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Soils of the Gulf Islands of British Columbia

Volume 5 Soils of Sidney, James, Moresby, Portland, and lesser islands

Report No. 43 British Columbia Soil Survey 1991

Canada

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Report No. 43
British Columbia Soil Survey

L.J.P. van Vliet, E.A. Kenney, and A.J. Green
B.C. Land Resource Unit
Land Resource Research Centre
Vancouver, B.C.

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Cover photo
James Island, looking north (courtesy of A.J. Green)

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PREFACE

Sidney, James, Moresby, Portland, and lesser islands cover a total area of 2628 ha in the Gulf Islands of British Columbia shown on map sheet 92B/11 of the National Topographic Series. The aim of this report is to provide detailed soils information at a scale of 1:20 000 for local planning purposes, and to emphasize the soil limitations that are important to residential development and agriculture.

The accompanying soil map shows the distribution and extent of the soil map units. The map legend identifies each map unit by color and symbol. It gives the proportion of dominant, subdominant, or minor soil components, the origin and texture of the parent materials, the soil depth, the soil drainage, and the landscape characteristics for each map unit. The report and map are complementary; therefore, it is necessary to use both to fully understand the soils. An interim soil map with extended legend has also been produced at a scale of 1:20 000 and has been made available from the Map Library, Maps B.C., Ministry of Environment, Victoria, B.C.

Note: This publication is the last in a series of five volumes on Soils of the Gulf Islands of British Columbia, Report No. 43 of the British Columbia Soil Survey. The other publications are entitled:

Volume 1 Soils of Saltspring Island;
Volume 2 Soils of North Pender, South Pender, Prevost, Mayne, Saturna, and lesser islands;
Volume 3 Soils of Galiano, Valdes, Thetis, Kuper, and lesser islands;
Volume 4 Soils of Gabriola Island and lesser islands.

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PART 1. INTRODUCTION

The first soil survey that included the Gulf Islands was completed in the late 1950s (Day et al. 1959). This survey at a scale of 1:63 360 (2.5 cm to 1 km) served a useful purpose for land planners and agriculturists over the years. During the Canada Land Inventory mapping program in the 1960s more soils information was obtained for the Gulf Islands to produce soil capability maps for agriculture and other uses (1:50 000). Since then, some of the Gulf Islands have been surveyed in more detail by different agencies in response to requests from the Islands Trust of the British Columbia Ministry of Municipal Affairs and Regional Districts. The soil maps have been used by planners to draft official community plans for the islands. However, no published soil survey reports accompanied these maps.

With increasing population pressures on the Gulf Islands (Barr 1978), the Islands Trust identified the need for more detailed resource information for land use planning. In 1978, the Islands Trust requested the Terrestrial Studies Section of the Surveys and Resource Mapping Branch, British Columbia Ministry of Environment, to undertake a comprehensive and detailed mapping program covering the Gulf Islands, from Newcastle Island opposite the city of Nanaimo to D'Arcy Island off Victoria, which are under the jurisdiction of the Islands Trust. It was decided to produce a biophysical data base by means of resource folios for each of the southern Gulf Islands at a scale of 1:20 000. The soil inventory part of these folios became the responsibility of British Columbia Soil Survey Unit, Agriculture Canada, Vancouver, under a program called the Gulf Islands soil survey. In addition to the islands under the jurisdiction of the Islands Trust, this soil survey program included all other southern Gulf Islands from Nanaimo to Victoria.

The objectives of the Gulf Islands soil survey are as follows:

- to produce an updated soil inventory for all the southern Gulf Islands at a scale of 1:20 000, using the latest techniques for soil survey, data handling, and map production;
- to produce soil maps and legends for the Islands Trust through the British Columbia Ministry of Environment;
- to produce interpretive soil ratings for the Islands Trust and other users; and
- to publish the soil maps and soil survey reports for each island or group of islands.

Fieldwork for the Gulf Islands soil survey commenced during the summer of 1979. It concluded during the summer of 1986 with the field mapping of Sidney, James, Moresby, Portland, and lesser islands east of the Saanich Peninsula on Vancouver Island. Interim soil maps and extended legends for the Gulf Islands were prepared by the British Columbia Soil Survey Unit in Vancouver, published by the Surveys and Resource Mapping Branch, British Columbia Ministry of Environment, and made available through Maps B.C.

PART 2. GENERAL DESCRIPTION OF THE AREA

Location and extent

This report, No. 5 for the Gulf Islands of British Columbia, covers a group of islands lying between longitudes 123°15' and 123°26' W and between latitudes 48°33' and 48°44' N. These islands lie in the Haro Strait between the southeastern coast of Vancouver Island (Saanich Peninsula) and the San Juan Islands of the United States (Fig. 1). The main islands discussed in this report are Sidney, James, Moresby, and Portland islands. Also included are a number of small islands and islets such as D'Arcy, Little D'Arcy, Gooch, Forrest, Domville, Brethour, Coal, Piers, Goudge, Fernie, Knapp, and Little Group islands. The survey area covers a total of 37 named islands and islets and 2 named rocks, which are all listed in Table 1. The size of the named islands, islets, and rocks are also included in Table 1. They cover a total area of 2578 ha. The total mapped area, including unnamed islets, rocks, and reefs is 2628 ha.

Several named, but very small rocky islands and islets (Greig Island, Musclow Islet, and Patrol Island), named rocks (Canoe, Graham, Joan, John, and Munroe), and named reefs (Arachne, Peck, South Cod, and Turnbull) were not mapped because of their small size (<0.4 ha). Therefore, they do not appear on the soil map and are not included in Table 1.

Table 1. Size of the surveyed islands, islets, and rocks

Name of island or islet	Area (ha)	Name of island or islet	Area (ha)
Arbutus Island	0.4	Kolb Islet	2.1
Brackman Island	4.8	Little D'Arcy Island	9.2
Brethour Island	18.4	Little Group Islands (excluding Little Shell, Ker, and Dock islands)	1.1
Chads Island	3.7		
Clive Island	0.4		
Coal Island	141.3		
Comet Island	3.9	Little Shell Island	0.5
D'Arcy Island	79.5	Mandarte Island	9.3
Dock Island	1.0	Moresby Island	595.5
Domville Island	29.6	Pellow Islets	1.2
Fernie Island	4.8	Piers Island	99.6
Forrest Island and lesser islands	23.0	Portland Island	219.6
		Pym Island	2.8
Gooch Island	44.2	Reay Island	1.1
Goudge Island	14.4	Rubly Island	2.4
Halibut Island	3.1	Rum Island	5.0
Hood Island	2.0	Ship Island	3.5
Imrie Island	0.7	Sidney Island	894.7
James Island	332.0	Tortoise Islets	3.7
Johnson Islet	0.5		
Ker Island	3.6	Sallas Rocks	1.9
Knapp Island	13.2	Unit Rocks	0.4

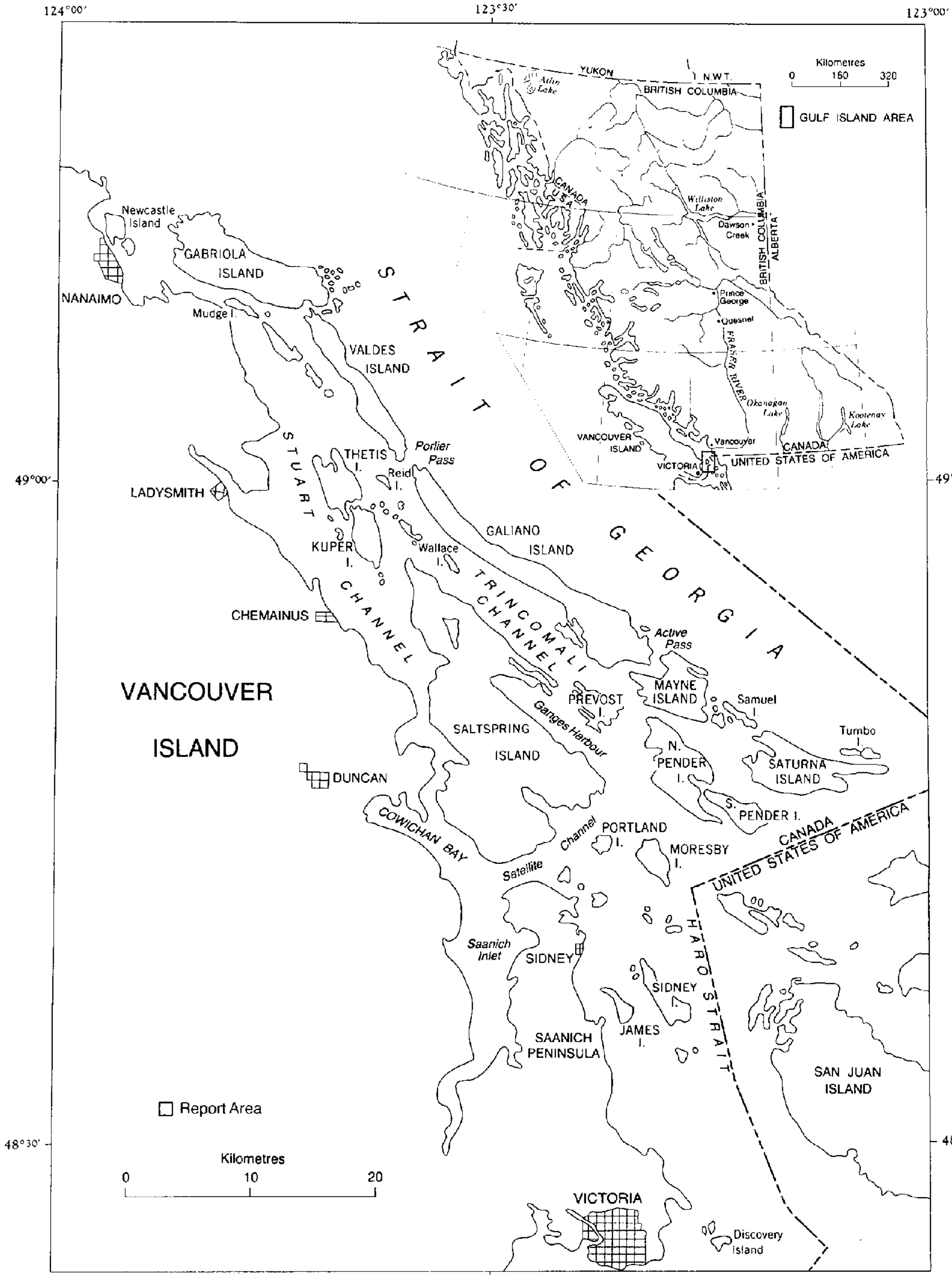

Figure 1. Locations of Sidney, James, Moresby, Portland and lesser islands in relation to the Gulf Islands and Province of British Columbia (inset map).

History and development

European explorers noted the area towards the end of the 18th century. A few of the island place names originate from the Spanish explorations of 1790-1792. Most of the waters and island place names were assigned by the British surveyor, Captain Richards, during 1858-1859. He named places after his ship and crew, after the naval ships and crew in service on the coast at that time, and also after the ships and crew of earlier Spanish explorers. James Island is an exception. It was named by early settlers in 1853 after Sir James Douglas, the first governor of British Columbia (Anon. 1930). A history of Gulf Island place names is given by Akrigg and Akrigg (1973).

Population

The southern Gulf Islands were used seasonally as a fishing, hunting, and a shellfish gathering base by the Coast Salish Indians (Duff 1961), who claimed to be the first inhabitants of the area. They regarded the islands as summer camps and stopover sites during long trips up the Fraser River. Borden (1968) suggested that during the period 1000-100 B.C. the Indians had their main centres on the Gulf Islands and visited the Fraser Valley seasonally.

Early white settlement came slowly and spread from Victoria to Saltspring Island and to the lesser islands. In 1860 the Hudson's Bay Company put up 2000 lots on Sidney Island for sale by auction, without much success, as only one or two lots sold (Gibbs 1973). The first recorded purchase for land on Moresby Island was in 1863 (Freeman 1961). Deeds for James Island date from the early 1870s (Bond 1979). The group of islands covered by this report never had the same settlement and population pressures that the other Gulf Islands experienced, probably because these smaller islands were predominantly privately owned. The most densely populated island is Piers Island, which has been subdivided around the shoreline into many small lots.

Ownership and land use

The nonaboriginal settlers and the subsequent early population were principally homesteaders and farmers (Plate Ia) who, besides supplying local needs, sold their products to the Vancouver Island and mainland markets (Boyes 1960; B.C. Min. Agric. 1978; Bond 1979). The apple orchard on James Island was reputed to be one of the best in British Columbia in 1913 (Bond 1979). Racehorses were once raised and trained on James Island; dogs were also raised there (Anon. 1930). The agriculture land reserve has a total of 980 ha of land on Sidney (494 ha), James (269 ha), Moresby (122 ha), Coal (83 ha), and Brethour (12 ha) islands, which is 38% of the map area.

During the 1890s James Island was owned by a group of wealthy Victorians (including the then-premier of British Columbia) who established a private hunting reserve on the island (Dickason 1949; Bond 1979). In 1897 the syndicate imported a herd of fallow deer from Britain (Hinkens 1982). "These deer were purchased from Chatsworth Park, one of the estates of the Duke of Devonshire" (Bond 1979). These deer became established and many descendants still live on the island. The group also imported other game animals including mountain sheep, pheasants, partridge, grouse, and quail (Bond 1979).

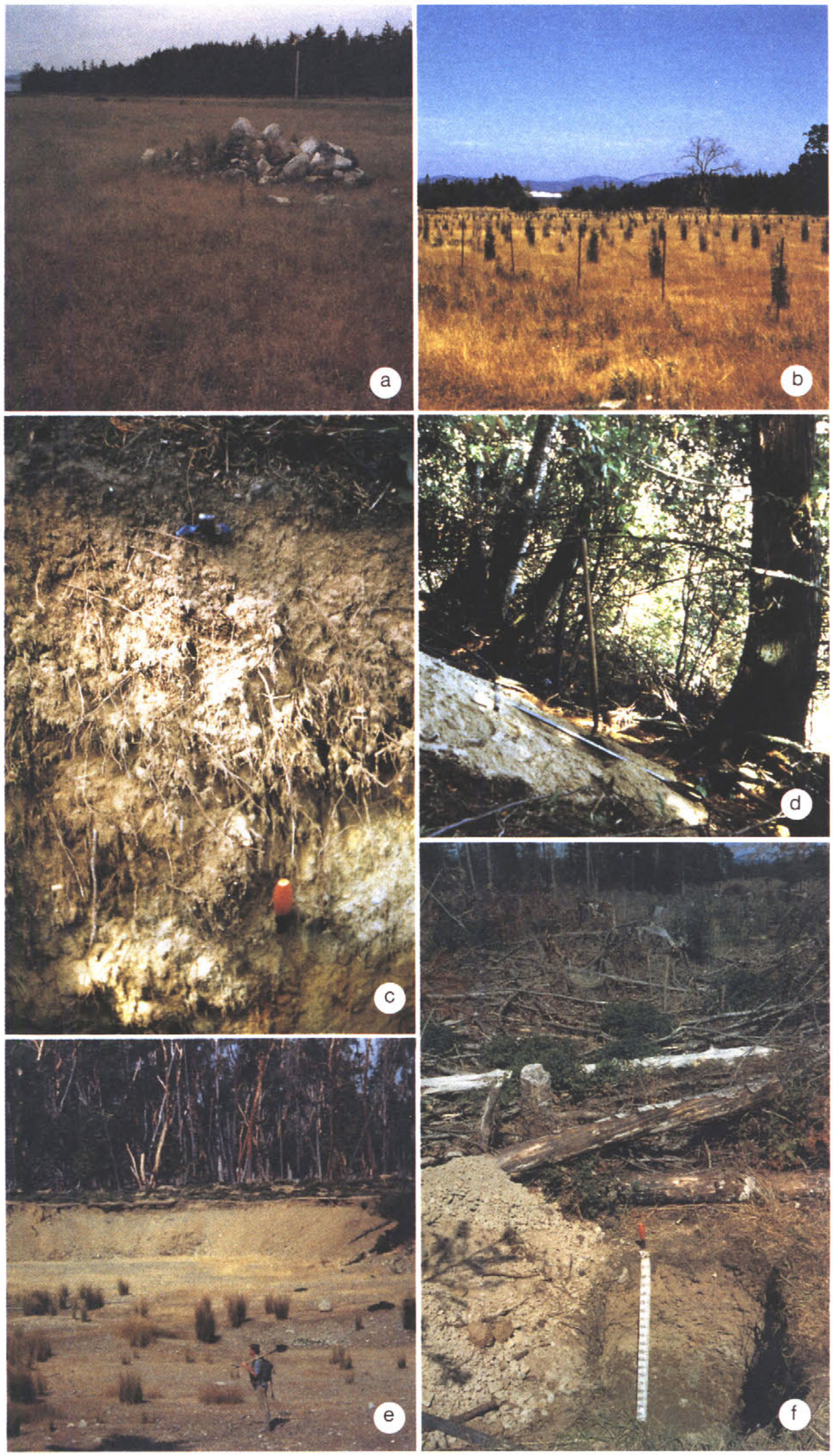

PLATE I

PLATE I

(a) Permanent pasture for sheep and deer on Sidney Island, on poorly drained Parksville and Tolmie soils; stonepiles (foreground) attest to times when farmers picked and piled up stones that hindered operations.

(b) Field on Sidney Island, traditionally used for agriculture, now planted with sitka spruce; cages protect trees from browsing deer.

(c) Deep coarse-textured marine, fluvial, or eolian materials are the parent materials of the rapidly to moderately well drained Beddis soil (low gravel content).

(d) Soil landscape of Beddis soil, on the upper part of the steeply sloping cliffs, east side of Sidney Island.

(e) Gravel pit on James Island; deep gravelly sandy deposits form parent materials of rapidly to well-drained Qualicum soils; similar but shallower deposits over compact till form parent materials of Trincomali soils.

(f) Soil landscape and profile of St. Mary soil on Sidney Island; 60 cm of moderately coarse textured marine or fluvial deposits overlie medium-textured marine deposits over compact glacial till at 95 cm.

Canadian Industries Limited (CIL) purchased James Island in 1913 and established a powder (explosives) plant there as well as a village for the workers and their families (MacRae 1970). During World War I, one-twelfth of all the TNT produced in the British Empire was manufactured on James Island (Anon. 1930), including the TNT that was onboard the French ship, Mont Blanc, which was involved in the Halifax explosion of 1917 (MacRae 1970). The village, which had an average population of 350 people (Anon. 1930), was closed down in 1961, and the workers in the plant commuted from Vancouver Island via a company-run ferry (MacRae 1970). The explosives plant was closed in 1978 (Bond 1979).

Sidney Island was sold in 1902 to Mr. Courtney (Gibbs 1973) who established the Sidney Island Brick and Tile Company in 1906 (Anon. 1981). Bricks manufactured from the clay deposits on the island were used in the construction of the Empress Hotel in Victoria, the original Hotel Vancouver, and the old CPR depot in Vancouver. The crown foreclosed on the company in 1925 (Anon. 1981).

In 1915, two-thirds of Sidney Island were sold to a syndicate of wealthy Victorians who used it as a private hunting reserve (Hinkens 1982). Gradually the syndicate broke up and control was gained by one individual (Mr. Todd) who raised sheep on the island. He also introduced pheasants, peacocks, wild turkeys, and blacktail deer. Fallow deer also became established, after swimming across from James Island, and it has been estimated that up to 900 of these deer now inhabit the island.

In 1981, Mr. Todd sold his holding on Sidney Island to the Sallas Forest Limited Partnership, an organization formed by 33 people in 1981. The Sallas Forest company established a tree farm and intends to practice modern forest management to maintain a substained-yield tree farm (Plate Ib). These practices include selective logging, thinning, and managing the deer herds to decrease the damage done to the trees by wildlife (Green 1982; Hinkens 1982). The company "hopes to make the island a show piece of good forest management" (Pearse 1982).

Second-growth timber provides a basis for a small logging industry run by local operators on the islands. The commercial tree species are coast Douglas fir, western hemlock, western red cedar, and grand fir (Islands Trust 1982). On Sidney Island the virgin timber was cut more than 60 years ago (Green 1982) and on James Island clearcutting occurred during the construction of the powder plant (Bond 1979). More logging occurred during the 1930s and 1940s and the second-growth timber was not well tended (Green 1982; Hinkens 1982).

Most of the land in the islands covered by this report is privately owned. There are four provincial marine parks in the report area: Princess Margaret on Portland Island (194 ha), Sidney Spit at the northern end of Sidney Island (400 ha), D'Arcy Island (84 ha), and Isle-de-Lis on Rum Island (5 ha) (B.C. Min. Lands, Parks, and Housing 1983). It is interesting to note how Princess Margaret Provincial Marine Park got its name. In 1958 the Province of British Columbia gave her Royal Highness, Princess Margaret, Portland Island as a commemorative gift for her visit to the province during the province's centennial year. She returned the island to the province a few years later, at which time the island was designated a marine park and named in her honor.

The only Indian reserve in the survey area is the Bare Island Indian Reserve 9 on Mandarte Island (8.3 ha), east of Sidney Island.

Transportation and energy

During the summer months a foot-passenger ferry operates between Sidney on Vancouver Island and Sidney Island so that people may use the provincial park. All other islands are accessed by private boats. When CIL was operating the explosives plant on James Island, the company provided ferry transportation for its workers to Vancouver Island. The company also operated a narrow-gauge railway to connect the various buildings of their operations (Anon. 1930; Ingham 1952). Gravel roads or vehicle tracks exist on Sidney, James, Portland, Moresby, Piers, and Coal islands.

Electricity for James Island was brought in from Vancouver Island by CIL via an underwater cable, which was laid in 1915 and is still in place (Bond 1979). Coal Island is the only other island known to have electricity from Vancouver Island.

Water supplies and drainage

Freshwater supplies on these islands are limited. Water supply is primarily from wells as there are only a few short intermittent streams and very few lakes. The limited groundwater storage is found in the faults and fractures in the bedrock and at contact zones between shale and sandstone bedrock. All recharge to the potable groundwater comes from precipitation,which falls during the late fall and winter months (Foweraker 1974).

No information about water quality and quantity is available for the islands in the survey area, probably because of the low population pressure. Water conservation is being encouraged by the Islands Trust (1984).

Most of the surface drainage is controlled by the sandstone ridges or by glacially formed relief. Excess rainwater in the winter finds its way to the sea through sluggish channels, often as groundwater flow. Seasonal streams,which flow vigorously during the winter months, dry up completely during the summer.

Climate

The climate of the southern Gulf Islands has been well described by Kerr (1951), Chilton (1975), and Coligado (1979). The climate is strongly influenced by the rain-shadow effects of the Olympic Mountains to the south in Washington State and the "Insular Mountains" of Vancouver Island to the west (Holland, 1976) and is moderated by the ocean. Kerr (1951) referred to the climate of the Gulf Islands as a "Transitional Cool Mediterranean Climate." The climate is characterized by warm and generally dry summers and humid, mild winters. January mean temperature is 3.4°C (2.9-3.8°) with a mean minimum temperature of just below freezing (Table 2). Most of the mean annual precipitation (80-85%) occurs during the months of October to April. Mean temperature in July is 16.8°C (16.3-17.3°C) with a mean maximum of 23.0°C

Table 2. Summary of climatic data for the southern Gulf Islands

Temperature	
January mean temperature	3.4°C
January mean minimum temperature	-0.5°C
Extreme low winter temperature	-16°C (Vesuvius, November 1970)
July mean temperature	16.8°C
July mean maximum temperature	23°C
Extreme high summer temperature	38°C (Ganges, July 1966)
Precipitation	
Average annual rainfall*	807 mm (715-990 mm)
Average annual snowfall*	35 cm (21-75 cm)
July and August (driest months)	<5% of annual precipitation
November-January (wettest months)	almost 50% of annual precipitation
October-April	80-85% of annual precipitation
Miscellaneous	
Freeze-free period	>200 days (longest growing season in Canada)
Hours with bright sunshine	
May-September	1300-1400
Annual	>1900
Fog occurrence (average)	30 days of the year (mainly September-February)
Windiest period	November-January
Least windy period	May-September

Source: after Coligado (1979).
* after Atmospheric Environment Service (1982a).

(22.0-24.0°C). Less than 5% of the mean annual precipitation falls during July and August. Also, during May-September the southern Gulf Islands are considered to be one of the sunniest places in Canada with 1300-1400 hrs of bright sunshine. These summer climatic conditions result both in deficits in soil moisture for crop production, particularly on coarse-textured soils, and in a high fire-hazard for forests.

Some of the more important climatic data pertaining to the southern Gulf Islands are summarized in Table 2. Specific long-term climatic data for James Island and shorter-term data (<10 years) for Piers Island are presented in Tables 3 and 4 and in Figs. 2 and 3 (Atmospheric Environment Service 1982 a,b,c).

Natural vegetation

The Gulf Islands occur in the drier maritime subzone of the coastal Douglas-fir (CDF) biogeoclimatic zone (Krajina 1969) and the Georgia Strait section of the Coast Forest region of Rowe's (1977) classification. The CDF zone ranges in elevation from sea level to 450 m in the southern portion, including southern Gulf Islands, and to 150 m in the northern portion (Klinka et al. 1979). The characteristic tree species of the CDF zone, and therefore of James, Sidney, Portland, Moresby, and lesser islands, is coast Douglas fir (*Pseudotsuga menziesii* var. *menziesii*). Spelling of all botanical names is according to Taylor and MacBryde (1977). Within the drier subzone, on drier, open sites where the soils are shallow over bedrock, Garry oak (*Quercus garryana*) and Pacific madrone (*Arbutus menziesii*) occur. The Garry oak generally forms pure stands and is of limited occurrence. Pacific madrone occurs more frequently than Garry oak, commonly in association with coast Douglas fir. Other coniferous tree species that occur are grand fir (*Abies grandis*), western red cedar (*Thuja plicata*), shore pine (*Pinus contorta*), Sitka spruce (*Picea sitchensis*), and western hemlock (*Tsuga heterophylla*). The deciduous trees occurring in the report area are red alder (*Alnus rubra*), bigleaf maple (*Acer macrophyllum*), northern black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), western flowering dogwood (*Cornus nuttallii*), and bitter cherry (*Prunus emarginata*).

The shrub layer is dominated by salal (*Gaultheria shallon*) and, to a lesser extent, by dull Oregon-grape (*Mahonia nervosa*), red huckleberry (*Vaccinium parvifolium*), and evergreen huckleberry (*Vaccinium ovatum*). Salmonberry (*Rubus spectabilis*) is common in moist areas. Herbs and mosses have a low presence, although a variety of ferns commonly occurs along with northern twinflower (*Linnaea borealis*) and American vanilla leaf (*Achlys triphylla*). Many species of spring flowers occur, especially in pockets of shallow soils on bedrock outcrops. The Gulf Island flora is likely one of the most varied in British Columbia (Krajina 1969; Lyons 1976; Klinka et al. 1979).

Species such as fireweed (*Epilobium angustifolium*), common gorse (*Ulex europaeus*), Scotch broom (*Cytisus scoparius*), American stinging nettle (*Urtica dioica* ssp. *gracilis*), western fescue (*Festuca occidentalis*), and orchard grass (*Dactylis glomerata*) occur on disturbed sites (Hirvonen et al. 1974).

Table 3. Mean temperatures, precipitation, rainfall, and snowfall for James and Piers islands

Climatic parameter	James Island	Piers Island
Temperature		
January mean minimum (°C)	1.9	-
July mean maximum (°C)	21.7	-
Annual mean temperature (°C)	10.0	-
Lowest minimum recorded (°C)	-13.9	-
Highest maximum recorded (°C)	35.0	-
Precipitation		
Annual (mm)	748	824
May-September (mm)	122	155
Extreme 24 hr (mm)	102	57
Number of days with precipitation	147	153
Rainfall		
Annual (mm)	715	802
May-September (mm)	122	155
Extreme 24 hour (mm)	77	57
Number of days with rain	142	152
Snowfall		
Annual (cm)	33	21
Extreme 24 hour (cm)	41	14
Number of days with snow	6	5

Source: after Atmospheric Environment Service (1982a).

Table 4. Dates for last spring and first fall frosts, frost-free period, and annual degree-days for James Island and at selected stations surrounding the survey area

Climate station	Last spring frost			First fall frost			Average frost-free period (days)	Annual degree-days (above 5°C)
	Average	Earliest	Latest	Average	Earliest	Latest		
James Island	Apr 23	No frost	Apr 23	Oct 19	Oct 19	No frost	266	1969
Saltspring Island (Vesuvius)	Mar 28	Feb 17	May 12	Nov 8	Sept 23	Dec 4	224	2038
South Pender Island	Apr 7	Mar 15	May 3	Nov 7	Oct 27	Nov 26	213	1951
Saanichton CDA	Apr 12	Mar 1	May 30	Nov 17	Oct 26	Dec 13	218	1887

Source: after Atmospheric Environment Service (1982b,c). Table 4

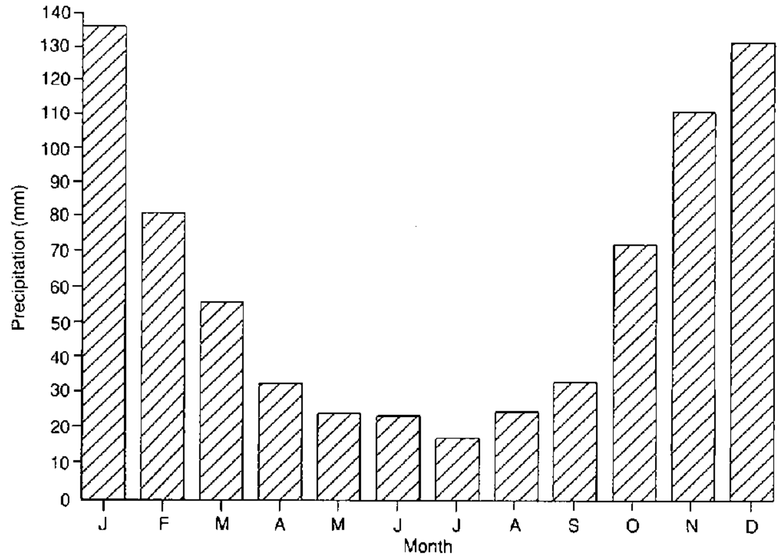

Figure 2. Mean monthly precipitation for James Island (after Atmospheric Environment Service 1982).

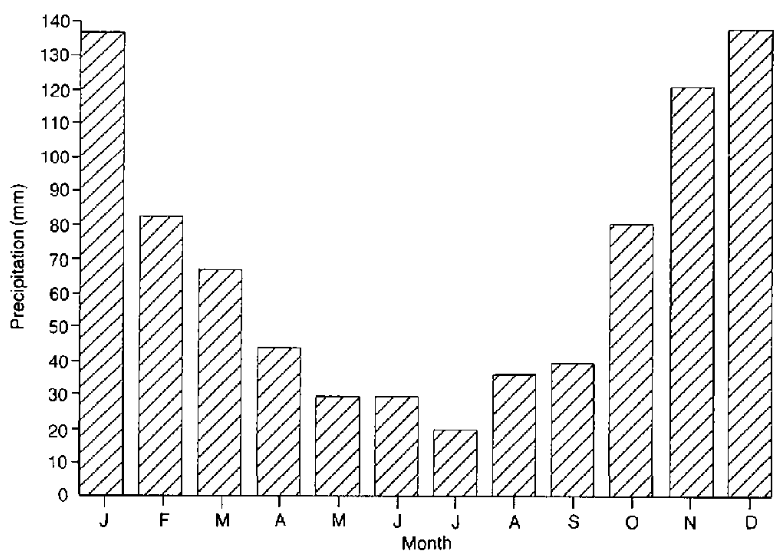

Figure 3. Mean monthly precipitation for Piers Island (after Atmospheric Environment Service 1982).

Geology

The islands in the report area are entirely underlain by the sedimentary formations of Upper Cretaceous age belonging to the Nanaimo Group. The Nanaimo Group is a conformable sequence of marine and nonmarine sediments for which five major depositional periods have been recognized (Muller 1977). These cycles show "a gradation from deltaic sandstones and/or conglomerates through marine rhythmic beds of siltstone, sandstone, and shale either into pure shale and mudstone or interbedded units richer in shale and mudstone" (Winsby 1973). These sequences are considered to be a series of transgressive cycles. Each cycle shows a progression from fluvial to deltaic and or lagoonal to nearshore marine and offshore marine (Muller and Jeletsky 1970).

The seaward Nanaimo formations suffered folding, faulting, and thrusting toward the northeast during Late Tertiary mountain building when the Cascades and Olympic Mountains were formed in Washington State. In the report area, the northeast folding is more gentle and regular with axes more widely spaced. Faulting is less common.

The Nanaimo Group is the main bedrock group to occur in the survey area and consists of the following sedimentary bedrock types: sandstone, shale, siltstone, conglomerate, and, very rarely, coal. The older, underlying formations representing the Triassic-Jurassic metamorphics and volcanics and the Jura-Cretaceous batholithic rocks outcrop on south Saltspring Island. In the report area, they outcrop on Portland, Moresby, Sidney, D'Arcy, Little D'Arcy, and Little Group (Little Shell, Ker, and Dock) islands (Muller 1977).

The Tyee intrusion of Triassic-Jurassic metamorphosed igneous rocks has formations primarily of altered granitoids and sericite schists consisting of the following major rock types: metagranodiorites, metaquartzdiorite, and metaquartz porphyry. The other bedrock type is Paleozoic metamorphosed sedimentary rock belonging to the graywacke-argillite formation of the Sicker Group. The principal rock types are metagraywacke, argillite-schist, and marble (Muller 1977).

Differential erosion of the bedrock by wave action has produced some interesting features. Concretions up to 1 m across are richer in carbonate than the surrounding rock and more resistant. Carbonate-filled networks of cracks also weather out in relief to produce a "honeycomb" weathering surface. Wave-cut "galleries" formed by undercutting of the sandstone at the high tidemark also occur. A "strongly ribbed" appearance is produced by differential erosion from wave action on thin bands of interbedded sandstone and shale (Muller and Jeletzky 1970).

The sedimentary bedrock strata dip gently towards the northeast. They dip steeply only in narrow fault zones (Muller and Jeletzky 1970). The bedrock on Coal, Gooch, and Domville islands is thick-bedded sandstones with steep dips and as a result there is little difference in the opposite slopes of these islands (Clapp 1913).

James Island is composed entirely of Quaternary sediments (Clapp 1913; Muller 1970). It is the only island of the southern Gulf Islands without any bedrock outcrops. A large portion of Sidney Island, i.e., the narrow-shaped part, is also composed of Quarternary sediments. These sediments are often referred to as Quadra Sand, pointing to an interglacial deposit (Armstrong and Clague 1977).

Physiography

James, Sidney, Portland, Moresby, and the lesser islands are situated in the Nanaimo Lowland subdivision of the Georgia Depression physiographic unit of British Columbia (Holland 1976). Differential erosion of the Nanaimo Group bedrock has resulted in the dominant landform pattern of the Nanaimo Lowland, which is characterized by ridges or hills with steep descents on one side and gentle slopes on the other side. These ridges are separated by narrow valleys. The ridges are capped by the more resistant sandstones and conglomerates whereas the valleys have been eroded out of the least resistant shales and mudstones, often along fault lines. The steep descents on the ridges face easterly or westerly depending on the dip of the rock formation. The relief was further modified by glacial erosion and the deposition of a fairly thick mantle of glacial and glaciofluvial materials (Williams and Pillsbury 1958; Holland 1976).

The highest point in the survey area is in the upland area on Moresby Island (148 m). The other islands have much lower elevations. The high point on Sidney Island is 77 m. Both Coal and Portland islands have high points of 59 m. The highest elevation for James Island is 58 m and 57 m for Piers Island (NTS map sheet 92 B/11).

There are sea cliffs along the eastern, western, and southern shores of James Island (cover photo). The southern cliffs are the highest and the wave action on these cliffs is particularly powerful, which results in a near-vertical shoreline. These sea cliffs are eroding at an average annual rate of about 30 cm. The eroded materials are transported northward by currents and deposited forming sandspits (cover photo). Active erosion by wind of the sea cliffs results in a buildup of sand at the soil surface on the southerly part of James Island. On the eastern shore of the Saanich Peninsula there is a similar sandspit and as these two spits grow in size they may eventually form a tombolo, joining James Island to the Saanich Peninsula. At present, these two spits represent an uncompleted tombolo. Long spits also extend northward from Sidney Island (Clapp 1913). Sidney and James islands have more sand on their beaches and islands than all the other southern Gulf Islands (Anon. 1930).

Soil parent materials

The soils of these southeasterly Gulf Islands are developed on many kinds of unconsolidated materials. Most of the soil parent materials found today were once transported and deposited by glaciers, rivers, lakes, and the sea since the last glaciation. On sloping topography, the soils have developed on colluvial and glacial till deposits. Fig. 4 shows a generalized cross section of soil parent materials and typical soils in relation to landscape position.

On James and Sidney islands there are extensive deposits of Quadra Sand. These sediments are well sorted sands with minor silts and gravels that were deposited by streams and rivers as outwash aprons, in front and along the margins of glaciers advancing down the Georgia Depression during the early phases of the Fraser Glaciation during the Late Wisconsinan. The Quadra Sand is overlain unconformably by Vashon tills and related glacial sediments. The Quadra Sand deposits are exposed in the cliffs of James and Sidney islands

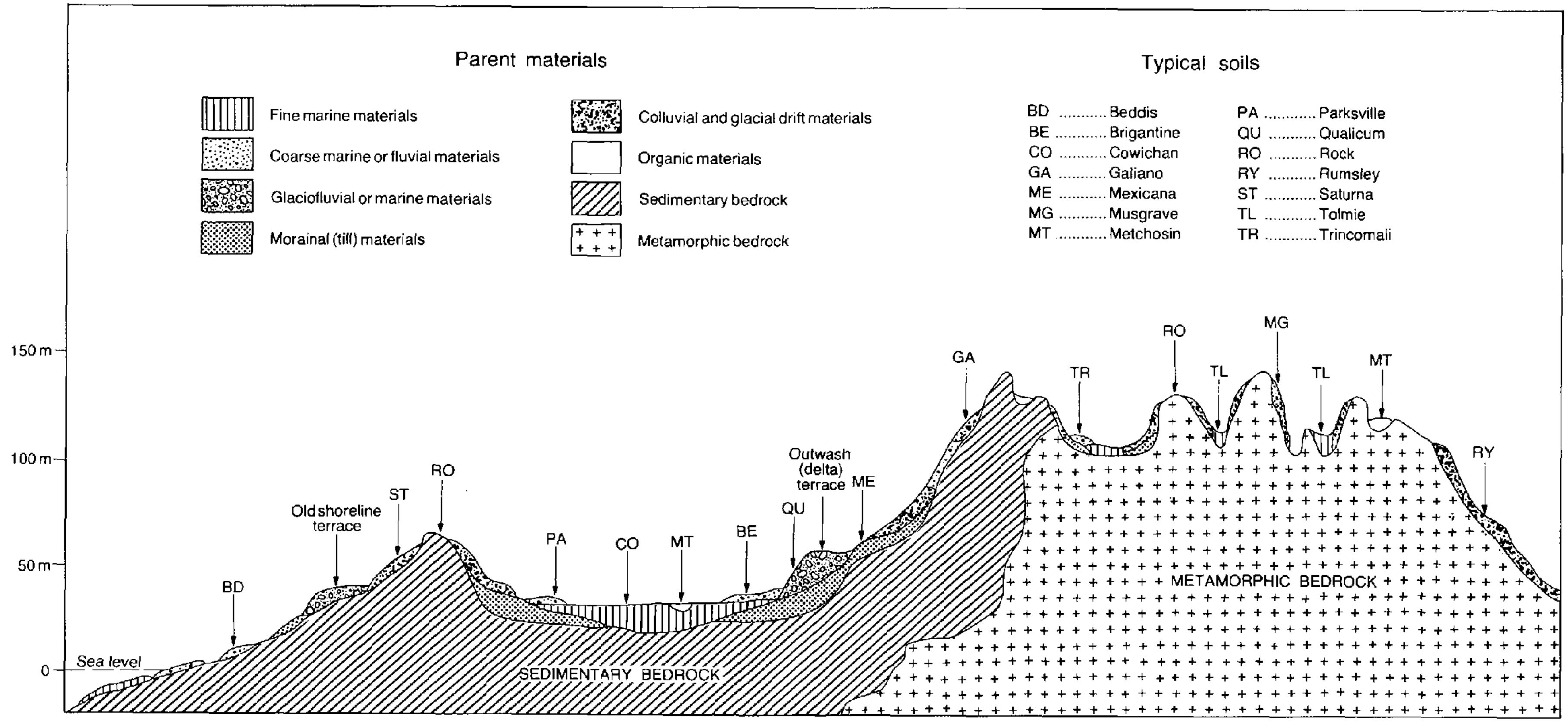

Figure 4. Generalized cross section of soil parent materials and typical soils in relation to landscape position.

(Armstrong and Clague 1977; Clague 1977). These materials form the parent materials of the Baynes, Beddis (Plate Ic), and Denman Island soils.

All the Gulf Islands were glaciated several times during the Pleistocene. The last major ice sheet, which occurred during the Vashon stage of the Fraser Glaciation, reached the Gulf Islands some time later than 25 000 years ago and attained a climax about 15 000 years ago (Mathews et al. 1970). The weight of ice depressed the land relative to the sea (Clague 1975). During and after the retreat of the Vashon ice, which was completed about 12 000 years ago (Mathews et al. 1970), the sea entered depressional areas and covered a large part of the present lowlands of the Gulf Islands, including James, Sidney, Moresby, Portland, and the lessser islands (Halstead 1968). Since the retreat of the glaciers, the islands have rebounded isostatically relative to the sea, so that now the highest marine deposits on the Gulf Islands are found at about 100 m elevation above mean sea level. The deep, fine to moderately fine-textured marine materials were deposited in depressional areas and basins, well protected from wave action. These deposits form the parent materials of the Tolmie soils. Similar deep, fine-textured materials occurring at elevations of >100 m above mean sea level are said to be of lacustrine origin (B. Thomson, personal communication 1980). When encountered, these lacustrine materials were so similar to the fine-textured marine materials that they were not mapped separately but wereincluded with the soils developed on fine to moderately fine textured marine parent materials. Deep, coarse to moderately coarse textured marine materials that were deposited in the sea or modified by the sea became the parent materials of the Baynes, Beddis (Plate Ic), and Denman Island soils (low gravel content), and Qualicum soils (high gravel content; Plate Ie). They occur as shoreline deposits, bars, and terraces. In many places they form shallow deposits over compact, glacial till (Trincomali soils) or over fine to moderately fine textured marine materials (Brigantine and Parksville soils; Plate IIa) or over moderately fine textured marine materials overlaying glacial till (St. Mary soils; Plate If).

The thick mantle of till that was deposited during the last glaciation was subsequently eroded. In many upland areas, these till deposits have been eroded down to the underlying bedrock, except for small pockets on protected side slopes. Deeper till deposits occur in the lowland areas, but are commonly covered by shallow, coarse-, and fine-textured marine deposits (Trincomali and St. Mary soils). The only till material recognized on these islands is a coarse to moderately coarse textured, stony (gravelly), compact till, which is the parent material of the Mexicana soil, usually occurring on mid- to lower-valley slopes.

During glacial retreat, meltwater streams deposited coarse-textured materials as terraces or deltas. These glaciofluvial deposits form the parent materials of the Baynes, Beddis (Plate Ic), and Denman Island soils (low in gravel content) and the Qualicum soils (high in gravel content; Plate Ie). During climatic drying after the last glacial retreat, coarse-textured nongravelly deposits were subjected to strong winds. Windblown or eolian deposits form the parent materials of the Baynes, Beddis (Plate Ic), and Denman Island soils.

The soils that have developed on shallow colluvial and glacial drift materials over bedrock are Saturna and Bellhouse (over sandstone bedrock), Galiano (over shale bedrock), Haslam soil complex (over sandstone, siltstone, and shale bedrock intermixed), Musgrave (Plate IIc) and Rumsley (Plate IIe) (over metamorphic bedrock), and Salalakim (over conglomerate bedrock).

Organic soils, occurring in tiny, closed depressions too small to be mapped, are indicated by an on-site symbol.

Old Indian middens, containing abundant fragments of clam shells in the dark-colored, gravelly sandy soil and occuping tiny but distinct areas of land too small to be mapped, are indicated by an on-site symbol.

A summary of the soils grouped by parent materials is provided in the legend to the accompanying soil map.

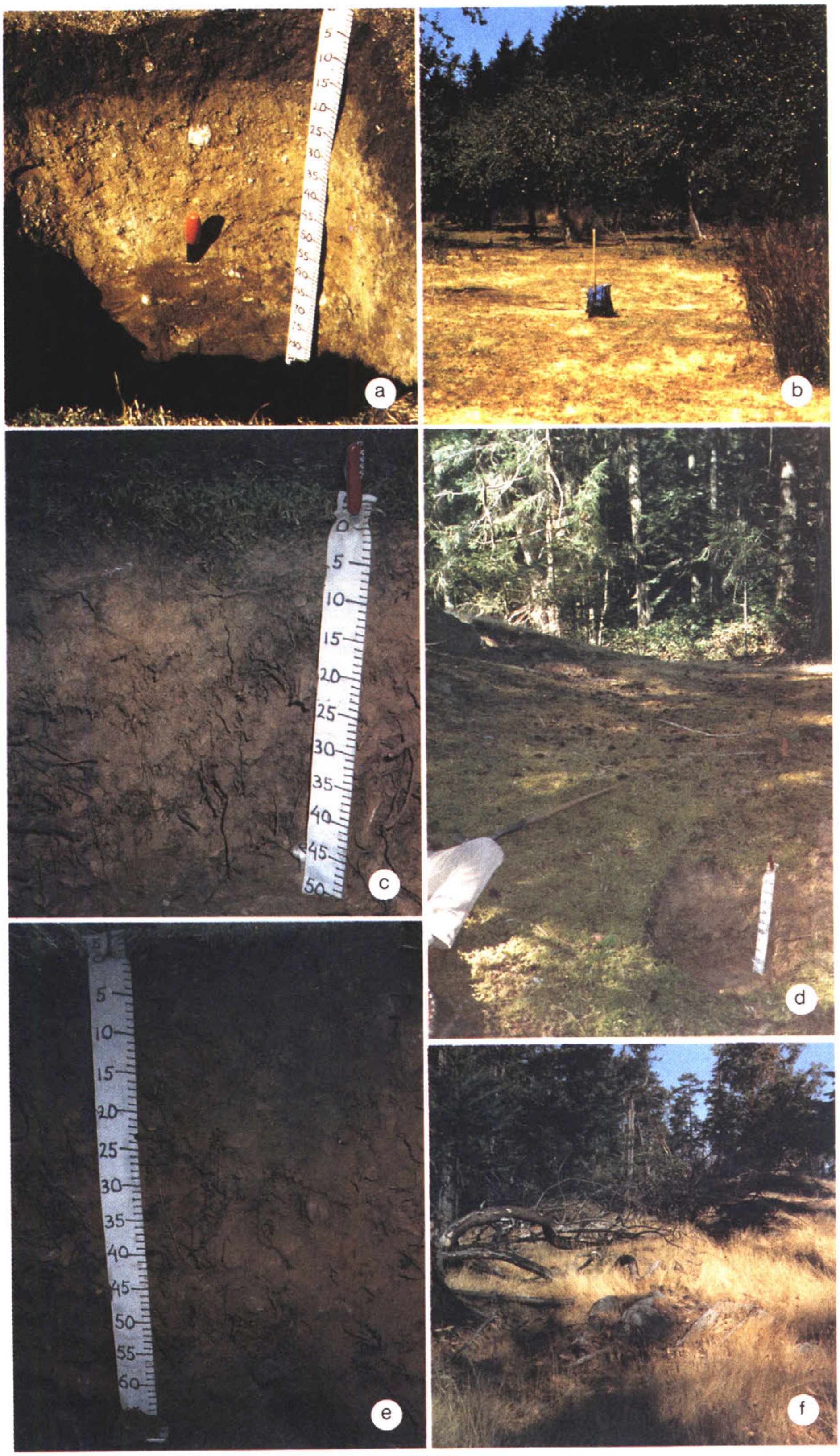

PLATE II

PLATE II

(a) Profile of poorly drained Parksville soil developed on a shallow deposit of coarse-textured gravelly marine materials overlying deep deposits of fine-textured marine materials at 60 cm.
(b) Landscape associated with Parksville soil on gentle slopes of Portland Island; note remnants of an orchard from earlier homesteading days.
(c) Profile of well-drained Musgrave soil; shallow, lithic, moderately coarse textured soil developed in a thin deposit of colluvium over metamorphosed sedimentary bedrock at about 50 cm.
(d) Landscape associated with Musgrave soil on moderately sloping terrain covered with moss, salal, and coast Douglas fir, on Portland Island.
(e) Profile of well-drained Rumsley soil; shallow, lithic, moderately coarse textured soil developed in a thin deposit of colluvium over metamorphosed intrusive bedrock at about 65 cm.
(f) Landscape associated with Rumsley soil, and typical for the Rock-Rumsley map unit, on ridged and rocky terrain covered with grasses and few, scattered, stunted trees on Sidney Island.

PART 3. SURVEY AND MAPPING PROCEDURES

How the soils were mapped

Before field mapping began, preliminary plotting of soil boundaries and areas assumed to have similar soils were marked on aerial photographs in the office. Boundaries between contrasting soils were mapped, using changes in visible landscape features and other indicators, such as slope, bedrock exposures and shallow soils, vegetation, landform (for example, terraces, ridge crests, and escarpments), peatlands containing Organic soils, and color tone indicating different drainage. Fieldwork involved checking these areas to determine the types of soils within them. Location of boundaries between contrasting soils were also checked either by visual examination or by digging and augering holes systematically on either side of them. They were then adjusted, if necessary, and finalized on the aerial photographs. Color aerial photographs at a scale of 1:20 000 were used for the field mapping of the islands during 1986.

At each inspection or observation site (a ground examination to identify or to verify the soil) of a given area, soil properties were recorded. External features such as site position, slope, aspect, elevation, stoniness, percentage bedrock exposed, and vegetation were noted and recorded. Then such properties as texture, drainage, depth to bedrock, root- and water-restricted layers, sequence of layers, and coarse fragment content were recorded from soil pits, auger holes, or road cuts. The control section for both mineral and Organic soils was 160 cm. Consequently, where bedrock was absent, the depth to bedrock was recorded as 160 cm. Where deep roadcuts were available for examination, the properties occurring below 160 cm were recorded as notes. For data-recording purposes during mapping, soil layers, not soil horizons, were recognized. Soil layers are differentiated primarily on the basis of significant changes in textures that would affect interpretations (for example, sandy loam to clay loam, loamy sand to loam, loam to silty clay loam), or of significant changes in coarse fragment content (for example, 10 to 25%), or of size distribution of coarse fragments (for example, cobbles to gravels). Consequently, one soil layer may be made up of one or more genetic soil horizons (for example, layer one might include Ap and Bm horizons if no significant change in soil texture were found). However, when soil profiles were described and sampled in detail, it was done on the basis of genetic soil horizons (Appendix 1). The total number of inspections made during the fieldwork in the survey area is 257.

This type of survey procedure is appropriate to a survey intensity of level 2, called detailed (Valentine and Lidstone 1985), having the following specifications: "At least one inspection in over 80% of delineations. One inspection per 4-25 ha. Boundaries checked along about 25% of total length in open country (15% in woodland). Other boundaries inferred from aerial photographs. Traverses less than 1 km apart. Inspection spacing about 200 m. Traverses mainly by foot and some by vehicle." The average area represented by one inspection (inspection density) in the survey area was 10.2 ha.

An existing list of soils based on the soil legend for the Gulf Islands and east Vancouver Island from previous surveys was used, modified, and updated. Several new soils were added to this list. The soils were given names from the areas where they were first found, plus symbols to denote the names on the aerial photographs. The final list of soils became the legend on the soil map. The soils were classified according to The Canadian System of Soil Classification (Agriculture Canada Expert Committee on Soil Survey 1987). At the end of each field season, typical profiles of the major soils were described and sampled in detail. Once fieldwork was completed and the soils were named, described, classified, and delineated on aerial photographs, production of the final map and legend was begun. The soil map accompanying this report is at a scale of 1:20 000.

Data handling

During the 1986 field season (survey of Sidney, James, Moresby, Portland, and lesser islands), data collected at each inspection site were entered on a Radioshack TRS 80 (Model 100) portable computer. Back-up capabilities included a printer to produce hard copies of the data on a daily basis and recording of the data on magnetic tape because of limited storage space in the computer. The properties (data variables) recorded for each inspection were recorded directly as measured numeric values (for example, as actual depths in centimetres or percent slope) or as letter (character) codes (for example, soil textures or classification), following specified coding guidelines. At the end of the field season the data were transferred to a MSDOS-based microcomputer. Data were entered into Aladin data base management (Advanced Data Institute America Incorporated 1983) and were exported to a commercial spreadsheet (Lotus Development Corporation 1983) for statistical evaluation. Summary statistics (mean, minimum, and maximum values) were generated for numeric data (for example, coarse fragment content), and frequencies (counts) were generated for character data (for example, textures and classification). Data for all 257 inspections were analyzed.

A polygon information form was filled out for each mapped delineation (polygon). Recorded information includes the map unit symbol and slope classes; the symbol, slope class, and proportion of the dominant, subdominant, and minor soils (inclusions) that occurred in the delineation; and the number of inspections (observations) per delineation. The data were entered into a MSDOS-based microcomputer. Computerized data handling of the polygon information occurred in the same way as for the daily records. Summary statistics include mean, minimum, and maximum percentage of soils in each map unit. During the field season, a total of 374 polygon forms were filled out,processed, and statistically analyzed.

Standardized forms and computerized data handling for large data sets have several advantages. Improvement in the detail, uniformity, and quality of description is usually found. If properties are described consistently and in a set order, the user can find the desired information more readily and also the collector records the required data more accurately and consistently. A standard format greatly facilitates data entry for computer processing. Computerized data handling allows for more efficient processing of the data, and statistical evaluations, such as frequency distributions, are readily done (Smeck et al. 1980).

Reliability of mapping

All the islands and islets in the survey area were visited for field mapping using an inflatable zodiac boat. Field mapping involved traversing the islands and islets by foot, making use of existing trails and old logging roads when available. Islands without a network of trails were traversed using compass bearings. Several steep, inaccessible areas on Portland and Sidney islands were not checked.

On average, 0.7 inspections per delineation were made in the survey area. Ten or more inspections per delineation were not uncommon for large delineations and for areas with complex soil materials or topography. Therefore, symbols within any delineation on the map do not describe accurately 100% of what is in that area. Mapping accuracy varies with access and complexity of soil parent materials, topography, depth to bedrock, and soil drainage. For example, because of the former influence of the sea between 0 and 100 m above mean sea level, complex depositional sequences took place that are reflected in intimately intermixed soil materials over very short distances. Generally, a higher inspection density took place in these areas, compared to that needed for the less complex patterns of soil landscape at higher elevations.

The soil map shows different areas of map units that have certain ranges of soils and soil properties. The reliability or accuracy of these ranges varies from one location of the map to another; it is never 100%. Therefore, to determine the qualities of a soil at a particular location, a site inspection must be made.

Soil series

The soils are recognized, named, and classified in The Canadian System of Soil Classification (Agriculture Canada Expert Committee on Soil Survey 1987) at the series level. Each named series consists of soils that have developed on similar parent materials and that are essentially alike in all major characteristics of their profile except for texture of the surface. Soil properties that are definitive for the soil series are texture, drainage, coarse fragment content, contrasting materials, thickness and degree of expression of horizons (for example, Ah and Bt horizon), and lithology. On these islands, 16 different soil series and one soil complex are recognized (see map legend). In addition, one nonsoil unit is recognized and mapped that consists dominantly of Rock (RO).

A soil complex is used where two defined soil units are so intimately intermixed geographically that it is impractical, because of the scale of mapping, to separate them. The Haslam soil complex includes Galiano and Saturna soils.

Variability in one or more soil properties is common. Where this variability is common and consistent enough to be mapped and where it affects the use interpretations and management of the soil, it is expressed as a soil phase in the map symbol. For example, an area with Saturna soil in which bedrock occurs consistently within 50 cm from the surface is mapped as a very shallow lithic phase (STsl). Soil variants are properties of soils believed to be sufficiently different from other known soils but occurring at too limited an aerial extent to justify a new soil (for example, sombric variant). All soil phases and variants used in the surveyed area are listed in the accompanying map legend and are expressed in the map symbol as one or two lowercase letter symbols attached to the soil symbol. A maximum of two soil phases or variants were recorded and mapped for a soil.

Map units

Soils are shown on the soil map either singly or grouped in map units. A map unit represents mappable portions of the soil landscape. Both soil and nonsoil (RO), called mapping individuals, occur as components in each map unit. A map unit contains one (called simple map unit) or more than one (called compound map unit) soil or nonsoil individual, plus a small proportion of a minor soil or nonsoil individual, called inclusions. The proportion of each of the component soils, nonsoil, and inclusions varies within defined limits for the map unit from one delineation to another. The map unit reflects the combined total variation of all delineations that contain the same symbol (Mapping Systems Working Group 1981). The dominant soil of the map unit is the most common soil, occupying between 50 and 100% of the map unit. The subdominant soil of the map unit is the less common soil, occupying between 25 and 50% of the map unit if limiting, or between 35 and 50% of the map unit if nonlimiting in the use interpretations. Minor soils or inclusions of the map occupy up to 25% of the map unit if limiting, or up to 35% of the map unit if nonlimiting in the use interpretations. For example, 0-25% bedrock exposures in the Saturna (ST) map unit is a limiting inclusion. However, an example of a nonlimiting minor soil or inclusion is 0-35% of an imperfectly drained Brigantine (BE) soil in the poorly drained Parksville (PA) map unit. Consequently, the proportion of the map unit with limiting inclusions is always lower (usually between 0 and 25%) compared to the nonlimiting inclusions (usually between 0 and 35%). A soil can be simultaneously the dominant component of one map unit, the subdominant component of another map unit, and a minor component or inclusion in a third map unit. An example of such a soil is Tolmie (TL); dominant soil in TL simple map unit, subdominant soil in BE-TL and PA-TL map units, and mentioned as minor components (inclusions) in the CO map unit. Also, many map units (both simple and compound) have inclusions of one or more minor soils (see "Part 4").

The map units are described in the legend to the accompanying map sheet and are identified by specific colors on the map according to parent materials of the dominant soil. Simple map units with dominant soils developed on moderately fine to fine textured marine materials are colored shades of blue (Brigantine, Parksville, and Tolmie). Map units with dominant soils developed on coarse to moderately coarse textured morainal or fluvial parent materials are colored shades of red (Baynes, Beddis, Denman Island, and Qualicum). Shades of yellow and light orange are used for simple map units with soils developed on colluvial materials (Galiano, Haslam soil complex, Musgrave, Rumsley, Salalakim, and Saturna). Shades of bright green are used for map units the dominant soils of which have compact till in the subsoil (Mexicana, St. Mary, and Trincomali). The Rock-dominated simple map unit is colored gray-brown. Colors for compound map units are composed of a combination of the color for the dominant and the subdominant soils in the map unit.

Each of the 23 different map units recognized on the islands are listed in Table 5 with the total number of delineations and aerial extent. Table 5 also lists land types that are recognized on the islands; coastal beach, made land, tidal flat, and small lakes (see also map legend). Land types are distinguished from map units by lacking a slope symbol.

Some areas on the map (delineations) are too small to be mapped separately. These areas are indicated by on-site symbols. They have been used for small areas in Rock (RO), Organic soils in marshes or swamps, and for small areas with native Indian middens (kitchen dumping grounds consisting of clam and oyster shells and organic debris). Other on-site symbols are used on the map to indicate site-specific information such as gravel pits, escarpments, gullies, rock or stone piles, marshes or swamps, and water (ponds or dugouts). A list of on-site symbols is shown on the map legend.

Table 5. Number of delineations and areal extent of each map unit and land type for the survey area

Map unit: Symbol	Name	Number of delineations	Areal extent (ha)	Proportion of total area (%)
BD	Beddis	28	336.1	12.8
BE	Brigantine	34	221.3	8.4
BE-TL	Brigantine-Tolmie	4	7.3	0.3
BY	Baynes	3	23.8	0.9
DA	Denman Island	10	33.5	1.3
GA	Galiano	10	60.0	2.3
HA	Haslam	7	39.3	1.5
ME	Mexicana	5	6.2	0.2
MG	Musgrave	15	103.9	3.9
PA	Parksville	6	55.3	2.1
PA-TL	Parksville-Tolmie	3	11.6	0.4
QU	Qualicum	12	57.3	2.2
RO	Rock	80	231.4	8.8
RO-BH	Rock-Bellhouse	3	6.6	0.2
RO-MG	Rock-Musgrave	15	172.3	6.6
RO-RY	Rock-Rumsley	16	106.7	4.1
RO-ST	Rock-Saturna	19	45.3	1.7
RY	Rumsley	13	85.3	3.2
SL	Salalakim	4	10.6	0.4
SM	St. Mary	6	38.2	1.5
ST	Saturna	48	227.8	8.7
TL	Tolmie	26	244.7	9.3
TR	Trincomali	24	410.5	15.6
Land type: Symbol	**Name**			
CB	Coastal beach	5	16.0	0.6
MD	Made land	2	4.6	0.2
TF	Tidal flat	3	59.2	2.3
W	Small lakes, ponds	12	12.9	0.5

PART 4. DESCRIPTION OF SOILS AND MAP UNITS

This section describes the properties of the soils and map units. It describes how the basic units, the soils, are related and grouped together to form map units, which are then related to landscape properties. Each soil description is followed by map unit descriptions for which that soil is a dominant component.

DESCRIPTION OF SOILS

Descriptions for each of the 16 different soils, 1 soil complex, and 1 nonsoil unit occurring in the survey area include sections on soil characteristics, water regime, variability in soil properties, similar soils to the one described, natural vegetation, land use of the soil, and in what map units the soil occurs.

After a description of each soil regarding the range in soil textures and coarse fragment content, the drainage, and the depth that are definitive characteristics, the section on soil characteristics also includes data on observed ranges and calculated mean values for soil properties that relate to depth, thickness, and coarse fragment content, and frequency of occurrence data for soil properties such as texture, drainage class, and classification. Detailed profile descriptions for soils occurring most commonly are provided in Appendix 1.

Soil characteristics

Conventions used for the soil characteristics are as follows:
For numeric data (for example, thickness of surface layer or cobble content of surface layer), the first three columns indicate mean, minimum, and maximum values for that property followed by the number of observations. A value of 160 cm corresponds with the depth of the control section (depth to which soil data were recorded) and indicates no value observed (for example, depth to bedrock or depth to mottles).
For character data (for example, texture or drainage), the frequency of occurrence in percent of different classes of that property are presented (for example, texture of subsurface layer: SL 56%, LS 25%, S 19%), followed by the number of observations.
LS, SL, L, and so on are the short forms for soil textures, explained in the map legend.
CF is the short form for coarse fragments.
Fine gravels range in size from 2 mm to 2.5 cm.
Coarse gravels range in size from 2.5 to 7.5 cm.
PSD is the short form for particle size discontinuity, which is used when significant changes in particle sizes occur between soil layers (horizons) as a result of material deposition. These changes have to be greater than one textural class on the texture triangle (for example, S-SL, SL-CL, L-C). Water movement is often impaired by particle size discontinuities (Miller 1973). PSD is used with Brigantine, Parksville, and St. Mary soils.

Variability

Conventions used to describe soil variability are as follows:

Frequency of occurrence, expressed both as the number of observations and as the percentage of total number of soil observations, is presented for each soil phase or variant symbol in alphabetical sequence. As some soil phases or variants occur in conjunction with others, the numbers may overlap, hence the total percentage frequency may be greater than 100. When soil variability is frequent and consistent enough to be mapped, it is expressed in the map symbols as a soil phase or variant for the delineation. Consequently, it is mentioned in the distribution and extent section.

Mean, followed by the range in values in parenthesis for numeric soil data, is presented in the variability column of this section (for example, coarse fragment content for very gravelly phase), after an explanation of the soil phase or variant symbol.

Further conventions used for soil descriptions, or the class limits for characteristics such as slope, can be found in The Canadian System of Soil Classification (Agriculture Canada Expert Committee on Soil Survey 1987) or in the map legend. Definitions of soil terms not explained in this report can be found in the Glossary of Terms in Soil Science (Canadian Society of Soil Science 1976).

DESCRIPTION OF MAP UNITS

Following each soil description are descriptions of map units for which that soil is a dominant component.

Each map unit description reports, based on all delineations of the map unit, the mean proportion in percent, followed in parentheses by the range (minimum and maximum proportion in percent) occupied by the dominant, the subdominant, and the minor soils (inclusions) in the map unit, calculated from the delineation (polygon) data. A minor soil does not occur in all delineations of the map unit. One that occurs in more than 20% of the delineations of the map unit is identified and listed. A minor soil that occurs in less than 20% of the delineations is not identified or listed, but collectively these minor soils are called unmentioned inclusions. Two minor soils occur in some delineations of the map unit.

Under landform and occurrence is described the landscape position, the surface form, and the dominant slopes for each map unit.

Under distribution and extent is described the geographic location of the map unit, the number and approximate size and shape of its delineations, and the areal extent of the map unit.

In the following sections soils and map units are described alphabetically. Detailed profile descriptions and analyses for the soils occurring most commonly are presented in alphabetical order in Appendixes 1 and 2.

BAYNES SOILS AND MAP UNITS

Baynes soils (BY)

Baynes soils are imperfectly drained soils that have developed on deep (>150 cm) fluvial, marine, or eolian materials of sandy loam to sand texture. Coarse fragment content is <20%. The profile description and analyses of a selected Baynes soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	37	25	50	7
Depth to bedrock (cm)	160	160	160	7
Depth to restricting layer (cm)	160	160	160	7
Depth to mottles (cm)	54	35	90	7
CF content surface layer (%)	10	4	20	5
Fine gravel content surface layer (%)	9	2	20	5
Coarse gravel content surface layer (%)	1	0	2	5
Cobble content surface layer (%)	0	0	0	5
CF content subsurface layer (%)	10	0	20	5
Fine gravel content subsurface layer (%)	9	5	20	5
Coarse gravel content subsurface layer (%)	1	0	5	5
Cobble content subsurface layer (%)	0	0	0	5

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(71), LS(14), L(14)	7
Texture of subsurface layer	LS(57), S(29), SL(14)	7
Drainage class	Imperfect(100)	7
Soil classification	GL.DYB(57), GL.SB(43)	7
Type of restricting layer	Absent	
Perviousness	Rapid to moderate	

Water regime

Baynes soils are imperfectly drained soils with distinct to prominant mottles between 35 and 90 cm, caused by seasonal fluctuations in the water table. They are saturated to about 45 cm from the surface during winter months. Where seepage water occurs the subsoil may be moist throughout the rest of the year. Droughty conditions may occur during the summer when the water table drops to below 75 cm of the surface. The C horizon in some places has a massive structure of compact sand that is less permeable than the overlying materials, which results in perched water table conditions.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
BYa	2	29	Sombric variant: Ah or Ap horizon >10 cm; classified as Gleyed Sombric Brunisol (GL.SB); also in conjunction with shallow (s) and strongly mottled or wetter (w) phases
BYg	2	29	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 23% (20-25%); also in conjunction with strongly mottled or wetter (w) phase
BYw	4	58	Strongly mottled phase: wetter moisture regime by mottling within 50 cm of surface; not a Gleysolic type landscape; also in conjunction with sombric (a) variant and gravelly (g) phase

Note: Other phases of the Baynes soil with very limited occurrence are loam (lo) and shallow (s) phases.

Similar soils

Baynes soils are similiar to the Beddis soils that are rapid to moderately well drained and to poorly drained Denman Island soils. Baynes soils are also similar to the Qualicum soils that have a higher (>20%) coarse fragment content throughout the profile and are rapidly to well drained.

Natural vegetation

The natural vegetation is characterized by western red cedar, red alder, and coast Douglas fir. The understory consists predominately of western sword fern (Polystichum munitum).

Land use

Most Baynes soils are tree covered. Some small areas of Baynes soil have been cleared for agriculture, primarily for pasture. The soils are droughty, fertility is low, soil reaction is strongly acid, and the base exchange is also low. With improvements, such as drainage, irrigation, and high inputs of fertilizer, these soils have good potential for producing a range of annual crops. At present, forestry represents their most common use.

Map units

Only one Baynes map unit is recognized, a simple map unit (BY) in which Baynes is the dominant soil. In addition, the Baynes soil occurs as a minor soil or unmentioned inclusion in some delineations of the Beddis (BD), Brigantine (BE), Denman Island (DA), Parksville (PA), Qualicum (QU), and Trincomali (TR) map units.

Baynes map unit (BY)

The Baynes map unit consists dominantly (70%) of the imperfectly drained Baynes soil. The map unit includes on average 30% of other soils, which may be one or a combination of the following minor soils: Beddis (BD), Denman Island (DA), or Brigantine (BE). In addition, unmentioned inclusions of other (poorly drained) soils do occur in each delineation.

The inclusions of poorly drained soils somewhat limit the land use possibilities and use interpretations for this map unit. Beddis and Brigantine minor soils are nonlimiting inclusions.

Landform and occurrence

Soils of the Baynes map unit occur on lower side-slope positions along drainageways or in flatter depressional areas as deep sandy deposits. The topography is very gently to moderately sloping (2-15%) and, in some places, strongly sloping (16-30%). Minor soils are scattered in some Baynes delineations.

Distribution and extent

Baynes is a very minor map unit that appears as three small- to medium-sized delineations on Sidney and Moresby islands only. On Sidney Island one delineation was mapped as BYw, and the one delineation on Moresby Island was mapped as BYg. This map unit represents an area of 23.8 ha (0.9% of total map area).

BEDDIS SOILS AND MAP UNITS

Beddis soils (BD)

Beddis soils are rapid to moderately well drained soils that have developed on deep (>150 cm) fluvial, marine, or eolian materials of sandy loam to sand texture. Coarse fragment content is <20%. The profile description and analyses of a selected Beddis soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	77	10	160	36
Depth to bedrock (cm)	160	160	160	36
Depth to restricting layer (cm)	160	160	160	36
Depth to mottles (cm)	149	105	160	36
CF content surface layer (%)	12	2	20	17
Fine gravel content surface layer (%)	11	2	20	17
Coarse gravel content surface layer (%)	1	0	5	17
Cobble content surface layer (%)	1	0	10	17
CF content subsurface layer (%)	14	0	20	8
Fine gravel content subsurface layer (%)	12	0	20	8
Coarse gravel content subsurface layer (%)	3	0	15	8
Cobble content subsurface layer (%)	0	0	0	8

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	LS(36), S(36), SL(25), FSL(3)	36
Texture of subsurface layer	S(57), LS(35), SL(4), FSL (4)	23
Drainage class	Rapid(53), well(33), moderately well (14)	36
Soil classification	O.DYB(53), O.SB(36), O.R(11)	36
Type of restricting layer	Absent	
Perviousness	Rapid to moderate	

Water regime

Beddis soils are well to moderately well drained with water tables remaining below 100 cm throughout the year. The soils remain moist during the winter months, but quickly becoming droughty in dry periods during the summer. The C horizon may in some places have a massive structure of compact sand, which is more slowly permeable than the overlying materials but is not enough to create perched water table conditions.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
BDa	13	36	Sombric variant: Ah or Ap horizon >10 cm; classified as Orthic Sombric Brunisol (O.SB); also in conjunction with gravelly (g) and shallow (s) phases

BDg	22	61	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 33% (25-40%); also in conjunction with sombric variant (a) and moderately cemented (mc) phase
BDt	4	11	Taxonomy change variant: taxonomy differs from specified classification (GL.DYB or GL.SB) into Orthic Regosol (O.R) for Beddis soils that have no profile development (located on sandspits)

Note: Other phases of the Beddis soil with very limited occurrence are shallow lithic (l), moderately cemented (mc), deep (d), shallow (s), and very shallow (vs) phases.

Similar soils

Beddis soils are similar to Qualicum soils, which have a higher (>20%) coarse fragment content throughout the profile. Beddis soils are similar to the Baynes soils that are imperfectly drained, and to the poorly drained Denman Island soils.

Natural vegetation

The natural vegetation is characterized by coast Douglas fir, grand fir, some shore pine, and scattered Pacific madrone. The understory consists of salal, western bracken (*Pteridium aquilinum*), and dull Oregon-grape. Western hemlock occurs on some sites with a northerly aspect.

Land use

Most Beddis soils support a tree cover. Some small areas have been cleared over the years for agricultural purposes, mainly for pasture and hay crops. The soils are very droughty, fertility is low, and soil reactions are strongly acid (pH 5.1-5.5); the base exchange is low as well. With improvements, such as irrigation and high inputs of fertilizer, these soils have good potential for producing a range of annual crops and tree fruits. Currently, forestry represents their most common use.

Map units

Only one Beddis map unit is recognized, a simple map unit in which Beddis is the dominant soil. In addition, Beddis soils occur as a minor soil or unmentioned inclusion in some delineations of the Baynes (BY), Brigantine (BE), Qualicum (QU), and Trincomali (TR) map units.

Beddis map unit (BD)

The Beddis map unit consists dominantly (83%; 60-100%) of the well to moderately well drained Beddis soils. The Beddis map unit includes on average 17% (up to 40%) of other soils. These other soils may be one or a combination of the following soils: Qualicum (QU), Trincomali (TR), or Baynes (BY), of which the Qualicum and Trincomali soils occur most widely (in more than half the number of delineations). Unmentioned inclusions of other soils occur in very few places.

Qualicum and Trincomali soils somewhat limit the land use possibilities and use interpretations for this map unit because of the higher coarse fragment content. The imperfectly drained Baynes (BY) soils limit the land use possibilities and use interpretations because they are wetter soils than Beddis.

Landform and occurrence

The Beddis map unit occurs both as narrow, discontinuous terraces along drainageways, as old beach deposits or as interglacial Quadra sand deposits, on very gently to moderately sloping (2-15%), and on some steeper sloping (16-30%) terrain. Three areas on James Island occurred on very steep bluff slopes (46-100%). Inclusions of other soils occur at random.

Distribution and extent

The Beddis map unit covers 28 variable-sized delineations throughout the survey area. Thirteen delineations were mapped on James Island and seven on Sidney Island, including some large and very large delineations. Fifteen of the Beddis delineations were mapped without soil phases as BD, eleven as BDg or BDg,a, one each as BDl and BDvs. This major map unit represents an area of 336.1 ha (12.8% of total map area).

BELLHOUSE SOILS AND MAP UNITS

Bellhouse soils (BH)

The well-drained Bellhouse soil has developed on shallow colluvial and glacial drift materials of channery and flaggy, sandy loam texture over fractured or smooth, unweathered sandstone bedrock within 100 cm. Coarse fragment content varies between 20 and 50%. The soil has a dark-colored Ah horizon of at least 10 cm thick that is high in organic matter content. The profile description and analyses of a selected Bellhouse soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	20	20	20	1
Depth to bedrock (cm)	20	20	20	1
Depth to restricting layer (cm)	20	20	20	1
Depth to mottles (cm)	160	160	160	1
CF content surface layer (%)	45	45	45	1
Fine gravel (channery) content surface layer (%)	15	15	15	1
Coarse gravel (channery) content surface layer (%)	30	30	30	1
Cobble content (flaggy) surface layer (%)	0	0	0	1

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(100)	1
Texture of subsurface layer	-	0
Drainage class	Well(100)	1
Soil classification	O.SB(100)	1
Type of restricting layer	Sandstone bedrock	
Perviousness	Rapid to moderate	

Water regime

Bellhouse soils are well drained. The soil remains moist throughout the winter months but is droughty from late spring to late fall. After infiltration, excess water drains freely and rapidly on top of the underlying sloping bedrock to lower areas.

Variability

Soil phase or variant	Frequency (no.)	Frequency (%)	Description of variability
BHsl	1	100	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth 20 cm (20-20 cm)

Similar soils

Bellhouse soils are similar to Saturna soils, which have thinner Ah or Ap horizons (0-10 cm). Saturna soils are found on all aspects, whereas the Bellhouse soils are more restricted to southerly and southwesterly aspects.

Natural vegetation

The natural vegetation is quite distinctive and consists of scattered clumps of Garry oak, coast Douglas fir, and Pacific madrone. Garry oak is a unique species, restricted to the warm and dry southerly and southwesterly aspects. Tree growth is often stunted from lack of moisture. The ground cover is predominantly grasses, spring flowers, common gorse, and Scotch broom.

Land use

Because of the shallow soil to bedrock, topographic limitations, and droughtiness, uses of the Bellhouse soil are restricted mainly to its natural vegetation and to limited grazing by wild sheep and deer.

Map units

Bellhouse soils only occur as the subdominant soil in one compound map unit in the survey area, the Rock-Bellhouse (RO-BH) map unit, which is described under Rock (RO). In addition, the Bellhouse soil may occur as a minor soil or unmentioned inclusion in some delineations of the Rock (RO) and Rock-Saturna (RO-ST) map units.

BRIGANTINE SOILS AND MAP UNITS

Brigantine soils (BE)

Brigantine soils are imperfectly drained soils that have usually between 30 and 100 cm of a sandy loam to loamy sand of marine or fluvial origin overlying deep (>100 cm), silty clay loam to loam deposits, that are usually stone free. In some places, overlay materials were shallower than 30 cm. Coarse fragment content of overlay materials <20%. The profile description and analyses of a selected Brigantine soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	45	10	90	33
Thickness of 2nd layer (cm)	39	10	100	33
Depth to bedrock (cm)	160	160	160	33
Depth to restricting layer (cm)	67	40	100	26
Depth to mottles (cm)	58	40	85	26
Depth to PSD (cm)	63	11	100	26
CF content surface layer (%)	10	2	15	10
Fine gravel content surface layer (%)	7	0	15	10
Coarse gravel content surface layer (%)	3	0	10	10
Cobble content surface layer (%)	0	0	2	10
CF content 2nd layer (%)	13	0	50	33
Fine gravel content 2nd layer (%)	9	0	35	33
Coarse gravel content 2nd layer (%)	3	0	25	33
Cobble content 2nd layer (%)	1	0	10	33
CF content 3rd layer (%)	2	0	15	23
Fine gravel content 3rd layer (%)	2	0	10	23
Coarse gravel content 3rd layer (%)	0	0	5	23
Cobble content 3rd layer (%)	0	0	0	23

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(58), LS(15), L(12), FSL(9), S (6)	33
Texture of 2nd layer	LS(33), SICL(24), L(12), SL(9), FSL(9), S(6), SCL(3), CL(3)	33
Texture of 3rd layer	SICL(70), SCL(13), CL(9), SL(4), L(4)	23
Drainage class	Imperfect(97), moderately well(3)	33
Soil classification	GL.DYB(55), GL.SB(42), O.DYB(3)	33
Type of restricting layer	Fine-textured subsoil, often massive structured	
Perviousness	Slow	

Water regime

Brigantine soils are imperfectly drained with seasonal fluctuations in the water table. They are saturated to within 60 cm of the surface during the winter months. Seepage water maintains the subsoil in a moist condition throughout the rest of the year. Droughty conditions may occur during the summer when the water table drops to below 75 cm from the surface. Perched water table conditions may occur above the fine-textured subsoil.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
BEa	14	42	Sombric variant: Ah or Ap horizon >10 cm; classified as Gleyed Sombric Brunisol (GL.SB); also in conjunction with gravelly (g) and strongly mottled or wetter (w) phases
BEd	7	21	Deep phase: depth to fine-textured subsoil between 100 and 150 cm; mean depth 114 cm (105-130 cm); also in conjunction with gravelly (g) phase
BEg	23	70	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 32% (20-50%); also in conjunction with sombric (a) variant, deep (d), and strongly mottled or wetter (w) phases
BEw	7	21	Strongly mottled phase: wetter moisture regime as evidenced by mottling within 50 cm of the surface; not a Gleysolic type landscape; also in conjunction with sombric (a) variant and gravelly (g) phase

Note: No other soil phases or variants of the Brigantine soil occur.

Similar soils

Brigantine soils are similar to the poorly drained Parksville soils. Shallow Brigantine soils over compact till materials within 100 cm of the surface have been mapped as St. Mary soils. Brigantine soils with coarse to moderately coarse textured overlays thicker than 150 cm have been classified and mapped as the better-drained Beddis or Qualicum soils, depending on the coarse fragment content.

Natural vegetation

The natural vegetation consists of western red cedar, red alder, and coast Douglas fir. The understory includes western sword fern, salal, and western bracken.

Land use

Brigantine soils in the survey area are used for pasture and hay crops and for growing trees. For agricultural purposes, the soil remains cold till late spring and is strongly acid (pH 5.1-5.5). The upper horizons have a moderately low moisture-holding capacity. The soil has low inherent fertility, so large amounts of fertilizer are required to produce a good crop. Brigantine soils can be improved with irrigation and subsurface drainage to some of the better agricultural soils, producing a wide range of crops and tree fruits.

Map units

Brigantine soils are some of the most widely mapped soils in the survey area and occur in several map units. In addition to the simple map unit BE, Brigantine soils have also been mapped as the dominant soil in the Brigantine-Tolmie (BE-TL) map unit. In addition, Brigantine soils occur as a minor soil or unmentioned inclusion in some delineations of the Beddis (BD), Mexicana (ME), Parksville (PA), Qualicum (QU), Rock-Musgrave (RO-MG), St. Mary (SM), Saturna (ST), and Tolmie (TL) map units.

Brigantine map unit (BE)

The Brigantine map unit consists dominantly (81%; 60-100%) of imperfectly drained Brigantine soils. The map unit includes on average 19% (up to 40%) of other soils, of which the Qualicum (QU), Parksville (PA), and Tolmie (TL) soils are the most frequently occurring minor soils in more than half the delineations of the map unit. Unmentioned inclusions of other soils occur sparsely.

The poorly drained Parksville and Tolmie soils are the most limiting inclusions for use interpretations of this map unit. The high coarse fragment content of the Qualicum soils will also be somewhat limiting.

Landform and occurrence

Soils of the Brigantine map unit occur on very gentle to moderate slopes (2-15%) as narrow areas surrounding depressional basins and draws that are occupied by poorly drained soils, usually Parksville but in some places Tolmie soils. Parksville and Tolmie soils occur in the lowest landscape positions as small unmappable inclusions in almost half of the Brigantine (BE) delineations. The inclusions of other minor soils occur at random in the Brigantine landscape. Elevation usually ranges from 0 to 100 m above mean sea level.

Distribution and extent

The Brigantine map unit is a major one. It has been mapped as 34 variable-sized, often narrow delineations throughout the survey area, from which 19 delineations occur on Moresby and Portland islands. Twenty-one delineations were mapped as BEg, three as BEg,a, three as BEd,g, and one each as BEd and BEa.

The remaining five delineations were mapped as BE without a soil phase. The Brigantine map unit represents 221.3 ha (8.4% of total map area).

Brigantine-Tolmie map unit (BE-TL)

The Brigantine soil dominates this map unit (60%; 50-75%). The map unit also contains 31% (25-40%) of poorly drained soils developed on deep, loam to silty clay textured (usually stone free) marine deposits (Tolmie soils). The map unit includes up to 20% of Parksville (PA) as a minor soil in half the number of delineations. No unmentioned inclusions of other soils were identified for the map unit.

Landform and occurrence

Soils of the Brigantine-Tolmie (BE-TL) map unit occur on very gentle to moderate (2-15%) slopes in narrow areas surrounding depressional basins and draws that are occupied by poorly drained Tolmie soils. Tolmie and Parksville soils occupy the lowest landscape positions, with Tolmie soils making up significant portions (25-40%) of the map unit. Elevation usually ranges between 0 and 100 m above mean sea level.

Distribution and extent

The Brigantine-Tolmie map unit has been mapped very widely as four relatively small delineations on Moresby and Piers islands. Two of the delineations were mapped as BEg-TL, one as BEa-TL, one as BE-TL. This map unit represents an area of 7.3 ha (0.3% of total map area).

DENMAN ISLAND SOILS AND MAP UNITS

Denman Island soils (DA)

Denman Island soils are poorly to very poorly drained soils that have developed on deep (>150 cm) fluvial, marine, or eolian materials of sandy loam to loamy sand texture. Coarse fragment content is <20%.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	23	20	25	2
Depth to bedrock (cm)	160	160	160	1
Depth to restricting layer (cm)	160	160	160	1
Depth to mottles (cm)	15	5	25	2
CF content surface layer (%)	4	0	8	2
Fine gravel content surface layer (%)	3	0	5	2
Coarse gravel content surface layer (%)	2	0	3	2
Cobble content surface layer (%)	0	0	0	2
CF content subsurface layer (%)	8	0	15	2
Fine gravel content subsurface layer (%)	5	0	10	2
Coarse gravel content subsurface layer (%)	3	0	5	2
Cobble content subsurface layer (%)	0	0	0	2

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(50), PEAT(50)	2
Texture of subsurface layer	SL(50), LS(50)	2
Drainage class	Poor(50), very poor(50)	2
Soil classification	O.HG(50), O.G(50)	2
Type of restricting layer	Absent	
Perviousness	Rapid to moderate	

Water regime

The Denman Island soils are poorly to very poorly drained and have distinct to prominent mottles within 50 cm of the surface. They are wet for long periods throughout the year with water tables at or within 30 cm of the surface during the winter (December to March). The water table drops quickly below 60 cm from the surface in early April and remains there until early November. Water tables in the Denman Island soils fluctuate rapidly over short periods after rainfall or drought. The C horizon may have a massive structure of compact sand, which is more slowly permeable than the overlying materials, resulting in a perched water table. Because of their low landscape position, Denman Island soils receive runoff water from the surrounding landscape.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
DApt	1	50	Peaty phase: <40 cm of mesic organic materials over mineral soil; mean thickness 20 cm (20-20 cm)
DAl	1	50	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 75 cm (75-75 cm); also in conjunction with loam (lo) phase
DAlo	1	50	Loam phase: surface texture is loam; mean thickness 25 cm (25-25 cm) also in conjunction with shallow lithic (l) phase

Note: Denman Island soils that are periodically inundated by seawater at very high tides are mapped as saline phases (sn).

Similar soils

Denman Island soils are similar to the Beddis soils that are rapidly to moderately well drained and to the Baynes soils that are imperfectly drained.

Denman Island soils are somewhat similar to the Qualicum soils that have a higher (>20%) coarse fragment content throughout the profile and that are rapidly to well drained.

Natural vegetation

The natural vegetation is characterized by western red cedar, red alder, and bigleaf maple. The understory consists predominantly of western sword fern, sedges, and rushes.

Land use

Denman Island soils are either tree covered or support salt-tolerant grasses in areas periodically inundated by seawater at very high tides.

Map units

Only one Denman Island map unit is recognized, a simple map unit (DA) in which Denman Island is the dominant soil. In addition, the Denman Island soil occurs as a minor soil or unmentioned inclusion in some delineations of the Baynes (BY) and Parksville (PA) map units.

Denman Island map unit (DA)

The Denman Island map unit consists dominantly (97%; 75-100%) of poorly to very poorly drained Denman Island soils. The map unit includes on average 3% (up to 25%) of other soils. Besides one delineation with 25% inclusions of Baynes and Saturna soils, no minor soils or inclusions were identified for the Denman Island map unit. The inclusion of Saturna soil limits most use interpretations for that delineation.

Landform and occurrence

Soils of the Denman Island map unit occur in narrow drainageways, draws, and depressions as deep sandy deposits. Some areas (three on James Island and one on Sidney Island) are periodically inundated by seawater at very high tides. The topography varies from depressional to level to very gently sloping (0-5%).

Distribution and extent

Denman Island is a minor map unit that has been mapped as 10 very small- to medium-sized delineations, of which 5 occur on James Island, 4 on Sidney Island, and 1 on Coal Island. Four delineations (two each on James and Sidney islands) were mapped as DApt, and the one on Coal Island as DA1,lo. The remaining five delineations did not have any soil phases. This map unit represents an area of 33.5 ha (1.3% of total map area).

GALIANO SOILS AND MAP UNITS

Galiano soils (GA)

Galiano soils are well to moderately well drained, shaly loam soils that have developed on shallow colluvial, residual, and glacial drift materials of weathered shale over shale bedrock within 100 cm of the surface. These soils usually have a thick layer of fractured bedrock (paralithic) between the solum and the unweathered consolidated bedrock. Coarse fragment content is between 20 and 50%. The profile description and analyses of a selected Galiano soil are given in the Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	38	13	55	5
Depth to bedrock (cm)	43	30	55	5
Depth to restricting layer (cm)	43	30	55	5
Depth to mottles (cm)	160	160	160	5
CF content surface layer (%)	39	32	45	5
Fine gravel content (shaly) surface layer (%)	34	25	40	
5Coarse gravel (shaly) content surface layer (%)	4	0	15	5
Cobble content (flaggy) surface layer (%)	1	0	5	5

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(100)	6
Texture of subsurface layer	-	0
Drainage class	Well(67), moderately well(33)	6
Soil classification	O.DYB(83), O.SB(17)	6
Type of restricting layer	Shale bedrock	
Perviousness	Moderate	

Water regime

Galiano soils are well to moderately well drained soils. Faint mottling may occur in the subsoil. They are wet during the winter months but are usually droughty during summer. Water tables do not remain within 100 cm from the surface for any prolonged period. During and shortly after wet periods, water may flow laterally through a saturated subsoil on top of sloping bedrock.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
GAd	1	17	Deep phase: depth to bedrock between 100 and 150 cm; mean depth 125 cm (125-125 cm)
GAl	1	17	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 55 cm (55-55 cm)
Gasl	4	67	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth 40 cm (30-45 cm); also in conjunction with very gravelly (vg) phase
GAvg	1	17	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 60% (60-60%); only in conjunction with very shallow lithic (sl) phase

Note: No other soil phases or variants of the Galiano soil occur.

Similar soils

Galiano soils are commonly found together with the well-drained, channery and flaggy, sandy loam to fine sandy loam textured Saturna soils that have developed on colluvial and glacial drift materials over sandstone bedrock within 100 cm of the surface. Both soils occur on similar slopes and in similar landscape positions. Galiano and Saturna soils commonly occur so closely together in the landscape, because of the intermixing of bedrock types, that they cannot be reasonably separated. Where this occurs, both soils are identified and mapped as Haslam soil complex (HA).

Natural vegetation

The natural vegetation consists of coast Douglas fir, some scattered Pacific madrone, and, in a few places, some western red cedar. The ground cover includes short salal, grasses, and moss.

Land use

All Galiano soils in the report area have a tree cover. Galiano soils are generally not suitable for agriculture because of steep topography, stoniness, shallow to bedrock, droughtiness, low fertility, and the many bedrock outcrops. The best use for Galiano soils is for growing coniferous trees.

Map units

Galiano soils occur as the dominant soil in the Galiano (GA) simple map unit. They are also a major component of the Haslam (HA) soil complex. In addition, Galiano soils occur as a minor soil or unmentioned inclusion in some delineations of the Beddis (BD), Rock (RO), Rock-Saturna (RO-St), Saturna (ST), and Tolmie (TL) map units.

Galiano map unit (GA)

The Galiano map unit consists dominantly (82%; 50-90%) of the well to moderately well drained Galiano soils. The Galiano map unit includes on average 18% (up to 50%) of other soils, of which bedrock outcrops of shale (RO) are the most widely occurring minor component in more than half the delineations. Unmentioned inclusions of other soils occur sporadically.

Bedrock exposures are usually associated with the very shallow lithic Galiano soils (GAsl) and limit the use interpretations. Inclusions of other soils are nonlimiting and are most commonly associated with the GA delineations.

Landform and occurrence

Soils of this map unit occur in areas of shallow soils over sedimentary bedrock, elongated parallel ridges and knolls with gentle to moderate (6-15%) slopes and in some places on very strong (31-45%) slopes. Soils in this map unit are commonly represented as long, narrow delineations. Inclusions of Rock and soils occur randomly as small areas.

Distribution and extent

The Galiano map unit is a minor one with 10 small- to medium-sized delineations on Piers, Knapp, Pym, Domville, and Coal islands. GAsl delineations, including two GAsl,vg delineations, occur more widely (70%) than GA delineations. The Galiano map unit represents an area of 60 ha (2.3% of total map area).

HASLAM SOIL COMPLEX AND MAP UNITS

Haslam soil complex (HA)

The Haslam soil complex consists of well-drained soils ranging in texture from channery and shaly sandy loam to channery and shaly loam colluvial, residual, and glacial drift materials over sandstone, siltstone, or shale bedrock within 100 cm of the surface. The soil materials usually have a layer of fractured bedrock (paralithic) between the solum and the unweathered solid bedrock. Coarse fragment content is between 20 and 50%. The different bedrock types that are the parent materials for Galiano and Saturna soils occur either sequentially or intermixed; consequently, Haslam is a complex of these soils.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	48	30	70	7
Depth to bedrock (cm)	48	30	70	7
Depth to restricting layer (cm)	48	30	70	7
Depth to mottles (cm)	160	160	160	9
CF content surface layer (%)	45	40	50	4
Fine gravel (shaly and channery) content surface layer (%)	20	10	35	4
Coarse gravel (shaly and channery) content surface layer (%)	23	15	25	4
Cobble content (flaggy) surface layer (%)	8	0	20	4

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(50), SL(50)	6
Texture of subsurface layer	-	0
Drainage class	Well (100)	9
Soil classification	O.DYB(100)	9
Type of restricting layer	Sandstone, siltstone, or shale bedrock	
Perviousness	Rapid to moderate	

Water regime

Haslam soil complex consists of well-drained soils. They are moist and occasionally wet during the winter months but droughty during the summer. Water tables do not remain within 100 cm of the surface for any prolonged time. During and shortly after wet periods, water may flow laterally through the saturated subsoil on top of sloping bedrock. The fractured bedrock materials on top of the unweathered, consolidated bedrock does not impede the movement of water.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
HAl	2	25	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 68 cm (65-70 cm); also in conjunction with very gravelly (vg) phase
HAsl	5	63	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth 39 cm (30-50 cm); also in conjunction with very gravelly (vg) phase
HAvg	5	63	Very gravelly phase: coarse fragment content in surface layers >50%; mean CF 58% (55-60%); only in conjunction with shallow lithic (l) and very shallow lithic (sl) phases

Note: There is also a very limited occurrence of the deep (d) phase of the Haslam soil complex.

Similar soils

Haslam is a complex of Galiano and Saturna soils where their respective bedrock types are so intimately intermixed that it is impractical to map them separately.

Natural vegetation

The natural vegetation on the Haslam soil complex consists of coast Douglas fir, Pacific madrone, and, in some places, western red cedar, western hemlock, and grand fir. The ground cover consists of short salal, western bracken, dull Oregon-grape, and grasses.

Land use

The Haslam soil complex is rarely used for agriculture because of many limiting factors, such as steep topography, stoniness, shallow to bedrock, droughtiness, low fertility, and the frequency of rock outcrops. The best use for these soils is for growing coniferous trees.

Map units

The Haslam soil complex is dominant in the simple Haslam (HA) map unit.

Haslam map unit (HA)

The Haslam map unit consists dominantly 84% (70-90%) of the well-drained Haslam complex with up to 20% of bedrock exposures (Rock). Unmentioned inclusions of another soil only occur in one delineation. The inclusions of bedrock exposures are a limiting factor in use interpretations for this map unit.

Landform and occurrence

Soils of the Haslam map unit occur in areas with shallow soils over sedimentary bedrock on elongated parallel ridges, knolls, and bench-like landscape positions having a wide variety of slopes ranging in steepness from 6 to 45%. The different types of bedrock (sandstone, shale, and siltstone) occur either sequentially or intermixed. The bedrock inclusions outcrop on the ridge and knoll crests.

Distribution and extent

The Haslam map unit is a minor one. It has been mapped as seven small- to medium-sized delineations on Goudge and Coal islands only. Although several soil phases were recognized for the Haslam soil complex, no soil phases were mapped for the Haslam map unit. The Haslam map unit represents an area of 39.3 ha (1.5% of total map area).

MEXICANA SOILS AND MAP UNITS

Mexicana soils (ME)

Mexicana soils are to moderately well to imperfectly drained soils that have developed on gravelly loam to gravelly sandy loam textured morainal deposits over deep, compact, unweathered till within 100 cm from the surface. Coarse fragment content is generally between 20 and 50%. The unweathered till materials have generally less than 20% clay content (loam texture) and usually occur below 50 cm in depth. These materials are the only till recognized in the survey area. Mexicana soils may have a coarse-textured marine or fluvial capping from 0 to 30 cm thick with a coarse fragment content of between 20 and 50%. The profile description and analyses of a selected Mexicana profile are presented in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	44	15	80	6
Depth to bedrock (cm)	160	160	160	6
Depth to restricting layer (cm)	60	22	80	6
Depth to mottles (cm)	88	20	160	6
CF content surface layer (%)	27	7	50	6
Fine gravel content surface layer (%)	20	5	40	6
Coarse gravel content surface layer (%)	5	2	10	6
Cobble content surface layer (%)	2	0	5	6
CF content subsurface layer (%)	18	5	45	4
Fine gravel content subsurface layer (%)	14	5	35	4
Coarse gravel content subsurface layer (%)	2	0	5	4
Cobble content subsurface layer (%)	2	0	7	4

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(66), SL(17), FSL(17)	6
Texture of subsurface layer (till)	L(75), FSL(25)	4
Drainage class	Imperfect(50), moderately well(33), poor(17)	6
Soil classification	GL.DYB(50), O.DYB(17), O.SB(17), O.HG(16)	6
Type of restricting layer	Compact till	
Perviousness	Slow	

Water regime

The Mexicana soils are generally moderately well to imperfectly drained soils with faint mottling throughout the solum, commonly increasing to distinct mottles below 50 cm from the surface. They are wet during the winter months but are dry and droughty during the summer. Perched water table conditions often occur on top of the compact till and seepage water is common. Water moves laterally over the compact till during the winter or after heavy rainfall. The till, when dry, is impervious to water and root growth. During the wetter part of the year, the top 10-15 cm of the unweathered till becomes somewhat pervious. The imperfectly drained Mexicana soils are mapped as an imperfectly drained phase (MEid).

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
MEa	1	17	Sombric variant: Ah or Ap horizons >10 cm; classified as Orthic Sombric Brunisol (O.SB); also in conjunction with poorly drained (pd) phase
MEid	3	50	Imperfectly drained phase: wetter moisture regime than specified for soil (Gleyed subgroups)
MEpd	1	17	Poorly drained phase: poorly drained (Gleysolic) with distinct to prominant mottles within 50 cm of the surface; also in conjunction with sombric (a) variant

Note: No other soil phases or variants of the Mexicana soil occur. Discontinuous, weakly but occasionally moderately cemented horizons may be present in the Mexicana soil.

Similar soils

Mexicana soils are similar to the well to moderately well drained Trincomali soils that have a gravelly sandy loam to sand textured overlay of between 30 and 100 cm thick over similar textured compact till. The unweathered compact till of the Mexicana soil is also found in the subsoil of the St. Mary soil.

Natural vegetation

The natural vegetation of the Mexicana soils consists of coast Douglas fir, western red cedar, and grand fir. The understory consists of salal, western sword fern, huckleberry, and dull Oregon-grape.

Land use

Little agricultural development has taken place on the Mexicana soils. Clearings when they occur are small, scattered, and used only for hay and pasture. The major limitations for agricultural use are their droughtiness, topography, and stoniness. Mexicana soils on slopes not exceeding 15% could be improved with irrigation and stone picking to grow a small range of annual crops. Tree fruits and berries seem to do well on these soils under irrigation. Mexicana soils are also good for growing coniferous trees.

Map units

Mexicana soils are the dominant soils in the Mexicana (ME) map unit. In addition, Mexicana soils occur as a minor soil or unmentioned inclusion in some delineations of the Galiano (GA), Rock-Saturna (RO-ST), Saturna (ST), and Trincomali (TR) map units.

Mexicana map unit (ME)

The Mexicana map unit consists dominantly (76%; 70-90%) of the moderately well to imperfectly drained Mexicana soils. The map unit includes on average 23% (10-30%) of other soils, of which the Trincomali (TR) soil is the most widely occurring minor soil. Unmentioned inclusions of other soils do occur. The higher coarse fragment content of the Trincomali soil may adversly influence some use interpretations for this map unit.

Landform and occurrence

Soils of the Mexicana map unit occur on very gently to moderately sloping (2-15%) subdued topography. They usually occur on side-slope positions in depressions and hollows where till deposits have been protected from erosional processes since last glaciation. Marine or fluvial cappings on top of the till (Trincomali soils) occur scattered in some delineations.

Distribution and extent

The Mexicana map unit occurs only as a minor map unit on Goudge, Moresby, James, and Sidney islands with five small delineations. The only delineation on Sidney Island was mapped as MEid. Although two more soil phases were recognized for the Mexicana soils, no other soil phases were mapped for the Mexicana map unit. The Mexicana map unit represents an area of 6.2 ha (0.2% of total map area).

MUSGRAVE SOILS AND MAP UNITS

Musgrave soils (MG)

Musgrave soils are well-drained soils that have developed on shallow deposits of gravelly sandy loam to silt loam textured colluvial and glacial drift materials over dominantly metamorphosed sedimentary bedrock within 100 cm of the surface. Coarse fragment content is between 20 and 50%. The profile description and analyses of a selected Musgrave soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	74	55	100	4
Depth to bedrock (cm)	63	55	70	3
Depth to restricting layer (cm)	63	55	70	3
Depth to mottles (cm)	160	160	160	4
CF content surface layer (%)	30	30	30	1
Fine gravel content surface layer (%)	10	10	10	1
Coarse gravel content surface layer (%)	15	15	15	1
Cobble content surface layer (%)	5	5	5	1
CF content subsurface layer (%)	25	25	25	1
Fine gravel content subsurface layer (%)	20	20	20	1
Coarse gravel content subsurface layer (%)	5	5	5	1
Cobble content subsurface layer (%)	0	0	0	1

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(50), FSL(25), SIL(25)	4
Texture of subsurface layer	L(100)	1
Drainage class	Well(75), moderately well(25)	4
Soil classification	O.DYB(75), O.HFP(25)	4
Type of restricting layer	Bedrock	
Perviousness	Rapid to moderate	

Water regime

Musgrave soils are well drained without evidence of mottling within 100 cm of the surface. They are moist throughout the winter months but quickly become droughty in dry periods during the summer. During and shortly after wet periods, water may flow laterally through the saturated subsoil on top of sloping bedrock.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
MGl	2	50	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 68 cm (65-70 cm); also in conjunction with very gravelly (vg) phase and taxonomy change (t) variant
MGvg	2	50	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 65% (50-75%); only in conjunction with shallow lithic (l) and paralithic (pl) phases

Note: Other phases of the Musgrave soil with very limited occurrence are paralithic (pl) phase and taxonomy change (t) variant, from Orthic Dystric Brunisol (O.DYB) into Orthic Humo-Ferric Podzol (O.HFP).

Similar soils

The Musgrave soils resemble other well-drained, shallow upland soils that have developed on similar-textured colluvium and glacial drift materials but overlie coarse-grained metamorphosed igneous bedrock (Rumsley). The main difference is in the rock type, but the morphology and soil characteristics are much the same.

Natural vegetation

The natural vegetation consists of coast Douglas fir, scattered Pacific madrone, some grand fir, and western hemlock with an understory of short salal, western bracken, dull Oregon-grape, and grasses.

Land use

The Musgrave soils are best left in their original vegetation. The soils are often too shallow, too steep, too stony, and too droughty for agricultural development. Occasionally, wild sheep and fallow deer are roaming free in areas where the vegetation consists dominantly of grasses.

Map units

Musgrave soils are the dominant soils in the Musgrave (MG) simple map unit. They also occur as subdominant soils in the Rock-Musgrave (RO-MG) map unit, which is described under Rock (RO). In addition, the Musgrave soil occurs as an unmentioned inclusion in one delineation of the Brigantine (BE) map unit.

Musgrave map unit (MG)

The Musgrave map unit consists dominantly (72%; 55-90%) of the well-drained Musgrave soils. The map unit includes on average 28% (10-45%) of other soils, of which metamorphosed sedimentary bedrock exposures (Rock), Qualicum soils, or both, occur in almost all the delineations of the map unit. The bedrock exposures limit the use interpretations of this map unit.

Landform and occurrence

Soils of the Musgrave map unit occur in areas with shallow soils over metamorphosed sedimentary bedrock. The soil landscape is undulating, hummocky, and ridged with gently to strongly sloping (6-30%) topography and, in some places, steeper slopes (31-45%). Bedrock exposures occur scattered.

Distribution and extent

The Musgrave map unit has 15 small- to medium-sized delineations, of which 9 were mapped on Moresby Island and 6 on Portland Island. Four delineations had bedrock within 50 cm from the surface (MGsl), whereas the remaining 11 delineations had no soil phases. The Musgrave map unit represents an area of 103.9 ha (3.9% of total map area).

PARKSVILLE SOILS AND MAP UNITS

Parksville soils (PA)

Parksville soils are poorly drained soils that have between 30 and 100 cm of a sandy loam to sand overlay of marine or fluvial origin over deep (>100 cm), silty clay loam, clay loam, and silty clay textured marine deposits that are usually stonefree. Coarse fragment content of overlay materials is <20%. The profile description and analyses of a selected Parksville soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	30	10	95	27
Thickness of 2nd layer (cm)	40	5	95	27
Depth to bedrock (cm)	160	160	160	27
Depth to restricting layer (cm)	68	30	100	21
Depth to mottles (cm)	26	19	35	21
Depth to PSD (cm)	48	15	95	21
CF content surface layer (%)	6	0	17	23
Fine gravel content surface layer (%)	5	0	15	23
Coarse gravel content surface layer (%)	1	0	5	23
Cobble content surface layer (%)	0	0	0	23
CF content 2nd layer (%)	7	0	20	26
Fine gravel content 2nd layer (%)	5	0	20	26
Coarse gravel content 2nd layer (%)	2	0	10	26
Cobble content 2nd layer (%)	1	0	10	26
CF content 3rd layer (%)	1	0	20	23
Fine gravel content 3rd layer (%)	1	0	20	23
Coarse gravel content 3rd layer (%)	0	0	0	23
Cobble content 3rd layer (%)	0	0	0	23

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(48), SL(37), SIL(7), FSL(4), FLS(4)	27
Texture of 2nd layer	SL(26), LS(26), FSL(15), S(11), SiCL(11), CL(7), L(4)	27
Texture of 3rd layer	SICL(61), CL(13), SL(9), SiC(9), SCL(4), FSL(4)	23
Texture of 4th layer (occurs when layer 3 is SL)	SICL(50), SCL(25), L(25)	4
Drainage class	Poor(100)	27
Soil classification	O.HG(96), O.G(4)	27
Type of restricting layer	Fine-textured subsoil, commonly massive structured	
Perviousness	Slow	

Water regime

Parksville soils are poorly drained and have distinct to prominent mottles within 50 cm of the surface. They are saturated with water to within 30 cm of the surface from late fall to spring. During summer, the water table drops to below 60 cm, allowing the surface horizons to become dry. Perched water tables occur on top of the fine-textured, massive-structured subsoil. As a result of their low landscape position, Parksville soils receive seepage and runoff water from surrounding areas, which keeps the subsoil in a moist condition during dry periods.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
PAd	5	19	Deep phase: depth to finer-textured subsoil between 100 and 150 cm; mean depth 121 cm (110-145 cm); also in conjunction with loam (lo), gravelly (g), and silt loam (si) phases
PAg	4	15	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 24% (20-30%); also in conjunction with deep (d), loam (lo), and silt loam (si) phases
PAlo	12	44	Loam phase: surface textured is loam; mean thickness 23 cm (12-35 cm); also in conjunction with deep (d) and gravelly (g) phases
PAsi	3	11	Silt loam phase: surface texture is silt loam; mean thickness 22 cm (15-30 cm); also in conjunction with deep (d) and gravelly (g) phases

Note: Another variant of the Parksville soil with very limited occurrence is a change in taxonomy (t), from Orthic Humic Gleysol (O.HG) into Orthic Gleysol (O.G).

Similar soils

The imperfectly drained member of the Parksville soils is similar to Brigantine soils. Parksville soils differ from the poorly drained Tolmie soils in having coarse-textured overlay materials thicker than 30 cm. Also Tolmie soils are usually saturated with water for a longer period during the year. Where the Parksville soils have a loam or silt loam texture (PAlo, PAsi), a layer of coarse-textured materials thicker than 30 cm overlies the finer-textured materials.

Natural vegetation

The natural vegetation on Parksville soils consists of western red cedar, red alder, hardhack, and some willow. The understory consists of western sword fern, common horsetail, and American vanilla leaf. American skunk cabbage commonly occurs in the wettest portions that have an organic surface layer (Oh).

Land use

Many Parksville soils in the survey area have been cleared for agriculture, primarily for pasture and hay production. The major limitation for growing a wider range of crops is the wetness in the late spring caused by high water tables, which could be overcome using artificial drainage. The upper, coarse-textured horizons have a moderately low moisture-holding capacity and would benefit from irrigation during the summer months. The soils are strongly acid (pH 5.1-5.5) at the surface and moderately acid (pH 5.6-6.0) in the subsurface.

Map units

Two map units occur in the survey area in which Parksville soils are dominant. They are the simple map unit Parksville (PA) and the compound map unit Parksville-Tolmie (PA-TL). In addition, Parksville soils also occur as a minor soil or unmentioned inclusion in some delineations of the Baynes (BY), Brigantine (BE), Brigantine-Tolmie (BE-TL), and Tolmie (TL) map units.

Parksville map unit

The Parksville map unit consists dominantly (86%; 70-100%) of poorly drained Parksville soils. The Parksville map unit includes on average 14% (up to 30%) of other soils, of which the poorly drained Tolmie (TL) soil is the most widely occurring minor soil. Unmentioned inclusions of other soils occur sporadically. The minor soil and inclusions do not limit the use interpretations for the map unit.

Landform and occurrence

Soils of the Parksville map unit occur on nearly level to very gently sloping (0.5-5%) topography in depressional areas, swales, and drainageways. Parksville soils usually occur around the periphery of marine basins where sandy materials have been deposited on top of fine-textured marine materials, or as fluvial deposits in drainageways. Tolmie soils occur as unmappable inclusions in the Parksville map unit in similar landscape positions. These soils are also found in depressions between bedrock ridges. Elevation is usually between 0 and 100 m above mean sea level.

Distribution and extent

The Parksville map unit has been mapped on Sidney, Moresby, and Piers islands as six small- to medium-sized, sometimes narrow delineations. From the two delineations on Moresby Island, one was mapped as a deep phase (PAd) and the other one with a loam textured surface horizon (PAlo). One delineation on Sidney Island was mapped as PAsi. This map unit represents an area of 55.3 ha (2.1% of total map area).

Parksville-Tolmie map unit (PA-TL)

The Parksville-Tolmie map unit consists dominantly (52%; 45-60%) of the poorly drained Parksville soils with a subdominant proportion (48%; 40-55%) of poorly drained Tolmie soils developed on deep (>100 cm) loam to silty clay textured, usually stonefree, marine deposits. In one place, the Tolmie soil is dominant whereas the Parksville soil is the subdominant one. No minor soils or unmentioned inclusions were identified for the map unit. Tolmie soils do not adversely affect the use interpretations for the PA-TL map unit.

Landform and occurrence

Soils of the Parksville-Tolmie (PA-TL) map unit occur on nearly level to gently sloping (0.5-9%) topography in depressions, swales, and drainageways at elevations between 0 and 100 m above mean sea level. The subdominant Tolmie soils commonly occupy the lowest landscape positions. However, although they cover significant portions of the map unit, they occur scattered in such a way that they cannot be mapped separately.

Distribution and extent

The Parksville-Tolmie map unit occurs as three small and narrow delineations on Moresby, Sidney, and Forest islands. This map unit represents an area of 11.6 ha (0.4% of total map area).

QUALICUM SOILS AND MAP UNITS

Qualicum soils (QU)

Qualicum soils are rapidly to well drained soils developed on deep (>150 cm) deposits of gravelly and cobbly sandy loam to gravelly sand textured glaciofluvial, fluvial, or marine deposits. Coarse fragment content throughout the profile is between 10 and 50%. The profile description and analyses of a selected Qualicum soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	70	12	150	18
Depth to bedrock (cm)	160	160	160	18
Depth to restricting layer (cm)	160	160	160	18
Depth to mottles (cm)	155	105	160	18
CF content surface layer (%)	39	10	50	10
Fine gravel content surface layer (%)	27	10	45	10
Coarse gravel content surface layer (%)	9	0	15	10
Cobble content surface layer (%)	4	0	7	10
CF content subsurface layer (%)	45	15	50	7
Fine gravel content subsurface layer (%)	29	10	45	7
Coarse gravel content subsurface layer (%)	11	0	40	7
Cobble content subsurface layer (%)	6	0	15	7

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	LS(39), S(33), SL(28)	18
Texture of subsurface layer	S(70), LS(20), SL(10)	10
Drainage class	Rapid(56), well(39), moderately well(5)	18
Soil classification	O.DYB(67), O.SB(33)	18
Type of restricting layer	Absent	
Perviousness	Rapid	

Water regime

Qualicum soils are rapidly to well drained. They are moist from the late fall until spring but quickly become very droughty during the summer. The water table remains well below 100 cm throughout the year.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
QUa	6	33	Sombric variant: Ah or Ap horizon >10 cm; classification is Orthic Sombric Brunisol (O.SB); also in conjunction with shallow (s) and very gravelly (vg) phases
QUs	5	28	Shallow phase: less deep (50-100 cm) than specified over similar materials but with coarse fragment content <20%; mean depth 81 cm (60-95 cm); mean total CF 24% (15-35%); mean fine gravels 20% (10-30%); mean coarse gravels and cobbles 4% (2-5%); also in conjunction with sombric (a) variant and very gravelly (vg) phase
QUvg	8	44	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 57% (50-70%); also in conjunction with sombric (a) variant and shallow (s) phase

Note: Another phase of the Qualicum soil with very limited occurrence is bedrock between 100 and 150 cm (deep phase, d).

Similar soils

Qualicum soils commonly occur together with soils of similar drainage and texture but which have a much lower (<20%) coarse fragment content (Beddis soils). Qualicum soils also occur with similar textured but moderately well drained and shallow (<100 cm) soils over compact, unweathered till (Trincomali soils). Qualicum soils are better drained and have a much greater coarse fragment content than the Baynes and Denman Island soils.

Natural vegetation

The natural vegetation on the Qualicum soils is coast Douglas fir and grand fir, with some shore pine and scattered Pacific madrone. Shore pine is the dominant species after fires have occurred. The groundcover consists mainly of short salal and western bracken.

Land use

No known areas of Qualicum soils in the survey area are used for agriculture. The major limitations that preclude agricultural development on these soils are the topography, droughtiness, and stoniness. Also, it is an infertile soil, low in nutrients and organic matter. However, with irrigation these soils could grow productive fruit trees. Qualicum soils are most extensively used as sources of sand and gravel for road building and construction purposes (for example, concrete). All abandoned and currently active gravel pits occur in areas with Qualicum soils. The location of these gravel pits are indicated as Ⓖ on the soil map. The present use is restricted to its natural vegetation.

Map units

Qualicum soils occur as the dominant soil in the Qualicum (QU) map unit. In addition, Qualicum soils occur as a minor soil or unmentioned inclusion in some delineations of the Beddis (BD), Brigantine (BE), Haslam (HA), Mexicana (ME), Musgrave (MG), Rock (RO), Rock-Musgrave (RO-MG), Rock-Rumsley (RO-RY), Rock-Saturna (RO-ST), Rumsley (RY), Saturna (ST), and Trincomali (TR) map units.

Qualicum map unit (QU)

The Qualicum map unit consists dominantly (75%; 60-90%) of the rapidly to well-drained Qualicum soils. The Qualicum map unit includes on average 25% (10-40%) of other soils. One or two of the following minor soils occur in most delineations of the Qualicum map unit: Trincomali (TR), Rumsley (RY), Saturna (ST), or Beddis (BD). Unmentioned inclusions of other soils do occur in very few places. Except for Beddis, the minor soils and unmentioned inclusions are limiting most use interpretations for the map unit.

Landform and occurrence

Soils of the Qualicum map unit occur as deep outwash (deltaic) and terraces associated with old drainageways and as beach deposits on very gently to moderately (2-15%) sloping landscape positions. The inclusions of other soils occur scattered in areas where bedrock or till are within 1 m of the surface.

Distribution and extent

The Qualicum map unit has 12 small- to medium-sized delineations including four on Moresby, three on Sidney, two on Coal, two on Piers, and one on Gooch islands. One delineation on Sidney Island was mapped as QUvg and one on Coal Island as QUvg,a. The other 10 delineations did not have any soil phases. This map unit represents an area of 57.3 ha (2.2% of total map area).

ROCK AS NONSOIL AND MAP UNITS

Rock as nonsoil (RO)

Rock as nonsoil consists of undifferentiated, consolidated bedrock either exposed or covered by mineral soil less than 10 cm thick over bedrock. It is also called Rock land or Rock outcrop.

Natural vegetation

The natural vegetation consists of mosses, grasses, spring flowers, and, in some places, broad-leaved stonecrop (*Sedum spathulifolium*), scattered dwarf coast Douglas fir, and Pacific madrone.

Map units

Because many large areas in the study area consist of bedrock exposures with shallow soils over bedrock, bedrock exposures (RO) occur in many map units. Rock is the dominant (55-100%) component in the simple Rock (RO) map unit. Rock is also the dominant (40-65%) component in four compound map units: Rock-Bellhouse (RO-BH), Rock-Musgrave (RO-MG), Rock-Rumsley (RO-RY), and Rock-Saturna (RO-ST). Each of these map units is described here. In addition, bedrock exposures (RO) also occur as minor soils or unmentioned inclusions in some delineations of the Beddis (BD), Brigantine (BE), Galiano (GA), Haslam (HA), Musgrave (MG), Rumsley (RY), Salalakim (SL), and Saturna (ST) map units.

Rock map unit (RO)

The Rock map unit consists dominantly (78%; 55-100%) of undifferentiated bedrock either exposed or covered by less than 10 cm of mineral soil and includes on average 22% (up to 45%) of well-drained soils developed on shallow, loamy sand to loam textured, colluvial and glacial drift materials over bedrock, usually within 50 cm of the surface. The coarse fragment content of the soil materials is between 20 and 50%. The kind of soil depends on the bedrock type on which it has developed: Bellhouse (BH), Galiano (GA), Musgrave (MG), Rumsley (RY), Salalakim (SL), and Saturna (ST). The inclusions of soil enhance the use interpretations for this map unit.

Landform and occurrence

The landscape represented by this map unit varies considerably in steepness and in surface expression. It includes areas with smooth, unweathered, sedimentary bedrock with very gentle to moderate slopes (2-15%) and strong to very strong slopes (16-45%), and rocky ridges and knolls (slopes 10-70%) of all rock types found on the islands. Minor areas of soil occur in places where the bedrock has been fractured and weathered, commonly indicated by clumps of tree growth. Rock occurs at all elevations and aspects.

Distribution and extent

Rock is a major map unit in the survey area. It occurs as 63 very small to medium sized delineations throughout the islands. This map unit includes many small islets. The Rock map unit represents an area of 231.4 ha (8.8% of total map area).

Rock-Bellhouse map unit (RO-BH)

The Rock-Bellhouse map unit consists dominantly (60%) of sandstone bedrock either exposed or covered by less than 10 cm of mineral soil. This map unit also contains subdominant proportions (40%) of well-drained soils developed on very shallow (10-50 cm), channery, sandy loam textured, colluvial and glacial drift materials over sandstone bedrock. These soils have an Ah horizon >10 cm (very shallow lithic Bellhouse soil, BHsl). No unmentioned inclusions of other soils were identified for the map unit. Bellhouse soils enhance the use interpretations for this map unit.

Landform and occurrence

Materials of the Rock-Bellhouse map unit occur on south-facing rock ridges in hummocky terrain with gentle to strong slopes ranging from 6 to 30%. The Bellhouse soils occur on the colluvial side slopes and randomly in areas where the bedrock has been fractured and weathered.

Distribution and extent

This Rock-Bellhouse map unit is a very minor one and occurs as three small- to medium-sized delineations on Portland Island. All delineations were mapped as RO-BHsl. This map unit represents 6.6 ha (0.2% of total map area).

Rock-Musgrave map unit (RO-MG)

This map unit consists dominantly (53%, 45-60%) of metamorphosed sedimentary bedrock either exposed or covered by less than 10 cm of mineral soil. A subdominant portion (40%; 35-55%) of well-drained soils has developed on gravelly sandy loam to silt loam textured, colluvial and glacial drift materials over metamorphosed sedimentary bedrock within 100 cm of the surface (Musgrave soil). The map unit includes Qualicum (QU) as a minor soil in about half the delineations. Unmentioned inclusions of other soils may occur in a few places. Musgrave soils and soil inclusions enhance the use interpretations for this map unit.

Landform and occurrence

Materials of this map unit occur on rocky ridges and in hummocky terrain,with slopes ranging from 6 to 45%. The Musgrave soil occurs on the colluvial side slopes and in areas where the bedrock is fractured and weathered. Isolated pockets of other soil inclusions occur scattered in some delineations.

Distribution and extent

The Rock-Musgrave map unit is not extensive. It occurs as 15 variable-sized delineations. Ten delineations, including a very large one, were mapped on Moresby Island and five on Portland Island. Four of the delineations on Portland Island and one on Moresby Island were mapped as RO-MGsl. No other soil phases were mapped for this map unit. The Rock-Musgrave map unit represents an area of 172.3 ha (6.6% of total map area).

Rock-Rumsley map unit (RO-RY)

This map unit consists dominantly (57%; 40-65%) of metamorphosed intrusive bedrock either exposed or covered by less than 10 cm of mineral soil. The map unit also contains subdominant proportions (41%; 35-50%) of well-drained soils developed on gravelly sandy loam to loamy sand textured,colluvial and glacial drift materials over metamorphosed intrusive bedrock within 100 cm of the surface (Rumsley soil). The map unit includes Qualicum (QU) as a minor soil in some delineations. Unmentioned inclusions of other soils occur in very few places. Rumsley soils and soil inclusions enhance the use interpretations for this map unit.

Landform and occurrence

Materials of the Rock-Rumsley map unit occur on rock ridges and in hummocky terrain with slopes ranging from 2-30%, and occasionally steeper. Rumsley soils occupy the colluvial side slopes and occur in areas where bedrock has been fractured and weathered. The inclusions of other soils occur scattered in pockets in some delineations.

Distribution and extent

This map unit occurs as 16 small- to medium-sized delineations, of which 8 were mapped on Sidney Island, 4 on the Little Group Islands, 3 on Moresby Island, and 1 on D'Arcy Island. All four RO-RYa delineations were mapped on the Little Group Islands (Little Shell, Ker, and Dock islands). No other soil phases were mapped. This map unit represents an area of 106.7 ha (4.1% of total map area).

Rock-Saturna map unit (RO-ST)

This map unit consists dominantly (52%; 45-60%) of sandstone bedrock either exposed or covered by less than 10 cm of mineral soil. This map unit also contains subdominant proportions (43%; 40-55%) of well-drained soils developed on shallow (10-50 cm), channery, sandy loam to fine sandy loam textured, colluvial and glacial drift materials over sandstone bedrock (Saturna soil). Soils have between 20 and 50% coarse fragments. Unmentioned inclusions of other soils may occur. Saturna and other soils enhance the use interpretations for this map unit.

Landform and occurrence

Materials of the Rock-Saturna map unit occur dominantly on rock ridges, knolls, and in areas with smooth, unweathered sandstone (slopes 6-45%), or in some places, on steeper landscape positions with slopes between 46 and 70%. Saturna soils occur on colluvial side slopes and in areas where bedrock has been fractured and weathered, commonly as pockets on top of or in between the ridges or knolls. Inclusions of other soils occur scattered on side slopes or in pockets.

Distribution and extent

Rock-Saturna has been mapped as 19 small- to medium-sized delineations throughout the survey area. Just over half of the delineations were mapped as RO-STs1. No other soil phases were mapped. This map unit represents an area of 45.3 ha, (1.7% of total map area).

RUMSLEY SOILS AND MAP UNITS

Rumsley soils (RY)

Rumsley soils are well-drained soils that have developed on shallow deposits of gravelly sandy loam to gravelly loamy sand textured, colluvial and glacial drift materials over coarse-grained, metamorphosed, intrusive bedrock within 100 cm of the surface. Coarse fragment content is between 20 and 50%. The profile description and analyses of a selected Rumsley soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	61	40	85	7
Depth to bedrock (cm)	64	40	85	5
Depth to restricting layer (cm)	64	40	85	5
Depth to mottles (cm)	160	160	160	5
CF content surface layer (%)	40	35	45	3
Fine gravel content surface layer (%)	22	10	30	3
Coarse gravel content surface layer (%)	10	5	15	3
Cobble content surface layer (%)	8	0	20	3
CF content subsurface layer (%)	45	45	45	1
Fine gravel content subsurface layer (%)	35	35	35	1
Coarse gravel content subsurface layer (%)	10	10	10	1
Cobble content subsurface layer (%)	0	0	0	1

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(71), SIL (29)	7
Texture of subsurface layer	LS(100)	2
Drainage class	Well(100)	7
Soil classification	O.DYB(86), O.SB(14)	7
Type of restricting layer	Bedrock	
Perviousness	Rapid to moderate	

Water regime

The Rumsley soils are well drained with no evidence of mottling within 100 cm from the surface. The soil is moist throughout the winter months but quickly becomes droughty in dry periods during summer. During and shortly after wet periods, water may flow laterally through the saturated subsoil on top of sloping bedrock.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
RYl	3	43	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 78 cm (75-85 cm); also in conjunction with very gravelly (vg) phase
RYsl	2	28	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth 43 cm (40-45 cm); also in conjunction with sombric (a) variant and very gravelly (vg) phase
RYvg	4	57	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 56% (50-60%); also in conjunction with deep (d), shallow lithic (l), and very shallow lithic (sl) phases

Note: Other variants and phases of the Qualicum soil with very limited occurrence are the sombric (a) variant and deep (d) phase with bedrock 100 and 150 cm.

Similar soils

The Rumsley soil is similar to the Musgrave soil; the main difference is the rock type, but the morphology and soil characteristics are alike.

Natural vegetation

The natural vegetation consists of coast Douglas fir, scattered Pacific madrone, and some grand fir, with an understory of salal, western bracken, and dull Oregon-grape.

Land use

No known areas with Rumsley soil are used for agricultural purposes. Steep slopes, stoniness, rockiness, and droughtiness preclude agricultural uses. In a few places, wild sheep and fallow deer roam free where the vegetation consists dominantly of grasses. These soils are best used for growing coniferous trees.

Map units

Rumsley soils occur in several map units. It is the dominant soil in the Rumsley (RY) simple map unit and a subdominant soil in the Rock-Rumsley (RO-RY) map unit, which was described earlier. In addition, Rumsley soils may occur as a minor soil or unmentioned inclusion in some delineations of the Brigantine (BE), Mexicana (ME), Qualicum (QU), Tolmie (TL), and Trincomali (TR) map units.

Rumsley map unit (RY)

The Rumsley map unit consists dominantly (72% 50-85%) of the well-drained Rumsley soils with an average 21% (10-25%) of metamorphosed intrusve bedrock exposed (Rock). Besides bedrock exposures, Qualicum soils occur in 30% of the Rumsley delineations. Bedrock exposures are the limiting factor for the use interpretations for the RY map unit.

Landform and occurrence

Soils of the Rumsley map unit occur in areas with shallow soils over metamorphic bedrock on very gently to strongly sloping (2-30%) topography in undulating, hummocky, and ridged landscape positions. Bedrock exposures occur scattered in most delineations. This map unit occurs at all elevations.

Distribution and extent

The Rumsley map unit consists of 13 small- to medium-sized delineations, of which 6 occur on D'Arcy and Little D'Arcy islands, 4 on Moresby Island, 2 on Sidney Island, and 1 on Kerr Island. Both delineations having bedrock within 50 cm from the surface (RYsl) occur on Moresby Island, and the one area mapped as RYvg occurs on D'Arcy Island. The remaining 10 delineations have no soil phases. This map unit represents an area of 85.3 ha (3.2% of total map area).

SALALAKIM SOILS AND MAP UNITS

Salalakim soils (SL)

Salalakim soils are well drained, gravelly sandy loam textured soils that have developed on shallow colluvial and glacial drift materials of weathered conglomerate over conglomerate bedrock. Depth to bedrock varies between 10 and 100 cm. Coarse fragment content is between 20 and 50%. The profile description and analyses of a selected Salalakim soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	49	28	70	2
Depth to bedrock (cm)	49	28	70	2
Depth to restricting layer (cm)	49	28	70	2
Depth to mottles (cm)	160	160	160	2
CF content surface layer (%)	25	25	25	1
Fine gravel content surface layer (%)	25	25	25	1
Coarse gravel content surface layer (%)	0	0	0	1
Cobble content surface layer (%)	0	0	0	1

	Frequency of occurence (%)	No. of observations
Texture of surface layer	SL(100)	2
Texture of subsurface layer	-	0
Drainage class	Well(100)	2
Soil classification	O.DYB(100)	2
Type of restricting layer	Conglomerate bedrock	
Perviousness	Rapid	

Water regime

Salalakim soils are well drained. They remain moist throughout the winter months but are droughty from late spring to late fall. During or shortly after wet periods water may move laterally through the subsoil on top of the sloping bedrock.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
SL1	1	50	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 70 cm (70-70 cm)
SLsl	1	50	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth 28 cm (28-28 cm); also in conjunction with the very gravelly (vg) phase
SLvg	1	50	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 65% (65-65%); in conjunction with the very shallow lithic (sl) phase

Note: No other soil variants and phases of the Salalakim soil were encountered.

Similar soils

Salalakim soils are similar in drainage and texture to Qualicum soils, which are much deeper (>150 cm). Also, the coarse fragments (gravel and cobbles) in the Salalakim soils are dominantly rounded (pebbles), whereas the coarse fragments in the Qualicum soils are rounded, subrounded, and in some places irregularly shaped.

Natural vegetation

The natural vegetation consists of coast Douglas fir, scattered Pacific madrone, and some grand fir. The understory consists of salal, common gorse, and grasses.

Land use

The use of the Salalakim soils in the survey area is restricted to theirnatural vegetation. The only potential agricultural use is for sheep-grazing in areas dominated by grass. Salalakim soils and conglomerate bedrock are occasionally used as sources of gravel for road building and construction purposes.

Map units

Salalakim soils are dominant in the Salalakim (SL) simple map unit. In addition, Salalakim soils occur as a minor soil or unmentioned inclusion in some delineations of the Beddis (BD), Galiano (GA), and Rock (RO) map units.

Salalakim map unit (SL)

The Salalakim map unit consists dominantly (72%; 50-85%) of the well-drained Salalakim soil. The map unit includes on average 26% (10-25%) bedrock exposures (Rock), which limits the use interpretations for this map unit. Nonlimiting inclusions of other minor soils also occur.

Landform and occurrence

The soil landscape consists of shallow soils over congolermate bedrock on gently to strongly sloping (6-30%) topography in subdued to hummocky terrain. The Salalakim map unit has also been mapped on ridges and knolls. Salalakim soils occupy the colluvial side slopes, with bedrock exposures usually occurring on top of the ridges and knolls. The inclusions of other soils occur scattered in pockets.

Distribution and extent

The Salalakim map unit only occurs on Rubbly, Gooch, and Piers islands. It has been mapped as four long and narrow delineations. The only delineation with a soil phase (SLsl,vg) was mapped on Piers Island. This map unit represents 10.6 ha (0.4% of total map area).

SATURNA SOILS AND MAP UNITS

Saturna soils (ST)

Saturna soils are well-drained soils that have developed on shallow deposits of channery, sandy loam to fine sandy loam textured, colluvial and glacial drift materials over sandstone bedrock within 100 cm of the surface. Coarse fragment content varies between 20 and 50%. The profile description and analyses of a selected Saturna soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	51	20	85	8
Depth to bedrock (cm)	51	20	85	8
Depth to restricting layer (cm)	51	20	85	8
Depth to mottles (cm)	160	160	160	8
CF content surface layer (%)	34	27	45	6
Fine gravel (channery) content surface layer (%)	25	15	35	6
Coarse gravel (channery) content surface layer (%)	8	0	10	6
Cobble content (flaggy) surface layer (%)	2	0	3	6

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(63), FSL(37)	8
Texture of subsurface layer	-	0
Drainage class	Well(100)	8
Soil classification	O.DYB(100)	8
Type of restricting layer	Sandstone bedrock	
Perviousness	Rapid	

Water regime

The Saturna soils are well drained. They are moist from late fall untilspring but are droughty during the summer months. During and shortly after wet periods, water flows laterally through the saturated subsoil on top of the sloping bedrock.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
STl	3	38	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 68 cm (55-85 cm); also in conjunction with paralithic (pl) phase
STpl	2	25	Paralithic phase: boundary of fracture sandstone rock between soil and solid bedrock; mean depth to fractured rock 57 cm (48-65 cm); in conjunction with very shallow lithic (sl) and shallow lithic (l) phases
STsl	5	63	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth 40 cm (20-48 cm); also in conjunction with paralithic (pl) and very gravelly (vg) phases
STvg	2	25	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 53% (50-55%); in conjunction with very shallow lithic (sl) phase

Note: No other soil variants and phases of the Saturna soil were encountered.

Similar soils

Saturna soils are similar to the Bellhouse soils, which have a thicker (>10 cm) Ah horizon. Saturna soils are found together with Galiano soils, both occurring on similar slopes and in similar landscape positions. When they cannot be separately mapped because of the intermixing of bedrock types, they have been identified as Haslam soil complex (HA).

Natural vegetation

The natural vegetation consists of coast Douglas fir, scattered Pacific madrone, and some grand fir. The understory consists of salal, western bracken, and dull Oregon-grape.

Land use

Generally, no agricultural development has taken place on Saturna soils. In areas where grass dominates the vegetation, they provide grazing for wild sheep and fallow deer. These soils are generally not suitable for the production of annual crops because of steep topography, stoniness, shallow soils over bedrock, droughtiness, low fertility, and the frequency of rock outcrops. Areas of Saturna soils remain in natural forest of coast Douglas fir and Pacific madrone with an understory of short, scattered salal. Tree growth is slow because of the lack of moisture during the summer. Such areas provide browse and protection for the deer.

Map units

Saturna soils occur in many map units. It is the dominant soil in the Saturna (ST) simple map unit. Saturna is also a subdominant soil in the Rock-Saturna (RO-ST) map unit, which has been described previously. In addition, Saturna soils occur as a minor soil or unmentioned inclusion in some delineations of the Brigantine (BE), Denman Island (DA), Galiano (GA), Qualicum (QU), Rock (RO), Salalakim (SL), St. Mary (SM), Tolmie (TL), and Trincomali (TR) map units.

Saturna map unit (ST)

The Saturna (ST) map unit consists dominantly (76%; 60-90%) of the well-drained Saturna soil and includes on average 18% (up to 40%) inclusions of sandstone bedrock exposures (Rock). Bedrock exposures, more than the Saturna soils, limit use interpretations for the map unit. Besides bedrock exposures (Rock), unmentioned, nonlimiting inclusions of other soils also occur in some delineations of this map unit.

Landform and occurrence

The soil landscape consists of shallow soils over sandstone bedrock either on very gently to strongly sloping (2-30%) topography in subdued to hummocky terrain or on very strongly sloping (31-45%) side slopes of rock ridges. Bedrock exposures occur at random. The unmentioned inclusions of other soils occur scattered in isolated pockets.

Distribution and extent

The Saturna map unit is a major map unit with 48, commonly long and narrow delineations of variable size occurring throughout the survey area. About 25% of the delineations have been mapped as STsl. Two delineations, both occurring on Sidney Island, have been mapped as STsl,a. The remaining delineations (70%) have been mapped as ST. This map unit represents an area of 227.8 ha (8.7% of total map area).

ST. MARY SOILS AND MAP UNITS

St. Mary soils (SM)

St. Mary soils are imperfectly to poorly drained soils. A sandy loam to sand textured capping (50-70 cm) of marine or fluvial deposits (coarse fragment content <20%) overlies 15-40 cm of silty clay loam to loam textured, usually stone-free, marine deposits. Those deposits are underlain by gravelly loam to sandy clay loam textured, unweathered, compact till within 100 cm of the surface. The profile description and analyses of a selected St. Mary soil are given in the Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	64	50	70	10
Thickness of 2nd layer (cm)	26	15	40	10
Depth to bedrock (cm)	160	160	160	10
Depth to restricting layer (cm)	89	65	100	12
Depth to mottles (cm)	56	25	90	13
Depth to 1st PSD (cm)	63	20	90	13
Depth to 2nd PSD (cm)	89	65	100	12
CF content surface layer (%)	3	2	3	2
Fine gravel content surface layer (%)	3	2	3	2
Coarse gravel content surface layer (%)	0	0	0	2
Cobble content surface layer (%)	0	0	0	2
CF content 2nd layer (%)	4	0	10	12
Fine gravel content 2nd layer (%)	4	0	10	12
Coarse gravel content 2nd layer (%)	0	0	3	12
Cobble content 2nd layer (%)	0	0	0	12
CF content 3rd layer (%)	10	2	15	13
Fine gravel content 3rd layer (%)	8	2	10	13
Coarse gravel content 3rd layer (%)	2	0	5	13
Cobble content 3rd layer (%)	0	0	0	13

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(50), LS(30), S(20)	10
Texture of 2nd layer	SICL(50), CL(30), SCL(10), L(10)	10
Texture of 3rd layer (till)	L(90), SCL(10)	10
Drainage class	Imperfect(62), poor(31), well(7)	13
Soil classification	GL.DYB(62), GL.SB(15), O.HG(15), O.DYB(8)	13
Type of restricting layer	Compact till	
Perviousness	Slow	

Water regime

St. Mary soils are imperfectly to poorly drained soils that are saturated to about 40 cm from the surface during winter and early spring. The soil receives seepage and runoff water from surrounding upland areas, which keeps the subsoil moist all summer. The downward movement of water may be restricted by the fine-textured, commonly massive-structured subsoil, and at a deeper level by the compact till, which creates perched water table conditions. Faint to distinct mottling occurs in the lower part of the solum, with distinct to prominent mottles below 50 cm from the surface. The poorly drained St. Mary soils, with a wetter water regime than for the imperfectly drained soils are recognized at the soil phase level (SMpd or SMw).

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
SMa	2	15	Sombric variant: Ah or Ap horizon >10 cm; classification as Gleyed Sombric Brunisol (GL.SB); also in conjunction with gravelly (g) phase
SMd	2	15	Deep phase: depth to compact till between 100 and 150 cm; mean depth 118 cm (105-130 cm); also in conjunction with gravelly (g) and very gravelly (vg) phases
SMg	7	50	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 39% (30-40%); also in conjunction with sombric (a) variant, deep (d) phase, and strongly mottled or wetter (w) phase
SMpd	2	15	Poorly drained phase: poorly drained (Gleysolic) with distinct to prominent mottles within 50 cm of the surface; also in conjunction with silt loam (si) phase
SMvg	4	31	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 59% (50-65%); also in conjunction with deep (d) and strongly mottled or wetter (w) phases
SMw	2	15	Strongly mottled phase: wetter moisture regime as evidenced by mottling within 50 cm of the surface; not a Gleysolic type landscape; also in conjuntion with gravelly (g) and very gravelly (vg) phases

Note: Another phase of the St. Mary soil with very limited occurrence is a silt loam capping (si) phase over the coarse-textured materials.

Similar soils

When the fine-textured marine subsoil is missing and the soil is slightly better drained and more gravelly, these soils are mapped as Trincomali (TR). Similar imperfectly drained soils without compact till in the subsoil are mapped as Brigantine (BE) soils. The till materials in the subsoil is the Mexicana type till.

Natural vegetation

The natural vegetation consists of western red cedar, red alder, and, in some places, bigleaf maple and coast Douglas fir. The understory includes western sword fern, western bracken, and salal.

Land use

Very little of the St. Mary soils in the survey area has been cleared of their original vegetation for agricultural use, such as pasture and hay production. These soils are similar to the Brigantine soils, regarding most use interpretations. The St. Mary soils can be improved with irrigation and fertilizer to produce a wide range of agricultural crops and tree fruits. Besides agriculture, growing deciduous trees is another good use for thesesoils.

Map units

St. Mary soils are the dominant component in the St. Mary (SM) simple map unit. In addition, St. Mary soils occur as a minor soil or unmentioned inclusion in some delineations of the Brigantine (BE), Parksville (PA), and Trincomali (TR) map units.

St. Mary map unit (SM)

The St. Mary map unit consists dominantly (77%; 65-100%) of imperfectly and poorly drained St. Mary soils. The map unit includes an average 23% of other soils. These other soils may be one or a combination of Trincomali (TR) soils and soils similar to St. Mary but without the sandy loam to loamy sand textured capping as minor soils. Unmentioned inclusions of other soils may also occur in some of the delineations. The minor soils and inclusions do not limit the use interpretations for this map unit.

Landform and occurrence

Soils of the St. Mary map unit occur on nearly level to gently sloping topography (0.5-9%). The nonlimiting inclusions and minor soils occur scattered in some delineations. Elevations are within 100 m above mean sea level.

Distribution and extent

St. Mary is a very minor map unit and occurs as six small- to medium-sized delinations on Sidney Island only; two were mapped as SMg, two as SMpd, one as SMpd,si, and one as SM. They represent an area of 38.2 ha (1.5% of total map area).

TOLMIE SOILS AND MAP UNITS

Tolmie soils (TL)

Tolmie soils are poorly drained soils that have developed on deep (>100 cm), loam to silty clay textured, marine deposits that are usually stone free. Sandy loam, loamy sand, and gravelly materials occur in pockets or in a thin layer or layers throughout the soil profile. The profile description and analyses of a selected Tolmie soil are given in Appendix 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	30	10	90	30
Depth to bedrock (cm)	160	160	160	30
Depth to restricting layer (cm)	42	13	160	30
Depth to mottles (cm)	23	5	42	30
CF content surface layer (%)	10	0	20	30
Fine gravel content surface layer (%)	6	0	15	30
Coarse gravel content surface layer (%)	3	0	10	30
Cobble content surface layer (%)	1	0	10	30
CF content subsurface layer (%)	5	0	20	29
Fine gravel content subsurface layer (%)	4	0	10	29
Coarse gravel content subsurface layer (%)	1	0	10	29
Cobble content subsurface layer (%)	1	0	10	29

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(60), SIL (27), SICL(7), Peat(3), CL(3)	30
Texture of 2nd layer	SICL(46), SL(14), SCL(11), CL(7), L(7), FSL(7), LS(4), SiC(4)	28
Texture of 3rd layer	SICL(79), SIC(14), SL(7)	14
Drainage class	Poor(93), very poor(7)	30
Soil classification	O.HG(93), O.G(7)	30
Type of restricting layer	Fine-textured subsoil, often massive structured	
Perviousness	Slow	

Water regime

Tolmie soils are poorly drained soils that have distinct to prominent mottles within 50 cm of the surface. They are wet for long periods throughout the year, and water tables are within 30 cm of the surface from late November to early March. In the spring, water tables drop quickly and remain below 50 cm of the surface from May to October. Water tables fluctuate rapidly in response to wetness and dryness. Perched water tables can occur temporarily on top of a massive-structured, fine-textured subsoil. As a result of their low landscape position, the Tolmie soils receive runoff water from their surroundings.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
TLpt	2	6	Peaty phase: <40 cm of mesic or humic organic materials over mineral soil; mean thickness 20 cm (10-40 cm)

Note: There is also a very limited occurrence of the gravelly (g), shallow lithic (l), and better-drained (id) phases, and taxonomy change (from Orthic Humic Gleysol to Orthic Gleysol) variant of the Tolmie soil. Commonly, a sandy loam to loamy sand layer of up to 20 cm thick occurs below the surface layer.

Similar soils

Tolmie soils are the only poorly drained, medium- to fine-textured soils in the map area. Therefore, no similar soils do occur. Where the coarse-textured layers below the surface layer are thicker than 20 cm, the soil was classified as a Parksville loam phase or silt loam phase, depending on the texture of the surface soil.

Natural vegetation

The natural vegetation on Tolmie soils consists of western red cedar, red alder, and bigleaf maple. The understory includes salmonberry, western sword fern, sedges, horsetail, western bracken, and, in the wettest landscape positions, commonly American skunk cabbage.

Land use

Many Tolmie soils in the survey area have been cleared for agricultural production. When their drainage is improved, they become some of the best agricultural soils. The surface soil is well supplied with organic matter and nitrogen. The soil is strongly to moderately acid (pH 5.1-6.0) and responds favorably to fertilizers. The unimproved agricultural land use is usually pasture and hay crops; spring planting of other crops is often impractical because of wet soil conditions.

Map units

Tolmie soils are dominant in the Tolmie (TL) simple map unit. Tolmie is a subdominant soil in the Brigantine-Tolmie (BE-TL) and Parksville-Tolmie (PA-TL) compound map units, which have already been described under Brigantine and Parksville. In addition, Tolmie soils occur as a minor soil or unmentioned inclusion in some delineations of the Baynes (BY), Brigantine (BE), Mexicana (ME), Musgrave (MG), Parksville (PA), Saturna (ST), and Trincomali (TR) map units.

Tolmie map unit (TL)

The Tolmie map unit consists dominantly (77%; 45-100%) of the poorly drained Tolmie soil. The unit includes an average 23% (up to 55%) of other soils. These other soils may be one or a combination of similar poorly drained soils with more uniform textures and Parksville (PA) soils as minor soils. Unmentioned inclusions of other soils occur sporadically. Although the minor soils do not limit the use interpretations, some of the unmentioned inclusions with shallow soils to bedrock do limit some use interpretations for the Tolmie map unit.

Landform and occurrence

The Tolmie landscape consists of depressions, basins, swales, and drainageways with nearly level to gently sloping (0.5-9%) topography, in which Parksville soils and inclusions of other soils occur scattered in some delineations.

Distribution and extent

The Tolmie map unit is extensive in the survey area, with 26 variable delineations; some are narrow and long. Some very large delineations occur on Portland, Moresby, and Sidney islands. Most (92%) of the delineations were mapped as TL. One delineation has peaty overlay materials (TLpt) and another has better drainage (TLid). The map unit represents an area of 244.7 ha (9.3% of total map area).

TRINCOMALI SOILS AND MAP UNITS

Trincomali soils (TR)

Trincomali soils are imperfectly to well-drained soils. They have developed on shallow (25-100 cm) deposits of gravelly sandy loam to sand textured, marine, fluvial, or glaciofluvial materials (10-50% gravels) that overlie gravelly loam to sandy loam textured, unweathered, compact till within 100 cm of the surface. The profile description and analyses of a selected Trincomali soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	52	10	90	35
Depth to bedrock (cm)	160	160	160	43
Depth to restricting layer (cm)	67	25	100	27
Depth to mottles (cm)	81	30	160	27
CF content surface layer (%)	31	10	50	36
Fine gravel content surface layer (%)	20	10	35	36
Coarse gravel content surface layer (%)	7	0	20	36
Cobble content surface layer (%)	4	0	15	36
CF content subsurface layer (%)	20	0	60	40
Fine gravel content subsurface layer (%)	14	2	40	40
Coarse gravel content subsurface layer (%)	5	2	15	40
Cobble content subsurface layer (%)	1	0	20	40

	Frequency of occurrence (%)	No of observations
Texture of surface layer	SL(47), LS(28), S(23), FSL(2)	43
Texture of subsurface layer (till)	L(64), SL(30), LS(2), S(2), SCL(2)	43
Drainage class	Imperfect(44), moderately well(28), well(23), poor(5)	43
Soil classification	O.DYB(40), GL.DYB(32), GL.SB(16), O.SB(12)	43
Type of restricting layer	Compact till	
Perviousness	Slow	

Water regime

Trincomali soils range from imperfectly to well drained. The imperfectly drained soils are usually associated with the compact till occurring within 100 cm of the surface (indicated as TRid), whereas the well to moderately well drained soils are usually associated with the deep phase, which has compact till occurring between 100 and 150 cm. After prolonged wetting, perched water table conditions are common on top of the compact till for short periods. Consequently, faint mottling is commonly found in the lower part of the soil profile directly above the till. During dry periods in summer the soils are very droughty.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
TRa	11	26	Sombric variant: Ah or Ap horizon >10 cm; classified as Gleyed Sombric Brunisol (GL.SB) or asOrthic Sombric Brunisol (O.SB); also in conjunction with deep (d), imperfectly drained (id), and strongly mottled (w) phases
TRd	15	35	Deep phase: depth to compact till between 100 and 150 cm; mean depth 124 cm (104-145 cm); also in conjunction with sombric (a) variant, imperfectly drained (id), moderately cemented (mc), and very gravelly (vg) phases
TRid	13	30	Imperfectly drained phase: wetter moisture regime than specified for soil (Gleyed subgroup); also in conjunction with sombric (a) variant, deep (d), and shallow lithic (l) phases
TRvg	5	12	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 56% (50-60%); also in conjunction deep (d) and strongly mottled (w) phases
TRw	7	16	Strongly mottled phase: wetter moisture regime as evidenced by mottling within 50 cm of the surface; not a Gleysolic-type landscape; also in conjunction with sombric (a) variant and very gravelly (vg) phases

Note: There is also a limited occurrence of the gravelly (g), shallow lithic (l), moderately cemented (mc), and silt loam (si) phases for the Trincomali soil.

Similar soils

Trincomali soils commonly occur together with Qualicum soils, which are deeper and better drained. Soils with coarse-textured overlays thicker than 150 cm have been mapped as Qualicum soils. Trincomali soils occur in some places together with Mexicana soils that have developed on till without the somewhat coarser textured overlay materials. When the sandy loam to loamy sand textured deposits over till are less than 30 cm thick, these soils are part of the Mexicana (ME) map unit. Trincomali soils are similar to St. Mary soils but lack the finer-textured layer above the till.

Natural vegetation

The natural vegetation consists of coast Douglas fir, with some grand fir and scattered Pacific madrone. The understory consists of salal, western bracken, and dull Oregon-grape.

Land use

Trincomali soils are rarely used for hay and pasture. The main limiting factors for agriculture on these soils are stoniness, droughtiness, and topography. In addition, the soils are very strongly to strongly acid (pH 4.6-5.5) and have a low inherent fertility. The best use for these soils is for growing coniferous trees.

Map units

Trincomali soils occur as the dominant soil in the Trincomali (TR) simple map unit. In addition, Trincomali soils occur as a minor soil or unmentioned inclusion in some delineations of the Beddis (BD), Brigantine (BE), Mexicana (ME), Musgrave (MG), Parksville (PA), Qualicum (QU), Rock-Rumsley (RO-RY), Rock-Saturna (RO-ST), Rumsley (RY), St. Mary (SM), and Saturna (ST) map units.

Trincomali map unit (TR)

The Trincomali (TR) map unit consists dominantly (80%; 65-100%) of the imperfectly to well-drained Trincomali soils. The Trincomali map unit includes an average 20% (up to 35%) of other soils, of which the Qualicum soil is the most commonly occurring minor soil (in half the delineations of the map unit). Unmentioned inclusions of other soils occur sporadically. Soils with very compact (Quadra) sands in the subsoil were included in the Trincomali map unit. Although the Qualicum minor soil does not limit the use interpretations, some of the imperfectly and poorly drained inclusions and the ones with shallow soils to bedrock do limit the use interpretations for the Trincomali map unit.

Landform and occurrence

The Trincomali landscape consists of shallow beach, terrace, or outwash deposits over till, usually near or at the shoreline or along drainageways. Soils of the Trincomali map unit (TR) occur on very gently to strongly sloping topography (2-30%) but occasionally on steeper bluff slopes (46-100%) on James Island. Qualicum soils occur at random where the coarse-textured deposits are deeper than 150 cm. Inclusions of other soils also occur scattered in some delineations.

Distribution and extent

The Trincomali map unit is the most extensive map unit in the survey area with 24 small- to large-sized delineations. Twelve delineations, including large ones, were mapped on Sidney Island, and five on James Island. Ten delineations were mapped as TR, five delineations were mapped as TRd, five as TRid, two as TRd,a, one each for TRid,a and TRpd. This map unit represents an area of 410 ha (15.6% of total map area).

SUMMARY OF AREAL EXTENT OF MAP UNITS IN THE SURVEY AREA

When the map units are grouped by the origin of parent materials or by parent material textures of the dominant soils, some comparisons can be made about the distribution of map units in the survey area (Table 6).

Table 6. Distribution of map units in survey area by parent materials

Dominant parent materials	Map unit	Area occupied (ha)	Area occupied (%)
1 Shallow colluvial and glacial drift (within 1 m)	GA, HA, MG, RY, SL, and ST over bedrock	527	20
2 Rock	RO, RO-BH, RO-MG, RO-RY, and RO-ST	562	21
3 Shallow over compact glacial till (within 1 m)	ME, SM, and TR	455	17
4 Deep, moderately fine to fine textured marine materials	TL	245	9
5 Deep, coarse to moderately coarse textured materials	BD, BY, DA, and QU	451	17
6 Coarse to moderately coarse over deep, moderately fine to fine textured marine materials	BE, BE-TL, PA, and PA-TL	296	11
Summary:			
1,2,3 Shallow soils and rock		1544	58
4,5,6, Deep soils		991	37

Note: The remaining area (5%) consists of land types such as CB, MD, TF, and W.

PART 5. LAND USE INTERPRETATIONS

Application of soil survey information is often required by the users of soil maps and reports. Information about soils, therefore, has to be interpreted for different uses. For the Gulf Islands, the main users are land use planners, for whom two kinds of land use interpretations have been identified:

- land constraints for the absorption of septic tank effluent; and
- land capability for agriculture.

In the following sections these two land use interpretations are described, and the map unit ratings are presented in table format. However, the map unit interpretations in the following tables cannot be regarded as site-specific. Not all the land limitations mentioned in the text or in the tables may be encountered in any particular location. These sections should be used as a guide to the types of limitations (problems) that could be encountered. Whether they will or will not be encountered, and how difficult they may be to overcome in a particular location, must be determined by on-site inspections.

LAND CONSTRAINTS FOR SEPTIC TANK EFFLUENT ABSORPTION

In the survey area, sewage disposal is handled by septic tanks and effluent absorption fields. With increasing pressure for residental development it is important to know the constraints or limitations the soil and landscape properties of each map unit impose on septic tank effluent absorption. Soil characteristics, more than any other factor, determine the success or failure in the performance of septic tank absorption fields. If an absorption field is to function properly, the soil must do three things: it must first accept the effluent, then treat it, and finally dispose of it.

Interpretations for septic tank effluent absorption are based on a number of soil and landscape properties. Four constraint classes (slight, moderate, severe, and very severe) have been defined to indicate problems or potential problems with effluent absorption that are caused by soil and landscape characteristics (Epp 1984). A rating of slight indicates that the soil is well suited for effluent absorption. As the severity of the constraint class increases from slight to very severe, the design and maintenance requirements for septic tank effluent disposal increase. Soils within a constraint class are similar in the degree of limitations but the kind of limitation (for example, depth to bedrock or drainage) may differ.

For the survey area the following six soil and landscape properties were used to indicate the limitations for septic tank effluent absorption (Epp 1984):

D DEPTH TO RESTRICTED LAYERS: Layers with low permeability near the surface limit the thickness of material available for effluent treatment and may result in saturated conditions in the overlying soil (for example, compact till and massive-structured horizons).

G COARSE FRAGMENT CONTENT: Coarse fragment content reduces the effectiveness of the soil for effluent treatment.

R DEPTH TO BEDROCK: Bedrock near the surface limits the thickness of material available for effluent treatment and may result in saturated conditions in the overlying soil.

S SOIL TEXTURE: Texture is not a major property for determining effluent disposal but rather for determining soil permeability.
T TOPOGRAPHY: Steepness and pattern of slopes limit effluent disposal.
W SOIL DRAINAGE: The rapidity and extent of water removal from the soil in relation to additions is important.

The methods, assumptions, definitions, and symbols for constraint classes and properties used in determining effluent absorption constraints are defined in MOE Manual 5 (Epp 1984).

The constraint class and soil and landscape limitations for septic tank effluent absorption are listed for each map unit in Table 7. The constraint class is determined by the most limiting soil and landscape property (or properties). These properties are indicated in capital letters behind the constraint class. Also, those limiting properties that occur at the next lower constraint class are indicated by a lowercase letter behind the ones indicated in capital letters. A maximum of three limitations per constraint class are presented in Table 7. The slight constraint class does not list subclass limitations.

The typical constraint classes for effluent absorption in columns 4 and 5 of Table 7 are based on the dominant occurrence of the limiting soil and landscape properties for the map unit as indicated in the map unit legend. Where a range is defined for a given property, for example slope or coarse fragment content, the calculated mean value is used to determine the typical constraint class. For compound map units the calculated mean proportion of dominant and subdominant soils is used, although for a specific delineation the actual proportions may vary within the limits indicated in the legend. Where inclusions of minor soils have been described, the proportion of the most frequent limiting soil is assumed to be 20%. In some delineations the proportion of minor soils may vary from this assumed proportion. The different soil proportions within each map unit are represented by superscripts for the ratings in Table 7.

For some delineations the constraint class may differ from the typical constraint class for one or more reasons. For example, slopes may be more or less steep than for the typical rating. Also, the range of slopes occurring in some delineations may span more than one constraint class. Therefore, columns 6, 7, and 8 of Table 7 indicate variations from the typical rating because of changes in slope class. Also the described range in soil properties such as coarse fragment content, texture, drainage, depth to bedrock, or other restricting layers may cover more than one constraint class. Variations in soil properties as indicated by the soil phase or variant symbol do occur, such as texture, coarse fragment content, depth to bedrock, or presence of an organic capping. Where the occurrence of a soil phase or variant results in the constraint rating of the map unit being different from the typical rating, this variation, along with the soil phase or variant is indicated in columns 9, 10, and 11 of Table 7. These ratings assume the same typical slope class (column 4). In addition, inclusions of unmappable (because of the size of the map scale) soils, or variations in the proportion of dominant, subdominant, and minor soils do occur for some delineations. These types of variations could not be expressed in the table.

Table 7. Constraint classes and soil and landscape limitations for septic tank effluent absorption

Map unit		Typical constraint class			Variation due to slope			Variation due to soil properties		
Symbol	Name	Slope class*	Constraint class	Soil limitations	Slope class*	Constraint class	Soil limitations	Soil phase*	Constraint class	Soil limitations
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
BD	Beddis	3	Moderate^{8}-severe^{2}	SW^{8}† -Dgw^{2}†	4	Moderate^{8}-severe^{2}	SW8-Dgw^{2}	BDg	Moderate^{8}-severe^{2}	GSW8-Dgw^{2}
					5	Moderate^{8}-severe^{2}	STw^{8}-Dtw^{2}	BDl	Severe	Rsw^{8}-Dgw^{2}
					6	Severe	Tsw^{8}-Dtw^{2}	BDvs	Severe	Gsw^{8}-Dgw^{2}
BE	Brigantine	4	Severe8-very severe^{2}	DWs8-wd2	5	Severe^{8}-very severe^{2}	DWt^{8}-Wd^{2}	BEd	Severe^{8}-very severe^{2}	DWs^{8}-Wd^{2}
								BEg	Severe^{8}-very severe^{2}	DWg^{8}-Wd^{2}
					6	Severe^{8}-very severe^{2}	DTW^{8}-Wd^{2}	BEd,g	Severe^{8}-very severe^{2}	DWg^{8}-Wd^{2}
BE-TL	Brigantine-Tolmie	3,4	Severe6 very severe^{4}	DWs6-W4	5	Severe^{6}-very severe^{4}	DWt^{6}-W^{4}	BEg^{6}-TL^{4}	Severe^{6}-very severe^{4}	DWg^{6}-W^{4}
BY	Baynes	2,3	Severe8-very severe^{2}	Ws8-W2	5	Severe^{8}-very severe^{2}	Wts^{8}-W^{2}	BYg	Severe^{8}-very severe^{2}	Wgs^{8}-W^{2}
					6	Severe	TW			
DA	Denman Island	2	Very severe	W				DAl,lo	Very severe	Wr

(continued)

Table 7. Constraint classes and soil and landscape limitations for septic tank effluent absorption (continued)

Map unit		Typical constraint class			Variation due to slope			Variation due to soil properties		
Symbol (1)	Name (2)	Slope class* (3)	Constraint class (4)	Soil limitations (5)	Slope class* (6)	Constraint class (7)	Soil limitations (8)	Soil phase* (9)	Constraint class (10)	Soil limitations (11)
GA	Galiano	5	Very severe	R	4,3	Very severe	R	GAsl,vg	Very severe	Rg^{8}–R^{2}
					6	Very severe	Rt			
					7	Very severe	RT			
HA	Haslam	5	Very severe	R	4	Very severe	R			
					6	Very severe	Rt			
					7,8	Very severe	RT			
ME	Mexicana	4	Very $severe^{8}$– $severe^{2}$	D^{8}–Dgw^{2}	3	Very $severe^{8}$– $severe^{2}$	D^{8}–Dgw^{2}	MEid	Very $severe^{8}$– $severe^{2}$	Dw^{8}–Dgw^{2}
					5	Very $severe^{8}$– $severe^{2}$	D^{8}–Dtw^{2}			
MG	Musgrave	5	$Severe^{2}$– very $severe^{2}$– $moderate^{1}$	Rgt^{7}–R^{2}–GTW^{1}	3,4	$Severe^{7}$– very $severe^{2}$– $moderate^{1}$	Rg^{7}–R^{2}–GSW^{1}	MGsl	Very severe	R
					6	$Severe^{8}$– very $severe^{2}$	RTg^{8}–Rt^{2}			
					7	Very severe	RT			
PA	Parksville	2,3	Very severe	Wd^{8}–W^{2}				PAd	Very severe	W
PA–TL	Parksville Tolmie	3	Very severe	Wd^{5}–W^{5}						

(continued)

Table 7. Constraint classes and soil and landscape limitations for septic tank effluent absorption (continued)

Map unit		Typical constraint class			Variation due to slope			Variation due to soil properties		
Symbol	Name	Slope class*	Constraint class	Soil limitations	Slope class*	Constraint class	Soil limitations	Soil phase*	Constraint class	Soil limitations
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
QU	Qualicum	4	Moderate[8]–severe[2]	GSW[8]–Dgw[2]	5	Moderate[8]–severe[2]	GTW[8]–Dtw[2]	QUvg	Severe	Gsw[8]–Dgw[2]
RO	Rock	3,4,5	Very severe	R	6 7,8,9	Very severe Very severe	Rt RT			
RO-BH	Rock–Bellhouse	4,5	Very severe	R	6	Very severe	Rt			
RO-MG	Rock–Musgrave	5	Very severe[5]–severe[5]	R[5]–Rgt[5]	4 6 7	Very severe[5]–severe[5] Very severe[5]–severe[5] Very severe	R[5]–Rg[5] Rt[5]–RTg[5] RT[5]–Tr[5]	RO-MGs1	Very severe	R
RO-RY	Rock–Rumsley	4	Very severe[6]–severe[4]	R[6]–Rg[4]	3 5 6 7	Very severe[6]–severe[4] Very severe[6]–severe[4] Very severe[6]–severe[4] Very severe	R[6]–Rg[4] R[6]–Rgt[4] Rt[6]–RTg[4] RT[6]–Tr[4]			
RO-ST	Rock–Saturna	3,4,5	Very severe	R	6 7,8	Very severe Very severe	Rt RT			

(continued)

Table 7. Constraint classes and soil and landscape limitations for septic tank effluent absorption (concluded)

Map unit		Typical constraint class			Variation due to slope			Variation due to soil properties		
Symbol (1)	Name (2)	Slope class* (3)	Constraint class (4)	Soil limitations (5)	Slope class* (6)	Constraint class (7)	Soil limitations (8)	Soil phase* (9)	Constraint class (10)	Soil limitations (11)
RY	Rumsley	3,4	Severe^{8}-very severe^{2}	Rg^{8}-R^{2}	5	Severe^{8}-very severe^{2}	Rgt^{8}-R^{2}	RYsl	Very severe	R
					6	Severe^{8}-very severe^{2}	RTg^{8}-Rt^{2}	RYvg	Severe^{8}-very severe^{2}	GR^{8}-R^{2}
SL	Salalakim	4,5	Very severe	R	6	Very severe	Rt	SLsl,vg	Very severe	Rg^{7}-R^{3}
SM	St. Mary	2	Severe	DW^{8}-Dgw^{2}				SMg	Severe	DWg^{8}-Dgw^{2}
								SMpd	Very severe^{8}-severe^{2}	Wd^{8}-Dgw^{2}
ST	Saturna	3,4,5	Very severe	R	6	Very severe	RT			
					7	Very severe	RT			
TL	Tolmie	1,2,3	Very severe	W	4	Very severe	W			
TR	Trincomali	3	Severe^{8}-moderate^{2}	Dwg^{8}-GSW^{2}	4	Severe^{8}-moderate^{2}	Dwg^{8}-GSW^{2}	TRd	Moderate	DGW^{8}-GSW^{2}
					5	Severe^{8}-moderate^{2}	Dtw^{8}-GTW^{2}	TRid	Severe^{8}-moderate^{2}	DWg^{8}-GSW^{2}
					6	Severe	DTw^{8}-Tgw^{2}	TRpd	Very severe^{8}-moderate^{2}	Wd^{8}-GSW^{2}
					8,9	Very severe	Td^{8}-T^{2}			

* See map legend.

† Percent soil component (see map legend for inclusions).

The ratings in Table 7 are to be used as a guide only. They are not specific to individual map delineations and therefore do not eliminate the need for detailed on-site investigations.

Results of Table 7 indicate that none of the map units for the survey area has a slight constraint rating for effluent absorption. Beddis map units have dominantly a moderate limitation for effluent absorption because of soil texture (S) and soil drainage (W) and slope below 15% (up to slope class 5) and gravelly phase (BDg). Also, the Qualicum (QU) and Trincomali deep (TRd) map units on moderate slopes (10-15%) have moderate limitations for effluent absorption. All other map units occurring in the survey area, including the foregoing map units on steeper topography (|15%), fall into the severe and very severe constraint classes for septic tank effluent absorption.

LAND CAPABILITY FOR AGRICULTURE

Land in the agricultural land reserve accounts for about 40% of the total surveyed area. With increasing pressures to use land for purposes other than agriculture (for example, residential development), it is important for planning purposes to know the agricultural capability class for the map units recognized in the survey area. This section evaluates the soil and landscape properties for the map units to determine soil and landscape limitations for agriculture capability.

Land capability ratings for agriculture are interpretations based on climatic, soil, and landscape characteristics. The <u>Land Capability Classification for Agriculture in British Columbia</u> (Kenk and Cotic 1983) groups soils into seven classes on the basis of the range of regionally adapted crops that can be grown, or the intensity of management inputs required to maintain crop production, or both. Class 1 soils are considered to have no limitations for crop production. As the class level increases from 1 to 7, the level of management input increases and the range of suitable crops decreases. Class 7 soils are considered to have no potential for natural grazing or arable crop production. Soils within a class are similar in the degree of limitation but the kind of limitation may differ. The subclasses indicate the nature of the soil limitations (Kenk and Cotic 1983).

For the survey area, the following six land capability subclasses were used to describe the soil and landscape limitations for agriculture capability:

A SOIL MOISTURE DEFICIENCY: Crops are adversely affected by droughtiness caused by soil and/or climate characteristics; improvable by irrigation.

D UNDESIRABLE SOIL STRUCTURE OR LOW PERVIOUSNESS OR BOTH: Soils are difficult to till, require special management for seedbed preparation, pose trafficability problems, have insufficent aeration, absorb and distribute water slowly, or have the depth of rooting zone restricted by conditions other than high water table, bedrock, or permafrost; improvement practices vary; no improvement is assumed in the absence of local experience.

P STONINESS: Coarse fragments significantly hinder tillage, planting, and harvesting operations; improvable by stone picking.

R DEPTH TO SOLID BEDROCK AND ROCKINESS: Bedrock near the surface or rockoutcrops, or both, restrict rooting depth and cultivation; not improvable.

T TOPOGRAPHY: Steepness or the pattern of slopes limits agricultural use; not improvable.

W EXCESS WATER: Excess free water, other than from flooding, limits agricultural use and may result from poor drainage, high water tables, seepage, or runoff from surrounding areas; improvable by drainage; feasibility and level of improvement is assessed on a site-specific basis.

The methods, assumptions, definitions, and symbols for classes and subclasses used in determining the agricultural capability ratings are described in MOE Manual 1 (Kenk and Cotic 1983).

In determining the agriculture capability, climatic limitations are evaluated first and, if neither soil nor landscape characteristics produce any limitations, then the regional climate determines the land capability for agriculture.

For the survey area, the climatic moisture deficit (CMD) is the limiting climatic parameter for agricultural capability. Potential evaporation data are not available for the survey area. For Saltspring Island, which is nearby in the same climatic regime, the CMD was calculated at 203-234 mm during the growing season (Coligado 1979). This CMD represents a Class 4 climate in the Climatic capability classification for agriculture in British Columbia (Air Studies Branch 1981).

The capability class and soil and landscape limitations (subclasses) for agricultural capability are listed for each map unit in Table 8. The capability class is determined by the most limiting soil and landscape property (or properties). These properties are indicated in capital letters behind the numerical capability class. Also, those limiting properties that occur at the next lower capability class are indicated by a lowercase letter behind the ones indicated in capital letters. A maximum of three limitations per capability class are presented in Table 8.

The typical land capability for agriculture ratings in columns 4 and 5 of Table 8 are based on the dominant occurrence of the limiting soil and landscape properties for each of the map units as indicated in the map legend. Where a range is defined for a given property, for example slope or coarse fragment content, the calculated mean value is used. Column 4 gives the unimproved rating. For some soils, capability can be improved through management practices such as irrigation, drainage, and stone picking, which is indicated by the improved ratings in column 5. For compound map units, calculated means of the proportion of dominant and subdominant soils are used,although for a specific delineation the actual proportions may vary within the limits indicated in the legend. Where inclusions of minor soils have been described, the proportion of the most frequent limiting minor soil is assumed to be 20%. In some delineations, the proportion of minor soils may vary from this assumed proportion. For the foregoing two examples, the proportions are represented by superscripts for the ratings in Table 8.

Table 8. Land capability ratings for agriculture

Map unit		Typical capability class			Variation due to slope			Variation due to soil properties		
Symbol (1)	Name (2)	Slope class* (3)	Unimproved rating (4)	Improved rating (5)	Slope Class* (6)	Unimproved rating (7)	Improved rating (8)	Soil phase* (9)	Unimproved rating (a)	Improved rating (a)
BD	Beddis	3	3Ap^{8}†-4AP^{2}†	2A^{8}-3Adp^{2}	4	3Apt^{8}-4APt^{2}	2AT^{8}-3APt^{2}	BDg	3Ap^{8}-3APd^{2}	3Ap^{8}-3Adp^{2}
					5	3ATp^{8}-4Apt^{2}	3Ta^{8}-3ATp^{2}	BDl	3ARp^{8}-3APd^{2}	3Ra^{8}-3Adp^{2}
					6	5T	5T	BDvs	4A^{8}-3APd^{2}	3A^{8}-3Adp^{2}
BE	Brigantine	4	3At^{8}-4W^{2}	2AT^{8}-2ADW^{2}	3	3A^{8}-4W^{2}	2A^{8}-2ADW^{2}	BEg	3AP^{8}-4W^{2}	3Ap^{8}-2ADW^{2}
					5	3AT^{8}-4W^{2}	3Ta^{8}-2ADW^{2}			
					6	4Ta^{8}-4W^{2}	4T^{8}-2ADW^{2}			
BE-TL	Brigantine-Tolmie	3	3A^{6}-4W^{4}	2A^{6}-2DW^{4}	4	3At^{6}-4W^{4}	2AT^{6}-2DW^{4}	BEg-TL	3AP^{6}-4W^{4}	3Ap^{6}-2DW^{4}
					5	3AT^{6}-4W^{4}	3Ta^{6}-2DW^{4}			
BY	Baynes	2,3	3A^{8}-4W^{2}	2A^{8}-2AW^{2}		3AT	3Ta	BYg	3AP^{8}-4W^{2}	2A§p-2AW^{2}
						4Ta	4Ta	BYw	3W^{8}-4W^{2}	2A^{8}-2AW^{2}
DA	Denman Island	1,2,3	4W	2AW				DAl,lo	4W	2RW
								DApt	5W	3W
GA	Galiano	5	4Rat^{8}-7R^{2}	4Rt-7R^{2}	4	4Ra^{8}-7R^{2}	4R^{8}-7R^{2}	GAsl,vg	4Rat^{8}-7R^{2}	4Rat^{8}-7R^{2}
					6	5Tr^{8}-7R^{2}	5Tr^{8}-7R^{2}			
					7	7T^{8}-7RT^{2}	7T^{8}-7RT^{2}			

(continued)

Table 8. Land capability ratings for agriculture (continued)

Map unit		Typical capability class			Variation due to slope			Variation due to soil properties		
Symbol	Name	Slope class*	Unimproved rating	Improved rating	Slope class*	Unimproved rating	Improved rating	Soil phase*	Unimproved rating	Improved rating
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
HA	Haslam	5	4APR^{8}-7R^{2}	4PRt^{8}-7R^{2}	4	4APR^{8}-7R^{2}	4PRa^{8}-7R^{2}			
					6	5Tar^{8}-7R^{2}	5Tpr^{8}-7R^{2}			
					7,8	7T^{8}-7RT^{2}	7T^{8}-7RT^{2}			
ME	Mexicana	4	3APt^{8}-4Ap^{2}	2APT^{8}-3Apt^{2}	3	3APd^{8}-4Ap^{2}	2APd^{8}-3Adp^{2}			
					5	3APT^{8}-4Ap^{2}	3Tap^{8}-3ATp^{2}			
MG	Musgrave	5	4Art^{7}-7R^{2} -4AT^{1}	3ART^{7}-7R^{2} -3APT^{1}	3	4Apr^{7}-7R^{2}-4Ap^{1}	3APR^{7}-7R^{2}-3Ap^{1}	MGs1	5Ra^{7}-7R^{2}-4Ap^{1}	5R^{7}-7R^{2}-3APT^{1}
					4	4Apr^{7}-7R^{2}-4Ap^{1}	3APR^{7}-7R^{2}-3APt^{1}			
					6	5Ta^{8}-7R^{2}	5T^{8}-7R^{2}			
					7	7T^{8}-7RT^{2}	7T^{8}-7RT^{2}			
PA	Parksville	2,3	4W	2ADW^{8}-2DW^{2}				PAd	4W	2AW^{8}-2DW^{2}
								PAlo	4W	3W^{8}-2DW^{2}
								PAsi	4W	2W^{8}-2DW^{2}
PA-TL	Parksville-Tolmie	3	4W	2ADW^{5}-2DW^{5}						
QU	Qualicum	4	4Ap	3Apt	3	4Ap	3Ap^{8}-3Adp^{2}	QUvg	5A^{8}-3Apt^{2}	5A^{8}-3Apt^{2}
					5	4Apt	3ATp			

(continued)

Table 8. Land capability ratings for agriculture (continued)

Map unit		Typical capability class			Variation due to slope			Variation due to soil properties		
Symbol	Name	Slope class*	Unimproved rating	Improved rating	Slope class*	Unimproved rating	Improved rating	Soil phase*	Unimproved rating	Improved rating
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
RO	Rock	3,4	$7R^8-5Rap^2$	$7R^2-5Rp^2$	5	$7R^8-5Ap^2$	$7R^8-5Ap^2$			
					6	$7R^8-4ATp^2$	$7R^8-5ATp^2$			
					7,8,9	$7RT^8-7T^2$	$7RT^8-7T^2$			
RO-BH	Rock-Bellhouse	4	$7R^6-6R^4$		5	$7R^6-6Rt^4$				
					6	$7R^6-6Rt^4$				
RO-MG	Rock-Musgrave	5	$7R^5-4Art^5$	$7R^5-3ART^5$	4	$7R^5-4Apr^5$	$7R^5-3APR^5$	RO-MGsl	$7R^5-5Ra^5$	$7R^5-5R^5$
					6	$7R^5-5Tap^5$	$7R^5-5T^5$			
					7	$7RT^5-7T^5$	$7RT^5-7T^5$			
RO-RY	Rock-Rumsley	4	$7R^6-4APr^4$	$7R^6-3APR^4$	3,5	$7R^6-4APr^4$	$7R^6-3APR^4$			
					6	$7R^6-5Tap^4$	$7R^6-5T^4$			
					7	$7RT^6-7T^4$	$7RT^6-7T^4$			
RO-ST	Rock-Saturna	5	$7R^5-4Art^5$	$7R^5-3ART^5$	3,4	$7R^5-3Apr^5$	$7R^5-3APR^5$	RO-STsl	$7R^5-5Ra^5$	$7R^5-5R^5$
					6	$7R^5-5Ta^5$	$7R^5-5T^5$			
					7,8	$7RT^5-7T^5$	$7RT^5-7T^5$			
RY	Rumsley	4	$4APr^8-7R^2$	$3APR^8-7R^2$	3	$4APr^8-7R^2$	$3APR^8-7R^2$	Rysl	$5Ra^8-7R^2$	$5R^8-7R^2$
					5	$4APr^8-7R^2$	$3APR^8-7R^2$	RYvg	$5AR^8-7R^2$	$5AR^8-7R^2$
					6	$5Tap^8-7R^2$	$5T^8-7R^2$			

(continued)

Table 8. Land capability ratings for agriculture (concluded)

Map unit		Typical capability class			Variation due to slope			Variation due to soil properties		
Symbol	Name	Slope class*	Unimproved rating	Improved rating	Slope class*	Unimproved rating	Improved rating	Soil phase*	Unimproved rating	Improved rating
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
SL	Salalakim	5	4Rat^{7}–7R^{3}	4Rt^{7}–7R^{2}	4	4Ra^{7}–7R^{3}	4R^{7}–7R^{3}	SLsl,vg	5AR^{7}–7R^{3}	5AR^{7}–7R^{3}
					6	5Tr^{7}–7R^{3}	5Tr^{7}–7R^{3}			
SM	St. Mary	2	3A^{8}–4Ap^{2}	2A^{8}–3Adp^{2}	3	3A^{8}–4Ap^{2}	2A^{8}–3Adp^{2}	SMg	4Ap	3Ap^{8}–3Adp^{2}
					4	3At^{8}–4Ap^{2}	2AT^{8}–3Apt^{2}	SMpd	4W^{8}–4Ap^{2}	2AW^{8}–3Adp^{2}
								SMpd,si	4W^{8}–4Ap^{2}	2W^{8}–3Adp^{2}
ST	Saturna	4	4Apr^{8}–7R^{2}	3APR^{8}–7R^{2}	3	4Apr^{8}–7R^{2}	3APR^{8}–7R^{2}	STsl	5Ra^{8}–7R^{2}	5R^{8}–7R^{2}
					5	4Art^{8}–7R^{2}	3ART^{8}–7R^{2}			
					6	5Ta^{8}–7R^{2}	5T^{8}–7R^{2}			
					7	7T^{8}–7RT^{2}	7T^{8}–7RT^{2}			
TL	Tolmie	1,2,3	4W	2DW^{8}–2ADW^{2}	4	4W	2DTW	TLid	3Ad	2D
								TLpt	5W	3Wd
TR	Trincomali	3	4Ap	3Adp^{8}–3Ap^{2}	4	4Ap	3Apt	TRd	4Ap	3Ap
					5	4Apt	3ATp	TRpd	4Wp^{8}–4Ap^{2}	2APW^{8}–3Ap^{2}
					6	5Ta	5T			
					8,9	7T	7T			

* See map legend.

† Percent soil component (see map legend for inclusions).

For some delineations, the land capability for agriculture may differ from the typical capability rating for one or more reasons. For example, slopes may be more or less steep than for the typical rating. Also, the range of slopes occurring in some delineations may span more than one land capability for agriculture class. Therefore, columns 6, 7, and 8 of Table 8 indicate the variations from the typical rating because of changes in slope class. Also, the described range in soil properties, such as coarse fragment content, may cover more than one capability class. Variations in soil properties, such as texture, coarse fragment content, depth to bedrock, and presence of an organic capping, do occur for some delineations. These are indicated by the soil phase or variant symbol in the map legend. Where the occurrence of a soil phase or variant results in the land capability for agriculture rating of the map unit being different from the typical rating, this difference, along with the soil phase or variant is indicated in columns 9, 10, and 11 of Table 8. These ratings assume the same typical slope class (column 4). In addition, inclusions of unmappable (because of the size of the map scale) soils, or variations in the proportion of dominant, subdominant, and minor soils do occur for some delineations. These types of variations could not be shown in the table.

The ratings in Table 8 are to be used as a guide only. They are not specific to individual map delineations and, therefore, do not eliminate the need for detailed on-site investigations.

Land capability for agriculture ratings in Table 8 show that soils of map units with the least degree of limitation for agricultural crop production generally occur below the 100-m contour either on gently sloping terrain or in valley bottoms. Most of these soils have developed on deep marine deposits with a low content of coarse fragments. Some of these map units represent the following soils: Baynes, Beddis, Brigantine, Denman Island, Parksville, and Tolmie. Similar soils with compact till occurring between 50 and 100 cm (St. Mary) fall into the same category.

Soils of map units having more severe limitations for agricultural crop production are generally found at the higher elevations and on more steeply sloping terrain. Most of these soils are shallow to bedrock or to compact till, because they have developed on colluvial and glacial drift materials. They usually have a high percentage of coarse fragments. The fact that these soils are difficult or impossible to improve realistically is indicated by the improved ratings (Table 8), which are the same as the unimproved ratings. Some of these map units represent the following soils: Galiano, Haslam soil complex, Musgrave, Rumsley, Salalakim, and Saturna soils. Agricultural uses on these soils are restricted to natural grazing, the production of perennial forage crops, or other specially adapted crops, such as tree fruits and grapes.

PART 6. DERIVED AND INTERPRETIVE MAPS

Besides the map unit interpretations discussed and presented in Part 5 of this report, similar or different interpretations that are specific for map delineations can be made.

Agriculture Canada is able to produce maps based on the soil information. These may be either interpretive maps like the land capability for agriculture, maps derived from the original soil information, such as maps of soil texture, slope, or drainage. Such maps can be made because the original boundaries and map unit symbols are stored in a computer as part of the Canada Soil Information System (CanSIS).

Soil maps are drafted by the Cartography Section in the Land Resource Research Centre of Agriculture Canada, Ottawa. As part of the cartographic procedure, the soil maps are digitized, and the locations of the map unit boundaries and their symbols are entered into the computer. The soil map, associated legend, and map unit symbols are then stored in the computer. This data base provides the basis for the production of derived or interpretive maps.

For example, it is possible that a map showing only the different types of soil parent materials is required. The procedure involves replacing the original map unit symbol by a new symbol that indicates the type of soil parent material. The same boundaries are retained, with the exception of those that have the same new symbols on either side. In this instance, the boundary is deleted. No new boundaries are added.

If users of the soil information need derived or interpretive maps, they should contact the senior author of this report at British Columbia Land Resource Unit, Agriculture Canada, 6660 N.W. Marine Drive, Vancouver, B.C. V6T 1X2 (Telephone (604) 224-4355).

REFERENCES

Advanced Data Institute America Incorporated. 1983. Aladin relational problem solver: Software and documentation. Sacramento, Calif.

Air Studies Branch. 1981. Climatic capability classification for agriculture in British Columbia. APD Tech. Pap. 4. Ministry of Environment, Victoria, B.C. 23 pp.

Agriculture Canada Expert Committee on Soil Survey. 1987. The Canadian system of soil classification. Agric. Can. Publ. 1646. 164 pp.

Akrigg, G.P.V.; Akrigg, H.B. 1973. 1001 British Columbia place names. Discovery Press, Vancouver, B.C. 195 pp.

Anonymous. 1930. Industrial island real beauty spot. Victoria Daily Times. Oct. 11, magazine section:1.

Anonymous. 1981. If your wondering. Victoria Times-Colonist, B.C., Dec. 23: 11.

Armstrong, J.E.; Clague, J.J. 1977. Two major Wisconsin lithostratigraphic units in southwest British Columbia. Can. J. Earth Sci. 14:1471-1480.

Atmospheric Environment Service. 1982a. Canadian climate normals: Temperature and precipitation 1951-1980, British Columbia. Environment Canada, Downsview, Ont. 268 pp.

Atmospheric Environment Service. 1982b. Canadian climate normals: Volume 6, frost 1951-1980. Environment Canada, Downsview, Ont. 276 pp.

Atmospheric Environment Service. 1982c. Canadian climate normals: Volume 4, degree days 1951-1980. Environment Canada, Downsview, Ont. 280 pp.

Barr, L.R. 1978. Land of the Trust Islands, a review of subdivision, housing, and ownership. Islands Trust, Ministry of Municipal Affairs and Housing, Victoria, B.C. 36 pp.

Bond, B. 1979. James Island...once a private hunting reserve. The Daily Colonist, Victoria, B.C., Feb. 11:4-5.

Borden, C.E. 1968. Prehistory of the Lower Mainland. Pages 9-26 in Siemens, A.H., ed. Lower Fraser Valley: Evolution of a cultural landscape. B.C. geographical series, number 9. Tantalus Research Ltd. Vancouver, B.C.

Boyes, E.B. 1960. Strange doings on Moresby Island. The Daily Colonist, Victoria, B.C., Sept. 18:8-9.

British Columbia Ministry of Agriculture. 1978. Agriculture on Vancouver Island and the Gulf Islands. Victoria, B.C. 16 pp.

British Columbia Ministry of Lands, Parks, and Housing. 1983. Coastal marine parks of British Columbia. Victoria, B.C. (map).

Canadian Society of Soil Science. 1976. Glossary of terms in soil science. Can. Dep. Agric. Publ. 1459. 44 pp.

Chilton, R.R. 1975. Climatology of the Gulf Islands trust area. Climate and Data Services Division, Environmental Land Use Committee Secretariat, Victoria, B.C. 20 pp.

Clague, J.J. 1975. Late Quaternary sea level fluctuations, Pacific Coast of Canada and adjacent areas. Geol. Surv. Can. Paper 75-1C:17-21.

Clague, J.J. 1977. Quadra Sand: A study of the Late Pleistocene geology and geomorphic history of coastal British Columbia. Geol. Surv. Can. Paper77-17. 24 pp.

Clapp, C.H. 1913. Geology of the Victoria and Saanich map-areas, Vancouver Island, B.C. Geol. Surv. Can. Memoir. 36. 143 pp. (plus appendices).

Coligado, M.C. 1979. Climate of the southern Gulf Islands. Pages 1 and 2 of resource folio for the Gulf Islands. Resource Analysis Branch, Ministry of Environment, Victoria, B.C. (maps).

Day, J.H.; Farstad, L.; Laird, D.G. 1959. Soil survey of southeast Vancouver Island and Gulf Islands, British Columbia. Report No. 6 of the B.C. Soil Survey, Department of Agriculture, Vancouver, B.C. 104 pp.

Dickason, A. 1949. Boom island. Vancouver Sun, June 4, magazine section: 6.

Duff, W. 1961. The Indians of the Gulf Islands. Pages 1-5 in A Gulf Islands patchwork: Some early events on the islands of Galiano, Mayne, Saturna, North and South Pender. Published for the Gulf Islands Branch, B.C. Historical Association.

Epp, P.F. 1984. Soil constraints for septic tank effluent absorption. MOE Manual 5. Surveys and Resource Mapping Branch, Ministry of Environment, Kelowna, B.C. 90 pp.

Foweraker, J.C. 1974. Groundwater investigations on Mayne Island. Report No. 1: Evaluation, development, and management of the groundwater resource on Mayne Island. Groundwater Division, Water Investigation Branch, B.C. Department of Lands, Forests and Water Resources. Victoria, B.C. 54 pp.

Freeman, B.J.S. 1961. Moresby Island. Page 81 in A Gulf Islands patchwork: Some early events on the islands of Galiano, Mayne, Saturna, North and South Pender. Published for the Gulf Islands Branch, B.C. Historical Association.

Gibbs, M. 1973. Pearl of the Gulf Islands. The Daily Colonist, Victoria, B.C., April 8, magazine section:4-5.

Green, J. 1982. Sidney Island tree farm still pearl of Gulf Islands, Victoria Times-Colonist, B.C., Nov. 7, magazine section:4-5.

Halstead, E.C. 1968. The Cowichan ice tongue, Vancouver Island. Can. J. Earth Sci. 5:1409-1415.

Hinkens, K. 1982. How to shoot a deer and save an island. Province, Vancouver, B.C., Oct. 24, magazine section:1,3.

Hirvonen, H.E.; Senyk, J.P.; Oswald, E.T. 1974. Saltspring Island, a landscape analysis. Can. For. Serv. Pac. For. Res. Cent. Inf. Rep. BC-X-99, Victoria, B.C., 54 pp.

Holland, S.S. 1976. Landforms of British Columbia, a physiographic outline. B.C. Dep. Mines and Petroleum Resources, Victoria, B.C. Bull. 48. 138 pp.

Ingham, D. 1952. Their powder boosts progress James Island runs own railway with toy-sized track and locos. Victoria Daily Times, B.C., May 29:10.

Islands Trust. 1982. Islands Trust regional plan. Draft, March 1982. Brochure, Ministry of Municipal Affairs, Victoria, B.C. 13 pp.

Islands Trust. 1984. Island water conservation information for residents and visitors. Brochure, Ministry of Environment and Ministry of Municipal Affairs, Victoria, B.C. 6 pp.

Kenk, E.; Cotic, I. 1983. Land capability classification for agriculture in British Columbia. MOE Manual 1. Ministry of Environment and Ministry of Agriculture and Food, Kelowna, B.C. 62 pp.

Kerr, D.P. 1951. The summer-dry climate of Georgia Basin, British Columbia. Trans. R. Can. Inst. 29:23-31.

Klinka, K.; Nuszdorfer, F.C.; Skoda, L. 1979. Biogeoclimatic units of central and southern Vancouver Island. B.C. Ministry of Forests, Victoria, B.C. 120 pp.

Krajina, V.J. 1969. Ecology of forest trees in British Columbia. Pages 1-146 in Krajina, V.J.; Brooke, R.C., eds. Ecology of western North America 2(1).

Lotus Development Corporation. 1983. Lotus 123: Release 1A. Lotus Development Corp., Cambridge, Mass.

Lyons, C.P. 1976. Trees, shrubs, and flowers to know in British Columbia. J.M. Dent and Sons (Canada) Ltd., Vancouver, B.C. 194 pp.

MacRae, D. 1970. This tight little island is determined not to blow it. Victoria Daily Times, B.C., Nov. 21:15.

Mapping Systems Working Group. 1981. A soil mapping system for Canada: revised. Land Resource Research Institute, Contribution No. 142, Agriculture Canada, Ottawa, Ont. 94 pp.

Mathews, W.H.; Fyles, J.G.; Nasmith, H.W. 1970. Postglacial crustal movement in northwestern British Columbia and adjacent Washington state. Can. J. Earth Sci. 7:690-702.

McKeague, J.A., ed. 1978. Manual on soil sampling and methods of analyses, second edition. Prepared by Subcommittee of Canada Soil Survey Committee on methods of analysis. Canadian Society of Soil Science, Ottawa, Ont. 212 pp.

Miller, D.E. 1973. Water retention and flow in layered soil profiles. Pages 107-117 in Bruce, R.P.; Flach, K.W.; Taylor, H.M., et al., eds. Field soil water regime. Special Publ. Series 5. Soil Science Society of America Inc., Madison, Wis.

Muller, J.E. 1977. Geology of Vancouver Island and Gulf Islands. Geological Survey of Canada, open file 463 (maps).

Muller, J.E.; Jeletzky, J.A. 1970. Geology of the Upper Cretaceous Nanaimo Group, Vancouver Island and Gulf Islands, Canada. Geol. Sur. Can. Paper69-25. 77 pp.

Pearse, P.H. 1982. Sidney Island is safe from desecration. Vancouver Sun, June 12:A5 (letter).

Rowe, J.S. 1977. Forest regions of Canada. Department of Fisheries and Environment, Ottawa, Ont. Can. For. Serv. Publ. 1300. 172 pp.

Smeck, N.E.; Norton, L.D.; Hall, G.F.; Bigham, J.M. 1980. Computerized processing and storing of soil descriptions and characterization data. Soil Sci. Soc. Am. J. 44:649-652.

Taylor, R.L.; MacBryde, B. 1977. Vascular plants of British Columbia. Univ. B.C. Press, Bot. Gard. Tech. Bull. No. 4. 754 pp.

Valentine, K.W.G.; Lidstone, A. 1985. Specifications for soil survey intensity (survey order) in Canada. Can. J. Soil Sci. 65:543-553.

Williams, M.Y.; Pillsbury, R.W. 1958. The Gulf Islands of British Columbia. Can. Geogr. J. 6:184-201.

Winsby, J.A. 1973. Geology of the Upper Cretaceous Nanaimo Group, Saltspring Island, British Columbia. B.Sc. Thesis, Department of Geology, University of British Columbia, Vancouver, B.C. 34 pp.

Wischmeier, W.H.; Smith, D.D. 1978. Predicting rainfall erosion losses - a guide to conservation planning. U.S. Department of Agriculture, Agric. Handb. 537. 58 pp.

APPENDIXES

APPENDIX 1. PROFILE DESCRIPTIONS AND ANALYTICAL DATA OF THE SOILS

This appendix is an alphabetical listing of profile descriptions and accompanying analytical data for most of the soils in the survey area. To best represent the most common profiles for the soils mapped in the survey area, selections have also been made from profiles described on adjoining Gulf Islands.

Standard methods of soil analyses (McKeague 1978) were followed in Agriculture Canada's soil survey laboratory in Vancouver, B.C. The relative soil erodibility (K-value) for each horizon was determined, using the methodology described by Wischmeier and Smith (1978).

Profile descriptions and analytical data for the following soils are included:

BAYNES SOIL

Location: along driveway to Madrona Studio, Mayne Island
Landform: blanket of marine deposits
Topography: very gentle slopes (2%), micromounded microtopography
Parent materials: deep marine sand deposits
Present land use: coast Douglas fir, red alder, and western sword fern
Remarks: surface horizon (Ah) much deeper than typical Baynes profile, (Baynes sombric phase), subsoil (BCg horizon) slightly cemented; commonly classified as Gleyed Dystric Brunisol

Longitude: 123°16'10"W
Latitude: 48°51'50"N
Elevation: 10 m
Drainage: imperfectly
Perviousness: moderately
Effective rooting depth: 27 cm
Classification: Gleyed Sombric Brunisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse fragments (%)
Ah	0-33	very dark gray (10YR 3/1)	very dark grayish brown (10YR 3/2)	sandy loam to loamy sand	weak	medium to coarse	granular	soft	very friable	none	15
Bgj	33-66	grayish brown (10YR 5/2)	light olive brown (2.5YR 5/4)	sand	weak	medium to coarse	subangular blocky	slightly hard	very firm	com.,coarse,dist. brown (10YR 4/3)	20
BCg	66-135	light olive brown (2.5YR 5/4)	light olive gray (5Y 6/2)	sand	weak	coarse	angular blocky	hard	very firm	many,coarse,dist. dark y. brown (10YR 4/6)	2
Cg	135-180	light gray (5 Y 7/2)	light brownish gray (2.5Y 6/2)	loamy sand			massive	slightly hard	firm	com.,fine,prom. yellowish brown (10YR 4/8)	1

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ah	4.6	3.7	0.26	14	0.5	0.2	15.5	3.8	0.9	0.1	0.1	32	73	5	20	7	0.14
Bgj	4.9	0.5	0.03	17	0.3	0.2	4.2	1.1	0.2	0.0	0.1	33	88		9	2	0.13
BCg	5.1	0.5	0.02	25			3.6	1.1	0.2	0.0	0.1	37	94		5	1	0.10
Cg	5.4	0.2	0.02	10			3.9	1.7	0.5	0.1	0.1	62	86		5	9	0.14

BEDDIS SOIL

Location: 250 m east of picnic shelter at north end of large field on B.C. Provincial park, Sidney Island
Landform: blanket of marine deposits
Topography: crest of convex very gentle slopes (4%)
Parent materials: coarse-textured marine deposit
Present land use: forested, primarily coast Douglas fir and western red cedar with understory of ocean spray and salal
Remarks: cut bank along Strait of Georgia side of the park; at 180 cm there is a stone line below which marine clay occurs; in Ah granules appear to be earthworm fecal pellets; weakly cemented sands in Bcj horizon can be crushed between fingers when dry; blocks disintegrate quickly in water; the Cc horizon is moderately cemented

Longitude: 123°19'20"W
Latitude: 48°38'15"N
Elevation: 30 m
Drainage: well
Perviousness: rapidly
Effective rooting depth: 110 cm
Classification: Orthic Dystric Brunisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence moist	Consistence wet	Mottles	Coarse fragments (%)
LF	2–0	mat of dead needles and twigs									
Ah	0–5	black (10YR 2/1)	dark grayish brown (10YR 4/2)	sandy loam	strong	medium	granular	very friable	nonsticky nonplastic	none	0
Bm1	5–15	dark yellowish brown (10YR 3/4)	brown (10YR 5/3)	loamy sand	weak	fine	granular blocky	very friable	nonsticky nonplastic	none	3
Bm2	15–40	dark yellowish brown (10YR 3/5)	yellowish brown (10YR 5/4)	sand	weak	fine	granular	loose	nonsticky nonplastic	none	5
BC	40–70	olive brown (2.5Y 4/4)	light yellowish brown (2.5Y 6/4)	sand	–	–	single grain	loose	nonsticky nonplastic	none	15
Bcj	70–110	dark yellowish brown (10YR 3/6)	brownish yellow (10YR 6/6)	fine sand	–	–	massive	very friable	nonsticky nonplastic	none	0
C1	110–120	light olive brown (2.5Y 5/4)	light gray (2.5Y 7/2)	fine sand	weak	medium to coarse	pseudo blocky	very friable	nonsticky nonplastic	none	0
Cc	120–145	light olive brown (2.5Y 5/6)	light yellowish brown (2.5Y 6/4)	fine sand	strong	medium to coarse	pseudo blocky	very friable	nonsticky nonplastic	none	0
C2	145–150+	light olive brown (2.5Y 5/4)	light gray to pale yellow (2.5Y 7/3)	fine sand	moderate	medium to coarse	pseudo blocky	very friable	nonsticky nonplastic	none	0

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ah	5.2	4.6	0.26	18	0.2	0.2	18.4	8.1	2.1	0.5	0.5	61	79	7	16	5	0.11
Bm	4.9	1.5	0.07	20	0.3	0.3	7.0	2.0	0.5	0.1	0.2	40	79	8	19	2	0.13
Bfj	5.1	0.9	0.04	20	0.2	0.2	5.9	1.8	0.5	0.1	0.3	45	87	4	12	1	0.08
BC	5.3				0.1	0.1	2.4	1.1	0.3	0.1	0.2	66	96	1	4	0	0.05
Bcj	5.3						2.6	1.2	0.3	0.1	0.2	71	95	7	4	1	0.05
C1	5.5						2.5	1.6	0.7	0.1	0.2	100+	94	4	5	1	0.05
Cc	5.5						3.1	1.8	0.8	0.0	0.3	95	92	5	7	1	0.05
C2	5.4						4.7	2.6	1.3	0.1	0.4	92	87	4	9	4	0.05

BELLHOUSE SOIL

Location: petroglyph site behind United Church, South Road, Gabriola Island
Landform: colluvial veneer overlying smooth, sandstone bedrock
Topography: nearly level (2%) within a moderate sloping (10-15%) area with smooth microtopography, southerly aspect
Parent materials: shallow channery sandy loam to channery sand colluvial materials over sandstone bedrock
Present land use: Garry oak and grasses with exposed sandstone bedrock, usually covered by moss, surrounded by coast Douglas fir
Remarks: organic iron cementation (Bc horizon) is not common for Bellhouse soil

Longitude: 123°43'50"W
Latitude: 49°08'18"N
Elevation: 45 m
Drainage: well
Perviousness: rapidly
Effective rooting depth: 25 cm
Classification: Orthic Sombric Brunisol

PROFILE DESCRIPTION

Horizon	Depth	Color		Texture	Structure			Consistence		Mottles	Coarse fragments
	(cm)	moist	dry		grade	class	kind	dry	moist		(%)
H	3-0										
Ah1	0-10	black (10YR 2/1)	dark brown (7.5YR 3/2)	sandy loam	weak	fine	columnar	slightly hard	friable	none	15
Ah2	10-20	black (10YR 2/1)	dark brown (10YR 3/3)	channery sandy loam	very weak	medium	subangular blocky	soft	very friable	none	40
Bm	20-23	dark yellowish brown (10YR 4/4)	dark brown brown (7.5YR 4/4)	channery loamy sand	very weak	fine	granular	soft	friable	none	45
Bc	23-26	dark brown (10YR 3/3)	black (10YR 2/1)	sand	strong		massive	rigid	very firm	none	
R	26+										

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C	Total N	C:N ratio	Pyrophos. Fe	Pyrophos. Al	Oxalate Fe	Oxalate Al	Cation exchange CEC	Ca	Mg	K	Na	Base sat.	Particle size distribution Total sand	Very fine sand	Silt	Clay	Soil erosion
		(%)	(%)		(%)	(%)	(%)	(%)	(meq/100 g soil)					(%)	(%)	(%)	(%)	(%)	(K value)
H	4.9	18.0	1.3	14	0.3	0.6	0.6	0.6	47.4	13.8	2.8	0.6	0.4	37					
Ah1	4.6	12.1	0.8	15	0.3	0.8	0.6	0.8	31.6	2.8	0.6	0.1	0.1	12	64	8	27	9	0.15
Ah2	4.6	5.8	0.5	12	0.3	0.8	0.6	1.0	23.2	1.8	0.4	0.1	0.1	10	71	8	23	6	0.18
Bm	4.8	5.7	0.5	11	0.2	0.8	0.5	1.8	21.4	1.2	0.3	0.1	0.1	8	81		15	4	0.06
Bc	4.8	2.2	0.2	11	0.5	0.5	1.8	1.5	12.4	0.8	0.1	0.0	0.0	8	89		9	2	0.08
R																			

BRIGANTINE SOIL

Location: Morgan Road Dyer's farm, Galiano Island
Landform: blanket of marine deposits overlying subdued terrain
Topography: gentle slope (7%), moderately mounded microtopography
Parent materials: shallow sandy loam marine deposits overlying deep loam marine deposits
Present land use: forested, dominated by western red cedar and coast Douglas fir
Remarks: subsoil usually finer textured

Longitude: 123°21'50"W
Latitude: 48°52'45"N
Elevation: 130 m
Drainage: imperfectly
Perviousness: moderately
Effective rooting depth: 67 cm
Classification: Gleyed Dystric Brunsiol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence moist	Consistence wet	Mottles	Coarse fragment (%)
Ah	0–9	very dark brown (10YR 2/2)	dark brown (10YR 4/3)	sandy loam	weak	medium to coarse	granular	friable	nonsticky	none	<10
Bm1	9–31	dark brown (7.5YR 3/4)	yellowish brown (10YR 5/4)	sandy loam	weak	fine to medium	subangular blocky	very friable	slightly sticky	none	<10
Bm2	31–58	strong brown (7.5YR 4/6)	yellowish brown (10YR 5/4)	sandy loam	weak to moderate	fine to medium	subangular blocky	very friable	slightly sticky	none	<10
Bm3	58–67	dark yellowish brown (10YR 4/6)	yellowish brown (10YR 5/4)	sandy loam	moderate	fine to medium	subangular blocky	friable	slightly sticky	none	<10
IIBg1	67–76	olive (2.5Y 5/4)	pale yellow (2.5Y 7/4)	loam	moderate	medium to coarse	subangular blocky	friable	sticky	com.,fine,prom. strong brown (7.5YR 4/6)	<5
IIBg2	76–96	olive (2.5Y 4/4)	very pale brown (10YR 7/4)	loam	moderate to strong	coarse	angular blocky	firm	sticky	many,medium,prom. strong brown (7.5YR 4/6)	<5
IICBg	96–115	olive (2.5Y 4/4)	light yellowish brown (2.5Y 6/4)	loam	moderate to strong	coarse	angular blocky	firm	sticky	few,fine,prom. strong brown (7.5YR 5/6)	<5

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Oxalate Fe (%)	Oxalate Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ah	4.9	4.6	0.21	22	0.3	0.3	0.5	0.3	21.2	6.8	1.2	0.7	0.1	42	59	13	30	12	0.22
Bm1	4.9	1.2	0.06	20	0.3	0.3	0.5	0.3	10.1	2.4	0.7	0.3	0.1	35	65	10	25	10	0.26
Bm2	4.8	0.9	0.06	15	0.3	0.3	0.5	0.3	9.8	2.3	0.7	0.2	0.1	34	63		26	11	0.23
Bm3	4.7	0.9	0.05	18	0.3	0.2	0.5	0.3	10.4	2.5	0.8	0.2	0.1	34	62		27	11	0.24
IIBg1	4.7	0.5	0.03	17	0.1	0.1	0.5	0.1	12.1	5.2	1.6	0.1	0.2	58	45		44	11	0.38
IIBg2	5.0	0.4	0.02	20			0.4	0.1	14.3	9.0	2.5	0.1	0.2	82	44		47	9	0.43
IICBg	5.9						0.2	0.1	15.0	10.6	2.7	0.1	0.3	91	45		44	10	0.40

GALIANO SOIL

Location: Yardarm Road, Magic Lake Estates, North Pender Island
Landform: colluvial veneer overlying shale bedrock
Topography: strongly sloping (25%) with a northerly aspect
Parent materials: shallow very shaly silt loam colluvial materials overlying shale bedrock
Present land use: residential subdivision
Remarks: Bfj horizon, normally a Bm horizon, meets all chemical requirements of Bf horizon but not morphologically (color)

Longitude: 123°18'7"W
Latitude: 48°46'30"N
Elevation: 85 m
Drainage: well
Perviousness: rapidly
Effective rooting depth: 40 cm
Classification: Orthic Dystric Brunisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse fragments (%)
Ah	0-9	very dark brown (10YR 2/2)	dark grayish brown (10YR 4/2)	very shaly silt loam	weak	fine	granular	soft	very friable	none	65
Bfj	9-40	very dark grayish brown (10YR 3/2)	dark brown (10YR 4/3)	very shaly silt loam	moderate	coarse	angular blocky	slightly hard	friable	none	65
C	40-55	dark brown (10YR 4/3)	brown (10YR 5/3)	very shaly silt loam	strong	coarse	angular blocky	hard	firm	none	85
R	55+										

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ah	4.9	7.1	0.34	21			23.2	16.5	2.4	1.1	0.2	87	33	7	54	14	0.30
Bfj	4.8	2.0	0.12	17	0.4	0.4	11.3	8.8	1.9	0.5	0.3	100+	30	7	56	14	0.33
C	4.7	1.5	0.10	15			19.5	10.8	2.5	0.7	0.3	73	25		61	14	0.34

MEXICANA SOIL

Location: Mansell and Robinson Road junction, about 60 m towards Bullock Lake, Saltspring Island
Landform: morainal blanket, rolling to undulating landscape
Topography: strongly sloping (20–25%), southwest aspect, moderately mounded microtopography
Parent materials: sandy loam morainal materials <100 cm deep
Present land use: forested with coastal Douglas fir, western red cedar, red alder, bigleaf maple, and western sword fern
Remarks: drainage is slower than is common for this soil in the Gulf Islands (commonly classified as Orthic Dystric Brunisol), but representative for the map area

Longitude: 123°30'10"W
Latitude: 48°52'24"N
Elevation: 35 m
Drainage: imperfectly
Perviousness: moderately
Effective rooting depth: 30 cm
Classification: Gleyed Dystric Brunisol

PROFILE DESCRIPTION

Horizon	Depth	Color		Texture	Structure			Consistence		Mottles	Coarse fragments
	(cm)	moist	dry		grade	class	kind	moist	wet		(%)
LF	2–0										
Ah	0–7	very dark brown (10YR 2/2)	dark grayish brown (10YR 4/2)	loam	strong	coarse	granular	friable	nonsticky	none	5
Bm1	7–20	dark grayish brown (10YR 4/4)	brown (10YR 5/3)	sandy loam	weak to moderate	fine to medium	subangular blocky	friable	nonsticky	none	10
Bm2	20–35	brown (10YR 5/3)	very pale brown (10YR 7/3)	sandy loam	moderate to strong	medium	angular blocky	firm	nonsticky	none	10
Bmgj	35–55	dark grayish brown (10YR 4/4)	light yellowish brown (10YR 6/4)	sandy loam	moderate to strong	coarse	angular blocky	firm	nonsticky	few,fine,faint	10
Bg	55–65	yellowish brown (10YR 5/4)	brown (10YR 5/3)	sandy loam	moderate to strong	coarse	platy	firm	slightly sticky	common,fine,dist dark brown (7.5YR 4/4)	10
BCg	65–85	light brownish gray (2.5Y 6/2)	light olive brown (2.5Y 5/4)	sandy loam	moderate to strong	coarse	angular blocky	friable	slightly sticky	many,fine.prom. strong brown (7.5YR 5/8)	10
Cg1	85–110	light brownish gray (2.5Y 6/2)	light olive brown (2.5Y 5/4)	sandy loam	moderate to strong	coarse	angular blocky	firm	slightly sticky	common,med.prom. dark brown (7.5YR 4/4)	10
Cg2	110–145+	olive brown (2.5Y 4/4)	pale olive (5Y 6/3)	sandy loam	moderate to strong	coarse	angular blocky	firm	slightly sticky		10

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Bulk density (g/cm^3)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ah	4.6	6.9	0.27	26	0.3	0.2		22.7	7.5	1.7	0.4	0.1	43	51	12	31	18	0.21
Bm1	4.4	1.6	0.07	23	0.3	0.2		11.1	2.7	1.1	0.2	0.1	37	56	13	34	10	0.33
Bm2	4.6	0.2	0.05	24	0.2	0.1		9.7	3.3	1.3	0.1	0.1	49	59		32	9	0.27
Bmgj	5.0	0.5	0.03	15	0.1	0.1		8.6	3.7	1.6	0.1	0.1	64	58		32	10	0.30
Bg	5.0	0.4	0.03	14	0.1	0.1	1.76	8.6	3.8	1.7	0.1	0.1	66	59		32	9	0.31
BCg	5.0	0.3	0.03	10			1.74	11.4	5.3	2.2	0.1	0.2	68	58		31	11	0.29
Cg	5.4	0.2	0.02	12			1.95	8.5	5.1	1.8	0.1	0.2	84	63		31	6	0.32
C	5.9	0.1	0.01	13			1.98	8.8	5.9	2.0	0.1	0.2	92	59		33	8	0.32

MUSGRAVE SOIL

Location: north of field near Royal Cove on Portland Island
Landform: colluvial veneer overlying metamorphosed sedimentary bedrock, ridged terrain
Topography: moderate slopes (13%), slightly mounded microtopography
Parent materials: shallow, very gravelly, sandy loam colluvial materials overlying bedrock
Present land use: coast Douglas fir and moss
Remarks: Bfj horizons, normally Bm horizons meet chemical but not morphological requirements of podzolic Bf horizons; common coarse fragment content is <50%

Longitude: 123°22'20"W
Latitude: 48°43'50"N
Elevation: 40 m
Drainage: well
Perviousness: rapidly
Effective rooting depth: 42 cm
Classification: Orthic Dystric Brunisol

PROFILE DESCRIPTION

Horizon	Depth	Color		Texture	Structure			Consistence		Mottles	Coarse fragments
	(cm)	moist	dry		grade	class	kind	dry	moist		(%)
LF	5-3	mat of dead needles, twigs, mosses									
H	3-0	very dark brown (10YR 2/2)	dark brown (10YR 3/3)		moderate to strong	fine to medium	granular	soft	friable	none	0
Bfj1	0-12	dark yellowish brown (10YR 3/4)	yellowish brown (10YR 5/4)	sandy loam	weak	medium	subangular blocky	soft	very friable	none	64
Bfj2	12-22	dark brown (7.5YR 3/2)	dark yellowish brown (10YR 4/4)	sandy loam	weak	fine to medium	granular	loose	very friable	none	75
BC	22-42	very dark grayish brown (10YR 3/2)	dark yellowish brown (10YR 4/4)	sandy loam			single grain	loose	very friable	none	50
R	42+										

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C	Total N	C:N ratio	Pyrophos. Fe	Pyrophos. Al	Oxalate Fe	Oxalate Al	Cation exchange CEC	Ca	Mg	K	Na	Base sat.	Particle size distribution Total sand	Very fine sand	Silt	Clay	Soil erosion
		(%)	(%)		(%)	(%)	(%)	(%)	(meq/100 g soil)					(%)	(%)	(%)	(%)	(%)	(K value)
H	4.1	18.1	0.54	33	0.4	0.5	0.5	0.6	57.7	13.9	1.7	1.0	0.3	29	44	5	43	13	0.18
Bfj1	4.8	3.3	0.13	25	0.2	0.7	0.5	1.4	16.7	2.7	0.3	0.3	0.1	20	52	6	42	6	0.23
Bfj2	4.5				0.2	0.8	0.4	1.2	20.2	1.9	0.2	0.3	0.1	12	58	5	37	5	0.18
BC	4.6				0.2	0.9	0.4	1.5	23.8	2.7	0.3	0.3	0.1	14	56	6	39	5	0.18

PARKSVILLE SOIL

Location: old orchard near Princess Bay, Portland Island
Landform: blanket of marine deposits, overlying level terrain
Topography: very gentle slope (3%) with smooth microtopography
Parent materials: shallow sandy marine deposits overlying deep, silty clay marine deposits
Present land use: old orchard with grass
Remarks: common coarse fragment content of overlay material <20%; Ae horizon not typical for Parksville soil

Longitude: 123°22'10"W
Latitude: 48°43'15"N
Elevation: 10 m
Drainage: poorly
Perviousness: moderately
Effective rooting depth: 60 cm
Classificaton: Orthic Humic Gleysol

PROFILE DESCRIPTION

Horizon	Depth	Color		Texture	Structure			Consistence		Mottles	Coarse fragments
	(cm)	moist	dry		grade	class	kind	dry	moist		(%)
L-H	2-0										
Ap	0-15	black (10YR 2/2)	dark grayish brown (10YR 4/2)	sandy loam	weak	medium	granular	soft	very friable	none	21
Aegj	15-23	dark grayish brown (2.5Y 4/2)	light brownish gray (2.5Y 6/2)	sand	weak	medium	single grain	loose	loose	few, fine, faint	34
Bg1	23-50	olive brown (2.5YR 4/3)	grayish brown (2.5Y 5/2)	sand	weak to moderate	medium	single grain	loose	loose	com., fine, prom. brown (7.5YR 5/5)	42
Bg2	50-60	olive brown (2.5Y 4/3)	light brownish gray (2.5Y 6/2)	sand	weak to moderate	medium	single grain	loose	loose	many, fine, prom. strong brown (7.5YR 5/6)	32
IICg1	60-110	dark greenish gray (5 GY 4/1)	gray (5Y 6/1)	silty clay	moderate to strong	medium	pseudo angular blocky	hard	firm	many, medium, prom. dark yellowish brown (10YR 4/4)	0
IICg2	110-150	olive (5Y 4/3)	pale olive (5Y 6/3)	silty clay	weak	medium	pseudo angular blocky	hard	firm	many, medium, prom. brown (10YR 4/3)	0

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Oxalate Fe (%)	Oxalate Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ap	5.4	3.5	0.34	10	0.1	0.2	0.4	0.3	19.2	12.0	1.1	0.1	0.2	70	76	2	14	10	0.11
Aegj	5.4	0.5	0.03	16	0.1	0.1	0.2	0.2	4.5	2.9	0.4	0.1	0.1	77	88	3	9	3	0.13
Bg1	5.5	0.4	0.02	22			0.3	0.2	5.0	3.2	0.5	0.1	0.1	78	89	2	8	3	0.11
Bg2	5.6						0.2	0.1	4.2	2.7	0.6	0.1	0.1	82	91	2	7	2	0.12
IICg1	6.0						0.4	0.3	27.8	17.1	9.3	0.3	0.6	98	6	2	48	46	0.26
IICg2	6.2						0.3	0.3	25.7	14.4	8.5	0.2	0.8	93	9	3	49	42	0.32

QUALICUM SOIL

Location: southwest of Ganges on north side of Fulford-Ganges Road, Saltspring Island
Landform: glaciofluvial blanket
Topography: strongly sloping (20%), moderately mounded microtopography
Parent materials: gravelly sandy to gravelly sandy loam, glaciofluvial deposits
Present land use: forested; bigleaf maple, red alder, western red cedar, and western sword fern
Remarks: representative Qualicum profile, except for vegetation

Longitude: 123°29'14"W
Latitude: 48°50'16"N
Elevation: 100 m
Drainage: well
Perviousness: rapidly
Effective rooting depth: 45 cm
Classification: Orthic Dystric Brunisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse fragments (%)
Lf	3-0										
Ah	0-9	very dark grayish brown (10YR 3/2)	dark brown (10YR 3/3)	very gravelly sandy loam	moderate	medium	granular	loose	friable	none	56
Bm1	9-45	olive brown (2.5Y 4/4)	yellowish brown (10YR 5/4)	gravelly loamy sand	very weak	medium	subangular blocky	soft	very friable	none	30
Bm2	45-65	olive brown (2.5Y 4/4)	light yellowish brown (2.5Y 6/4)	gravelly sand	moderate	medium	subangular blocky	slightly hard	friable	none	29
BC	65-100+	light olive brown (2.5Y 5/4)	pale yellow (2.5Y 7/4)	gravelly sandy loam	very weak	medium	angular blocky	slightly hard	friable	none	43

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Oxalate Fe (%)	Oxalate Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ah	5.3	10.9	0.45	24	0.2	0.2			35.4	16.2	2.3	0.4	0.1	53	75	19	6	0.05
Bm1	5.3	1.0	0.05	20	0.2	0.3	0.5	0.6	8.4	2.5	0.3	0.1	0.0	35	83	15	2	0.11
Bm2	5.6	0.3	0.02	15	0.0	0.1	0.3	0.4	3.6	1.0	0.1	0.1	0.0	33	88	10	2	0.09
BC	5.0								4.8	1.3	0.2	0.1	0.0	35	72	23	5	0.20

RUMSLEY SOIL

Location: 200 m east of big field (pasture) on shallow to bedrock area, Sidney Island
Landform: colluvial veneer overlying metamorphosed intrusive bedrock; rocky, ridged terrain
Topography: gentle slope (6%), moderately mounded microtopography
Parent materials: shallow, gravelly sandy loam colluvial materials overlying bedrock
Present land use: coast Douglas fir, bunch grass, and mosses
Remarks: normally, profile has Bm horizons and is classified as an Orthic Dystric Brunisol

Longitude: 123°17'45"W
Latitude: 48°36'20"N
Elevation: 60 m
Drainage: well
Perviousness: moderately
Effective rooting depth: 65 cm
Classification: Orthic Humo-Ferric Podzol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse fragments (%)
LFH	2-0										
Bf1	0-10	dark brown (7.5YR 3/2)	brown to dark brown (10YR 4/3)	loam	weak	very fine	granular	soft	very friable	none	19
Bf2	10-25	dark brown (7.5YR 3/4)	dark yellowish brown (10YR 4/4)	sandy loam	weak	fine	granular	soft	very friable	none	33
Bm	25-45	dark brown (7.5YR 3/4)	dark yellowish brown (10YR 4/4)	sandy loam	weak	fine	granular	soft	very friable	none	50
BC	45-65	dark brown (7.5YR 3/2)	dark yellowish brown (10YR 4/4)	sandy loam	weak	medium	subangular blocky	soft	very friable	none	25
R	65+										

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Oxalate Fe (%)	Oxalate Al (%)	Cation exchange (meq/100 g soil) CEC	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Bf1	5.1	6.5	0.33	20	0.3	1.1	0.6	1.5	27.2	6.7	0.8	0.5	0.2	30	45	4	48	7	0.23
Bf2	4.8	3.4	0.19	18	0.2	1.0	0.5	1.5	19.6	1.8	0.2	0.2	0.1	12	48	4	48	4	0.26
Bm3	4.6	4.0	0.22	18	0.2	1.1	0.4	1.7	23.0	0.9	0.1	0.2	0.1	5	57	4	39	4	0.22
BC	4.2				0.3	1.5	0.4	1.8	37.4	1.1	0.2	0.2	0.1	4	66	8	29	5	0.23

SALALAKIM SOIL

Location: Gowlland Point Road, South Pender Island
Landform: colluvial blanket, ridged terrain
Topography: extremely sloping (65%), with southerly aspect, slightly mounded microtopography
Parent materials: gravelly loam, colluvial materials over conglomerate bedrock
Present land use: forested; coast Douglas fir, Pacific madrone, grasses, hairy honeysuckle, and common gorse
Remarks: profile deeper (□100 cm), finer textured, and slower perviousness than common Salalakim soil

Longitude: 123°12'43"W
Latitude: 48°44'26"N
Elevation: 55 m
Drainage: well
Perviousness: moderately
Effective rooting depth: 78 cm
Classification: Orthic Dystric Brunisol

PROFILE DESCRIPTION

Horizon	Depth	Color		Texture	Structure			Consistence		Mottles	Coarse fragments
	(cm)	moist	dry		grade	class	kind	dry	moist		(%)
Ah	0-4	dark brown (7.5YR 3/2)	dark brown (7.5YR 4/2)	gravelly loam	moderate to strong	fine	granular	hard	friable	none	35
Bm1	4-33	dark brown (7.5YR 3/2)	dark brown (7.5YR 4/2)	gravelly loam to sandy loam	moderate	very fine	subangular blocky	hard	friable	none	35
Bm2	33-78	dark brown (7.5YR 4/2)	dark brown (7.5YR 4/2)	gravelly loam to sandy loam	moderate	very fine	subangular blocky	hard	friable	none	40
BC	78-120+	dark brown (7.5YR 3/2)	brown (7.5YR 5/2)	gravelly loam to sandy loam	weak to moderate	fine	subangular blocky	hard	friable	none	30

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C	Total N	C:N ratio	Pyrophos. Fe	Pyrophos. Al	Cation exchange CEC	Ca	Mg	K	Na	Base sat.	Particle size distribution Total sand	Very fine sand	Silt	Clay	Soil erosion
		(%)	(%)		(%)	(%)	(meq/100 g soil)					(%)	(%)	(%)	(%)	(%)	(K value)
Ah	5.9	3.9	0.27	14	0.1	0.0	23.2	12.8	6.1	1.2	0.1	83	47	13	37	16	0.24
Bm1	5.3	1.0	0.06	17	0.1	0.1	21.6	10.5	6.7	0.4	0.1	82	52	14	33	15	0.39
Bm2	5.5	1.9	0.09	21	0.1	0.1	21.9	11.4	4.4	0.1	0.1	75	52		35	13	0.20
BC	5.7	1.0	0.06	17	0.1	0.1	17.8	10.7	4.0	0.1	0.1	86	51		38	11	0.30

SATURNA SOIL

Location: south arm of Hess Road, 100 m before dead end, 10 m east in trees, Gabriola Island
Landform: colluvial veneer over sandstone bedrock, rolling landscape
Topography: moderate to strong slopes (15%) southerly aspect, slightly mounded microtopography
Parent materials: sandy loam colluvial materials over sandstone bedrock
Present land use: forested; coast Douglas fir, and salal
Remarks: Ah deeper and textures finer than typical Saturna soil; commonly classified as Orthic Dystric Brunisol

Longitude: 123°47'30"W
Latitude: 49°09'20"N
Elevation: 140 m
Drainage: well
Perviousness: rapidly
Effective rooting depth: 60 cm
Classification: Orthic Sombric Brunisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse fragments (%)
LF	3-0										
Ah	0-11	very dark grayish brown(10YR 3/2)	brown to dark brown(7.5YR 4/2)	channery loam	strong	coarse	granular	slightly hard	friable	none	20
Bm1	11-30	brown,dark brown (10YR 4/3)	dark brown (7.5YR 3/2)	channery loam to sandy loam	strong	medium	angular blocky	slightly hard	friable	none	25
Bm2	30-50	brown,dark brown (10YR 4/3)	brown, dark brown(7.5YR 4/4)	very channery sandy loam	moderate	medium	angular blocky	slightly hard	friable	none	60
CB	50-80	yellowish brown (10YR 5/4)	brown, dark brown(7.5YR 4/4)	very channery sandy loam	weak	very fine	angular blocky	slightly hard	friable	none	90
R	80+										

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Oxalate Fe (%)	Oxalate Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
LF	4.9	36.2	1.30	28	0.0	0.1	0.2	0.2	88.8	32.7	7.8	3.4	0.4	50					
Ah	4.7	7.1	0.37	19	0.2	0.2	0.4	0.3	32.0	11.5	2.7	0.6	0.1	47	48	10	42	10	0.24
Bm1	4.9	1.5	0.09	17	0.2	0.2	0.4	0.3	19.0	7.0	1.7	0.5	0.1	49	52	11	38	10	0.30
Bm2	4.8	1.3	0.08	16	0.2	0.2	0.5	0.5	17.1	5.3	1.3	0.5	0.1	42	55		34	11	0.24
CB	4.8				0.1	0.1	0.5	0.3							53		40	7	0.28

ST. MARY SOIL

Location: southwest of big field (pasture) near caretaker's house, Sidney Island
Landform: shallow marine deposits overlying till blanket; topography controlled by underlying bedrock
Topography: very gentle slope (2%), micromounded microtopography
Parent materials: shallow gravelly sandy loam and loam marine materials overlying compact glacial till deposits
Present land use: coast Douglas fir, grand fir, Pacific madrone; disturbed site due to logging
Remarks: normally, coarse fragment content in overlay materials is <20%

Longitude: 123°18'35"W
Latitude: 48°36'20"N
Elevation: 20 m
Drainage: imperfectly
Perviousness: moderately
Effective rooting depth: 45 cm
Classification: Gleyed Dystric Brunisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse fragments (%)
LFH	2-0										
Ahu	0-10	dark brown (7.5YR 3/2)	yellowish brown (10YR 5/4)	sandy loam	weak	fine	granular	loose	very friable	none	33
Bm	10-25	dark brown (7.5YR 3/4)	brown (7.5 YR 5/4)	sandy loam	weak to moderate	medium	angular blocky	soft	very friable	none	23
Bgj	25-45	dark brown (10YR 3/3)	light yellowish brown (10YR 6/4)	sandy loam to loamy sand	weak	fine	subangular blocky	soft	very friable	few,medium,dist. strong brown (7.5YR 5/6)	39
BCgj	45-60	dark yellowish brown (10YR 4/4)	light yellowish brown (10YR 6/4)	sandy loam to loamy sand	moderate	medium	subangular blocky	slightly hard	friable	few,medium,dist. strong brown (7.5YR 5/6)	60
IICg	60-95	light olive brown (2.5Y 5/4)	light gray (2.5Y 7/2)	loam	weak	fine to medium	pseudo angular blocky	hard	firm	many,medium,prom. strong brown (7.5YR 5/6)	2
IIICg	95-110	olive brown (2.5Y 4/4)	light brownish gray (2.5Y 6/2)	loam			massive	hard	firm	few,faint,prom. reddish yellow (7.5YR 7/6)	10

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Oxalate Fe (%)	Oxalate Al (%)	Cation exchange CEC (meq/100 g soil)	Ca (meq/100 g soil)	Mg (meq/100 g soil)	K (meq/100 g soil)	Na (meq/100 g soil)	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ahu	4.8	2.3	0.15	18	0.2	0.3	0.5	0.4	13.1	3.3	0.8	0.2	0.1	34	72	4	22	6	0.12
Bm	5.1	1.7	0.09	19	0.3	0.3	0.6	0.5	10.4	3.0	0.9	0.3	0.1	41	72	4	23	5	0.20
Bgj	5.1	1.1	0.07	16	0.2	0.3	0.4	0.5	8.9	2.7	1.0	0.2	0.1	44	75	4	20	5	0.23
BCgj	5.1				0.2	0.2	0.4	0.4	8.6	2.5	1.2	0.2	0.2	47	78	6	14	8	0.20
IICg	4.7						0.4	0.2	14.3	4.1	4.1	0.1	0.4	61	47	9	35	18	0.35
IIICg	5.5						0.3	0.1	15.1	5.9	5.3	0.1	0.6	79	45	9	40	15	0.39

TOLMIE SOIL

Location: Port Washington Road, North Pender Island
Landform: marine blanket
Topography: nearly level (1%) slope
Parent materials: fine marine blanket, sandy marine horizons
Present land use: forested; red alder, with salmonberry and western sword fern understory
Remarks: watertable at 105 cm (14/05/82); Ae horizon not typical for Tolmie soil

Longitude: 123°17'55"W
Latitude: 48°48'29"N
Elevation: 30 m
Drainage: poorly
Perviousness: slowly
Effective rooting depth: 45 cm
Classification: Orthic Humic Gleysol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse fragmen (%)
LF	1–0										
Ah	0–15	black (10YR 2/1)	grayish brown (10YR 5/2)	silty clay loam	strong	coarse	granular	slightly hard	friable	none	<5
Aegj	15–28	grayish brown (2.5Y 5/2)	light gray (10YR 7/1)	silt loam	weak to moderate	fine	platy	slightly hard	friable	few, faint	<5
IIBg	28–38	gray (5Y 5/1)	light gray (10YR 7/2)	loamy sand			single grain	loose	loose	many, fine, prom. yellowish brown (10YR 5/6)	<5
IIIBg	38–85	gray (5Y 5/1)	light brownish gray (2.5Y 6/2)	clay loam	weak to moderate	fine	angular blocky	hard	firm	many, fine, prom. yellowish brown (10YR 5/6)	<2
IIICg	85–105+	dark gray (5Y 4/1)	light brownish gray (2.5Y 6/2)	silty clay loam	moderate to strong	fine to medium	angular blocky	hard	firm	com., fine, prom. dark yellowish brown (10YR 4/6)	<2

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Oxalate Fe (%)	Oxalate Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ah	4.1	7.4	0.75	10	0.2	0.2	0.3	0.2	33.5	10.6	2.4	0.1	0.3	38	16	6	51	33	0.27
Aegj	5.1	0.6	0.06	10	0.0	0.1	0.1	0.1	12.7	7.8	2.5	0.0	0.2	83	20		58	22	0.46
IIBg	5.1	0.2	0.02	10	0.0	0.0	0.1	0.0	4.7	3.2	1.0	0.0	0.1	91	76		21	4	0.21
IIIBg	6.3	0.2	0.02	10	0.1	0.01	0.2	0.1	26.4	19.1	8.7	0.2	0.3	100+	30		39	31	0.33
IIICg	6.5	0.4	0.02	20					27.4	20.2	8.5	0.2	0.3	100+	14		47	39	0.31

TRINCOMALI SOIL

Location: 700 m from turnoff to village before bend in road heading towards farm at south end of Kuper Island
Landform: marine veneer overlying glacial till blanket, rolling landscape
Topography: moderate slopes (12%), slightly mounded microtopography
Parent materials: shallow, gravelly loamy sand marine deposits overlying gravelly sandy loam, glacial till deposits
Present land use: second-growth coast Douglas fir, western red cedar, with red alder, bigleaf maple, and Pacific madrone; ground cover of salal
Remarks: drainage slower than usual for this soil in the Gulf Islands (commonly classified as Orthic Dystric Brunisol), but representative for the map area; slower drainage reflects nontypical vegetation species

Longitude: 123°38'20"W
Latitude: 48°58'5"N
Elevation: 60 m
Drainage: imperfectly
Perviousness: slowly
Effective rooting depth: 60 cm
Classification: Gleyed Dystric Brunisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color		Texture	Structure			Consistence		Mottles	Coarse fragments (%)
		moist	dry		grade	class	kind	dry	moist		
LF	3-0										
Ah	0-4	dark brown (7.5YR 3/2)	dark brown (10YR 3/3)	gravelly loamy sand	weak	medium to coarse	granular	soft	very friable	none	50
Bf	4-12	reddish brown (5YR 4/3)	reddish brown (5YR 5/4)	gravelly loamy sand	weak	medium	subangular blocky	loose	very friable	none	40
Bm1	12-50	dark reddish brown (5YR 3/4)	brown (7.5YR 5/4)	gravelly loamy sand	weak	medium	subangular blocky	loose	very friable	none	40
Bm2	50-60	dark yellowish brown (10YR 4/4)	light yellowish brown (10YR 6/4)	gravelly loamy sand	weak	medium	subangular blocky	loose	very friable	none	30
IIBCgj	60-65	olive brown (2.5Y 4/4)	light yellowish brown (2.5Y 6/4)	sandy loam	moderate	coarse	subangular blocky	soft	very friable	few, coarse, faint yellowish brown (10YR 5/6)	15
IICg	65-80	grayish brown (2.5Y 5/2)	light gray (2.5Y 7/2)	gravelly sandy loam	weak	fine to medium	pseudo platy	very hard	extremely firm	many, coarse, dist. brown to dark brown (7.5YR 4/4)	30
IICcg	80-100+	olive brown (2.5Y 4/4)	light brownish gray (2.5Y 6/2)	gravelly loamy sand	moderate to strong	fine	pseudo platy	extremely hard	extremely firm	common, medium, dist. brown to dark brown (7.5YR 4/4)	25

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Oxalate Fe (%)	Oxalate Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
LF	5.1	41.9	1.54	27															
Ah	4.8	6.2	0.25	25	0.3	0.5	0.7	0.7	24.5	6.3	1.1	0.6	0.1	33	71	7	24	5	0.20
Bf	4.8	1.9	0.09	21	0.2	0.4	0.8	0.9	11.4	2.0	0.3	0.2	0.0	22	75	7	21	4	0.22
Bm1	5.0	1.2	0.05	24	0.1	0.3	0.7	0.9	7.9	1.4	0.2	0.1	0.0	21	77	6	20	3	0.25
Bm2	5.0	0.6	0.04	15	0.1	0.2	0.6	0.9	6.2	0.8	0.1	0.0	0.0	15	82	7	16	2	0.17
IIBCgj	5.0				0.0	0.2	0.4	0.8	4.8	0.7	0.1	0.0	0.0	17	69	13	28	3	0.39
IICg	4.6				0.1	0.3	0.3	0.6	6.4	0.8	0.1	0.1	0.0	16	67	14	30	3	0.44
IICcg	4.7				0.1	0.2	0.6	0.5	6.0	0.8	0.1	0.0	0.1	17	73	14	25	2	0.40

APPENDIX 2. SOIL MOISTURE DATA FOR THE SOIL PROFILES

Table 2.1 includes data on available water storage capacity (AWSC) and the Atterberg limits of the mineral soils for the same profiles as in Appendix 1.

AWSC represents the amount of water that can be extracted from the soil by plants or is available for plant use. Quantitatively, it is determined by the arithmetic difference between percent water at field capacity (1/3 atm.) and permanent wilting point (15 atm.). AWSCs have been determined for horizons in about the top 50 cm of the soil.

The Atterberg limits (liquid and plastic limits) measure the effect of moisture on the consistence of the soil material. This engineering property of the soil varies with the amount of water present. Atterberg limits have been determined for the subsoil (BC and C) horizons. The plasticity index is the arithmetic difference between the liquid and plastic limits. Some soils are nonplastic (NP).

The methods for the determination of AWSC and Atterberg limits are described by McKeague (1978).

Table 2.1 Selected soil moisture data for the soil profiles

Soil	Horizon	Depth (cm)	AWSC (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)
Baynes	Ah	0-33	13	-	-	-
	Bgj	33-66	2	-	-	-
	BCg	66-135	-	NP*	NP	NP
	CG	135-180	-	NP	NP	NP
Beddis	Ah	0-5	11	-	-	-
	Bm	5-15	6	-	-	-
	Bfj	15-40	4	-	-	-
	BC	40-70	1	-	-	-
	Bcj	70-110	4	-	-	-
	C1	110-120	3	NP	NP	NP
	Cc	120-145	4	NP	NP	NP
	C2	145-150+	4	NP	NP	NP
Bellhouse	Ah1	0-10	29	-	-	-
	Ah2	10-20	19	-	-	-
	Bm	20-23	11	-	-	-
	C	23-26+	-	NP	NP	NP
Brigantine	Ah	0-9	13	-	-	-
	Bm1	9-31	7	-	-	-
	Bm2	31-58	7	20	18	2
	IICBg	96-115	-	22	17	5
Galiano	Ah	0-9	21	-	-	-
	Bfj	9-40	19	-	-	-
	C	40-55+	17	33	28	5
Mexicana	Ap	0-7	17	-	-	-
	Bm1	7-20	9	-	-	-
	Bm2	20-35	8	-	-	-
	Bgj	35-55	6	-	-	-
	BCg	65-85	6	NP	NP	NP
	C1	85-110	5	NP	NP	NP
	C2	110-145+	6	NP	NP	NP

(continued)

Table 2.1 Selected soil moisture data for the soil profiles (continued)

Soil	Horizon	Depth (cm)	AWSC (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)
Musgrave	H	3-0	27	-	-	-
	Bf1	0-12	13	-	-	-
	Bf2	12-22	13	-	-	-
	BC	22-42	13	NP	NP	NP
Parksville	Ap	0-15	9	-	-	-
	Aegj	15-23	3	-	-	-
	Bg1	23-50	3	-	-	-
	Bg2	50-60	2	-	-	-
	IICg1	60-110	14	48	23	25
	IICg2	110-150	14	43	21	22
Qualicum	Ah	0-9	12	-	-	-
	Bm1	9-45	4	-	-	-
	BC	65-100+	-	NP	NP	NP
Rumsley	Bf1	0-10	23	-	-	-
	Bf2	10-25	17	-	-	-
	Bm	25-45	15	-	-	-
	BC	45-65	13	NP	NP	NP
Salalakim	Ah	0-4	15	-	-	-
	Bm1	4-33	9	-	-	-
	Bm2	33-78	12	27	22	5
	BC	78-120	-	23	20	3
Saturna	Ah	0-11	10	-	-	-
	Bm1	11-30	8	-	-	-
	Bm2	30-50	6	-	-	-
	CB	50-80	-	NP	NP	NP
St. Mary	Ahu	0-10	11	-	-	-
	Bm	10-25	12	-	-	-
	Bgj	25-45	10	-	-	-
	BCgj	45-60	5	NP	NP	NP
	IICg	60-95	12	26	19	7
	IIICg	95-110	11	26	15	7

(continued)

Table 2.1 Selected soil moisture data for the soil profiles (concluded)

Soil	Horizon	Depth (cm)	AWSC (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)
Tolmie	Ah	0-15	62	-	-	-
	Aegj	15-28	51	-	-	-
	IIBg	28-38	9	-	-	-
	IIICg1	85-105	-	46	21	25
	IIICg2	at 225	-	51	25	26
Trincomali	Ah	0-4	15	-	-	-
	Bf	4-12	8	-	-	-
	Bm1	12-50	10	-	-	-
	IICg	65-80	-	NP	NP	NP
	IICcg	80-100	-	NP	NP	NP

* Nonplastic.