kc)	VIs
Klaus gravelly loam, 15 to 30 percent slopes (Kd)	VIe
Klaus sandy loam, 0 to 3 percent slopes (Kk)	VIs
Klaus sandy loam, 3 to 8 percent slopes (Km)	VIs
Klaus sandy loam, 8 to 15 percent slopes (Kn)	VIs
Klaus sandy loam, 15 to 30 percent slopes (Ko)	VIs
Kline silt loam, 1 to 3 percent slopes (Kv)	IVs
Kline loam, 1 to 3 percent slopes (Ks)	IVs
Kline loam, 3 to 8 percent slopes (Kt)	IVs
Kline gravelly loam, 1 to 3 percent slopes (Kp)	IVs
Kline gravelly loam, 3 to 8 percent slopes (Kr)	IVs
Kline sandy loam, 1 to 3 percent slopes (Ku)	IVs
Lummi silt loam, 0 to 1 percent slopes (La)	IIIw
Lummi silty clay loam, 0 to 1 percent slopes (Lb)	IIIw
Lynden sandy loam, 0 to 3 percent slopes (Lm)	IVs
Lynden sandy loam, 3 to 8 percent slopes (Ln)	IVs
Lynden loamy sand, 0 to 3 percent slopes (Lg)	IVs
Lynden loamy sand, 3 to 8 percent slopes (Lh)	IVs
Lynden loamy sand, 8 to 15 percent slopes (Lk)	IVs
Lynden loam, 0 to 3 percent slopes (Le)	IIIs
Lynden loam, 3 to 8 percent slopes (Lf)	IIIs
Lynden gravelly loam, 0 to 3 percent slopes (Lc)	IVs
Lynden gravelly loam, 3 to 8 percent slopes (Ld)	IVs
Made land (Ma)	VIII
Marblemount stony loam, 15 to 30 percent slopes (Mb)	VIe
Mukilteo peat, 0 to 1 percent slopes (Mc)	IIw
Mukilteo peat, shallow, 0 to 1 percent slopes (Md)	IIIw
Neptune sandy loam, 0 to 3 percent slopes (Na)	IVs
Nookachamps silty clay loam, 0 to 2 percent slopes (Nc)	IIw
Nookachamps silt loam, 0 to 2 percent slopes (Nb)	IIw
Norma silt loam, 0 to 2 percent slopes (Ne)	IIIw
Norma silt loam, 2 to 5 percent slopes (Nf)	IIIw
Norma loam, 0 to 2 percent slopes (Nd)	IIIw
Norma silty clay loam, 0 to 2 percent slopes (Ng)	IIIw
Oso loam, 15 to 30 percent slopes (Oc)	VIe
Oso loam, 30 to 60 percent slopes (Od)	VIIe
Oso loam, 3 to 8 percent slopes (Oa)	VIs
Oso loam, 8 to 15 percent slopes (Ob)	VIs
Pilchuck fine sand, 0 to 3 percent slopes (Pa)	VIs
Pilchuck loamy sand, 0 to 3 percent slopes (Pc)	VIs
Pilchuck sandy loam, 0 to 3 percent slopes (Pd)	VIs
Pilchuck gravelly sand, 0 to 3 percent slopes (Pb)	VIs
Puget silt loam, 0 to 1 percent slopes (Pg)	IIw
Puget silty clay loam, 0 to 1 percent slopes (Ph)	IIw
Puget loam, 0 to 1 percent slopes (Pf)	IIw
Puget fine sandy loam, 0 to 3 percent slopes (Pe)	IIs
Puyallup fine sandy loam, 0 to 3 percent slopes (Pk)	IIIs
Puyallup loamy sand over Puget soil material, 0 to 3 percent slopes (Pn)	IIIs
Puyallup loam, 0 to 3 percent slopes (Pm)	IIs
Puyallup silt loam, 0 to 3 percent slopes (Po)	IIs
Rifle peat, 0 to 1 percent slopes (Ra)	IIw
Rifle peat, shallow, 0 to 1 percent slopes (Rb)	IIIw
Riverwash, 0 to 3 percent slopes (Rc)	VIII
Rough broken land (Rd)	VIIe
Rough mountainous land, Cathcart soil material (Re)	VIIe
Rough mountainous land, Heisler soil material (Rf)	VIIe
Rough mountainous land, Marblemount soil material (Rg)	VIIe
Rough mountainous land, Oso soil material (Rh)	VIIe
Rough rocky land (Rk)	VIIs
Samish silty clay loam, 0 to 1 percent slopes (Sb)	IIw
Samish silt loam, 0 to 1 percent slopes (Sa)	IIw
Sauk loam, 0 to 3 percent slopes (Sc)	IIIs
Sauk loam, 3 to 8 percent slopes (Sd)	IIIs
Saxon silt loam, 3 to 8 percent slopes (Se)	IIIs
Saxon silt loam, 8 to 15 percent slopes (Sf)	IVe
Saxon silt loam, 15 to 30 percent slopes (Sg)	VIe
Semiahmoo muck, 0 to 1 percent slopes (Sh)	IIw
Semiahmoo muck, shallow, 0 to 1 percent slopes (Sk)	IVw
Skiyou gravelly loam, 3 to 8 percent slopes (Sm)	IVs
Skiyou gravelly loam, 8 to 15 percent slopes (Sn)	IVs
Skiyou gravelly loam, 15 to 30 percent slopes (So)	VIe
Skiyou gravelly loam, 30 to 45 percent slopes (Sp)	VIIe
Skykomish gravelly sandy loam, 3 to 8 percent slopes (Sv)	VIs
Skykomish gravelly sandy loam, 8 to 15 percent slopes (Sw)	VIs
Skykomish gravelly sandy loam, 15 to 30 percent slopes (Sx)	VIs
Skykomish cobbly sandy loam, 0 to 3 percent slopes (Sr)	VIs
Skykomish cobbly sandy loam, 3 to 8 percent slopes (Ss)	VIs
Skykomish cobbly sandy loam, 8 to 15 percent slopes (St)	VIs
Skykomish cobbly sandy loam, 15 to 30 percent slopes (Su)	VIs
Snohomish silt loam, 0 to 1 percent slopes (Sy)	IIw
Snohomish silty clay loam, 0 to 1 percent slopes (Sz)	IIw
Squalicum gravelly silt loam, 0 to 3 percent slopes (S2)	IVs
Squalicum gravelly silt loam, 3 to 8 percent slopes (S3)	IVs
Squalicum gravelly silt loam, 8 to 15 percent slopes (S4)	IVs
Squalicum gravelly silt loam, 15 to 30 percent slopes (S5)	VIe
Squalicum gravelly silt loam, 30 to 45 percent slopes (S6)	VIIe
Sultan silt loam, 0 to 3 percent slopes (S12)	I
Sultan loam, 0 to 3 percent slopes (S8)	I
Sultan fine sandy loam, 0 to 3 percent slopes (S7)	IIs
Sultan loamy sand, 0 to 3 percent slopes (S9)	IVs
Sumas silt loam, 0 to 1 percent slopes (S13)	IIw
Sumas silt loam, shallow, 0 to 1 percent slopes (S15)	IIw
Sumas silt loam, deep, 0 to 1 percent slopes (S14)	IIw
Sumas silty clay loam, 0 to 1 percent slopes (S16)	IIw
Tanwax peat, 0 to 1 percent slopes (Ta)	IIIw
Tanwax peat, shallow, 0 to 1 percent slopes (Tb)	IVw
Thornton clay, 0 to 2 percent slopes (Tc)	IVs
Thornton silty clay loam, 0 to 2 percent slopes (Td)	IVs
Thornwood gravelly loam, 0 to 3 percent slopes (Te)	IVs
Thornwood gravelly loam, 3 to 8 percent slopes (Tf)	IVs
Thornwood gravelly loam, 8 to 15 percent slopes (Tg)	IVs
Thornwood gravelly loam, 15 to 30 percent slopes (Th)	IVs
Thornwood gravelly sandy loam, 0 to 3 percent slopes (Tk)	IVs
Thornwood gravelly sandy loam, 3 to 8 percent slopes (Tm)	IVs
Thornwood gravelly sandy loam, 8 to 15 percent slopes (Tn)	IVs
Thornwood gravelly sandy loam, 15 to 30 percent slopes (To)	IVs
Thornwood gravelly sandy loam, 30 to 45 percent slopes (Tp)	VIIe
Tidal marsh, 0 to 1 percent slopes (Tr)	VIII
Tisch silty clay loam, 0 to 1 percent slopes (Ts)	IIIw
Wickersham shaly loam, 0 to 3 percent slopes (Wa)	IIIs
Wickersham shaly loam, 3 to 8 percent slopes (Wb)	IIIs
Wickersham shaly silt loam, 0 to 3 percent slopes (Wc)	IIIs
Wickersham shaly silt loam, 3 to 8 percent slopes (Wd)	IIIs
Woodinville silt loam, 0 to 1 percent slopes (We)	IIw

Management of Soils

The soils of Skagit County differ widely in physical and chemical characteristics and, consequently, in use and management needs. In many of the soils, the supply of plant nutrients can be replenished by applying manure and phosphate and following a systematic crop rotation. Some soils need complete fertilizer. Lime is not generally required, but each soil should be tested to determine whether it is needed or not.

Generally, the soils should be kept in soil-building crops half the time. A good rotation consists of 2 years of cultivated crops followed by 2 years or more of grasses and clovers. During the grass-clover phase of the rotation, a minimum of 6 tons of manure and 50 pounds of phosphoric acid fertilizer per acre should be applied. Other nutrients should be applied if deficiencies are indicated by plant growth. Rosen rye and winter vetch seeded in fall will serve both as a winter cover crop, which will keep the soil from blowing or washing away, and as a green-manure crop, which, when turned under in spring, will add organic matter and improve tilth. Other suitable green-manure crops are oats, barley, Italian ryegrass, and any of the annual or biennial legumes.

The soils of Skagit County are used principally for hay and pasture. Because dairy products are the major source of income on most of the farms, the production of sufficient pasture and hay of good quality is of primary importance. To insure high yields and good quality, it is necessary to use suitable mixtures of grasses and legumes, to seed at the right time and in properly prepared seedbeds, to fertilize adequately, to manage the pastures well, and to use suitable methods of harvesting and storing hay.

Suitable hay and pasture plants.—Only a few soils in Skagit County are suitable for alfalfa, which requires a deep, permeable, well-drained, fertile soil. A greater number are suited to ryegrass, alta fescue, and orchardgrass (*2*). Ryegrass and orchardgrass are good for early spring pasture and are especially useful on soil that is dry enough for grazing in early spring. Tall meadow oats, alta fescue, and orchardgrass are drought resistant and consequently are good for soils that become very dry in summer. Cascade lotus (birdsfoot trefoil) is now widely used and is good for silage and hay, especially if grown with orchardgrass or alta fescue. Creeping foxtail and reed canarygrass are suited to the wet soils.

The most common grass-legume mixture used for hay is Italian ryegrass with red clover or alsike clover. Alsike clover is suitable for soils too wet for red clover. Timothy can be used in place of ryegrass, but ryegrass makes better feed for dairy cows. For pasture, a good mixture is orchardgrass and white clover, with or without Ladino clover. These mixtures are best for well drained or moderately well drained fertile soils.

For the well drained or moderately well drained alluvial soils, the following long-lived mixture for hay or pasture is good—English ryegrass, orchardgrass, red clover, and white Dutch clover (*3*). For the coarser textured soils, including the fine sandy loams and the gravelly soils, a mixture of orchardgrass, alta fescue, and white Dutch clover will do better. A suitable pasture mixture on alluvial soils may consist of perennial ryegrass, orchardgrass, alta fescue, white Dutch clover, and alsike clover.

These mixtures may also be sown on soils that have poor natural drainage but are adequately drained artificially. If drainage is not well established, ryegrass should be omitted from the mixture. For areas where the water table remains high throughout most of the year, meadow foxtail, alta fescue, and white Dutch clover are best. This mixture is also good for poorly drained areas in the uplands. Where drainage is impractical, reed canarygrass can be grown for hay or pasture. This grass will also do well on uplands wherever there is adequate moisture.

For upland soils underlain by cemented or fine-textured glacial drift or unconsolidated bedrock, a pasture and hay mixture may consist of the following grasses and legumes: alta fescue, orchardgrass, white Dutch clover, and red clover. For pasture only, a mixture of subterranean clover, creeping red fescue, orchardgrass, and perennial ryegrass is good. These two mixtures are also suited to the medium-textured terrace soils that are underlain by glacial outwash. The mixtures suitable for the well-drained alluvial soils may also be used.

If droughty soils are used for pasture, a good mixture consists of creeping red fescue, orchardgrass, red clover, and white Dutch clover. For areas that can be used for pasture only during spring and fall, a mixture of creeping red fescue and subterranean clover may be used. Tall oatgrass in a hay mixture is also suited to dry sites.

Flat pea is a good forage crop on logged-off, rough, or untillable soils. It can compete successfully with the native vegetation. Stump lands and other partially cleared woodland pasture have a high carrying capacity if stands of grasses and legumes are established and competition from the native vegetation is kept to a minimum.

Seeding.—Grasses, clovers, or mixtures can be seeded in February, or earlier if moisture conditions permit. They can be seeded at the same time the spring nurse crop is seeded or immediately afterward. Grasses may be seeded up to September 1, but clover may be winterkilled if not seeded in spring. If the soils are irrigated, grass and clover mixtures may be seeded any time between February 15 and September 1. In unirrigated areas, alfalfa should be seeded between May 15 and June 15; in irrigated areas it can be seeded up to September 1.

Pastures should be reseeded when the stands become thin. The seedbed must be fairly free of weeds. Growing cultivated or annual crops the previous year will help to reduce the number of weeds or the sod binding. The seedbed for grasses and legumes must be fine and firmly packed. A loose, rough, or cloddy seedbed results in uneven and poor stands.

Fertilizer.—The amendments most needed are nitrogen, phosphorus, and organic matter. The need for potassium depends upon previous management and the response of crops to potash. Lime, if needed, should be applied 3 to 6 months before seeding. The rate will depend on the degree of acidity and the texture of the soil. The sandy soils require less lime than the silt loams or silty clay loams. Limestone is commonly applied for alfalfa.

Large amounts of nitrogen increase the amount of grass and reduce the amount of legumes. Legumes respond to phosphate, potash, and calcium. A well-balanced fertilizer will maintain a desirable proportion of grasses and legumes. The benefit that soils derive from fertilizer depends partly upon an adequate supply of moisture.

Pasture management.—Pastures should be stocked to capacity but not overstocked. Overgrazing causes weak-

ening of plants and promotes the growth of weeds. Good pasture-management practices include dragging to spread droppings uniformly, periodic clipping to destroy weeds and remove undesirable tough forage, and grazing in rotation. Each pasture should have a rest period of 2 to 4 weeks, depending on the vigor of the plants. As a shortage of soil moisture cuts down the yield very quickly, irrigation is a common practice on some soils.

Cutting and harvesting.—Because of showery weather in June, the first cutting of hay may not be of high quality. However, if the first crop is used for silage, it is possible to cut earlier and get a second crop of better quality later when the weather is better. Grass for silage should be cut in spring when the grass grows faster than the livestock use it. This saves feed that would otherwise be wasted by trampling. It also prevents the growth of undesirable grasses and weeds.

A high-quality livestock feed with very little wastage can be obtained by dehydrating freshly cut hay. Hay for this purpose should be cut several times a season and immediately dehydrated.

Management Groups

The soils and miscellaneous land types of Skagit County are placed in management groups on the basis of characteristics that determine their similarity in use suitability and management needs. Suitable crops are given along with suggested fertilization and other management. The crops are not necessarily equally well suited to each soil in a group. The suggested fertilization is in general terms only.

Soil tests will aid in determining the kinds and amounts of fertilizer needed. More specific information on fertilization can be obtained from the county agent, the Agricultural Experiment Station, the Soil Conservation Service, or any persons who have an adequate knowledge of the soils of the county.

The general suggestions on fertilization were based principally on Bulletin No. 386 (revised) February 1950, Fertilizer for Western Washington, published by the Extension Service, State College of Washington, Pullman, Washington (7). This bulletin, as well as more recent publications, should be consulted for more detailed information.

Management group 1

This group consists of the following gravelly, moderately coarse textured to medium textured, droughty soils underlain by glacial till.

Alderwood gravelly sandy loam, 0 to 3 percent slopes.
Alderwood gravelly sandy loam, 3 to 8 percent slopes.
Alderwood gravelly sandy loam, 8 to 15 percent slopes.
Alderwood gravelly sandy loam, shallow, 0 to 3 percent slopes.
Alderwood gravelly sandy loam, shallow, 3 to 8 percent slopes.
Alderwood gravelly sandy loam, shallow, 8 to 15 percent slopes.
Alderwood gravelly loam, 0 to 3 percent slopes.
Alderwood gravelly loam, 3 to 8 percent slopes.
Alderwood gravelly loam, 8 to 15 percent slopes.
Cagey gravelly fine sandy loam, 0 to 3 percent slopes.
Cagey gravelly fine sandy loam, 3 to 8 percent slopes.
Cagey gravelly sandy loam, moderately shallow, 0 to 3 percent slopes.
Cagey gravelly sandy loam, moderately shallow, 3 to 8 percent slopes.
Cagey gravelly sandy loam, moderately shallow, 8 to 15 percent slopes.
Skiyou gravelly loam, 3 to 8 percent slopes.
Skiyou gravelly loam, 8 to 15 percent slopes.
Squalicum gravelly silt loam, 0 to 3 percent slopes.
Squalicum gravelly silt loam, 3 to 8 percent slopes.
Squalicum gravelly silt loam, 8 to 15 percent slopes.

Suitable crops

Grasses and grass-legume mixtures (largely for pasture); clovers and vetches; oats for hay; strawberries.

Suitable rotations

Green-manure crops should precede strawberries, which may be grown for 4 years. The soils are better suited to hay and pasture than to rotation crops.

Suggested fertilization and other management

Grasses and grass-legume mixtures (largely for pasture): A complete fertilizer, or manure with phosphate only. Broadcast early in spring.

Clovers and vetches: For new stands, a complete fertilizer; for old stands, phosphate and potash. Broadcast early in spring.

Oats for hay: Manure and phosphate, or nitrogen and phosphate. Apply nitrogen or manure early in spring and phosphate at time of seeding.

Strawberries: A complete fertilizer; for new plantings, manure or a cover crop plowed under before planting time.

Management group 2

In this group are the following medium-textured, well-drained soils underlain by bedrock:

Cathcart loam, 3 to 8 percent slopes.
Cathcart loam, 8 to 15 percent slopes.
Cathcart clay loam, 3 to 8 percent slopes.
Cathcart gravelly loam, 3 to 8 percent slopes.
Cathcart gravelly loam, 8 to 15 percent slopes.
Heisler gravelly loam, 3 to 8 percent slopes.
Heisler gravelly loam, 8 to 15 percent slopes.
Oso loam, 3 to 8 percent slopes.
Oso loam, 8 to 15 percent slopes.

Suitable crops

Grasses and grass-legume mixtures (largely for pasture); clovers and vetches; oats for hay; strawberries.

Suitable rotations

These soils are not generally suited to rotation crops because of their location in remote areas.

Suggested fertilization and other management

Grasses and grass-legume mixtures (largely for pasture): A complete fertilizer or manure and phosphate. Apply early in spring.

Clovers and vetches: For old stands, phosphate and potash; for new stands, a complete fertilizer. Apply early in spring.

Oats for hay: Manure and phosphate or nitrogen and phosphate. Apply nitrogen or manure early in spring; phosphate at time of seeding.

Strawberries: A complete fertilizer; for new plantings, manure or a cover crop plowed under before planting.

Management group 3

This group consists of the following moderately coarse textured and medium textured, somewhat excessively drained soils underlain by loose glacial drift.

Everett gravelly sandy loam, 0 to 3 percent slopes.
Everett gravelly sandy loam, 3 to 8 percent slopes.

Everett gravelly sandy loam, 8 to 15 percent slopes.
Everett cobbly sandy loam, 0 to 3 percent slopes.
Indianola loamy sand, 3 to 8 percent slopes.
Indianola loamy sand, 8 to 15 percent slopes.
Indianola sandy loam, 3 to 8 percent slopes.
Klaus gravelly sandy loam, 0 to 3 percent slopes.
Klaus gravelly sandy loam, 3 to 8 percent slopes.
Klaus gravelly sandy loam, 8 to 15 percent slopes.
Klaus gravelly loam, 0 to 3 percent slopes.
Klaus gravelly loam, 3 to 8 percent slopes.
Klaus gravelly loam, 8 to 15 percent slopes.
Klaus sandy loam, 0 to 3 percent slopes.
Klaus sandy loam, 3 to 8 percent slopes.
Klaus sandy loam, 8 to 15 percent slopes.
Thornwood gravelly loam, 0 to 3 percent slopes.
Thornwood gravelly loam, 3 to 8 percent slopes.
Thornwood gravelly loam, 8 to 15 percent slopes.
Thornwood gravelly sandy loam, 0 to 3, percent slopes.
Thornwood gravelly sandy loam, 3 to 8 percent slopes.
Thornwood gravelly sandy loam, 8 to 15 percent slopes.

Suitable rotations

Not suitable for rotation crops. Cleared areas should be kept in permanent pasture of grasses and legumes. A few low-lying areas that have a higher moisture-supplying capacity may be suited to hay, particularly the Indianola sandy loam and the Thornwood gravelly loams.

Management group 4

This group consists of the following coarse, moderately coarse, and medium textured, somewhat excessively drained soils underlain by loose glacial outwash.

Greenwater loamy sand, 0 to 3 percent slopes.
Greenwater loamy sand, 3 to 8 percent slopes.
Greenwater loamy sand, 8 to 15 percent slopes.
Greenwater sandy loam, 0 to 3 percent slopes.
Lynden sandy loam, 0 to 3 percent slopes.
Lynden sandy loam, 3 to 8 percent slopes.
Lynden loamy sand, 0 to 3 percent slopes.
Lynden loamy sand, 3 to 8 percent slopes.
Lynden loamy sand, 8 to 15 percent slopes.
Lynden loam, 0 to 3 percent slopes.
Lynden loam, 3 to 8 percent slopes.
Lynden gravelly loam, 0 to 3 percent slopes.
Lynden gravelly loam, 3 to 8 percent slopes.
Skykomish gravelly sandy loam, 3 to 8 percent slopes.
Skykomish gravelly sandy loam, 8 to 15 percent slopes.

Suitable crops

Grasses and grass-legume mixtures (largely for pasture); clovers and vetches; strawberries; forest only for the Lynden loamy sand and the Skykomish gravelly sandy loams. The other soils in this group have limited use for cultivated crops.

Suitable rotations

A green-manure crop, then strawberries or legumes and grasses. Strawberries, 3 to 5 years; hay or pasture, 3 to 5 years.

Suggested fertilization and other management

For grasses and grass-legume mixtures (largely for pasture): A complete fertilizer, or manure and phosphate. Apply early in spring.

Clovers and vetches: For old stands, phosphate and potash; to establish new stands, a complete fertilizer. Apply early in spring.

Strawberries: A complete fertilizer. Apply manure or plow under a cover crop before planting.

Management group 5

This group consists of the following medium-textured, well-drained to poorly drained soils underlain by fine-textured glacial till or glacial lake materials.

Bow silt loam, 0 to 3 percent slopes.
Bow silt loam, 3 to 8 percent slopes.
Bow silt loam, 8 to 15 percent slopes.
Bow silt loam, shallow, 0 to 3 percent slopes.
Bow silt loam, shallow, 3 to 8 percent slopes.
Bow gravelly loam, 0 to 3 percent slopes.
Bow gravelly loam, 3 to 8 percent slopes.
Bow gravelly loam, 8 to 15 percent slopes.
Bow loam, 0 to 3 percent slopes.
Bow loam, shallow, 0 to 3 percent slopes.
Bow loam, 3 to 8 percent slopes.
Coveland gravelly loam, 0 to 3 percent slopes.
Coveland gravelly loam, 3 to 8 percent slopes.
Coveland silt loam, 0 to 3 percent slopes.
Coveland gravelly silt loam, 3 to 8 percent slopes.
Saxon silt loam, 3 to 8 percent slopes.
Saxon silt loam, 8 to 15 percent slopes.

Suitable crops

Grasses and grass-legume mixtures; clovers and vetches; oats for grain or hay. The Coveland and Saxon soils are suited to peas, wheat, potatoes, and strawberries.

Suitable rotations

Hay or pasture, 2 to 5 years, followed by oats. Green-manure crop should be plowed under before reseeding to legumes and grasses.

Suggested fertilization and other management

Grasses and grass-legume mixtures: A complete fertilizer or manure and phosphate. Broadcast early in spring.

Clovers and vetches: For old stands, phosphate and potash; for new stands, a complete fertilizer. Apply early in spring.

Oats for grain or hay: Manure and phosphate, or phosphate and nitrogen. Apply manure and nitrogen early in spring and phosphate at time of seeding.

Management group 6

This group consists of the following medium-textured, predominantly well drained to moderately well drained soils of the terraces underlain by glacial outwash.

Corkindale loam, 0 to 3 percent slopes.
Corkindale loam, 3 to 8 percent slopes.
Corkindale loam, 8 to 15 percent slopes.
Giles silt loam, 0 to 3 percent slopes.
Giles silt loam, 8 to 15 percent slopes.
Giles loam, 0 to 3 percent slopes.
Giles loam, 3 to 8 percent slopes.
Gilligan silt loam, 0 to 3 percent slopes.
Gilligan silt loam, moderately shallow, 0 to 3 percent slopes.
Gilligan loam, 0 to 3 percent slopes.
Gilligan gravelly loam, moderately shallow, 0 to 3 percent slopes.
Sauk loam, 0 to 3 percent slopes.
Sauk loam, 3 to 8 percent slopes.

Suitable crops

Grasses and grass-legume mixtures; clovers and vetches; alfalfa (not suitable for the Corkindale soils); oats for hay or grain; strawberries; raspberries.

Suitable rotations

Hay or pasture, 2 to 5 years; row or field crops, 1 year. Alfalfa, 5 to 7 years, or a green-manure crop for 1 year,

and a field or row crop for 1 or 2 years. Strawberries, 4 years; field or row crop, 2 years; and a green-manure crop, 1 year.

Suggested fertilization and other management

Grasses and grass-legume mixtures: A complete fertilizer. Apply early in spring.

Clovers and vetches: For old stands, phosphate and potash; for new stands, a complete fertilizer. Apply early in spring.

Alfalfa: For old stands, nitrogen and phosphate; for new stands, a complete fertilizer.

Oats for hay or grain: Manure and phosphate, or nitrogen and phosphate. Apply phosphate at time of seeding.

Strawberries: A complete fertilizer. Apply in spring and after harvest. Apply manure or plow under a cover crop before planting.

For raspberries, manure and phosphate or a complete fertilizer. Apply in fall or early in spring.

Management group 7

In this group are the following poorly drained soils that need artificial drainage. Except for the Tisch soil, they are underlain by glacial drift.

Bellingham silt loam, 0 to 2 percent slopes.
Bellingham silt loam, 2 to 5 percent slopes.
Bellingham silt loam, light colored variant, 0 to 3 percent slopes.
Bellingham silty clay loam, 0 to 2 percent slopes.
Bellingham silty clay loam, 2 to 5 percent slopes.
Bellingham clay, 0 to 2 percent slopes.
Bellingham clay loam, light colored variant, 0 to 3 percent slopes.
Norma silt loam, 0 to 2 percent slopes.
Norma silt loam, 2 to 5 percent slopes.
Norma loam, 0 to 2 percent slopes.
Norma silty clay loam, 0 to 2 percent slopes.
Tisch silty clay loam, 0 to 1 percent slopes.

Suitable crops

Grasses and grass-legume mixtures; oats for hay or grain. Permanent pasture best for the Bellingham clay.

Suitable rotations

Hay or pasture, 2 or more years; row crops, 2 years.

Suggested fertilization and other management

Grasses and grass-legume mixtures: A complete fertilizer. Apply early in spring.

Oats for hay or grain: A complete fertilizer. Apply in spring.

Management group 8

This group consists of somewhat excessively drained to moderately well drained alluvial soils that are underlain by coarse-textured alluvium. They are occasionally flooded and can be irrigated. The Pilchuck soils on 0 to 3 percent slopes are very droughty and frequently flooded.

Belfast silt loam, 0 to 3 percent slopes.
Coveland silt loam, moderately well drained variant, 0 to 3 percent slopes.
Kline silt loam, 1 to 3 percent slopes.
Kline loam, 1 to 3 percent slopes.
Kline loam, 3 to 8 percent slopes.
Kline gravelly loam, 1 to 3 percent slopes.
Kline gravelly loam, 3 to 8 percent slopes.
Kline sandy loam, 1 to 3 percent slopes.
Neptune sandy loam, 0 to 3 percent slopes.
Pilchuck fine sand, 0 to 3 percent slopes.
Pilchuck loamy sand, 0 to 3 percent slopes.
Pilchuck sandy loam, 0 to 3 percent slopes.
Pilchuck gravelly sand, 0 to 3 percent slopes.
Puyallup fine sandy loam, 0 to 3 percent slopes.
Puyallup loam, 0 to 3 percent slopes.
Puyallup silt loam, 0 to 3 percent slopes.
Wickersham shaly loam, 0 to 3 percent slopes.
Wickersham shaly loam, 3 to 8 percent slopes.
Wickersham shaly silt loam, 0 to 3 percent slopes.
Wickersham shaly silt loam, 3 to 8 percent slopes.

Suitable crops

Grasses and grass-legume mixtures; clovers and vetches; alfalfa; oats for hay or grain; strawberries; potatoes; peas; raspberries; vegetable-seed crops (most suitable for silt loams).

Suitable rotations

Strawberries, 4 years; oats, 1 year; row crops, 2 years; green-manure crops, 1 year; or alfalfa, 5 to 7 years; a green-manure crop, 1 year; field or row crops, 1 or 2 years; or any combination of suitable crops including green-manure crops, hay, or pasture or other soil-building crops for half the time. Permanent pasture only for the Pilchuck fine sand, Pilchuck loamy sand, and Pilchuck sandy loam.

Suggested fertilization and other management

Grasses and grass-legume mixtures: A complete fertilizer or manure and phosphate. Apply fertilizer early in spring.

Clovers and vetches: For old stands, phosphate and potash; for new stands, a complete fertilizer. Apply early in spring.

Alfalfa: For old stands, nitrogen and phosphate; for new stands, a complete fertilizer. Apply at time of seeding.

Oats for hay or grain: Manure and phosphate or a complete fertilizer. Apply in spring.

Strawberries: Manure or a cover crop plowed under before planting and a complete fertilizer applied in spring and after harvest.

Potatoes: For seed potatoes, a complete fertilizer with or without manure; for commercial potatoes, a complete fertilizer without manure.

Peas: Phosphate, with or without manure; or phosphate and potash.

Raspberries: Manure and phosphate; or a complete fertilizer. Apply in spring.

Vegetable-seed crops: A complete fertilizer.

Management group 9

The soils of this group are improved by artificial drainage. They are the following imperfectly drained to well drained soils that are underlain by medium textured alluvium.

Puget fine sandy loam, 0 to 3 percent slopes.
Puyallup loamy sand over Puget soil material, 0 to 3 percent slopes.
Sultan silt loam, 0 to 3 percent slopes.
Sultan loam, 0 to 3 percent slopes
Sultan fine sandy loam, 0 to 3 percent slopes.
Sultan loamy sand, 0 to 3 percent slopes.

Suitable crops

Grasses and grass-legume mixtures; clovers and vetches; alfalfa; small grains for hay or grain; strawberries; peas; potatoes; vegetable-seed crops.

Suitable rotations

Any combination of suitable crops that will keep the soils in soil-building crops at least half the time.

Suggested fertilization and other management

Grasses and grass-legume mixtures: A complete fertilizer, or manure and phosphate. Apply early in spring.

Clovers and vetches: For old stands, nitrogen and phosphate; for new stands, a complete fertilizer. Apply early in spring.

Alfalfa: For old stands, nitrogen and phosphate; for new stands, a complete fertilizer. Apply in fall or early in spring.

Small grains for hay or grain: Manure and phosphate, or a complete fertilizer. Apply at time of seeding.

Strawberries: Manure or a cover crop plowed under before planting, and a complete fertilizer. Apply in spring and after harvest.

Peas: Phosphate with or without manure; or potash and phosphate with or without manure.

Potatoes: For seed potatoes, a complete fertilizer; for commercial potatoes, a complete fertilizer with or without manure. If manure is used, apply to previous crop.

Vegetable-seed crops: A complete fertilizer.

Management group 10

The soils of this group need artificial drainage. They are the following poorly drained soils derived from alluvial materials.

Cokedale silt loam, 0 to 3 percent slopes.
Cokedale silt loam over Puyallup soil material, 0 to 3 percent slopes.
Cokedale loam, 0 to 3 percent slopes.
Cokedale sandy loam, 0 to 3 percent slopes.
Cokedale silty clay loam, 0 to 3 percent slopes.
Cokedale silty clay loam over Puyallup soil material, 0 to 3 percent slopes.
Hovde loamy sand, 0 to 1 percent slopes.
Lummi silt loam, 0 to 1 percent slopes.
Lummi silty clay loam, 0 to 1 percent slopes.
Nookachamps silty clay loam, 0 to 2 percent slopes.
Nookachamps silt loam, 0 to 2 percent slopes.
Puget silt loam, 0 to 1 percent slopes.
Puget silty clay loam, 0 to 1 percent slopes.
Puget loam, 0 to 1 percent slopes.
Samish silty clay loam, 0 to 1 percent slopes.
Samish silt loam, 0 to 1 percent slopes.
Snohomish silt loam, 0 to 1 percent slopes.
Snohomish silty clay loam, 0 to 1 percent slopes.
Sumas silt loam, 0 to 1 percent slopes.
Sumas silt loam, shallow, 0 to 1 percent slopes.
Sumas silt loam, deep, 0 to 1 percent slopes.
Sumas silty clay loam, 0 to 1 percent slopes.
Thornton clay, 0 to 2 percent slopes.
Thornton silty clay loam, 0 to 2 percent slopes.
Woodinville silt loam, 0 to 1 percent slopes.

Suitable crops

Grasses and grass-legume mixtures; clovers and vetches; small grains for hay or grain; peas; strawberries; vegetables for seed—turnip, cabbage, beets, spinach, and rutabagas—(grown mostly on the Puget and Sumas soils); potatoes (commercial or seed). Permanent pasture best for the Hovde and Thornton soils. The following soils are commonly not sufficiently well drained for all the crops listed. They are limited to shallow-rooted crops or hay or pasture. They are: Cokedale silty clay loam, 0 to 3 percent slopes, Cokedale silty clay loam over Puyallup soil material, 0 to 3 percent slopes, Lummi silt loam, 0 to 1 percent slopes, Lummi silty clay loam, 0 to 1 percent slopes, Nookachamps silty clay loam, 0 to 2 percent slopes, Sumas silty clay loam, 0 to 1 percent slopes, Thornton silty clay loam, 0 to 2 percent slopes.

Suitable rotations

Strawberries, 4 years; oats, 1 year; row crops, 2 years; and a green-manure crop, 1 year; or any combination of suitable crops that keep the soils in soil-building crops at least half the time.

Suggested fertilization and other management

Grasses and grass-legume mixtures: A complete fertilizer, or manure and phosphate. Apply early in spring

Clovers and vetches: For old stands, phosphate and potash; for new stands, a complete fertilizer. Apply early in spring.

Small grains for hay or grain: Manure and phosphate, or a complete fertilizer. Apply at time of seeding.

Peas: Phosphate and potash, with or without manure. Avoid contact of potash with seed. Placement of fertilizer is recommended.

Strawberries: Manure or a cover crop plowed under before planting and a complete fertilizer applied in spring and after harvest.

Vegetables for seed: For turnip, cabbage, beets, spinach, and rutabagas, heavy applications of complete fertilizers.

Potatoes: For seed potatoes, a complete fertilizer; for commercial potatoes, a complete fertilizer with or without manure. Apply manure to previous crop and apply fertilizer at time of seeding.

Management group 11

The soils of this group need artificial drainage. They are the following very poorly drained organic soils:

Carbondale muck, 0 to 1 percent slopes.
Carbondale muck, shallow, 0 to 1 percent slopes.
Greenwood peat, 0 to 1 percent slopes.
Mukilteo peat, 0 to 1 percent slopes.
Mukilteo peat, shallow, 0 to 1 percent slopes.
Rifle peat, 0 to 1 percent slopes.
Rifle peat, shallow, 0 to 1 percent slopes.
Semiahmoo muck, 0 to 1 percent slopes.
Semiahmoo muck, shallow, 0 to 1 percent slopes.
Tanwax peat, 0 to 1 percent slopes.
Tanwax peat, shallow, 0 to 1 percent slopes.

Suitable crops

Grasses and grass-legume mixtures; oats for hay; blackberries; boysenberries; loganberries; youngberries; blueberries; vegetables; potatoes. The only crop suitable for Greenwood peat is cranberries. The Tanwax peats are best used for permanent pasture.

Suitable rotations

No rotation needed for truck and berry crops. If soils are not drained, use only water-tolerant grasses. Soil-building crops should be grown at least half the time.

Suggested fertilization and other management

Grasses and grass-legume mixtures: A complete fertilizer with or without manure. Nitrogen may be omitted. Apply in spring.

Oats for hay: A complete fertilizer. Apply at time of seeding.

Blackberries, boysenberries, loganberries, and youngberries: A complete fertilizer or manure and phosphate. Apply in spring.

Blueberries: Phosphate and potash, with or without nitrogen. Apply in spring.

Vegetables: Heavy applications of complete fertilizers.

Potatoes: A complete fertilizer, with or without manure. Apply manure to previous crop; apply fertilizer at time of seeding.

Management group 12

This group consists of the following hilly, steep, or stony soils and miscellaneous land types:

Alderwood gravelly sandy loam, 15 to 30 percent slopes.
Alderwood gravelly sandy loam, 30 to 45 percent slopes.
Alderwood gravelly sandy loam, shallow, 15 to 30 percent slopes.
Alderwood gravelly loam, 15 to 30 percent slopes.
Alderwood gravelly loam, 30 to 45 percent slopes.
Bow silt loam, 15 to 30 percent slopes.
Bow silt loam, 30 to 45 percent slopes.
Bow gravelly loam, 15 to 30 percent slopes.
Bow gravelly loam, 30 to 45 percent slopes.
Bow loam, 15 to 30 percent slopes.
Cathcart loam, 15 to 30 percent slopes.
Cathcart loam, 30 to 60 percent slopes.
Cathcart gravelly loam, 15 to 30 percent slopes.
Cathcart stony loam, 8 to 15 percent slopes.
Cathcart stony loam, 15 to 30 percent slopes.
Cathcart stony loam, 30 to 60 percent slopes.
Coastal beach, 0 to 3 percent slopes.
Corkindale loam, 15 to 30 percent slopes.
Corkindale loam, 30 to 45 percent slopes.
Everett gravelly sandy loam, 15 to 30 percent slopes.
Everett gravelly sandy loam, 30 to 45 percent slopes
Fidalgo rocky loam, 8 to 15 percent slopes.
Fidalgo rocky loam, 15 to 30 percent slopes.
Fidalgo rocky loam, 30 to 45 percent slopes.
Heisler stony loam, 15 to 30 percent slopes.
Heisler stony loam, 30 to 45 percent slopes.
Heisler gravelly loam, 15 to 30 percent slopes.
Indianola loamy sand, 15 to 30 percent slopes.
Indianola loamy sand, 30 to 45 percent slopes.
Klaus gravelly sandy loam, 15 to 30 percent slopes.
Klaus gravelly loam, 15 to 30 percent slopes.
Klaus sandy loam, 15 to 30 percent slopes.
Made land.
Marblemount stony loam, 15 to 30 percent slopes.
Oso loam, 15 to 30 percent slopes.
Oso loam, 30 to 60 percent slopes.
Riverwash, 0 to 3 percent slopes.
Rough broken land.
Rough mountainous land, Cathcart soil material.
Rough mountainous land, Heisler soil material.
Rough mountainous land, Marblemount soil material.
Rough mountainous land, Oso soil material.
Rough rocky land.
Saxon silt loam, 15 to 30 percent slopes.
Skiyou gravelly loam, 15 to 30 percent slopes.
Skiyou gravelly loam, 30 to 45 percent slopes.
Skykomish gravelly sandy loam, 15 to 30 percent slopes.
Skykomish cobbly sandy loam, 0 to 3 percent slopes.
Skykomish cobbly sandy loam, 3 to 8 percent slopes.
Skykomish cobbly sandy loam, 8 to 15 percent slopes.
Skykomish cobbly sandy loam, 15 to 30 percent slopes.
Squalicum gravelly silt loam, 15 to 30 percent slopes.
Squalicum gravelly silt loam, 30 to 45 percent slopes.
Thornwood gravelly sandy loam, 15 to 30 percent slopes.
Thornwood gravelly sandy loam, 30 to 45 percent slopes.
Thornwood gravelly loam, 15 to 30 percent slopes.
Tidal marsh, 0 to 1 percent slopes.

These hilly, steep, and stony soils are suited only to forest. The miscellaneous land types are not suited to forest. Coastal beach and Riverwash materials can be used for construction.

Estimated Yields

Good management practices will help to conserve the soil, improve the quality of crops, and increase their yield. Table 3 shows the estimated average yields to be expected over a period of years. Yields in columns A represent those to be expected under management most commonly practiced on each soil; those in columns B are to be expected under such practices of good management as are related in this section. The yields given are for adequately drained areas and for well-cleared fields.

Formation and Classification of Soils

In table 4, the soil series in Skagit County are listed by soil orders and great soil groups and some of the factors in the formation of each series are described.

Factors of Soil Formation

The nature of a soil depends upon the effects of a combination of five major factors—climate, parent material, living organisms, relief, and time. All five of these factors come into play in the formation of every soil. The relative importance of each differs from place to place. It is possible, but not common, for one factor to dominate in the formation of a soil and to fix most of its properties. Generally, it is the interaction of the five factors that determine the character of each soil.

The soils of Skagit County are extremely variable because there is a wide range in climate, relief, and drainage and because they developed from many different kinds of parent material.

Climate.—Climate directly influences soil formation through its effect on the weathering of rocks, the removal and deposition of materials by water, wind, and glaciers, and the moisture in the soil. Indirectly it influences the soil to an even greater degree through its effect upon vegetation.

The present-day climate of Skagit County is a maritime or somewhat modified continental type influenced by winds from the Pacific Ocean. It is characterized by fairly cool, dry summers and mild, moist winters. Both temperature and precipitation vary considerably from place to place. The average annual temperature is about 50° F. As a rule, the amount of rainfall increases from west to east. The differences in rainfall result in significant differences in soils that have developed from similar parent materials. The average yearly rainfall at Anacortes is 26.60 inches, and at Concrete, 60.79 inches. At higher elevations east of Concrete, the amount of rainfall is much greater. Most of the rain falls between October and March. The summers are therefore especially dry. The pattern of rainfall in the county has probably had a decided effect on characteristics of the soils. The rain falls gently and effectively moistens the soil. The relative humidity is about 80 percent for much of the year, but for short periods during the summer it may drop to 50 or lower.

Some snow falls at the lower elevations, but it remains on the ground for only a few days. At higher elevations, where the temperature falls below freezing and the ground is frozen for long periods, snow remains for several months. At lower elevations the soil is seldom frozen below the surface crust.

Parent material.—The three kinds of parent material in the surveyed part of the county are (1) glacial drift, (2) residuum from bedrock, and (3) alluvium.

TABLE 3.—*Estimated average acre yields of crops to be expected over a period of years and rating for pasture and forest*

[Yields in columns A are to be expected under management most commonly practiced; those in columns B are to be expected under better than average management. Dashed lines indicate that soil is generally not used for the crop]

Soil	Clover and grass hay		Oat hay		Oats		Wheat		Peas (green)		Potatoes		Strawberries		Pasture	Forest
	A	B	A	B	A	B	A	B	A	B	A	B	A	B		
	Tons	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*		
Alderwood gravelly sandy loam, 0 to 3 percent slopes	1¾	2¼	2	2½	25	30							2,000	2,300	Fair	Good.
Alderwood gravelly sandy loam, 3 to 8 percent slopes	1¾	2¼	1¾	2¼	25	30							1,800	2,200	Fair	Good.
Alderwood gravelly sandy loam, 8 to 15 percent slopes	1½	2	1½	2	20	25							1,600	2,000	Fair	Good.
Alderwood gravelly sandy loam, 15 to 30 percent slopes															Poor	Good.
Alderwood gravelly sandy loam, 30 to 45 percent slopes																Fair.
Alderwood gravelly sandy loam, shallow, 0 to 3 percent slopes	1½	2	1¾	2¼											Fair	Poor.
Alderwood gravelly sandy loam, shallow, 3 to 8 percent slopes	1½	2	1¾	2¼											Fair	Poor.
Alderwood gravelly sandy loam, shallow, 8 to 15 percent slopes	1⅓	1¾	1½	2											Fair	Poor.
Alderwood gravelly sandy loam, shallow, 15 to 30 percent slopes															Poor	Poor.
Alderwood gravelly loam, 0 to 3 percent slopes	2	2½	2¼	2¾	30	35							2,200	2,500	Fair	Good.
Alderwood gravelly loam, 3 to 8 percent slopes	2	2½	2¼	2¾	30	35							2,000	2,400	Fair	Good.
Alderwood gravelly loam, 8 to 15 percent slopes	1¾	2¼	2	2½	25	30							1,800	2,200	Fair	Good.
Alderwood gravelly loam, 15 to 30 percent slopes															Poor	Good.
Alderwood gravelly loam, 30 to 45 percent slopes															Not suitable	Poor.
Belfast silt loam, 0 to 3 percent slopes	3¼	4½	3½	4⅔	75	85	40	50	2,700	3,500			3,900	4,500	Very good	Excellent.
Bellingham silt loam, 0 to 2 percent slopes	2¾	3¼	2¾	3½	65	75									Very good	Fair.
Bellingham silt loam, 2 to 5 percent slopes	2¾	3¼	2¾	3½	65	75									Very good	Fair.
Bellingham silt loam, light colored variant, 0 to 3 percent slopes	2⅔	3⅓	2¾	3½											Very good	Fair.
Bellingham silty clay loam, 0 to 2 percent slopes	2½	2⅔	2½	2⅔	60	70									Very good	Fair.
Bellingham silty clay loam, 2 to 5 percent slopes	2½	2⅔	2½	2⅔	60	70									Very good	Fair.
Bellingham clay, 0 to 2 percent slopes	1¾	2	1¾	2											Good	Poor.
Bellingham clay loam, light colored variant, 0 to 3 percent slopes	2¾	3½	3	3¾											Very good	Fair.
Bow silt loam, 0 to 3 percent slopes	2¾	3¼	2½	3	50	65									Good	Good.
Bow silt loam, 3 to 8 percent slopes	2¾	3¼	2½	3	50	65									Good	Good.
Bow silt loam, 8 to 15 percent slopes	2½	3	2¼	2¾	40	55									Good	Good.
Bow silt loam, 15 to 30 percent slopes															Poor	Good.
Bow silt loam, 30 to 45 percent slopes															Not suitable	Fair.
Bow silt loam, shallow, 0 to 3 percent slopes	2	2½	2	2½	35	50									Fair	Fair.
Bow silt loam, shallow, 3 to 8 percent slopes	2	2½	2	2½	35	50									Fair	Fair.
Bow gravelly loam, 0 to 3 percent slopes	2⅔	3¼	2¼	2⅔	40	55									Good	Good.
Bow gravelly loam, 3 to 8 percent slopes	2⅔	3¼	2¼	2⅔	40	55									Good	Good.
Bow gravelly loam, 8 to 15 percent slopes	2¼	2¾	2	2½	30	45									Good	Good.
Bow gravelly loam, 15 to 30 percent slopes															Poor	Good.
Bow gravelly loam, 30 to 45 percent slopes																Fair.
Bow loam, 0 to 3 percent slopes	2⅔	3¼	2⅓	2¾	45	60									Good	Good.
Bow loam, 3 to 8 percent slopes	2⅔	3¼	2⅓	2¾	45	60									Good	Good.
Bow loam, 15 to 30 percent slopes															Poor	Good.
Bow loam, shallow, 0 to 3 percent slopes	2	2½	2	2½	35	50									Fair	Fair.
Cagey gravelly fine sandy loam, 0 to 3 percent slopes	1¾	2¼	2	2½	25	30							2,000	2,300	Fair	Good.
Cagey gravelly fine sandy loam, 3 to 8 percent slopes	1¾	2¼	2	2½	25	30							2,000	2,300	Fair	Good.

Cagey gravelly sandy loam, moderately shallow, 0 to 3 percent slopes	1⅔	2	1¾	2⅓	20	25							1,800	2,200	Fair	Good.
Cagey gravelly sandy loam, moderately shallow, 3 to 8 percent slopes	1⅔	2	1¾	2⅓	20	25							1,800	2,200	Fair	Good.
Cagey gravelly sandy loam, moderately shallow, 8 to 15 percent slopes	1½	2	1⅔	2	20	25							1,600	2,000	Fair	Good.
Carbondale muck, 0 to 1 percent slopes	3½	4¼	3¼	4	80	90									Excellent	Good.
Carbondale muck, shallow, 0 to 1 percent slopes	3½	4¼	3¼	4	75	85									Excellent	Good.
Cathcart loam, 3 to 8 percent slopes	2⅔	3½	2½	3	50	65									Good	Very good.
Cathcart loam, 8 to 15 percent slopes	2½	3	2¼	2¾	45	60									Good	Very good.
Cathcart loam, 15 to 30 percent slopes															Poor	Very good.
Cathcart loam, 30 to 60 percent slopes																Good.
Cathcart clay loam, 3 to 8 percent slopes	2¾	3½	2⅔	3¼	55	70									Good	Very good.
Cathcart gravelly loam, 3 to 8 percent slopes															Fair	Very good.
Cathcart gravelly loam, 8 to 15 percent slopes															Fair	Very good.
Cathcart gravelly loam, 15 to 30 percent slopes																Very good.
Cathcart stony loam, 8 to 15 percent slopes																Very good.
Cathcart stony loam, 15 to 30 percent slopes																Very good.
Cathcart stony loam, 30 to 60 percent slopes																Good.
Coastal beach, 0 to 3 percent slopes																
Cokedale silt loam, 0 to 3 percent slopes	3¼	4½	3½	5	75	85			2,800	3,600			3,600	4,000	Excellent	Very good.
Cokedale silt loam over Puyallup soil material, 0 to 3 percent slopes	3¼	4½	3½	5	75	85			2,800	3,600			3,600	4,000	Excellent	Very good.
Cokedale loam, 0 to 3 percent slopes	3¼	4½	3½	5	75	85			2,800	3,600			3,600	4,000	Excellent	Very good.
Cokedale sandy loam, 0 to 3 percent slopes															Very good	Good.
Cokedale silty clay loam, 0 to 3 percent slopes	3	4	3¼	4½	65	75							3,400	3,800	Very good	Good.
Cokedale silty clay loam over Puyallup soil material, 0 to 3 percent slopes	3¼	4½	3½	5	75	85			2,800	3,600			3,600	4,000	Excellent	Very good.
Corkindale loam, 0 to 3 percent slopes			1¼	1½											Fair	
Corkindale loam, 3 to 8 percent slopes			1¼	1½											Fair	Very good.
Corkindale loam, 8 to 15 percent slopes			1	1⅓											Fair	Very good.
Corkindale loam, 15 to 30 percent slopes																Very good.
Corkindale loam, 30 to 45 percent slopes																Good.
Coveland gravelly loam, 0 to 3 percent slopes	2¾	3½	2¾	3½	55	75									Very good	Good.
Coveland gravelly loam, 3 to 8 percent slopes	2¾	3½	2¾	3½	55	75									Very good	Good.
Coveland silt loam, 0 to 3 percent slopes	3	3¾	3	3¾	65	85									Very good	Good.
Coveland silt loam, moderately well drained variant, 0 to 3 percent slopes	2¾	3¼	3	3¾											Good	
Coveland gravelly silt loam, 3 to 8 percent slopes	3	3¾	3	3¾	65	85									Very good	Good.
Everett gravelly sandy loam, 0 to 3 percent slopes															Poor	Fair.
Everett gravelly sandy loam, 3 to 8 percent slopes															Poor	Fair.
Everett gravelly sandy loam, 8 to 15 percent slopes															Poor	Fair.
Everett gravelly sandy loam, 15 to 30 percent slopes																Fair.
Everett gravelly sandy loam, 30 to 45 percent slopes																Poor.
Everett cobbly sandy loam, 0 to 3 percent slopes																Fair.
Fidalgo rocky loam, 8 to 15 percent slopes																Good.
Fidalgo rocky loam, 15 to 30 percent slopes																Good.
Fidalgo rocky loam, 30 to 45 percent slopes																Fair.
Giles silt loam, 0 to 3 percent slopes	2¾	3¼	2⅔	3⅔	60	75							2,600	3,000	Very good	Excellent.
Giles silt loam, 8 to 15 percent slopes	2½	3	2⅓	3½	50	65							2,200	2,500	Very good	Excellent.
Giles loam, 0 to 3 percent slopes	2⅔	3	2½	3¼	55	70							2,500	2,800	Very good	Excellent.
Giles loam, 3 to 8 percent slopes	2⅔	3	2½	3	55	70							2,500	2,800	Very good	Excellent.
Gilligan silt loam, 0 to 3 percent slopes	2¾	3¼	2⅔	3⅔	60	75							2,600	3,000	Very good	Excellent.
Gilligan silt loam, moderately shallow, 0 to 3 percent slopes	2¼	2¾	2	3	45	55							2,300	2,600	Very good	Excellent.
Gilligan loam, 0 to 3 percent slopes	2⅔	3	2½	3¼	55	70							2,500	2,800	Very good	Excellent.
Gilligan gravelly loam, moderately shallow, 0 to 3 percent slopes	2¼	2¾	1¾	2¼	40	50							2,000	2,300	Very good	Excellent.
Greenwater loamy sand, 0 to 3 percent slopes																Fair.
Greenwater loamy sand, 3 to 8 percent slopes																Fair.
Greenwater loamy sand, 8 to 15 percent slopes																Fair.
Greenwater sandy loam, 0 to 3 percent slopes																Good.
Greenwood peat, 0 to 1 percent slopes																
Heisler stony loam, 15 to 30 percent slopes																Very good.

TABLE 3.—*Estimated average acre yields of crops to be expected over a period of years and rating for pasture and forest*—Continued

[Yields in columns A are to be expected under management most commonly practiced; those in columns B are to be expected under better than average management. Dashed lines indicate that soil is generally not used for the crop]

Soil	Clover and grass hay		Oat hay		Oats		Wheat		Peas (green)		Potatoes		Strawberries		Pasture	Forest
	A	B	A	B	A	B	A	B	A	B	A	B	A	B		
	Tons	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*		
Heisler stony loam, 30 to 45 percent slopes																Good.
Heisler gravelly loam, 3 to 8 percent slopes																Very good.
Heisler gravelly loam, 8 to 15 percent slopes																Very good.
Heilser gravelly loam, 15 to 30 percent slopes																Very good.
Hovde loamy sand, 0 to 1 percent slopes															Poor	
Indianola loamy sand, 3 to 8 percent slopes	1	1½													Poor	Good.
Indianola loamy sand, 8 to 15 percent slopes	1	1½													Poor	Good.
Indianola loamy sand, 15 to 30 percent slopes																Good.
Indianola loamy sand, 30 to 45 percent slopes																Fair.
Indianola sandy loam, 3 to 8 percent slopes	1½	1¾	1½	1¾											Fair	Good.
Klaus gravelly sandy loam, 0 to 3 percent slopes																Good.
Klaus gravelly sandy loam, 3 to 8 percent slopes																Good.
Klaus gravelly sandy loam, 8 to 15 percent slopes																Good.
Klaus gravelly sandy loam, 15 to 30 percent slopes																Good.
Klaus gravelly loam, 0 to 3 percent slopes															Fair	Good.
Klaus gravelly loam, 3 to 8 percent slopes															Fair	Good.
Klaus gravelly loam, 8 to 15 percent slopes															Fair	Good.
Klaus gravelly loam, 15 to 30 percent slopes																Good.
Klaus sandy loam, 0 to 3 percent slopes																Good.
Klaus sandy loam, 3 to 8 percent slopes																Good.
Klaus sandy loam, 8 to 15 percent slopes																Good.
Klaus sandy loam, 15 to 30 percent slopes																Good.
Kline silt loam, 1 to 3 percent slopes	3¼	4½	3½	4⅔	75	85							3, 900	4, 500	Very good	Very good.
Kline loam, 1 to 3 percent slopes	3	4	3¼	4½	70	80							3, 700	4, 300	Very good	Very good.
Kline loam, 3 to 8 percent slopes	3	4	3¼	4½	70	80							3, 700	4, 300	Very good	Very good.
Kline gravelly loam, 1 to 3 percent slopes	2½	3	2¾	3½	55	65							3, 200	3, 800	Very good	Very good.
Kline gravelly loam, 3 to 8 percent slopes	2½	3	2¾	3½	55	65							3, 200	3, 800	Very good	Very good.
Kline sandy loam, 1 to 3 percent slopes																Very good.
Lummi silt loam, 0 to 1 percent slopes	3	4¼	3½	4½	80	90									Excellent	Poor.
Lummi silty clay loam, 0 to 1 percent slopes	2¾	4	3	4	70	80									Excellent	Poor.
Lynden sandy loam, 0 to 3 percent slopes	1½	1¾	1½	1¾									2, 000	2, 400	Fair	Good.
Lynden sandy loam, 3 to 8 percent slopes	1½	1¾	1½	1¾									2, 000	2, 400	Fair	Good.
Lynden loamy sand, 0 to 3 percent slopes															Poor	Good.
Lynden loamy sand, 3 to 8 percent slopes															Poor	Good.
Lynden loamy sand, 8 to 15 percent slopes															Poor	Good.
Lynden loam, 0 to 3 percent slopes	1¾	2	1¾	2									2, 200	2, 500	Fair	Good.
Lynden loam, 3 to 8 percent slopes	1¾	2	1¾	2									2, 200	2, 500	Fair	Good.
Lynden gravelly loam, 0 to 3 percent slopes	1½	1¾	1½	1¾									2, 000	2, 400	Fair	Good.
Lynden gravelly loam, 3 to 8 percent slopes	1½	1¾	1½	1¾									2, 000	2, 400	Fair	Good.
Made land																
Marblemount stony loam, 15 to 30 percent slopes																Very good.
Mukilteo peat, 0 to 1 percent slopes	2¾	3¼	2⅔	3½	70	80									Very good	Poor.
Mukilteo peat, shallow, 0 to 1 percent slopes	2¾	3¼	2⅔	3½	65	75									Very good	Poor.
Neptune sandy loam, 0 to 3 percent slopes															Good	Poor.
Nookachamps silty clay loam, 0 to 2 percent slopes	3	4¼	3⅓	4⅓	75	90			3, 200	4, 200					Excellent	Good.
Nookachamps silt loam, 0 to 2 percent slopes	3¼	4¼	3½	4½	80	95			3, 400	4, 400					Excellent	Good.
Norma silt loam, 0 to 2 percent slopes	2¾	3¼	2⅔	3											Very good	Good.
Norma silt loam, 2 to 5 percent slopes	2¾	3¼	2⅔	3											Very good	Good.
Norma loam, 0 to 2 percent slopes	2¾	3¼	2⅔	3											Very good	Good.
Norma silty clay loam, 0 to 2 percent slopes	2⅔	3	2½	2¾											Very good	Good.
Oso loam, 15 to 30 percent slopes																Very good.

Oso loam, 30 to 60 percent slopes																Very good.
Oso loam, 3 to 8 percent slopes																Very good.
Oso loam, 8 to 15 percent slopes																Very good.
Pilchuck fine sand, 0 to 3 percent slopes															Poor	Poor.
Pilchuck loamy sand, 0 to 3 percent slopes															Poor	Poor.
Pilchuck sandy loam, 0 to 3 percent slopes															Poor	Poor.
Pilchuck gravelly sand, 0 to 3 percent slopes															Poor	Poor.
Puget silt loam, 0 to 1 percent slopes	3¾	4½	3¾	4½	85	95	55	70	3, 500	4, 500	250	300	3, 700	4, 000	Excellent	Very good.
Puget silty clay loam, 0 to 1 percent slopes	3⅔	4⅓	3⅔	4⅓	80	90	50	60	3, 200	4, 200	230	280	3, 500	3, 800	Excellent	Very good.
Puget loam, 0 to 1 percent slopes	3¾	4½	3¾	4½	85	95	55	70	3, 500	4, 500	250	300	3, 700	4, 000	Excellent	Very good.
Puget fine sandy loam, 0 to 3 percent slopes	3¼	4	3¼	4	80	90	50	60	2, 800	3, 400	260	310	3, 800	4, 000	Very good	Very good.
Puyallup fine sandy loam, 0 to 3 percent slopes	3	3¾	2¾	3½	50	70	35	50	2, 600	3, 000	250	300	3, 600	4, 000	Very good	Very good.
Puyallup loamy sand over Puget soil material, 0 to 3 percent slopes	3	3¾	3	3¾			40	50	2, 400	2, 800			3, 200	3, 600	Very good	Very good.
Puyallup loam, 0 to 3 percent slopes	3¼	4	3½	4	60	80	40	60	2, 800	3, 400	250	300	3, 800	4, 200	Excellent	Very good.
Puyallup silt loam, 0 to 3 percent slopes	3⅓	4¼	3⅔	4½	75	90	50	70	3, 000	3, 600	260	310	4, 000	4, 500	Excellent	Very good.
Rifle peat, 0 to 1 percent slopes	3	4	2¾	3¾	75	85									Excellent	Good.
Rifle peat, shallow, 0 to 1 percent slopes	3	4	2¾	3¾	70	80									Excellent	Good.
Riverwash, 0 to 3 percent slopes																
Rough broken land																Fair.
Rough mountainous land, Cathcart soil material																Very good.
Rough mountainous land, Heisler soil material																Very good.
Rough mountainous land, Marblemount soil material																Very good.
Rough mountainous land, Oso soil material																Very good.
Rough rocky land																Variable.
Samish silty clay loam, 0 to 1 percent slopes	3	4	3	4	70	80									Very good	Good.
Samish silt loam, 0 to 1 percent slopes	3¼	4¼	3¼	4¼	75	85			3, 300	4, 200			3, 500	3, 800	Very good	Very good.
Sauk loam, 0 to 3 percent slopes	2⅔	3	2½	3½											Good	Excellent.
Sauk loam, 3 to 8 percent slopes	2⅔	3	2½	3½											Good	Excellent.
Saxon silt loam, 3 to 8 percent slopes															Good	Excellent.
Saxon silt loam, 8 to 15 percent slopes															Good	Excellent.
Saxon silt loam, 15 to 30 percent slopes																Excellent.
Semiahmoo muck, 0 to 1 percent slopes	3¼	4	3	3¾	75	85									Excellent	Poor.
Semiahmoo muck, shallow, 0 to 1 percent slopes	3¼	4	3	3¾	70	80									Excellent	Poor.
Skiyou gravelly loam, 3 to 8 percent slopes	1¾	2¼	2	2½											Fair	Good.
Skiyou gravelly loam, 8 to 15 percent slopes	1½	2	1¾	2¼											Fair	Good.
Skiyou gravelly loam, 15 to 30 percent slopes																Good.
Skiyou gravelly loam, 30 to 45 percent slopes																Fair.
Skykomish gravelly sandy loam, 3 to 8 percent slopes															Poor	Fair.
Skykomish gravelly sandy loam, 8 to 15 percent slopes															Poor	Fair.
Skykomish gravelly sandy loam, 15 to 30 percent slopes																Fair.
Skykomish cobbly sandy loam, 0 to 3 percent slopes																Fair.
Skykomish cobbly sandy loam, 3 to 8 percent slopes																Fair.
Skykomish cobbly sandy loam, 8 to 15 percent slopes																Fair.
Skykomish cobbly sandy loam, 15 to 30 percent slopes																Fair.
Snohomish silt loam, 0 to 1 percent slopes	3½	4¼	3¾	4½	85	95	55	70	3, 500	4, 500	250	300			Excellent	Very good.
Snohomish silty clay loam, 0 to 1 percent slopes	3⅓	4¼	3⅔	4⅓	80	90	50	60	3, 200	4, 200	230	280			Excellent	Very good.
Squalicum gravelly silt loam, 0 to 3 percent slopes	1¾	2¼	2	2½	25	30									Fair	Good.
Squalicum gravelly silt loam, 3 to 8 percent slopes	1¾	2¼	2	2½	25	30									Fair	Good.
Squalicum gravelly silt loam, 8 to 15 percent slopes	1½	2	1¾	2¼	20	25									Fair	Good.
Squalicum gravelly silt loam, 15 to 30 percent slopes															Poor	Good.
Squalicum gravelly silt loam, 30 to 45 percent slopes																Fair.
Sultan silt loam, 0 to 3 percent slopes	3½	4½	3¾	4½	85	95	55	70	3, 800	4, 800	250	300	4, 000	4, 500	Excellent	Excellent.
Sultan loam, 0 to 3 percent slopes	3⅓	4⅓	3⅔	4⅓	80	90	50	60	3, 600	4, 600	250	300	3, 800	4, 200	Excellent	Excellent.

TABLE 3.—*Estimated average acre yields of crops to be expected over a period of years and rating for pasture and forest*—Continued

[Yields in columns A are to be expected under management most commonly practiced; those in columns B are to be expected under better than average management
Dashed lines indicate that soil is generally not used for the crop]

Soil	Clover and grass hay		Oat hay		Oats		Wheat		Peas (green)		Potatoes		Strawberries		Pasture	Forest
	A	B	A	B	A	B	A	B	A	B	A	B	A	B		
	Tons	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*		
Sultan fine sandy loam, 0 to 3 percent slopes	3¼	4	3¼	3¾	70	80	45	55	3, 400	4, 200	225	275	3, 800	4, 200	Very good	Excellent.
Sultan loamy sand, 0 to 3 percent slopes	2½	3	2½	3					3, 000	3, 600			3, 600	4, 000	Very good	Very good.
Sumas silt loam, 0 to 1 percent slopes	3¾	4½	3¾	4½	85	95	55	70	3, 700	4, 800	250	300	3, 800	4, 200	Excellent	Very good.
Sumas silt loam, shallow, 0 to 1 percent slopes	3½	4	3½	4	75	85	45	55	3, 500	4, 600	250	300	3, 800	4, 200	Excellent	Very good.
Sumas silt loam, deep, 0 to 1 percent slopes	3¾	4½	3¾	4½	85	95	55	70	3, 700	4, 800	250	300	3, 700	4, 000	Excellent	Very good.
Sumas silty clay loam, 0 to 1 percent slopes	3⅔	4⅓	3⅔	4⅓	80	90	50	60	3, 500	4, 500	230	280	3, 600	3, 900	Excellent	Very good.
Tanwax peat, 0 to 1 percent slopes																Poor.
Tanwax peat, shallow, 0 to 1 percent slopes																Poor.
Thornton clay, 0 to 2 percent slopes															Fair	Fair.
Thornton silty clay loam, 0 to 2 percent slopes															Fair	Fair.
Thornwood gravelly loam, 0 to 3 percent slopes	1½	2													Fair	Good.
Thornwood gravelly loam, 3 to 8 percent slopes	1½	2													Fair	Good.
Thornwood gravelly loam, 8 to 15 percent slopes															Fair	Good.
Thornwood gravelly loam, 15 to 30 percent slopes																Good.
Thornwood gravelly sandy loam, 0 to 3 percent slopes															Poor	Good.
Thornwood gravelly sandy loam, 3 to 8 percent slopes															Poor	Good.
Thornwood gravelly sandy loam, 8 to 15 percent slopes															Poor	Good.
Thornwood gravelly sandy loam, 15 to 30 percent slopes																Good.
Thornwood gravelly sandy loam, 30 to 45 percent slopes																Fair.
Tidal marsh, 0 to 1 percent slopes															Poor	Poor.
Tisch silty clay loam, 0 to 1 percent slopes															Good	Poor.
Wickersham shaly loam, 0 to 3 percent slopes	2	2½	2¼	2¾											Good	Good.
Wickersham shaly loam, 3 to 8 percent slopes	2	2½	2¼	2¾											Good	Good.
Wickersham shaly silt loam, 0 to 3 percent slopes	2¼	2¾	2⅓	3											Very good	Good.
Wickersham shaly silt loam, 3 to 8 percent slopes	2¼	2¾	2⅓	3											Very good	Good.
Woodinville silt loam, 0 to 1 percent slopes	3⅔	4½	3¾	4½	80	90	50	65	3, 400	4, 200	230	280			Excellent	Good.

TABLE 4.—*Soil series classified by higher categories, and some of the factors that have contributed to their development*

ZONAL

Great soil groups and series	Relief	Natural drainage	Parent material
Podzols:			
Greenwater	Nearly level to sloping	Somewhat excessive	Sandy mixed material influenced by pumice.
Heisler	Undulating to steep	Good	Glacial till influenced by mica-schist, shale, and argillite.
Klaus	Nearly level to hilly	Somewhat excessive	Gravelly glacial drift.
Marblemount	Hilly	Good	Weathered granitic material.
Sauk	Nearly level to gently sloping.	Good	Sandy and silty glacial outwash.
Brown Podzolic soils:			
Alderwood	Nearly level to steep	Good	Cemented coarse-textured glacial till.
Cagey	Nearly level to rolling	Moderately good	Glacial outwash over cemented till.
Cathcart	Undulating to steep	Good	Glacial material overlying sandstone and shale.
Corkindale	Nearly level to steep	Good to somewhat excessive.	Glacial outwash or till.
Everett	Nearly level to steep	Somewhat excessive	Gravelly drift.
Fidalgo	Rolling to steep	Good to moderately good.	Glacial drift overlying serpentine.
Giles	Nearly level to sloping	Good	Clayey or silty sediment over sandy, glacial outwash.
Gilligan	Nearly level	Moderately good	Sandy and silty glacial outwash influenced by mica-schist.
Indianola	Undulating to steep	Somewhat excessive	Sandy glacial drift.
Lynden	Nearly level to rolling	Somewhat excessive	Sandy glacial outwash.
Oso	Undulating to steep	Good	Glacial drift overlying argillite bedrock.
Saxon [1]	Undulating to hilly	Good	Silty glacial-lake sediments.
Skiyou	Undulating to steep	Good	Cemented, medium-textured glacial till containing mica-schist.
Skykomish	Nearly level to hilly	Somewhat excessive	Cobbly glacial outwash.
Squalicum	Nearly level to steep	Good	Cemented, medium-textured glacial till.
Thornwood	Nearly level to steep	Somewhat excessive	Gravelly glacial drift containing mica-schist.

INTRAZONAL

Planosols:			
Bow	Nearly level to steep	Imperfect	Compact, fine-textured till with embedded gravel or glacial-lake sediments.
Humic Gley soils:			
Bellingham	Nearly level to gently sloping.	Poor	Fine-textured glacial-lake or marine sediments.
Coveland	Nearly level to gently sloping.	Poor	Compact, fine-textured till, sediments reworked and deposited in marine and glacial lakes.
Hovde	Level	Poor	Coastal beach.
Lummi	Level	Poor	Mixed delta deposits including glacial flour.
Nookachamps	Nearly level	Poor	Fine-textured mixed alluvial material washed from glacial uplands.
Norma	Level to gently sloping	Poor	Sandy glacial drift.
Puget	Level	Poor	Fine-textured mixed alluvial material including glacial flour.
Samish	Level	Poor	Alluvial material, dominantly mica-schist, talc, and argillite.
Snohomish	Level	Poor	Mixed material including glacial flour over peat.
Sumas	Level	Poor	Fine-textured mixed alluvial material including glacial flour overlying sand.
Thornton	Level	Poor	Talc and mica materials.
Tisch	Nearly level	Poor	Diatomaceous earth.
Woodinville	Level	Poor	Stratified, mixed alluvial and peaty material.
Bog:			
Carbondale muck	Level	Very poor	Woody accumulations.
Greenwood peat	Level	Very poor	Moss accumulations.
Mukilteo peat	Level	Very poor	Sedge accumulations and sedimentary material.
Rifle peat	Level	Very poor	Dominantly woody accumulations.
Semiahmoo muck	Level	Very poor	Sedge accumulations.
Tanwax peat	Level	Very poor	Sedimentary accumulations.

[1] The Saxon soils have some characteristics of the Podzols.

TABLE 4.—*Soil series classified by higher categories, and some of the factors that have contributed to their development*—Con.

AZONAL

Great soil groups and series	Relief	Natural drainage	Parent material
Alluvial soils:			
Belfast	Nearly level	Moderately good to good	Dominantly glacial material.
Cokedale	Nearly level	Imperfect	Dominantly mica-schist, talc, and argillite.
Kline	Very gently sloping to gently sloping.	Good	Dominantly glacial material.
Neptune	Nearly level	Good	Coastal beach and marine shells.
Pilchuck	Nearly level	Somewhat excessive	Mixed sandy sediments and glacial flour.
Puyallup	Nearly level	Good	Mixed material including glacial flour.
Sultan	Nearly level	Moderately good	Mixed material including glacial flour.
Wickersham	Nearly level to gently sloping.	Good	Mica-schist; some shale, and argillite.

According to Bretz (*1*), glacial material was deposited in this area by at least two continental glaciers of the Pleistocene Epoch. The material consists mostly of the pre-Wisconsin Admiralty till and the Wisconsin Vashon till. The two kinds of till are separated by peat and stratified sediments, partly marine. Exposures of Admiralty till are rare, and probably none of the soils have developed from it. Between the Admiralty and Vashon glaciations the area was uplifted and eroded; then it sank. Probably the major features of relief and drainage were established during that period. In the higher mountains, however, the relief may have been established in preglacial time. Most of the glacial till in the mountain valleys in the eastern part of the county was deposited by alpine glaciers.

On many foot slopes, a thin layer of Vashon till covers glacier-scoured bedrock of the Cenozoic, Mesozoic, and Paleozoic eras, but in rough mountainous areas the soil material consists mostly of residuum.

The physical character of the glacial deposits varies considerably. In many places the deposits consist of gray, sandy material that is strongly cemented or partially cemented and embedded with many pebbles. In some places stones and cobblestones are common. These glacial materials were derived from granite, quartzite, argillite, shale, gneiss, and andesite, and to a lesser extent from basalt and schist. Considerable quantities of mica-schist occur in some areas, generally those near mountains where the bedrock is mica-schist. The parent materials of the Skiyou and Thornwood soils are particularly influenced by mica-schist.

In the lower areas of the uplands, clayey till is fairly extensive. It is gray and contains a few small pebbles. It is compact but not cemented. It appears to be younger than the sandier cemented till. Other glacial materials are sandy or very gravelly and loose. The mountainous areas in the western part of the county are underlain mostly by arkose sandstone and shale of the Cenozoic era. In the eastern part, the principal rocks are argillite, shale, and mica-schist of the Mesozoic and Paleozoic eras. In some areas the rock is Mesozoic granite. On the islands in the west, outcrops of dunite and serpentine are common. In the bottom lands, where most of the good agricultural soils occur, the parent material is recently deposited alluvium of varying texture and composition.

Living organisms.—The predominant vegetation under which the soils developed consisted of a dense growth of conifers and a ground cover of ferns, mosses, and vines. In areas where the conifers were not so dense, there were some deciduous trees and shrubs. In depressions and bottom lands, deciduous trees and brush were more common. Marshy flats and intermittently ponded areas supported sedges, mosses, reeds, and other water-loving plants. Deciduous vegetation is now more common than coniferous; in upland areas that have been logged, it is dominant.

Relief.—The relief, or lay of the land, is an important cause of differences among the soils of Skagit County. It ranges from level, on the flats of the Skagit River delta, to steep in the mountains of the Cascade Range. On the steep slopes of the mountains, the soils are shallow, stony, and extremely variable. In some of the level areas and depressions, water stands on the soil and the water table is high. The relief affects drainage, and drainage affects the formation of the soils.

Time.—It takes time for soils to develop from parent materials. Less time is required for distinct horizons to develop in cool humid regions than in arid regions, but in either kind of climate soils may develop at different rates. For example, in Skagit County, the alluvial soils of the bottom lands do not have distinct profiles because their materials were recently deposited.

Classification of Soils by Higher Categories

The highest category of soil classification is the order—zonal, intrazonal, or azonal. Soils of all three orders occur in Skagit County. Zonal soils have genetic horizons that reflect the predominant influence of climate and living organisms, chiefly vegetation. Intrazonal soils have genetic horizons that reflect the dominant influence of relief, parent material, or time. Because of the youth of the parent material, azonal soils have no well-developed horizons.

The next category generally used is the great soil group. Six great soil groups are represented in Skagit County. The zonal order is represented by Podzols and Brown Podzolic soils; the intrazonal order by Planosols, Humic Gley soils, and Bog soils; and the azonal order by Alluvial soils.

Throughout the well-drained, timbered uplands and terraces, zonal soils have developed. They are fairly light-colored Podzols and Brown Podzolic soils. They are associated with darker colored, highly organic intrazonal soils in poorly drained areas. Azonal soils have developed in nearly level stream bottoms and deltas.

Zonal soils

Zonal soils have well-developed soil characteristics that reflect the influence of the active factors of soil formation—climate and living organisms.

Podzols.—The Podzols in this county have a 1- to 3-inch mat of organic matter, which decomposes slowly and is mixed but little with the underlying soil material. They are characteristically light colored, shotty, and low in organic matter. The lower part is nearly black and generally is partially decomposed. The organic mat is extremely acid to very strongly acid; the pH ranges from 4.0 to 4.8. Below the mat is a thin, gray, leached, very strongly acid A_2 layer 1 to 2 inches thick. This A_2 horizon is characteristic of Podzols in undisturbed areas, but in most areas logging operations have destroyed it.

The upper part of the B horizon is generally light colored, shotty, and strongly acid. The lower part is lighter colored and less acid. The B_2 horizons are compact and weakly developed. They are generally less than 4 inches thick and contain lumps of weakly cemented ortstein. The transition to the layer below is gradual.

The rest of the profile is fairly uniform in texture and in color. It is shotty, coarse textured, and strongly acid. The color is strong brown, reddish brown, or yellowish brown. With depth, the profile becomes less acid, less shotty, coarser textured, and lighter colored.

In Skagit County, as well as in many other counties in the Puget Sound region, shot are considered to be a normal development. According to Wheeting (*8*) the shot form during the dry summer period. Very little leaching takes place during the summer, but soluble iron and aluminum compounds are precipitated around sand grains or other nuclei and are dehydrated. The shot pellets contain more sesquioxides and phosphorus than the soil material surrounding them. The dry period limits the general downward movement and retards the development of a distinct zone of illuviation, or B horizon. Wheeting concludes that the shot may represent an imperfect B horizon consisting of a scattered, ortsteinlike concentration of sesquioxides. As shot occur to some extent in excessively drained soils, the formation of shot cannot be attributed to imperfect drainage. Shot pellets are, however, significantly more numerous in soils that have slow internal drainage. They are more common in the Brown Podzolic soils than in the Podzols.

The Podzols in Skagit County are transitional between the Brown Podzolic soils and the strongly developed Podzols that occur in the higher mountains to the east where the precipitation is very high. They generally have, below the A_2 horizon, a B_2 horizon that is more pronounced and thicker than the B_2 horizon in Brown Podzolic soils. Because of the extremely irregular relief and the accompanying variable microclimate, there is wide variation in the degree of profile differentiation.

The following soils of the Podzol group have been mapped in the county: Marblemount, Heisler, Greenwater, Klaus, and Sauk.

The Marblemount soils have formed from weathered granite or granodiorite. In some areas these soils directly overlie the bedrock; in others they overlie colluvium. Outcrops of bedrock are numerous.

Profile description of Marblemount stony loam (NE¼NW¼ sec. 8, T. 35 N., R. 11 E.):

A_{00} 2 to 1¾ inches, loose forest litter consisting mostly of undecomposed fir needles and leaves.

A_0 1¾ to 0 inches, very dark grayish brown or very dark-brown,[3] loose, partly decomposed needles, leaves, wood fragments, moss, and roots; very strongly acid; lower part more decomposed and nearly black when moist; abrupt boundary.

A_2 0 to ½ inch, gray (10YR 6/1) to light brownish-gray (10YR 6/2) sandy loam; when moist, gray (10YR 5/1); single grained; very friable; very strongly acid; abrupt boundary.

B_{21} ½ to 4 inches, brown (7.5YR 5/3) loam; when moist, dark brown (7.5YR 4/3); weak subangular blocky structure; contains aggregates or lumps of dark reddish-brown very weakly cemented ortstein, some rounded shot, many small rock fragments and some stones; strongly acid to very strongly acid.

B_{22} 4 to 12 inches, brown (7.5YR 5/3) stony loam; when moist, dark brown (7.5YR 4/3); weak fine subangular blocky; friable; contains many small rock fragments and some shot; medium acid to strongly acid.

B_3 12 to 24 inches, light yellowish-brown (10YR 6/4) to yellowish-brown (10YR 5/4) stony loam; when moist, dark yellowish brown (10YR 4/4); weak medium subangular blocky structure; contains angular rock fragments and very little shot; friable; medium acid to strongly acid.

C 24 to 36 inches, pale-yellow to light brownish-gray or pale-brown sandy loam and partly decomposed granite or granodiorite; massive; firm; medium acid.

D_r 36 inches+, weathered granite or granodiorite bedrock.

The material from which the Heisler soils developed was derived mainly from mica-schist but includes some shale and argillite. The upper part of the profile is largely glacial material deposited by lobes of the Vashon glaciers or by alpine glaciers. Large areas of Heisler soils have been mapped in Whatcom County. Some of the lower lying areas of these soils have characteristics of the Brown Podzolic soils.

The Klaus soils were derived from coarse-textured gravelly drift deposited by alpine glaciers. The drift consists of mixed sedimentary and acidic and basic igneous materials. The Klaus are similar to the Skykomish but have a redder subsoil and are more acid and much less gravelly and cobbly.

Profile description of Klaus gravelly sandy loam (NW¼NW¼ sec. 31, T. 34 N., R. 10 E.):

A_0 1½ to 0 inch, very dark grayish brown (10YR 3/2) mat; when moist, very dark brown (10YR 2/2); highly decomposed conifer needles, leaves, and moss; loose covering of needles; extremely acid; abrupt transition to horizon below.

A_2 0 to 1 inch, gray (10YR 5/1) to light-gray (10YR 7/1) sandy loam; when moist, dark gray to gray (10YR 4/1–5/1); single grained; contains less fine-textured material than layers below; slightly less acid than layer above; abrupt transition to horizon below.

B_{21} 1 to 4 inches, reddish-brown (5YR 5/4) gravelly sandy loam; when moist, dark reddish brown (5YR 3/4); weak subangular blocky structure; firm or compact; contains lumps of weakly cemented ortstein, which are iron stained or darker reddish brown in color; contains very little shot; strongly acid; gradual transition to layer below.

[3] The profile colors given in this section are for dry soil unless otherwise designated.

B_{22} 4 to 10 inches, reddish-brown to yellowish-red (5YR 5/5) gravelly sandy loam; when moist, dark reddish brown (5YR 3/4); weak subangular blocky structure; friable to firm; medium acid to strongly acid; gradual transition to layer below.

B_3 10 to 20 inches, yellowish-red (5YR 5/8) to light yellowish-brown (10YR 6/4) gravelly sandy loam; when moist, strong brown (7.5YR 5/6) to dark yellowish brown (10YR 4/4); massive to very weak subangular blocky; friable; loose and structureless when removed; medium acid; abrupt boundary.

C_1 20 to 36 inches, pale-olive (5Y 6/4) and brownish-yellow (10YR 6/6) gravelly sand; when moist, olive (5Y 5/4) and yellowish brown (10YR 5/4); some gravel is stained with iron oxides; gravel is angular and subangular; single grained; loose; slightly acid; diffuse boundary.

C_2 36 inches+, similar to layer above but more olive colored; contains more gravel; in many places texture is sandy gravel; somewhat looser than layer above; slightly acid.

The Sauk series was correlated for the first time in Skagit County. Profile description of Sauk loam (SW¼SW¼ sec. 7, T. 35 N., R. 11 E.):

A_{00} 2 to 1¾ inches, organic litter consisting mostly of loose undecomposed fir needles.

A_0 1¾ to 0 inches, very dark grayish brown or very dark brown, loose, partially decomposed needles, leaves, wood fragments, moss, and roots; very strongly acid; the lower part is darker colored and more highly decomposed; abrupt lower boundary.

A_2 0 to ¼ inch, light-gray (10YR 7/1) loam; when moist, gray (10YR 5/1); single grained; friable; very strongly acid to extremely acid; very abrupt lower boundary.

B_{21} ¼ to 1 inch, reddish-brown (5YR 5/3) or dark reddish-gray (5YR 4/2) loam ortstein; when moist, dark reddish brown (5YR 3/4); contains a little shot; somewhat brittle, very weakly cemented; very strongly acid; discontinuous; 0 to 1½ inches thick.

B_{22} 1 to 3 inches, reddish-brown (5YR 5/3) to brown (7.5YR 5/4) loam; when moist, dark reddish brown (5YR 3/4); weak subangular blocky structure; contains a few, firm, darker, reddish lumps and varying amounts of shot; friable; very strongly acid.

B_{31} 3 to 18 inches, yellowish-red (5YR 5/6) loam; in some areas color of moist soil ranges from yellowish brown to reddish yellow when dry; when moist, yellowish red (5YR 4/6); nearly massive to weak fine subangular blocky structure; friable; contains some shot; medium acid to strongly acid.

B_{32} 18 to 36 inches, light yellowish-brown (10YR 6/4) to brownish-yellow (10YR 6/6) fine sandy loam or loam; when moist, dark yellowish brown (10YR 4/4); weak medium subangular blocky structure; firm in place; very little shot or none; medium acid.

C_{11} 36 to 48 inches, light yellowish-brown (10YR 6/4) fine sandy loam; when moist, yellowish brown (10YR 5/6); massive and firm in place but crumbles readily to single grains when removed; contains a few pebbles; medium acid to slightly acid.

C_{12} 48 inches +, sandy alluvial or outwash material; single grained; loose; gravelly in places.

The Greenwater soils have developed on river terraces from mixed sandy material that includes many fragments of pumice. They differ from the Sauk soils in containing pumice and in having a more porous and coarser textured profile.

Large areas of Podzols occur also in the Rough mountainous lands, where the soils are only generally differentiated.

Brown Podzolic soils.—The Brown Podzolic soils in this county are somewhat excessively drained to moderately well drained, and medium acid. They have a fairly thin, dark-colored organic layer over dark-brown or brown mineral material. In the lower part, the color grades to dark yellowish brown or yellowish brown. The boundary between the organic mat and the mineral soil is abrupt. There is no appreciable zone of accumulation of clay, organic colloids, or sesquioxides, but shot pellets 1/10 to ¼ inch in diameter occur, most abundantly in the upper 12 inches of the profile. The underlying material is cemented, coarse- or medium-textured till; coarse-textured outwash; loose, porous, coarse-textured drift; medium-textured lacustrine deposits; or bedrock.

The Brown Podzolic soils are only slightly podzolized. They have developed in regions that receive less rainfall and have milder winters than those in which the Podzols have developed. The organic mat is less acid than that of the Podzols, and the A_2 horizon is weakly developed or lacking.

In Skagit County, 16 soil series are classed as Brown Podzolic soils. Each developed from a different kind of parent material. The Alderwood, Squalicum, and Skiyou soils are underlain by cemented glacial till at depths of about 30 inches. The Cagey soils are underlain by cemented glacial till at depths of 4 to 5 feet. The Alderwood soils have developed from coarse-textured cemented till; the Squalicum from medium-textured cemented till; the Skiyou from medium-textured cemented till that contains much mica-schist; and the Cagey from glacial outwash overlying cemented glacial till.

Profile description of Alderwood gravelly sandy loam (SE¼SW¼ sec. 26, T. 34 N., R. 2 E.):

A_0 1½ to 0 inch, very dark grayish-brown (10YR 3/2) organic mat consisting mostly of fir and hemlock needles, some leaves, and moss; lower part highly decomposed and nearly black when moist; strongly acid to very strongly acid.

A_2 0 to ¼ inch, gray (10YR 6/1 to 5/1) sandy loam or loamy fine sand; when moist, dark gray (10YR 4/1); single grained; very friable; very strongly acid; abrupt boundary.

B_{21} ¼ to 4 inches, brown (10YR 5/3) gravelly sandy loam; when moist, dark brown (10YR 4/3 to 3/3); friable; contains some firm, strong-brown to dark reddish-brown, subangular blocky aggregates and small iron and manganese shot concretions 1/16 to ⅛ inch in diameter; strongly acid to medium acid.

B_{22} 4 to 12 inches, pale-brown (10YR 6/3) to light yellowish-brown (10YR 6/4) gravelly sandy loam; when moist, dark brown (10YR 4/3); very weak subangular blocky structure; very friable; contains shot; medium acid.

B_{31} 12 to 24 inches, light yellowish-brown (10YR 6/4) gravelly sandy loam; when moist, dark yellowish brown (10YR 4/4); single-grained; very friable; contains less shot than layer above; medium acid.

B_{32} 24 to 30 inches, similar to layer above but more compact and variable in color; contains a few faint streaks or mottles of gray, reddish brown, and yellow; very little shot; medium acid to slightly acid; plant roots form a mat in the lower part directly above the wavy underlying layer; abrupt transition to layer below.

C_{m1} 30 to 34 inches, pale-olive (5Y 6/3) or light olive-gray (5Y 6/2) gravelly sandy loam; when moist, olive (5Y 4/3); platy, cemented hardpan moderately mottled with brownish yellow, yellowish brown, and gray; slightly acid; a few roots penetrate cracks and spaces between horizontal plates.

C_{m2} 34 inches+, light-gray (5Y 7/1) gravelly sandy loam; when moist, olive gray (5Y 5/2); very few mottles; strongly cemented; when removed, can be crushed with the hands with difficulty; slightly acid.

The Skiyou series was correlated for the first time in Skagit County.

Profile description of Skiyou gravelly loam (NE¼SE¼ sec. 32, T. 35 N., R. 5 E.):

A_0 1½ to 0 inches, very dark grayish-brown (10YR 3/2) organic litter consisting mostly of fir and hemlock needles, leaves, wood fragments, moss, and roots; the lower part is more highly decomposed and mixed with some mineral matter; strongly acid to very strongly acid; abrupt boundary.

A_2 0 to ¼ inch, gray (10YR 6/1 to 5/1) fine sandy loam; when moist, dark gray (10YR 4/1); single grained; friable; discontinuous; very strongly acid; abrupt boundary.

B_{21} ¼ to 3 inches, light-brown (7.5YR 6/4) to brown (10YR 5/3) gravelly loam; when moist, reddish brown (5YR 4/4 or 5/4), weak subangular blocky structure; friable; contains some iron-stained, darker reddish-brown, firm lumps and a little shot; strongly acid; variable and discontinuous.

B_{22} 3 to 8 inches, pale-brown (10YR 6/3) to light-brown (7.5YR 6/4) gravelly loam; when moist, dark brown or dark yellowish brown (10YR 4/3 or 4/4); weak subangular blocky structure; friable; contains a litle shot and some schist; medium acid.

B_{23} 8 to 24 inches, light yellowish-brown (10YR 6/4) gravelly loam; when moist, yellowish brown to dark yellowish brown (10YR 5/4 to 4/4); weak subangular blocky structure; friable; contains a little shot and a few fragments of schist; very little shot in the lower part; medium acid.

B_3 24 to 28 inches, pale-olive (5Y 6/3) gravelly loam or sandy loam; when moist, olive (5Y 4/3); many, faint to distinct, yellow and brown mottles; weak subangular blocky structure; firm; contains considerable schistose material; mat of roots immediately above C layer; slightly acid to medium acid; abrupt boundary.

C_{m1} 28 to 36 inches, light olive-gray (5Y 6/2) or light-gray (5Y 7/2) gravelly sandy loam (glacial till); when moist, olive gray or dark gray (5Y 4/2 or 4/1); highly mottled with brown iron stains; cemented, compact; contains successive thin wavy fragments of plates, particularly in the upper part; slightly acid to neutral.

C_{m2} 36 inches+, light-gray (5Y 7/1) gravelly sandy loam to sandy clay loam; when moist, dark gray to olive gray (5Y 4/1 to 4/2); very few mottles; contains considerable but variable amounts of schistose material; strongly cemented; pockets or lenses of fine-textured micaceous material are common; neutral to slightly acid; many feet thick.

The Cathcart, Oso, and Fidalgo soils have developed from several kinds of bedrock and from a thin mantle of glacial material. The Cathcart soils are shallow over bedrock of soft or hard sandstone and shale, which is overlain by a thin, intermittent mantle of glacial drift derived from granite and other rocks. In places the glacial materials have modified the surface soil material, but the sandstone and shale have influenced most of the profile.

Areas of these soils at elevations higher than 1,000 feet show the effects of podzolization to a greater degree than areas at lower elevations. The Fidalgo soils are shallow and stony. They have developed from serpentinized bedrock and were influenced by varying amounts of glacial material. Rock outcrops are numerous, and the soils are closely associated with Rough rocky land. The Oso soils have developed mainly from dark-colored argillites.

The Saxon soils, which developed from lacustrine or silty glacial-lake sediments, are somewhat less well developed, partly because the materials have been more recently deposited and partly because of the more slowly permeable character of the laminated or varved materials. These soils occur in an area of moderately high rainfall, but they have not developed the characteristics of normal Podzols of the region. Areas are included, however, in which the upper part of the profile is very strongly acid and has a thin, leached, gray A_2 horizon.

The Giles and Gilligan soils are well drained to moderately well drained. They occupy, for the most part, nearly level glacial outwash terraces. They have developed from stratified sandy and silty outwash. The Gilligan soils differ in having been influenced by mica-schist and talc. These soils are closely associated with the Lynden soils, which have developed from sandier glacial outwash and are moderately shallow to the sandy substratum. The Gilligan series was correlated for the first time in Skagit County.

Profile description of Gilligan silt loam (SE¼SW¼ sec. 20, T. 35 N., R. 6 E.):

A_{00} and A_0 2 to 0 inches, very dark grayish-brown or very dark brown organic litter composed largely of fir needles, leaves, wood fragments, moss, and roots; the upper part is loose and largely undecomposed; the lower part is nearly black and more highly decomposed and is mixed with some mineral matter; strongly acid; abrupt boundary.

B_{21} 0 to 8 inches, light-brown (7.5YR 6/4) silt loam; when moist, dark brown to brown (7.5YR 4/4); weak subangular blocky structure; friable; contains a little shot; medium acid.

B_{22} 8 to 21 inches, pale-olive (5Y 6/3) silt loam; when moist, olive (5Y 5/3), in places variegated with olive gray; weak medium subangular blocky structure; friable to firm; contains some shot; medium acid.

B_{23} 21 to 36 inches, light-gray (5Y 7/2) silt loam; when moist, pale olive (5Y 6/3); faint yellow and brown mottles; very smooth and slightly greasy in feel; weak medium subangular blocky structure; firm; in places stratified with coarser and finer textured materials; strongly acid.

C_1 36 to 50 inches, pale-olive (5Y 6/3) sandy loam; when moist, olive (5Y 5/3); massive; very friable; contains some gravel and angular fragments of mica-schist and a few lenses of finer textured material; slightly acid.

C_2 50 inches+, stratified coarse-textured material containing some gravel and lenses of silts; massive.

The Everett, Thornwood, and Skykomish soils have developed from gravelly or cobbly outwash or drift. The Thornwood soils are strongly influenced by mica-schist. The Skykomish soils are more gravelly and cobbly than the Everett soils. The Indianola soils differ from the Everett soils in having developed from sandy glacial drift that is typically free of gravel.

The inextensive Corkindale soils occur in an area where slightly more than 60 inches of rain falls annually. The soils in this area have not developed the characteristic A_2 horizon that is common in the Podzols. It is believed that the limestone dust from a cement plant at Concrete a few miles to the west, has retarded the podzolization process. The organic litter is generally only slightly acid, but the surface soil is strongly and very strongly acid. The nearer the soils are to the cement plant, the less acid they are. In the vicinity of the plant, the soils are calcareous in the upper few inches.

The Corkindale soils have developed from glacial outwash or till that has been modified by local, or Cascade, glaciation. They are comparatively free of gravel in the upper part of the profile. All of these soils—Everett, Thornwood, Skykomish, Indianola, and Corkindale—are open and porous throughout and well drained to somewhat excessively drained. They are not strongly podzolized.

The Thornwood and Corkindale series were correlated for the first time in Skagit County.

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Profile description of Thornwood gravelly loam (NW¼NW¼ sec. 30, T. 36 N., R. 5 E.):

A_0 1½ to 0 inches, very dark brown or very dark grayish-brown organic litter composed of partially decomposed fir needles, leaves, roots, woody fragments, and moss; nearly black lower part is more highly decomposed and is mixed with some mineral matter; very strongly acid.

B_{21} 0 to 6 inches, pale-brown (10YR 6/3) gravelly loam; when moist, brown to dark-brown (10YR 4/3); weak subangular blocky structure; friable; contains a little shot; in places the uppermost 2 inches contains an incipient ortstein line, that generally is not continuous; strongly acid.

B_{22} 6 to 15 inches, light yellowish-brown (10YR 6/4) gravelly loam or gravelly sandy loam; when moist, dark yellowish brown (10YR 4/4); weak subangular blocky structure; friable; contains less shot than layer above; contains a few fragments of mica-schist; medium acid.

B_3 15 to 22 inches, pale-olive (5Y 6/4) or light olive-gray (5Y 6/2) gravelly sandy loam; when moist, olive (5Y 5/4) or yellowish brown (10YR 5/4); single grained; very friable; contains scattered fragments of mica-schist; slightly acid to medium acid.

C 22 inches +, olive, dark-gray, gray, very pale brown, and light-gray loose sandy gravel; single grained; contains variable amounts of schist fragments; many feet deep; color is more olive with depth; considerable variation in amount of gravel, which is partly subangular and angular; slightly acid.

Profile description of Corkindale loam (SW¼SE¼ sec. 27, T. 35 N., R. 9 E.):

A_{00} 2 to 1¾ inches, loose forest litter consisting mostly of fir needles and leaves.

A_0 1¾ to 0 inches, very dark grayish-brown or very dark gray (10YR 3/2 or 10YR 3/1) fibrous organic litter consisting of partially decomposed fir needles, leaves, wood fragments, moss, and roots; slightly acid to medium acid; abrupt transition to layer below.

B_{21} 0 to 3 inches, reddish brown (5YR 5/4) loam; when moist, dark reddish brown (5YR 3/4); moderate fine subangular blocky structure; contains small shot and lumps of iron-stained orterde or weakly cemented ortstein; strongly acid to very strongly acid.

B_{22} 3 to 12 inches, reddish-brown (5YR 5/3) loam; when moist, reddish brown to yellowish red (5YR 4/4 to 4/6); weak fine subangular blocky structure; friable: contains a few pebbles and as much shot as, or more than, the layer above; medium acid to strongly acid.

B_{23} 12 to 20 inches, light yellowish-brown (10YR 6/4) to light reddish-brown (5YR 6/4) gravelly loam containing only a little shot; when moist, dark yellowish brown (10YR 4/4); friable; weak fine subangular blocky structure; medium to strongly acid; the change to the substratum is generally quite clear.

C_1 20 to 38 inches, pale-olive (5Y 6/4) or light yellowish-brown (10YR 6/4) gravelly sand; colors when moist, include olive and pale olive (5Y 4/4 and 6/3) light gray, gray, and dark gray; contains some cobblestones; single grained; loose; slightly acid.

C_2 38 inches +, similar to layer above but has less olive and pale olive colors and is more gravelly; many feet thick; shows some stratification.

Intrazonal soils

Intrazonal soils have been dominantly influenced by relief, age, or parent material rather than by climate and vegetation.

The intrazonal soils of Skagit County are in three great soil groups—Humic Gley soils, Bog soils, and Planosols. The Humic Gley soils occupy poorly drained areas in the glacial uplands, terraces, and flood plains. The Bog soils occupy very poorly drained areas or ponded basins. The Planosols occupy imperfectly drained areas of compact clayey till.

Humic Gley soils.—The Bellingham, Coveland, and Norma soils occur on terraces or in the glacial uplands. Except for the Coveland, these soils have developed under a dense growth of deciduous trees, conifers, brush, and other water-tolerant vegetation. The plants have contributed large quantities of organic residues that are high in bases. The Coveland soils developed under native grass and brush and are also high in organic matter. All of these soils are characterized by a dark-colored solum. The substratum is of different textures and is dominantly gray or olive gray in color. It has many brown, yellow, yellowish-brown, and gray mottles. These colors result from changes in moisture conditions, which, in poorly drained soils, cause successive reduction, oxidation, and hydration.

The Bellingham soils have developed from fine-textured glacial-lake or marine sediments. The Coveland soils are similar to the Bellingham but were derived from clay till that was reworked by marine or glacial-lake waters. The Norma soils, on the other hand, have developed from more permeable, coarse-textured glacial materials, which are underlain by sandy or gravelly glacial till.

The Coveland soils occupy nearly level to very gently sloping concave areas, which receive considerable seepage, rather than basins or distinct depressions such as the other two series occupy. Surface drainage is very slow, and internal drainage is slow because of the shallowness to the fine-textured compact parent material.

The following profile of Bellingham silt loam, observed in the NW¼SE¼ sec. 20, T. 34 N., R. 4 E., is representative of the Humic Gley soils.

A_1 0 to 10 inches, dark-gray (10YR 4/1) silt loam; when moist; very dark gray (10YR 3/1); moderate coarse granular structure; friable; high in organic matter; strongly acid; abrupt transition to layer below.

B_g 10 to 14 inches, light-gray (10YR 7/1) to light brownish-gray (10YR 6/2) silt loam to sandy clay loam; when moist, gray to dark gray (10YR 5/1–4/1); many distinct yellowish-brown mottles; weak medium prismatic to moderate medium blocky structure; firm to friable; hard to very hard in place but crumbles readily when removed; contains some rounded pebbles in places; medium acid.

G 14 to 24 inches, light-gray (10YR 7/1) clay or silty clay; when moist, gray (10YR 5/1); many distinct yellowish-brown and brown mottles; fractures to strong medium angular or subangular blocky aggregates, which are very hard when dry; plastic when wet; medium acid.

C 24 inches+, light-gray (10YR 7/1) dense clay; when moist, gray (10YR 5/1); very faintly mottled; strong coarse blocky or subangular blocky aggregates; very hard when dry, plastic when wet; contains some embedded gravel; slightly acid; many feet deep, but in some places gravelly fine-textured glacial till is at depths of 3 to 5 feet.

The Puget, Sumas, Lummi, Snohomish, Woodinville, Tisch, Samish, Thornton, Nookachamps, and Hovde soils are poorly drained. They occur largely on the delta of the Skagit River and in the valley of the Samish River. They are grayish in color and mottled from the surface or from slightly below the surface. They have a weak A horizon and no B horizon. The Puget soil is fine-textured throughout the profile, whereas the Sumas is underlain by porous sandy material at depths of about 30 to 36 inches. The Lummi soils occur at the extremity of the delta and are younger than the Puget soils. They are bedded with sedge remains and, in their virgin state, contain some salt from sea water. The Snohomish soils occur in slightly depressed back bottoms. They are associated with the Puget soils and differ from them in

being more highly organic and underlain by peaty material at a depth of about 2 feet. The Woodinville soil has thin peaty lenses in the upper part of the profile. Its lower subsoil and substratum are like those of the Puget soils. The Tisch soils were derived from silty, diatomaceous earth. Except for the very shallow, highly organic surface soil, the profile is practically like the nearly white parent material. The Samish soils occur largely in the valley of the Samish River. They were derived from alluvium containing much mica-schist, talc, and argillite. They are moderately fine textured throughout.

The Thornton soils have developed from light-colored mica-schist and talc. Except for the topmost 2 or 3 inches, which consists of highly organic material, the soil is a light-gray, massive, clayey material having a few lenses of coarser textured material. This micaceous material is very tough and only slightly plastic but feels very greasy. These soils are poorly drained and are moderately mottled in the upper part. The Nookachamps soils have developed from materials washed from glacial and residual soils of the uplands. They are poorly drained and subject to flooding. Because of the fluctuating water table, they are prominently mottled. The Hovde soils occur in sandy wet basins behind coastal beach deposits.

Bog soils.—These soils have a mucky or peaty surface soil underlain by peat. They have developed under swamp or marsh vegetation in a humid climate. They occur in low basins or depressions that are ponded or have a high water table. Generally, the soils have formed from remains of plants in the following stages of ascending succession: Aquatic vegetation in open water, forming sedimentary (Tanwax) peat; then sedges and reeds in open marshes, accumulating to form sedge (Mukilteo) peat; followed by brush, shrubs, trees, and water-tolerant vegetation in swamps and forests, forming woody (Rifle) peat. Sphagnum, lipnum, and other mosses may follow if the bases become exhausted and the soil material becomes so extremely acid that it cannot be tolerated by the existing plants. The character of the plants and the stages of decomposition are the factors identifying and classifying the soils.

In Skagit County, there are six Bog soils. Those in which the plant remains of partially decomposed fibers and matted materials can be readily identified are designated as peats. In this county, there are woody, sedge, sedimentary, and moss peats, which are correlated as Rifle, Mukilteo, Tanwax, and Greenwood peats, respectively. The type of material in the uppermost 12 inches determines the type of peat.

Muck consists of organic remains so well decomposed that the fibers are not recognizable in the uppermost 6 to 12 inches of the soil. The mucks are identified by the vegetative cover, their association with identified peats, and the type of organic remains. Woody muck correlated as Carbondale muck, and sedge muck, correlated Semiahmoo muck, were recognized in this county.

Planosols.—Planosols, like the Humic Gley soils, are hydromorphic. They are imperfectly drained, podzolized soils of the uplands. They are characterized by a claypan and a strongly leached surface soil. The only Planosols mapped in this county are the soils of the Bow series. The Bow soils have developed in compact clayey till of smooth ground moraines. They have a fairly shallow, dark-brown, shotty A_1 horizon and a weakly developed A_2 horizon or no A_2 horizon. The grayish or olive-gray, mottled B horizon has a somewhat degraded subangular blocky structure. The underlying material is compact, dense, fractured clay till in which a few pebbles are embedded. The till is many feet thick.

Azonal soils

Soils that have no well-developed profile characteristics, because of their youth or because of the kind of parent material or relief, are azonal soils.

Alluvial soils.—These soils lack well-developed profiles because they are fairly young. They occur on stream bottoms, deltas, and fans. They have formed from materials rather recently transported and deposited by recurring floods. Normally, they are low in organic matter. Drainage ranges from imperfect to somewhat excessive. Only where conditions are fairly stable has much organic matter accumulated. Most of these soils are grayish in color.

The Alluvial soils are the only azonal soils in Skagit County. They differ from one another principally as a result of differences in drainage, in parent materials, and in the manner in which these materials have been sorted and deposited. Differences in drainage and parent materials are shown in table 4.

Much of the material of which the Alluvial soils are formed is deposited by active streams that rise in glaciers in the Cascade Mountains. These streams carry mixed material that includes varying amounts of glacial flour. The sediments are relatively unaltered or unleached, compared to the material carried and deposited by streams in lower lying areas. The Sultan, Puyallup, and Pilchuck soils received sediments from glacial streams. They are moderately well drained to somewhat excessively drained and occur adjacent to stream channels. The Sultan and Puyallup soils occupy natural levees along streams. The Sultan is medium textured throughout its profile, whereas the Puyallup is coarse textured in the lower subsoil and substratum. The Pilchuck has formed from very recent, gray, sandy alluvium. It is near stream channels and hence is subject to frequent overflow.

The Cokedale and Wickersham soils have developed from sediments deposited by smaller streams. These sediments, mostly mica-schist and talc, washed from glaciated uplands and mountains that generally have a thin mantle of glacial material overlying bedrock of various types. Their very dark color is inherited from mica-schist. The imperfectly drained Cokedale soils are underlain by sandy material. The Wickersham soils occupy fans. They overlie shaly, coarse-textured material.

The Belfast and Kline soils have developed from materials washed from highly leached glacial and residual soils of the uplands. The Belfast soils have developed mostly from glacial materials. They are moderately well drained to well drained, brown in color, and have mottling in the lower part of the profile. The well-drained Kline soils occupy fans. They are similar to the Belfast soils.

The Neptune soils have developed from sandy coastal beach materials containing many marine shells. The surface soil is fairly dark colored, and the profile is mildly alkaline throughout.

Settlement and Development of the County

Skagit County was created by the Territorial Legislature on November 28, 1883. Before that, the area was the southern part of Whatcom County, which had been organized in 1854.

The first permanent white settlers came in 1854. Many were from the midwest, but the population was drawn from many sources. Scandinavians were first attracted by the fishing and lumbering industries; now many of them are farmers. Many farmers are of German, Dutch, and southern European descent.

Settlement progressed most rapidly in the alluvial valleys and in the broad delta flats at the mouths of the Skagit and Samish Rivers. These areas are now thickly settled and are practically all cleared and farmed. Only small areas in the uplands are cleared and farmed because of the high cost of clearing the heavily timbered land. Vast areas in the mountains are uninhabited.

According to the 1950 Federal Census, the population of the whole county was 43,273. The population in 1920 was 33,373; in 1930, 35,142; and in 1940, 37,650.

Mount Vernon, the county seat, had a population of 5,230 in 1950; Anacortes, 6,919; Sedro-Woolley, 3,299; Burlington, 2,350; Concrete, 760; La Conner, 594; Lyman, 378; and Hamilton, 294. Some of the other towns and communities are Conway, Edison, Big Lake, McMurray, Allen, Blanchard, Clear Lake, Birdsview, Rockport, Marblemount, and Avon.

Industries

Since the time of earliest settlement, lumbering has been one of the most important industries. The eastern half of the county is still heavily forested, and logging supplies many residents with full or part-time employment. Large and small sawmills are scattered throughout the county. The principal sawmills, a large pulp mill, and a plywood plant are located in Anacortes.

Anacortes is one of the most important fish-processing centers in the State. There are several salmon canneries and some facilities for canning crab, tuna, clams, and oysters. Oysters are produced commercially in Samish Bay.

Dairy products are handled by 3 large plants, 2 in Mount Vernon and 1 in Burlington. The plant at Burlington produces a considerable amount of powdered milk.

Large seed companies process and market the vegetable seeds grown in the county. Canneries and freezing plants handle the crops of peas, sweet corn, squash, carrots, spinach, beans, broccoli, brussel sprouts, strawberries, and raspberries. Several auction houses auction off livestock and other agricultural products.

Many people who work in the industries have small subsistence farms on which they raise vegetables and fruits, mostly for home use, and keep a few cows and chickens. Most of the feed is purchased.

Limestone is one of the most important industrial materials in the county. It supports a large cement manufacturing plant at Concrete. Other nonmetallic minerals produced in the county (*5*) include olivine, silica, talc, soapstone, flake mica, pumicite, clay, sand, and gravel. An olivine mine is operated on Cypress Island. Silica, flake mica, and soapstone are mined near Marblemount and in other places in the eastern part of the county.

The only metallic products mined at present are lead and a little silver. One mine is in operation. The ore is taken out of the State for refining.

Transportation and Markets

Scheduled daily freight and passenger trains of the Great Northern Railway run between Seattle and Vancouver by way of Mount Vernon. Connecting freight lines serve Anacortes and points up the Skagit River valley. The Northern Pacific Railway offers freight service on a line that runs north and south through Big Lake and Sedro-Woolley and connects with points in Whatcom and Snohomish Counties.

From the port of Anacortes, ocean-going vessels provide intercoastal, coastwise, and foreign steamship service to all parts of the world. The river boats on the Skagit River provide direct water transportation for freight between Mount Vernon and Seattle. The county has excellent automotive freight and passenger services, which serve the entire area and maintain intrastate and interstate connections. An airport is located about 5 miles from Mount Vernon. One scheduled airline serves the area.

Skagit County has a good system of highways and roads, including U. S. 99, the main north-south highway between Seattle and Vancouver, British Columbia. Hard-surfaced or paved State highways serve the agricultural areas. More than 90 percent of the farms are within 0.2 mile of an all-weather road.

The agricultural products go to local, national, and world-wide markets. Dairy products and breeding and milking stock are shipped to many parts of the world and to all parts of the United States.

Community Services and Recreational Facilities

The towns and rural school districts have grade schools. High schools are located in Mount Vernon, Burlington, La Conner, Anacortes, Sedro-Woolley, and Concrete. School buses serve all outlying districts. Mount Vernon has a junior college and an accredited business college. Churches of various denominations are scattered throughout the county, though most are in the western half. Hospitals are maintained in Mount Vernon and Sedro-Woolley. Grange and other community halls are conveniently located throughout the rural sections.

Telephone service is available to most sections of the county. Rural electrification is being extended to all parts of the county, and in 1954 all but 41 farms reported they had electricity. The county receives its power from several power dams on the Skagit River and from a dam at Concrete, which furnishes considerable power to western Washington.

Opportunities for outdoor recreation are excellent. There is fishing for salmon in Puget Sound, for trout in the mountain streams, and for bass in the lakes. Both mountain resorts and salt-water beaches are readily accessible. Deception Pass State Park, which is partly on the southern end of Fidalgo Island and partly on Whidbey

Island in Island County, is well equipped for camping and picnicking.

In the fall, ducks and geese can be hunted on the Skagit River delta. Deer, elk, bear, and other game are plentiful in the uplands and mountainous regions (fig. 10).

Figure 10.—**Cavanaugh Lake in the south-central part of the county—a sportsman's paradise, where fish and game are plentiful. Oso soils predominate here.**

Agriculture

Only a small part of Skagit County is used for farming. Most of the rest is in forest. The farms are chiefly in the western part. Dairy farms far outnumber all other types except the unclassified farms, which produce a variety of products for home use. Of the total rural population of 27,825, according to the 1950 census, only 10,480 people live on farms. Most of the rural nonfarm population is employed in the lumber industry.

Land Use

According to the 1954 Census of Agriculture, 13.6 percent of the total area of the county, or 151,328 acres, was in farms. The total number of farms was 2,352. Since 1920, the acreage used for farming has increased only slightly. Most of the increase has occurred in the uplands. The average size of farms has increased from 56.8 acres to 64.3 acres since 1920. In 1954, the number of farms in different size ranges was as follows:

Acres	*Number*
Less than 10	380
10 to 29	666
30 to 49	450
50 to 69	225
70 to 99	231
100 to 139	162
140 to 179	94
180 to 219	43
220 to 259	25
260 to 499	49
500 to 999	21
1,000 and more	6

The present use of farm land, according to the 1954 census, is as follows: Cropland, including idle or fallow land, 88,295 acres; pasture (not cropland and not woodland), 8,229 acres; woodland, 47,586 acres; and all other land, such as wasteland, farm roads, and house lots, 7,218 acres.

Crops

Table 5 shows the acreage of the major crops in Skagit County in stated years. The most important recent trend is the decrease in acreage of cereal grains, especially oats. The acreage decreased from 19,707 acres in 1939 to 9,492 acres in 1954. The decrease has largely been offset by the increase in acreage of green peas and other special crops. There has also been an increase in the acreage of hay crops, especially in the cultivated grasses that are used for dehydration. The number of acres in grains cut for hay decreased from 3,039 in 1939 to 601 in 1954.

Most of the changes have taken place on the highly productive soils of the delta plain, mainly the Puget and Sumas silt loams. The reasons for the changes are that peas and vegetable-seed crops produce a much higher income per acre than cereal grains and that the market for these crops is steady, though limited.

Most of the farm crops are grown on the alluvial soils on the Skagit River delta and bottom lands. All of the vegetable-seed crops, potatoes, and peas are grown on these soils. Some cereal grains are grown on alluvial soils in the western part of the county; some oats (for hay) and strawberries are also grown on the better soils of the terraces and uplands.

TABLE 5.—*Acreage of major crops and number of fruit and nut trees of bearing age in stated years*

Crop	1929	1939	1949	1954
Hay:				
Clover, timothy, and mixed clover and grasses	*Acres* 20,734	*Acres* 21,359	*Acres* 19,978	*Acres* 15,707
Alfalfa	240	1,625	1,338	1,918
Small grains cut for hay	2,185	3,039	1,313	601
Wild hay cut	407	468	836	335
Hay cut for silage (grasses, alfalfa, clover, or small grains)	[1]	[1]	2,342	4,273
Other hay cut	904	1,299	1,762	2,246
Small grains:				
Oats	17,746	19,707	11,926	9,492
Wheat	1,622	723	1,108	1,169
Barley	382	548	290	149
Vegetables for home use or for sale:				
Peas	691	1,960	7,081	11,773
Irish potatoes	1,005	2,020	2,068	2,024
Other vegetables	488	321	839	3,588
Small fruits:				
Strawberries	331	554	1,010	1,156
Raspberries	174	28	207	95
Blackberries and dewberries	78	27	36	28
Fruit and nut trees:	*Number* [2]	*Number* [2]	*Number* [2]	*Number*
Apple	24,356	15,858	9,307	1,951
Pear	4,575	3,863	1,878	379
Peach	106	52	166	34
Plum and prune	6,175	5,163	3,128	606
Cherry	14,445	11,942	3,312	543
Filbert and hazelnut	[3] 411	6,688	18,469	9,075

[1] Not reported.
[2] One year later than year at head of column.
[3] Hazelnuts only.

Livestock and Livestock Products

Table 6 shows the number of livestock on farms in Skagit County from 1929 to 1954. Skagit County is one of the leading dairy regions of the State. Most of the dairy farms are on the alluvial soils. Although a majority of the farms in the uplands have a few dairy cows, the total number is small and the products are mainly for home use. The principal dairy breeds are Jersey, Guernsey, and Holstein-Friesian. Most of the herds consist of both grade stock and registered purebreds. All the cattle in some herds are registered. The number of beef cattle is increasing, but is small compared to the number of dairy cattle. Hereford is the principal beef breed. Many of the beef cattle are raised on farms in the uplands where partially cleared or wooded areas are used for early pastures. Much of the hay fed during the winter months is grown on the farm, but a great deal of the grain is purchased from local feed stores. Farms in the Skagit River delta produce more of their feed than farms elsewhere. Little grain and hay are grown on the farms in the uplands.

Poultry raising is second to dairying in agricultural importance. Poultry farms are generally located on the moderately well drained or well drained soils. Most of the poultry feed is purchased.

Livestock products are sold largely to local industries. Most dairy farms sell whole milk, which is picked up daily by creameries. Chickens and eggs are sold to cooperatives, hatcheries, or other local establishments.

TABLE 6.—*Number of livestock on farms in stated years*

Livestock	1930	1940	1950	1954
	Number	*Number*	*Number*	*Number*
Horses and colts	2, 921	[1] 2, 936	1, 420	[2] 1, 005
Mules and mule colts	55	[1] 132	47	[3]
Cattle and calves	31, 458	[1] 30, 996	36, 010	43, 257
Sheep and lambs	5, 453	[4] 1, 691	1, 449	2, 074
Goats and kids	190	[5] 378	[6]	147
Pigs and hogs	3, 386	[5] 2, 544	1, 731	1, 168
Chickens	[1] 280, 998	[5] 216, 973	[5] 150, 016	[5] 206, 022

[1] Over 3 months old, Apr. 1.
[2] Includes mules and mule colts.
[3] Not reported separately.
[4] Over 6 months old, Apr. 1.
[5] Over 4 months old, Apr. 1.
[6] Not reported.

Farm Power

The number of horses has decreased steadily since 1930. On the basis of a census sample, it was estimated that there were 1,005 horses and mules in the county in 1954. Many were riding horses. Tractors have generally supplanted horses and mules as sources of farm power. On the 2,352 farms, it was estimated, there were 2,299 tractors and 1,771 motortrucks. Tillage equipment is normally

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Af	Alderwood gravelly sandy loam, 0 to 3 percent slopes.	Dark brown to dark yellowish brown; friable; shotty; strongly to medium acid.	Dark yellowish-brown, very friable gravelly sandy loam; medium acid.	Dark-gray, strongly cemented sandy gravelly till.	Good
Ag	Alderwood gravelly sandy loam, 3 to 8 percent slopes.	Same	Same	Same	Good
Ah	Alderwood gravelly sandy loam, 8 to 15 percent slopes.	Same	Same	Same	Good
Ak	Alderwood gravelly sandy loam, 15 to 30 percent slopes.	Same	Same	Same	Somewhat excessive
Am	Alderwood gravelly sandy loam, 30 to 45 percent slopes.	Same	Same	Same	Somewhat excessive
An	Alderwood gravelly sandy loam, shallow, 0 to 3 percent slopes.	Grayish brown to brown; friable; shotty; medium acid.	Grayish-brown, friable to firm gravelly sandy loam; medium acid.	Same	Moderately good
Ao	Alderwood gravelly sandy loam, shallow, 3 to 8 percent slopes.	Same	Same	Same	Moderately good
Ap	Alderwood gravelly sandy loam, shallow, 8 to 15 percent slopes.	Same	Same	Same	Good
Ar	Alderwood gravelly sandy loam, shallow, 15 to 30 percent slopes.	Same	Same	Same	Good

up-to-date. The number of combines is increasing, but on some farms binders and threshing machines are still used to harvest the grain. Green-pea viners are furnished by the local canneries. The operators of many of the small farms hire hands to do all their fieldwork.

Types of Farms

Based on major source of income in 1954, the 2,352 farms in the county are listed according to type as follows:

	Number
Fruit-and-nut	105
Vegetable	125
Field crop, other than fruit-and-nut or vegetable	25
Dairy	822
Poultry	120
Livestock, other than dairy or poultry	91
General farms	92
Miscellaneous and unclassified	972

The large number of miscellaneous and unclassified farms are producing products primarily for household use. Many of the farms are worked by part-time operators who depend on employment in towns or in the lumber camps for cash income.

Farm Tenure

In 1954, 2,142 farms were operated by owners or part owners, 204 by tenants, and 6 by managers. Of the 204 farms operated by tenants, 131 were rented for cash, 13 were operated on a share-cash basis, 14 by crop-share tenants and croppers, 11 by livestock-share tenants, and 35 under other arrangements.

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THE SOILS OF SKAGIT COUNTY, WASHINGTON

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Slow	Medium to cemented till; very slow below till.	None	Moderate	20 to 36	Moderately low	Fertility maintenance needed.
Slow	Same	None	Moderate	20 to 36	Moderately low	Same.
Slow to medium	Same	None	Moderate	20 to 36	Moderately low	Same.
Medium	Same	None	Moderately low	20 to 36	Moderately low	Suited to forestry and some pasture.
Rapid	Same	None	Moderately low	20 to 36	Moderately low	Suited only to forest.
Very slow	Same	Intermittent in winter.	Moderately low	12 to 20	Moderately low	Fertility maintenance and some drainage needed.
Slow	Same	Same	Moderately low	10 to 20	Moderately low	Fertility maintenance needed.
Slow to medium	Same	Same	Moderately low	10 to 20	Moderately low	Conservation of moisture needed.
Medium	Same	Same	Moderately low	10 to 20	Moderately low	Not suited to cultivation.

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Aa	Alderwood gravelly loam, 0 to 3 percent slopes.	Dark brown to dark yellowish brown; medium granular; friable; shotty; strongly acid to medium acid.	Brown, friable gravelly loam to gravelly sandy loam.	Dark-gray, strongly cemented sandy gravelly till.	Good
Ab	Alderwood gravelly loam, 3 to 8 percent slopes.	Same	Same	Same	Good
Ac	Alderwood gravelly loam, 8 to 15 percent slopes.	Same	Same	Same	Good
Ad	Alderwood gravelly loam, 15 to 30 percent slopes.	Same	Same	Same	Good
Ae	Alderwood gravelly loam, 30 to 45 percent slopes.	Same	Same	Same	Good
Ba	Belfast silt loam, 0 to 3 percent slopes.	Brown to dark brown; friable; granular.	Grayish-brown to brown, firm, coarse- and medium-textured materials; faintly mottled.	Mixed alluvial sediments dominantly influenced by glacial sediments.	Moderately good to good.
Bd	Bellingham silt loam, 0 to 2 percent slopes.	Very dark gray to nearly black; friable; granular; strongly acid.	Light-gray, dense, plastic clay; mottled; medium to strongly acid.	Fine-textured, mixed glacial-lake or marine sediments.	Poor
Be	Bellingham silt loam, 2 to 5 percent slopes.	Same	Same	Same	Poor
Bf	Bellingham silt loam, light colored variant, 0 to 3 percent slopes.	Dark grayish brown; friable; granular.	Very light gray, very plastic silty clay loam or clay loam; mottled.	Old, fine-textured, mixed alluvial and glacial-lake sediments.	Poor
Bg	Bellingham silty clay loam, 0 to 2 percent slopes.	Very dark gray to nearly black; friable; granular; strongly acid.	Light-gray silty clay loam; mottled; medium to strongly acid.	Same	Poor to very poor
Bh	Bellingham silty clay loam, 2 to 5 percent slopes.	Same	Same	Same	Poor
Bb	Bellingham clay, 0 to 2 percent slopes.	Very dark gray to nearly black; firm; granular; strongly acid.	Gray, dense, plastic clay.	Same	Very poor
Bc	Bellingham clay loam, light colored variant, 0 to 3 percent slopes.	Dark grayish brown; friable; granular.	Light-gray, very plastic silty clay loam or clay loam; mottled.	Same	Poor
Bv	Bow silt loam, 0 to 3 percent slopes.	Dark brown; friable; granular; shotty; strongly acid to medium acid.	Brown to grayish-brown, firm silt loam to light sandy clay loam; subangular blocky; medium acid.	Compact, fine-textured glacial till and glacial-lake sediments.	Imperfect
Bw	Bow silt loam, 3 to 8 percent slopes.	Dark brown; friable; granular; shotty; strongly acid to medium acid.	Brown to grayish-brown, firm silt loam to light sandy clay loam; subangular blocky; medium acid.	Compact, fine-textured glacial till and glacial-lake sediments.	Imperfect
Bx	Bow silt loam, 8 to 15 percent slopes.	Same	Same	Same	Imperfect
By	Bow silt loam, 15 to 30 percent slopes.	Same	Same	Same	Imperfect
Bz	Bow silt loam, 30 to 45 percent slopes.	Same	Same	Same	Imperfect
B2	Bow silt loam, shallow, 0 to 3 percent slopes.	Dark brown, dark grayish brown, or dark brownish gray; friable; granular; shotty; strongly acid to medium acid.	Dark olive-gray or brown, firm to very firm loam or sandy clay loam; medium acid.	Very plastic clay	Poor
B3	Bow silt loam, shallow, 3 to 8 percent slopes.	Same	Same	Very plastic clay	Poor

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Very slow	Medium to cemented till; very slow below till.	None	Moderate	20 to 36	Moderate	Fertility maintenance needed and stones removed from plow layer.
Slow	Same	None	Moderate	20 to 36	Moderate	Same.
Slow to medium	Same	None	Moderate	20 to 36	Moderate	Same.
Medium	Same	None	Moderately low	20 to 36	Moderately low	Not suited to cultivation.
Rapid	Same	None	Moderately low	20 to 36	Moderately low	Suited only to forestry.
Medium	Medium	Intermittent in winter.	Moderately high	60+	Moderately high	Requires some drainage in places.
Very slow	Very slow	In fall and winter	High	20 to 36	Moderately high	Drainage needed.
Slow	Very slow	In fall and winter	High	20 to 36	Moderately high	Drainage needed.
Very slow	Very slow	In fall and winter	High	20 to 36	Moderate	Drainage needed.
Very slow	Very slow	In fall and winter	High	20 to 36	Moderately high	Drainage needed.
Slow	Very slow	In fall and winter	High	20 to 36	Moderately high	Drainage needed.
Very slow	Very slow	In fall and winter	High	20 to 36	Moderately high	Drainage needed.
Very slow	Very slow	In fall and winter	High	20 to 36	Moderate	Need for artificial drainage.
Very slow	Slow	Intermittent in winter.	Moderately high	18 to 30	Moderate	Fertility maintenance needed.
Slow	Slow	Same	Moderately high	18 to 30	Moderate	Fertility maintenance needed.
Medium	Slow	Same	Moderately high	18 to 30	Moderate	Some erosion if cleared.
Rapid	Slow	Same	Moderately high	18 to 30	Moderate	Same.
Very rapid	Slow	None	Moderately low	18 to 30	Moderate	Suited only to forest.
Very slow	Slow	Intermittent in winter.	Moderately high	10 to 18	Moderate	Fertility maintenance and some drainage needed.
Slow	Slow	Same	Moderately high	10 to 18	Moderate	Fertility maintenance needed.

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SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Bk	Bow gravelly loam, 0 to 3 percent slopes.	Dark brown; friable; granular; shotty; medium acid to strongly acid.	Brown to grayish-brown gravelly loam; medium acid.	Compact, fine-textured glacial till and glacial-lake sediments.	Imperfect
Bm	Bow gravelly loam, 3 to 8 percent slopes.	Same	Same	Same	Imperfect
Bn	Bow gravelly loam, 8 to 15 percent slopes.	Same	Same	Same	Imperfect
Bo	Bow gravelly loam, 15 to 30 percent slopes.	Same	Same	Same	Imperfect
Bp	Bow gravelly loam, 30 to 45 percent slopes.	Same	Same	Same	Imperfect
Br	Bow loam, 0 to 3 percent slopes.	Same	Brown to grayish-brown, heavy gravelly loam; medium acid.	Same	Imperfect
Bs	Bow loam, 3 to 8 percent slopes.	Same	Same	Same	Imperfect
Bt	Bow loam, 15 to 30 percent slopes.	Same	Same	Same	Imperfect
Bu	Bow loam, shallow, 0 to 3 percent slopes.	Same	Same	Same	Imperfect
Ca	Cagey gravelly fine sandy loam, 0 to 3 percent slopes.	Brown to reddish brown; friable; shotty.	Yellowish-brown, loose gravelly loamy sand to gravelly sand.	Gravelly outwash over cemented till.	Moderately good
Cb	Cagey gravelly fine sandy loam, 3 to 8 percent slopes.	Same	Same	Same	Moderately good
Cc	Cagey gravelly sandy loam, moderately shallow, 0 to 3 percent slopes.	Brown to dark brown; friable; shotty.	Same	Same	Moderately good
Cd	Cagey gravelly sandy loam, moderately shallow, 3 to 8 percent slopes.	Same	Same	Same	Moderately good
Ce	Cagey gravelly sandy loam, moderately shallow, 8 to 15 percent slopes.	Dark brown; friable; shotty.	Same	Same	Moderately good
Cf	Carbondale muck, 0 to 1 percent slopes.	Very dark brown to nearly black; friable; granular.	Very dark brown woody and fibrous accumulations in various stages of decomposition.	Organic woody accumulations.	Very poor
Cg	Carbondale muck, shallow, 0 to 1 percent slopes.	Same	Same	Organic woody accumulations; mineral soil at 8 to 24 inches.	Very poor
Co	Cathcart loam, 3 to 8 percent slopes.	Dark brown to brown; friable; granular; strongly acid.	Yellowish-brown, firm, gritty or gravelly fine sandy loam to loam.	Glacial till overlying shale and sandstone.	Good
Cp	Cathcart loam, 8 to 15 percent slopes.	Same	Same	Same	Good
Cr	Cathcart loam, 15 to 30 percent slopes.	Same	Same	Same	Good
Cs	Cathcart loam, 30 to 60 percent slopes.	Same	Same	Same	Good
Ch	Cathcart clay loam, 3 to 8 percent slopes.	Dark brown	Yellowish-brown clay loam or sandy clay loam.	Same	Good
Ck	Cathcart gravelly loam, 3 to 8 percent slopes.	Dark brown to brown; friable; granular; strongly acid.	Yellowish-brown gravelly loam or gritty sandy clay loam.	Glacial materials overlying arkose sandstone.	Good

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Very slow	Slow	Intermittent in winter.	Moderately high	20 to 36	Moderate	Fertility maintenance needed.
Slow	Slow	Same	Moderately high	20 to 36	Moderate	Same.
Slow to medium	Slow	Same	Moderately high	20 to 36	Moderate	Erodes if left bare.
Medium	Slow	Same	Moderately high	20 to 36	Moderately low	Best suited to forestry
Rapid	Slow	Same	Moderately high	20 to 36	Moderately low	Suited only to forestry.
Very slow	Slow	Same	Moderately high	20 to 36	Moderate	Fertility maintenance needed.
Slow	Slow	Same	Moderately high	20 to 36	Moderate	Same.
Medium	Slow	Same	Moderately high	20 to 36	----------	Best suited to forestry.
Very slow	Slow	Same	Moderately high	10 to 18	Moderate	Fertility maintenance and some drainage needed.
Very slow	Rapid to cemented till; very slow in till.	Same	Moderate	36 to 60	Moderately low	Fertility maintenance and conservation of moisture needed.
Slow	Same	Same	Moderate	36 to 60	Moderately low	Same.
Very slow	Same	None	Moderate	24 to 36	Moderately low	Same.
Slow	Same	None	Moderate	24 to 36	Moderately low	Same.
Slow	Same	None	Moderately low	20 to 36	Moderately low	Same.
Ponded	Very slow; medium if drained.	In fall, winter, and spring.	High	36 to 60	High	Drainage needed.
Ponded	Same	Same	High	8 to 24	High	Drainage needed.
Slow	Medium	None	Moderate	60+	Moderate	Fertility maintenance needed.
Slow to medium	Medium	None	Moderate	60+	Moderate	Prevention of erosion and conservation of moisture needed.
Medium	Medium	None	Moderate	60+	Moderate	Best suited to forestry.
Rapid	Medium	None	Moderate	60+	Moderate	Same.
Slow to medium	Medium	None	Moderately high	60+	Moderate	Fertility maintenance needed.
Slow	Medium	None	Moderate	60+	Moderate	Same.

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Cm	Cathcart gravelly loam, 8 to 15 percent slopes.	Dark brown to brown; friable; granular; strongly acid.	Yellowish-brown gravelly loam or gritty sandy clay loam.	Glacial materials overlying arkose sandstone.	Good
Cn	Cathcart gravelly loam, 15 to 30 percent slopes.	Same	Yellowish-brown, firm, gritty or gravelly fine sandy loam to loam.	Unsorted glacial drift and talus rubble overlying arkose sandstone.	Good
Ct	Cathcart stony loam, 8 to 15 percent slopes.	Same	Yellowish-brown gravelly loam or gritty sandy clay loam.	Glacial materials overlying arkose sandstone.	Good
Cu	Cathcart stony loam, 15 to 30 percent slopes.	Same	Same	Same	Good
Cv	Cathcart stony loam, 30 to 60 percent slopes.	Same	Same	Same	Good
Cw	Coastal beach, 0 to 3 percent slopes.	No profile differentiation.	No profile differentiation.	Gravelly coastal beach material.	Excessive
Cz	Cokedale silt loam, 0 to 3 percent slopes.	Dark gray to very dark gray; friable; greasy; mottled; slightly acid to medium acid.	Dark-gray, firm, stratified medium- and coarse-textured material; strongly to medium acid.	Alluvium, chiefly from soils developed from mica-schist, talc, and argillite.	Imperfect
C2	Cokedale silt loam over Puyallup soil material, 0 to 3 percent slopes.	Same	Same	Alluvium, chiefly from soils formed from mica-schist, talc, and argillite overlying Puyallup soil material.	Imperfect
Cx	Cokedale loam, 0 to 3 percent slopes.	Grayish brown, brownish gray, or gray; friable; greasy; mottled; slightly acid to medium acid.	Same	Alluvium, chiefly from soils developed from mica-schist, talc, and argillite.	Imperfect
Cy	Cokedale sandy loam, 0 to 3 percent slopes.	Same	Same	Same	Moderately good
C3	Cokedale silty clay loam, 0 to 3 percent slopes.	Very dark gray, friable; greasy; slightly acid to medium acid.	Very dark gray, firm silty clay loam or silt loam; mottled.	Light-gray, gray, and dark-gray, stratified fine sandy loam, very fine sand, and fine sand.	Imperfect
C4	Cokedale silty clay loam over Puyallup soil material, 0 to 3 percent slopes.	Same	Same	Light-gray, gray, and dark-gray, stratified fine sandy loam, very fine sand, and fine sand overlying Puyallup soil material.	Imperfect
C5	Corkindale loam, 0 to 3 percent slopes.	Dark reddish brown to yellowish red; friable; granular; shotty; very strongly acid to strongly acid.	Reddish-brown to dark yellowish-brown, friable gravelly loam; very strongly acid to strongly acid.	Glacial, loose gravelly sand or sandy gravel.	Good to somewhat excessive.
C6	Corkindale loam, 3 to 8 percent slopes.	Same	Same	Same	Same
C7	Corkindale loam, 8 to 15 percent slopes.	Same	Same	Same	Same
C8	Corkindale loam, 15 to 30 percent slopes.	Same	Same	Same	Same
C9	Corkindale loam, 30 to 45 percent slopes.	Same	Same	Same	Somewhat excessive
C12	Coveland gravelly loam, 0 to 3 percent slopes.	Nearly black; friable; granular; medium acid.	Grayish-brown, gray, or brown, firm gravelly sandy loam to gravelly loamy sand.	Compact, fine-textured till and glacial-lake or marine sediments.	Imperfect
C13	Coveland gravelly loam, 3 to 8 percent slopes.	Same	Same	Same	Imperfect
C15	Coveland silt loam, 0 to 3 percent slopes.	Same	Brownish-gray, gray, or brown sandy loam or loam.	Same	Imperfect

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Slow to medium	Medium	None	Moderate	36 to 60	Moderate	Fertility maintenance, prevention of erosion, and conservation of moisture needed.
Medium	Medium	None	Moderate	0 to 60	Moderate	Not suited to cultivation.
Slow to medium	Medium	None	Moderate	0 to 36	Moderate	Too stony for farm crops.
Medium	Medium	None	Moderate	0 to 36	Moderate	Suited only to forestry.
Rapid	Medium	None	Moderate	0 to 36	Moderate	Suited to forestry.
Very slow	Very rapid	Continual				Not suited to agriculture.
Very slow	Medium	In winter	High	36 to 60	Moderately high	Drainage needed.
Very slow	Medium	In winter	High	36 to 60	Moderately high	Drainage needed.
Very slow	Medium	In winter	High	36 to 60	Moderately high	Drainage needed.
Very slow	Rapid when the water table is low.	In winter	Moderately high	36 to 60	Moderate	Drainage needed.
Very slow	Medium	In winter	High	36 to 60	Moderately high	Drainage needed.
Very slow	Rapid	In winter	High	36 to 60	Moderately high	Drainage needed.
Very slow	Rapid	None	Moderately low	20 to 24	Low	Fertility maintenance and conservation of moisture needed.
Very slow to slow	Rapid	None	Moderately low	15 to 24	Low	Same.
Slow	Rapid	None	Moderately low	20 to 36	Low	Conservation of moisture needed.
Slow to medium	Rapid	None	Moderately low	20 to 36	Low	Suited only to forestry.
Medium	Rapid	None	Low	20 to 36	Low	Same.
Slow	Slow	Intermittent in winter.	Moderately high	20 to 36	Moderately high	Some drainage needed.
Slow	Slow	Same	Moderately high	20 to 36	Moderately high	Same.
Very slow	Slow	Same	Moderately high	20 to 36	Moderately high	Same.

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
C16	Coveland silt loam, moderately well drained variant, 0 to 3 percent slopes.	Very dark brown to very dark grayish brown; friable; granular; medium acid.	Dark yellowish-brown, friable, heavy silt loam; strongly acid.	Mixed sediments, mainly of glacial origin.	Moderately good
C14	Coveland gravelly silt loam, 3 to 8 percent slopes.	Dark grayish brown to black; friable; granular; medium acid.	Brownish-gray, gray, or brown sandy loam or loam.	Compact, fine-textured till and glacial-lake or marine sediments.	Poor
Eb	Everett gravelly sandy loam, 0 to 3 percent slopes.	Brown to dark brown; very friable; strongly acid to medium acid.	Dark yellowish-brown to brown, loose, very gravelly sandy loam to very gravelly loamy sand.	Gravelly drift of many different kinds of rocks.	Somewhat excessive
Ec	Everett gravelly sandy loam, 3 to 8 percent slopes.	Same	Same	Same	Somewhat excessive
Ed	Everett gravelly sandy loam, 8 to 15 percent slopes.	Same	Same	Same	Somewhat excessive
Ee	Everett gravelly sandy loam, 15 to 30 percent slopes.	Same	Same	Same	Somewhat excessive
Ef	Everett gravelly sandy loam, 30 to 45 percent slopes.	Same	Same	Same	Somewhat excessive
Ea	Everett cobbly sandy loam, 0 to 3 percent slopes.	Same	Dark yellowish-brown to brown, loose, very cobbly sandy loam to very cobbly loamy sand.	Cobbly drift of many different kinds of rocks.	Somewhat excessive
Fa	Fidalgo rocky loam, 8 to 15 percent slopes.	Dark brown to dark reddish brown; friable; strongly acid; rock outcrops.	Dark-brown to brown, friable, rocky loam or sandy loam; strongly acid to medium acid.	Glacial till overlying serpentine rock.	Good or moderately good.
Fb	Fidalgo rocky loam, 15 to 30 percent slopes.	Same	Same	Same	Same
Fc	Fidalgo rocky loam, 30 to 45 percent slopes.	Same	Same	Same	Same
Gc	Giles silt loam, 0 to 3 percent slopes.	Strong brown to reddish brown; friable; shotty; strongly acid.	Brown to dark yellowish-brown, friable to firm silt loam and sandy loam; subangular blocky; medium acid.	Glacial outwash materials of varied origin.	Good
Gd	Giles silt loam, 8 to 15 percent slopes.	Same	Same	Same	Good
Ga	Giles loam, 0 to 3 percent slopes.	Same	Same	Same	Good
Gb	Giles loam, 3 to 8 percent slopes.	Same	Same	Same	Good
Gg	Gilligan silt loam, 0 to 3 percent slopes.	Dark brown to brown; friable; granular; strongly acid.	Olive to brown, friable to firm silt loam; medium acid to strongly acid.	Glacial outwash materials of varied origin but containing some mica-schist and talc materials.	Moderately good
Gh	Gilligan silt loam, moderately shallow, 0 to 3 percent slopes.	Same	Same	Same	Moderately good
Gf	Gilligan loam, 0 to 3 percent slopes.	Same	Same	Same	Moderately good
Ge	Gilligan gravelly loam, moderately shallow, 0 to 3 percent slopes.	Same	Same	Same	Moderately good

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Very slow	Medium	Intermittent in winter.	Moderate	60+	Moderately high	Fertility maintenance needed.
Very slow	Slow	Same	Moderately high	18 to 24	Moderately high	Same.
Very slow	Very rapid	Same	Low	20 to 36	Low	Very droughty; conservation of moisture and fertility maintenance needed.
Very slow	Very rapid	Same	Low	20 to 36	Low	Same.
Very slow	Very rapid	Same	Low	20 to 36	Low	Same.
Slow	Very rapid	Same	Low	20 to 36	Low	Best suited to forestry.
Medium	Very rapid	Same	Low	20 to 36	Low	Same.
Very slow	Very rapid	Same	Low	20 to 36	Low	Same.
Slow to medium	Medium	None	Moderately low	10 to 24	Low	Same.
Medium	Medium	None	Moderately low	10 to 20	Low	Same.
Rapid	Medium	None	Moderately low	10 to 20	Low	Same.
Very slow	Medium	None	Moderately high	60+	Moderate	Fertility maintenance needed.
Slow to medium	Medium	None	Moderately high	60+	Moderate	Same.
Very slow	Medium	None	Moderate	60+	Moderate	Same.
Slow	Medium	None	Moderate	60+	Moderate	Same.
Very slow	Medium	None	Moderately high	60+	Moderate	Fertility maintenance needed.
Very slow	Medium	None	Moderate	20 to 36	Moderate	Same.
Very slow	Medium	None	Moderate	60+	Moderate	Same.
Very slow	Medium	None	Moderate	20 to 36	Moderate	Same.

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Gk	Greenwater loamy sand, 0 to 3 percent slopes.	Brown or brownish gray; loose; pumicy; strongly acid to medium acid.	Yellowish-brown or olive, pumicy, coarse loamy sand; medium acid to slightly acid.	Coarse-textured old alluvium of mixed origin, containing pumice fragments.	Somewhat excessive.
Gm	Greenwater loamy sand, 3 to 8 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Gn	Greenwater loamy sand, 8 to 15 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Go	Greenwater sandy loam, 0 to 3 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Gp	Greenwood peat, 0 to 1 percent slopes.	Dark yellowish-brown to brown, spongy mixture of living and dead sphagnum and roots; extremely acid.	Yellowish-brown moss peat; extremely acid.	Organic sphagnum accumulations.	Very poor.
Hd	Heisler stony loam, 15 to 30 percent slopes.	Brown to dark brown; friable; strongly acid.	Dark yellowish-brown to yellowish-brown, firm to friable gravelly loam or clay loam; medium acid.	Glacial till over mica-schist.	Good.
He	Heisler stony loam, 30 to 45 percent slopes.	Same.	Same.	Same.	Good.
Ha	Heisler gravelly loam, 3 to 8 percent slopes.	Same.	Same.	Glacial till and mica-schist.	Good.
Hb	Heisler gravelly loam, 8 to 15 percent slopes.	Same.	Same.	Same.	Good.
Hc	Heisler gravelly loam, 15 to 30 percent slopes.	Same.	Same.	Same.	Good.
Hf	Hovde loamy sand, 0 to 1 percent slopes.	Dark grayish brown; loose; medium acid.	Grayish-brown, loose, loamy sand.	Coastal beach material.	Poor.
Ia	Indianola loamy sand, 3 to 8 percent slopes.	Brown to dark yellowish brown; very friable; medium acid.	Yellowish-brown to olive, loose loamy sand; medium acid.	Sandy glacial drift of mixed origin.	Somewhat excessive.
Ib	Indianola loamy sand, 8 to 15 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Ic	Indianola loamy sand, 15 to 30 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Id	Indianola loamy sand, 30 to 45 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Ie	Indianola sandy loam, 3 to 8 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Ke	Klaus gravelly sandy loam, 0 to 3 percent slopes.	Dark reddish brown; very friable; strongly acid to medium acid.	Reddish-brown to yellowish-red, very friable gravelly sandy loam; strongly acid to medium acid.	Gravelly sandy glacial drift of varied origin.	Somewhat excessive.
Kf	Klaus gravelly sandy loam, 3 to 8 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Kg	Klaus gravelly sandy loam, 8 to 15 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Kh	Klaus gravelly sandy loam, 15 to 30 percent slopes.	Same.	Same.	Same.	Somewhat excessive.

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Very slow	Very rapid	None	Low	60+	Low	Very droughty; conservation of moisture and fertility maintenance needed.
Very slow	Very rapid	None	Low	60+	Low	Same.
Very slow	Very rapid	None	Low	60+	Low	Same.
Very slow	Rapid	None	Low	60+	Low	Same.
Ponded	Very slow to none	In fall, winter, and spring.	High	10−	Low	Nonagricultural except for cranberries.
Medium	Medium	None	Moderate	36 to 60+	Moderately low	Too hilly and inaccessible for agriculture.
Rapid	Medium	None	Moderate	36 to 60+	Moderately low	Same.
Slow	Medium	None	Moderate	36 to 60+	Moderately low	Fertility maintenance needed.
Slow to medium	Medium	None	Moderate	36 to 60+	Moderately low	Same.
Medium	Medium	None	Moderate	36 to 60+	Moderately low	Not suited to cultivation.
Very slow to ponded.	Slow	Continual	High	10 to 20	Very low	Except for some native pasture, generally nonagricultural.
Very slow	Rapid	None	Low	20 to 36	Low	Droughty; conservation of moisture and fertility maintenance needed.
Very slow	Very rapid	None	Low	20 to 36	Low	Same.
Slow	Very rapid	None	Low	20 to 36	Low	Best suited to forestry.
Medium	Very rapid	None	Low	20 to 36	Very low	Steep and droughty.
Slow	Rapid	None	Low	20 to 36	Moderately low	Droughty; conservation of moisture and fertility maintenance needed.
Very slow	Very rapid	None	Low	20 to 36	Low	Very droughty; inaccessible.
Very slow	Very rapid	None	Low	20 to 36	Low	Very droughty; fairly good for timber.
Very slow	Very rapid	None	Low	20 to 36	Low	Very droughty; best suited to forestry.
Slow	Very rapid	None	Low	20 to 36	Low	Inaccessible; best suited to forestry.

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Ka	Klaus gravelly loam, 0 to 3 percent slopes.	Dark reddish brown; friable; strongly acid to medium acid.	Reddish-brown to yellowish-red, friable gravelly loam or gravelly sandy loam.	Gravelly sandy glacial drift of varied origin.	Somewhat excessive.
Kb	Klaus gravelly loam, 3 to 8 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Kc	Klaus gravelly loam, 8 to 15 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Kd	Klaus gravelly loam, 15 to 30 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Kk	Klaus sandy loam, 0 to 3 percent slopes.	Dark reddish brown; very friable; strongly acid to medium acid.	Reddish-brown to yellowish-red, friable sandy loam to gravelly sandy loam.	Same.	Somewhat excessive.
Km	Klaus sandy loam, 3 to 8 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Kn	Klaus sandy loam, 8 to 15 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Ko	Klaus sandy loam, 15 to 30 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Kv	Kline silt loam, 1 to 3 percent slopes.	Dark brown to dark grayish brown; friable; granular; strongly acid.	Yellowish-brown to olive, firm, stratified, medium-textured material; strongly acid.	Alluvium largely of glacial origin.	Good.
Ks	Kline loam, 1 to 3 percent slopes.	Same.	Same.	Same.	Good.
Kt	Kline loam, 3 to 8 percent slopes.	Same.	Same.	Same.	Good.
Kp	Kline gravelly loam, 1 to 3 percent slopes.	Same.	Yellowish-brown to olive, firm, stratified, medium-textured gravelly material; strongly acid.	Same.	Good.
Kr	Kline gravelly loam, 3 to 8 percent slopes.	Same.	Same.	Same.	Good.
Ku	Kline sandy loam, 1 to 3 percent slopes.	Same.	Yellowish-brown to olive, friable, stratified sandy loam; strongly acid.	Same.	Good.
La	Lummi silt loam, 0 to 1 percent slopes.	Grayish brown or dark grayish brown; mottled; friable; very strongly acid to extremely acid.	Gray to olive-gray, very plastic silty clay loam to clay; mottled; very strongly acid to extremely acid.	Mixed alluvium.	Poor.
Lb	Lummi silty clay loam, 0 to 1 percent slopes.	Same.	Same.	Mixed alluvium.	Poor.
Lm	Lynden sandy loam, 0 to 3 percent slopes.	Brown, dark brown, or dark yellowish brown; very friable; medium acid.	Yellowish-brown, loose loamy sand; medium acid to slightly acid.	Sandy glacial outwash of mixed origin.	Somewhat excessive.
Ln	Lynden sandy loam, 3 to 8 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Lg	Lynden loamy sand, 0 to 3 percent slopes.	Brown, dark brown, or dark yellowish brown; loose; medium acid.	Same.	Sandy glacial outwash of mixed origin; some mica-schist.	Somewhat excessive.
Lh	Lynden loamy sand, 3 to 8 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Lk	Lynden loamy sand, 8 to 15 percent slopes.	Same.	Same.	Same.	Somewhat excessive.
Le	Lynden loam, 0 to 3 percent slopes.	Brown, dark brown, or dark yellowish brown; friable; granular.	Yellowish-brown, very friable sandy loam to loamy sand.	Same.	Somewhat excessive.
Lf	Lynden loam, 3 to 8 percent slopes.	Same.	Same.	Same.	Somewhat excessive.

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Very slow	Rapid	None	Moderately low	20 to 36	Moderately low	Fertility maintenance and moisture conservation.
Slow	Rapid	None	Moderately low	20 to 36	Moderately low	Droughty; remote.
Slow to medium	Rapid	None	Moderately low	20 to 36	Moderately low	Best suited to forestry.
Medium	Rapid	None	Moderately low	20 to 36	Moderately low	Suited only to forestry.
Very slow	Rapid	None	Low	20 to 36	Low	Very droughty; fertility maintenance needed; best suited to forestry.
Very slow	Rapid	None	Low	20 to 36	Low	Same.
Slow	Rapid	None	Low	20 to 36	Low	Same.
Slow to medium	Rapid	None	Low	20 to 36	Low	Not suited to cultivation.
Slow	Medium	Occasionally in winter.	Moderately high	60+	Moderately high	Fertility maintenance and some drainage needed.
Very slow	Medium	Same	Moderately high	60+	Moderately high	Same.
Slow	Medium	None	Moderately high	60+	Moderately high	Same.
Very slow	Medium	None	Moderate	60+	Moderate	Same.
Slow	Medium	None	Moderate	60+	Moderate	Much of it occurs in areas too remote for agriculture.
Very slow	Rapid	None	Moderately low	60+	Moderate	Fertility maintenance and conservation of moisture needed.
Ponded	Very slow	Continual	High	20 to 36	High	Drainage needed.
Ponded	Very slow	Continual	High	20 to 36	High	Drainage needed.
Very slow	Rapid	None	Moderately low	20 to 36	Moderately low	Fertility maintenance and conservation of moisture needed.
Very slow	Rapid	None	Moderately low	20 to 36	Moderately low	Same.
Very slow	Very rapid	None	Low	20 to 36	Low	Same.
Very slow	Very rapid	None	Low	20 to 36	Low	Same.
Very slow	Very rapid	None	Low	20 to 36	Low	Best suited to forestry.
Very slow	Medium	None	Moderately low	20 to 36	Moderately low	Fertility maintenance needed.
Slow	Medium	None	Moderately low	20 to 36	Moderately low	Same.

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Lc	Lynden gravelly loam, 0 to 3 percent slopes.	Brown, dark brown, or dark yellowish brown; friable; granular.	Yellowish-brown; very friable gravelly loam to sandy loam.	Sandy and gravelly glacial outwash of mixed origin; some mica-schist.	Somewhat excessive.
Ld	Lynden gravelly loam, 3 to 8 percent slopes.	Same	Same	Same	Somewhat excessive.
Ma	Made land			Variety of materials	
Mb	Marblemount stony loam, 15 to 30 percent slopes.	Brown to dark brown; friable; granular; strongly acid to medium acid.	Dark yellowish-brown, shotty, friable to firm stony loam; medium acid.	Granite residuum	Good
Mc	Mukilteo peat, 0 to 1 percent slopes.	Dark-brown, partially decomposed sedge peat.	Dark yellowish-brown fibrous sedge peat.	Organic sedge accumulations.	Very poor
Md	Mukilteo peat, shallow, 0 to 1 percent slopes.	Same	Dark yellowish-brown, fibrous sedge peat; variable mineral material at 10 to 24 inches.	Same	Very poor
Na	Neptune sandy loam, 0 to 3 percent slopes.	Brown to dark grayish brown; very friable; mildly alkaline.	Dark grayish-brown to grayish-brown, loose loamy sand; mildly alkaline.	Coastal beach deposits with embedded marine shells over clay loam or clay.	Good
Nc	Nookachamps silty clay loam, 0 to 2 percent slopes.	Grayish brown to dark grayish brown; friable; mottled; slightly acid to medium acid.	Gray, mottled; very plastic silty clay loam; slightly acid to medium acid.	Mixed fine-textured alluvial sediments, including glacial materials.	Poor
Nb	Nookachamps silt loam, 0 to 2 percent slopes.	Same	Gray, mottled, very plastic silty clay loam or silt loam; slightly acid to medium acid.	Same	Poor
Ne	Norma silt loam, 0 to 2 percent slopes.	Dark gray, very dark gray, or almost black; friable; granular; strongly acid to medium acid.	Olive-gray or olive, firm sandy loam; mottled; slightly acid.	Sandy glacial till	Poor
Nf	Norma silt loam, 2 to 5 percent slopes.	Same	Same	Sandy glacial till	Poor
Nd	Norma loam, 0 to 2 percent slopes.	Same	Same	Sandy glacial till	Poor
Ng	Norma silty clay loam, 0 to 2 percent slopes.	Same	Olive-gray or olive, firm sandy clay loam or heavy loam; mottled; slightly acid.	Sandy glacial till	Poor
Oc	Oso loam, 15 to 30 percent slopes.	Reddish brown, brown, or dark brown; friable; strongly acid.	Yellowish-red or yellowish-brown, firm loam or silt loam; medium acid.	Residuum from fine-textured argillite and glacial materials.	Good
Od	Oso loam, 30 to 60 percent slopes.	Same	Same	Same	Good
Oa	Oso loam, 3 to 8 percent slopes.	Same	Same	Same	Good
Ob	Oso loam, 8 to 15 percent slopes.	Same	Same	Same	Good
Pa	Pilchuck fine sand, 0 to 3 percent slopes.	Brownish gray or olive gray; loose; medium acid to slightly acid.	Dark-gray, olive, olive-gray, gray, and light-gray stratified sands; loose; medium acid to slightly acid.	Mixed alluvium and glacial flour.	Somewhat excessive.
Pc	Pilchuck loamy sand, 0 to 3 percent slopes.	Same	Same	Same	Somewhat excessive.
Pd	Pilchuck sandy loam, 0 to 3 percent slopes.	Brownish gray or olive gray; very friable; medium acid to slightly acid.	Same	Same	Somewhat excessive.

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Very slow	Rapid	None	Moderately low	20 to 36	Moderately low	Same.
Very slow	Rapid	None	Moderately low	20 to 36	Moderately low	Same.
						Not suited to agriculture.
Medium	Medium	None	Moderate	36+	Low	Same.
Ponded	Very slow; medium if drained.	In fall, winter, and spring.	High	20 to 36	Moderately high	Drainage needed.
Ponded	Same	Same	High	24−	Moderately high	Drainage needed.
Very slow	Rapid	In winter	Moderately low	42+	Moderate	Droughty; fertility maintenance needed.
Very slow	Very slow	Fall, winter, and spring.	High	20 to 36	Moderately high	Drainage needed.
Very slow	Very slow	Same	High	20 to 36	Moderately high	Drainage needed.
Very slow	Very slow	Same	High	20 to 36	Moderate	Drainage and fertility maintenance needed.
Slow	Slow	Winter	High	20 to 36	Moderate	Same.
Very slow	Very slow	Fall, winter, and spring.	High	20 to 36	Moderate	Same.
Very slow	Very slow	Same	High	20 to 36	Moderate	Same.
Medium	Medium	None	Moderately low	36 to 60	Moderate	Hilly and inaccessible; suited only to forestry.
Rapid	Medium	None	Moderately low	36 to 60	Moderate	Hilly and rough; suited only to forestry.
Slow	Medium	None	Moderate	36 to 60	Moderate	Fertility maintenance needed.
Slow to medium	Medium	None	Moderate	36 to 60	Moderate	Remote and inaccessible.
Very slow	Very rapid	Intermittent	Low	10 to 20	Low	Very droughty; frequently flooded; fertility maintenance needed.
Very slow	Very rapid	Intermittent	Low	10 to 20	Low	Same.
Very slow	Rapid	Intermittent	Low	10 to 20	Low	Droughty.

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Pb	Pilchuck gravelly sand, 0 to 3 percent slopes.	Brownish gray or olive gray; very friable; medium acid to slightly acid.	Dark-gray, olive, olive-gray, gray, and light-gray stratified gravelly sands; loose; medium acid to slightly acid.	Mixed alluvium and glacial flour.	Somewhat excessive.
Pg	Puget silt loam, 0 to 1 percent slopes.	Grayish brown to olive gray; friable; granular; very strongly acid to strongly acid.	Gray to olive-gray, mottled, very plastic silty clay loam to clay; very strongly acid to strongly acid.	Same	Poor
Ph	Puget silty clay loam, 0 to 1 percent slopes.	Same	Same	Same	Poor
Pf	Puget loam, 0 to 1 percent slopes.	Grayish brown to brown; friable; granular; medium acid to strongly acid.	Same	Same	Poor
Pe	Puget fine sandy loam, 0 to 3 percent slopes.	Brown to grayish brown; very friable; medium acid to slightly acid.	Grayish-brown (mottled), loose, stratified loamy sand, abruptly overlying gray silts and clays at 24 to 36 inches.	Same	Imperfect
Pk	Puyallup fine sandy loam, 0 to 3 percent slopes.	Brown to dark brown or grayish brown; very friable; slightly acid to medium acid.	Grayish-brown or olive-gray loamy fine sand and fine sand; very friable; stratified; slightly acid to medium acid.	Mixed alluvium and glacial flour.	Good
Pn	Puyallup loamy sand over Puget soil material, 0 to 3 percent slopes.	Brown to dark brown or grayish brown; loose; slightly acid to medium acid.	Grayish-brown or olive-gray loamy fine sand and fine sand; stratified; very friable; slightly acid to medium acid; Puget soil material at 24 to 40 inches.	Mixed alluvium and glacial flour over fine-textured Puget soil material.	Good
Pm	Puyallup loam, 0 to 3 percent slopes.	Brown to dark brown or grayish brown; friable; slightly acid to medium acid.	Grayish-brown or olive-gray, loamy fine sand, fine sandy loam, and silt loam; friable; stratified; slightly acid to medium acid.	Mixed alluvium and glacial flour.	Good
Po	Puyallup silt loam, 0 to 3 percent slopes.	Same	Same	Same	Good
Ra	Rifle peat, 0 to 1 percent slopes.	Very dark brown to nearly black partially decomposed woody peat.	Dark-brown to very dark grayish-brown, partially decomposed, woody peat, roots, and woody fragments.	Organic woody accumulations.	Very poor
Rb	Rifle peat, shallow, 0 to 1 percent slopes.	Same	Dark-brown to very dark grayish-brown, partially decomposed woody peat, roots, and woody fragments, over mineral material at 8 to 24 inches.	Same	Very poor
Rc	Riverwash, 0 to 3 percent slopes.	Sand, gravel, and boulders reworked by streams.	Sand, gravel, and boulders reworked by streams.	Sand and gravel alluvium.	Excessive
Rd	Rough broken land	Generally steep, coarse-textured, open, and porous material.		Miscellaneous glacial materials.	Excessive
Re	Rough mountainous land, Cathcart soil material.	Variable	Variable	Arkose sandstone	Variable

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Very rapid	Very rapid	Intermittent	Low	10 to 20	Low	Not suited to agriculture.
Very slow	Very slow	Fall, winter, and spring.	High	20 to 36	High	Drainage needed.
Very slow	Very slow	Same	High	20 to 36	High	Drainage needed.
Very slow	Very slow	Same	High	20 to 36	High	Drainage needed.
Very slow	Medium to clay substratum then very slow.	Intermittent in winter.	Moderately high	36 to 60	High	Some drainage and fertility maintenance needed.
Very slow	Rapid	Same	Moderate	60+	Moderate	Occasional flooding; fertility maintenance needed.
Very slow	Very rapid to clay substratum then very slow.	Same	Moderately low	36 to 60	Moderately low	Fertility maintenance needed.
Very slow	Medium	Same	Moderate	60+	Moderately high	Same.
Very slow	Medium	Same	Moderately high	60+	High	Drainage needed after heavy rains; fertility maintenance needed.
Ponded	Very slow; medium if drained.	Fall, winter, and spring.	High	36 to 60	High	Drainage needed.
Ponded	Same	Same	High	36 to 60	High	Drainage needed.
Very slow	Very rapid	Same	High	36 to 60	High	Has no agricultural value.
Rapid	Variable	Same	High	36 to 60	High	Droughty and steep.
Rapid	Variable	None	Variable	0 to 60	Variable	Suited only to forestry.

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Rf	Rough mountainous land, Heisler soil material.	Variable	Variable	Mica-schist, talc, and glacial materials.	Variable
Rg	Rough mountainous land, Marblemount soil material.	Variable	Variable	Granite or granodiorite.	Variable
Rh	Rough mountainous land, Oso soil material.	Variable	Variable	Argillite and glacial materials.	Variable
Rk	Rough rocky land	Variable	Variable	Glacial materials and residuum.	Variable
Sb	Samish silty clay loam, 0 to1 percent slopes.	Dark gray to very dark gray; friable; granular; strongly acid.	Dark-gray to very dark gray silt loam, silty clay loam, or very fine sandy loam; firm when dry, plastic when wet; strongly acid.	Mixed alluvial sediments high in mica-schist, talc, and argillite.	Poor
Sa	Samish silt loam, 0 to 1 percent slopes.	Dark gray to very dark gray; friable; granular; strongly acid to medium acid.	Same	Same	Poor
Sc	Sauk loam, 0 to 3 percent slopes.	Dark reddish brown or yellowish red; friable; shotty; very strongly acid to strongly acid.	Yellowish-brown to dark yellowish-brown fine sandy loam to loam; firm; strongly acid to medium acid.	Glacial outwash materials of varied origin.	Good
Sd	Sauk loam, 3 to 8 percent slopes.	Same	Same	Same	Good
Se	Saxon silt loam, 3 to 8 percent slopes.	Dark brown to brown; friable; granular; strongly acid.	Yellowish-brown to dark yellowish-brown, firm silt loam to silty clay loam; strongly acid.	Mixed, medium to moderately fine-textured glacial-lake sediments.	Good
Sf	Saxon silt loam, 8 to 15 percent slopes.	Same	Same	Same	Good
Sg	Saxon silt loam, 15 to 30 percent slopes.	Same	Same	Same	Good
Sh	Semiahmoo muck, 0 to 1 percent slopes.	Dark-brown, very dark brown, or almost black sedge muck; very strongly acid to strongly acid.	Brown to dark yellowish-brown, fibrous, matted sedge peat; strongly acid.	Organic sedge accumulations over mineral soil.	Very poor
Sk	Semiahmoo muck, shallow, 0 to 1 percent slopes.	Same	Same	Same	Very poor
Sm	Skiyou gravelly loam, 3 to 8 percent slopes.	Brown to dark brown; friable.	Yellowish-brown, friable gravelly loam to gravelly sandy loam.	Cemented gravelly glacial till of mixed origin, contains some mica-schist.	Good
Sn	Skiyou gravelly loam, 8 to 15 percent slopes.	Same	Same	Same	Good
So	Skiyou gravelly loam, 15 to 30 percent slopes.	Same	Same	Same	Good
Sp	Skiyou gravelly loam, 30 to 45 percent slopes.	Same	Same	Same	Good
Sv	Skykomish gravelly sandy loam, 3 to 8 percent slopes.	Brown to dark brown; very friable; medium acid.	Yellowish-brown cobbly or gravelly sandy loam to cobbly loamy sand; very friable to loose; slightly acid.	Glacial outwash and glacial-stream terrace materials.	Somewhat excessive
Sw	Skykomish gravelly sandy loam, 8 to 15 percent slopes.	Same	Same	Same	Somewhat excessive
Sx	Skykomish gravelly sandy loam, 15 to 30 percent slopes.	Same	Same	Same	Somewhat excessive

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Rapid	Variable	None	Variable	0 to 60	Variable	Erodible if cleared; suited only to forestry.
Rapid	Variable	None	Variable	0 to 60	Variable	Suited only to forestry.
Rapid	Variable	None	Variable	0 to 60	Variable	Same.
Rapid	Variable	None	Variable	0 to 20	Variable	Steep, stony, and droughty.
Very slow	Very slow	In fall, winter, and spring.	High	24 to 36	Moderate	Drainage and fertility maintenance needed.
Slow	Slow	Same	High	24 to 36	Moderately high	Same.
Very slow	Medium	None	Moderate	60+	Moderate	Fertility maintenance needed.
Slow	Medium	None	Moderate	60+	Moderate	Same.
Slow	Medium	None	Moderately high	60+	Moderate	Same.
Slow to medium	Medium	None	Moderately high	60+	Moderate	Same.
Medium	Medium	None	Moderately high	60+	Moderate	Hilly; best suited to forestry.
Ponded	Very slow	In fall, winter, and spring.	High	20 to 36	Moderately high	Drainage needed.
Ponded	Very slow	Same	High	20 to 36	Moderately high	Drainage needed.
Slow	Medium to cemented till, then very slow.	None	Moderate	20 to 36	Moderately low	Fertility maintenance needed.
Slow to medium	Same	None	Moderate	20 to 36	Moderately low	Same.
Medium	Same	None	Moderately low	20 to 36	Moderately low	Droughty and hilly; best suited only to forestry.
Rapid	Same	None	Moderately low	20 to 36	Moderately low	Same.
Very slow	Very rapid	None	Low	20 to 36	Low	Droughty; best suited to forestry.
Very slow	Very rapid	None	Low	20 to 36	Low	Same.
Slow	Very rapid	None	Low	20 to 36	Low	Not suited to cultivation.

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Sr	Skykomish cobbly sandy loam, 0 to 3 percent slopes.	Brown to dark brown very friable; medium acid.	Yellowish-brown cobbly or gravelly sandy loam to cobbly loamy sand; very friable to loose; slightly acid.	Glacial outwash and glacial-stream terrace materials.	Somewhat excessive.
Ss	Skykomish cobbly sandy loam, 3 to 8 percent slopes.	Same	Same	Same	Somewhat excessive.
St	Skykomish cobbly sandy loam, 8 to 15 percent slopes.	Same	Same	Same	Somewhat excessive.
Su	Skykomish cobbly sandy loam, 15 to 30 percent slopes.	Same	Same	Same	Somewhat excessive.
Sy	Snohomish silt loam, 0 to 1 percent slopes.	Very dark grayish brown to dark grayish brown; friable; granular; slightly acid.	Gray, plastic silt loam and silty clay loam; stratified; mottled; medium acid.	Mixed alluvial mineral materials over organic accumulations.	Poor
Sz	Snohomish silty clay loam, 0 to 1 percent slopes.	Same	Same	Same	Poor
S2	Squalicum gravelly silt loam, 0 to 3 percent slopes.	Dark brown to brown; shotty; friable.	Dark yellowish-brown, firm to friable gravelly silt loam.	Cemented, medium-textured glacial till embedded with mixed gravel.	Good
S3	Squalicum gravelly silt loam, 3 to 8 percent slopes.	Same	Same	Same	Good
S4	Squalicum gravelly silt loam, 8 to 15 percent slopes.	Same	Same	Same	Good
S5	Squalicum gravelly silt loam, 15 to 30 percent slopes.	Same	Same	Same	Good
S6	Squalicum gravelly silt loam, 30 to 45 percent slopes.	Same	Same	Same	Somewhat excessive.
S12	Sultan silt loam, 0 to 3 percent slopes.	Brown, dark brown, or grayish brown; friable; granular; medium acid to slightly acid.	Brown, olive, or grayish-brown silt loam; friable; slightly acid.	Mixed alluvium and glacial flour.	Moderately good
S8	Sultan loam, 0 to 3 percent slopes.	Same	Brown, olive, or grayish-brown loam and silt loam; stratified; friable; slightly acid.	Same	Moderately good
S7	Sultan fine sandy loam, 0 to 3 percent slopes.	Same	Brown, olive, or grayish-brown medium-textured material; stratified; friable; slightly acid.	Same	Moderately good
S9	Sultan loamy sand, 0 to 3 percent slopes.	Brown, dark brown, or grayish brown; loose; granular; medium acid to slightly acid.	Same	Same	Good
S13	Sumas silt loam, 0 to 1 percent slopes.	Dark gray, gray, or grayish brown; friable; strongly acid to very strongly acid.	Gray to olive-gray silty clay loam, silty clay, or clay, stratified; mottled; very plastic; very strongly acid.	Sand	Poor
S15	Sumas silt loam, shallow, 0 to 1 percent slopes.	Same	Same	Sand	Poor
S14	Sumas silt loam, deep, 0 to 1 percent slopes.	Same	Same	Sand	Poor
S16	Sumas silty clay loam, 0 to 1 percent slopes.	Dark gray, gray, or grayish brown; mottled; friable; strongly acid to very strongly acid.	Same	Sand	Poor

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Very slow	Very rapid	None	Low	20 to 36	Low	Not suited to cultivation.
Very slow	Very rapid	None	Low	20 to 36	Low	Same.
Very slow	Very rapid	None	Low	20 to 36	Low	Same.
Slow	Very rapid	None	Low	20 to 36	Low	Same.
Very slow	Slow	In fall, winter, and spring.	High	20 to 36	High	Drainage needed.
Very slow	Slow	Same	High	20 to 36	High	Flooded many months of the year.
Very slow	Medium to cemented till, then very slow.	None	Moderate	20 to 36	Moderately low	Fertility maintenance needed.
Slow	Same	None	Moderate	20 to 36	Moderately low	Same.
Slow to medium	Same	None	Moderate	20 to 36	Moderately low	Same.
Medium	Same	None	Moderately low	20 to 36	Moderately low	Not suited to cultivation.
Rapid	Same	None	Moderately low	20 to 36	Moderately low	Not suited to cultivation.
Very slow	Medium	In winter	Moderately high	60+	High	Artificial drainage benefits early seeded crops.
Very slow	Medium	In winter	Moderate	60+	High	Same.
Very slow	Medium	In winter	Moderate	60+	High	May be somewhat droughty for shallow rooted or late seeded crops.
Very slow	Medium	In winter	Moderate	60+	Moderate	Same.
Very slow	Very slow	In fall, winter, and spring.	High	20 to 36	High	Drainage needed.
Very slow	Very slow	Same	High	10 to 20	High	Drainage needed.
Very slow	Very slow	Same	High	36 to 60	High	Drainage needed.
Very slow	Very slow	Same	High	20 to 36	High	Drainage needed.

SUMMARY OF OUTSTANDING CHARACTERISTICS OF

Map symbol	Soil	Surface soil (moist)	Subsoil (moist)	Substratum or parent material	Natural drainage
Ta	Tanwax peat, 0 to 1 percent slopes.	Very dark gray or very dark grayish-brown sedimentary peat.	Very dark gray or very dark grayish-brown sedimentary peat.	Organic and colloidal material over compact cemented glacial drift.	Very poor
Tb	Tanwax peat, shallow, 0 to 1 percent slopes.	Same	Same	Same	Very poor
Tc	Thornton clay, 0 to 2 percent slopes.	Gray, olive, or olive gray; firm; greasy; strongly acid.	Gray massive clay; firm; greasy; mottled.	Alluvial mica-schist and talc over shaly coarse-textured material.	Poor
Td	Thornton silty clay loam, 0 to 2 percent slopes.	Grayish brown, dark grayish brown, or olive gray; friable.	Same	Same	Poor
Te	Thornwood gravelly loam, 0 to 3 percent slopes.	Brown to dark brown; friable; strongly acid.	Olive or yellowish-brown gravelly sandy loam; loose to very friable; strongly acid to medium acid.	Glacial drift of varied origin, but including considerable mica-schist.	Somewhat excessive
Tf	Thornwood gravelly loam, 3 to 8 percent slopes.	Same	Same	Same	Somewhat excessive
Tg	Thornwood gravelly loam, 8 to 15 percent slopes.	Same	Same	Same	Somewhat excessive
Th	Thornwood gravelly loam, 15 to 30 percent slopes.	Same	Same	Same	Somewhat excessive
Tk	Thornwood gravelly sandy loam, 0 to 3 percent slopes.	Brown to dark brown; very friable; strongly acid.	Olive or yellowish-brown gravelly sandy loam to loamy sand; loose to very friable; strongly acid to medium acid.	Same	Somewhat excessive
Tm	Thornwood gravelly sandy loam, 3 to 8 percent slopes.	Same	Same	Same	Somewhat excessive
Tn	Thornwood gravelly sandy loam, 8 to 15 percent slopes.	Same	Same	Same	Somewhat excessive
To	Thornwood gravelly sandy loam, 15 to 30 percent slopes.	Same	Same	Same	Somewhat excessive
Tp	Thornwood gravelly sandy loam, 30 to 45 percent slopes.	Same	Same	Same	Somewhat excessive
Tr	Tidal Marsh, 0 to 1 percent slopes.	Variable gray, mottled, medium- and fine-textured delta deposits.		Mixed alluvium and marine deposits.	Very poor
Ts	Tisch silty clay loam, 0 to 1 percent slopes.	Very dark gray to dark grayish brown; friable; granular; medium acid.	White, firm, silty, diatomaceous earth; nearly neutral.	Diatomaceous earth over glacial materials.	Poor
Wa	Wickersham shaly loam, 0 to 3 percent slopes.	Very dark gray; friable; granular; strongly acid.	Very dark gray or dark gray, shaly loam or sandy loam; very friable; medium acid.	Alluvium of mica-schist, argillite, and shale.	Good
Wb	Wickersham shaly loam, 3 to 8 percent slopes.	Same	Same	Same	Good
Wc	Wickersham shaly silt loam, 0 to 3 percent slopes.	Same	Same	Same	Good
Wd	Wickersham shaly silt loam, 3 to 8 percent slopes.	Same	Same	Same	Good
We	Woodinville silt loam, 0 to 1 percent slopes.	Dark grayish brown or dark gray; friable; granular; medium acid to strongly acid.	Gray silty clay loam, silty clay or clay; mottled; very plastic; medium acid to slightly acid.	Mixed basic alluvial materials, glacial flour, and peaty inclusions.	Poor

THE SOILS OF SKAGIT COUNTY, WASHINGTON—Continued

Surface runoff	Internal drainage	Occurrence of high water table	Moisture-supplying capacity	Depth of root zone	Natural fertility	Remarks
				Inches		
Ponded	Very slow	Continual	High	10 to 20	Moderate	Drainage needed.
Ponded	Very slow	Continual	High	10 to 20	Moderate	Drainage needed.
Very slow	Very slow	In fall, winter, and spring.	High	10 to 20	Moderately low	Drainage and fertility maintenance needed.
Very slow	Very slow	Same	High	10 to 20	Moderately low	Same.
Very slow	Rapid	None	Moderately low	20 to 36	Low	Droughty; fertility maintenance needed.
Slow	Rapid	None	Moderately low	20 to 36	Low	Same.
Slow to medium	Rapid	None	Moderately low	20 to 36	Low	Same.
Medium	Rapid	None	Moderately low	20 to 36	Low	Hilly; droughty; best suited to forestry.
Very slow	Very rapid	None	Low	20 to 36	Low	Droughty; fertility maintenance needed; best suited to forestry.
Very slow	Very rapid	None	Low	20 to 36	Low	Same.
Very slow	Very rapid	None	Low	20 to 36	Low	Same.
Slow	Very rapid	None	Low	20 to 36	Low	Droughty; not suited to cultivation.
Medium	Very rapid	None	Low	20 to 36	Low	Same.
Ponded	Very slow to none	Continual	High	10—	Low	Not suited to agriculture.
Very slow to ponded.	Very slow	In fall, winter, and spring.	High	10 to 20	Moderately low	Drainage needed.
Very slow	Medium	None	Low	20 to 36	Moderate	Fertility maintenance needed.
Slow	Medium	None	Low	20 to 36	Moderate	Same.
Very slow	Medium	None	Moderate	20 to 36	Moderate	Same.
Slow	Medium	None	Moderate	20 to 36	Moderate	Same.
Very slow	Very slow	In fall, winter, and spring.	High	20 to 36	High	Drainage needed.

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