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Soils of the Gulf Islands of British Columbia

Volume 4 Soils of Gabriola and lesser islands

Report No. 43 British Columbia Soil Survey 1990

Canada

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Report No. 43
British Columbia Soil Survey

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

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Cover photo
Wave-cut "galleries" and "honeycomb" erosion

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CONTENTS

Page

LIST OF TABLES AND ILLUSTRATIONS

TABLES

FIGURES

PLATES

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PREFACE

Gabriola and lesser islands cover a total area of 6029 ha in the Gulf Islands of British Columbia shown on map sheet 92G/4 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 fourth 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; and
Volume 5 Soils of Sidney, James, Moresby, Portland, and lesser islands.

The correct citation for this report is as follows:

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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 soil survey at a scale of 1:63 360 (one inch to one mile) 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 capability maps for agriculture and other uses (1:50 000). Since that time, some of the Gulf Islands were surveyed in more detail by different agencies in response to requests from the Islands Trust of the Ministry of Municipal Affairs and Regional Districts. The soil maps have been used by planners to draft official community plans for the islands. 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 Land Resource Unit, Agriculture Canada, Vancouver, B.C., 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 of 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 interpretive soil ratings for the Islands Trust and for other users;
- 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, with the soil inventory for Galiano, Valdes, and Thetis islands. Interim soil maps and legends as part of the resource folios for these islands were published in 1979 by the Resource Analysis Branch, British Columbia Ministry of Environment, as follows: the Galiano Island map sheet by Green (1979), the Thetis Island map sheet by van Vliet and Brierley (1979a), and the Valdes Island map sheet by van Vliet and Brierley (1979b). Fieldwork for the soil inventory for Saltspring Island was completed during the summer of 1981. Interim soil maps (north and south sheets) with an extended legend were published in 1983 as part of the resource folio for Saltspring Island (van Vliet et al. 1983). The final report and soil map were published in 1987 as Soils of the Gulf Islands of British Columbia Volume 1 Soils of Saltspring Island (van Vliet et al. 1987).

Fieldwork for the soil inventory for North and South Pender, Prevost, Mayne, Saturna, and lesser islands took place during the summers of 1982 and 1983. Interim soil maps with extended legends were published on two map sheets during the following year (van Vliet et al. 1984; Kenney and van Vliet 1984). The final report and soil maps were published in 1988 as Volume 2 Soils of North Pender, South Pender, Prevost, Mayne, Saturna, and lesser islands (Kenney et al. 1988).

Field work for Kuper and the lesser islands was completed during the summer of 1984. Also, some additional field checking took place on Galiano and Thetis islands. The final report and soil maps were published in 1989 as Volume 3 Soils of Galiano, Valdes, Thetis, Kuper, and lesser islands (Green et al. 1989)

Fieldwork for Gabriola and lesser islands took place during the summers of 1984 and 1985. The interim soil map with an extended legend was published in 1986 (Kenney and van Vliet 1986).

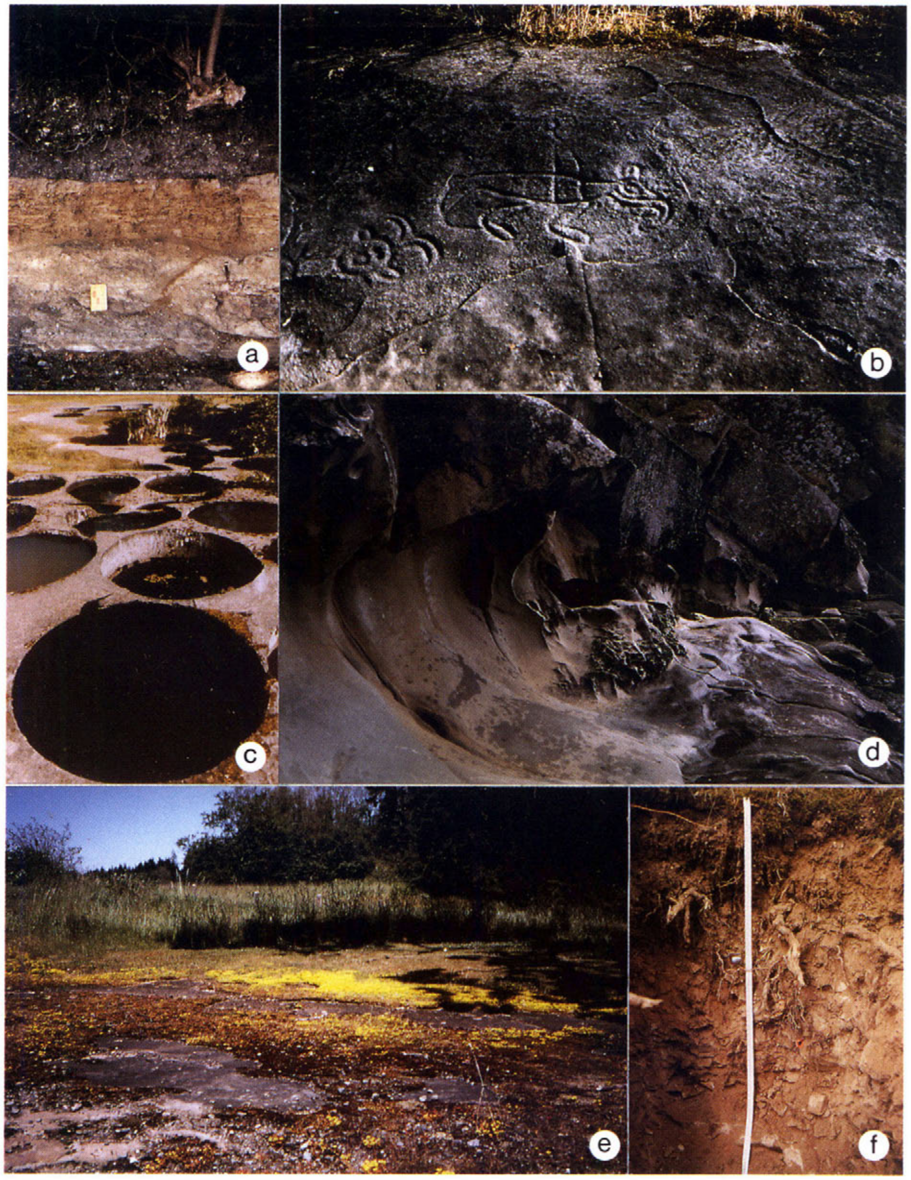

Plate I

(a) Indian midden along False Narrows, underlain by compact till deposits on top of shale bedrock.
(b) Indian rock carvings (petroglyphs) on smooth sandstone outcrops are found in several places on Gabriola Island.
(c) Local sandstone on Gabriola Island was quarried for pulp millstones from 1887 to 1918. (Photo credit: Kenchenten Associates, Gabriola Island).
(d) Wave-cut "galleries" and "honeycomb" weathering are some erosional coastal features on the islands.
(e) Smooth, flat-lying beds of sandstone outcrop in many places. When weathered, they form the parent materials for Saturna and Bellhouse soils.
(f) Profile of a shallow Saturna soil (Orthic Dystric Brunisol) overlying sandstone bedrock.

PART 2. GENERAL DESCRIPTION OF THE AREA

Location and extent

This fourth volume of the British Columbia Soil Survey Report No. 43 for the Gulf Islands covers a group of islands lying between longitudes 123°40' and 123°56'W and between latitudes 49°7' and 49°12'N (Fig. 1). These islands lie in the Strait of Georgia between the delta of the Fraser River and the southeastern coast of Vancouver Island.

Gabriola Island occupies an area of 5075.5 ha (Islands Trust 1978a) and is about 15 km long and 4 km wide (Oswald 1977). In addition to Gabriola Island, this survey covers 20 named lesser islands, of which Newcastle, Protection, Mudge, Link, Breakwater, and the Flat Top islands are the best known, and 3 named reefs, which are all listed in Table 1. The size of the named islands are also included in Table 1. These lesser islands cover a total area of 720.5 ha.

Several small unnamed islands, islets, rocks, and reefs have not been included in this compilation of area calculations. Discrepancies in area may occur because of the difficulty of locating the high-water shoreline of the islands on the 1:20 000 base maps. The total area mapped, including lakes, named and unnamed islands, islets, and rocks, is 6029 ha.

History and development

A few of the island place names originate from the Spanish explorations of 1790-1792. The majority of the water and island place names were assigned by the British surveyor, Captain Richards, during 1858-1859. He named places after his ship and crew, the naval ships and crew in service on the coast at that time, and also after the ships and crew of earlier Spanish explorers. A history of Gabriola and adjacent island place names is given by Akrigg and Akrigg (1973) and Lewis-Harrison (1982).

Population

Gabriola Island and the adjacent islands were used seasonally as a fishing and shellfish-gathering base by the Coast Salish Indians (British Columbia Ministry of Lands, Parks, and Housing 1984a), although 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. Excavations of the Indian midden along False Narrows, Gabriola Island (Plate Ia), suggested that up to 2000 Indians lived at this site (Lewis-Harrison 1982). This midden has been dated at A.D. 280 ± 90 (Mitchell 1971). Gabriola Island is also noted for having several locations with petroglyphs (Indian rock carvings) of unknown age (Plate Ib), which have been described in detail by Bentley and Bentley (1981).

The first European settlers arrived on Gabriola Island in the mid 1800s. The population grew slowly and the voters list of 1888 listed 46 people for Gabriola Island (Lewis-Harrison 1982). The 1981 census indicated a

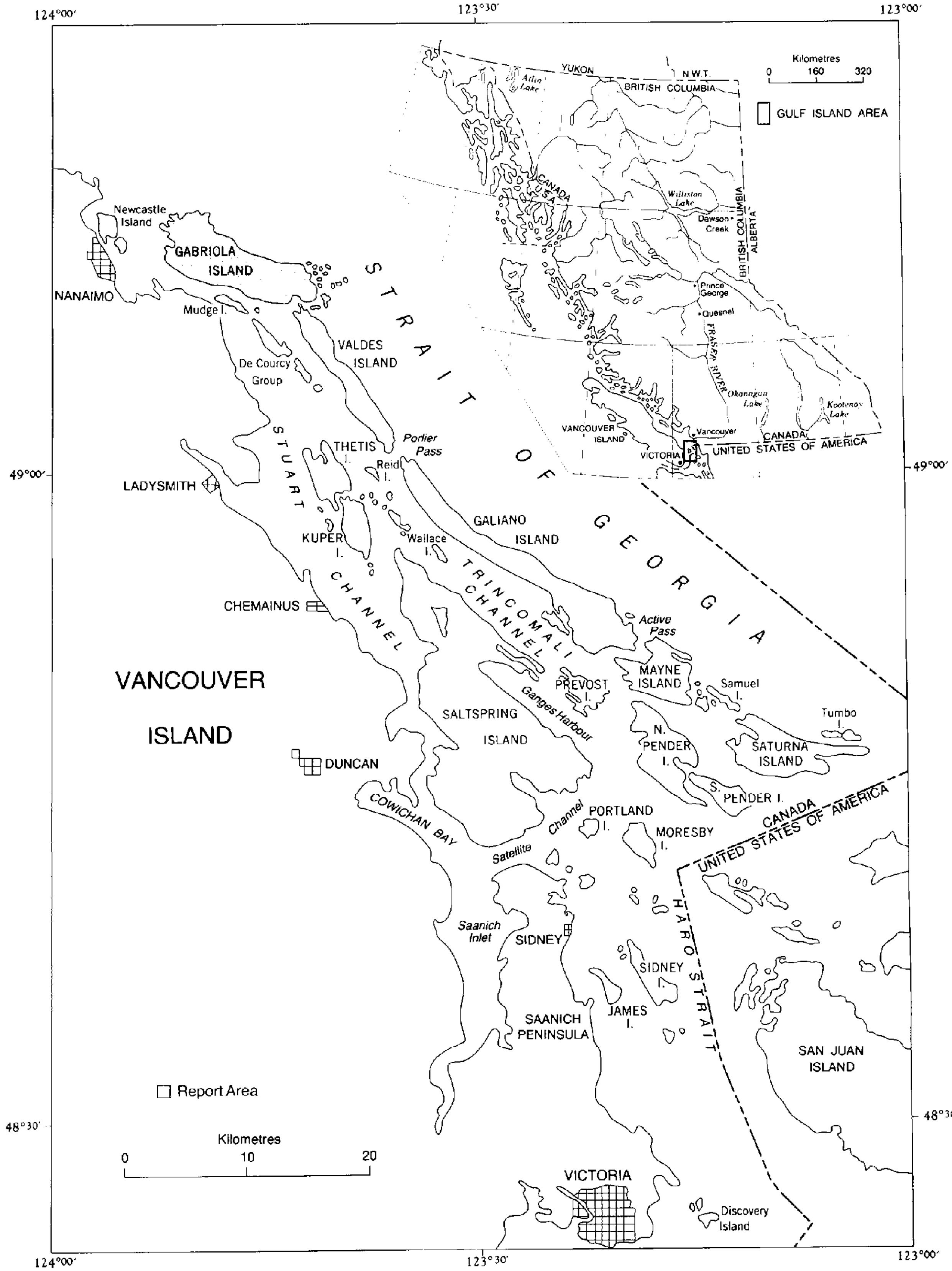

Figure 1. Location of Gabriola and lesser islands in relation to the Gulf Islands and the Province of British Columbia (inset map).

Table 1. Size of the named surveyed islands and names of the reefs

Name of islands and reefs	Area (ha)
Acorn Island*	9.4
Bath Island*	4.1
Brandon Islands	1.1
Breakwater Island	25.7
Carlos Island*	0.8
Entrance Island	2.3
Five Finger Island	0.8
Gabriola Island	5075.5
Gaviola Island*	3.8
Jesse Island	3.8
Lily Island*	3.0
Link Island	25.4
Mudge Island	218.6
Newcastle Island	313.1
Protection Island	66.0
Round Island	2.8
Saturnina Island*	4.2
Sear Island*	12.2
Snake Island	2.0
Tugboat Island*	11.8
Vance Island*	9.6
Brant Reef	
Gabriola Reefs	
Rogers Reef	

* These islands are collectively called Flat Top Islands.

permanent population of 1627 people for Gabriola Island (Ovanin, T. Personal Communication, Islands Trust, Victoria, B.C., 1985).

The economic base of the islands is centred around farming, fishing, logging, tourism, retirement living, and the services these require (Islands Trust 1982a). Gabriola Island also has a portion of its population living on the island and working in Nanaimo. Gabriola Island is in demand for weekend recreation, retirement, and summer cottages. During the summer months the population of Gabriola Island may triple (Oswald 1977).

Land use

The nonaboriginal settlers and the subsequent early population were principally homesteaders and farmers who sold their products to the Vancouver Island (Nanaimo) markets in addition to supplying local needs. Sheep and lambs, beef and dairy cattle, poultry, and hay are the main agricultural commodities along with small amounts of potatoes, fruit, and vegetables all produced primarily for the local market (British Columbia Ministry of Agriculture 1978). Gabriola Island also has a farm producing goat cheese. The agricultural land reserve on Gabriola Island has a total of 890 ha (17.5% of the island) (Islands Trust 1978a). Plate IIe shows such an area. The lesser islands in the survey area have no land in the agricultural land reserve (British Columbia Department of Municipal Affairs 1985).

Second-growth timber provides a basis for a small logging industry. The commercial tree species are coast Douglas fir, western hemlock, western red cedar, and grand fir (Islands Trust 1982a). Gabriola Island has two certified tree farms with a total area of 1117 ha (about 22% of the island) operated primarily by Weldwood of Canada Limited. There are also small operators on private land and some selective horse logging is being conducted on Gabriola Island.

Coal mining occurred on Newcastle Island from 1853 until 1883 (British Columbia Ministry of Lands, Parks, and Housing 1984a). The coal seam on Newcastle Island was one of two original mines in the Nanaimo area (Howatson 1979). Coal was also mined on Protection Island (Greater Nanaimo Chamber of Commerce 1984).

Sandstone for building stone was quarried on Newcastle Island from 1869 to 1932 during which time material for the construction of the San Francisco Mint and other west coast buildings was produced (British Columbia Ministry of Lands, Parks, and Housing 1984a,b). Sandstone for pulp millstones was also quarried from 1887 to 1918 on Gabriola Island (Plate Ic) and the sandstone for the Nanaimo Court House was quarried on Protection Island (Lewis-Harrison 1982). Shales were quarried on Gabriola Island from 1895 to 1952 for use in brick manufacture (Greater Nanaimo Chamber of Commerce 1984).

Most land on these islands is privately owned and many of the lesser islands are wholly privately owned. The main exceptions are Newcastle Island, which is a provincial marine park; Entrance and Snake islands, and Hudson Rocks, which are federal government reserves; and Protection Island, which is partly owned by the City of Nanaimo as well as privately (Islands Trust

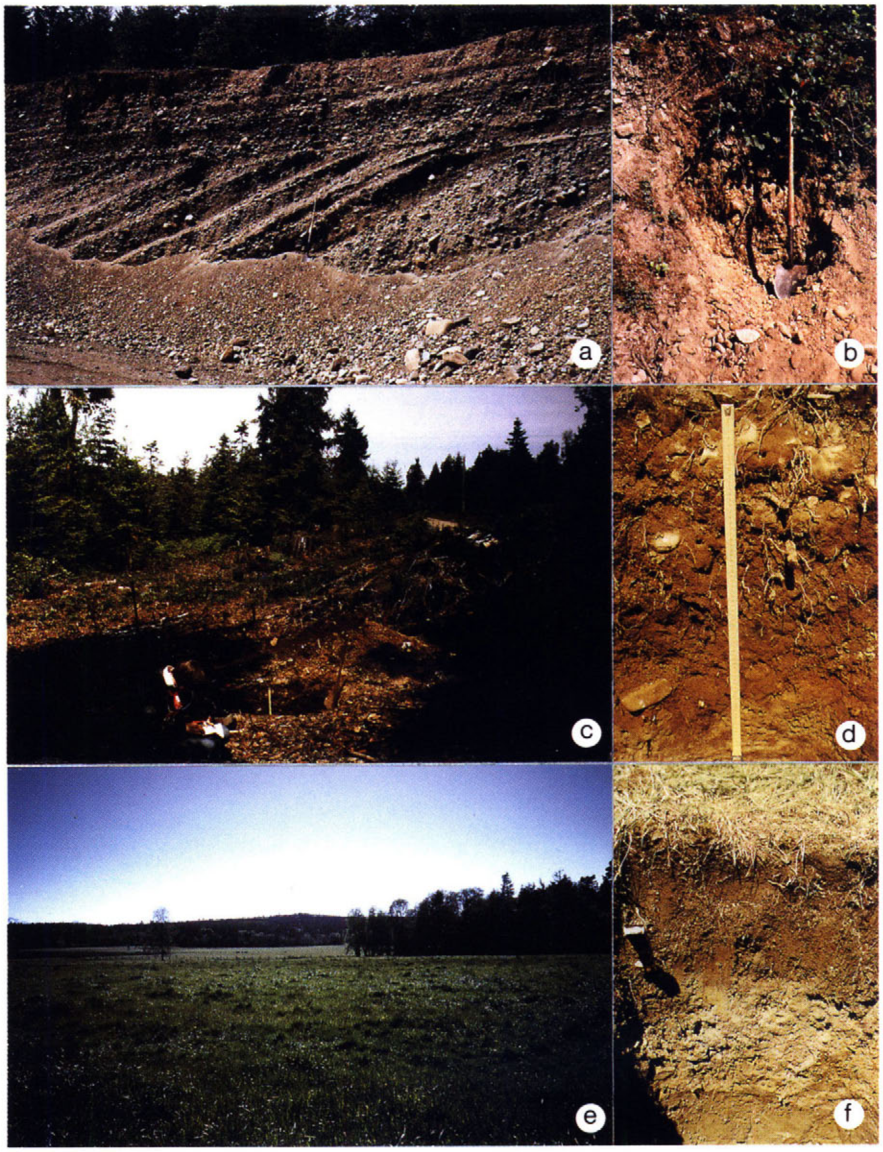

Plate II

(a) Deltaic deposit of gravels, orginating from outwash streams entering large, deep bodies of water during glacial retreat. These glaciofluvial deposits form the parent materials for Qualicum soils.
(b) Profile of a Qualicum soil developed on deep, gravelly, coarse-textured glaciofluvial, fluvial, or marine deposits.
(c) Landscape associated with the Trincomali soil dominated by coast Douglas fir and a ground cover of salal.
(d) Profile of the Trincomali soil developed on shallow, coarse-textured marine deposits overlying moderately coarse- to medium-textured, compact glacial till.
(e) Landscape associated with the Cowichan soils is typical of land in the agricultural land reserve.
(f) Profile of the Cowichan soil developed on deep deposits of moderately fine- to fine-textured marine materials.

1982b). Gabriola Island has two provincial parks (Gabriola Sands to the northwest of the island and Drumbeg to the southeast of the island), which cover a total of 26 ha. The area in Crown land is 217 ha (Islands Trust 1978a). Two Indian reserves occur in the survey area; Gabriola Island Indian Reserve 5 is located at the southeastern tip of Gabriola Island at Degnen Bay, and Indian Reserve 6 is the small unnamed island in Degnen Bay.

The increasing population has resulted in a high demand for residential land over the past few years. An official community plan for Gabriola Island and the adjacent lesser islands specifies the different land use categories and regulates development in accordance with agreed-upon goals and policies (Islands Trust 1978b).

Transportation and energy

The provincial government operates a ferry with regular sailings to Gabriola Island from Nanaimo. During the summer months a foot-passenger ferry operates between Nanaimo and Newcastle Island. Access to the other islands is by private boat (British Columbia Ministry of Lands, Parks, and Housing 1984b). The road system on Gabriola Island is paved (Fig. 2). There is a road system on Protection and Mudge islands and a series of hiking trails on Newcastle Island (Fig. 3). Electric power is brought in from the mainland via 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 (Foweraker 1974; Hodge 1978). During the summer months when the demand for water is highest, shortages may occur as surface water sources dry up and the recharge of the groundwater storage is at its lowest. All recharge to potable groundwater comes from precipitation, which falls during the late fall and winter months (Foweraker 1974).

Water quality in some areas of these islands may also be a problem, either as a result of saltwater intrusion or from contamination by domestic or agricultural wastes (Islands Trust 1982b, 1984).

A study of groundwater quantity and quality has been done for Gabriola Island, where Hodge (1978) reports a total of 824 wells. Drilled wells supply about 85% of the groundwater used on Gabriola Island; dug wells and springs supply the remaining 15% (Hodge 1978). Hoggan Lake, which covers about 24 ha, is an artificial lake created in the early 1900s by damming the outlet of an existing wetland. This lake may be a potential water supply for the southwestern portion of Gabriola Island. Groundwater demand may be exceeding supply in the Gabriola Sands area (Taylor Bay to Orlebar Point), south of Descanso Bay, and along False Narrows. Similar in the area west of Lock Bay and, if development continues, in the Silva Bay area. The remaining areas of Gabriola Island are considered to have an adequate supply of groundwater at present (Hodge 1978). The groundwater quality of Gabriola Island is

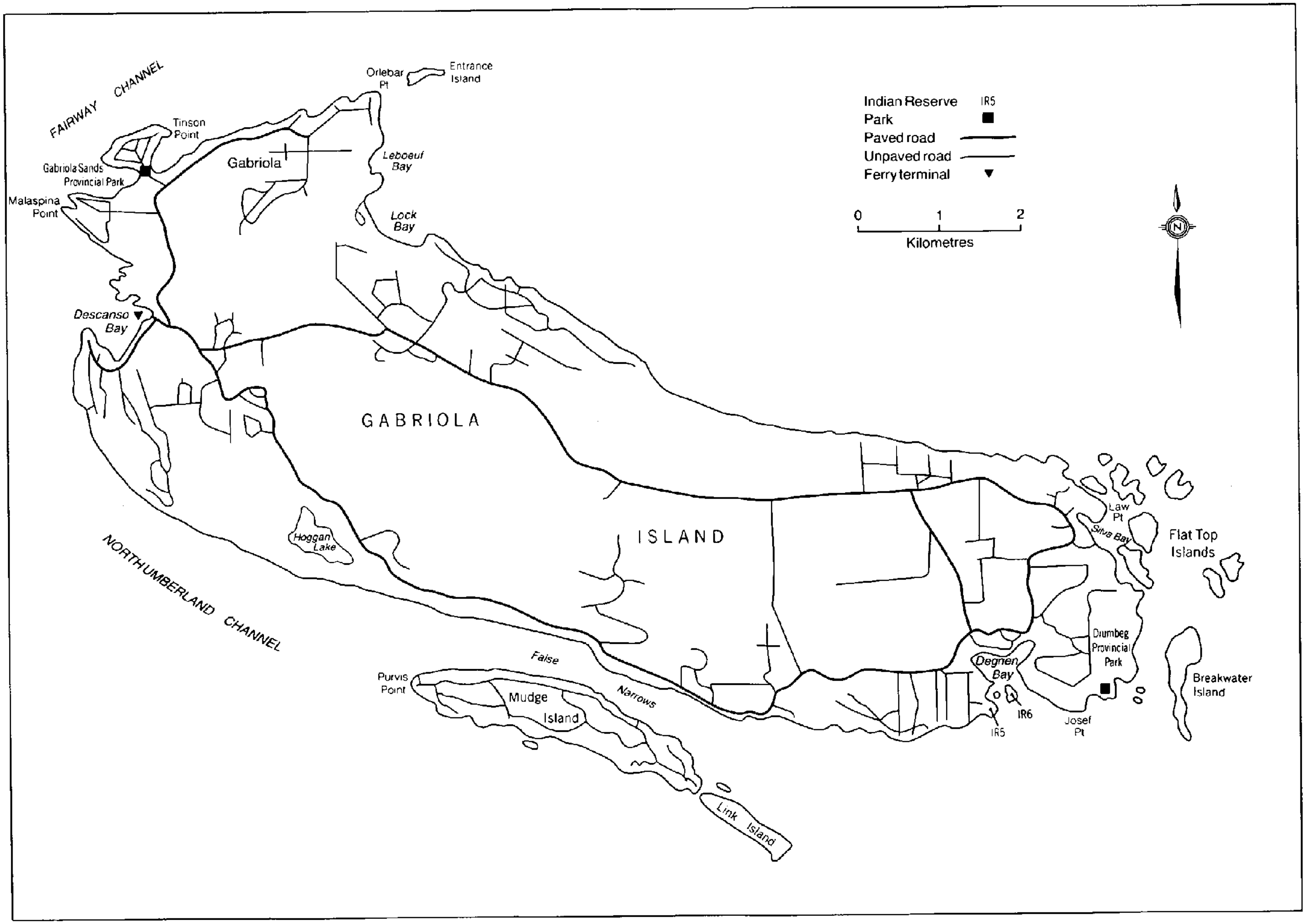

Figure 2. Gabriola and lesser islands.

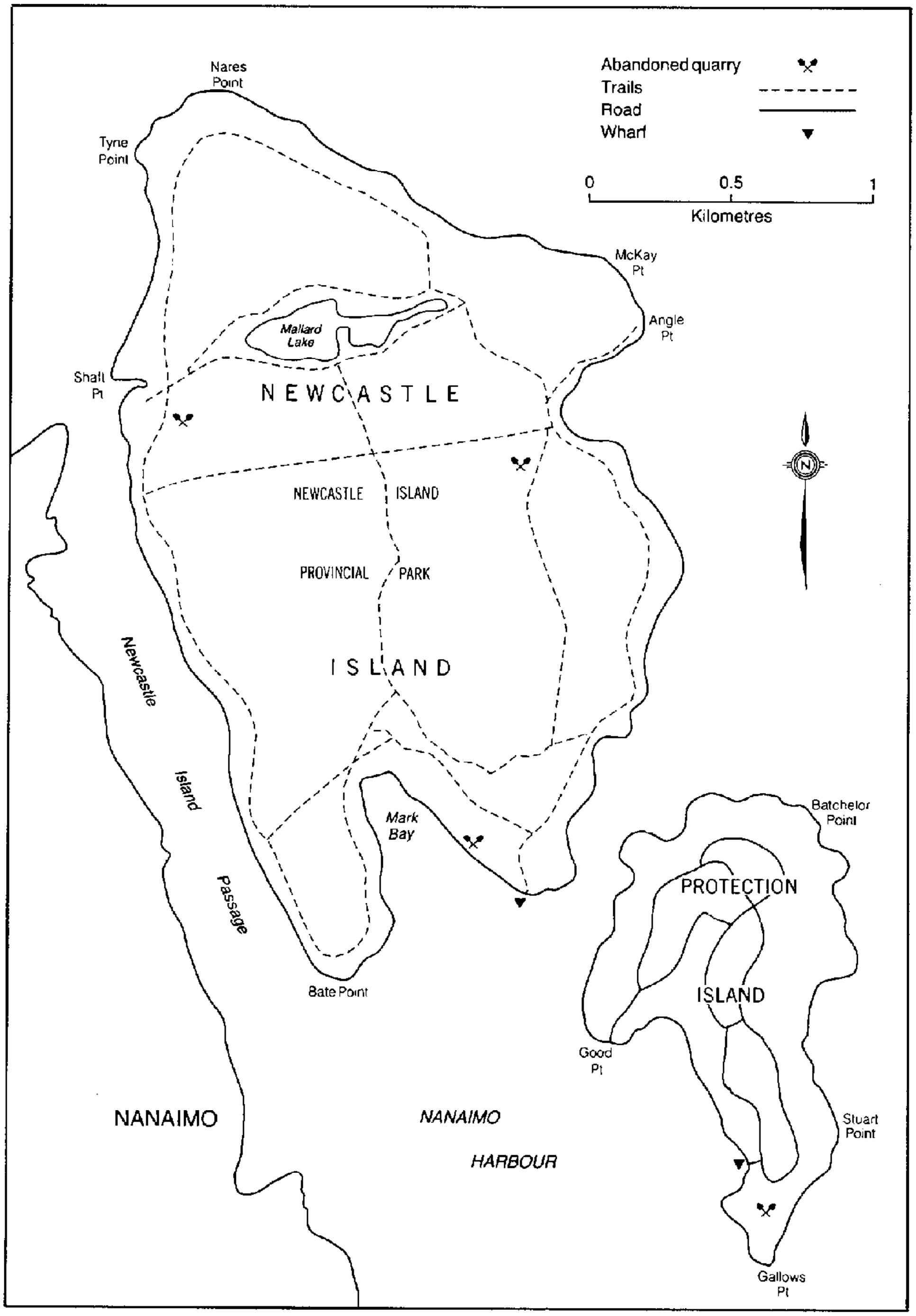

Figure 3. Newcastle and Protection islands.

considered good, as it is generally soft and moderately mineralized. Salt water is intruding in some coastal areas, particularly in the Silva Bay area, in the area east of Lock Bay, and in the Degnen Bay and Pilot-Taylor Bay areas. This intrusion is likely the result either of overpumping or of drilling coastal wells too deep (Hodge 1978). The only other lake in the survey area is Mallard Lake on Newcastle Island, which was also created artificially to supply water for the former coal mines on the island (British Columbia Ministry of Lands, Parks, and Housing 1984a).

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 cool and generally dry summers and humid, mild winters. January mean temperatures range from 2.9-3.8°C 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 temperatures in July range from 16.3-17.3°C with a mean maximum of 23°C. Less than 5% of the mean annual precipiation 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 h of bright sunshine. These summer climatic conditions result both in soil moisture deficits for crop production, particularly on coarse-textured soils, and in a high hazard for forest fires.

Some of the more important climatic data pertaining to the southern Gulf Islands are summarized in Table 2. Specific long-term climatic data for Gabriola Island are presented in Table 3 and Fig. 4.

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 Gabriola 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 tends to form pure stands and is of limited occurrence. Pacific madrone occurs more frequently than Garry oak, often 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 on

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 1920)
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 (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 (1982).

Table 3. Precipitation for Gabriola Island

Climatic parameter	Mean
<u>Rainfall</u>	
Annual (mm)	815
May-September (mm)	166
Extreme 24 h (mm)	49
No. of days with rain	121
<u>Snowfall</u>	
Annual (cm)	38
Extreme 24 h (cm)	64
No. of days with snow	6

Source: after Atmospheric Environment Service (1982).

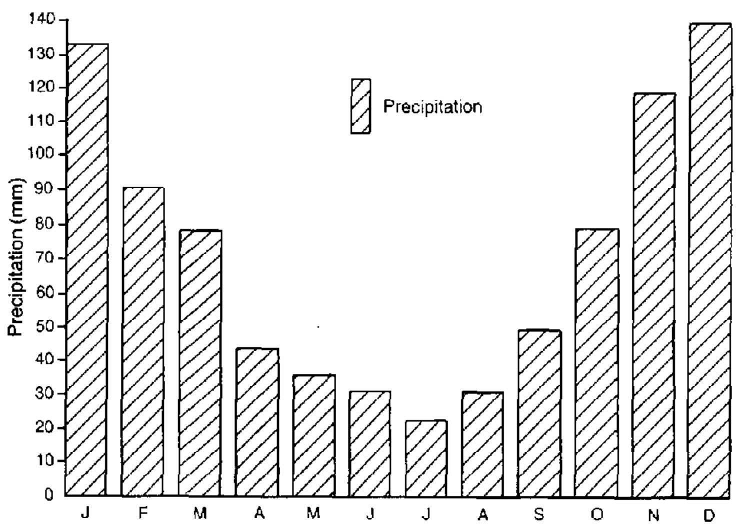

Figure 4. Mean monthly precipitation for Gabriola Island (after Atmospheric Environment Service 1982).

Gabriola and lesser islands are red alder (Alnus rubra), big leaf maple (Acer macrophyllum), 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; Oswald 1977; 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). Gabriola Island, like the other Gulf Islands, has been disturbed extensively by logging and fire (Oswald 1977).

Oswald (1977) included the vegetation as a component of the landscape units described for Gabriola Island. Detailed community descriptions and species list for the seaweeds have been done for the Flat Top Islands (Lindstrom and Foreman 1978).

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 or lagoonal to nearshore marine and offshore marine (Muller and Jeletzky 1970).

The Nanaimo Group is the only bedrock group to occur on Gabriola and lesser islands and consists of the following sedimentary bedrock types: sandstone, shale, siltstone, conglomerate, and, very rarely, coal. The older, underlying formations representing the Triassic-Jurassic metamorphic and volcanics and the Jura-Cretaceous batholithic rocks outcrop only on south Saltspring, Portland, Moresby, Sidney, and D'Arcy islands (Williams and Pillsbury 1958; 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 and more resistant than the surrounding rock. Carbonate-filled networks of cracks also weather out in relief to produce a "honeycomb" surface relief. Wave-cut "galleries" formed by undercutting of the sandstone at the high tidemark also occur (Plate Id). The "Malispina Galleries" on Gabriola Island are an excellent example (cover photo). 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). Folds are associated with longitudinal and crossfaulting on these islands (Muller and Jeletsky 1970). The Trincomali anticline is the most outstanding structural feature of the southern Gulf Islands. Cliffs along this anticline dip seaward (Williams and Pillsbury 1958).

Gabriola Island is structurally different from the islands to the south, which are primarily limbs of an anticlinal fold. The De Courcy Group (including Mudge and Link islands) are the northeastern limb of the Trincomali anticline. Gabriola Island is primarily a syncline, which has been complicated by thrust and cross faults. Newcastle and Protection islands dip gently seaward as part of the Nanaimo coal basin (Clapp 1914; Williams and Pillsbury 1958).

Physiography

Gabriola and 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 a gentle slope 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 less resistant shales and mudstones, commonly 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).

Topography on these islands generally reflects the structure of the underlying bedrock. On Gabriola Island the bedrock along the northeast and southwest coasts dips towards the centre of the island. The land surface is generally higher along the southwest coastal region, where a prominant sandstone ridge rises nearly vertically from the sea to a height of about 152 m. Along False Narrows this ridge is separated from the coast by a narrow band of shales. On this inland ridge to the north of False Narrows is the highest point on Gabriola Island at about 167 m. The sandstone ridge along the northeast coast is about 30 m above sea level (Clapp 1914; Oswald 1977; Hodge 1978).

Soil parent materials

The islands in the survey area are underlain by a succession of sandstone, shale, and conglomerate formations often exposed along shorelines, in steep bluffs, and on ridge tops (Muller 1977). Exposed flat-lying beds commonly present a smooth surface (Plate Ie), whereas vertically inclined beds are subject more readily to penetration by water and to physical breakdown. Areas with less than 10 cm of soil are shown as Rock on the soils map. Soils occur on deposits of predominantly weathered rock, namely Saturna and Bellhouse soils developed on sandstone fragments (Plate If), Galiano soils developed on shale, and Salalakim soils developed on conglomerate. Intermixed with the local rock fragments are erratics of granitic and volcanic rocks varying in size from pebbles to boulders, which have been transported from their original source by ice.

During the Pleistocene epoch (1.8 million years ago), the ice margin that spread across southwestern British Columbia fluctuated several times. The ice was exceedingly thick and its weight depressed the land (Mathews et al. 1970; Clague 1975). Thus, when the ice finally receded, much of the land was inundated after a deluge of meltwater caused a rise in relative sea level (Halstead 1968). The maximum elevation for marine deposition has been established at about 100 m above mean sea level in the southern Gulf Islands. In the islands, gravels occur either in "pockets" along the base of high, steep banks of bluffs, whence they are excavated for road material, or as thin deposits overlying other glacial material. The small, confined pockets of gravels originated either as deltas (Plate IIa) where outwash streams entered larger, deep bodies of water or from the water-sorting along beaches. On these gravel deposits, Qualicum soils developed (Plate IIb). Deep, sandy deposits are the source for Beddis soils and, in areas of restricted drainage, are the parent material of Baynes and Denman Island soils.

As glaciers overrode the islands, material plucked from the sedimentary bedrock was mixed with the granitic and volcanic detritus carried from Vancouver Island. As the ice melted, the load of material became too great for the glacier to carry and was deposited as glacial till. Deep deposits of compact, loam to sandy loam till were deposited in generally protected sites, such as the valleys between the ridges of sedimentary rock. Mexicana soils are the only ones developed directly in the deep, compact till. Over much of the till lies a veneer of sands and gravels of glaciomarine or fluvial origin (Plate IIc), and on this material Trincomali soils have developed (Plate IId). Suffolk soils have developed on a medium- to moderately fine-textured veneer over compact till. Deep deposits of fine-textured marine material (Plate IIe), which are generally uniform in texture with depth are the parent material of the poorly drained Cowichan soils (Plate IIf) and the imperfectly drained Fairbridge soils. Less uniform texture throughout the deposit gives rise to the development of the poorly drained Tolmie soils, which occur in depressions in narrow valleys. Along the edge of the fine-textured marine deposits are found a veneer of moderately coarse-textured sandy material over moderately fine- to fine-textured marine materials. Parksville soils have developed on this material and are poorly drained. On imperfectly drained portions, Brigantine soils have developed on the same materials. Brigantine soils are often found in close conjunction with Tolmie soils.

Peatlands, composed mainly of moderately well decomposed organic deposits of sedges, willow, and hardhack, occur in depressions in valleys. In some places sedimentary peat occurs. Metchosin soils have developed on these organic deposits.

Along the coastline of the islands, old Indian middens are recognized by the dark-colored, gravelly sandy soils containing an abundance of clam shell fragments (Plate Ia). Neptune soils, developed on these anthropogenic deposits, occupy tiny but distinct parcels of land.

Recent fluvial (alluvial), stratified deposits of variable textures are the parent materials of the Chemainus soils, which are moderately well to imperfectly drained.

The relationships of the soil parent materials to the landscape is shown in Fig. 5, and the soils are classified and grouped by parent materials in the legend of the accompanying soil map.

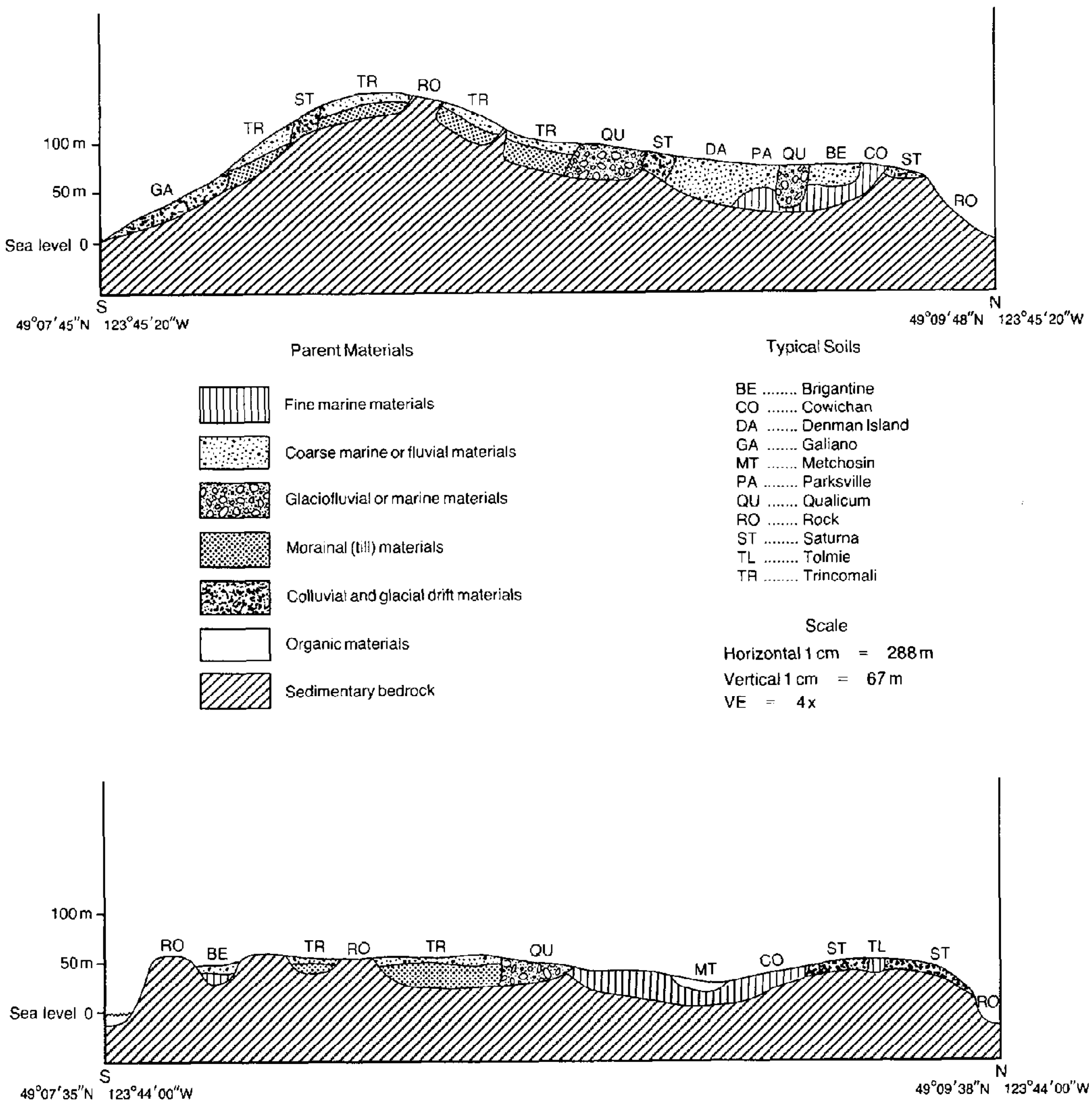

Figure 5. Generalized cross sections of soil parent materials and typical soils in relation to landscape position for Gabriola Island.

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. Boundary locations 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 1984 and 1985.

At each inspection or observation (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 properties, such 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 changes in percentage of 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 may include Ap and Bm horizons if no significant change in soil texture was 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 (observations) made during the fieldwork in the survey area was 1295.

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 4.4 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 1984 and 1985 field seasons (survey of Gabriola and lesser islands), the data collected at each inspection were recorded on a standardized daily record form designed specially for the survey and for subsequent computerized handling. 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 soil classification), following specified coding guidelines. At the end of the field season, the data were entered into 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 1295 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 computer. Computerized data handling of the polygon information occurred in the same way as for the daily records. Summary statistics include mean, minimum, and maximum percentages of soils in each map unit. During the two field seasons, 477 polygon forms were filled out and 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 data, and statistical evaluations such as frequency distributions are readily done (Smeck et al. 1980).

Reliability of mapping

These southern Gulf Islands have a good system of roads that provided easy access to all lowland areas, particularly in the more heavily populated parts of the islands. At higher elevations and in the less densely populated parts of the island, there was less access and four-wheel drive vehicles were often necessary. Fieldwork involved traveling all the available roads and tracks by motor vehicle. Areas inaccessible to motor vehicles (for example, small islands, some interior parts of Gabriola Island) were traversed by foot where the terrain was not too steep. Steep, inaccessible areas were not checked. On average, 2.7 inspections per delineation were made in the survey area, whereas 10 or more inspections per delineation were not uncommon for large delineations and for areas with complex soil materials or topography, or both. 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 density of inspections was needed in these areas, compared to that required 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. In this survey area, 19 different soil series are recognized and mapped (see map legend). In addition, one nonsoil unit is recognized and mapped that consists dominantly of Rock (RO).

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 over too limited an areal 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 lower case 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 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 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 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 of this report).

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, Cowichan, Fairbridge, Parksville, and Tolmie). Map units with dominant soils developed on fluvial parent materials are colored shades of red (Baynes, Beddis, Chemainus, Denman Island, and Qualicum). Shades of yellow and light orange are used for simple map units with soils developed on colluvial materials (Bellhouse, Galiano, Salalakim, and Saturna). Shades of bright green are used for map units the dominant soils of which have compact till in the subsoil (Mexicana, Suffolk, and Trincomali). The Rock-dominated simple map unit is colored gray-brown. The Organic soil - dominated map unit is colored brown (Metchosin), whereas the anthropogenic soil - dominated map unit is colored purple (Neptune). 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 26 different map units recognized are listed in Table 4 with the total number of delineations and areal extent. Table 4 also lists land types that are recognized in the surveyed area; made land, tidal flat, and small lakes (see also map legend). Land types are distinguished from map units by lacking a slope symbol.

For map units, such as Rock (RO), Neptune (NT), and Metchosin (MT) in marshes or swamps, some areas on the map (delineations) are too small to be mapped separately. These areas are indicated by on-site symbols. Other on-site symbols are used on the map to indicate site-specific information, such as gravel pits, shale pits, escarpments, gullies, rock or stone piles, marshes or swamps, stone quarries, and water (ponds or dugouts). A list of on-site symbols is shown on the map legend.

Table 4. 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	13	40.3	0.7
BE	Brigantine	56	236.4	3.9
BE-TL	Brigantine-Tolmie	6	40.6	0.7
BH	Bellhouse	11	32.2	0.5
BY	Baynes	15	72.9	1.2
CH	Chemainus	5	6.2	0.1
CO	Cowichan	8	150.5	2.5
DA	Denman Island	5	18.0	0.3
FB	Fairbridge	13	43.2	0.7
GA	Galiano	18	307.5	5.1
ME	Mexicana	6	41.0	0.7
MT	Metchosin	32	61.3	1.0
NT	Neptune	4	8.2	0.1
PA	Parksville	9	15.4	0.3
PA-TL	Parksville-Tolmie	17	179.8	3.0
QU	Qualicum	29	253.5	4.2
RO	Rock	51	66.1	1.1
RO-BH	Rock-Bellhouse	16	27.7	0.5
RO-SL	Rock-Salalakim	3	30.6	0.5
RO-ST	Rock-Saturna	31	324.2	5.4
SL	Salalakim	3	36.8	0.6
ST	Saturna	68	2651.7	44.0
ST-QU	Saturna-Qualicum	13	535.4	8.9
SU	Suffolk	6	22.4	0.4
TL	Tolmie	35	125.9	2.1
TR	Trincomali	24	631.6	10.5
Land type Symbol	**Name**			
MD	Made land	8	26.6	0.4
TF	Tidal flat	5	12.0	0.2
W	Small lakes	3	31.2	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 19 different soils and 1 nonsoil unit in the survey area (Gabriola and lesser islands) include sections on soil characteristics, water regime, variability in soil properties, similar soils to the ones 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 most commonly ocurring soils are provided in Appendix 1.

Soil characteristics

The 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 Suffolk 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 parentheses 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 listed, but collectively these minor soils are called unmentioned inclusions. Two or more 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 less than 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)	68	5	135	30
Depth to bedrock (cm)	160	160	160	21
Depth to restricting layer (cm)	160	160	160	20
Depth to mottles (cm)	64	48	95	39
CF content surface layer (%)	4	0	15	31
Fine gravel content surface layer (%)	3	0	10	31
Coarse gravel content surface layer (%)	1	0	5	31
Cobble content surface layer (%)	0	0	5	31
CF content subsurface layer (%)	9	0	37	28
Fine gravel content subsurface layer (%)	7	0	35	28
Coarse gravel content subsurface layer (%)	2	0	10	28
Cobble content subsurface layer (%)	0	0	2	28

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(49), L(23), LS(20), SIL(5), S(3)	39
Texture of subsurface layer	LS(50), SL(36), S(14)	28
Drainage class	Imperfect(100)	39
Soil classification	GL.SB(64), GL.DYB(36)	39
Type of restricting layer	Absent	
Perviousness	Rapid to moderate	

Water regime

Baynes soils are imperfectly drained with seasonal fluctuations in the water table. They are saturated to about 60 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 from the surface. The C horizon in some places has a massive structure of compact sand that is moderately cemented and is more slowly permeable than the overlying materials, which results in perched water table conditions.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
BYa	25	64	Sombric variant: Ah or Ap horizon >10 cm; classified as Gleyed Sombric Brunisol (GL.SB); also in conjunction with gravelly (g), shallow lithic (l), loam (lo), and silt loam (si) phases
BYg	8	21	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 30% (20-50%); also in conjunction with loam (lo) and shallow lithic (l) phases and sombric (a) variant
BYlo	7	23	Loam phase: surface texture is loam; mean thickness 39 cm (15-65 cm); also in conjunction with gravelly (g) and shallow lithic (l) phases and sombric (a) variant
BYl	11	28	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 75 cm (55-95 cm); also in conjunction with gravelly (g), loam (lo), and silt loam (si) phases and sombric (a) variant

Note: Other phases of the Baynes soil with very limited occurrence are: moderately cemented (mc), shallow (s), and silt loam (si) phases.

Similar soils

Baynes soils are similiar to the Beddis soils that are rapid to moderately well drained and to the Denman Island soils that are poorly to very poorly drained. 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 predominantly 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 and hay production. 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), Galiano (GA), Qualicum (QU), Tolmie (TL), and Trincomali (TR) map units.

Baynes map unit (BY)

The Baynes map unit consists dominantly (80%; 60-100%) of the imperfectly drained Baynes soil. The map unit includes on average 20% (up to 40%) of other soils, which may be one or a combination of the following, common, minor soils: Beddis (BD) or Denman Island (DA). Unmentioned inclusions of other soils occur in a very few places.

The inclusions of Denman Island soils somewhat limit the land use possibilities and use interpretations for this map unit because of the poor drainage. Beddis soils are nonlimiting inclusions.

Landform and occurrence

Soils of the Baynes map unit occur both in narrow areas on lower side-slope positions along drainageways as fluvial deposits and in draws and depressional areas as beach deposits. The topography is very gently to gently sloping (2-9%) and, in some places, moderately sloping (10-15%). Beddis soils occur in the better-drained landscape positions in most Baynes delineations. Denman Island soils occur in the lowest landscape positions as small, unmappable inclusions in about one-third of the Baynes delineations.

Distribution and extent

Baynes is a minor map unit that appears as 15 small- and medium-sized delineations throughout the map area, except on Newcastle and Protection islands. Four of the Baynes delineations were mapped as BYa; three as BYl,a; two each as BY and BYl; and one each as BYg, BYlo,a, BYs, and BYsi,a. This map unit represents an area of 72.9 ha (1.2% of total map area).

Beddis soils (BD)

Beddis soils are rapidly 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 less than 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)	72	5	160	48
Depth to bedrock (cm)	160	160	160	25
Depth to restricting layer (cm)	160	160	160	25
Depth to mottles (cm)	155	100	160	52
CF content surface layer (%)	8	0	20	28
Fine gravel content surface layer (%)	5	0	15	28
Coarse gravel content surface layer (%)	2	0	5	28
Cobble content surface layer (%)	1	0	10	28
CF content subsurface layer (%)	15	0	45	17
Fine gravel content subsurface layer (%)	11	0	40	17
Coarse gravel content subsurface layer (%)	4	0	15	17
Cobble content subsurface layer (%)	1	0	5	17

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(50), LS(40), L(6), S(4)	52
Texture of subsurface layer	LS(63), S(37)	19
Drainage class	Well(56), rapid(27), moderately well(17)	52
Soil classification	O.DYB(77), O.SB(19), E.DYB(2), CU.R(2)	52
Type of restricting layer	Absent	
Perviousness	Rapid to moderate	

Water regime

Beddis soils are rapidly to moderately well drained with water tables remaining below 100 cm throughout the year. The soil remains moist during the winter months, but quickly becomes 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	10	19	Sombric variant: Ah or Ap horizon >10 cm; classified as Orthic Sombric Brunisol (O.SB); also in conjunction with loam (lo), shallow (s), and shallow lithic (l) phases
BDg	24	46	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 30% (20-50%); also in conjunction with very shallow lithic (sl) and shallow lithic (l) phases
BDl	21	40	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 75 cm (52-100 cm); also in conjunction with sombric (a) variant and gravelly (g) and loam (lo) phases
BDsl	3	6	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth 36 cm (23-48 cm); also in conjunction with gravelly (g) phase

Note: Other phases and variants of the Beddis soil with very limited occurrence are: loam (lo) and shallow (s) phases and taxonomy change (t) variant.

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 Denman Island soils that are poorly to very poorly drained.

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.

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. Gabriola Sands Provincial Park is located on Beddis soils. The soils are very droughty, fertility is low, and soil reactions 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, the Beddis soil occurs as a minor soil or unmentioned inclusion in some delineations of the Baynes (BY), Brigantine (BE), Denman Island (DA), Galiano (GA), Qualicum (QU), Saturna (ST), Saturna-Qualicum (ST-QU), Tolmie (TL), and Trincomali (TR) map units.

Beddis map unit (BD)

The Beddis map unit consists dominantly (80%; 60-100%) of the rapidly to moderately well drained Beddis soils. The Beddis map unit includes on average 20% (up to 40%) of other soils. These other soils may be one or a combination of the following soils: Qualicum (QU) or Saturna (ST) soils of which the Qualicum soils occur most widely. Unmentioned inclusions of other soils occur in a very few places.

Qualicum soils somewhat limit the land use possibilities and use interpretations for this map unit because of the higher coarse fragment content. The Saturna soils limit the land use possibilities and use interpretations because of their higher coarse fragment content and shallowness to bedrock.

Landform and occurrence

Soils of the Beddis map unit occur both on narrow, discontinuous terraces along drainageways and in old beach deposits, on very gently to moderately sloping (2-15%), and on some steeper sloping (16-70%) terrain. Inclusions of other soils occur at random.

Distribution and extent

Beddis is a minor map unit. It has been mapped as 13 small- and medium-sized delineations throughout the survey area. Six of the Beddis delineations were mapped as BD, four as BDg, one each as BDl, BDs, and BDg,a. This map unit represents an area of 40.3 ha (0.7% of total map area).

BELLHOUSE SOILS AND MAP UNITS

Bellhouse soils (BH)

Bellhouse soils are rapidly to well-drained soils that have developed on shallow colluvial and glacial drift materials of channery, 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)	25	10	67	24
Depth to bedrock (cm)	29	12	67	24
Depth to restricting layer (cm)	29	12	67	24
Depth to mottles (cm)	160	160	160	23
CF content surface layer (%)	30	18	45	19
Fine gravel (channery) content surface layer (%)	16	5	25	19
Coarse gravel (channery) content surface layer (%)	10	3	20	19
Cobble (flaggy) content surface layer (%)	4	0	15	19
CF content subsurface layer (%)	34	30	40	3
Fine gravel (channery) content subsurface layer (%)	23	15	30	3
Coarse gravel (channery) content subsurface layer (%)	11	2	15	3
Cobble (flaggy) content subsurface layer (%)	0	0	0	3

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(83), L(13), LS(4)	24
Texture of subsurface layer	SL(100)	2
Drainage class	Well(67), rapid(25), moderately well(4), imperfect(4)	24
Soil classification	O.SB(96), GL.SB(4)	24
Type of restricting layer	Sandstone bedrock	
Perviousness	Rapid to moderate	

Water regime

Bellhouse soils are well to rapidly drained. They remain moist throughout the winter months but are 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.)	(%)	Description of variability
BHlo	3	13	Loam phase: surface texture is loam; mean thickness 21 cm (15-28 cm); also in conjunction with imperfectly drained (id), shallow lithic (l), and very shallow lithic (sl) phases
BHng	3	13	Nongravelly phase: coarse fragment content in surface layer <20%; mean CF 8% (5-10%); also in conjunction with very shallow lithic (sl) phase
BHsl	22	92	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth 26 cm (12-50 cm); also in conjunction with nongravelly (ng), loam (lo), and very gravelly (vg) phases

Note: Other phases of the Bellhouse soil with limited occurrence are: imperfectly drained (id), shallow lithic (l), and very gravelly (vg) phases.

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 their natural vegetation and to limited sheep grazing.

Map units

Bellhouse soils occur as the dominant soil in the Bellhouse simple map unit (BH) and 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, Bellhouse soils occur as a minor soil or unmentioned inclusion in some delineations of the Rock (RO), Rock-Saturna (RO-ST), and Saturna (ST) map units.

Bellhouse map unit (BH)

The Bellhouse map unit consists dominantly (83%; 70-100%) of the well- to rapidly drained Bellhouse soils with sandstone bedrock occurring within 100 cm from the surface. The map unit includes on average 17% (up to 30%) of sandstone rock outcrops. Bedrock outcrops are more limiting than the Bellhouse soils for use interpretations for the map unit. Unmentioned, nonlimiting inclusions of other soils also occur in some delineations of this map unit.

Landform and occurrence

The Bellhouse landscape consists of shallow soils over sandstone bedrock on gently to moderately sloping (2-15%) topography in subdued (undulating) terrain, and in some places on steeply sloping (16-30%) sideslopes of rock ridges. Bedrock exposures and minor inclusions of other soils are scattered in the map unit area.

Distribution and extent

The Bellhouse map unit is a minor one with 11 small-sized delineations in the survey area. All delineations were mapped as BHsl. This map unit occupies 32.2 ha (0.5% of total map area).

BRIGANTINE SOILS AND MAP UNITS

Brigantine soils (BE)

Brigantine soils are imperfectly drained soils that have 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 sandy clay loam textured, marine deposits that are usually stone free. Coarse fragment content of the overlay materials is less than 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)	48	10	95	86
Thickness of 2nd layer (cm)	33	5	110	86

Depth to bedrock (cm)	160	160	160	66
Depth to restricting layer (cm)	68	29	100	104
Depth to mottles (cm)	68	50	110	66
Depth to PSD (cm)	67	29	100	95
CF content surface layer (%)	7	0	20	64
Fine gravel content surface layer (%)	5	0	15	64
Coarse gravel content surface layer (%)	2	0	10	64
Cobble content surface layer (%)	0	0	7	64
CF content 2nd layer (%)	11	0	70	124
Fine gravel content 2nd layer (%)	8	0	60	124
Coarse gravel content 2nd layer (%)	3	0	20	124
Cobble content 2nd layer (%)	2	0	35	124
CF content 3rd layer (%)	5	0	60	82
Fine gravel content 3rd layer (%)	3	0	40	82
Coarse gravel content 3rd layer (%)	2	0	10	82
Cobble content 3rd layer (%)	0	0	10	82

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(60), L(24), LS(10), S(2), SIL(2), CL(2)	124
Texture of 2nd layer	SL(33), SICL(23), LS(19), L(9), CL(8), SCL(3), S(3), SIL(1), SIC(1)	124
Texture of 3rd layer	SICL(66), CL(13), SCL(9), SIL(5), L(5), SL(2)	82
Drainage class	Imperfect(96), moderately well(3), well(1)	124
Soil classification	GL.DYB(56), GL.SB(40), O.DYB(3), O.SB(1)	124
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	51	41	Sombric variant: Ah or Ap horizon >10 cm; classified as Gleyed Sombric Brunisol (GL.SB); also in conjunction with deep (d), gravelly (g), strongly mottled (w), very gravelly (vg), and loam (lo) phases, and taxonomy change (t) variant
BEd	17	14	Deep phase: depth to fine-textured subsoil between 100 and 150 cm; mean depth 127 cm (110-145 cm); also in conjunction with sombric (a) variant and gravelly (g), loam (lo), silt loam (si), and very gravelly (vg) phases
BEg	48	39	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 32% (20-48%); also in conjunction with sombric (a) variant and deep (d), loam (lo), strongly mottled (w), and shallow lithic (l) phases
BEl	13	10	Shallow lithic phase: bedrock between 50 and 100 cm; mean depth 84 cm (64-100 cm); also in conjunction with sombric (a) variant and gravelly (g), loam (lo), and very gravelly (vg) phases
BElo	30	24	Loam phase: surface texture is loam; mean thickness 28 cm (8-60 cm); also in conjunction with deep (d), gravelly (g), shallow lithic (l), strongly mottled (w), and very gravelly (vg) phases and sombric (a) variant
BEvg	11	9	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 55% (50-70%), also in conjunction with sombric (a) variant and deep (d) and shallow lithic (l) phases
BEw	9	7	Strongly mottled phase: wetter moisture regime in profile evidenced by mottling within 50 cm of the surface; not a gleysolic type landscape; also in conjunction with sombric (a) variant and gravelly (g) and loam (lo) phases

Note: Other phases of the Brigantine soil with very limited occurrence are: silt loam (si) phase and taxomony change (t) variant.

Similar soils

Brigantine soils are similar to the poorly drained Parksville soils. Brigantine soils with coarse- to moderately coarse-textured overlays thicker than 150 cm have been classified and mapped as Baynes soils or as the better-drained Beddis or Qualicum soils, depending on the coarse fragment content and the drainage.

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 soils remain cold till late spring and are strongly acid (pH 5.1-5.5). The upper horizons have a moderately low moisture-holding capacity. The soils have low inherent fertility; consequently, large amounts of fertilizer are required to produce a good crop. The Brigantine soils can be improved with irrigation and subsurface drainage to some of the better agricultural soils and can produce 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 Beddis (BD), Chemainus (CH), Fairbridge (FB), Parksville (PA), Parksville-Tolmie (PA-TL), Qualicum (QU), Saturna (ST), Tolmie (TL), and Trincomali (TR) map units.

Brigantine map unit (BE)

The Brigantine map unit consists dominantly (85%; 60-100%) of imperfectly drained Brigantine soils. The Brigantine map unit includes on average 15% (up to 40%) of other soils, of which the Baynes (BY), Parksville (PA), and Tolmie (TL) soils are the most widely occurring minor soils. Unmentioned inclusions of other soils occur very sparsely.

The poorly drained soils are the most limiting inclusions for use interpretations of this map unit. The Baynes soils do not limit the use interpretations for this map unit.

Landform and occurrence

Soils of the Brigantine map unit occur on very gentle to gentle slopes (2-10%) as narrow areas surrounding depressional basins and draws that are occupied by poorly drained soils, usually Parksville or Tolmie soils but in some places Denman Island or Cowichan soils. These poorly drained soils occur in the lowest landscape positions as small, unmappable inclusions (0-30%) in about one-third of the Brigantine (BE) delineations. The inclusions of other minor soils occur at random in the Brigantine landscape position. 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 56 small- to medium-sized, often narrow delineations throughout the survey area. Of these, 28 delineations were mapped as BE; 16 delineations were mapped as BEg; 4 as BEd; 3 as BElo; 3 as BElo,a; and 2 as BEd,g. This map unit represents 236.4 ha (3.9% of total map area).

Brigantine-Tolmie map unit (BE-TL)

Brigantine soil dominates this map unit (55%; 40-70%). The map unit also contains 34% (20-45%) of poorly drained soils developed on deep, loam to silty clay textured (usually stone free), marine deposits (mainly Tolmie but some Cowichan soils). The map unit includes on average 11% (up to 20%) of other soils, of which the Parksville (PA) soils are the most widely occurring minor soils. Unmentioned inclusions of other soils occur very sparsely. The poorly drained Tolmie and Parksville soils adversely affect the use interpretations for this map unit.

Landform and occurrence

Soils of the Brigantine-Tolmie (BE-TL) map unit occur on very gentle to gentle (2-9%) slopes in narrow areas surrounding depressional basins and draws that are occupied by poorly drained Tolmie (Cowichan) soils. Tolmie (Cowichan) and Parksville soils occupy the lowest landscape positions as significant portions (20-60%) of the map unit. Minor inclusion of other soils occur at random. Elevation usually ranges between 0 and 100 m above sea level.

Distribution and extent

The Brigantine-Tolmie map unit has been mapped less widely than Brigantine (BE) map units and has six relatively small delineations throughout the survey area. It represents 40.6 ha (0.7% of total map area).

CHEMAINUS SOILS AND MAP UNITS

Chemainus soils (CH)

Chemainus soils on the Gulf Islands are usually moderately well drained, deep (>100 cm) soils that have developed on recent fluvial (alluvial), stratified deposits of silt loam or loam texture, commonly over coarse materials with variable texture (sandy loam to loamy sand) at variable depth (15-110 cm). Coarse fragment content in the surface soil is less than 20% but increases to 35% with depth. In this map area, however, all Chemainus soils are imperfectly drained and are mapped as CHid.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	52	15	90	5
Depth to bedrock (cm)	160	160	160	5
Depth to restricting layer (cm)	132	80	160	5
Depth to mottles (cm)	70	45	90	5
CF content surface layer (%)	6	0	20	5
Fine gravel content surface layer (%)	6	0	20	5
Coarse gravel content surface layer (%)	0	0	0	5
Cobble content surface layer (%)	0	0	0	5
CF content subsurface layer (%)	11	0	35	5
Fine gravel content subsurface layer (%)	8	0	25	5
Coarse gravel content subsurface layer (%)	3	0	10	5
Cobble content subsurface layer (%)	1	0	5	5

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SIL(60), L(40)	5
Texture of subsurface layer	SL(60), SICL(20), LS(20)	5
Drainage class	Imperfect(100)	5
Soil classification	GL.SB(60), GLCU.HR(40)	5
Type of restricting layer	Change in particle size: fine-textured subsoil underlying coarse-textured surface or coarser-textured subsoil underlying finer-textured surface layer	
Perviousness	Moderate to slow	

Water regime

Chemainus soils are usually moderately well drained with seasonal fluctuations in the water table. However, in this map area, all Chemainus soils are imperfectly drained, which is recognized at the soil phase level as CHid. The soils 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 below 100 cm from the surface.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
CHa	3	60	Sombric variant: Ah or Ap horizon <10 cm; classified as Gleyed Sombric Brunisol (GL.SB); also in conjunction with imperfectly drained (id), shallow lithic (l), and strongly mottled (w) phases and taxonomy change (t) variant
CHid	5	100	Imperfectly drained phase: moisture regime wetter (Gleyed subgroups) than specified for soil; also in conjunction with sombric (a) and taxonomy change (t) variants and shallow lithic (l) and gravelly (g) phases
CHt	2	40	Taxonomy change variant: taxonomy differs from specified classification; used when soils are classified as Gleyed Cumulic Humic Regosols (GLCU.HR); also in conjunction with imperfectly drained (id) phase and sombric (a) variant

Note: Other phases of Chemainus soils with very limited occurrence are: gravelly (g), shallow lithic (l), peaty (pt), poorly drained (pd), and strongly mottled (w) phases.

Similar soils

Chemainus soils are the only alluvial soils found in the survey area. Chemainus soils without the coarse-textured subsoil materials resemble Fairbridge soils.

Natural vegetation

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

Land use

The current land use of most of the Chemainus soils is restricted to its natural vegetation. Some selective logging took place about 60 years ago. These soils are best for growing deciduous trees. Some limited clearing for pasture and hay production has occurred.

Map units

Chemainus soils occur only in one simple map unit in the survey area, the Chemainus (CH) map unit. In addition, Chemainus soils occur as a minor soil or unmentioned inclusion in some delineations of the Qualicum (QU).

Chemainus map unit (CH)

The Chemainus map unit consists dominantly (87%; 70-100%) of Chemainus soil. The map unit includes on average 13% (up to 30%) of other soils of which Brigantine occurs most frequently. Inclusions of Brigantine soils do not limit the use interpretations for this map unit. Unmentioned inclusions of other soils occur sparsely.

Landform and occurrence

Soils of the Chemainus map unit are found usually along stream channels. They also occur along narrow, continuous drainage channels with intermittent flow on nearly level to very gentle slopes (0.5-5%), commonly in between bedrock ridges. Active alluvial processes result in deposition and erosion of sediments and changes in soil texture. Inclusions of other soils occur at random.

Distribution and extent

The Chemainus map unit is a very minor one. It has been mapped as five small delineations. The one delineation on Mudge Island was mapped as CHpd,pt. The other four delineations, which occur on Gabriola Island, were mapped as CHid (two delineations); CHid,a; and CHw,a. This map unit represents an area of 6.2 ha (0.1% of total map area).

COWICHAN SOILS AND MAP UNITS

Cowichan soils (CO)

Cowichan soils are poorly to very poorly drained soils that have developed on silt loam over deep (>100 cm), silty clay loam to silty clay, marine deposits that are usually stone free. The soils are generally well-developed Humic Luvic Gleysols or Orthic Humic Gleysols. They have a dark-colored Ah or Ap horizon, often a leached (Ae) horizon, and a well-developed Btg horizon. The profile description and analyses of a selected Cowichan soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	29	10	90	35
Depth to bedrock (cm)	160	160	160	32
Depth to restricting layer (cm)	23	0	54	32
Depth to mottles (cm)	22	0	50	35
CF content surface layer (%)	1	0	20	35
Fine gravel content surface layer (%)	1	0	5	35
Coarse gravel content surface layer (%)	1	0	5	35
Cobble content surface layer (%)	0	0	10	35
CF content subsurface layer (%)	1	0	5	35
Fine gravel content subsurface layer (%)	1	0	5	35
Coarse gravel content subsurface layer (%)	0	0	0	35
Cobble content subsurface layer (%)	1	0	15	35

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SIL(63), PEAT(23), SICL(14)	35
Texture of subsurface layer	SICL(81), SIC(19)	31
Drainage class	Poor(80), very poor(20)	35
Soil classification	HU.LG(51), O.HG(46), O.G(3)	35
Type of restricting layer	Fine-textured Btg horizon or massive-structured subsoil	
Perviousness	Slow	

Water regime

The Cowichan soils are poorly to very poorly drained and have distinct to prominent mottles within 50 cm of the surface. They are wet for much of 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 Cowichan soils fluctuate rapidly over short periods after rainfall or drought. Perched water table conditions occur temporarily on top of the fine-textured Btg horizon. Cowichan soils receive runoff water from the surrounding landscape, as a result of their low landscape position.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
COde	6	17	Diatomaceous earth phase: diatomaceous earth as a layer or layers >5 cm thick in the soil profile; organic carbon content <17%; also in conjunction with peaty (pt) and shallow lithic (l) phases
COl	3	9	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 73 cm (60-85 cm); also in conjunction with diatomaceous earth (de) and shallow lithic (l) phases
COpt	8	23	Peaty phase: <40 cm of mesic or humic organic materials over mineral soil; mean thickness 24 cm (10-40 cm); also in conjunction with diatomaceous earth (de) and shallow lithic (l) phases

Note: Other phases and variants of the Cowichan soil with very limited occurrence are: gravelly (g) phase and taxonomy change (t) variant.

Similar soils

Cowichan soils are similar to the poorly drained Tolmie soils, but the latter mostly have a less uniform texture and are commonly more distinctly mottled in the subsoil than the Cowichan soils. The imperfectly drained member of the Cowichan soil is the Fairbridge soil.

Natural vegetation

Nearly all the larger areas of Cowichan soils have been cleared for agriculture. The natural vegetation on the remaining areas, which are often small and narrow, consists of red alder, western red cedar, and commonly bigleaf maple. The shrubs are represented by patches of salmonberry and hardhack (*Rosaceae douglasii*). The herb layer is characterized by western sword fern, American-skunk cabbage (*Lysichiton americanum*), rushes (*Juncus* spp.), sedges (*Carex* spp.), and common horsetail (*Equisetum arvense*).

Land use

Cowichan soils represent one of the most important agricultural soils in the survey area. The surface soil is well supplied with organic matter and nitrogen and is strongly acid (pH 5.1-5.5). Poor drainage is the major limitation for growing a large variety of agricultural crops on these soils, and, for this reason, they are mainly used for pasture and hay crops. With improved drainage (for example, artificial drainage), these soils are good for growing a wide variety of crops, including vegetables, berries, and small fruits.

Map units

Cowichan soils are the dominant soil in the simple Cowichan (CO) map unit. In addition, Cowichan soils occur as a minor soil or unmentioned inclusion in some delineations of the Brigantine (BE), Fairbridge (FB), Metchosin (MT), and Tolmie (TL) map units.

Cowichan map unit (CO)

The Cowichan map unit consists dominantly (81%; 50-100%) of poorly drained Cowichan soils. The map unit includes on average 19% (up to 50%) of other soils, of which Tolmie (TL) soils are the most widely occurring minor soils. Unmentioned inclusions of other soils occur very sparsely. Inclusions of Tolmie soils do not limit the use interpretations for this map unit.

Landform and occurrence

Soils of the Cowichan map unit are found on level to very gently sloping (0-5%) topography in depressional areas, basins, and swales where the former sea deposited large amounts of fine-textured sediments. They also occur in between bedrock ridges with shallow, colluvial soils, often receiving runoff water from the surrounding landscape. Tolmie soils occur at random in the form of many small inclusions not exceeding 40% of the map unit. Other minor inclusions also occur at random. Elevations usually range from 0 to 100 m above mean sea level.

Distribution and extent

Cowichan is a minor map unit. It has been mapped as eight small- to medium-sized delineations and one large delineation, all of which occur on Gabriola Island. Three of the Cowichan delineations were mapped as COpt. This map unit represents an area of 150.5 ha (2.5% 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 with sandy loam to sand texture. In this survey area, however, these soils are commonly underlain by bedrock. Coarse fragment content is less than 20%.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	55	20	160	18
Depth to bedrock (cm)	126	40	160	18
Depth to restricting layer (cm)	126	40	160	18
Depth to mottles (cm)	22	0	40	18
CF content surface layer (%)	3	0	15	16
Fine gravel content surface layer (%)	2	0	10	16
Coarse gravel content surface layer (%)	1	0	5	16
Cobble content surface layer (%)	0	0	0	16
CF content subsurface layer (%)	6	0	50	14
Fine gravel content subsurface layer (%)	6	0	50	14
Coarse gravel content subsurface layer (%)	0	0	0	14
Cobble content subsurface layer (%)	0	0	0	14

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(44), PEAT(28), SIL(17), L(11)	18
Texture of subsurface layer	SL(50), LS(29), S(21)	14
Drainage class	Poor(72), very poor(28)	18
Soil classification	O.HG(83), R.HG(11), O.G(6)	18
Type of restricting layer	Impermeable bedrock, if present	
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 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 in some places have a massive structure of compact sand, which is more slowly permeable than the overlying materials and results in perched water table conditions. Commonly, the Denman Island soils are underlain by impermeable bedrock, which also results in perched water table conditions. Denman Island soils receive runoff water from the surrounding landscape, as a result of their low landscape position.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
DAg	2	11	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 25% (20-30%); also in conjunction with loam (lo) and saline (sn) phases
DAl	3	17	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 72 cm (60-81 cm); also in conjunction with loam (lo) and peaty (pt) phases
DAlo	2	11	Loam phase: surface texture is loam; mean thickness 25 cm (20-30 cm); also in conjunction with gravelly (g) and shallow lithic (l) phases
DApt	5	28	Peaty phase: <40 cm of mesic or humic organic materials over mineral soil; mean thickness 15 cm (10-20 cm); also in conjunction with shallow lithic (l) phase
DAsi	3	17	Silt loam phase: surface texture is silt loam; mean thickness 25 cm (20-30 cm); also occurs in conjunction with saline (sn) phase
DAsl	3	17	Very shallow lithic phase: Depth to bedrock between 10 and 50 cm; mean depth 41 cm (40-43 cm)
DAsn	2	11	Saline phase: soluble salts restrict vegetation to native salt-tolerant species; electrical conductivity of the extract from a water-saturated paste >20 mS/cm; also in conjunction with gravelly (g) and silt loam (si) phases

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 also 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

Most Denman Island soils are tree covered. Small areas of Denman Island soils have been cleared for agriculture, primarily for pasture and hay production. The soils are droughty, fertility is low, soil reactions are 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 Denman Island map unit is recognized, a simple map unit (DA) in which Denman Island is the dominant soil. In addition, Denman Island soils occur as a minor soil or unmentioned inclusion in some delineations of the Baynes (BY), Beddis (BD), Brigantine (BE), Cowichan (CO), and Tolmie (TL) map units.

Denman Island map unit (DA)

The Denman Island map unit consists dominantly (83%; 65-100%) of poorly to very poorly drained Denman Island soils. The map unit includes on average 17% (up to 35%) of other soils, which may be one or a combination of the following widely occurring minor soils: Baynes (BY) or Beddis (BD). Unmentioned inclusions of other soils occur very sparsely. Inclusions of Baynes and Beddis soils do not limit use interpretations.

Landform and occurrence

Soils of the Denman Island map unit occur both in narrow drainageways as fluvial deposits and in draws and depressional areas as beach deposits. The topography is level to very gently sloping (0-5%). Baynes or Beddis soils occur at random in the better-drained landscape positions in some Denman Island delineations.

Distribution and extent

The Denman Island map unit is a minor one and has been mapped as five small delineations on Gabriola Island. The one delineation occurring in the Lock Bay estuary is mapped as DAsn,t. This map unit represents an area of 18.0 ha (0.3% of total map area).

FAIRBRIDGE SOILS AND MAP UNITS

Fairbridge soils (FB)

Fairbridge soils are imperfectly drained soils that have developed on loam to silt loam over deep (>100 cm), silty clay loam to clay loam, marine deposits that are usually stone free. Concretions of iron oxide may be present in the B horizons. The profile description and analyses of a selected Fairbridge soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	59	13	120	44
Depth to bedrock (cm)	160	160	160	39
Depth to restricting layer (cm)	86	20	160	44
Depth to mottles (cm)	71	50	160	32
CF content surface layer (%)	5	0	15	34
Fine gravel content surface layer (%)	3	0	10	34
Coarse gravel content surface layer (%)	1	0	5	34
Cobble content surface layer (%)	0	0	5	34
CF content subsurface layer (%)	2	0	10	40
Fine gravel content subsurface layer (%)	2	0	10	40
Coarse gravel content subsurface layer (%)	0	0	10	40
Cobble content subsurface layer (%)	0	0	0	40

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(73), SIL(23), CL(4)	44
Texture of 2nd layer	SICL(55), CL(25), SCL(13), SIL(7)	40
Texture of 3rd layer	SICL(70), SI(10), SCL(10), SL(10)	10
Drainage class	Imperfect(91), moderately well(7), well(2)	44
Soil classification	GL.DYB(61), GL.SB(32), GLE.SB(5), O.DYB(5)	44
Type of restricting layer	Fine-textured, often massive-structured subsoil	
Perviousness	Slow	

Water regime

Fairbridge soils are imperfectly drained and have distinct to prominent mottles between 50 and 100 cm. They are saturated to within 60 cm of the surface during the winter months, often by a perched water table. The water table drops quickly in spring and droughty conditions may even prevail during extended dry periods in the summer.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
FBa	16	37	Sombric variant: Ah or Ap horizon >10 cm; classified as Gleyed Sombric Brunisol (GL.SB) or Gleyed Eluviated Sombric Brunisol (GLE.SB); also in conjunction with strongly mottled (w) and very gravelly (vg) phases
FBg	8	18	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 33% (20-45%); also in conjunction shallow lithic (l) and strongly mottled (w) phases and taxonomy change (t) variant
FBl	5	11	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 91 cm (70-105 cm); also in conjunction with gravelly (g) phase
FBw	7	16	Strongly mottled phase: wetter moisture regime in profile evidenced by mottling within 50 cm of the surface; not a gleysolic-type landscape; also in conjunction with gravelly (g) phase and sombric (a) variant

Note: There are also very limited occurrences of the very gravelly (vg) phase and the taxonomy change (t) variant of the Fairbridge soil.

Similar soils

The Fairbridge soil materials are similar to the poorly drained Cowichan soil, where profile textures are relatively uniform, and to the poorly drained Tolmie soil, where profile textures are more variable. Where compact till underlies the Fairbridge soils, they are mapped as Suffolk (SU) soils. The poorly drained member of the Fairbridge soils is the Cowichan soil.

Natural vegetation

The natural vegetation consists of red alder, western red cedar, coast Douglas fir, and bigleaf maple. The understory consists of western sword fern, salal, nettles (*Urtica* spp.), and western bracken.

Land use

As with the Cowichan soils, most of the land with Fairbridge soils in the survey area has been cleared for agriculture. Fairbridge soils are considered to be one of the better agricultural soils in the survey area. They are used for hay production and pasture, but they could be used for a large range of crops upon improvement. Because of droughty conditions during the summer, irrigation is recommended for maximum production. The soil reaction, usually strongly to moderately acid (pH 5.1-6.0), is occasionally very strongly acid (pH 4.5-5.0). The fertility level and organic matter content of Fairbridge soils are relatively low. Deterioration in soil structure, such as compaction and puddling, results after repeated cultivation under wet conditions but can be controlled with good soil management techniques.

Map units

Fairbridge soils occur as the dominant soil in the Fairbridge (FB) simple map unit and as a minor soil or unmentioned inclusion in some delineations of the Brigantine (BE), Cowichan (CO), Parksville (PA), Parksville-Tolmie (PA-TL), Saturna (ST), and Tolmie (TL) map units.

Fairbridge map unit (FB)

The Fairbridge map unit consists dominantly (89%; 75-100%) of the imperfectly drained Fairbridge soils. The Fairbridge map unit includes on average 11% (up to 25%) of inclusions of other soils. These other soils may be one or a combination of the following widely occurring minor soils: Cowichan (CO), Tolmie (TL), or Brigantine (BE). Unmentioned inclusions of other soils occur very sparsely. The poorly drained soils limit the use interpretations for this map unit.

Landform and occurrence

The soils of this map unit occur on subdued (undulating) terrain with very gentle to gentle slopes (2-9%), in which minor areas of the poorly drained soils occupy the lower landscape positions. Brigantine soil inclusions occur at random in the Fairbridge landscape. Elevations are usually between 0 and 100 m above mean sea level.

Distribution and extent

The Fairbridge map unit is a minor one. Of the 13 small- to medium-sized delineations mapped, 5 were mapped as FBa. The Fairbridge map unit represents an area of 43.2 ha (0.7% of total map area).

GALIANO SOILS AND MAP UNITS

Galiano soils (GA)

Galiano soils are well-drained, shaly loam textured soils that have developed on shallow, colluvial, residual, and glacial drift materials of weathered shale or siltstone over shale or siltstone 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%, often increasing with depth.

The profile description and analyses of a selected Galiano soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	53	8	160	61
Depth to bedrock (cm)	55	20	100	56
Depth to restricting layer (cm)	125	35	160	56
Depth to mottles (cm)	160	160	160	59
CF content surface layer (%)	33	15	45	31
Fine gravel (shaly) content surface layer (%)	22	10	45	31
Coarse gravel (shaly) content surface layer (%)	9	0	25	31
Cobble (flaggy) content surface layer (%)	2	0	10	31
CF content subsurface layer (%)	35	0	80	12
Fine gravel (shaly) content subsurface layer (%)	30	0	80	12
Coarse gravel (shaly) content subsurface layer (%)	5	0	20	12
Cobble (flaggy) content subsurface layer (%)	4	0	30	12

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(87), SL(8), SIL(3), CL(2)	61
Texture of subsurface layer	L(75), CL(17), SL(8)	12
Drainage class	Well(88), poor(5), rapid (3), moderately well(2), imperfect(2)	61
Soil classification	O.DYB(74), O.SB(21), GL.DYB(3), O.HG(2)	61
Type of restricting layer	Consolidated shale bedrock	
Perviousness	Moderate	

Water regime

Galiano soils are well drained. Faint mottling may occur in the subsoil. They are wet during the winter but are usually droughty during the summer months. 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 a saturated subsoil on top of sloping bedrock.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
GAa	13	21	Sombric variant: Ah or Ap horizon >10 cm; classified as Gleyed Sombric Brunisol (GL.SB); also in conjunction with shallow lithic (l) and very shallow lithic (sl) phases
GAd	5	8	Deep phase: depth to bedrock between 100 and 150 cm; mean depth 130 cm (103-160 cm); also in conjunction with imperfectly drained (id) and very gravelly (vg) phases
GAl	28	46	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 71 cm (52-100 cm); also in conjunction with sombric (a) variant, nongravelly (ng), and very gravelly (vg) phases
GAng	13	21	Nongravelly phase: less coarse fragments than specified for soil (<20%); mean CF 6% (0-12%); also in conjunction with shallow lithic (l) and very shallow lithic (sl) phases
GAsl	28	46	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth: 38 cm (20-50 cm); also in conjunction with sombric (a) variant, nongravelly (ng), poorly drained (pd), and very gravelly (vg) phases
GAvg	17	28	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 62% (50-85%); also in conjunction with deep (d), shallow lithic (l), and very shallow lithic (sl) phases

Note: Other phases of the Galiano soil with very limited occurrence are: imperfectly drained (id) and poorly drained (pd).

Similar soils

Galiano soils are commonly found together with the well-drained, channery and flaggy, sandy loam to loamy sand textured Saturna soils that have developed on colluvial and glacial drift materials over sandstone bedrock within 100 cm of the surface. The soils occur on similar slopes and in similar landscape positions.

Natural vegetation

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

Land use

In only a few instances in the survey area, Galiano soils have been cleared for pasture and hay crops and for sheep grazing. Galiano soils are generally not suitable for agriculture because of steep topography, stoniness, shallow depth 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 one map unit: the Galiano (GA) simple map unit. In addition, the Galiano soils occur as a minor soil or unmentioned inclusion in some delineations of the Beddis (BD), Mexicana (ME), Qualicum (QU), and Saturna (ST) map units.

Galiano map unit (GA)

The Galiano map unit consists dominantly (90%; 60-100%) of the well-drained Galiano soils. The Galiano map unit includes on average 10% (up to 40%) of shale or siltstone bedrock (RO) or other minor soils, of which Qualicum soils occur most widely. Unmentioned inclusions of other soils occur sparsely.

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 as long, narrow delineations in areas with shallow soils over sedimentary bedrock, on elongated parallel ridges and knolls having a wide variety of slopes ranging in steepness from 6 to 70%, or more. The GAsl delineations are generally found in rocky areas with very strong to steep slopes (31-70%, or more), whereas the GA delinations are more restricted to gently, moderately, and strongly sloping (6-30%) landscape positions. Inclusions of Rock and other soils occur as small areas at random. Soils of this map unit occur at all elevations.

Distribution and extent

The Galiano map unit is a major one. It was mapped as 18 small- to large-sized delineations throughout the survey area. GAsl delineations occur more widely (61%) than GA or GAl delineations. The Galiano map unit represents an area of 307.5 ha (5.1% of total map area).

Metchosin soils (MT)

Metchosin soils are very poorly drained Organic soils that have developed on deep (>160 cm) deposits of black, humic, well-decomposed peat materials, composed mainly of sedge and woody plant remains. The soil is stone free. The profile description and analyses of a selected Metchosin soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface tier (cm)	40	40	40	32
Depth to bedrock (cm)	160	160	160	31
Depth to restricting layer (cm)	160	160	160	17
Depth to mottles (cm)	160	160	160	17
CF content surface tier (%)	0	0	0	32
Fine gravel content surface tier (%)	0	0	0	32
Coarse gravel content surface tier (%)	0	0	0	32
Cobble content surface tier (%)	0	0	0	32
CF content subsurface tiers (%)	0	0	5	32
Fine gravel content subsurface tiers (%)	0	0	0	32
Coarse gravel content subsurface tiers (%)	0	0	0	32
Cobble content subsurface tiers (%)	0	0	0	32

	Frequency of occurrence (%)	No. of observations
Organic material, surface tier (0-40 cm)	humic(62), mesic(19), fibric(19)	32
Organic material, middle tier (40-120 cm)	humic(87), mesic(10), coprogenous(3)	31
Organic material, bottom tier (120-160 cm)	humic(90), coprogenous (10)	19
Drainage class	Very poor(84), poor(6)	32
Soil classification	TY.H(44), T.H(38), LM.H(9), TME.H(3), LM.M(3), T.M(3)	32
Type of restricting layer	Absent	
Perviousness	Moderate to slow	

Water regime

Metchosin soils are very poorly drained. They are the wettest soils found in the survey area. The water table remains at, or close to, the surface for most of the year, although it may drop below 50 cm from the surface during late summer (August and September). Because of their low landscape position, Metchosin soils receive large amounts of runoff and seepage water from the surrounding landscape.

Variability

Soil phase or variant	Frequency (no.)	Frequency (%)	Description of variability
MTde	13	41	Diatomaceous earth phase: diatomaceous earth as a layer or layers >5 cm thick; organic carbon content <17%; also in conjunction with shallow lithic (l) and sedimentary peat (sp) phases
MTso	14	44	Shallow organic phase: thickness of organic materials between 40 and 160 cm over mineral soil; mean thickness 66 cm (40-95 cm); also in conjunction with diatomaceous earth (de) phase and taxonomy change (t) variant
MTsp	4	13	Sedimentary peat phase: sedimentary peat as a layer or layers >5 cm thick; organic carbon content >17%; also in conjunction with diatomaceous earth (de) phase and taxonomy change (t) variant

Note: There is also a very limited occurrence of the taxonomy change (t) variant, used when significantly thick fibric and mesic peat or limnic materials were found in the soil profile, and a very limited occurrence of the shallow lithic (l) phase.

Similar soils

Metchosin soils are the only Organic soils recognized in the survey area. They occur together with the poorly drained, fine-textured Cowichan and Tolmie soils in similar landscape positions.

Natural vegetation

The natural vegetation consists of sedges, grasses, rushes, scattered willow (*Salix* spp.), and hardhack.

Land use

The only limited agricultural uses of Metchosin soils in the survey area are for pasture and the production of hay. Most of these soils are left undisturbed. When adequately drained, they can provide one of the best soils for vegetable production. The production of berry crops (blueberries and cranberries) is also reasonable on these soils. Metchosin soils are very strongly acid (pH 4.5-5.0) to strongly acid (pH 5.0-5.5) and need applications of lime, phosphorus, and potassium fertilizers to improve crop production.

When exposed by tillage, sedimentary peat and diatomaceous earth close to the surface can cause management problems. Upon drying, these materials form clods that are difficult to re-wet and breakdown.

Map units

Metchosin soils only occur as the dominant soil in the Metchosin (MT) simple map unit, which includes the following soil phases: MTso, MTsp, and MTde. In addition, Metchosin soils occur as a minor soil or unmentioned inclusion in some delineations of the Denman Island (DA) and Tolmie (TL) map units.

Metchosin map unit (MT)

The Metchosin (MT) map unit consists dominantly (97%; 80-100%) of very poorly drained, deep (>160 cm) Metchosin soils. Peaty phases of Tolmie and Cowichan soils occur as inclusions in a very few places.

Landform and occurrence

Soils of the Metchosin map unit occur in level to slightly depressional basins with slopes varying from 0 to 1%. In the upland areas they occur in many small, wet areas between bedrock ridges. Inclusions of shallow-phase Metchosin soils (MTso) or peaty-phase mineral soils are located at the periphery of some delineations. Soils of this map unit occur at all elevations.

Distribution and extent

The Metchosin map unit occurs as 32 small and very small delineations, throughout the survey area, of which 7 were mapped as MT, 6 as MTso, 7 as MTso,de, 7 as MTde, and 3 as MTde,sp. Only a few delineations were recognized as other phases of MT. Collectively, they represent an area of 61.3 ha (1.0% of total map area).

Mexicana soils (ME)

Mexicana soils are moderately well to imperfectly drained soils that have developed on loam to sandy loam textured morainal deposits over deep, compact, unweathered till within 100 cm from the surface. Coarse fragment content varies between 5 and 50%. The unweathered till materials have generally less than 20% clay content (loam texture) and usually occur below 50 cm in depth. These are the only till materials 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 given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	66	18	120	30
Depth to bedrock (cm)	158	106	160	23
Depth to restricting layer (cm)	63	20	100	25
Depth to mottles (cm)	120	45	160	26
CF content surface layer (%)	25	5	50	28
Fine gravel content surface layer (%)	13	5	30	28
Coarse gravel content surface layer (%)	9	0	20	28
Cobble content surface layer (%)	3	0	10	28
CF content subsurface layer (%)	18	0	40	12
Fine gravel content subsurface layer (%)	12	0	20	12
Coarse gravel content subsurface layer (%)	6	0	20	12
Cobble content subsurface layer (%)	2	0	10	12

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(73), SL(27)	30
Texture of subsurface layer	L(66), SL(34)	12
Drainage class	Imperfect(40), moderately well(37), well(20), poor(3)	30
Soil classification	O.DYB(50), GL.DYB(30), GL.SB(10), O.SB(7), O.G(3)	30
Type of restricting layer	Compact till	
Perviousness	Slow	

Water regime

The Mexicana soils are usually moderately well drained with faint mottling throughout the solum, often increasing to distinct mottles below 50 cm from the surface. They are wet during the winter and droughty during the summer months. 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. Imperfectly drained Mexicana soils also occur and are recognized at the soil phase level. 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.

Variability

Soil phase or variant	Frequency (no.)	Frequency (%)	Description of variability
MEa	5	17	Sombric variant: Ah or Ap horizon >10 cm; classified as Gleyed Sombric Brunisol (GL.SB); also in conjunction with imperfectly drained (id) phase
MEd	4	13	Deep phase: depth to compact unweathered till between 100 and 150 cm; mean depth 109 cm (108-110 cm); also in conjunction with imperfectly drained (id) phase
MEid	10	33	Imperfectly drained phase: wetter moisture regime than specified (Gleyed subgroups) for soil; also in conjunction with sombric (a) variant and deep (d) phase
MEl	3	10	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 62 cm (55-88 cm)

Note: There is also very limited occurrence of the poorly drained (pd), strongly mottled (w), very gravelly (vg), and very shallow lithic (sl) phases. Discontinuous, weakly, (some moderately) cemented horizons may be present in the Mexicana soil.

Similar soils

Mexicana soils are similar to the moderately well to imperfectly drained Trincomali soils that have a gravelly sandy loam and gravelly loamy 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 Suffolk 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

No agricultural development has taken place on the Mexicana soils. The major limitations for agricultural use are the 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 soil is the dominant soil in the Mexicana (ME) map unit. In addition, Mexicana soils occur as a minor soil or as unmentioned inclusions in some delineations of the Galiano (GA), Rock (RO), Saturna (ST), and Trincomali (TR) map units.

Mexicana map unit (ME)

The Mexicana map unit consists dominantly (75%; 60-100%) of the moderately well drained Mexicana soils and includes on average 25% (up to 40%) of other soils. These other soils may be one or a combination of the following widely occurring minor soils: Saturna (ST) or Trincomali (TR). Unmentioned inclusions of other soils occur very sparsely. The Saturna soils are the most limiting inclusions for this map unit. Trincomali soils do not limit the use interpretations of the ME map unit.

Landform and occurrence

The soils of the Mexicana map unit occur on moderately to strongly sloping (10-30%), subdued and hummocky terrain and on very strong slopes (31-45%) in upland areas. Soils of this map unit commonly occur on side-slope positions in depressions and hollows, where till deposits have been protected from erosional processes since last glaciation. Scattered Trincomali and Saturna soils occur. Soils of this map unit occur at all elevations.

Distribution and extent

The Mexicana map unit occurs as a minor map unit on Gabriola Island with six small delineations, of which one was mapped as MEid and one as MEid,a. The Mexicana map unit represents an area of 41.0 ha (0.7% of total map area).

NEPTUNE SOILS AND MAP UNITS

Neptune soils (NT)

Neptune soils are rapidly to well-drained, black, calcareous, anthropogenic soils consisting of shallow (<100 cm) gravelly sandy loam to gravelly loamy sand, marine deposits mixed with clam and oyster shells, organic debris, and, in some places, human artifacts (Indian middens) over sandy marine deposits or bedrock. The soils have no profile development. Coarse fragment content is between 30 and 55%.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	45	20	70	2
Depth to bedrock (cm)	90	20	160	2
Depth to restricting layer (cm)	90	20	160	2
Depth to mottles (cm)	160	160	160	2
CF content surface layer (%)	43	30	55	2
Fine gravel content surface layer (%)	20	10	30	2
Coarse gravel content surface layer (%)	20	20	20	2
Cobble content surface layer (%)	3	0	5	2
CF content subsurface layer (%)	-	-	-	0
Fine gravel content subsurface layer (%)	-	-	-	0
Coarse gravel content subsurface layer (%)	-	-	-	0
Cobble content subsurface layer (%)	-	-	-	0

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(50), LS(50)	2
Texture of subsurface layer	-	0
Drainage class	Well(50), rapid(50)	2
Soil classification	O.HR(100)	2
Type of restricting layer	Bedrock if present	
Perviousness	Rapid to moderate	

Water regime

Neptune soils are rapidly to well drained. They are moist during the winter months but very droughty during the summer months. No mottles are discernible within 120 cm of the surface.

Variability

Although the texture of the Neptune soils is very uniform, the coarse fragment content and quantity of shells varies considerably. Neptune soils may overlie coarse-textured marine materials or bedrock. The high calcium carbonate content from the shells prevents any significant profile development, as indicated by the absence of a B horizon, but there are limited occurrences of the very shallow lithic (sl) phase.

Similar soils

Because of their uniqueness, Neptune soils are not related to any other soils.

Natural vegetation

The natural vegetation consists of grasses and scattered coast Douglas fir.

Land use

Neptune soils are of more interest archaeologically than agriculturally. In the survey area, this soil is sometimes used for gardening, as it is calcareous and very high in organic matter and nitrogen content. A major limitation is droughtiness and stoniness.

Map units

The Neptune soil only occurs as the dominant soil in the Neptune (NT) map unit.

Neptune map unit (NT)

The Neptune map unit consists purely (100%) of the Neptune soil.

Landform and occurrence

Soils of the Neptune map unit occur as narrow, discontinuous deposits along the seashore on nearly level to very gently sloping (2-9%) topography and, in a few places, on moderately sloping (10-50%) topography.

Distribution and extent

The Neptune map unit is a very minor one, occurring as four small, narrow delineations, one of which was mapped as NTsl. The Neptune map unit represents an area of 8.2 ha (0.1% of total map area). Many smaller, unmappable areas with Neptune soils are indicated with the on-site symbol (N).

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 loamy sand overlay of marine or fluvial origin over deep (>100 cm), silty clay loam to sandy clay loam textured, marine deposits that are usually stone free. The coarse fragment content of the overlay materials is less than 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)	49	20	85	13
Thickness of 2nd layer (cm)	36	5	76	13
Depth to bedrock (cm)	160	160	160	51
Depth to restricting layer (cm)	64	35	100	53
Depth to mottles (cm)	27	0	48	56
Depth to PSD (cm)	62	35	100	47
CF content surface layer (%)	4	0	15	52
Fine gravel content surface layer (%)	3	0	10	52
Coarse gravel content surface layer (%)	1	0	10	52
Cobble content surface layer (%)	0	0	5	52
CF content 2nd layer (%)	5	0	65	56
Fine gravel content 2nd layer (%)	4	0	60	56
Coarse gravel content 2nd layer (%)	1	0	20	56
Cobble content 2nd layer (%)	0	0	0	56
CF content 3rd layer (%)	1	0	10	47
Fine gravel content 3rd layer (%)	1	0	5	47
Coarse gravel content 3rd layer (%)	2	0	5	47
Cobble content 3rd layer (%)	0	0	0	47

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(32), SL(25), SIL(21), PEAT(20), LS(2)	56
Texture of 2nd layer	SL(48), SIL(14), LS(14), SICL(11), L(5), SCL(4), CL(2), SIC(2)	56
Texture of 3rd layer	SICL(64), SL(19), CL(7), SCL(4), L(2), SIL(2), SIC(2)	47
Texture of 4th layer	SICL(50), SCL(18), L(8), CL(8), SIC(8), (occurs when layer 3 is SL,LS) SL(8)	12
Drainage class	Poor(95), very poor(5)	56

Soil classification	O.HG(91), O.G(9)	56
Type of restricting layer	Fine-textured, often massive-structured subsoil	
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 the 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 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
PAde	8	14	Diatomaceous earth phase: diatomaceous earth as a layer or layers >5 cm thick in the soil profile with organic carbon content <17%; in conjunction with loam (lo) or peaty (pt) phases
PAl	5	9	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 70 cm (49-98 cm); also occurs in conjunction with gravelly (g), loam (lo), and silt loam (si) phases and taxonomy change (t) variant
PAlo	18	32	Loam phase: surface texture is loam; mean thickness 24 cm (15-37 cm); also in conjunction with deep (d), diatomaceous earth (de), gravelly (g), and shallow lithic (l) phases
PApt	11	20	Peaty phase: <40 cm of mesic or humic organic materials over mineral soil; mean thickness 12 cm (5-20 cm); also in conjunction with diatomaceous earth (de) and silt loam (si) phases and taxonomy change (t) variant
PAsi	12	21	Silt loam phase: surface texture is silt loam; mean thickness 29 cm (12-45 cm); also in conjunction with shallow lithic (l) and peaty (pt) phases and taxonomy change (t) variant

Note: Other phases of Parksville soils with very limited occurrence are: deep (d), gravelly (g), and very gravelly (vg) phases and taxonomy change (t) variant.

Similar soils

The imperfectly drained member of the Parksville soils is Brigantine soil. Parksville soils differ from the poorly drained Tolmie soils in having coarse-textured overlay materials thicker than 30 cm. In addition, Tolmie soils are usually saturated with water for more of the year. Where the Parksville soils have a loam or silt loam texture (PAlo, PAsi), there is a layer of coarse-textured materials thicker than 30 cm over 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

Most of the 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 wetness in the late spring caused by high water tables, which could be overcome with 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 is a minor soil in the Brigantine (BE) map unit, which is discussed under Brigantine (BE). Parksville soils also occur as a minor soil or unmentioned inclusion in some delineations of the Baynes (BY), Brigantine-Tolmie (BE-TL), Cowichan (CO), Tolmie (TL), and Trincomali (TR) map units.

Parksville map unit (PA)

The Parksville map unit consists dominantly (91%; 70-100%) of poorly drained Parksville soils. The Parksville map unit includes on average 9% (up to 30%) of other soils, of which Brigantine (BE) is the most widely occurring minor soil. Unmentioned inclusions of other poorly drained soils occur. The minor soils 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 and Brigantine soils usually occur together either 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. Brigantine soils are found in the better-drained landscape positions and occur as unmappable inclusions in the Parksville map unit. This map unit is also found in depressional areas in between bedrock ridges. Elevation is usually between 0 and 100 m above mean sea level.

Distribution and extent

The Parksville map unit occurs as nine small-sized, often narrow, delineations, of which two have loam-textured surface horizons (PAlo) and four have peaty surface layers (PApt). This map unit represents an area of 15.4 ha (0.3% of total map area).

Parksville-Tolmie map unit (PA-TL)

The Parksville-Tolmie map unit consists dominantly (52%; 50-65%) of the poorly drained Parksville soils with a subdominant proportion (39%; 30-50%) of poorly drained soils developed on deep (>100 cm), loam to silty clay textured, usually stone-free, marine deposits (Tolmie soils). In a few places, Tolmie soils are dominant (50%) and the Parksville soils are subdominant (25-45%). This map unit includes on average 9% (up to 25%) of other minor soils, which may be one or a combination of the following two soils: Brigantine (BE) and Fairbridge (FB), of which Brigantine occurs most widely. Unmentioned inclusions of other soils occur in some locations. Tolmie soils, minor soils, and soil inclusions do not adversely affect the use interpretations for the Parksville-Tolmie map unit.

Landform and occurrence

Soils of the Parksville-Tolmie map unit occur on nearly level to gently sloping (0.5-9%) topography in depressional areas, swales, and drainageways at elevations between 0 and 100 m above mean sea level. The subdominant Tolmie soils occupy the lowest landscape positions but are scattered within the area in such a way that they cannot be mapped separately. Brigantine and Fairbridge soils occupy the better-drained landscape positions.

Distribution and extent

The Parksville-Tolmie map unit occurs throughout the survey area as 17 medium- to small-sized, long and narrow delineations. Of these, 4 occur as PAlo-TL, 4 as PAsi-TL, 1 as PAg-TL, and another 1 as PApt-TLpt. The remaining delineations were mapped as PA-TL. This map unit represents an area of 179.8 ha (3.0% 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), gravelly sandy loam to gravelly sand textured, glaciofluvial, fluvial, or marine deposits. Coarse fragment content throughout the profile is between 10 and 70%, but does not exceed 50% in the surface layer. The profile description and analyses of a selected Qualicum soil are given in Appendixes 1 and 2.

<u>Soil characteristics</u>

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	72	8	160	136
Depth to bedrock (cm)	160	148	160	47
Depth to restricting layer (cm)	160	148	160	47
Depth to mottles (cm)	159	115	160	47
CF content surface layer (%)	35	10	50	57
Fine gravel content surface layer (%)	18	5	35	57
Coarse gravel content surface layer (%)	12	0	20	57
Cobble content surface layer (%)	5	0	25	57
CF content subsurface layer (%)	35	10	70	26
Fine gravel content subsurface layer (%)	21	5	50	26
Coarse gravel content subsurface layer (%)	14	0	30	26
Cobble content subsurface layer (%)	9	0	30	26

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	LS(44), SL(36), S(15), L(5)	136
Texture of subsurface layer	S(38), LS(26), SL(26), L(10)	34
Drainage class	Rapid(46), well(43), moderately well(7), imperfect(3), poor(1)	136
Soil classification	O.DYB(80), O.SB(14), GL.DYB(3), E.DYB(2), O.HG(1)	136
Type of restricting layer	Absent	
Perviousness	Rapid	

Water regime

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

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
QUa	20	15	Sombric variant: Ah or Ap horizon >10 cm; classified as Gleyed Sombric Brunisol (GL.SB); also in conjunction with loam (lo), shallow (s), and shallow lithic (l) phases
QUl	58	43	Shallow lithic phase: bedrock at between 50 and 100 cm; mean depth 74 cm (50-100 cm); also in conjunction with sombric (a) variant and paralithic (pl), shallow (s), and very gravelly (vg) phases
QUs	8	6	Shallow phase: less deep (50-100 cm) than specified over similar materials but with coarse fragment content <20%; mean depth 74 cm (50-102 cm); mean CF 6% (0-10%); mean coarse gravels and cobbles 1% (0-5%); also in conjunction with sombric (a) variant and imperfectly drained (id), shallow lithic (l), and very gravelly (vg) phases
QUsl	18	13	Very shallow lithic phase: bedrock at between 10 and 50 cm; mean depth 40 cm (25-49 cm); also in conjunction with poorly drained (pd) and very gravelly (vg) phases
QUvg	76	56	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 59% (50-75%); also in conjunction with taxonomy change (t) variant and deep (d), imperfectly drained (id), shallow lithic (l), shallow (s), and very shallow lithic (sl) phases

Note: Other phases and variants of the Qualicum soil with limited occurrences are: deep (d), loam (lo), imperfectly drained (id), paralithic (pl), poorly drained (pd), and very shallow (vs) phases and taxonomy change (t) variant.

Similar soils

Qualicum soils commonly occur together with similar drained and textured soils that have a much lower (<20%) coarse fragment content (Beddis soils). Qualicum soils also occur with similar textured but moderately well to imperfectly 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 either Baynes or Denman Island soils.

Natural vegetation

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

Land use

Small areas of Qualicum soils in the survey area are used for pasture land and orchards. The major limitations that preclude more intensive 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 used most extensively 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 locations of these gravel pits are indicated as Ⓖ on the accompanying map.

Map units

Qualicum soils occur in different map units; they are dominant in the Qualicum (QU) map unit and form the subdominant component in the Saturna-Qualicum (ST-QU) map unit. In addition, Qualicum soils occur as a minor soil or unmentioned inclusion in some delineations of the Baynes (BY), Beddis (BD), Brigantine (BE), Denman Island (DA), Galiano (GA), Rock (RO), Rock-Saturna (RO-ST), Saturna (ST), and Trincomali (TR) map units.

Qualicum map unit (QU)

The Qualicum map unit consists dominantly (84%; 50-100%) of the rapidly to well-drained Qualicum soils but includes on average 16% (up to 50%) of other soils. These other soils may be one or a combination of the following widely occurring minor soils: Beddis (BD), Saturna (ST), or Trincomali (TR). Inclusions of other soils occur in a very few places. Saturna soils are most commonly associated with the shallow, lithic Qualicum soils (QU1). Saturna and Trincomali soils limit the use interpretations for this map unit.

Landform and occurrence

Soils of the Qualicum map unit occur as deep, outwash (deltaic) terrace deposits associated with old drainageways and as beach deposits on very gently to strongly sloping (2-30%) landscape positions. The inclusions of other soils are scattered throughout the area covered by this map unit.

Distribution and extent

The Qualicum map unit is a major one that occurs throughout the survey area. Of 29 small- to large-sized delineations, 10 were mapped as QU; 3 were mapped as QUvg; 1 as QUa; 1 as QUd,vg; 6 as QUl; and 8 as QUl,vg. This map unit represents an area of 253.5 ha (4.2% of total map area).

ROCK AS NONSOIL AND MAP UNITS

Rock as nonsoil (RO)

Rock as nonsoil consists of undifferentiated, consolidated bedrock 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 occasionally broad-leaved stonecrop (*Sedum spathulifolium*), scattered dwarf coast Douglas fir, and Pacific madrone.

Map units

Because many large areas in the survey area consist of bedrock exposures with shallow soils over bedrock, bedrock exposures (RO) occur in many map units. Rock is the dominant (70-100%) component in the simple Rock (RO) map unit. Rock is also the dominant (40-70%) component in three compound map units: Rock-Bellhouse (RO-BH), Rock-Salalakim (RO-SL), and Rock-Saturna (RO-ST). Each of these map units are described here. In addition, bedrock exposures (RO) also occur as minor components or unmentioned inclusions in some delineations of the Brigantine (BE), Bellhouse (BH), Galiano (GA), Qualicum (QU), Salalakim (SL), Saturna (ST), Saturna-Qualicum (ST-QU), Tolmie (TL), and Trincomali (TR) map units.

Rock map unit (RO)

The Rock map unit consists dominantly (86%; 70-100%) of undifferentiated bedrock exposed or covered by less than 10 cm of mineral soil and includes on average 14% (up to 30%) of well-drained soils developed on shallow, loamy sand to loam textured, colluvial and glacial drift materials over bedrock, usually within 50 cm. 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) on sandstone, Galiano (GA) on shale or siltstone, Salalakim (SL) on conglomerate, and Saturna (ST) on sandstone. 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 in some places hummocky terrain with strong to very strong slopes (16-45%), rock ridges and rocky knolls (slopes 10-70%), and rock bluffs, cliffs, and escarpments with steep to very steep slopes (71 to over 100%, or more) of all rock types found on the islands. Minor areas of soil occur in places where the bedrock has been fractured and weathered, often indicated by clumps of tree growth. This type of landscape occurs at all elevations and aspects.

Distribution and extent

Rock is a major map unit in the survey area. It occurs as 51 small- to medium-sized delineations throughout the islands and includes many small islets. The Rock map unit represents an area of 66.1 ha (1.1% of total map area).

Rock-Bellhouse map unit (RO-BH)

The Rock-Bellhouse map unit consists dominantly (60%; 50-70%) of sandstone bedrock exposed or covered by less than 10 cm of mineral soil. This map unit also contains subdominant proportions (40%; 30-50%) of rapidly to 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 greater than 10 cm (very shallow lithic Bellhouse soil, BHsl). Unmentioned inclusions of other soils occur in a very few places. 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 outcrops in subdued (undulating) terrain with very gently to moderately sloping (2-15%) topography, and in a few places in hummocky terrain with strong slopes (16-30%). The Bellhouse soils occur on colluvial side slopes and at random in pockets where the bedrock has been fractured and weathered.

Distribution and extent

The Rock-Bellhouse map unit is a very minor one. It occurs as 16 small- to medium-sized delineations in the survey area, of which 14 were mapped as RO-BHsl, 1 as RO-BHsl,lo, and 1 as RO-BH. This map unit represents 27.7 ha (0.5% of total map area).

Rock-Salalakim map unit (RO-SL)

This map unit consists dominantly (50%; 40-55%) of conglomerate bedrock exposed or covered by less than 10 cm of mineral soil. The map unit also contains subdominant proportions (40%; 30-45%) of well-drained soils developed on sandy loam textured, colluvial and glacial drift materials over conglomerate bedrock within 100 cm of the surface (Salalakim soils). Soils contain between 20 and 50% gravels. Unmentioned inclusions of other soils occur in a very few places. Salalakim soils and soil inclusions enhance the use interpretations for this map unit.

Landform and occurrence

Materials of this map unit occur on conglomerate rock ridges, rocky knolls, and in steep terrain including bluffs and cliffs with slopes between 16 and 100%. Salalakim soils (SLsl) occupy colluvial side slopes and areas where bedrock has been fractured and weathered. They commonly occur in pockets on top of, or in between, the knolls and ridges. Inclusions of other soils occur scattered in pockets on side-slope positions. Materials of this map unit occur at all elevations.

Distribution and extent

Three medium-sized delineations of the Rock-Salalakim map unit have been mapped (as RO-SLsL) in the survey area. Two occur along the coast on Newcastle Island; one from Shaft Point to Type Point, and the other from Nares Point to McKay Point. The third delineation occurs on Gabriola Island just north of Percy Anchorage. This map unit represents an area of 30.6 ha (0.5% of total map area).

Rock-Saturna map unit (RO-ST)

This map unit consists dominantly (54%; 45-60%) of sandstone bedrock exposed or covered by less than 10 cm of mineral soil. This map unit also contains subdominant proportions (43%; 30-55%) of well-drained soils developed on shallow (10-50 cm), channery sandy loam textured, colluvial and glacial drift materials over sandstone bedrock (very shallow lithic Saturna soil, STsl). Soils have between 20 and 50% coarse fragments. Unmentioned inclusions of other soils occur in a very few places. Saturna and other soils enhance the use interpretations for this map unit.

Landform and occurrence

The materials of this map unit occur dominantly in areas of subdued (undulating) terrain with smooth, unweathered sandstone (slopes 2-15%), in areas of hummocky terrain on rock ridges and knolls (slopes 16-70%), and, in a few places, on steeper landscape positions (bluffs, cliffs, escarpments) with slopes of 46-100%. Saturna soils (STsl) occur on colluvial side slopes and in areas where bedrock has been fractured and weathered, commonly in pockets on top of, or in between, the ridges or knolls. Inclusions of other soils occur scattered on the side slopes or in pockets. These materials occur at all elevations.

Distribution and extent

Rock-Saturna is a major map unit. It has been mapped as 31 small- to large-sized delineations throughout the survey area. Most delineations (93%) were mapped as RO-STsl. The remaining delineations were mapped as RO-STsl,vg. This map unit represents an area of 324.2 ha (5.4% 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 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)	48	18	80	7
Depth to bedrock (cm)	48	18	80	7
Depth to restricting layer (cm)	48	18	80	7
Depth to mottles (cm)	160	160	160	7
CF content surface layer (%)	41	37	45	2
Fine gravel content surface layer (%)	18	10	25	2
Coarse gravel content surface layer (%)	13	10	15	2
Cobble content surface layer (%)	11	2	20	2
CF content subsurface layer (%)	0	0	0	0
Fine gravel content subsurface layer (%)	0	0	0	0
Coarse gravel content subsurface layer (%)	0	0	0	0
Cobble content subsurface layer (%)	0	0	0	0

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(86), LS(14)	7
Texture of subsurface layer	-	0
Drainage class	Well(100)	7
Soil classification	O.DYB(86), O.SB(14)	7

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
SLl	3	43	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 73 cm (65-80 cm); also in conjunction with the very gravelly (vg) phase
SLsl	4	57	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth 30 cm (18-45 cm); also in conjunction with the very gravelly (vg) phase
SLvg	5	71	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 55% (50-62%); also in conjunction with shallow lithic (l) and very shallow lithic (sl) phases

Note: There is also very limited occurrence of the sombric (a) variant.

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 mainly to their natural vegetation. The only potential agricultural use is for sheep grazing in areas dominated by grass. In some places, Salalakim soils and conglomerate bedrock are used as sources of gravel for road building and construction purposes.

Map units

Salalakim soils occur as the dominant soil in the Salalakim (SL) simple map unit. They are also a subdominant component in the Rock-Salalakim (RO-SL) map unit. In addition, Salalakim soils occur as a minor soil or unmentioned inclusion in some delineations of the Brigantine-Tolmie (BE-TL), Parksville-Tolmie (PA-TL), Rock (RO), Rock-Saturna (RO-ST), Saturna (ST), and Trincomali (TR) map units.

Salalakim map unit (SL)

The Salalakim map unit consists dominantly (82%; 70-90%) of the well-drained Salalakim soil, with bedrock occurring within 100 cm but most commonly within 50 cm of the surface (SLs1). The map unit includes on average 18% (up to 30%) bedrock exposures (Rock), which is a limiting factor in the use interpretations for this map unit. Nonlimiting inclusions of other soils also occur in a very few places.

Landform and occurrence

Soils in all the Salalakim delineations are mapped as SLs1 and occur dominantly on moderately steep to steep conglomerate rock ridges (slopes 15-30%). Salalakim soils occupy colluvial side slopes and occur with bedrock exposures usually on top of the ridges and knolls. Inclusions of other soils occur scattered in pockets on the side slopes.

Distribution and extent

The Salalakim map unit only occurs on the north end of Newcastle Island. It has been mapped as one large-sized and two small-sized delineations. This map unit represents 36.8 ha (0.6% 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 textured colluvial and glacial drift 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)	45	10	99	315
Depth to bedrock (cm)	45	10	99	315
Depth to restricting layer (cm)	49	10	99	315
Depth to mottles (cm)	160	160	160	317
CF content surface layer (%)	37	20	47	111
Fine gravel (channery) content surface layer (%)	17	2	40	111
Coarse gravel (channery) content surface layer (%)	14	0	30	111
Cobble content (flaggy) surface layer (%)	5	0	30	111
CF content subsurface layer (%)	36	20	60	4
Fine gravel (channery) content subsurface layer (%)	14	10	20	4
Coarse gravel (channery) content subsurface layer (%)	23	10	50	4
Cobble content (flaggy) subsurface Layer (%)	10	0	20	4

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(90), LS(8), L(2)	317
Texture of subsurface layer	SL(75), LS(25)	4
Drainage class	Well(90), rapid(10)	317
Soil classification	O.DYB(94), E.DYB(3), O.SB(3)	317
Type of restricting layer	Sandstone bedrock	
Perviousness	Rapid	

Water regime

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

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
STl	138	44	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 66 cm (50-99 cm); also in conjunction with loam (lo), nongravelly (ng), paralithic (pl), very gravelly (vg) phases and sombric (a) and taxonomy change (t) variants
STpl	26	8	Paralithic phase: boundary between soil and solid bedrock consists of fractured sandstone rock; mean depth to fractured rock 54 cm (10-90 cm); mean thickness of fractured rock 87 cm (7-140 cm); occurs in conjunction with loam (lo), very shallow lithic (sl), and shallow lithic (l) phases and sombric (a) variant
STsl	177	56	Very shallow lithic phase: depth to bedrock between 10 and 50 cm; mean depth 35 cm (10-50 cm); also in conjunction with loam (lo), nongravelly (ng), paralithic (pl), and very gravelly (vg) phases and sombric (a) and taxonomy change (t) variants
STvg	184	58	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 59% (50-80%); in conjunction with deep (d), shallow lithic (l), and very shallow lithic (sl) phases and sombric (a) and taxonomy change (t) variants

Note: There is also a very limited occurrence of the sombric (a) variant for the Saturna soil, mainly used where a sombric Ap horizon is present and where vegetation is introduced pasture grasses. The Ap horizon has a loam texture. In addition, there is a sporadic occurrence of the taxonomy change (t) variant, which is used when the soil is classified as an Eluviated Dystric Brunisol (E.DYB). In addition, there is a sporadic occurrence of the deep (d), loam (lo), and nongravelly (ng) phases.

Similar soils

Saturna soils are similar to the Bellhouse soils, which have a thicker (>10 cm) Ah horizon developed under natural vegetation. Saturna soils are found together with Galiano soils, both occurring on similar slopes and in similar landscape positions.

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 the vegetation is dominated by grasses, these soils are used for grazing sheep and cattle. Some small areas have been cleared and seeded for pasture. Saturna soils are generally unsuitable for the production of annual crops because of steep topography, stoniness, shallow soils over bedrock, droughtiness, low fertility, and the many rock outcrops. Despite these limitations, Saturna soils are used by some islanders to produce vegetables, although their production can only be accomplished with high monetary inputs and labor-intensive management. Most areas of Saturna soils remain in natural forest of coast Douglas fir and Pacific madrone with a scattered understory of stunted 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. They are the dominant soils in the Saturna (ST) simple map unit and in the Saturna-Qualicum (ST-QU) compound map unit. Saturna is also a subdominant soil in the Rock-Saturna (RO-ST) map unit. In addition, Saturna soils occur as a minor soil or unmentioned inclusion in some delineations of the Beddis (BD), Bellhouse (BH), Brigantine (BE), Fairbridge (FB), Galiano (GA), Mexicana (ME), Parksville-Tolmie (PA-TL), Qualicum (QU), Rock (RO), Rock-Bellhouse (RO-BH), Rock-Salalakim (RO-SL), Tolmie (TL), and Trincomali (TR) map units.

Saturna map unit (ST)

The Saturna (ST) map unit consists dominantly (79%; 60-100%) of the well-drained Saturna soil and includes on average 21% (up to 40%) of sandstone bedrock exposures (Rock). The bedrock outcrops are usually associated with the very shallow lithic Saturna soil (STsl). Bedrock outcrops limit use interpretations for the map unit more than do the Saturna soils. Unmentioned, nonlimiting inclusions of other soils also occur in some delineations of this map unit.

Landform and occurrence

The landscape of this map unit consists of shallow soils over sandstone bedrock either on gently to strongly sloping (6-30%) topography in subdued to hummocky terrain or on very strongly to steeply sloping (31-100%) side slopes of rock ridges. Bedrock exposures occur at random, most commonly in association with the very shallow lithic Saturna soils (STsl). The minor inclusions of other soils occur scattered in isolated pockets.

Distribution and extent

The Saturna map unit is a major unit with 68, mostly long and narrow delineations of variable size occurring throughout the survey area. About 75% of the delineations have been mapped as STsl. In about 10% of the delineations, very shallow lithic (STsl) and shallow lithic (STl) Saturna soils occur in about equal proportions with coarse fragment content exceeding 50%. These delineations have been mapped as STvg. Two delineations were mapped as STsl,pl and eight as STsl,vg. This map unit represents 2651.7 ha (44.0% of total map area).

Saturna-Qualicum map unit (ST-QU)

The Saturna-Qualicum map unit consists dominantly (58%; 50-70%) of well-drained Saturna soils. The map unit contains a subdominant component (35%; 15-40%) of rapidly to well-drained, deep (>150 cm), gravelly sandy loam to gravelly sand textured soils developed on glaciofluvial, fluvial, or marine deposits with 20-50% coarse fragments (Qualicum soils). Some Qualicum soils may be minor and Beddis gravelly phased (BDg) soils are subdominant. This map unit also includes on average 7% (up to 30%) other soils and bedrock outcrops. The Qualicum soil is less limiting than the Saturna soil for use interpretations for this map unit.

Landform and occurrence

The landscape consists of subdued, hummocky, and ridged terrain with gentle to strong slopes (6-30%). The Qualicum and other soils occupy side-slope positions as fluvioglacial deltas, beach gravels on terraces, or in between ridges as outwash or marine deposits over bedrock (QUl). The Qualicum soils may also occur as isolated pockets in the Saturna soils. The Saturna soils generally are very shallow to bedrock (STsl). Rock outcrops occur along ridge or knoll crests.

Distribution and extent

The Saturna-Qualicum map unit is a minor one and is mapped as 13 small- to large-sized delineations in the survey area. Five delineations were mapped as STsl-QUl. The map unit represents an area of 535.4 ha (8.9% of total map area).

SUFFOLK SOIL AND MAP UNITS

Suffolk soils (SU)

Suffolk soils on the Gulf Islands are usually imperfectly drained soils with 30-80 cm of a loam to sandy clay loam textured, usually stone-free overlay of marine origin underlain by gravelly loam to sandy clay loam textured, unweathered, compact till within 100 cm of the surface. In this map area, however, most Suffolk soils are poorly drained and mapped as SUpd and

SUw. The profile description and analyses of a selected Suffolk soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	37	15	80	24
Thickness of 2nd layer (cm)	23	3	55	24
Depth to bedrock (cm)	160	160	160	24
Depth to restricting layer (cm)	67	30	90	24
Depth to mottles (cm)	56	46	75	7
Depth to 1st PSD (cm)	137	30	160	24
CF content surface layer (%)	7	0	15	11
Fine gravel content surface layer (%)	4	0	10	11
Coarse gravel content surface layer (%)	2	0	5	11
Cobble content surface layer (%)	1	0	5	11
CF content 2nd layer (%)	13	0	40	24
Fine gravel content 2nd layer (%)	8	0	20	24
Coarse gravel content 2nd layer (%)	5	0	20	24
Cobble content 2nd layer (%)	2	0	10	24
CF content 3rd layer (%)	8	0	20	18
Fine gravel content 3rd layer (%)	6	0	15	18
Coarse gravel content 3rd layer (%)	2	0	10	18
Cobble content 3rd layer (%)	0	0	2	18

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(67), SIL(21), CL(8), SCL(4)	24
Texture of 2nd layer	L(29), SCL(25), SICL(17), SL(17), CL(8), SIL(4)	24
Texture of 3rd layer (till)	L(67), SICL(17), SL(11), SCL(5)	18
Texture of 4th layer (till)	L(67), SL(33) (occurs when layer 3 is SICL not till)	3
Drainage class	Poor(54), imperfect(42), well(4)	24
Soil classification	GL.SB(42), O.HG(42), O.G.(12), O.DYB(4)	24
Type of restricting layer	Compact till	
Perviousness	Slow	

Water regime

Suffolk soils are usually imperfectly drained and saturated to about 60 cm from the surface during winter and early spring. The soil receives seepage and runoff water from surrounding upland areas, which maintains the subsoil in a moist condition throughout the summer. Downward movement of water may be restricted by the fine-textured and, in many places, massive-structured subsoil and deeper by the compact till, which causes perched water table conditions. Faint mottling occurs in the lower part of the solum, with distinct to prominent mottles below 50 cm from the surface. In this map area, most Suffolk soils are poorly drained, which is recognized at the phase level as SUpd and SUw.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
SUa	10	42	Sombric variant: Ah or Ap horizon >10 cm; classified as Gleyed Sombric Brunisol (GL.SB); also in conjunction with diatomaceous earth (de), gravelly (g), and very gravelly (vg) phases
SUg	11	46	Gravelly phase: coarse fragment content between 20 and 50%; mean CF 29% (20-45%); also in conjunction with sombric (a) variant and poorly drained (pd) and strongly mottled (w) phases
SUpd	13	54	Poorly drained phase: poorly drained (Gleysolic) instead of imperfectly drained; soils classified as either Orthic Humic Gleysols (O.HG) or Orthic Gleysols (O.G); also in conjunction with gravelly (g) phase
SUw	5	21	Strongly mottled phase: wetter moisture regime in profile evidenced by mottling within 50 cm of the surface; not a gleysolic type landscape; also in conjunction with gravelly (g) phase

Note: Suffolk soils also have very limited occurrences of diatomaceous earth (de) and very gravelly (vg) phases. The till materials are generally weakly cemented but may, in some places, be moderately cemented.

Similar soils

Similar imperfectly drained soils without compact till in the subsoil are mapped as Fairbridge (FB) soils. Similar poorly drained soils without compact till in the subsoil are mapped as Tolmie (TL) soils. The till in the subsoil is the Mexicana-type till.

Natural vegetation

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

Land use

Most areas of Suffolk soils in the survey area have been cleared of their original vegetation for agricultural use, such as pasture and hay production. Suffolk soils are considered to be one of the better agricultural soils in the survey area. The Suffolk soils (like Fairbridge soils) can be improved with irrigation and fertilizer to produce a wide range of agricultural crops. Besides agriculture, growing deciduous trees is another good use for these soils.

Map units

Suffolk soils are the dominant component in the Suffolk (SU) simple map unit. In addition, Suffolk soils occur as a minor soil or unmentioned inclusion in some delineations of the Brigantine (BE), Fairbridge (FB), Galiano (GA), and Trincomali (TR) map units.

Suffolk map unit (SU)

The Suffolk map unit consists dominantly (90; 70-100%) of imperfectly drained Suffolk soils with up to 30% of similar soils with a sandy loam to loamy sand textured capping. Trincomali soils occur also as inclusions in some of the Suffolk delineations. These inclusions do not limit the use interpretations for this map unit.

Landform and occurrence

Soils of the Suffolk map unit occur on very gently to gently sloping topography (2-9%) in subdued and undulating terrain. The Trincomali inclusions occur scattered in some delineations. Elevations are within 100 m of mean sea level.

Location and extent

Suffolk is a very minor unit and occurs as six small delinations on Gabriola Island. Five of these delineations have wetter moisture regimes than the imperfectly drained Suffolk soils and are mapped as SUg,pd; SUpd; SUg,w; SUw,a; and SUw. One delineation was mapped as SUg,a. They represent an area of 22.4 ha (0.4% of total map area).

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 thin layers throughout the soil profile. The profile description and analyses of a selected Tolmie soil are given in Appendixes 1 and 2.

Soil characteristics

Characteristic	Mean	Minimum	Maximum	No. of observations
Thickness of surface layer (cm)	31	12	90	92
Depth to bedrock (cm)	160	160	160	104
Depth to restricting layer (cm)	43	0	160	104
Depth to mottles (cm)	25	0	50	121
CF content surface layer (%)	3	0	15	110
Fine gravel content surface layer (%)	3	0	15	110
Coarse gravel content surface layer (%)	1	0	10	110
Cobble content surface layer (%)	0	0	5	110
CF content subsurface layer (%)	3	0	35	120
Fine gravel content subsurface layer (%)	2	0	20	120
Coarse gravel content subsurface layer (%)	1	0	15	120
Cobble content subsurface layer (%)	0	0	10	120

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	L(50), SIL(17), Peat(17), SL(9), CL(4), SICL(3)	121
Texture of 2nd layer	SICL(41), SL(15), SIL(11), SCL(11), CL(11), L(9), SIC(1), LS(1)	120
Texture of 3rd layer	SICL(60), SCL(10), SIC(9), SL(7), CL(6), L(4), LS(3), SC(1)	66
Drainage class	Poor(84), very poor(16)	121
Soil classification	O.HG(88), HU.LG(7), O.G(5)	121
Type of restricting layer	Fine-textured, often massive-structured subsoil	
Perviousness	Slow	

Water regime

Tolmie soils are 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 within 30 cm of the surface from late November to early March. In spring, water tables drop quickly and remain below 50 cm from 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. The Tolmie soils receive runoff water from the surrounding landscape, as a result of their low landscape position.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
TL	11	9	Diatomaceous earth phase: diatomaceous earth as a layer or layers >5 cm thick in the soil profile; organic carbon content <17%; also in conjunction with peaty (pt) phase
TLg	11	9	Gravelly phase: coarse fragment content in surface layer between 20 and 50%; mean CF 26% (20-40%); also in conjunction with sandy (sa) and shallow lithic (l) phases
TLl	17	14	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 73 cm (51-95 cm); also in conjunction with gravelly (g), peaty (pt), and sandy (sa) phases and taxonomy change (t) variant
TLpt	21	17	Peaty phase: <40 cm of mesic or humic organic materials over mineral soil; mean thickness 16 cm (3-40 cm); also in conjunction with taxonomy change (t) variant and diatomaceous earth (de), sandy (sa), and shallow lithic (l) phases
TLsa	11	9	Sandy phase: Surface texture is sandy loam and thickness is <30 cm; mean thickness 21 cm (10-30 cm); also in conjunction with gravelly (g), peaty (pt), and shallow lithic (l) phases

Note: There is also a very limited occurrence of the taxonomy change (t) variant of the Tolmie soil.

Similar soils

Tolmie and Cowichan soils are similar. The Cowichan soils are also poorly drained, silt loam to silty clay loam textured, marine soils. They have a more uniform and often finer texture than the Tolmie soils. Tolmie soils differ from Parksville soils by having a thinner (<30 cm) sandy overlay or thinner (<30 cm) sandy layer underlying a loam or silt loam surface layer if present. Tolmie soils are also similar to the imperfectly drained Fairbridge (FB) soils and to the poorly drained phases of Suffolk soils that have compact till within 100 cm of the surface.

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, common horsetail, western bracken, and, commonly in the wettest places, American skunk cabbage.

Land use

Most of the Tolmie soils in the survey area have been cleared for agricultural production. When drainage is improved, they are 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 use of unimproved agricultural land is usually for pasture and hay crops, as 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 and subdominant in the Brigantine-Tolmie (BE-TL) and Parksville-Tolmie (PA-TL) compound map units, which have been described earlier under BE and PA. In addition, Tolmie soils occur as a minor soil or unmentioned inclusion in some delineations of the Brigantine (BE), Cowichan (CO), Chemainus (CH), Fairbridge (FB), Metchosin (MT), and Parksville (PA) map units.

Tolmie map unit (TL)

The Tolmie map unit consists dominantly (90%; 70-100%) of the poorly drained Tolmie soil. The Tolmie map unit includes on average 10% (up to 30%) of other minor soils (Parksville, Brigantine, and Cowichan) of which the Brigantine (BE) soil occurs most widely. Unmentioned inclusions of other soils also occur in a very few places. These minor soils and inclusions do not limit the 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 the Parksville and Cowichan soils occur scattered. The Brigantine soils occur in the better-drained landscape positions.

Distribution and extent

The Tolmie map unit is a major one in the survey area, with 35 small- to medium-sized, mostly narrow and long delineations. Of these, 16 were mapped as TL, 10 have peaty overlay materials (TLpt), and another 6 delineations have bedrock between 50 and 100 cm (TL1). In addition 1 delineation each is mapped as TLde, TLg, and TLsa. The Tolmie map unit represents an area of 125.9 ha (2.1% of total map area).

TRINCOMALI SOILS AND MAP UNITS

Trincomali soils (TR)

Trincomali soils are moderately well to imperfectly drained soils that have developed on shallow (30-100 cm) deposits of gravelly sandy loam to gravelly sand textured, marine, fluvial, or glaciofluvial materials (20-50% gravels) over 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)	55	10	97	125
Depth to bedrock (cm)	160	160	160	137
Depth to restricting layer (cm)	74	38	100	119
Depth to mottles (cm)	114	40	160	113
CF content surface layer (%)	33	20	46	70
Fine gravel content surface layer (%)	18	5	46	70
Coarse gravel content surface layer (%)	11	0	20	70
Cobble content surface layer (%)	4	0	15	70
CF content subsurface layer (%)	17	0	60	148
Fine gravel content subsurface layer (%)	11	0	45	148
Coarse gravel content subsurface layer (%)	6	0	20	148
Cobble content subsurface layer (%)	1	0	25	148

	Frequency of occurrence (%)	No. of observations
Texture of surface layer	SL(67), LS(18), L(11), S(4)	148
Texture of subsurface layer (till)	L(70), SL(20), LS(5), SCL(5)	148

Drainage class	Imperfect(41), moderately well(36), well(13), poor (10), rapid(1)	148
Soil classification	O.DYB(41), GL.DYB(28), O.SB(8), GL.SB(13), O.HG(7), O.G(3)	148
Type of restricting layer	Compact till	
Perviousness	Slow	

Water regime

Most Trincomali soils are moderately well to imperfectly drained. After prolonged wetting, perched water table conditions are common on top of the compact till for short periods. Consequently, faint mottling is common in the lower part of the soil profile directly above the till. During dry periods in summer the soils are very droughty. Some Trincomali soils are wetter and are poorly drained.

Variability

Soil phase or variant	Frequency (no.)	(%)	Description of variability
TRa	31	21	Sombric variant: Ah or Ap horizon >10 cm; classifiedas Gleyed Sombric Brunisol (GL.SB) or as Orthic Sombric Brunisol (O.SB); also in conjunction with imperfectly drained (id), loam (lo), moderately cemented (mc), nongravelly (ng), poorly drained (pd), shallow lithic (l), and very gravelly (vg) phases
TRd	19	13	Deep phase: depth to compact till between 100 and 150 cm: mean depth 119 cm (105-160 cm); also in conjunction with imperfectly drained (id), loam (lo), nongravelly (ng), poorly drained (pd), and very gravelly (vg) phases
TRid	61	41	Imperfectly drained phase: wetter moisture regime than specified (Gleyed subgroups) for soil; also in conjunction with sombric (a) variant and deep (d), loam (lo), moderately cemented (mc), nongravelly (ng), shallow lithic (l), and very gravelly (vg) phases
TRl	11	7	Shallow lithic phase: depth to bedrock between 50 and 100 cm; mean depth 73 cm (53-95 cm); also in conjunction with sombric (a) variant and imperfectly drained (id), loam (lo), nongravelly (ng), and very gravelly (vg) phases
TRlo	16	11	Loam phase: surface texture is loam; mean thickness 18 cm (5-45 cm); also in conjunction with deep (d),

			imperfectly drained (id), moderately cemented (mc), nongravelly (ng), poorly drained (pd), shallow lithic (l), and very gravelly (vg) phases and sombric (a) variant
TRng	37	25	Nongravelly phase: coarse fragment content in surface layer <20%; mean CF 7% (0-16%); also in conjunction with sombric (a) variant and deep (d), imperfectly drained (id), loam (lo), poorly drained (pd), shallow lithic (l), and strongly mottled (w) phases
TRpd	15	10	Poorly drained phase: wetter moisture regime than specified for soil (Gleysolic); soils classified as either Orthic Humic Gleysol (O.HG) or Orthic Gleysol (O.G); also in conjunction with sombric (a) variant and nongravelly (ng), shallow lithic (l), and very gravelly (vg) phases
TRvg	41	28	Very gravelly phase: coarse fragment content in surface layer >50%; mean CF 58% (50-81%); also in conjunction with sombric (a) variant and deep (d), poorly drained (pd), shallow lithic (l), imperfectly drained (id), and loam (lo) phases

Note: There is also a limited occurrence of the moderately cemented (mc) and strongly mottled (w) phases for the Trincomali soil. In some places the unweathered till is not compacted within 160 cm of the surface.

Similar soils

Trincomali soils commonly occur together with Qualicum soils, which are deeper and rapid to well drained. Soils with coarse-textured overlays thicker than 150 cm have been mapped as Qualicum soils. Trincomali soils without the somewhat coarser textured overlay materials have been mapped as Mexicana soils.

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

Small areas of Trincomali soils in the survey area are used for pasture land and hay production. 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. Another good use for these soils is growing coniferous trees.

Map units

Trincomali soils occur as the dominant soil in the Trincomali (TR) simple map unit and as a minor soil or unmentioned inclusion in some delineations of the Brigantine (BE), Cowichan (CO), Galiano (GA), Mexicana (ME), Qualicum (QU), Rock-Saturna (RO-ST), Salalakim (SL), Saturna (ST), Saturna-Qualicum (ST-QU), and Suffolk (SU) map units.

Trincomali map unit (TR)

The Trincomali (TR) map unit consists dominantly (81%; 55-100%) of the moderately well to imperfectly drained Trincomali soils. The Trincomali map unit includes on average 19% (up to 45%) of other soils, which may be one or a combination of the following minor soils: Qualicum (QU), Mexicana (ME), or Suffolk (SU), of which Qualicum soils occur most widely. Unmentioned inclusions of other soils occur in a very few places.

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. The Trincomali map unit (TR) occurs on very gently to gently sloping topography (2-9%). Qualicum soils occur in scattered locations where the coarse-textured deposits are deeper than 150 cm. Mexicana soils occur in some places where the coarse-textured overlay is absent. Some minor inclusions of other soils also occur.

Distribution and extent

The Trincomali map unit is a major one in the survey area. Of the 24 small- to large-sized delineations, 10 were mapped as TR, 5 as TRid; 1 as TRid,a; 2 as TRng, 2 as TRng,pd; 3 as TRvg; and 1 as TRvg,pd. This map unit occupies an area of 631.6 ha (10.5% 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 and parent material textures of the dominant soils, some comparisons can be made about the distribution of map units in the survey area (Table 5).

Table 5. Distribution of map units in survey area by parent materials

Dominant parent materials	Map units	Area occupied (ha)	Area occupied (%)
1 Shallow colluvial and glacial drift over bedrock (within 1 m)	BH, GA, SL, ST, and ST-QU	3564	59
2 Rock	RO, RO-BH, RO-SL, and RO-ST	449	7
3 Shallow over compact glacial till (within 1 m)	ME, SU, and TR	695	12
4 Deep, moderately fine to fine-textured, marine materials	CO, FB, and TL	320	5
5 Deep, coarse- to moderately coarse-textured materials	BD, BY, DA, and QU	385	6
6 Coarse to moderately coarse over deep, moderately fine to fine-textured, marine materials	BE, BE-TL, PA, and PA-TL	472	8
7 Fluvial, organic, and anthropogenic materials	CH, MT, and NT	76	1
Summary			
1,2,3	Shallow soils and rock	4708	78
4,5,6,7	Deep soils	1253	21

Note: The remaining area consists of land types such as 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 residential 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 6. 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 6. The slight constraint class does not list subclass limitations.

The typical constraint classes for effluent absorption in columns 4 and 5 of Table 6 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 6.

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 6 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

Table 6. 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 (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)
BD	Beddis	3	Moderate	S^{8}†-GSW^{2}†	5	Moderate	ST^{8}-GTW^{2}	BDg	Moderate	GSW
					6	Severe	T	BDl	Severe	R
					8	Very severe	T	BDs	Moderate	GSW
BE	Brigantine	3	Severe^{8}-very severe^{2}	DWs^{8}-Wd^{2}	5	Severe	DWt	BEd	Severe^{8}-very severe^{2}	Wds^{8}-Wd^{2}
					6	Severe	DTW	BEd,g	Severe^{8}-very severe^{2}	Wdg^{8}-Wd^{2}
								BEg	Severe^{8}-very severe^{2}	DWg^{8}-Wd^{2}
								BEl	Severe^{8}-very severe^{2}	RWs^{8}-Wd^{2}
								BEl,g	Severe^{8}-very severe^{2}	RWg^{8}-Wd^{2}
BE-TL	Brigantine-Tolmie	3,4	Severe^{6}-very severe^{4}	DWs^{6}-W^{4}	5	Severe^{6}-very severe^{4}	DWt^{6}-W^{4}	BEg-TL	Severe^{6}-very severe^{4}	DWg^{6}-W^{4}
BH	Bellhouse	3	Very severe	R	6	Very severe	Rt			
BY	Baynes	3,4	Severe^{8}-very severe^{2}	Ws^{8}-W^{2}	5	Severe^{8}-very severe^{2}	Wts^{8}-W^{2}	BYg	Severe^{8}-very severe^{2}	Wgs^{8}-W^{2}
								BYl	Severe^{8}-very severe^{2}	RWs^{8}-W^{2}
								Bys	Severe^{8}-very severe^{2}	Wgs^{8}-W^{2}

(Continued)

Table 6. 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)
CH	Chemainus	2,3	Severe	W				CHpd,pt	Very severe	W
								CHw	Very severe	W
CO	Cowichan	2,3	Very severe	W				CO1	Very severe	Wr
DA	Denman Island	2,3	Very severe^{8}-severe^{2}	W^{8}-Ws^{2}				DA1	Very severe^{8}-severe^{2}	Wr^{8}-WRs^{2}
								DAs1	Very severe	RW
FB	Fairbridge	3,4	Severe^{8}-very severe^{2}	Ws^{8}-W^{2}	5	Severe^{8}-very severe^{2}	Wst^{8}-W^{2}	FBg	Severe^{8}-very severe^{2}	Wgs^{8}-W^{2}
								FBg,w	Very severe	W
								FB1	Severe^{8}-very severe^{2}	WRs^{8}-W^{2}
								FB1,w	Very severe	Wrs^{8}-W^{2}
								FBw	Very severe	W
GA	Galiano	4	Very severe	R	3	Very severe	R	GAs1,vg	Very sever e	Rg^{8}-R^{2}
					6	Very severe	Rt	GA1	Severe^{8}-very severe^{2}	Rg^{8}-R^{2}
					7,8,9	Very severe	RT	GA1,vg	Severe^{8}-very severe^{2}	GR^{8}-R^{2}
ME	Mexicana	6	Severe	DTw	5	Severe	Dtw	MEid	Severe	DTW
					7,8	Very severe	Td			
MT	Metchosin	1	Very severe	W				MTso	Very severe	Wd

(Continued)

Table 6. 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)
NT	Neptune	3,4	Moderate	GS	5	Severe	Tgs	NTsl	Very severe	R
PA	Parksville	2,3	Very severe^{8}-severe^{2}	Wd^{8}-DWs^{2}				PAl,lo	Very severe^{8}-severe^{2}	Wr^{8}-DWs^{2}
PA-TL	Parksville-Tolmie	2,3,4	Very severe	Wd^{6}-DW^{4}						
QU	Qualicum	3,4	Moderate^{8}-severe^{2}	GSW^{8}-Dgw^{2}	5	Moderate^{8}-severe^{2}	GTW^{8}-Dtw^{2}	QUd,vg	Severe	GRw^{8}-Dgw^{2}
					6	Severe	Tgw^{8}-DTw^{2}	QUl	Severe	Rgw^{8}-Dgw^{2}
								QUl,vg	Severe	GRw^{8}-Dgw^{2}
								QUvg	Severe	Gsw^{8}-Dgw^{2}
RO	Rock	3,4,5	Very severe	R	6	Very severe	Rt			
					7,8,9	Very severe	RT			
RO-BH	Rock-Bellhouse	3,4,5	Very severe	R	6	Very severe	Rt			
RO-SL	Rock-Salalakim	7,8	Very severe	RT	4,5	Very severe	R			
					6	Very severe	Rt			
RO-ST	Rock-Saturna	3,4,5	Very severe	R	6	Very severe	Rt	RO-STsl,vg	Very severe	R^{6}-Rg^{4}
					7,8,9	Very severe	RT			

(Continued)

Table 6. 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)
SL	Salalakim	4,5	Very severe	R	6	Very severe	Rt			
ST	Saturna	3,4,5	Very severe	R	6	Very severe	Rt	STsl,vg	Very severe	Rg[8]-R[2]
					7,8,9	Very severe	RT	STvg	Severe[8]- very severe[2]	GR[8]-R[2]
ST-QU	Saturna-Qualicum	3,4	Very severe[6]- moderate[4]	R[6]-GSW[4]	5	Very severe[6]- moderate[4]	R[6]-GTW[4]	STl-QUl	Severe	Rg[6]-Rgw[4]
					6	Very severe[6]- severe[4]	Rt[6]-Tgw[4]	STsl-QUl	Very severe[6]- severe[4]	R[6]-Rgw[4]
								STsl-QUsl	Very severe	R
								STsl,vg-QU	Very severe[6]- moderate[4]	R[6]-GSW[4]
								Stsl,vg-QUl	Very severe[6]- severe[4]	Rg[6]-Rgw[4]
								STsl,vg-QUl, vg	Very severe[6]- severe[4]	Rg[6]-GRw[4]
SU	Suffolk	3,4	Severe	DW				SUg,a	Severe	DWg
								SUg,pd	Very severe	Wdg
								SUg,w	Very severe	Wdg
								SUpd	Very severe	Wd
								SUw	Very severe	Wd
TL	Tolmie	1,2,3,4	Very severe	W				TLl	Very severe	Wr

(Continued)

Table 6. 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	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)
TR	Trincomali	3,4	Severe^{8}-moderate^{2}	Dwg^{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}	TRng	Severe^{8}-moderate^{2}	Dw^{8}-GSW^{2}
								TRng,pd	Very severe^{8}-moderate^{2}	Wd^{8}-GSW^{2}
								TRvg	Severe^{8}-moderate^{2}	Dw^{8}-GSW^{2}
								TRvg,pd	Very severe^{8}-moderate^{2}	Wd^{8}-GSW^{2}

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

or variant is indicated in columns 9, 10, and 11 of Table 6. 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.

The ratings in Table 6 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 6 indicate that none of the map units for the survey area has a slight constraint rating for effluent absorption. However, Beddis (BD) map units consisting of dominantly sandy loam instead of loamy sand soils have slight limitations for effluent absorption on slopes of less than 10%. Also, the Chemainus (CH), Neptune (NT), and Qualicum (QU) map units on moderate slopes (10-15%) all have moderate limitations for effluent absorption. All other map units occurring in the survey area, including those units on steeper topography (>15%) and those with drainage (id, pd, w) phases 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 almost 18% 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 agricultural capability.

Land capability ratings for agriculture are interpretations based on climatic, soil, and landscape characteristics. The Land Capability Classification for Agriculture in British Columbia (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 agricultural 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 rock outcrops, 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, and/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 agricultural 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 Nanaimo Airport, which is nearby in the same climatic regime, the CMD was calculated at 256 mm during the growing season (Coligado 1979). This 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 7. 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 7.

The typical land capability for agriculture ratings in columns 4 and 5 of Table 7 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

Table 7. Land capability ratings for agriculture

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)
BD	Beddis	3	$4A^8$†-$4Ap^2$†	$2A^8$-$3AP^2$	4	$4A^8$-$4Ap^2$	$2AT^8$-$3APt^2$	BDg	$4A^8$-$4Ap^2$	$3Ap^8$-$3AP^2$
					5	$4At^8$-$4Apt^2$	$3Ta^8$-$3APT^2$	BDl	$4A^8$-$4Ap^2$	$2AR^8$-$3AP^2$
					6	$5Ta^8$-$5Ta^2$	$5T^8$-$5T^2$			
					7,8	7T	7T			
BE	Brigantine	3	$4A^8$-$4W^2$	$2A^8$-$2ADW^2$	4	$4A^8$-$4W^2$	$2AT^8$-$2ADW^2$	BEg	$4Ap^8$-$4W^2$	$3Ap^8$-$2ADW^2$
					5	$4At^8$-$4W^2$	$3Ta^8$-$2ADW^2$	BEl	$4A^8$-$4W^2$	$2AR^8$-$2ADW^2$
					6	4AT	4T	Bel,g	$4Ap^8$-$4W^2$	$3Apr^8$-$2ADW^2$
								BElo	$3A^8$-$4W^2$	1^8-$2ADW^2$
								BEw,a	$3W^8$-$4W^2$	$2A^8$-$2ADW^2$
BE-TL	Brigantine-Tolmie	3	$4A^6$-$4W^4$	$2A^6$-$2DW^4$	4	$4A^6$-$4W^4$	$2AT^6$-$2DW^4$	BEg-TL	$4A^6$-$4W^4$	$3Ap^6$-$2DW^4$
					5	$4At^6$-$4W^4$	$3Ta^6$-$2DW^4$	BEg,lo-TL	$4A^6$-$4W^4$	$2AP^6$-$2DW^4$
								BElo-TL	$3A^6$-$4W^4$	1^6-$2DW^4$
								BE-TLpt	$4A^6$-$5W^4$	$2A^6$-$3Wd^4$
BH	Bellhouse	3	$5Ra^8$-$7R^2$	$5R^8$-$7R^2$	6	$5RT^8$-$7R^2$	$5RT^8$-$7R^2$			
BY	Baynes	3	$4A^8$-$4W^2$	$2A^8$-$2AW^2$	4	$4A^8$-$4W^2$	$2AT^8$-$2AW^2$	BYg	$4Pa^8$-$4W^2$	$2AP^8$-$2AW^2$
					5	$4At^8$-$4W^2$	$3Ta^8$-$2AW^2$	BYl	$4A^8$-$4W^2$	$2AR^8$-$2AW^2$
								BYlo	$3A^8$-$4W^2$	1^8-$2AW^2$
								BYsi	$3A^8$-$4W^2$	1^8-$2AW^2$
CH	Chemainus	3	3A	1^8-$2A^2$				CHpd,pt	5W	2W
								CHw	3W	1

(Continued)

Table 7. Land capability ratings for agriculture (continued)

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 (10)	Improved rating (11)
CO	Cowichan	2,3	4W	2DW				COl	4Wr	3Rdw
								COpt	5W	3DW
DA	Denman Island	3	$4W^{8}-4A^{2}$	$2AW^{8}-2A^{2}$				DAl	4Wr	3Raw
								DAl,pt	5W	3RW
								DApt	5W	3W
								DAsl	4RW	4R
								DAsn,t	$6NW^{8}-O6NW^{2}$	$6NW^{8}-O6NW^{2}$
FB	Fairbridge	3	$3Ad^{8}-4W^{2}$	$2D^{8}-2DW^{2}$	4	$3Adt^{8}-4W^{2}$	$2DT^{8}-2DW^{2}$	FBg	$4Ap^{8}-4W^{2}$	$2ADP^{8}-2DW^{2}$
					5	$3ATd^{8}-4W^{2}$	$3Td^{8}-2DW^{2}$	FBg,w	$4Apw^{8}-4W^{2}$	$2ADP^{8}-2DW^{2}$
								FBl	$3Ar^{8}-4W^{2}$	$2DR^{8}-2DW^{2}$
								FBl,w	$3Wr^{8}-4W^{2}$	$2DR^{8}-2DW^{2}$
								FBw	$3W^{8}-4W^{2}$	$2D^{8}-2DW^{2}$
GA	Galiano	4	$4Ap^{8}-7R^{2}$	$3Pat^{8}-7R^{2}$	3	$4AP^{8}-7R^{2}$	$3Pa^{8}-7R^{2}$	GAsl,vg	$4Ap^{8}-7R^{2}$	$3AP^{8}-7R^{2}$
					5	$4Apt^{8}-7R^{2}$	$3PTa^{8}-7R^{2}$	GAl,vg	$4Ap^{8}-7R^{2}$	$3AP^{8}-7R^{2}$
					6	$5Ta^{8}-7R^{2}$	$5T^{8}-7R^{2}$			
					7,8,9	$7T^{8}-7RT^{2}$	$7T^{8}-7Rt^{2}$			
ME	Mexicana	6	4ATp	4T	4	4Ap	2APT			
					5	4Apt	3Tap			
					7,8	7T	7T			
MT	Metchosin	1	O5W	O3W	2	O5W	O3W	MTso	O5W	O3Wd

(Continued)

Table 7. Land capability ratings for agriculture (continued)

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 (10)	Improved rating (11)
NT	Neptune	4	4AP	3APt	3 5	4AP 4APt	3AP 3APT	NTs1	6R	6R
PA	Parksville	3	$4W^8-4A^2$	$2ADW^8-2A^2$				PA1,1o PAlo PApt	$4w^8-4A^2$ $4W^8-4A^2$ 5W	$3Rw^8-2A^2$ $2DW^8-2A^2$ 3Wd
PA-TL	Parksville-Tolmie	3	4W	$2ADW^6-2DW^4$	4	4W	$2ADT^6-2DTW^4$	PA-TLpt PAg-TL PAlo-TL PAsi-TL PApt-TLpt PAsi,pt-TLpt	$4W^6-5W^4$ $4Wp^6-4W^4$ 4W 4W 5W 5W	$2ADW^6-3Wd^4$ $2APD^6-2DW^4$ 2DW 2DW 3Wd 3Wd
QU	Qualicum	4	4Ap	3APt	3 5 6	4AP 4APt 5Ta	$3AP^8-3APd^2$ 3APT 5T	QU1 Qul,vg Quvg	4Apr 5Ap 5Ap	3APR 5Ap 5Ap
RO	Rock	3	$7R^8-5Rap^2$	$7R^8-5R^2$	6 7,8,9	$7R^8-5RTa^2$ $7RT^8-7T^2$	$7R^8-5RT^2$ $7RT^8-7T^2$			
RO-BH	Rock-Bellhouse	3	$7R^6-5Ra^4$	$7R^6-5R^4$	6	$7R^6-5RTa^4$	$7R^6-5RT^4$			
RO-SL	Rock-Salalakim	7,8	$7RT^5-7T^4$	$7RT^5-7T^5$	4,5 6	$7R^5-5Rap^5$ $7R^5-5RTp^5$	$7R^5-5R^5$ $7R^5-5RT^5$			

(Continued)

Table 7. Land capability ratings for agriculture (continued)

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 (10)	Improved rating (11)
RO-ST	Rock-Saturna	3,4	$7R^6$-$5Ra^4$	$7R^6$-$5R^4$	6 7,8,9	$7R^6$-$5RTa^4$ $7RT^6$-$7T^4$	$7R^6$-$5RT^4$ $7RT^6$-$7T^4$	RO-STsl,vg	$7R^6$-$5ARp^4$	$7R^6$-$5ARp^4$
SL	Salalakim	6	$5RTp^8$-$7R^2$	$5RT^8$-$7R^2$	4,5	$5Rap^8$-$7R^2$	$5R^8$-$7R^2$			
ST	Saturna	3,4	$4Apr^8$-$7R^2$	$3APR^8$-$7R^2$	5 6 7,8,9	$4Art^8$-$7R^2$ $5Ta^8$-$7R^2$ $7T^8$-$7TR^2$	$3ART^8$-$7R^2$ $5T^8$-$7R^2$ $7T^8$-$7TR^2$	STsl STsl,vg STvg	$5Ra^8$-$7R^2$ $5ARp^8$-$7R^2$ $5Ap^8$-$7R^2$	$5R^8$-$7R^2$ $5ARp^8$-$7R^2$ $5Ap^8$-$7R^2$
ST-QU	Saturna-Qualicum	3	$4Apr^6$-$4Ap^4$	$3APR^6$-$3AP^4$	4 5 6	$4Apr^6$-$4Ap^4$ $4Art^6$-$4Apt^4$ 5Ta	$3APR^6$-$3APt^4$ $3ART^6$-$3APT^4$ 5T	STl-QUl STsl-QUl STsl-QUsl STsl,vg-QU STsl,vg-QUl STsl,vg-Qul, vg	4Apr $5Ra^6$-$4Apr^4$ 5Ra $5ARp^6$-$4Ap^4$ $5ARp^6$-$4Apr^4$ $5ARp^6$-$5Ap^4$	3APR $5R^6$-$3APR^4$ 5R $5ARp^6$-$3AP^4$ $5ARp^6$-$3APR^4$ $5ARp^6$-$5Ap^4$
SU	Suffolk	4	3At	2DT	3	3A	2D	SUg SUg,pd SUg,w SUpd SUw	4Ap 4Wp 3PWd 4W 3Wd	3Pad 3Pdw 3Pda 2DW 2D
TL	Tolmie	1,2,3	4W	2DW	4	4W	2DTW	TLg TLl TLl,pt TLpt	4Wp 4Wr 5W 5W	2DPW 3Rw 3RW 3Wd

(Continued)

Table 7. 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)
TR	Trincomali	3	4Ap	3AP	4	4Ap	3APt	TRng	4A	2AD
					5	4Apt	3APT	TRng,pd	4W	2ADW
					6	5Ta	5T	TRvg	5Ap	5Ap
								TRvg,pd	4PW	4Pa

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

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 7.

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 class of land capability for agriculture. Therefore, columns 6, 7, and 8 of Table 7 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 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 shown in the table.

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.

Land capability for agriculture ratings in Table 7 show that soils of map units with the least degree of limitation for agricultural crop production generally occur below the 100-m contour 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, Chemainus, Cowichan, Denman Island, Fairbridge, Parksville, and Tolmie. Similar soils with compact till occurring between 50 and 100 cm from the surface (Suffolk) fall into the same category.

Soils of map units with 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 7), which are the same as the unimproved ratings. Some of these map units represent the following soils: Bellhouse, Galiano, 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, such as land capability for agriculture, or maps derived from the original soil information, such as those 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 associated legend and map unit symbols are then also 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 which case 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).

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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 soils in the survey area. To best represent 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 common 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		Texture	Structure			Consistence		Mottles	Coarse fragments (%)
		moist	dry		grade	class	kind	dry	moist		
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	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
							(meq/100 g soil)										
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 frag. (%)
LF	2-0	mat of dead needles and twigs									
Ah	0-5	black (10YR 2/1)	dark grayish brown (10YR 4/2)	loamy sand	strong	medium	granular	very friable	nonsticky nonplastic	none	0
Bm	5-15	dark yellowish brown (10YR 3/4)	brown (10YR 5/3)	loamy sand	weak	fine	granular	very friable	nonsticky nonplastic	none	3
Bfj	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 (%)	CEC	Ca	Mg	K	Na	Base sat. (%)	Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
							Cation exchange (meq/100 g soil)						Particle size distribution				
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 (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse frag. (%)
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 (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (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 Brunisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence moist	Consistence wet	Mottles	Coarse fragments (%)
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	light olive brown (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	dark grayish brown (2.5Y 4/2)	light yellowish brown (2.5Y 6/4)	loam	moderate to strong	coarse	angular blocky	firm	sticky	many,medium,prom. strong brown (7.5YR 4/6)	<5
IICBg	96-115	olive brown (2.5Y 4/4)	olive (5 Y 6/3)	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

COWICHAN SOIL

Location: field behind old Mission School, Kuper Island
Landform: blanket of marine deposits; drumlinized, rolling terrain
Topography: very gentle slopes (2-5%), smooth microtopography
Parent materials: silty clay, marine deposits
Present land use: pasture
Remarks: typical Cowichan soil profile

Longitude: 123°39'10"W
Latitude: 48°58'25"N
Elevation: 10 m
Drainage: poorly
Perviousness: slowly
Effective rooting depth: 24 cm
Classification: Humic Luvic Gleysol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence moist	Consistence wet	Mottles	Coarse fragments (%)
Ap	0-24	dark brown (7.5YR 3/2)	brown (10YR 5/3)	silt loam	strong	coarse	granular	friable	nonsticky	none	0
Aeg1	24-33	gray, light gray (5Y 6/1)	light gray (10YR 7/2)	silt loam	moderate to strong	medium	subangular blocky	friable	slightly sticky	many,fine,prom. yellowish brown (10YR 5/6)	2
Aeg2	33-40	gray, light gray (5Y 6/1)	white (10YR 8/1)	silt loam to loam	moderate to strong	medium to coarse	subangular blocky	firm	sticky	com.,fine,prom. yellowish brown (10YR 5/6)	5
Btg1	40-53	gray (5Y 5/1)	pale brown (10YR 6/3)	silty clay	moderate	coarse	angular blocky	firm	sticky	many,medium,prom. yellowish brown (10YR 5/6)	0
Btg2	53-70	gray (5Y 5/1)	pale brown (10YR 6/3)	silty clay			massive	firm	sticky	many,medium,prom. strong brown (7.5YR 5/6)	0
BCg	70-90+	olive gray (5Y 4/2)	light gray (2.5Y 7/2)	silty clay	weak	fine	pseudo-platy	firm	sticky	none	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	4.9	3.3	0.24	14	0.4	0.3	0.9	0.4	21.4	5.5	2.1	0.6	0.1	39	17	7	58	25	0.33
Aeg1	4.8	0.5	0.03	17	0.2	0.1	0.5	0.2	8.1	2.7	1.5	0.1	0.1	55	22	11	60	19	0.58
Aeg2	4.8	0.5	0.04	13	0.2	0.1	0.4	0.2	8.3	2.8	1.8	0.1	0.1	58	29		51	19	0.46
Btg1	5.0				0.1	0.1	0.8	0.3	26.5	10.0	9.9	0.2	0.3	76	6		43	50	0.27
Btg2	5.4				0.1	0.1	0.5	0.2	30.3	14.2	13.6	0.2	0.4	93	5		46	48	0.29
BCg	5.8				0.1	0.1	0.5	0.3	29.9	15.1	13.8	0.2	0.4	100+	1		48	51	0.31

FAIRBRIDGE SOIL

Location: east side of old tidal flat area on slope, Thetis Island
Landform: blanket of marine deposits
Topography: moderately sloping (12%), southwest-facing, moderately mounded microtopography
Parent materials: deep, marine silt over clay deposits
Present land use: forested; dominant coast Douglas fir and red alder; salal, willow, western bracken, western sword fern
Remarks: representative of the "wetter" sites where Fairbridge soils occur; commonly classified as Gleyed Eluviated Dystric Brunisol

Longitude: 123°40'00"W
Latitude: 48°59'45"N
Elevation: 12 m
Drainage: imperfectly
Perviousness: slowly
Effective rooting depth: 125 cm
Classification: Gleyed Brunisolic Gray Luvisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence moist	Consistence wet	Mottles	Coarse frag. (%)
L-F-H	4-0										
Bm1	0-20	dark brown (10YR 4/3) brown (10YR 4/3) to dark yellowish brown (10YR 4/4)	very pale brown (10YR 7/4)	silt loam	weak to moderate	medium	subangular blocky	friable	sticky plastic	none	10
Bm2	20-29	yellowish brown (10YR 5/4)	pale brown (10YR 6/3)	silt loam	moderate	medium to coarse	subangular blocky	friable	sticky plastic	few,fine,dist. strong brown (7.5YR 4/6)	5
IIAegj	29-37	light yellowish brown (2.5Y 6/4)	very pale brown (10YR 7/3)	silty clay	moderate to strong	coarse	angular blocky	friable	sticky plastic	man.med.prom. strong brown (7.5YR 5/8)	<5
IIBtg	37-65	light gray (5Y 7/2) and light olive gray (5Y 6/2)	white (2.5Y 8/2)	silty clay	weak	coarse to very coarse	subangular blocky	friable	sticky plastic	man.med.prom. strong brown (7.5YR 5/8)	0
IICBg	65-80	gray (5Y 5/1)	light gray (5Y 7/2)	silty clay loam	moderate	medium	angular blocky	friable	sticky plastic	com.fine.prom. brownish yellow (10YR 6/8)	0
IICg1	80-125	gray (5Y 5/1)	olive (5Y 5/4)	silty clay	strong	coarse	angular blocky	firm	sticky plastic	no mottles, manganese staining	0
IICg2	125+	gray (5Y 5/1)	olive (5Y 5/4)	silty clay	weak	medium	pseudo platy	firm	sticky plastic		

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)
L-F-H	5.1	29.6	0.78	38													
Bm1	4.3	2.3	0.08	29	0.3	0.3	16.0	2.1	1.1	0.5	0.1	24	21	3	60	19	0.38
Bm2	5.1	1.3	0.08	16	0.3	0.2	16.0	6.4	2.3	0.3	0.1	57	24	4	54	22	0.43
IIAegj	5.0	0.6	0.11	5	0.2	0.2	19.3	8.6	4.1	0.2	0.2	68	9	2	50	41	0.34
IIBtg	5.1	0.7	0.05	14	0.1	0.1	30.8	15.6	9.3	0.3	0.3	83	3	1	46	51	0.27
IICBg	5.3	0.5					32.7	18.4	10.5	0.2	0.4	90	6	2	56	38	0.40
IICg1	5.7	0.4					32.4	20.3	10.7	0.2	0.4	98	6	1	52	42	0.35
IICg2	6.0	0.4					29.7	18.5	9.6	0.2	0.4	97	5	1	54	40	0.37

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: moderately
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

METCHOSIN SOIL

Location: Henshaw Farm, South Pender Island
Landform: fen
Topography: level, 1% slope with smooth microtopography
Parent materials: peat (organic deposits) of sedges and reeds with <10% woody materials
Present land use: pasture with grasses, sedges, and rushes
Remarks: water table at 105 cm (82/09/23)

Longitude: 123°13'00"W
Latitude: 48°44'56"N
Elevation: 70 m
Drainage: very poorly
Perviousness: moderately
Effective rooting depth: 35 cm
Classification: Typic Humisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color moist	Color dry	Texture	Von post scale	Rubbed fibre (%)	Mottles	Coarse fragments (%)
Op	0-20	black (10YR 2/1)	black (10YR 2/1)	humic	06	2	none	0
Oh1	20-27	very dark brown (10YR 2/2)	black (10YR 2/1)	humic	08	2	none	0
Oh2	27-35	very dark brown (10YR 2/2)	black (10YR 2/1)	humic	07	2	none	0
Oh3	35-40	very dark brown (10YR 2/2)	black (10YR 2/1)	humic	08	2	none	0
Oh4	40-80	black (10YR 2/1)	very dark brown (10YR 2/2)	humic	08	4	none	0
Oh5	80-160	black (10YR 2/1)	very dark brown (10YR 2/2)	humic	09	2	none	0
Oh6	160-200+	black (10YR 2/1)	very dark brown (10YR 2/2)	humic	10	4	none	0

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Cation exchange (meq/100 g soil) CEC	Ca	Mg	K	Na	Base sat. (%)	Pyrophosphate index
Op	5.2	49.2	1.93	25	192.3	103.1	21.7	0.2	4.9	68	1
Oh1	4.9	51.9	1.85	28	217.9	106.5	25.3	0.1	5.2	63	1
Oh2	5.0	51.5	2.18	24	184.0	83.0	19.5	0.1	5.2	59	1
Oh3	5.0	51.9	2.27	23	197.2	90.4	24.2	0.1	5.6	61	1
Oh4	5.1	52.6	1.48	36	208.1	95.7	29.6	0.1	7.6	64	3
Oh5	5.1	51.8	1.61	32	196.5	93.8	29.1	0.1	8.4	67	4
Oh6	5.3	52.5	1.63	32	177.9	85.9	30.7	0.1	8.4	70	4

MEXICANA SOIL

Location: northside of Bullock Lake, Saltspring Island
Landform: morainal blanket, rolling to hilly landscape
Topography: strong to very strong slopes (21-31%) mounded microtopography
Parent materials: gravelly sandy loam to gravelly loam, morainal deposits <100 cm deep over compact, unweathered till
Present land use: second-growth coast Douglas fir with predominantly salal ground cover
Remarks: Mexicana soil is commonly classified as Orthic Dystric Brunisol; only a few Mexicana soils have a well-developed Bt horizon, mottling noticeable only when the soil is dry

Longitude: 123°30'25"W
Latitude: 48°52'30"N
Elevation: 90 m
Drainage: moderately well
Perviousness: moderately
Effective rooting depth: 30 cm
Classification: Brunisolic Gray Luvisol

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	0-4	very dark grayish brown (10YR 5/3)	brown (10YR 3/2)	sandy loam	strong	coarse	granular	soft	friable	none	15
Bm	4-23	dark yellowish brown (10YR 4/4)	light yellowish brown (10YR 6/4)	sandy loam	moderate	medium	subangulur blocky	slightly hard	friable	none	25
BA	23-50	brown to dark brown (10YR 4/3)	yellowish brown (10YR 5/4)	sandy loam			massive	hard	firm	few,fine,faint, yellow brown (10YR 5/6)	5
Bt	50-95	dark yellowish brown (10YR 4/4)	yellowish brown (10YR 5/4)	loam			massive	hard	very firm	common, medium, faint brown to dark brown (7.5YR 4/4)	10
BC	95-130	dark yellowish brown (10YR 4/4)	yellowish brown (10YR 5/4)	loam			massive	hard	firm	few, medium, faint strong brown (7.5YR 5/6)	15
R	130+			sandstone							

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	5.4	4.7	0.17	28	0.2	0.2	19.1	9.8	1.6	0.8	0.1	64	58	18	32	10	0.26
Bm	5.0	1.0	0.05	20	0.2	0.2	9.9	3.9	0.8	0.5	0.1	53	59	19	30	11	0.37
BA	4.9	0.5	0.03	17	0.1	0.1	9.4	4.1	1.3	0.3	0.1	62	58	17	29	13	0.39
Bt	5.1	0.4	0.03	13			12.4	5.3	2.7	0.1	0.2	67	53	18	26	21	0.35
BC	4.9	0.5	0.02	25			11.7	5.0	2.4	0.1	0.2	66	51	12	35	14	0.36

PARKSVILLE SOIL

Location: east of "hairpin turn" Bedwell Harbour Road, North Pender Island
Landform: blanket of marine deposits overlying level terrain
Topography: level (2% slope), with smooth microtopography
Parent materials: sandy loam, marine deposits overlying silty clay loam, marine deposits
Present land use: pasture; rushes and grasses
Remarks: sand lens present in BCg; Ap horizon much finer textured than common Parksville soil

Longitude: 123°16'31"W
Latitude: 48°47'5"N
Elevation: 50 m
Drainage: poorly
Perviousness: slowly
Effective rooting depth: 20 cm
Classification: Orthic Humic Gleysol

PROFILE DESCRIPTION

Horizon	Depth	Color		Texture	Structure			Consistence		Mottles	Coarse fragments
	(cm)	moist	dry		grade	class	kind	dry	moist		(%)
Ap	0-20	very dark brown (10YR 2/2)	dark brown (10YR 3/3)	clay loam	strong	coarse	angular blocky	hard	friable	none	<5
Bg	20-50	olive brown (2.5Y 4/4)	pale brown (10YR 6/3)	sandy loam	moderate	very coarse	angular blocky	slightly hard	very friable	com.,fine,prom. dark yellowish brown (10YR 4/6)	<5
BCg	50-70	grayish brown (2.5Y 5/2)	light yellowish brown (2.5Y 6/4)	loam	strong	very coarse	angular blocky	hard	very friable	com.,medium,prom. strong brown (7.5YR 5/6)	<5
IICg	70-100+	olive brown (5Y 5/2)	light browish gray (2.5Y 6.5/2)	silty clay loam			massive	very hard	firm	com.,fine,prom. yellowish brown (10YR 5/6)	<5

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C	Total N	C:N ratio	Oxalate		Cation exchange					Base sat.	Particle size distribution				Soil erosion
					Fe	Al	CEC	Ca	Mg	K	Na		Total sand	Very fine sand	Silt	Clay	
		(%)	(%)		(%)	(%)	(meq/100 g soil)					(%)	(%)	(%)	(%)	(%)	(K value)
Ap	5.3	3.9	0.29	13	1.0	0.5	32.2	18.4	4.1	0.4	0.2	70	36	8	36	28	0.28
Bg	5.3	0.3	0.03	10	0.3	0.2	11.4	7.7	2.3	0.1	0.1	89	61		30	10	0.32
BCg	5.6	0.3	0.03	10	0.4	0.2	18.5	12.7	4.2	0.1	0.2	93	50		32	18	0.30
IICg	5.9	0.2	0.02	10	0.5	0.3	25.1	18.3	6.7	0.2	0.3	100+	12		55	33	0.42

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: typical Qualicum profile, except for the 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		Texture	Structure			Consistence		Mottles	Coarse fragments (%)
		moist	dry		grade	class	kind	dry	moist		
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.		Oxalate		Cation exchange					Base sat.	Particle size distribution			Soil erosion
					Fe	Al	Fe	Al	CEC	Ca	Mg	K	Na		Total sand	Silt	Clay	
		(%)	(%)		(%)	(%)	(%)	(%)	(meq/100 g soil)					(%)	(%)	(%)	(%)	(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

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, and common gorse
Remarks: profile deeper (>100 cm), finer textured and slower perviousness than typical 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 (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse fragments (%)
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 (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	5.9	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 common 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

SUFFOLK SOIL

Location: 300 m on logging road northwest of Hunter Farm boundary, 7 m upslope, Thetis Island
Landform: marine veneer overlying glacial till blanket, rolling landscape
Topography: moderate slopes (15%), smooth microtopography
Parent materials: shallow, loam to silty clay loam, marine deposits overlying sandy loam, glacial till deposits
Present land use: forested; coast Douglas fir, salal, and dull Oregon-grape
Remarks: much higher CF percentage in surface horizons than common in Suffolk soil

Longitude: 123°41'35"W
Latitude: 48°59'55"N
Elevation: 20 m
Drainage: imperfectly
Perviousness: slowly
Effective rooting depth: 60 cm
Classification: Gleyed Dystric Brunisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color: moist	Color: dry	Texture	Structure: grade	Structure: class	Structure: kind	Consistence: moist	Consistence: wet	Mottles	Coarse frag. (%)
LFH	5-0										
Ah	0-10	very dark brown (7.5YR 2.53)	brown (10YR 5/3)	gravelly loam	moderate to strong	medium	granular	friable	nonsticky	none	40
Bm1	10-28	dark yellowish brown(10YR 3/4)	pale brown (10YR 6/3)	gravelly loam	moderate	medium	subangular blocky	friable	nonsticky	none	35
Bm2	28-40	dark yellowish brown (10YR 4/4)	pale yellow (2.5Y 7/4)	silt loam	weak to moderate	medium	subangular blocky	friable	nonsticky	none	10
Bm3	40-55	dark yellowish brown (10YR 4/4)	pale yellow (2.5Y 7/4)	silt loam to silty clay loam	moderate	medium	subangular blocky	firm	sticky	none	0
BCg	55-73	dark yellowish brown (10YR 4/4)	pale brown (2.5Y 7/4)	silty clay loam	moderate	medium	pseudo-platy	firm	sticky	many,medium,prom. dark brown (5YR 4/4)	0
Cg	73-100	grayish brown (2.5Y 5/2)	light gray (2.5Y 7/2)	silt loam	strong	medium to coarse	pseudo-platy	very firm	slightly sticky	many,medium,prom. dark brown (5YR 4/4)	0
IICg	100-106+	olive brown (2.5Y 4/4)	pale yellow (2.5Y 7/4)	gravelly sandy loam			massive	friable	nonsticky	many,medium,prom. yellowish brown (10YR 5/6)	20

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)
LFH	5.4				0.1	0.2	0.4	0.3	75.9	51.1	7.1	1.8	0.1	79					
Ah	5.4	5.7	0.24	24	0.3	0.3	0.7	0.5	33.1	14.6	2.5	1.0	0.1	55	41	9	42	17	0.30
Bm1	5.4	1.6	0.10	16	0.3	0.3	0.6	0.6	17.7	5.8	1.3	0.7	0.1	45	46	7	36	18	0.32
Bm2	4.7				0.2	0.2	0.8	0.5	22.0	5.9	2.5	0.3	0.2	40	23		52	25	0.42
Bm3	4.5				0.2	0.2	1.0	0.5	28.5	6.9	3.3	0.3	0.2	37	19		54	27	0.44
BCg	4.4				0.2	0.2	1.1	0.5	25.0	6.1	2.8	0.2	0.2	37	13		57	30	0.44
Cg	4.1				0.1	0.2	0.8	0.4	21.9	4.7	2.0	0.1	0.2	32	19		61	20	0.53
IICg	4.4				0.1	0.1	0.6	0.4	12.2	2.1	0.8	0.1	0.1	25	56		37	7	0.40

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 (82/05/14); Ae horizon not common 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		Texture	Structure			Consistence		Mottles	Coarse fragments (%)
		moist	dry		grade	class	kind	dry	moist		
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 (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)
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 typical profile, reflected in nontypical vegetation

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 moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse frag. (%)
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 (%)	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. (%)	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 only for horizons in about the top 50 cm of the soil.

The Atterberg limits (liquid limit and plastic limit) 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 only 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	-	-	-
	Bc	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
Cowichan	Ap	0-24	22	-	-	-
	Aeg1	24-33	15	-	-	-
	Aeg2	32-40	7	-	-	-
	Btg1	40-53	16	-	-	-
	BCg	70-90	-	51	25	26
Fairbridge	Bm1	0-20	19	-	-	-
	Bm2	20-29	14	-	-	-
	IIAegj	29-37	15	-	-	-
	IIBtg	37-65	14	-	-	-
	IICBg	65-80	14	-	-	-
	IICg1	80-125	13	48	29	19
	IICg2	125+	13	44	25	19
Galiano	Ah	0-9	21	-	-	-
	Bfj	9-40	19	-	-	-
	C	40-55	17	33	28	5

(continued)

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

Soil	Horizon	Depth (cm)	AWSC (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)
Mexicana	Ah	0-4	13	-	-	-
	Bm	4-23	11	-	-	-
	BA	23-50	8	-	-	-
	Bt	50-95	-	23	18	5
	BC	95-130	-	19	18	1
Parksville	Ap	0-20	13	-	-	-
	Bg	20-50	11	-	-	-
	IICg	70-100	-	42	22	20
Qualicum	Ah	0-9	12	-	-	-
	Bm1	9-45	4	-	-	-
	BC	65-100	-	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
Suffolk	Ah	0-10	11	-	-	-
	Bm1	10-28	6	-	-	-
	Bm2	28-40	7	-	-	-
	Bm3	40-55	13	-	-	-
	BCg	55-73	-	41	28	13
	Cg	73-100	-	35	24	11
	IICg	100-106+	-	NP	NP	NP
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.