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Soils of the Gulf Islands of British Columbia

Volume 3 Soils of Galiano, Valdes, Thetis, Kuper, and lesser islands

Report No. 43 British Columbia Soil Survey 1989

Canada

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Report No. 43
British Columbia Soil Survey

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(Acompanying map sheets from Soils of the Gulf Islands of British Columbia series:
- Galiano and lesser islands
- Valdes and lesser islands
- Thetis, Kuper, and lesser islands)

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Cover photo: Galiano Island looking northwest over Montague Harbour and Trincomali Channel.

Courtesy: A.J. Green

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PREFACE

Galiano, Valdes, Thetis, Kuper, and lesser islands cover a total area of 11 468 ha in the Gulf Islands of British Columbia shown on map sheets 92B/13 and 14 and 92 G/4 in 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 three accompanying soil maps show the distribution and extent of the soil map units. The map legends identify each map unit by color and symbol. Each gives the proportion of dominant, subdominant, or minor soil components, the origin and texture of the parent materials, the soil depth, soil drainage, and the landscape characteristics for each map unit. The report and maps are complementary; therefore, it is necessary to use both to fully understand the soils. The soil maps with extended legends have also been produced on a 1:20 000 orthophoto base and may be viewed at the Map Library, Maps B.C., Ministry of Environment, Victoria, B.C.

Note: This publication is the third 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 4 Soils of Gabriola Island and lesser islands; and
Volume 5 Soils of Sidney, James, Moresby, Portland, and lesser islands.

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PART 1. INTRODUCTION

The first soil survey that included the Gulf Islands was completed in the late 1950s (Day et al. 1959). At a scale of 1:63 360 (one inch to one mile), this survey served a useful purpose to land planners and agriculturists over the years. During the Canada Land Inventory mapping program in the 1960s more soils information was obtained for the Gulf Islands to produce soil capability maps for agriculture and other uses (1:50 000). Since 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 were used by planners to draft official community plans for the islands, but no published soil survey reports accompanied them. With increasing population pressures on the Gulf Islands, Islands Trust identified the need for more detailed resource information for land use planning (Barr 1978).

In 1978, Islands Trust requested the Terrestrial Studies Section of the Surveys and Resource Mapping Branch, Ministry of Environment, Victoria, B.C., to undertake a comprehensive and detailed mapping program covering the Gulf Islands, south of Nanaimo, that 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 the resource folios became the responsibility of the British Columbia Soil Survey 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 program included all other southern Gulf Islands from Nanaimo to Victoria.

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

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

Fieldwork for the Gulf Islands soil survey commenced during the summer of 1979, 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 1980 by the Terrestrial Studies Section, British Columbia Ministry of Environment. 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 Volume 1 Soils of Saltspring Island (van Vliet et al. 1987).

Fieldwork for the soil inventory for North Pender, 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 years (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).

Fieldwork 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.

PART 2. GENERAL DESCRIPTION OF THE AREA

Location and extent

Soil Survey Report No. 3 for the Gulf Islands includes a group of islands lying between longitudes 123°18'30" and 123°46'0"W and between latitudes 48°51'40" and 49°7'30"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. The main islands discussed in this report are Galiano, Valdes, Thetis, and Kuper islands (see Fig. 1). Also included are a number of small islands such as Gossip Island off Galiano Island in Active Pass, and Parker, Wallace, Secretary, Jackscrew, Norway, and Hall islands, which lie in Trincomali Channel. Ruxton and De Courcy islands are located between Valdes and Vancouver islands. Many named islets are also included, such as Ballingall and Miami islets. Table 1 lists the size of the islands within the survey area.

Several small unnamed islands have not been included in this compilation of area calculations. Discrepancies in area size may occur because of the difficulty of locating the high-water shoreline of the islands on the 1:50 000 topographic maps.

History and development

The first inhabitants of the area were the Coastal Salish Indians who had villages on Vancouver and Kuper islands and who included the southern Gulf islands as part of their territory for hunting, fishing, and clam digging. The islands were regarded as summer camps and stopover sites during long trips up the Fraser River. On many of the islands are large middens showing successive cultures going back at least to the Locarno culture recognized at Vancouver and dated by carbon 14 as 2300 years old. Mitchell (1971) used carbon 14 dating on archeological site deposits from the north end of Galiano Island and suggested that the assemblage of these deposits took place between the 1st century B.C. and the 6th century A.D. Porlier Pass seems to have been exploited seasonally by the Penelekut Indians from Kuper Island and the Tetukka Indians from Shingle and Cardale points on Valdes Island (Suttles 1952). Suttles (1952, p. 12) reports, "It was in Porlier Pass that the Penelekuts and their neighbours hunted sea-lions."

European explorers noted the area towards the end of the 18th century. In June 1792, Capt. George Vancouver met Galiano and Valdes, lieutenants of the Spanish commander Quadra and exchanged information on the passes between the mainland and the large island later known as "Quadra's and Vancouver's Island," which had just been circumnavigated by the Spaniards. These passes, very dangerous for sailing ships, were those among what are now known as the Gulf Islands. Place names throughout the islands commemorate the men and ships of those early expeditions (Akrigg and Akrigg 1973).

Early white settlement came slowly, sparked by coal mining at Nanaimo and the gold rushes up the Fraser River and into the Cariboo region. Settlers spread from Victoria to Saltspring Island and to the lesser islands. They had trouble with the Cowichan Indians, who came at intervals to dig and cure clams

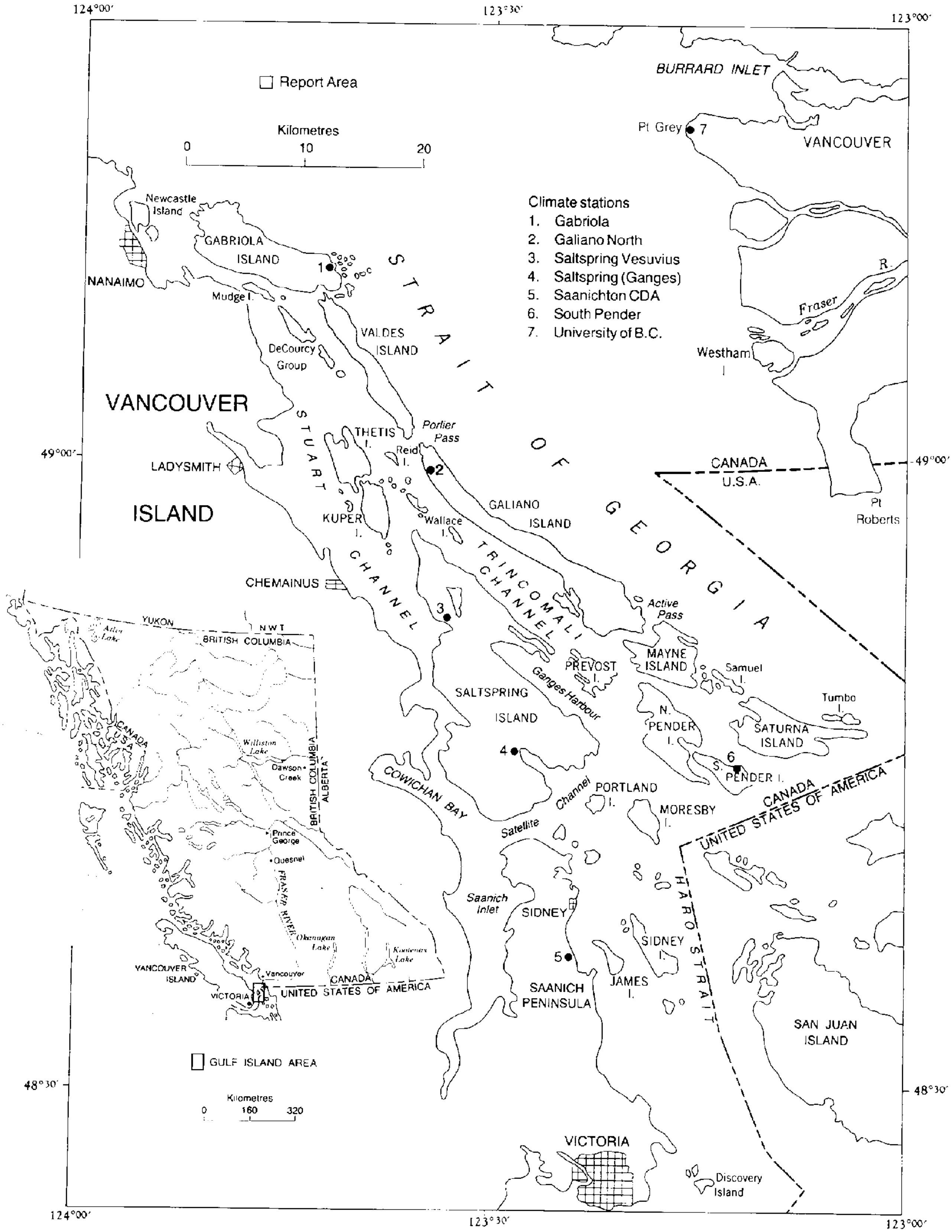

Figure 1. Location of Galiano, Valdes, Thetis, Kuper, and lesser islands in relation to the Gulf Islands and the Province of British Columbia (inset)

Table 1. Size of the surveyed islands by map sheet

Name of island or islet		Area (ha)
a. Galiano and lesser islands		
Ballingall Islets		1.6
Charles Island		6.6
Galiano Island		5787.0
Gossip Island		50.0
Julia Island		5.6
Lion Islets		2.5
Parker Island		165.8
Retreat Island		3.3
Sphinx Island		4.4
Wise Island		20.8
Boscowitz Rock		
Romulus Rock		
Walker Rock		
York Rock		
	Total	6047.6
b. Valdes and lesser islands		
Canoe Islet		0.6
De Courcy Island		221.9
Kendrick Island		8.3
Link Island		35.8
Long Island		12.0
Pylades Island		65.0
Ruxton Island		110.8
Tree Island		1.7
Valdes Island		2488.0
Black Rock		
Virago rock		
	Total	2944.1

(Continued)

Table 1. Size of the surveyed islands by map sheet (concluded)

Name of island or islet	Area (ha)
c. Thetis, Kuper, and lesser islands	
Dayman Island	9.3
Hall Island	29.3
Hudson Island	20.8
Jackscrew Island	12.5
Kuper Island	968.3
Leech Island	2.5
Miami Islets	1.7
Mowgli Island	7.5
Norway Island	21.7
Ragged Islets	0.8
Reid Island	112.5
Rose Islets	0.8
Scott Island	2.5
Secretary (North) Island	75.0
Secretary (South) Island	36.7
Tent Island	30.8
Thetis Island	1036.0
Wallace Island	115.0
Whaleboat Island	4.2
Inset - Ladysmith Harbour	
Woods Islands	15.0
Dunsmuir Island	4.0
Inset - Shoal Islands in Stuart Channel	
Willy Island	45.0*
Alarm Rock	
Sandstone Rocks	
Total	2551.9

* Estimated.

on the beaches. The Indians considered the settlers intruders and occasionally attacked them. Some homes were burned and some settlers were murdered. In Victoria, authorities took disciplinary action and from then on the settlers had much less trouble. Settlers at the end of the 19th century were predominantly British military officers retired from service in India and other parts of the Empire. They and their families lived leisurely lifestyles and development progressed at a snail's pace. Fishing and logging were the main industries and small farms, predominantly dairy cattle and sheep, prospered. Farm produce was shipped by steamer to Vancouver. After 1946, transport was difficult, competition was keen, and farming in the islands declined. In the 1950s, after B.C. Ferries came into being, travel to and from the islands became more accessible and traffic increased rapidly. Much land on the islands was subdivided and sold as sites for summer homes and for retirement homes. The population in the islands swelled dramatically during the summer. Service industries grew to take care of more people. Tourist resorts and marinas were built to attract tourists.

Wildlife

Apart from the deer, no large mammals are left on the islands. The wapiti, black bear, cougar, and wolf have been unable to remain on small islands where people have settled for generations. At present, the principal mammals are deer, northwest raccoons, mink, sea otters, and squirrels. Of these, only the deer are found on all the islands.

Marine life and bird life

A lucid description of the marine life of the Gulf Islands was given in the Canadian Geographic Journal (Williams and Pillsbury 1958). Birds, especially sea birds, are abundant. Cormorants, gulls, guillemots, and black oyster catchers nest on reefs, rocky islets, and cliffs according to their specific preference. Crows, ravens, and bald eagles nest throughout the islands. Other interesting birds in the islands are pheasants, grouse, California quail, turkey vultures, and rufous humming-birds. The latter feed much on the nectar and insects in blooms of red-flowering currant (Ribes sanguineum).

All year-round killer whales can be seen following the salmon. Harbor seals are common, tame, and most inquisitive. They breed on smooth, rocky reefs everywhere. Porpoises can be seen in the channels. Any rocky shore is home to at least six species of star fish, of which the most common is the purple star (Pisaster ochraceus). They are found in great masses, scores together in the mid-tide region. They are up to 45 cm across and are blue-purple to dull orange in color.

The largest of these starfish are pests on clam beaches and oyster farms. Worst are the sunflower stars, which are soft and very fast-moving for starfish. They have been known to destroy a bed of cockles in a season. Also they invade crab traps and eat the bait.

Sea urchins, mostly green ones (Strongylo-centrotus drobachiensis), come in great swarms at times. Below the low tide level are the great red urchins (S. franciscanus). On the sandy beaches live the sand dollars (Dendraster excentricus), which have brown-purple cookie shapes.

Every gravelly beach has its clams: littlenecks (Protothaca staminea), butter clams (Saxidomus giganteus), and horse clams (Schizothaerus nuttallii) and (S. capax). On a few sandy beaches are the famous geoducks (Panope generosa), huge animals with shells no bigger than horse clams but unable to get inside them (Williams and Pillsbury 1958).

Beaches swarm with square-bodied shore crabs - large red ones (Hemigrapsus nudus) and smaller, dull gray-green ones (H. oregonensis) that have hairy legs. The latter are inclined to burrow; the bare-legged ones never do. There are three species of Hermit crabs (Pagurus). Low down, near extremely low water, are many spider crabs, several of which decorate themselves with seaweeds, having special rows of curling hairs to hold such objects.

Market crabs (Cancer magister) are common on eelgrass (Zostera marina) beds and down to ten fathoms on sand or mud bottom. The Americans call these Dungeness crabs after Dungeness, site of a great crab fishery on the Strait of Juan de Fuca. The rock crab (C. productus) is smaller than the market crab, seldom reaching more than 15 cm across. It is found on rocky beaches and is very good to eat. It is mahogany-red in color.

The variety of seaweeds and marine algaes is much greater here than on the Atlantic coast. Most evident are the rockweeds and kelps. One that never fails to interest is the sea onion or bull kelp (Nereocystis leutkana) with its large base-ball size float at the tip of a stem 7.5-15 m long.

In the eelgrass are great numbers of small shrimps and fishes of many kinds such as rock fish (Sebastodes sp.) and surfperch (Embiotocidae).

Land use

In the early days of settlement, Galiano was regarded by many as the least fertile of the Gulf Islands for its size. However, in the southwestern end some arable land with subdued relief is found. The first land to be cleared was in wet depressions that stay moist for long periods and that have heavy stone-free soils. Once some drainage had been provided, these soils were well suited for pasture and for the cultivation of vegetables and hay. Fruit trees were planted upslope on gravelly surface soils overlying imperfectly drained silty clay, which allowed them to have moisture during the dry summers but still to be located above high-water level during wet winters. Cattle pastured on the higher ground around the cultivated areas, whereas sheep grazed the open forest and rocky knolls. Farming in the early days supplied produce to markets on Vancouver Island and on the mainland. However, increased competition for the markets and the lack of good land on which to expand has led to a decline in production except for the local trade and for specialities, such as spring lamb. Of a total area of 5787 ha on Galiano Island, 382 ha are in the agriculture land reserve.

After 1945, many people were attracted by the mild winters and dry, sunny summers as well as by the quiet, rural atmosphere of the island. Many built recreational homes for summer use whereas others retired from the work force and became permanent island residents. The population of the islands has risen slowly but steadily since the late 1940s.

The growth of tourism in the islands, particularly during the months of May through to October, promotes outdoor activities such as swimming, fishing, and hiking. Several marinas now cater to the needs of recreational boaters and commercial fisherman.

About two-thirds (4572 ha) of Galiano Island is held under tree farm licence by MacMillan Bloedel Ltd. and an active logging program has been pursued for the past few years (Plate Ia).

Thetis Island has a similar pattern of land use as Galiano but is much smaller and has no tree farm licence; but some timber is logged periodically. Of a total area of 1036 ha, 51 ha is in the agriculture land reserve (Plate Ib).

Valdes Island, which covers an area of 2488 ha, has had very little development because most of the land is in tree farm licence (1026 ha) and Indian Reserve. Indians use the reserve particularly for clam digging but do not live there on a year-round basis. Kuper Island is the main Indian center in the Gulf Islands. Neither Valdes nor Kuper islands are involved with the Islands Trust.

Of the total survey area of 11 468 ha, the greater part is privately owned. Apart from small holdings there are tree farm licences over extensive lands on Galiano and Valdes islands. Six Indian reserves are located on four of the islands, the largest being on Kuper Island. Two provincial parks are both located on Galiano Island (Bellhouse and Montague Harbour Marine Park). Another marine park is located on De Courcy Island (Pirate's Cove). One marine life ecological reserve is located on Canoe Islets off Valdes Island and another in Trincomali Channel (Rose Islets). There is also a nature park on Ballingall Islets in Trincomali Channel.

Transportation and energy

The B.C. Ferry Corporation provides daily service from Galiano Island to Tsawwassen on the mainland and to Swartz Bay on Vancouver Island. Thetis and Kuper islands have daily ferry service to Chemainus on Vancouver Island. Valdes and the smaller islands can be reached by water taxi or by private boat.

Galiano, the largest island in the survey area has a 74-km network of paved roads mainly on the south end of the island; one paved road serves the northwest end of the island. Thetis is also served by paved roads. Valdes has a network of old logging roads whereas Kuper Island has unpaved roads leading from the ferry dock to the Indian village and to several other points on the island.

B.C. Hydro supplies electrical power to Galiano, Thetis, and Kuper islands. Telephone service is also available.

Climate

The climate of the southern Gulf Islands has been well described by Kerr (1951), Chilton (1975), and Coligado (1979). Kerr (1951) referred to the climate of the Gulf Islands as a "Transitional, Cool Mediterranean Climate." Because of the rainshadow effect of the Olympic Mountains to the south in Washington State and the "Insular Mountains" to the west on Vancouver Island (Holland 1976) as well as the moderating effects of the ocean, summers are warm and generally droughty. These conditions lead to soil moisture deficits for crop production, particularly on coarse-textured soils, and often creates a high fire hazard for the forest.

Climatic records have been kept for many years at various stations within, and around, the Gulf Islands. The location of the stations mentioned in this report are shown (see Fig. 1).

The islands are considered to be one of the sunniest places in Canada with 1300-1400 hours of bright sunshine. Mean monthly temperatures and extreme maximum and minimum temperatures are shown graphically (Fig. 2) for Saltspring Island (Vesuvius). This climatic station is just outside the survey area but temperature trends for it are typical of the survey area. Information on soil temperature is limited; only two stations report. The mean annual soil temperature at a depth of 50 cm is 12°C at the Vancouver (University of British Columbia) station to the east across the Strait of Georgia. It is 11.8°C at Saanichton (Canada Department of Agriculture) on the Saanich peninsula, Vancouver Island.

Heating degree days (HDD) are a measure of the heating requirements of an area. HDD below 18°C amount to around 3000 to 3100 degree days on the southern Gulf Islands. To compare the mildness of winter of the Gulf Islands to other places, HDD for Prince George in central British Columbia amount to 5300 and for Fort Nelson in northeastern British Columbia are 7100.

During the winter months, the weather is cool. About 80% of the rain comes at this time (Fig. 3 and Table 2), but snowfall is light. Visibility is quite often restricted by fog. During winter, the prevailing surface winds in the southern Gulf Islands are southeasterly, however, local relief and frontal passages often disturb this pattern, which leads to a variety of directions. In the warm season, strong northwesterly winds blow along the coast but they produce little rain.

The occurrence of frost is of concern in agriculture because the choice of growing such crops as beans or tomatoes, or even hardier ones such as potatoes or cabbages, is made primarily by considering the expected number of days that are free of frost during the growing season. The variability in the frost-free period is important in many farming operations such as the scheduling of planting and harvesting. The frost hazard is considered primarily an agricultural risk of local concern (Chilton 1980).

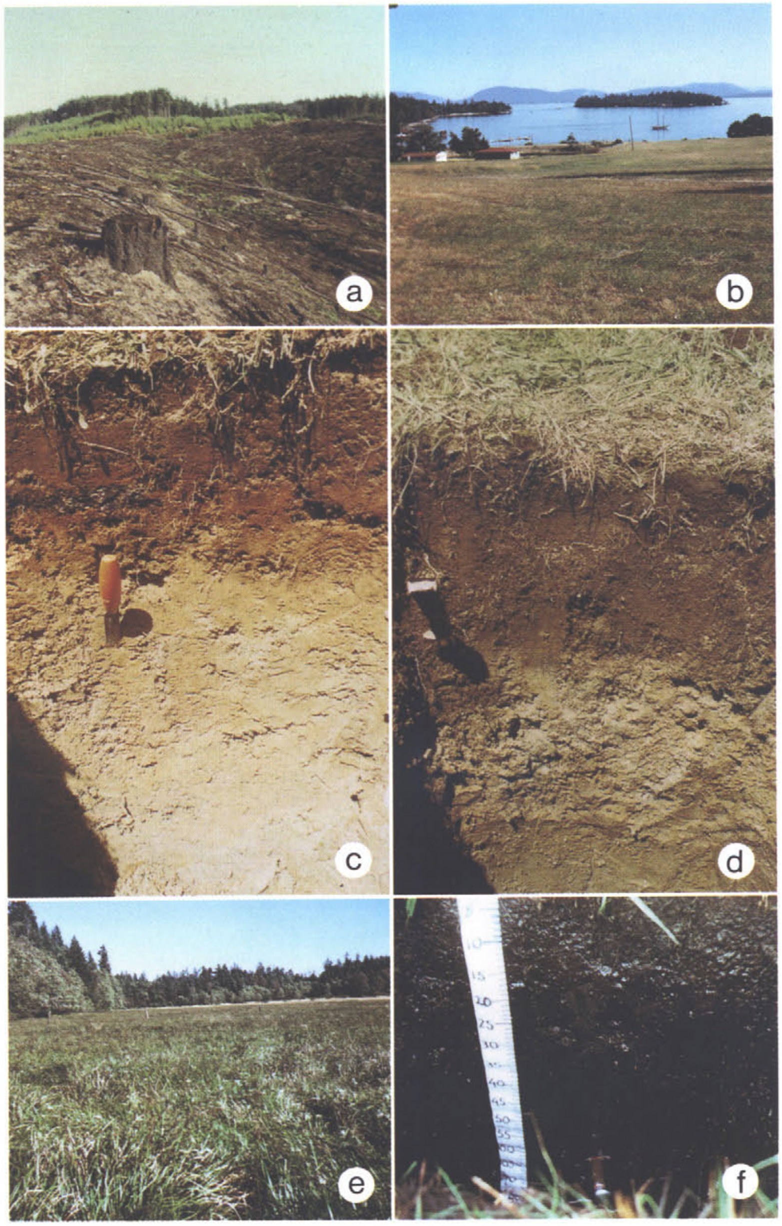

PLATE I (a) Landscape associated with the Saturna soil series: in the foreground is clear-cut logging whereas in the background is 40-year old coast Douglas fir (dark green) and 10-year old regeneration (light green) on Galiano Island.

(b) Landscape associated with the Cowichan, Tolmie, and Fairbridge soil series developed on moderately fine-textured marine deposits, Thetis Island. Typical example of land in the agriculture land reserve.

(c) Profile of the Suffolk soil series that has developed on a shallow deposit of moderately fine-textured marine materials overlying moderately coarse- to medium-textured, compact glacial till.

(d) Profile of the Cowichan soil series in a field that has been drained and cultivated for some time.

(e) Landscape associated with the Metchosin soil series dominated by sedges.

(f) Profile of the Metchosin soil series composed primarily of well-decomposed organic remains of aquatic plants such as sedges and rushes.

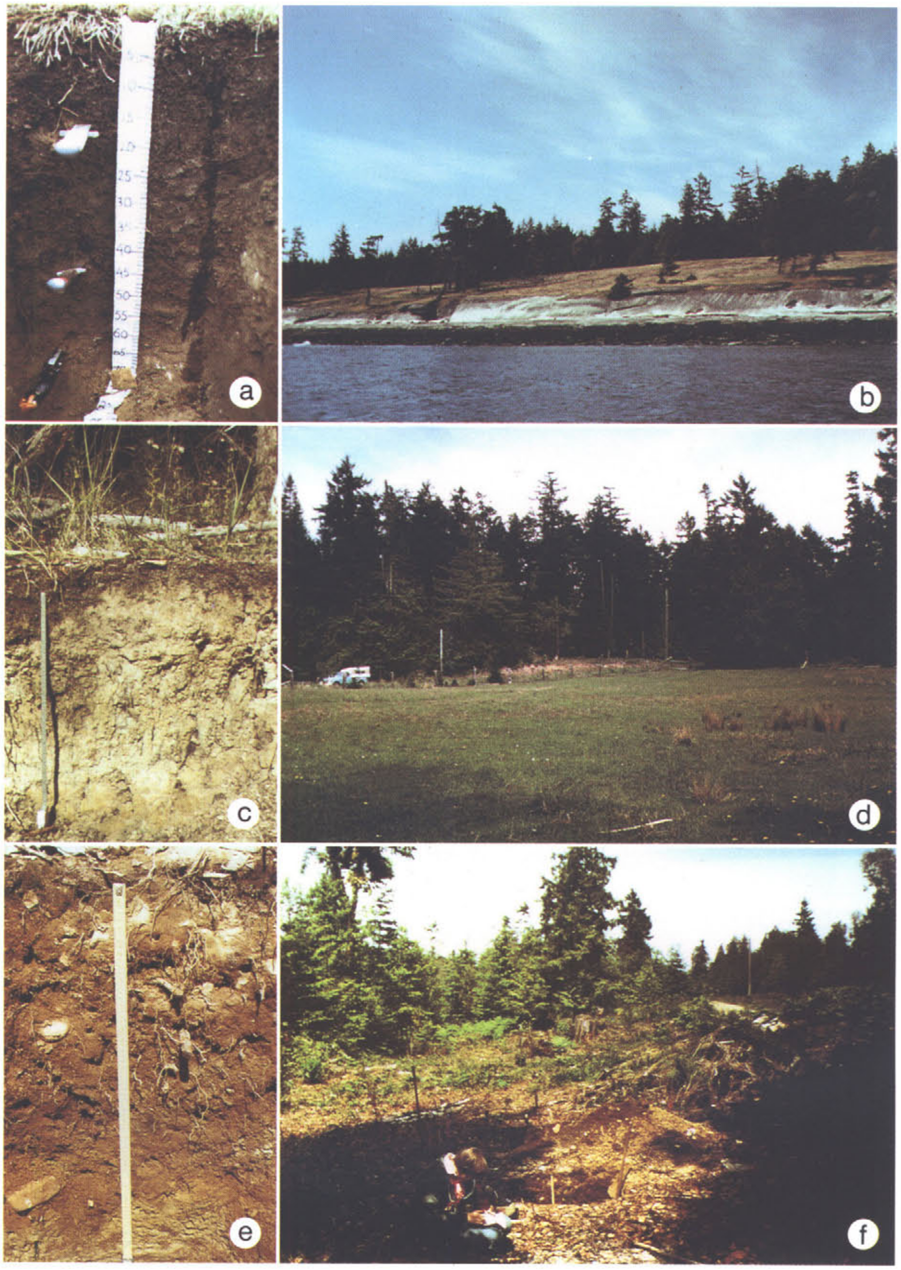

PLATE II (a) Profile of the Bellhouse soil series. A shallow, lithic, coarse-textured soil developed in a thin deposit of colluvium and glacial till over sandstone bedrock.

(b) Landscape associated with the Bellhouse soil series. Very gently sloping sandstone bedrock under a cover of grasses and a few, scattered, stunted trees.

(c) Profile of the Galiano soil series. A loamy soil dominated by shale fragments.

(d) Landscape associated with the Galiano soil series with gently rolling terrain under coast Douglas fir. In the foreground is pastureland on the Tolmie soil series.

(e) Profile of the Trincomali soil series developed on shallow, coarse-textured, marine deposits overlying moderately coarse- to medium-textured, compact glacial till.

(f) Landscape associated with the Trincomali soil series dominated by coast Douglas fir and a ground cover of salal.

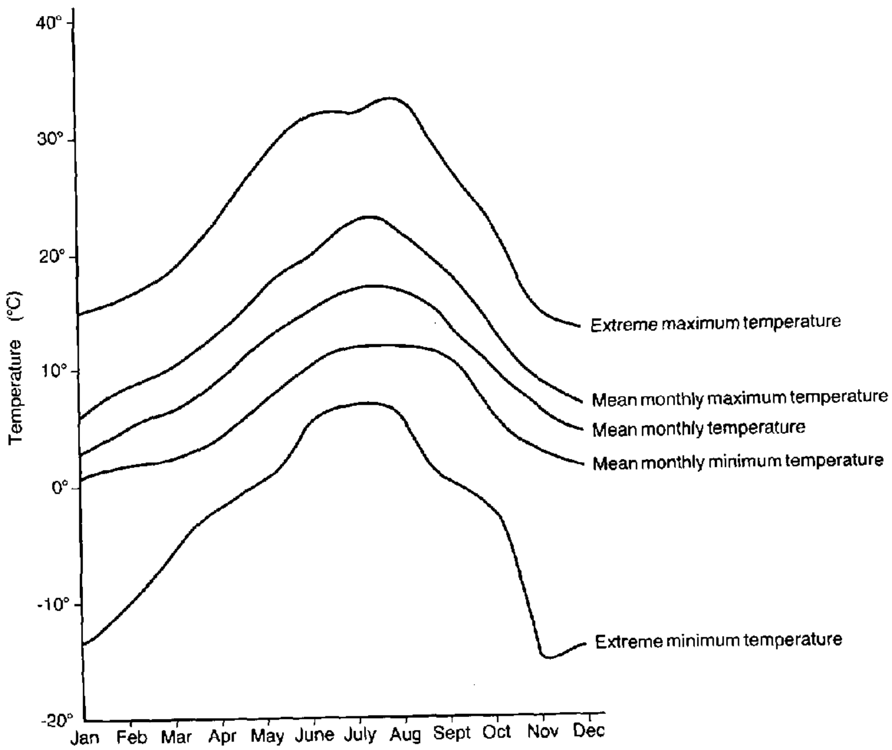

Figure 2. Extreme maximum and minimum temperatures and average temperatures for Saltspring Island (Vesuvius), which is in the proximity of the survey area

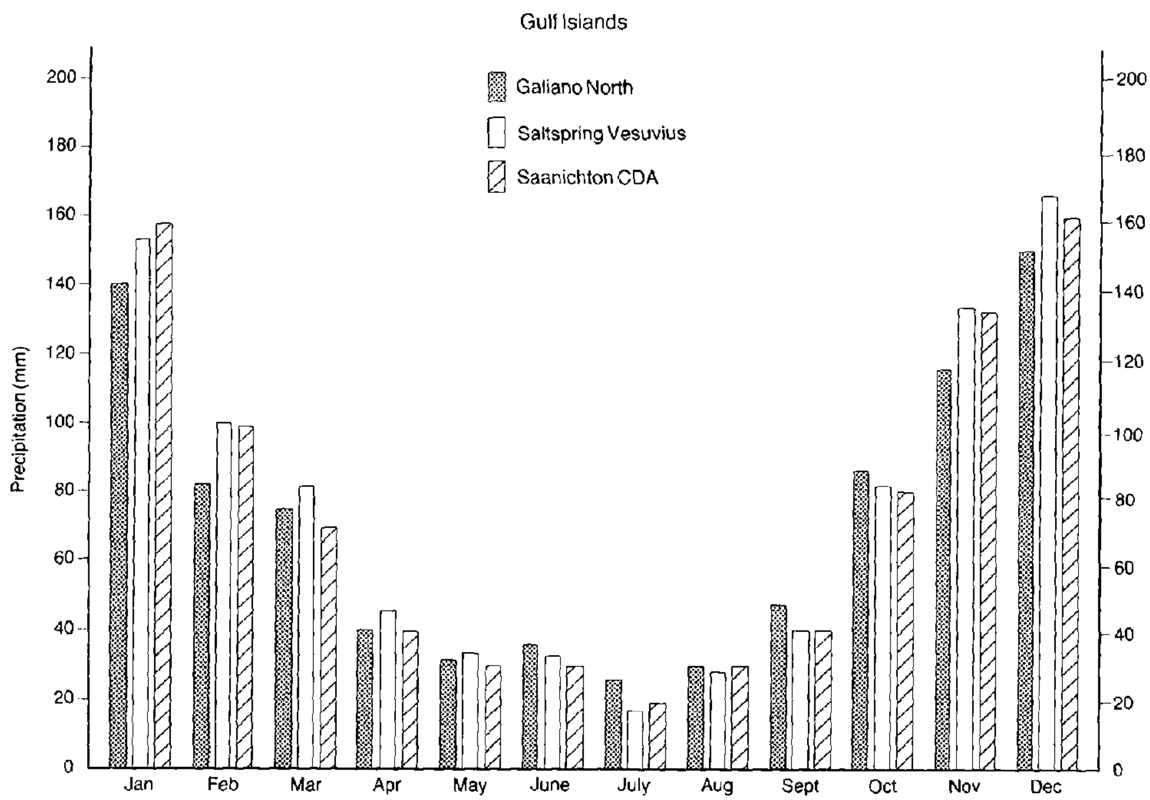

Figure 3. Average monthly precipitation for locations in the proximity of the survey area

Table 2. Average number of days per month having precipitation (rain plus snow)

STATION	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Yearly total
Gabriola Island	15	12	12	12	8	6	5	6	8	11	15	17	125
Galiano North	18	15	15	11	9	8	5	6	8	14	16	18	143
Saltspring Island (Ganges)	19	15	15	12	9	9	6	7	8	14	16	19	149
Saltspring Island (Vesuvius)	19	15	15	11	9	8	5	7	9	13	17	19	147
Saanichton (CDA)	19	15	14	11	9	7	5	7	9	14	17	20	147
South Pender Island	19	16	17	12	11	8	5	7	9	15	18	21	158
Vancouver (U.B.C.)	19	17	17	14	11	10	6	9	10	15	18	21	167

Source: Atmospheric Environment Service (1982).

Information regarding calendar dates for the last frost in the spring and the first frost in the fall are given in Table 3. The climatic stations selected are within and surrounding the survey area (see Fig. 1).

Data for Thetis and Kuper islands is also included in Table 3 although climatic records were kept on those islands only for a relatively short time before 1949. From those records the data on the frost-free period were calculated (Connor 1949).

With a frost-free period of more than 200 days per year, the southern Gulf Islands have the longest growing season in Canada. Some areas susceptible to freezing have frost-free periods of 160 to 170 days, nevertheless, this time is long enough to mature most annual crops (Coligado 1979). The accumulated growing degree days and the effective growing degree days are between 1900-2000 and 1000-1100 respectively. This thermal potential and growing season means that climatically, this area is one of the best for agriculture in British Columbia (B.C. Ministry of Agriculture 1978). Even though all the climatic stations are located below 100 m above mean sea level differences in elevation are less likely to produce changes in climate than are factors such as slope, aspect, and wind exposure.

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 the southern Gulf Islands) and to 150 m in the northern portion (Klinka et al. 1979). The characteristic tree species of the CDF zone is coast Douglas fir (Pseudotsuga menziesii var. menziesii). This species is dominant and the most valuable commercially in virgin and second-growth stands. Drainage of the soils on which it grows ranges from somewhat excessive to imperfect. Krajina (1969) noted that coast Douglas fir grows best on sites of the sword fern association with Gleyed Brunisols in the coast Douglas fir zone or even with Gleyed Ferro-Humic Podzols in the wetter subzone of the western hemlock (Tsuga heterophylla), in which the humus is friable of either the moder or even the mull type.

Associated with the coast Douglas fir on drier sites (coarse-textured and/or shallow soils) is a ground cover of salal (Gaultheria shallon) and dull Oregon-grape (Mahonia nervosa). Mosses (for example, Eurhynchium oreganum and Hylocomium splendens) make a feathery carpet that is bright green in damp weather.

On moister sites in draws and depressions western red cedar (Thuja plicata) is common. Grand fir (Abies grandis) also occurs on mesic to moist sites. Western hemlock is usually found on cooler and moister north-facing slopes. Western yew (Taxus brevifolia) occurs in some places and Rocky Mountain juniper (Juniperus scopulorum) usually occurs on dry, rocky knolls.

Table 3. Dates for last spring and first fall frost, average frost-free period, and annual degree days at selected stations within and surrounding the survey area

Station	Elevation above mean sea level (m)	Dates for last frost in spring			Dates for first frost in fall			Average frost-free period (days)	Annual degree-days (above 5°C)*
		Average	Earliest	Latest	Average	Earliest	Latest		
Galiano North*	6	Mar 10	Jan 30	Apr 7	Nov 20	Nov 10	Nov 27	254	-
Saltspring Island (Ganges)*	73	Mar 31	Jan 26	May 10	Nov 12	Sept 23	Dec 13	225	1963
Saltspring Island (Vesuvius)*	8	Mar 28	Feb 17	May 12	Nov 8	Sept 23	Dec 4	224	2038
Saanichton (CDA)*	61	Apr 12	Mar 1	May 30	Nov 17	Oct 26	Dec 13	218	1887
South Pender Island*	61	Apr 7	Mar 5	May 3	Nov 7	Oct 27	Nov 26	213	1951
Vancouver (U.B.C.)*	87	Mar 16	Feb 2	Apr 5	Nov 16	Oct 27	Dec 12	244	1964
Kuper Island**	6	Apr 24	Apr 5	May 15	Oct 20	Sept 21	Nov 7	179	-
Thetis Island**	9	Apr 24	Apr 12	May 4	Oct 30	Oct 18	Nov 18	189	-

* Atmospheric Environment Service (1982).
** Connor (1949).

On dry, rocky sites, south-facing and usually quite close to the shoreline, Garry oak (Quercus garryana) is found along with Pacific madrone (Arbutus menziesii) and, in some places, bigleaf maple (Acer macrophyllum). The ground cover is often grasses along with broad-leaved stonecrop (Sedum spathulifolium) and nodding onion (Allium cernuum). Some oceanspray (Holodiscus discolor ssp. discolor) bushes occur and Scotch broom (Cytisus scoparius) may be found in clumps.

Much of the land in these Gulf Islands has been disturbed either by logging or by fire and much has been cleared for farming and settlement. Consequently, much of the vegetation no longer represents virgin sites but rather represents pioneer species recolonizing after fires and species introduced by people. In the case of logging, red alder (Alnus rubra) is common on moist sites along with American stinging nettle (Urtica dioica) and western sword fern (Polystichum munitum).

Bigleaf maple occurs generally on moist sites along the edge of cleared fields and pastures; it is commonly dominant in old, treed pastures along with western red cedar. Scouring-rush (Equisetum hyemale) and common horsetail (Equisetum arvense) are found in wetter sites. Buttercups (Ranunculus spp.) are found in pastures, American skunk-cabbage (Lysichiton americanum) and sedges (Carex spp.) occur in wet, sluggish drainageways. Bogs are common under a dense cover of hardhack (Spiraea douglasii), willows (Salix spp.), and sedges.

Scotch broom takes over many abandoned fields: common gorse (Ulex europaeus) is less common. Orchard grass (Dactylis glomerata) is the most common grass and is found in fields and alongside roads and trails.

Western flowering dogwood (Cornus nuttallii) is found scattered in mixed stands of hardwoods and conifers on mesic sites. Pacific trailing blackberry (Rubus ursinus), western bracken (Pteridium aquilinum pubescens), and fireweed (Epilobium angustifolium) are pioneer species coming in after burning and on logged over sites.

Salmonberry (Rubus spectabilis) is found on moist sites commonly in association with western red cedar. Red huckleberry (Vaccinium parvifolium) is found in cool, shady sites at forest openings and along roadsides.

Shore pine (Pinus contorta var. contorta) occurs in a few places on coarse-textured rocky sites close to the shoreline particularly on northern exposures. MacMillan Bloedel Ltd. has a plantation of Lodgepole pine (Pinus contorta var. latifolia) on a cutover area on Valdes Island.

A list of common trees, shrubs, and herbs (Clement 1981) that occur in this survey area is given in Appendix 1.

Geology

The survey area is entirely underlain by the sedimentary formations of Upper Cretaceous age (Muller and Jeletzky 1970). These formations comprise alternating beds of conglomerates, sandstones, and shales with an estimated total thickness of 3050 m (Williams and Pillsbury 1958). They are an extension of the Nanaimo coal-bearing series of Vancouver Island. The seaward Nanaimo formations underwent folding, faulting, and thrusting toward the northeast during Late Tertiary mountain building when the Cascades and Olympic Mountains were formed in Washington State. In the surveyed area, the northeastward folding is more gentle and regular with axes more widely spaced. Faulting is less common. The islands take on a linear character parallel to outcrops of the more resistant formations. Numerous vertical faults cross the folds at right angles to their axis. Active Pass between Galiano and Mayne islands suggests a tear fault. The narrow boat channel between Thetis and Kuper islands is on the locus of a tear fault.[1]

The most outstanding structural feature of the southern Gulf Islands is the Trincomali anticline, which continues from Dodd Narrows near Nanaimo to the southeast end of Saturna Island. Its axis follows a gentle curve concave to the northeast, through continuous waterways of which Trincomali Channel is the most prominent.

Physiography

Surface features of the Gulf Islands reflect the geology of the region. The dominant landforms are long cuestas (ridges) overlooking interior lowlands that are generally submerged. Island ridges and peaks are capped by hard conglomerate and sandstones. Smaller valleys have been eroded out of softer, shaly sediments. Larger elongated valleys, mostly submarine, are anticlinal in origin; that is, they have been eroded along the axes of the anticlines where the rocks have suffered tension jointing, making them readily accessible to the agents of erosion. Passes crossing the axes of the islands are mostly, if not entirely, dependent upon structure. Gabriola Passage occurs at a break in structure between Gabriola and Valdes islands.

Both Galiano and Valdes islands are long and quite narrow and strongly reflect the linear character of the underlying sedimentary bedrock. Ridges and hills are much more pronounced on Galiano than on any of the other islands, and the bedrock strata can be seen to dip steeply towards the Strait of Georgia. Sutil Mountain in the southeastern part of the island is 290 m and Mount Galiano is 311 m high. The topography on Valdes Island is more subdued--generally gently rolling with a few steep bluffs. The highest point is Mexicana Hill at 208 m elevation. Thetis Island is about as broad as it is long, generally hilly with a few gently undulating vales. The highest point is Moore Hill at 154 m. Kuper Island to the south of Thetis, has a gently rolling, low profile being no more than 80 m above sea level. Bluffs and bedrock outcrops are rare. Most of the lesser islands are low lying and have bedrock outcrops, particularly along the shoreline.

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[1] A tear fault is one, in which the movement is dominantly strike-slip, i.e., horizontal.

The shores of the islands exhibit interesting erosional structures, including fretted rock surfaces, stacks, and galleries. Beautifully honeycombed or fretted sandstone occurs on the southern tip of Thetis Island.

Notable shore features along westerly or northerly exposures have resulted from dominant westerly winds directing waves against formations that dip mainly easterly (Williams and Pillsbury 1958).

Drainage

On the larger islands surveyed, such as Galiano and Valdes, many depressions between rock ridges and small valleys are filled with poorly drained silts and clays and are occupied by small bogs and lakes. Most surface drainage is controlled by sandstone ridges or by glacially formed relief. Excess rain water in winter finds its way to the sea first through sluggish channels and then through short, deep gorges along faults lying at right angles to the sandstone ridges. These seasonal streams flow vigorously from late fall to late spring and then dry up completely during summer.

Most of the islands' soils are moderately well to well drained because of the widespread presence of coarse-textured, colluvial, glacial drift, and glaciofluvial materials. On Thetis Island, and on Kuper Island in particular, imperfectly drained soils and the cool, wet winters, result in relatively low surface runoff and saturation of the lower part of the soil profile. Although this condition creates high potential for groundwater recharge, it generates problems for urbanization. Poor drainage affects on-site sewage disposal and causes basement flooding. The same condition also creates problems for forest management, such as shallow rooting depth and windthrow hazard.

Water resources

Freshwater supplies on these islands are limited. On the larger islands, water is supplied primarily from wells as there are only a few, short, intermittent streams and only a very few small lakes and bogs. Limited groundwater storage is found in the faults and fractures as well as at the contact zones between the shale and sandstone strata of sedimentary bedrock (Foweraker 1974; Mordaunt and Hodge 1983). During summer, when demand for water is highest, shortages may occur as sources of surface water dry up and the recharge of the groundwater storage is at its lowest level. Potable groundwater is recharged only by precipitation that falls during the late fall and winter (Foweraker 1974). On small islands, residents must store rainwater in cisterns or bring water to the islands.

Water quality in some areas of these islands is also a problem, either where seawater intrudes, where well water is extracted from formations of marine sediments that contain residual salts, or where water is contaminated by domestic or agricultural wastes (Islands Trust 1982, 1984). Water quality data indicate that, in some instances, concentrations of iron, chloride, and hydrogen sulfide surpass the recommended limits for water for domestic use. Iron seems to be the most troublesome contaminant in water for domestic use.

It is commonly associated with shale formations and with acid or neutral water, which may be corrosive. In its insoluble form of ferric hydroxide it stains porcelain. It may also be associated with saltwater intrusion. High concentration of chloride on the islands is from water extracted from marine-deposited sediments containing residual salts or from the intrusion of seawater. The recommended limit for specific electrical conductance in drinking water is 1000 mS/cm. Sulfurous water containing hydrogen sulfide produces a smell of rotten eggs in some wells.

Within the survey area, the only island that has recently had a groundwater study done is Galiano. Detailed information is presented by Mordaunt and Hodge (1983). An observation well was drilled as part of the Water Management Branch's 1979-80 observation well network expansion program. The purpose of the well is to monitor long-term water level fluctuations in an area where increasing development is occurring; to provide information on the amount of recharge to, and the effects of groundwater withdrawal from, the aquifer; and to check on interference with neighboring wells. It is a 15-cm bedrock well drilled to a depth of 90 m. Water-bearing fractures were obtained at depths of 15, 46, 58, and 59 m. Well yield for short-term pumping has been determined as about 174 L/min. Chemical analysis indicates the water is soft and moderately mineralized.

The average well depth and well yield of about 500 plotted well records is 47 m and 17 L/min. The deepest well is 157 m and the greatest well yield reported is 265 L/min.

The major water-bearing sources throughout most of the survey area are the contact zones between shale and "shaly" sandstone. Fractured conglomerate constitutes the major water-bearing source around the Georgeson Bay area.

In the northwestern end of the island demand-to-storage ratios are often greater than 100%. Well density in the southeast far exceeds that in the northwestern area. Water quality problems also occur during periods of peak demand. It may eventually be necessary to conserve rainwater in cisterns and to have a community water supply to service areas where, for example, saltwater contamination is a problem.

Soil parent materials

The islands in the survey area are underlain by a succession of sandstone, shale, and conglomerate formations (Muller 1977). These are often exposed along shorelines, in steep bluffs, and on ridge tops. Exposed flat-lying beds usually present a smooth surface whereas beds vertically inclined are subject more readily to the penetration of 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 IIa), Galiano soils developed on shale (Plate IIc) 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.

In rough, hummocky terrain, where sandstone and shale formations lie in close proximity and are overlain by a veneer of colluvial and glacial drift materials, the soils show much variety. Such materials are called the Haslam Soil Complex.

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. As the ice finally receded, much of the land was inundated after a deluge of meltwater and a rise in relative sea level. In the islands, gravels occur either in "pockets" along the base of high, steep banks or 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 where outwash streams entered larger, deep bodies of water or from the water sorting along beaches. On these gravel deposits, Qualicum soils developed. Deep, sandy deposits are the source for Beddis soils and, in areas of restricted drainage, are the parent material of Baynes soils.

As glaciers overrode the islands, they plucked very little from the sedimentary bedrock to mix with the granitic and volcanic detritus carried from Vancouver Island. As the ice melted, its load was deposited as glacial till. Deep deposits of compact, sandy loam till were deposited in generally protected sites, such as in the valleys between the ridges of sedimentary rock. Mexicana soils are the only ones developed directly in the deep, compact till. In most cases, a veneer of sands and gravels of marine or fluvial origin overlie the compact till, and on this material Trincomali soils have developed (Plate IIe). Suffolk soils have developed on a moderately fine-textured veneer over compact sandy loam till (Plate Ic). The origin of the gravels is more than likely glaciomarine because the maximum elevation for marine deposition has been established at about 100 m in the southern Gulf Islands. Deep deposits of fine-textured marine material, which are generally uniform in texture with depth are the parent material of the poorly drained Cowichan soils (Plate Id) and the imperfectly drained Fairbridge soils. Less uniform texture throughout the deposit gives rise to the development of 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 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 with organic deposits of sedges, willow, and hardhack occur in depressions in valleys (Plate Ie). Most of the peat materials are moderately well decomposed. In some places sedimentary peat occurs. Metchosin soils have developed on these organic deposits (Plate If).

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. Neptune soils developed on these anthropogenic deposits, which occupy tiny but distinct parcels of land.

St. Mary soils have developed on a veneer of coarse-textured materials over a very thin deposit of moderate to fine-textured marine materials over compact unweathered till. These soils must have occupied narrow estuaries or perhaps shorelines in glacial times.

The relationships of the soil parent materials to the landscape is shown in Figure 4, and the soils are classified and grouped by parent materials in the legend to each accompanying soil map (see back pocket).

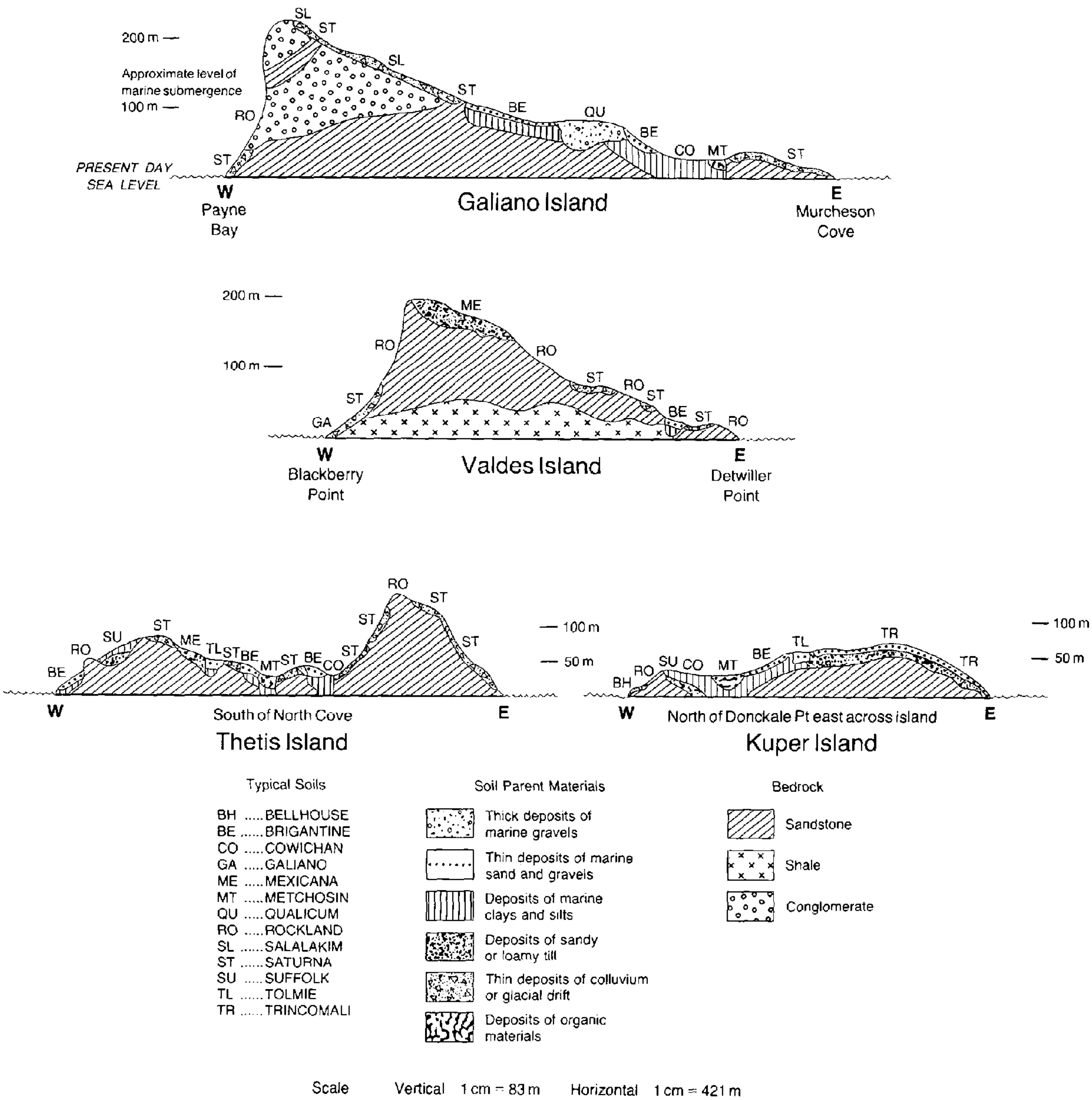

Figure 4. Representative cross-sections of Galiano, Valdes, Thetis, and Kuper islands illustrating the relationship of the physiography to geologic materials and soils

PART 3. SURVEY AND MAPPING PROCEDURES

How the soils were mapped

Before field mapping began, preliminary plotting of soil boundaries and areas assumed to have similar soils were marked on aerial photographs in the office. Boundaries between contrasting soils were mapped, using changes in visible landscape features and other indicators such as slope, bedrock exposures and shallow soils, vegetation, landform (for example, terraces, ridge crests, and escarpments), peatlands containing organic soils, and color tone indicating different drainage. Fieldwork involved checking these areas to determine the types of soils within them. Location of boundaries between contrasting soils were also checked, were adjusted if necessary, and were finalized on the aerial photographs either by visual examination or by digging and augering holes systematically on either side of them. During the 1979 field season, 1976 black and white (1:15 840) aerial photographs were used for the field mapping of Galiano, Valdes, and Thetis islands, whereas 1980 color (1:20 000) aerial photographs were used during the 1984 field mapping of Kuper and lesser islands.

At each inspection (a ground examination to identify or to verify the soil) of a given area, soil properties were recorded by noting external features, such as site position, slope, aspect, elevation, stoniness, percentage of bedrock exposed, and vegetation. Then properties such as texture, drainage, depth to bedrock, root- and water-restricted layers, sequence of horizons, and coarse fragment content were recorded from soil pits, auger holes, and road cuts. The total number of inspections made during the fieldwork in the survey area was 908, including 173 for the Galiano map sheet, 250 for the Valdes map sheet, 176 for Thetis Island, and 309 for Kuper and lesser islands.

This type of survey procedure is appropriate to a survey intensity of level 2 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 12.7 ha. More specifically, the inspection density is 35.0 ha for the Galiano map sheet, 11.7 ha for the Valdes map sheet, 5.9 ha for Thetis Island, and 4.9 ha for Kuper and lesser islands.

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 named 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 maps and legends was begun. The three soil maps accompanying this report are at a scale of 1:20 000.

Reliability of mapping

Galiano and Thetis islands have a good system of roads that provides easy access to most areas. In contrast, access was relatively poor on Valdes, Kuper, and many lesser islands, which all lacked a good road network. Fieldwork involved traveling all the available roads and trails by motor vehicle. Areas inaccessible to motor vehicles were traversed by foot when the terrain was not too steep. Steep, inaccessible areas were not checked. On average, 1.1 inspections per delineation were made in the surveyed area. More specifically, the average number of inspections per delineation are 0.8 on the Galiano map sheet, 1.1 on the Valdes map sheet, 1.9 on Thetis Island, and 1.0 on Kuper and lesser islands. Five or more inspections per delineation were not uncommon for large delineations and for areas with complex soil materials and/or topography. Thus, the 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 influence of higher former sea levels to about 100 m elevation, complex sequences were deposited that are now reflected in intimately intermixed soil materials over very short distances. Generally, inspection densities were higher in these areas, compared to the less complex soil landscape patterns at higher elevations. Consequently, a relative higher reliability of mapping is expected in areas with a high inspection density than in areas that have lower inspection densities.

The soil maps show different areas that have certain ranges of soils and soil properties. The reliability or accuracy of these ranges varies from one location 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 according to 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 horizons), and lithology. Eighteen different soil series and one soil complex are recognized in this survey area (see map legends). In addition, one nonsoil unit is recognized and mapped that consists dominantly of Rock (RO).

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

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 or variant in the map symbol. For example, an area with Saturna soil, in which bedrock occurs consistently within 50 cm of the surface, is mapped as a very shallow lithic phase (STsl). All soil phases and variants used in the surveyed area are listed in the accompanying map legends. A maximum of two soil phases or variants were recorded and mapped for a soil.

Map units

Soils are shown on the soil maps 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 individuals, plus a small proportion of minor soils or nonsoil individuals (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, which occupies between 50 and 100% of the map unit. The subdominant soil of the map unit is the less common soil and occupies between 25 and 50% of the map unit if limiting the use interpretations, or between 35 and 50% of the map unit if nonlimiting. Minor soils or inclusions of the map unit occupy up to 25% of the map unit if limiting the use interpretations, or up to 40% of the map unit if nonlimiting. For example, 0 to 25% bedrock exposures in the Saturna (ST) map unit is a limiting inclusion. However, an example of a nonlimiting inclusion is 0 to 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 40%). 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 unit. Also, many map units (both simple and compound) have inclusions of one or more minor soils (see Part 4 of this report).

For each mapped delineation, a polygon form was filled out. Recorded information included 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 polygon (delineation) data were entered into an MSDOS-based microcomputer using the Aladin data base management package (Advance Data Institute America Incorporated 1983) and were exported to a commercial spreadsheet (Lotus Development Corporation 1983) for statistical analyses.

The map units are described in the legends to the accompanying map sheets and are colored on the maps according to parent materials of the dominant and subdominant soils. Map units with dominant soils developed on moderately fine- to fine-textured marine parent 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, and Qualicum). Shades of yellow and light orange are used for simple map units with dominant soils developed on colluvial materials (Bellhouse, Galiano, Haslam soil complex, Salalakim, and Saturna). Shades of bright green are used for map units representing dominant soils having compact till in the subsoil (Mexicana, St. Mary, 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 by map sheet (Tables 4, 5, and 6). The total number of delineations and total areal extent of the map units in the survey area are listed in Table 7. These tables also list land types that are recognized in the surveyed area; CB for coastal beach, MD for made land, TF for tidal flat, and W for small lakes (see also map legends). 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, escarpments, gullies, and water. A list of on-site symbols is shown on the map legends.

Table 4. Number of delineations and areal extent of each map unit and land type for the Galiano Island map sheet

Map unit Symbol	Name	Number of delineations	Areal extent (ha)	Proportion of total area (%)
BD	Beddis	0	0	0
BE	Brigantine	17	386.2	6.4
BE-TL	Brigantine-Tolmie	2	25.9	0.4
BH	Bellhouse	3	9.2	0.2
BY	Baynes	0	0	0
CO	Cowichan	3	49.5	0.8
FB	Fairbridge	3	21.4	0.4
GA	Galiano	7	138.9	2.3
HA	Haslam	1	12.3	0.2
ME	Mexicana	0	0	0
MT	Metchosin	17	46.4	0.8
NT	Neptune	2	0.9	0
PA	Parksville	7	83.6	1.4
PA-TL	Parksville-Tolmie	0	0	0
QU	Qualicum	13	66.9	1.1
RO	Rock	12	360.8	6.0
RO-BH	Rock-Bellhouse	2	3.3	0.1
RO-ST	Rock-Saturna	20	539.0	8.9
SL	Salalakim	6	95.2	1.6
SM	St. Mary	0	0	0
ST	Saturna	69	3599.4	59.4
ST-BE	Saturna-Brigantine	2	60.7	1.0
ST-QU	Saturna-Qualicum	3	386.7	6.4
SU	Suffolk	0	0	0
TL	Tolmie	17	79.2	1.3
TR	Trincomali	4	84.7	1.4
Land type Symbol	**Name**			
CB	Coastal beach	1	0.8	0
MD	Made land	0	0	0
TF	Tidal flat	1	1.5	0
W	Small lakes	2	3.6	0.1

Table 5. Number of delineations and areal extent of each map unit and land type for the Valdes Island map sheet

Map unit Symbol	Name	Number of delineations	Areal extent (ha)	Proportion of total area (%)
BD	Beddis	0	0	0
BE	Brigantine	17	193.5	6.9
BE-TL	Brigantine-Tolmie	2	34.5	1.2
BH	Bellhouse	5	15.0	0.5
BY	Baynes	0	0	0
CO	Cowichan	4	9.5	0.3
FB	Fairbridge	0	0	0
GA	Galiano	2	44.9	1.6
HA	Haslam	0	0	0
ME	Mexicana	3	171.0	6.1
MT	Metchosin	11	13.6	0.5
NT	Neptune	2	2.2	0.1
PA	Parksville	0	0	0
PA-TL	Parksville-Tolmie	2	25.8	0.9
QU	Qualicum	18	108.7	3.9
RO	Rock	39	315.8	11.2
RO-BH	Rock-Bellhouse	0	0	0
RO-ST	Rock-Saturna	21	217.2	7.7
SL	Salalakim	0	0	0
SM	St. Mary	0	0	0
ST	Saturna	49	1242.9	44.3
ST-BE	Saturna-Brigantine	7	120.3	4.3
ST-QU	Saturna-Qualicum	5	120.2	4.3
SU	Suffolk	0	0	0
TL	Tolmie	16	76.6	2.7
TR	Trincomali	9	81.5	2.9
Land type Symbol	**Name**			
CB	Coastal beach	0	0	0
MD	Made land	0	0	0
TF	Tidal flat	0	0	0
W	Small lakes	5	15.0	0.5

Table 6. Number of delineations and areal extent of each map unit and land type for the Thetis, Kuper, and lesser islands map sheet

Map unit Symbol	Name	Number of delineations	Areal extent (ha)	Proportion of total area (%)
BD	Beddis	6	22.8	0.9
BE	Brigantine	33	222.1	8.8
BE-TL	Brigantine-Tolmie	4	15.8	0.6
BH	Bellhouse	0	0	0
BY	Baynes	3	19.8	0.8
CO	Cowichan	11	166.1	6.6
FB	Fairbridge	9	58.1	2.3
GA	Galiano	13	53.5	2.1
HA	Haslam	4	19.8	0.8
ME	Mexicana	2	21.0	0.8
MT	Metchosin	6	14.2	0.6
NT	Neptune	5	9.2	0.4
PA	Parksville	6	6.0	0.2
PA-TL	Parksville-Tolmie	7	39.7	1.6
QU	Qualicum	6	34.1	1.3
RO	Rock	24	26.4	1.0
RO-BH	Rock-Bellhouse	6	15.8	0.6
RO-ST	Rock-Saturna	43	191.7	7.6
SL	Salalakim	0	0	0
SM	St. Mary	3	28.6	1.1
ST	Saturna	52	856.0	33.8
ST-BE	Saturna-Brigantine	3	64.3	2.5
ST-QU	Saturna-Qualicum	2	7.1	0.3
SU	Suffolk	10	68.1	2.7
TL	Tolmie	24	212.8	8.4
TR	Trincomali	3	343.7	13.6
Land type Symbol	**Name**			
CB	Coastal beach	0	0	0
MD	Made land	2	13.4	0.5
TF	Tidal flat	0	0	0
W	Small lakes	3	1.3	0.1

Table 7. Total number of delineations and areal extent of each map unit and land type for survey area

Map unit Symbol	Name	Number of delineations	Areal extent (ha)	Proportion of total area (%)
BD	Beddis	6	22.8	0.2
BE	Brigantine	67	801.8	7.0
BE-TL	Brigantine-Tolmie	8	76.2	0.7
BH	Bellhouse	8	24.2	0.2
BY	Baynes	3	19.8	0.2
CO	Cowichan	18	225.1	2.0
FB	Fairbridge	12	79.5	0.7
GA	Galiano	22	237.3	2.1
HA	Haslam	5	32.1	0.3
ME	Mexicana	5	192.0	1.7
MT	Metchosin	34	74.2	0.7
NT	Neptune	9	12.3	0.1
PA	Parksville	13	89.6	0.8
PA-TL	Parksville-Tolmie	9	65.5	0.6
QU	Qualicum	37	209.7	1.8
RO	Rock	75	703.0	6.2
RO-BH	Rock-Bellhouse	8	19.1	0.2
RO-ST	Rock-Saturna	84	947.9	8.3
SL	Salalakim	6	95.2	0.8
SM	St. Mary	3	28.6	0.3
ST	Saturna	170	5698.3	50.0
ST-BE	Saturna-Brigantine	12	245.3	2.2
ST-QU	Saturna-Qualicum	11	514.0	4.5
SU	Suffolk	10	68.1	0.6
TL	Tolmie	57	368.6	3.2
TR	Trincomali	16	509.9	4.5
Land type Symbol	**Name**			
CB	Coastal beach	1	0.8	0
MD	Made land	2	13.4	0.1
TF	Tidal flat	1	1.5	0
W	Small lakes	10	19.9	0.2

PART 4. DESCRIPTION OF THE SOILS AND MAP UNITS

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

DESCRIPTION OF SOILS

Descriptions for each of the 18 different soils and 1 soil complex occurring in the survey area (Galiano, Valdes, Thetis, Kuper, 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 soils, and in what map units the soils occur.

In addition to the range in soil textures that is definitive for each soil, the section on soil characteristics also includes data on observed ranges and estimated mean values of soil properties that relate to depth, thickness, and coarse fragment content. Detailed profile descriptions for the most commonly occurring soils are given in Appendix 2.

The conventions used for the soil characteristics section are as follows:
- Mean values (usually estimated, occasionally calculated) for soil characteristics are followed by the observed range in values in parentheses (e.g., depth of solum: 85 cm (60-100 cm)).
- Use of parentheses for soil characteristics other than indicating the range in values refer to occasional occurrence (e.g., for thickness of surface soil, texture).
- LS, SL, L, and so on are the short forms for soil texture explained in the map legend.
- CF is the short form for coarse fragments.

Further conventions used for soil descriptions, or the class limits for characteristics such as slope, can be found either 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 the map unit descriptions for which those soils are a dominant component. The map unit section reports, based on all delineations of the map unit, the mean proportion in percent, followed in parenthesis 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. Minor soils do not occur in all delineations of the map unit. Where they occur in more than 20%

of the delineations of the map unit, they are identified and listed. Minor soils that occur only in a few places (in less than 20% of the delineations) are not listed but collectively are called unmentioned inclusions. The landform and occurrence section describes the landscape position, the surface form, the dominant slopes, and elevation for each map unit. The distribution and extent section describes 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 most commonly occurring soils are presented also in alphabetical order in Appendixes 2 and 3.

BAYNES SOILS AND MAP UNITS

Baynes soils (BY)

Baynes soils are imperfectly drained soils that have developed on deep (>150 cm), fluvial and marine materials of sandy loam to sand texture. Coarse fragment content is <20%. The profile description and analysis of a selected Baynes profile are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm or Bm 0-35 cm
Texture, surface soil (0-30 cm)	: SL-LS(L)
Texture, subsurface soil	: SL-LS(S)
Depth of solum (A and B horizons)	: 75 cm (50-100 cm)
Depth of soil (A, B, and C horizons)	: >150 cm
Depth to bedrock	: >150 cm
Depth and type of restricting layer	: Absent
Effective rooting depth	: 75 cm (25-110 cm)
CF content and type (0-30 cm)	: 5% (0-15%), gravelly and angular gravelly
CF content and type (subsurface)	: 10% (0-40%), gravelly
Perviousness	: Rapid
Percolation	: Rapid
Soil classification	: Gleyed Dystric Brunisol

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 water seepage 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 may, in a few places, have a massive structure of compact sand, which, because it is more slowly permeable than the overlying materials, results in perched water table conditions.

Variability

The only variation that occurs in Baynes soils in the survey area is the coarse fragment content in the surface layer exceeding 20%, mapped as a gravelly phase (BYg).

Similar soils

Baynes soils are similiar to Beddis soils, which have better drainage. Baynes soils are also similar to Qualicum soils, which have a higher (>20%) coarse fragment content throughout the profile and which have also better drainage.

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.

Land use

All Baynes soils in the survey area have a tree cover. However, with improvements, such as drainage, irrigation, and high inputs of fertilizer, these soils have good potential for producing a range of agricultural crops. Baynes soils are mainly used for growing trees.

Map units

Only one Baynes map unit is recognized, a simple map unit (BY) in which Baynes is the dominant soil. In addition, Baynes soil occurs as a minor inclusion in some delineations of the Brigantine (BE) map unit.

Baynes map unit (BY)

The Baynes map unit consists purely (100%) of the imperfectly drained Baynes soil. The map unit includes no other soils.

Landform and occurrence

Soils of the Baynes map unit occur either as narrow areas on lower side-slope positions along drainageways or in draws and depressional areas as raised beach deposits. The topography is gently to moderately sloping (6-15%), with some steeper slopes (16-30%).

Distribution and extent

Baynes is a very minor map unit. It has been mapped as three small-sized delineations on Thetis and Kuper islands only. BYg occurs as one delineation on Thetis Island. This map unit represents an area of 19.8 ha (<0.2% of total map area).

BEDDIS SOILS AND MAP UNITS

Beddis soils (BD)

Beddis soils are well- to rapidly drained soils that have developed on deep (>150 cm), fluvial, marine, or eolian deposits of loamy sand to sandy loam texture. Coarse fragment content is <20%. The profile description and analyses of a selected Beddis soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm or Bm 0-35 cm (Ap 10-15 cm)
Texture, surface soil (0-30 cm)	: LS-SL(S)
Texture, subsurface soil	: LS-SL(S)
Depth of solum (A and B horizons)	: 85 cm (60-100 cm)
Depth of soil (A, B, and C horizons)	: >150 cm
Depth to bedrock	: >150 cm
Depth and type of restricting layer	: Absent
Effective rooting depth	: 85 cm (40-110 cm)
CF content and type (0-30 cm)	: 10% (0-20%), gravelly and angular gravelly
CF content and type (subsurface)	: 5% (0-25%), gravelly
Perviousness	: Rapid
Percolation	: Rapid
Soil classification	: Orthic Dystric Brunisol

Water regime

Beddis soils are well- to rapidly drained with water tables remaining below 100 cm throughout the year. The soil remains moist during winter but quickly becomes droughty in dry periods during summer.

Variability

Several variations in the profile of Beddis soils occur. The surface may be gravelly or angular gravelly with coarse fragment content exceeding 20% (BDg). Where bedrock occurs between 50 and 100 cm, the soil has been mapped as BD1. The C horizon may, in a few places, have a massive structure of compact sand that is more slowly permeable than the overlying materials, but which is not enough to create perched water table conditions.

Similar soils

Beddis soils are similar to Qualicum soils, which have a higher (>20%) coarse fragment content throughout the profile. Beddis soils are also similar to the Baynes soils, which are imperfectly 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, and dull Oregon-grape.

Land use

All Beddis soils in the survey area have a tree cover. However, with improvements such as irrigation and high inputs of fertilizer, these soils have good potential for producing a range of agricultural crops and tree fruits. Beddis soils are mainly used for growing trees.

Map units

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

Beddis map unit (BD)

The Beddis map unit consists dominantly (87%; 60-100%) of the well- to rapidly drained Beddis soils. The map unit includes, on average, 13% (up to 40%) of other soils. These other soils may be one, or a combination, of the following minor soils: Qualicum (QU), Saturna (ST), Trincomali (TR), and Rock (RO). The inclusions limit both land use possibilities and use interpretations for this map unit mainly because of the higher coarse fragment content.

Landform and occurrence

Soils of the Beddis map unit occur as narrow, discontinuous terraces along drainageways and as raised beaches, on very gently to moderately sloping (2-15%) terrain and, in a few places, on strongly sloping (16-30%) terrain. One delineation with sand bluffs on the east coast of Kuper Island has extreme to steep slopes (46-100%). Minor soil inclusions are sparsely distributed in the Beddis delineations.

Distribution and extent

Beddis is a minor map unit. It has been mapped as six small- and medium-sized delineations on Kuper, Hudson, and Woods islands. This map unit represents 22.8 ha (0.2% 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 gravelly sandy loam to gravelly loamy sand texture over fractured or smooth, unweathered sandstone bedrock within 100 cm of the surface. Coarse fragment content varies between 10 and 45%. 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 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 15 cm (10-25 cm)
Texture, surface soil (0-30 cm)	: SL-LS
Texture, subsurface soil	: SL-LS
Depth of solum (A and B horizons)	: 35 cm (10-50 cm)
Depth of soil (A, B, and C horizons)	: 60 cm (10-80 cm)
Depth to bedrock	: 60 cm (10-80 cm)
Depth and type of restricting layer	: 60 cm (10-80 cm) consolidated bedrock
Effective rooting depth	: 30 cm (10-70 cm)
CF content and type (0-30 cm)	: 30% (10-60%), channery and gravelly
CF content and type (subsurface)	: 35% (15-75%), channery and gravelly
Perviousness	: Rapid to moderate
Percolation	: Rapid to moderate
Soil classification	: Orthic Sombric Brunisol

Water regime

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

Variability

The most important variation in the Bellhouse profile regarding use is depth to bedrock. Where bedrock occurs within 50 cm of the surface, these soils were mapped as Bellhouse very shallow lithic phase (BHsl). Where coarse fragment content in the surface soil exceeds 50%, Bellhouse soils were mapped as a very gravelly phase (BHvg). In a few places, the Ah horizon is less than 10 cm thick (Orthic Dystric Brunisol) or a podzolic Bf horizon is present (Sombric Humo-Ferric Podzol).

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 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. The ground cover is predominantly grasses, common gorse, and Scotch broom. Distribution of Garry oak is restricted to the warm and dry southerly and southwesterly aspects. Tree growth is often stunted from lack of moisture.

Land use

The use of Bellhouse soils is restricted to natural vegetation with some limited sheep grazing mainly because of the shallow soil to bedrock, topographic limitations, and droughtiness.

Map units

Bellhouse soils occur as the dominant soil in the Bellhouse (BH) map unit and as the subdominant soil in the RO-BH map unit. The latter is described under Rock as nonsoil (RO). Bellhouse soils may also occur as a minor soil or as unmentioned inclusions in some delineations of the undifferentiated Rock (RO) map unit, the Saturna (ST), and Rock-Saturna (RO-ST) map units.

Bellhouse map unit (BH)

The Bellhouse map unit consists dominantly (81%; 60-90%) of the rapidly to well-drained Bellhouse soils with bedrock occurring within 100 cm of the surface. All delineations of the Bellhouse map unit include, on average, 16% (10-25%) sandstone bedrock (Rock) exposures, which is a limiting factor for use interpretations. One delineation includes 30% Trincomali soil.

Landform and occurrence

Soils of the Bellhouse map unit usually occur in areas with flat-lying or slightly dipping, unweathered sandstone bedrock with scattered rock outcrops. They are found on southerly to southwesterly aspects under grass and Garry oak vegetation. Topography ranges from gentle to strong slopes (6-30%).

Distribution and extent

The Bellhouse map unit is a minor one in the survey area with eight small- to medium-sized delineations mapped; five of these have bedrock within 50 cm of the surface (BHsl). The Bellhouse map unit does not occur on the Thetis - Kuper islands map sheet. This map unit represents an area of 24.2 ha (0.2% 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 loamy sand to sandy loam of marine or fluvial origin overlying deep (>100 cm), silty clay loam to silty clay marine deposits that are usually stone-free. The profile description and analyses of a selected Brigantine soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm (Ap 10-15 cm)
Texture, surface soil (0-30 cm)	: LS-SL
Texture, subsurface soil	: LS-SL, deeper SiCL-SiC
Thickness of overlay material and solum depth (A and B horizons)	: 80 cm (30-100 cm)
Depth of soil (A, B, and C horizons)	: >100 cm
Depth to bedrock	: >100 cm
Depth and type of restricting layer	: 80 cm (30-100 cm), fine-textured subsoil, often massive structured
Effective rooting depth	: 80 cm (30-100 cm)
CF content and type (0-30 cm)	: 0-10%, gravelly and angular gravelly
CF content and type (subsurface)	: 0-5%, gravelly
Perviousness	: Moderately to slow
Percolation	: Rapid in surface 80 cm, very slow below 80 cm
Soil classification	: Gleyed Dystric Brunisol

Water regime

Brigantine soils are imperfectly drained with seasonal fluctuations in the water table. They are saturated to about 60 cm from the surface during the winter. Water seepage 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

The most common (60%) variation in the Brigantine soil is the coarse fragment content in the surface soil exceeding 20% (BEg). In a few places, angular colluvial materials are mixed in with the surface soil. Where the depth to the fine-textured subsoil is between 100 and 150 cm, the soil has been mapped as a deep phase (BEd). Where the Ap or Ah horizon is thicker than 10 cm, the Brigantine soil has been mapped as BEa, which changes the classification into Gleyed Sombric Brunisol. A loam surface (BElo) or bedrock between 50 and 100 cm from the surface (BEl) are very uncommon variations of the Brigantine soil.

Similar soils

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

Natural vegetation

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

Land use

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

Map units

As some of the most frequently mapped soils in the survey area, Brigantine soils occur in many 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. Brigantine is a subdominant soil in the Saturna-Brigantine (ST-BE) map unit, which is described under Saturna (ST). In addition, Brigantine is a minor soil or unmentioned inclusion in some delineations of the Parksville (PA), Qualicum (QU), Cowichan (CO), Fairbridge (FB), Saturna (ST), Suffolk (SU), Tolmie (TL), and Trincomali (TR) map units.

Brigantine map unit (BE)

The Brigantine map unit consists dominantly (81%; 50-100%) of imperfectly drained Brigantine soils. The map unit includes, on average, 19% (up to 50%) of other soils. These minor soils may be one or a combination of Parksville (PA) and Saturna (ST) soils. Unmentioned inclusions of other soils occur in a very few places. The poorly drained soil inclusions (PA) and shallow soils (ST) are the limiting factor for use interpretations for this map unit.

Landform and occurrence

Soils of the Brigantine map unit occur mainly on very gentle to gentle slopes (2-9%), some on moderate slopes (10-15%), as narrow areas surrounding depressional basins and draws that are commonly occupied by poorly drained Parksville soils. Parksville soils occur in the lowest landscape positions as small unmappable inclusions. Other inclusions are scattered in a few places. Elevation usually ranges from 0 to 100 m above mean sea level.

Distribution and extent

This Brigantine map unit is a major one. It has been mapped as 67 small-sized, mainly long and narrow delineations throughout the survey area. Most of these delineations represent the gravelly phase (BEg), six represent the deep phase (BEd), three represent the sombric variant (BEa), and three represent the loam phase (BElo). This map unit represents an area of 801.8 ha (7.0% of total map area).

Brigantine-Tolmie map unit (BE-TL)

Brigantine soils dominate this map unit (61%; 50-70%). It also contains 31% (30-40%) of poorly drained soils developed on deep loam to silty clay marine deposits that are usually stone-free (usually Tolmie soils but some Cowichan soils). The map unit also includes on average 8% (up to 20%) of other soils, of which the most common are Fairbridge (FB) soils. Unmentioned inclusions of other soils may occur in a very few places. The poorly drained soils (TL, CO) are the limiting factor for use interpretations for this map unit.

Landform and occurrence

Soils of the Brigantine-Tolmie (BE-TL) map unit occur mainly on very gentle to gentle slopes (2-9%), some on moderate slopes (10-15%), as narrow areas surrounding depressional basins and draws that are occupied by poorly drained Tolmie or Cowichan soils. Tolmie and Cowichan soils occupy the lowest landscape positions as significant portions (30-40%) of the map unit. Scattered inclusions of other soils occur. Elevation usually ranges between 0 and 100 m above mean sea level.

Distribution and extent

The Brigantine-Tolmie map unit (BE-TL) has been mapped in fewer locations than BE map units and has eight relatively small delineations. Soils of this map unit do not occur on Kuper Island. The map unit represents 76.2 ha (0.7% of total map area).

COWICHAN SOILS AND MAP UNITS

Cowichan soils (CO)

Cowichan soils are poorly drained soils that have developed on deep (>100 cm), silty loam to silty clay marine deposits that are usually stone-free. The soil is well developed and has a dark-colored surface horizon, a leached (Aeg) horizon, and a well-developed Btg horizon. The profile description and analyses of a selected Cowichan soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah or Ap 10-30 cm
Texture, surface soil (0-30 cm)	: SiL (SiCL)
Texture, subsurface soil	: SiCL-SiC (SiL)
Depth of solum (A and B horizons)	: 80 cm (65-100 cm)
Depth of soil (A, B, and C horizons)	: >100 cm
Depth to bedrock	: >100 cm
Depth and type of restricting layer	: 45 cm (30-60 cm); fine-textured Btg horizon or subsoil
Effective rooting depth	: 45 cm (20-60 cm)
CF content and type (0-30 cm)	: 0-5%, gravelly
CF content and type (subsurface)	: 0-5%, gravelly
Perviousness	: Slow
Percolation	: Slow
Soil classification	: Humic Luvic Gleysol

Water regime

The Cowichan soils are poorly drained soils that have distinct to prominent mottles within 50 cm of the surface. They are wet for long periods throughout the year 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 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. These soils receive runoff water from the surrounding landscape.

Variability

Some variations in the Cowichan soils occur. In some places a well-decomposed organic surface layer (COp) is present with a thickness varying between 5 and 40 cm. Other variations occurring in a few places are bedrock between 50 and 100 cm (CO1) and subject to inundation at very high tides (COsn). The depth of some of the fine-textured marine deposits may exceed 4.5 m.

Similar soils

Cowichan soils are similar to the poorly drained Tolmie soils. The latter have a less uniform texture, commonly lack the eluviated (Ae) horizon and Btg horizon, and are usually more distinctly mottled in the subsoil than are the Cowichan soils. The imperfectly drained members of the Cowichan soils are the Fairbridge soils.

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, and western red cedar, and commonly bigleaf maple. The shrubs are represented by patches of salmonberry and hardhack. The herb layer is characterized by western sword fern, American skunk-cabbage, rushes (*Juncus* spp.), sedges, and common horsetail.

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. The soils are 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 used mainly for pasture and hay crops. With improved drainage, these soils are good for growing a wide variety of crops, including vegetables, berries, and small fruits.

Map units

Cowichan is the dominant soil in the Cowichan (CO) map unit. In addition, Cowichan soils occur as minor soils or unmentioned inclusions in some delineations of the Brigantine-Tolmie (BE-TL), Fairbridge (FB), Metchosin (MT), Suffolk (SU), and Tolmie (TL) map units.

Cowichan map unit (CO)

The Cowichan map unit consists dominantly (82%; 60-100%) of the poorly drained Cowichan soils. The map unit includes, on average, 18% (up to 40%) of other soils, of which Tolmie (TL) is the most commonly occurring minor soil. Unmentioned inclusions of other soils may occur in a very few places. The Tolmie minor soil does not affect the use interpretations for the Cowichan map unit.

Landform and occurrence

Soils of the Cowichan map unit are found on very gently sloping (1-5%), some gently sloping (6-9%), landscape positions such as depressions, basins, and swales in which the sea at formerly higher levels deposited large amounts of fine-textured sediments. The Cowichan soils also occur between bedrock ridges with shallow colluvial soils, commonly receiving runoff water from the surrounding landscape. Tolmie soils and other inclusions are scattered as many small unmappable areas. Elevation usually ranges from 0 to 100 m above mean sea level.

Distribution and extent

The Cowichan map unit has 18 delineations, most of which occur on the Thetis - Kuper islands map sheet. Many delineations occupy small- to medium-sized areas, but some larger-sized delineations were mapped on Thetis and Kuper islands. Two delineations with COpt soils were mapped, two with CO1, and one with COsn; all but one occur on the Thetis - Kuper islands map sheet. The Cowichan (CO) map unit represents an area of 225.1 ha (2.0% of total map area).

FAIRBRIDGE SOILS AND MAP UNITS

Fairbridge soils (FB)

Fairbridge soils are imperfectly drained soils that have developed on deep (>100 cm), silt loam to loam over silty clay loam to clay loam marine deposits that are usually stone-free. Concretions of iron oxide may be present throughout the profile. The profile description and analyses of a selected Fairbridge soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm (Ap 10-15 cm)
Texture, surface soil (0-30 cm)	: SiL-L
Texture, subsurface soil	: SiCL-CL (SiC)
Depth of solum (A and B horizons)	: 70 cm (50-100 cm)
Depth of soil (A, B, and C horizons)	: >100 cm
Depth to bedrock	: >100 cm
Depth and type of restricting layer	: 70 cm, fine-textured subsoil, often massive structured

Effective rooting depth	: 45 cm (25-125 cm)
CF content and type (0-30 cm)	: 0-5%, gravelly
CF content and type (subsurface)	: 0-5%, gravelly
Perviousness	: Slow
Soil classification	: Gleyed Eluviated Dystric Brunisol

Water regime

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

Variability

Fairbridge soils with cultivated Ap surface horizons or Ah horizons that are thicker than 10 cm are indicated by FBa, which changes the classification into a Gleyed Sombric Brunisol. An uncommon variation is shallow (50-100 cm) Fairbridge soils over bedrock, which are phased as FBl, and the ones with wetter water regime (FBw). Also, the morphology of Fairbridge soils can be variable. A leached (Ae) horizon may occur under the Ah (Ap) horizon or under a Bm horizon (Gleyed Eluviated Dystric Brunisol). In some places, a Btg horizon is present below an Ae or Bm horizon (Gleyed Brunisolic Gray Luvisol). Neither of these variations in morphology was consistent enough to be mapped.

Similar soils

Fairbridge soils are similar to Suffolk soils, which are shallow over compact till within 100 cm of the surface. Poorly drained members of the Fairbridge soils are the Cowichan soils.

Natural vegetation

The natural vegetation consists of red alder, western red cedar, coast Douglas fir, and bigleaf maple, with an understory of western sword fern, salal, American stinging nettle, and western bracken.

Land use

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

Map units

The Fairbridge soils occur as the dominant soil in the Fairbridge (FB) simple map unit. Fairbridge soils occur as the minor soil in some delineations of the Brigantine (BE), Brigantine-Tolmie (BE-TL), Cowichan (CO), Parksville-Tolmie (PA-TL), Tolmie (TL), and Trincomali (TR) map units.

Fairbridge map unit (FB)

The Fairbridge map unit consists dominantly (84%, 70-100%) of the imperfectly drained Fairbridge soils. The map unit includes, on average, 16% (up to 30%) of other soils. These minor soils may be Cowichan (CO), Tolmie (TL), or Brigantine (BE) soils. Unmentioned inclusions of other soils occur in a very few places. Poorly drained soil inclusions (CO, TL,) limit the use interpretations for this map unit.

Landform and occurrence

Soils of this map unit occur on undulating topography with very gentle to moderate slopes (2-15%). Minor areas of the poorly drained soils occupy lower landscape positions. On the maps, the Fairbridge map unit commonly occurs adjacent to map units dominated by poorly drained soils (CO, TL). Elevations are usually between 0 and 100 m above mean sea level.

Distribution and extent

The Fairbridge map unit has 12 small- and medium-sized delineations, of which 3 occur on Galiano Island. Fairbridge soils have not been mapped on Valdes Island map sheet. All the different phases or variants of the Fairbridge map unit (FBa, FBl, FBw) occur on Thetis - Kuper islands map sheet. This map unit represents an area of 79.5 ha (0.7% of the total map area).

GALIANO SOILS AND MAP UNITS

Galiano soils (GA)

Galiano soils are well- to moderately well-drained, shaly loam to shaly silt loam 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 layer of fractured bedrock (paralithic) between the solum and the unweathered consolidated bedrock. Coarse fragment content is between 20 and 50% and often exceeds 50% with depth. The profile description and analyses of a selected Galiano soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: AH 0-10 cm (if absent, Bm horizon)
Texture, surface soil (0-30 cm)	: L-Sil
Texture, subsurface soil	: L-Sil (CL)
Depth of solum (A and B horizons)	: 40 cm (20-70 cm)
Depth of soil (A, B, and C horizons)	: 50 cm (20-100 cm), controlled by bedrock
Depth to fractured bedrock	: 50 cm (20-100 cm)
Depth and type of restricting layer	: 60 cm (20-100 cm), consolidated bedrock
Effective rooting depth	: 45 cm (20-80 cm)
CF content and type (0-30 cm)	: 35% (20-60%), shaly
CF content and type (subsurface)	: 60% (30-80%), shaly and flaggy
Perviousness	: Moderate
Percolation	: Moderate
Soil classification	: Orthic Dystric Brunisol

Water regime

Galiano soils are well- to moderately well-drained soils. Faint mottling may occur in the subsoil. They are wet during winter but are usually droughty during summer. Water tables do not remain within 90 cm of the surface for any length of time. During and shortly after wet periods, water may flow laterally through a saturated subsoil on top of sloping bedrock.

Variability

The most variable characteristic of the Galiano soil is the depth to bedrock. When bedrock occurs within 50 cm of the surface, the soils are mapped as a very shallow lithic phase (GAsl). If it cannot be reasonably determined at what depth the bedrock occurs within the 100 cm or if the depth to bedrock is highly variable, then these areas are mapped as the simple map unit (GA). The sombric variation (GAa) and very gravelly variation (GAvg) occur in a very few places. In some places, an eluviated (Ae) horizon occurs or some movement of fine clays takes place. The layer of fractured bedrock between the solum and the consolidated, unweathered bedrock is between 5 and 25 cm thick (average 10 cm). Roots and the downward movement of water are not necessarily restricted by this layer.

Similar soils

Galiano soils are commonly found together with the well-drained, 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. Both soils occur on similar slopes and in similar landscape positions. In many places, because of the intermixing of bedrock types, Galiano and Saturna soils occur so closely together in the landscape that they cannot be reasonably separated. Where this proximity occurs, both soils are identified as Haslam soil complex (HA).

Natural vegetation

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

Land use

Galiano soils are generally unsuitable for agriculture because of steep topography, stoniness, shallowness to bedrock, droughtiness, low fertility, and the frequency of bedrock outcrops. The best use for Galiano soils is for growing coniferous trees.

Map units

Galiano soils occur as the dominant soil in the Galiano (GA) simple map unit. They also form part of the Haslam soil complex. In addition, they may also occur as a minor soil or unmentioned inclusion in the undifferentiated Rock (RO) map unit, and in some delineations of the Fairbridge (FB), Mexicana (ME), Qualicum (QU), Rock-Saturna (RO-ST), Saturna (ST), and Tolmie (TL) map units.

Galiano map unit (GA)

The Galiano map unit consists dominantly (88%; 70-100%) of the well- to moderately well-drained Galiano soils. The map unit includes, on average, 12% (up to 30%) of other soils, of which inclusions of shale or siltstone bedrock exposures (Rock) and Saturna (ST) soils occur most commonly. Bedrock exposures are usually associated with the very shallow lithic Galiano soils (GAsl) and are a limiting factor for use interpretations. Unmentioned inclusions of other soils may occur in a very few places.

Landform and occurrence

Soils of this map unit occur in areas with shallow soils over sedimentary bedrock with the dominant slopes ranging from 6 to 30%. Several delineations on the Shoal Islands (Thetis - Kuper islands map sheet) with ridged topography have steeper slopes (31-70%, or more). The GAsl delineations are generally found in rocky areas with strong to steep slopes (31% to more than 70%, or more), whereas the GA delineations are more restricted to moderately and strongly sloping (10-30%) landscape positions. Inclusions of Rock and other minor soils occur as small areas. This map unit occurs at all elevations.

Distribution and extent

Most of the 22 Galiano delineations are found on the Thetis - Kuper islands map sheet; only 2 delineations occur on Valdes Island near Blackberry Point. GAsl delineations occur slightly more commonly than the GA delineations; both occur as medium- to large-sized, often narrow, elongated delineations. All different phases or variants of the Galiano map unit (GAsl, GAvg, GAa) occur on the Thetis - Kuper islands map sheet. The Galiano map unit represents an area of 237.3 ha (2.1% of the total map area).

HASLAM SOIL COMPLEX AND MAP UNITS

Haslam soil complex (HA)

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

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm (if absent, Bm horizon)
Texture, surface soil (0-30 cm)	: SL-SiL
Texture, subsurface soil	: SL-SiL (LS)
Depth of solum (A and B horizons)	: 60 cm (20-75 cm)
Depth of soil (A, B, and C horizons)	: 65 cm (25-95 cm)
Depth to fractured bedrock	: 65 cm (20-100 cm)
Depth and type of restricting layer	: 75 cm (20-100 cm), consolidated bedrock
Effective rooting depth	: 60 cm (20-90 cm)
CF content and type (0-30 cm)	: 35% (20-50)%, shaly and channery
CF content and type (subsurface)	: 55% (40-70%), shaly, channery, and flaggy
Perviousness	: Rapid to moderate
Percolation	: Moderate
Soil classification	: Orthic Dystric Brunisol

Water regime

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

Variability

The most variable characteristics of the Haslam soil complex are the depth to bedrock and the kind of bedrock. Where bedrock occurs within 50 cm of the surface, the complex is mapped as a very shallow lithic phase (HAsl). Where it cannot be reasonably determined at what depth bedrock occurs within the 100-cm range, or where the depth to bedrock is highly variable, these areas are mapped as HA. In some places, the coarse fragment content in the surface soil exceeds 50% (HAvg). Soil textures are also variable for the Haslam soil complex, depending on the type of underlying bedrock. Where the soils have developed on sandstone materials, textures are generally sandy loam and, in some places, loamy sand. Where the soils have developed on shale materials, textures are generally loam and, in some places, clay loam. Soils developed on siltstone materials are generally of silt loam texture. The layer of fractured bedrock between the solum and the unweathered consolidated bedrock is usually between 5 and 25 cm thick (average 10 cm). Roots and the downward movement of water are not necessarily restricted by this layer.

Similar soils

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

Natural vegetation

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

Land use

Soils of the Haslam soil complex are not used for agriculture because of many limiting factors such as steep topography, stoniness, shallow to bedrock, droughtiness, low fertility, and the frequency of rock outcrops. Currently, Haslam soils are being used for growing coniferous trees.

Map units

The Haslam soil complex dominates the Haslam (HA) map unit. In addition, it may also occur as a minor component in the undifferentiated Rock (RO) map unit.

Haslam map unit (HA)

The Haslam map unit consists dominantly (90%; 80-100%) of the well-drained Haslam complex with, on average, 10% bedrock exposures (Rock). Inclusions of bedrock exposures are a limiting factor in use interpretations for the Haslam map unit.

Landform and occurrence

Soils of the Haslam map unit occur in areas with shallow soils over sedimentary bedrock, usually in bench-like landscape positions, with the dominant slopes ranging in steepness from 10 to 30%. Some steeper slopes (31-45%) occur in ridged topography. The different types of bedrock (sandstone, shale, siltstone) occur either sequentially or intermixed. The Haslam map unit occurs at all elevations.

Distribution and extent

The Haslam map unit is of very limited extent in the survey area with five delineations, of which one occurs on Galiano Island and the remainder on the Thetis - Kuper islands map sheet. Only one delineation was mapped as HAsl. Delineations are small to medium sized. The Haslam map unit represents an area of 32.1 ha (0.3% of the total map area).

METCHOSIN SOILS AND MAP UNITS

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 Appendix 2.

Soil characteristics

Organic material, surface tier (0-40 cm)	: Moderately decomposed to almost completely decomposed (mesic to humic peat materials (Om-Oh)
Organic material, middle tier (40-120 cm)	: Strongly to almost completely decomposed (humic) peat materials (Oh)
Organic material, bottom tier (120-160 cm)	: Dominantly strongly to almost completely decomposed (humic) peat materials (Oh)
Depth of soil	: >160 cm
Depth to bedrock	: >160 cm
Depth and type of restricting layer	: Absent
Effective rooting depth	: 0-35 cm
CF content and type (0-30 cm)	: 0%
CF content and type (subsurface)	: 0%
Perviousness	: Moderate
Percolation	: Moderate
Soil classification	: Typic Humisol

Water regime

Metchosin soils are very poorly drained soils. 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, dropping to below 50 cm from the surface only during late summer (August and September). Because of their position in depressional landscapes, Metchosin soils receive large amounts of runoff and seepage water from surrounding areas.

Variability

The most variable characteristic is the depth of Organic soil to the mineral substratum. Where this occurs between 40 and 160 cm, the soils are mapped as shallow Metchosin soils (MTso) and classified as Terric Humisols. In some places, mesic, fibric, or cumulo layers are found in the surface or middle tiers which are indicated with MTt. The mineral subsoil, where present, is usually silty clay loam or silty clay. The depth of some of these organic deposits exceeds 4.5 m. Organic soils with limno layers of coprogenous earth or diatomaceous earth may occur but are not extensive enough to be mapped.

Similar soils

Metchosin soils are the only Organic soils recognized in the report 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 willows, and hardhack.

Land use

The only agricultural use of Metchosin soils is for pasture and the production of hay. Most of these soils are left undisturbed. When adequately drained, they can be one of the best soils for vegetable production. The production of berry crops (blueberries and cranberries) is also recommended for 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, nitrogen, phosphorus, and potassium fertilizers depending on the kind of crop to be grown.

Sedimentary peat and diatomaceous earth close to the surface of the soil can cause management problems when exposed by tillage. Upon drying the sedimentary peat forms clods that are difficult to re-wet and breakdown.

Map units

Metchosin soils occur as the dominant soil only in the Metchosin (MT) map unit. Metchosin soils occur as minor soils or unmentioned inclusions in the Brigantine-Tolmie (BE-TL), Cowichan (CO), and Parksville (PA) map units.

Metchosin map unit (MT)

The Metchosin (MT) map unit consists dominantly (94%; 70-100%) of very poorly drained and deep (>160 cm) Metchosin soil, with up to 20% of similar but shallower soils (40 and 160 cm) over mineral soil (Metchosin shallow organic, MTso). Inclusions of Cowichan (CO) and Tolmie (TL) soils occur in a very few places.

Landform and occurrence

Soils of the Metchosin map unit occur in wet areas throughout the survey area at all elevations in level to slightly depressional basins and swales with slopes varying from 0 to 2%. Shallow Organic soils (MTso) occur around the edges of the basins and swales.

Distribution and extent

Except for a few medium-sized delineations, the Metchosin map unit occurs as many small and very small delineations, throughout the survey area, of which more occur on the Galiano map sheet than on the Thetis - Kuper islands map sheet. The majority of the 34 Metchosin delineations are mapped as shallow organic (MTso). Only two delineations were recognized as MTt, both occurring on Galiano Island. Collectively they represent an area of 74.2 ha (0.7% of the total map area).

MEXICANA SOILS AND MAP UNITS

Mexicana soils (ME)

Mexicana soils are moderately well-drained soils that have developed on gravelly sandy loam to gravelly loam morainal deposits overlying deep, compact, unweathered till within 100 cm of the surface. Coarse fragment content is on average 20%. Unweathered till materials have generally less than 20% clay content and usually occur at 70 cm depth. The profile description and analyses of a selected Mexicana soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm (Ap 10-15 cm)
Texture, surface soil (0-30 cm)	: SL-L
Texture, subsurface soil	: SL-L
Depth of solum (A and B horizons)	: 60 cm (40-90 cm)
Depth of soil (A, B, and C horizons)	: 70 cm (40-100 cm)
Depth to bedrock	: >100 cm
Depth and type of restricting layer	: 70 cm (40-100 cm); compact, unweathered till
Effective rooting depth	: 70 cm (30-100 cm)
CF content and type (0-30 cm)	: 20% (15-50%), gravelly
CF content and type (subsurface)	: 15% (5-35%, gravelly
Perviousness	: Moderate to slow
Percolation	: Moderate in B horizon, slow in C horizon
Soil classification	: Orthic Dystric Brunisol

Water regime

The Mexicana soils are generally moderately well-drained soils with faint mottling throughout the solum, which commonly increases to distinct mottles below 50 cm from the surface. Mexicana soils are wet during winter months but are dry and droughty during summer. Perched water table conditions often occur on top of the compact till. Water seepage is common. Water moves laterally over the compact till during the winter or after heavy rainfall. Imperfectly drained Mexicana soils occur in some places. 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

Mexicana soils can be variable in one or more properties. The most variable characteristic is depth to compact, unweathered till. Drainage also varies in the Mexicana soils. Dominantly imperfectly drained Mexicana soils are mapped as MEid. Where bedrock was observed to occur between 50 and 100 cm, the soil is mapped as MEl. Weakly cemented and, in some places, moderately cemented horizons may be present as thin, discontinuous bands.

Similar soils

Mexicana soils are similar to the moderately well-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 soils is also found in the subsoil of Suffolk and St. Mary soils.

Natural vegetation

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

Land use

No agricultural development has taken place on Mexicana soils in the survey area. 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 predominantly used for growing coniferous trees.

Map units

Mexicana soils are the dominant soil in the Mexicana (ME) map unit. They also occur as a minor soil or an unmentioned inclusion in the Rock-Saturna (RO-ST), Saturna (ST), Saturna-Qualicum (ST-QU), and Trincomali map units.

Mexicana map unit (ME)

The Mexicana map unit consists dominantly (70%; 60-80%) of the moderately well-drained Mexicana soils with, on average, 30% (up to 40%) of other soils. The other soils may be one or a combination of the following minor soils; Saturna (ST), Suffolk (SU), and Galiano (GA). The soil inclusions limit some use interpretations of the ME map unit.

Landform and occurrence

Soils of the Mexicana map unit occur dominantly on gently to moderately sloping (6-15%), subdued topography and, in some places, on strong slopes (16-30%). The till soils in the map unit occupy many different landscape positions, such as depressions and hollows on side slopes, where till deposits have been protected from subsequent erosional processes after the last glaciation. Inclusions of Saturna and Galiano soils occur in small areas where bedrock is close to the surface. This map unit occurs at all elevations.

Distribution and extent

The Mexicana map unit is a minor one with five delineations, of which three occur on Valdes Island and two on Thetis Island. Both variations (MEid and ME1) are found on Thetis Island. The map unit represents an area of 192.0 ha (1.7% of the total map area).

NEPTUNE SOILS AND MAP UNITS

Neptune soils (NT)

Neptune soils are well-drained, black-colored calcareous soils consisting of shallow gravelly loamy sand to gravelly sand marine deposits mixed with clam and oyster shells, organic debris, and sometimes human artifacts (Indian middens) over sandy marine deposits between 70 and 120 cm. Coarse fragment content is between 15 and 35%. Soils have no profile development.

Soil characteristics

Thickness of surface soil	: Ah 75 cm (40-120 cm)
Texture, surface soil (0-30 cm)	: LS-SL
Texture, subsurface soil	: LS-S
Depth of solum (A horizon)	: 75 cm (40-120 cm)
Depth of soil (A and C horizons)	: 90 cm (70-120 cm)
Depth to bedrock	: >100 cm
Depth and type of restricting layer	: absent
Effective rooting depth	: 0-20 cm
CF content and type (0-30 cm)	: 15-35%, gravelly and angular gravelly
CF content and type (subsurface)	: 20-50%, gravelly
Perviousness	: Rapid
Percolation	: Rapid
Soil classification	: Orthic Humic Regosol

Water regime

Neptune soils are moist during the winter but very droughty during the summer. There are no discernible mottles within 120 cm of the surface.

Variability

Although the texture of Neptune soils is very uniform, the coarse fragment content and quantity of shells varies considerably. Between 70 and 120 cm depth, the Neptune soils may overlie coarse-textured marine materials. The high calcium carbonate content from the shells prevents any significant profile development as indicated by the absence of a B horizon. Where bedrock occurs between 50 and 100 cm, the soil is mapped as NT1.

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. They are calcareous soils, very high in organic matter and nitrogen content. A major limitation to agricultural use is droughtiness and stoniness.

Map units

Neptune soils occur as the dominant soil in the Neptune (NT) map unit. In addition, Neptune soils were observed as an unmentioned inclusion in one delineation each of the Qualicum (QU) and Saturna (ST) map units.

Neptune map unit (NT)

The Neptune map unit consists almost purely (98%; 90-100%) of Neptune soil. One delineation has a 10% inclusion of exposed bedrock (Rock).

Landform and occurrence

Soils of the Neptune map unit occur as narrow, discontinuous deposits along the seashore on nearly level to very gently sloping (0.5-5%), in some places on steeper sloping (10-15%), topography. Scattered inclusions of bedrock occur in very few places.

Distribution and extent

The Neptune map unit is a very minor one, occurring as nine small and narrow delineations of which two are in Montague Park on Galiano Island, two are at Single and Cardale points on Valdes Island, and five are on the Thetis - Kuper islands map sheet. It represents an area of 12.3 ha (0.1% of the total map area). Many more, but smaller, unmappable areas with Neptune soils were indicated with the on-site symbol Ⓝ.

PARKSVILLE SOILS AND MAP UNITS

Parksville soils (PA)

Parksville soils are poorly drained soils that have between 30 and 100 cm of a loamy sand to sandy loam of marine or fluvial origin overlying deep (>100 cm), silty clay loam to silty clay textured, marine deposits that are usually stone-free. The profile description and analyses of a selected Parksville soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 15 cm (10-25 cm)
Texture, surface soil (0-30 cm)	: SL (LS)
Texture, subsurface soil	: SL-LS, deeper SiCL-SiC
Thickness of overlay materials	: 70 cm (30-90 cm)
Depth of solum (A and B horizons)	: 70 cm (30-90 cm)
Depth of soil (A, B, and C horizons)	: >100 cm
Depth to bedrock	: >100 cm
Depth and type of restricting layer	: 70 cm (30-90 cm), fine-textured, often massive-structured subsoil
Effective rooting depth	: 70 cm (20-110 cm)
CF content and type (0-30 cm)	: 0-10%, gravelly and angular gravelly
CF content and type (subsurface)	: 0-5%, gravelly
Perviousness	: Slow
Percolation	: Rapid in surface 70 cm, very slow below 70 cm
Soil classification	: Orthic Humic Gleysol

Water regime

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

Variability

Some variations of Parksville soils occur. A well-decomposed organic surface layer (Oh) may be present (PApt). Also, the overlay materials (LS-SL) may be deeper than 100 cm (PAd) or a loam (PAlo) or silt loam (PAsi) surface texture occurs. Shallow Parksville soils over bedrock occurring between 50 and 100 cm from the surface are mapped as PAl.

Similar soils

Imperfectly drained members of the Parksville soils are the Brigantine soils. Parksville soils differ from the poorly drained Tolmie soils in having loamy sand and sandy loam coarse-textured overlay materials thicker than 30 cm. Also, Tolmie soils are usually saturated with water for longer during the year.

Natural vegetation

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

Land use

Most Parksville soils have been left in their original vegetation. However, some Parksville soils are used for pasture and hay crops. The major limitation for growing a wider range of crops is the wetness into the late spring caused by high water tables. This problem could be overcome with artificial drainage. 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: the simple map unit Parksville (PA) and the compound map unit Parksville-Tolmie (PA-TL). In addition, Parksville soils are minor soils or unmentioned inclusions in some delineations of the Brigantine (BE), Cowichan (CO), Fairbridge (FB), Qualicum (QU), Rock-Saturna (RO-ST), and Tolmie (TL) map units.

Parksville map unit

The Parksville map unit consists dominantly (80%; 60-100%) of the poorly drained Parksville soils. The map unit includes, on average, 20% (up to 40%) of other soils, from which the imperfectly drained Brigantine soils developed on the same parent material sequence are the most frequently occurring minor soils. These Brigantine soils do not limit, but rather enhance, the use interpretations for the map unit. Unmentioned inclusions of other soils may occur in a very few places.

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 around the periphery of marine basins where sandy materials have been deposited on top of fine-textured marine materials. Brigantine soils are found on the better-drained landscape positions. Brigantine soils occur as unmappable minor inclusions in the Parksville map unit. Scattered inclusions of other soils occur. Soils of the Parksville map unit are also found in depressional areas between bedrock ridges. In some places, the Parksville (PA) soils occur on gentle seepage slopes (6-9%). Elevation is usually between 0 and 100 m above mean sea level.

Distribution and extent

This map unit occurs as 13 small- to medium-sized, often long and narrow shaped delineations on the Galiano and the Thetis - Kuper islands map sheets. Variations in the Parksville map unit (PApt, PAl, PAd, PAsi) all occur on the Thetis - Kuper islands map sheet. The map unit represents an area of 89.6 ha (0.8% of the total map area).

Parksville-Tolmie map unit (PA-TL)

The Parksville-Tolmie map unit consists dominantly (55%; 50-60%) of the poorly drained Parksville soils with a subdominant proportion (39%; 30-45%) of poorly drained soils developed on deep (>100 cm) silt loam to silty clay loam marine deposits that are usually stone-free (Tolmie soils). Unmentioned inclusions of other soils may occur in a very few places. The Tolmie soil does not adversely affect the use interpretations for the PA-TL map unit.

Landform and occurrence

Soils of the Parksville-Tolmie (PA-TL) map unit occur on nearly level to very gently sloping (0.5-5%) topography in depressional areas, swales, and drainageways at elevations between 0 and 100 m above sea level. Tolmie soils occupy the lowest landscape positions as significant portions of the map unit. However, they occur scattered within the map unit; hence they cannot be mapped separately. In some places, the Parksville-Tolmie (PA-TL) map unit is found on gentle seepage slopes (6-9%).

Distribution and extent

This map unit, which is a minor one, occurs as nine small, often elongated delineations, two of which occur on Valdes and Link islands. No PA-TL delineations were mapped on Galiano Island. The unit represents an area of 65.5 ha (0.6% of total map area).

QUALICUM SOILS AND MAP UNITS

Qualicum soils (QU)

Qualicum soils are rapidly to moderately well-drained soils developed on deep (>150 cm) deposits of gravelly sandy loam to gravelly sand textured, glaciofluvial, fluvial, or marine deposits. Coarse fragment content throughout the profile is between 20 and 50%. The profile description and analyses of a selected Qualicum soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm (Ap 10-15 cm)
Texture, surface soil (0-30 cm)	: LS-SL
Texture, subsurface soil	: SL-S
Depth of solum (A and B horizons)	: 60 cm (35-120 cm)
Depth of soil (A, B, and C horizons)	: >150 cm
Depth to bedrock	: >150 cm
Depth and type of restricting layer	: Occasionally discontinuous cementation
Effective rooting depth	: 60 cm (35-120 cm)
CF content and type (0-30 cm)	: 35% (15-60%); gravelly and cobbly
CF content and type (subsurface)	: 30% (10-70%); gravelly, cobbly, stony
Perviousness	: Rapid
Percolation	: Rapid
Soil classification	: Orthic Dystric Brunisol

Water regime

Qualicum soils are rapidly to moderately well-drained soils. They are moist throughout the late fall to spring but quickly become very droughty during summer. The water table remains below 90 cm from the surface throughout the year.

Variability

Four variations of Qualicum soil occur in a few places in the report area. Imperfectly drained Qualicum soil is indicated by QUid. Bedrock may occur between 50 and 100 cm (Qul). Shallow Qualicum soil (QUs) has similar materials, but with >20% coarse fragments occurring between 50 and 100 cm depth. Another variation with a fluvial silt loam capping was mapped as QUsi. Wetter water regimes occurred in some places (QUid). Also, Qualicum soils may have either discontinuous, weakly cemented, or moderately cemented horizons, or podzolic Bf horizons. These variations are not consistent enough to be mapped.

Similar soils

Qualicum soils commonly occur together with similarly drained and textured soils that have a much lower coarse fragment content (<20%), the Beddis soils. Qualicum soils also occur with similarly textured but shallow (<100 cm) soils overlying compact, unweathered till (Trincomali soils).

Natural vegetation

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

Land use

Small areas of Qualicum soils were once cultivated but are now used as pasture land. The major limitations that preclude more intensive agricultural development on these soils are the topography, droughtiness, and stoniness. Also, they are infertile soils, low in nutrients and organic matter. 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 location of these gravel pits are indicated by the symbol G on the soil maps.

Map units

Qualicum soils occur in many map units. They are the dominant soil in the Qualicum (QU) map unit. Qualicum soils are a subdominant component in the Saturna-Qualicum (ST-QU) map unit and they occur as minor soils in the Trincomali (TR) and Beddis (BD) map units. In addition, Qualicum soils occur in a few places as a minor soil or unmentioned inclusion in some delineations of the Brigantine (BE), Brigantine-Tolmie (BE-TL), Rock (RO), Rock-Saturna (RO-ST), Saturna (ST), and Saturna-Brigantine (ST-BE) map units.

Qualicum map unit (QU)

The Qualicum map unit consists dominantly (86%; 50-100%) of the rapidly to moderately well-drained Qualicum soils. The map unit includes, on average, 14% (up to 50%) of other soils. These other soils may be one or a combination of the following commonly occurring minor soils: Brigantine (BE) and Saturna (ST). Unmentioned inclusions of other soils occur in a very few places. The inclusions limit most use interpretations for the map unit.

Landform and occurrence

Soils of the Qualicum map unit occur as deep outwash (deltaic) and terrace deposits associated with old drainageways and as raised beach deposits on very gently to strongly sloping (2-30%) landscape positions. Brigantine soils occur in the lower and wetter landscape positions. Saturna soil inclusions occur in areas that are shallow (<100 cm) to bedrock. These and other inclusions are scattered as small unmappable portions of the map unit.

Distribution and extent

The Qualicum map unit occurs commonly throughout the report area with 37 small- to medium-sized delineations. Two delineations are mapped each as QUs, QUid, and QUl. One delineation on Valdes Island is mapped as QUsi. The Qualicum map unit represents an area of 209.7 ha (1.8% 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 consolidated bedrock. It is also called rockland or rock outcrop.

Natural vegetation

The vegetation consists of mosses, grasses, and, in some places, broad-leaved stonecrop, along with scattered coast Douglas fir, Pacific madrone, and Garry oak.

Map units

Beause many large areas consist of bedrock exposures with shallow soils over bedrock, bedrock exposures (RO) occur in many map units. Rock is the dominant component in the simple Rock (RO) map unit, Rock is also the dominant component in the Rock-Bellhouse (RO-BH) and Rock-Saturna (RO-ST) map units. In addition, bedrock exposures (RO) also occur as minor areas in the following five map units: Bellhouse (BH), Galiano (GA), Haslam (HA), Salalakim (SL), and Saturna (ST). These map units are described elsewhere in this part of the report. Minor amounts of bedrock exposures may also occur in some delineations of many other map units (BD, BE, NT, PA-TL, ST-BE, ST-QU, TL).

Rock map unit (RO)

This map unit consists dominantly (85%; 60-100%) of undifferentiated bedrock exposed or covered by less than 10 cm of mineral soil with, on average, 15% (up to 40%) of well-drained soils developed on shallow, loamy sand to loam colluvial and glacial drift materials over bedrock, usually within 50 cm of the surface. The coarse fragment content of the soil materials is between 20 and 50% (undifferentiated mineral soil, depending on bedrock type: BHsl, GAsl, HAsl, SLsl, STsl). The most common minor soil in the map unit is Saturna (ST). Unmentioned inclusions of other soils occur in a very few places. 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 (slopes 6-30%), rock ridges and rocky knolls (slopes 31-70%), and rock bluffs, cliffs, and escarpments (slopes 71% to over 100%) of all rock types found in the survey area. Minor areas of soil occur in places where the bedrock has been fractured and weathered, often indicated by clumps of tree growth. Rock outcrops occur at all elevations and aspects.

Distribution and extent

This major map unit consists of 75 delineations of various sizes, in some cases very large, throughout the survey area. This map unit includes many small islets off the sea coast. It represents an area of 703.0 ha (6.2% of total map area).

Rock-Bellhouse map unit (RO-BH)

This map unit consists dominantly (59%; 50-65%) of sandstone bedrock exposed or covered by less than 10 cm of mineral soil. This map unit also contains a subdominant proportion (41%; 35-50%) of well-drained soils developed on very shallow (10-50 cm), channery, sandy loam textured, colluvial and glacial drift materials over sandstone bedrock. These soils have an Ah horizon >10 cm (very shallow lithic phase of Bellhouse soil, BHsl). Bellhouse soils enhance the use interpretations for the map unit.

Landform and occurrence

Landscape of the Rock-Bellhouse map unit occurs on south-facing areas in hummocky and ridged terrain, with slopes varying between 6-30%. The Bellhouse soils occur on the colluvial side slopes and in pockets where the bedrock has been fractured and weathered.

Distribution and extent

This map unit is very minor and occurs as eight, small delineations of which two are on Galiano Island (Dionisio Point area) and the remainder on Thetis - Kuper islands map sheet. Six delineations were mapped as RO-BHsl and one as RO-BHsl,vg. This map unit represents 19.1 ha (<0.2% of total map area).

Rock-Saturna map unit (RO-ST)

This map unit consists dominantly (56%; 45-70%) of sandstone bedrock exposed or covered by less than 10 cm of mineral soil. This map unit also contains subdominant proportions (42%; 20-55%) of well-drained soils developed on shallow (10-50 cm, in some places 10-100 cm), channery, sandy loam to channery, loamy sand textured, colluvial and glacial drift materials over sandstone bedrock (very shallow lithic Saturna soil, STsl; in some places ST). Soils have 20-50% coarse fragments. Saturna soils enhance the use interpretations for this map unit. Unmentioned inclusions of other soils occur in a very few places.

Landform and occurrence

Landscape of this map unit occurs dominantly on rock ridges and knolls (slopes 31-70%) and in areas with smooth, unweathered sandstone (slopes 6-30%). Saturna soils (ST) occur on colluvial side slopes and in areas where bedrock has been fractured and weathered, commonly as pockets on top of, or in between, the ridges or knolls. Inclusions occur at random in the map unit.

Distribution and extent

The Rock-Saturna map unit represents one of the most extensive and frequently mapped areas throughout the report area with 84 small- to medium-sized delineations, that are commonly narrow. This map unit occupies an area of 947.9 ha (8.3% of total map area).

SALALAKIM SOILS AND MAP UNITS

Salalakim soils (SL)

Salalakim soils are rapidly to well-drained, gravelly sandy loam textured soils that have developed on shallow, colluvial and glacial drift materials of weathered conglomerate over conglomerate bedrock within 100 cm of the surface. Coarse fragment content is between 20 and 50%. The profile description and analyses of a selected Salalakim soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm
Texture, surface soil (0-30 cm)	: SL (LS;L)
Texture, subsurface soil	: SL (LS-S)
Depth of solum (A and B horizons)	: 40 cm (10-50 cm)
Depth of soil (A, B, and C horizons)	: 55 cm (10-65 cm)
Depth to fractured bedrock	: 55 cm (10-65 cm)
Depth and type of restricting layer	: 60 cm (10-80 cm); consolidated bedrock
Effective rooting depth	: 30 cm (25-80 cm)
CF content and type (0-30 cm)	: 35% (20-60%), gravelly (cobbly)
CF content and type (subsurface)	: 35% (20-60%), gravelly and cobbly
Perviousness	: Rapid
Percolation	: Rapid
Soil classification	: Orthic Dystric Brunisol

Water regime

Salalakim soils are rapidly to well-drained soils. They remain moist throughout the winter 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

The most variable characteristic of the Salalakim soil is depth to bedrock. Commonly, bedrock occurs within 50 cm of the surface (SLsl). In some places, the Ah horizon is thicker than 10 cm or a podzolic Bf horizon is present (Orthic Humo-Ferric Podzol). The soil usually has a thin layer 5 cm thick (0-10 cm) of broken and fractured bedrock on top of the unweathered consolidated bedrock. This layer does not impede root development or water movement. Although the dominant texture is sandy loam, Salalakim soils with loam or loamy sand textures do occur in some places but not commonly and consistently enough to be mapped separately.

Similar soils

Salalakim soils are similar in drainage and texture to Qualicum soils, but the latter 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 some irregularly shaped.

Natural vegetation

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

Land use

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

Map units

Salalakim soils occur as the dominant soil in the Salalakim (SL) map unit. They also occur as a minor soil or unmentioned inclusion in some delineations of the undifferentiated Rock (RO), Saturna (ST), and Qualicum (QU) map units.

Salalakim map unit (SL)

The Salalakim map unit consists dominantly (85%; 80-100%) of the rapidly to well-drained Salalakim soil, with bedrock occurring within 100 cm of the surface. The map unit includes, on average, 15% (up to 20%) of conglomerate bedrock exposures (Rock), which is a limiting factor in the use interpretations for this map unit.

Landform and occurrence

Soils of the Salalakim (SLsl) map unit occur dominantly on moderately to strongly sloping (10-45%) topography where they occupy the colluvial side slopes. Bedrock exposures commonly occur on top of the ridges and knolls.

Distribution and extent

The Salalakim map unit is a minor one; only six small- to medium-sized delineations were mapped on Galiano Island. Four delineations were mapped as SLsl. This map unit represents an area of 95.2 ha (0.8% of total map area).

SATURNA SOILS AND MAP UNITS

Saturna soils (ST)

Saturna soils are well-drained soils that have developed on shallow deposits of channery, sandy loam to channery, loamy sand textured, colluvial and glacial drift materials over sandstone bedrock within 100 cm of the surface. Coarse fragment content varies between 20 and 50%. The profile description and analyses of a selected Saturna soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm
Texture, surface soil (0-30 cm)	: SL-LS
Texture, subsurface soil	: SL-LS
Depth of solum (A and B horizons)	: 45 cm (25-75 cm)
Depth of soil (A, B, and C horizons)	: 55 cm (25-125 cm)
Depth to fractured bedrock	: 55 cm (10-100 cm)
Depth and type of restricting layer	: 60 cm (25-125 cm), consolidated bedrock
Effective rooting depth	: 45 cm (25-75 cm)
CF content and type (0-30 cm)	: 40% (20-80%), channery and flaggy
CF content and type (subsurface)	: 50% (30-70%), channery and flaggy
Perviousness	: Rapid
Percolation	: Rapid
Soil classification	: Orthic Dystric Brunisol

Water regime

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

Variability

Depth to bedrock is the most variable characteristic of the Saturna soils. More than half of the Saturna soils have bedrock within 50 cm of the surface (STsl). Other variations that occur in a very few places are: bedrock between 50 and 100 cm (STl), bedrock deeper than 100 cm (STd), sombric variant (STa), and a shallow layer of fractured bedrock (paralithic layer) on top of the solid bedrock (STpl). Also, the sandstone fragment content is variable but is generally higher in the subsoil than in the surface soil. Where coarse fragment content exceeds 50% in the surface soil, the soil is mapped as either very gravelly phase (STvg) or bouldery phase when rock fragments are more than 60 cm in diameter (STb). Where the surface layer has a loam texture, the soil is mapped as STlo.

Similar soils

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

Natural vegetation

The natural vegetation consists of coast Douglas fir, scattered Pacific madrone, and some grand fir, with an understory 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, some sheep- and cattle-grazing takes place. 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 frequency of rock outcrops. Despite these limitations, some property owners have been able to use Saturna soils for productive vegetable gardens. However, this use could only be accomplished with high monetary inputs and labour-intensive management. Most of the areas of Saturna soils remain in natural forest of coast Douglas fir, Pacific Madrone and stunted, scattered salal. Tree growth is slow because of the lack of moisture in the summer. Such areas provide browse and protection for deer.

Map units

As the most commonly mapped soil in the survey area, Saturna soils occur in most map units. They are dominant in the Saturna (ST) simple map unit and in the Saturna-Brigantine (ST-SE) and Saturna-Qualicum (ST-QU) map units. Saturna is also a subdominant soil in the Rock-Saturna (RO-ST) map unit, which has already been described under Rock (RO). In addition, Saturna soils occur as a minor soil or unmentioned inclusion in the undifferentiated Rock (RO) map unit, and in some delineations of many other map units (BD, BE, BE-TL, CO, GA, HA, ME, PA-TL, QU, SU, TL, and TR).

Saturna map unit (ST)

The Saturna (ST) map unit consists dominantly (82%; 55-100%) of the well-drained Saturna soils. The map unit includes, on average, 18% (up to 45%) of other soils and nonsoil, of which sandstone bedrock exposures (Rock) are the most commonly occurring inclusions in the map unit. Bedrock exposures are usually associated with the very shallow lithic Saturna soil (STsl). They are more limiting than the Saturna soils for use interpretations of the map unit. Unmentioned inclusions of other soils occur in a very few places.

Landform and occurrence

The soil landscape consists of shallow soils over sandstone bedrock on usually gently to very strongly sloping (6-45%) topography in subdued and hummocky terrain. In some places, the Saturna map unit occupies steeper landscape positions such as side slopes (46-100%) of rock ridges. Bedrock exposures are scattered, most commonly in association with the very shallow lithic Saturna soils (STsl).

Distribution and extent

The Saturna (ST) map unit is the most common and extensive unit throughout the survey area with 170 delineations of various sizes, many very large. Many delineations (112, 65%) have shallow Saturna soils with bedrock within 50 cm of the surface (STsl), and 49 delineations (28%) have bedrock within 100 cm (ST). Most of the variations occurring less commonly (STl, STpl, STd, STb, STvg, STa) have been mapped on the Thetis - Kuper islands map sheet. The Saturna map unit represents an area of 5698.3 ha (50.0% of total map area).

Saturna-Brigantine map unit (ST-BE)

The Saturna-Brigantine map unit consists dominantly (58%; 45-70%) of the well-drained Saturna soils. The map unit contains a subdominant proportion (37%; 25-55%) of imperfectly drained soils with a capping of loamy sand to sandy loam texture (30-100 cm) over deep (>100 cm), silty clay loam to silty clay, marine deposits that are usually stone-free (Brigantine soils). In addition, bedrock exposures (Rock) are the most commonly occurring inclusions. Unmentioned inclusions of other soils may occur in a very few places. The Brigantine soils are the less limiting soils in the ST-BE map unit. Consequently, they influence favorably the use interpretations for this map unit. The reverse is true for inclusions of bedrock exposures.

Landform and occurrence

The soil landscape consists dominantly of subdued and hummocky terrain with gentle to strong slopes (6-30%) and, in some places, of ridged terrain with steeper slopes (31-45%). In the latter terrain shallow Saturna soils alternate with depressions and draws occupied by Brigantine soils (slopes 2-15%). The two soils occur either sequentially or scattered in the landscape in such a way that they can not be reasonably divided into individual map units. Other inclusions occur as small areas at random. This map unit usually occurs at elevations between 0 and 100 m above mean sea level.

Distribution and extent

The Saturna-Brigantine map unit occurs as 12 medium-sized delineations, seven of which occur on the Valdes map sheet. Only two delineations occur on Galiano Island. Seven of the delineations were mapped as ST-BEg. Two delineations were mapped each as STs1-BE and ST-BEd. The map unit represents an area of 245.3 ha (2.2% of total map area).

Saturna-Qualicum map unit (ST-QU)

The Saturna-Qualicum map unit consists dominantly (57%; 45-60%) of well-drained Saturna soils. The map unit contains a subdominant proportion (33%; 25-55%) of rapidly to well-drained deep (>150 cm), sandy loam to sand textured soils developed on glaciofluvial, fluvial, or marine deposits with 20-50% coarse fragments (Qualicum soils). In addition, bedrock exposures (Rock) are the most commonly occurring inclusions. Unmentioned inclusions of other soils occur in a few places. The Qualicum soil is the less limiting soil for use interpretations for the map unit. The inclusions of bedrock are more limiting than the Saturna soil inclusions for use interpretations.

Landform and occurrence

The soil landscape consists of subdued, hummocky, and ridged terrain with moderate to extreme slopes (10-70%) and, in some places, with more gentle slopes (2-9%). The Qualicum soils occur either on side-slope positions as deep, ancient beach gravels on terraces, or in between ridges as deep outwash deposits. Qualicum soils also occur in isolated pockets between the Saturna soils. Qualicum soils occur in such an intricate way among the Saturna soils that they cannot be mapped separately as individual map units. Inclusions of bedrock exposures and other soils occur at random.

Distribution and extent

The Saturna-Qualicum map unit occurs as 11 delineations of various sizes throughout the survey area. Three delineations are mapped on Galiano Island, two of which are very large; all three are mapped as ST-QU. Four other delineations have bedrock within 100 cm of the surface for both soil components in the map unit (ST-QU1). This map unit represents an area of 514.0 ha (4.5% of total map area).

ST. MARY SOILS AND MAP UNITS

St. Mary soils (SM)

St. Mary soils are imperfectly drained soils with 30-70 cm of a sandy loam to loamy sand textured capping of marine or fluvial deposits over 20-50 cm of sandy clay loam to silty clay loam textured, usually stone-free, marine deposits underlain by gravelly sandy loam to gravelly loam, compact, unweathered till within 100 cm of the surface. The profile description and analyses of a selected St. Mary soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm (Ap 10-15 cm)
Texture, surface soil (0-30 cm)	: SL-LS
Texture, subsurface soil	: SCL-SiCL over SL-L till
Thickness of overlay materials	: 30-70 cm, SL-LS 20-50 cm, SCL-SiCL
Depth of solum (A and B horizons)	: 50 cm (30-70 cm)
Depth of soil (A, B, and C horizon)	: 90 cm (50-120 cm)
Depth to bedrock	: >100 cm
Depth and type of restricting layer	: 90 cm (50-120 cm), compact till
Effective rooting depth	: 50 cm (30-70 cm)
CF content and type (0-30 cm)	: 5% (5-10%), gravelly
CF content and type (subsurface)	: 0-5%, but 15-25% in till, gravelly
Perviousness	: Moderate to slow
Percolation	: Moderate to slow
Soil classification	: Gleyed Dystric Brunisol

Water regime

St. Mary soils are imperfectly drained soils that are saturated to within about 60 cm of 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. The downward movement of water may be restricted by the fine-textured, often massive-structured subsoil and, deeper, by the compact till, which creates 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.

Variability

The most variable characteristic is the thickness and texture of both overlay materials (50-120 cm) and, therefore, the depth to the compact till. The till materials are usually weakly cemented but, in some places, are moderately cemented. Most St. Mary soils in the report area have a coarse fragment content between 20 and 50% in the surface (SMg). Till material in the subsoil is of the Mexicana type.

Similar soils

St. Mary soils without the SL-LS capping are mapped as Suffolk (SU) soils. Where the fine-textured marine subsoil is missing and the soil is slightly better drained and more gravelly, it is mapped as Trincomali (TR) soil. Similar imperfectly drained soils without compact till in the subsoil are mapped as Brigantine (BE) soils.

Natural vegetation

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

Land use

Most of the St. Mary soils have been cleared of their original vegetation for agricultural use, such as pasture and hay production. This soil is similar to the Brigantine soil regarding most use interpretations. The St. Mary soils can be improved with irrigation and fertilizer to produce a wide range of agricultural crops and tree fruits. Besides agriculture, growing deciduous trees is another good use of this soil.

Map units

The St. Mary soils occur as the dominant soil in the St. Mary (SM) map unit and as a minor soil in one delineation of the Suffolk (SU) map unit.

St. Mary map unit (SM)

The St. Mary map unit consists dominantly (80%; 60-100%) of the imperfectly drained St. Mary soils. Two out of the three delineations of the St. Mary map unit have 10-20% inclusions of Trincomali (TR) soils, and one delineation includes 30% Suffolk (SU) soils. These inclusions do not limit the use interpretations for this map unit.

Landform and occurrence

Soils of the St. Mary map unit occur on very gently to moderately sloping (3-15%) landscape positions in subdued terrain, often in conjunction with larger areas consisting of deep, marine deposits. Soil inclusions are scattered in this unit. Elevations are less than 100 m above mean sea level.

Location and extent

St. Mary is a very minor map unit with three medium-sized delineations, all of which occur on Thetis Island. All three delineations are mapped as SMg. They represent an area of 28.6 ha (0.3% of total map area).

SUFFOLK SOILS AND MAP UNITS

Suffolk soils (SU)

Suffolk soils are imperfectly drained soils that have developed on shallow, loam to silty clay loam, marine deposits that are usually stone-free, overlying gravelly sandy loam to gravelly loam textured, compact, unweathered till within 100 cm of the surface. The profile description and analyses of a selected Suffolk soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah 0-10 cm (Ap 10-15 cm)
Texture, surface soil (0-30 cm)	: SiL-L
Texture, subsurface soil	: CL-SiCL over SL-L till
Thickness of overlay materials	: 80 cm (60-115 cm)
Depth of solum (A and B horizons)	: 70 cm (55-110 cm)
Depth of soil (A, B, and C horizons)	: 80 cm (65-125 cm)
Depth to bedrock	: >100 cm
Depth and type of restricting layer	: 80 cm (65-125 cm), compact till
Effective rooting depth	: 45 cm (35-70 cm)
CF content and type (0-30 cm)	: 0-5%, gravelly
CF content and type (subsurface)	: 0-5%, in till; 15-25%, gravelly
Perviousness	: Slow
Percolation	: Moderate to slow
Soil classification	: Gleyed Dystric Brunisol

Water regime

Suffolk soils are imperfectly drained soils with distinct to prominent mottles between 50 and 100 cm. They are saturated to about 60 cm from the surface during the winter, often by a perched water table on top of the compact till. The water table drops quickly in spring and droughty conditions may even prevail during extended dry periods in summer. Poorly drained Suffolk soils occur in the lower landscape positions.

Variability

Variation in drainage occurs most commonly in the Suffolk soil. Poorly drained soils are mapped as SUpd, and soils with a wetter moisture regime but not quite poorly drained are indicated as SUw. In addition the morphology of the Suffolk soils varies as much as that described for the Fairbridge soils. A leached Ae horizon and/or a Btj horizon may occur, but these variations are too inconsistent to map separately. When an Ap horizon thicker than 10 cm is present, the soil is mapped as SUa. Also, Suffolk soils with compact till deeper than 1 m occur (SUd). The till materials, which are usually weakly cemented, are, in some places, moderately cemented in discontinuous layers. The wetter Suffolk soils usually have a sandy clay loam textured till, closer to the surface. Till in the subsoil is of the Mexicana type.

Similar soils

Suffolk soils are similar to the deeper Fairbridge soils which do not overlie compact till. Suffolk soils are somewhat similar to St. Mary soils, which have a shallow (30-70 cm) SL-LS capping.

Natural vegetation

The natural vegetation consists of western red cedar, red alder, bigleaf maple, and some coast Douglas fir, with an understory of western sword fern, salal, American stinging nettle, western bracken, and dull Oregon-grape.

Land use

Some land with Suffolk soils has been cleared for agriculture. These soils are some of the better agricultural soils in the survey area. They are used for hay production and pasture but, upon improvement, could be used for a larger range of annual crops. Because of droughty conditions during the growing season, irrigation is recommended for maximum production.

Map units

The Suffolk soils occur as the dominant soil in the Suffolk (SU) map unit. They are also a minor soil or unmentioned inclusion in some delineations of the Fairbridge (FB), Mexicana (ME), St. Mary (SM), Tolmie (TL), and Trincomali (TR) map units.

Suffolk map unit (SU)

The Suffolk map unit consists dominantly (86%; 60-100%) of the imperfectly drained Suffolk soils. The map unit includes, on average, 14% (up to 40%) of other soils. The other soils may be one or a combination of the following minor soils; similar but poorly drained Suffolk soils (SUpd), Brigantine, and Saturna soils. Unmentioned inclusions of other soils occur in a few places. The poorly drained Suffolk soils limit the use interpretations for this map unit.

Landform and occurrence

Soils of this map unit occur in subdued terrain on usually very gently to moderately sloping (6-15%) topography often in conjunction with larger areas consisting of deep marine deposits. Poorly drained inclusions occupy the lower landscape positions. Other inclusions occur scattered in the map unit. Elevations are usually between 0 and 100 m above mean sea level.

Distribution and extent

The Suffolk map unit occurs only on Thetis and Kuper islands in 10 small delineations. More than half the delineations have wetter moisture regimes (SUpd, SUw), most of which are mapped on Thetis Island. This map unit represents an area of 68.1 ha (0.6% of total map area).

TOLMIE SOILS AND MAP UNITS

Tolmie soils (TL)

Tolmie soils are poorly drained soils that have developed on deep (>100 cm), loam to silty clay loam, marine deposits that are usually stone-free. Sandy, 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 2 and 3.

Soil characteristics

Thickness of surface soil	: Ah or Ap 10-20 cm
Texture, surface soil (0-30 cm)	: L-SiL (SCL-CL)
Texture, subsurface soil	: SiCL-CL (SiC;L)
Depth of solum (A and B horizons)	: 60 cm (45-80 cm)
Depth of soil (A, B, and C horizons)	: >100 cm
Depth to bedrock	: >100 cm
Depth and type of restricting layer	: 60 cm (45-80 cm), massive-structured Cg horizon
Effective rooting depth	: 60 cm (30-90 cm)
CF content and type (0-30 cm)	: 0-5%, gravelly
CF content and type (subsurface)	: 0-5%, gravelly
Perviousness	: Slow
Percolation	: Slow
Soil classification	: Orthic Humic Gleysol

Water regime

Tolmie soils are poorly drained soils that have distinct to prominent mottles within 50 cm of the surface. They are wet for long periods throughout the year with water tables within 30 cm of the surface from late November to early March. In the spring, water tables drop quickly and remain below 50 cm 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, fine-textured subsoil. The Tolmie soils receive runoff water from the surrounding landscape.

Variability

The texture within the Tolmie soil profile varies from a light loam to a heavy silty clay soil, often with coarser-textured, discontinuous, thin layers or pockets. In some places, a shallow (<30 cm), sandy loam to loamy sand capping may be present. About 10% of the Tolmie soils have a well-decomposed organic surface layer, which is indicated by TLpt. Other infrequently mapped soil phases or variants in the Tolmie soil are: bedrock between 50 and 100 cm (TLl), a slightly better-drained soil (TLid), subject to seawater inundation (TLsn), a surface layer exceeding 20% coarse fragments (TLg), and a taxonomy change (TLt). Occasionally, Ae and Btg horizons are present, in soil profiles with textures not uniform enough to classify the soil as Cowichan (CO).

Similar soils

Tolmie and Cowichan soils are very 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. Soils with morphology similar to Cowichan soils but with variable textures (e.g., coarse-textured materials in discontinuous thin layers or pockets) were mapped as Tolmie soils. Soils similar to Parksville soils but with shallow (<30 cm), loamy sand and sandy loam cappings (<30 cm) have been called Tolmie soils.

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, in the wettest landscape positions, commonly American skunk-cabbage.

Land use

Large areas of Tolmie soils have been cleared for agricultural production. When drainage is improved, they are one 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. Unimproved agricultural land is usually used for pasture and hay crops as the spring planting of other crops is often impractical because of wet soil conditions.

Map units

As one of the most commonly mapped soils in the survey area, Tolmie soils occur in many map units, especially as the dominant soil in the Tolmie (TL) map unit. Tolmie soils are a subdominant soil in the Brigantine-Tolmie (BE-TL) and Parksville-Tolmie (PA-TL) map units, as described earlier under Brigantine and Parksville. Tolmie soils are minor soils or unmentioned inclusions in some delineations of the Brigantine (BE), Cowichan (CO), Fairbridge (FB), and Parksville (PA) map units; and in one delineation each of the Galiano (GA), Haslam complex (HA), Metchosin (MT), Saturna-Brigantine (ST-BE), and Suffolk (SU) map units.

Tolmie map unit (TL)

The Tolmie map unit consists dominantly (87%; 60-100%) of the poorly drained Tolmie soil. The map unit includes, on average, 13% (up to 40%) of other soils. These other soils may be one or a combination of the following minor soils; Brigantine (BE), Parksville (PA), and Cowichan (CO), of which Brigantine soils occur most frequently. Unmentioned inclusions of other soils occur in a very few places. The Brigantine minor soil enhances the use interpretations of the 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 Brigantine soils occur in the better-drained landscape positions. Other soil inclusions occur scattered within the map unit. Elevation is usually between 0 and 100 m above mean sea level.

Distribution and extent

The Tolmie map unit occurs commonly throughout the survey area with 57 small-sized, usually narrow and long delineations. All six TLpt delineations occur on the Thetis - Kuper islands map sheet. The map unit represents an area of 368.6 ha (3.2% of total map area).

TRINCOMALI SOILS AND MAP UNITS

Trincomali soils (TR)

Trincomali soils are moderately well-drained soils that have developed on shallow (30-100 cm) deposits of gravelly sandy loam to gravelly loamy sand textured, marine, fluvial, or glaciofluvial materials (15-50% gravels) over gravelly sandy loam to gravelly loam textured, compact, unweathered till within 100 cm of the surface. The profile description and analyses of a selected Trincomali soil are given in Appendixes 2 and 3.

Soil characteristics

Thickness of surface	: Ah 0-10 cm (Ap 10-15 cm)
Texture, surface soil (0-30 cm)	: SL-LS
Texture, subsurface soil	: SL-LS over SL-L till
Thickness of overlay materials	: 80 cm (45-120 cm)
Depth of solum (A and B horizons)	: 60 cm (40-80 cm)
Depth of soil (A, B, and C horizon)	: 80 cm (45-120 cm)
Depth to bedrock	: >100 cm
Depth and type of restricting layer	: 80 cm (45-120 cm), compact till
Effective rooting depth	: 60 cm (50-110 cm)
CF content and type (0-30 cm)	: 30% (10-50%), gravelly and angular gravelly
CF content and type (subsurface)	: 20% (10-50%), gravelly
Perviousness	: Slow
Percolation	: Rapid in solum, very slow in till
Soil classification	: Orthic Dystric Brunisol

Water regime

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

Variability

The most common variation in the Trincomali soils is in soil drainage. About one-third of the Trincomali soils are imperfectly drained (TRid). Also, the thickness of the overlay materials varies considerably (45-120 cm) but it is usually less than 100 cm. When it is deeper than 100 cm, it is mapped as TRd. In some places, a podzolic Bf horizon is present, which changes the classification into an Orthic Humo-Ferric Podzol. This variation is too inconsistent to express in the map symbol. The Mexicana-type till in the subsoil usually has less than 20% clay and is commonly weakly (in some places moderately) cemented.

Similar soils

Trincomali soils commonly occur together with similar-textured Qualicum soils, which are deeper and usually better drained. Trincomali soils with overlays thicker than 150 cm are mapped as Qualicum. Trincomali soils also may occur together with Mexicana soils, which are similar but have developed on till without the coarser-textured overlay materials. When the sandy loam to loamy sand textured deposits over till are less than 30 cm thick, these soils are part of the Mexicana (ME) map unit.

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

Only small areas with Trincomali soils have been cleared for agriculture. These are being used for grazing sheep and horses. The main limiting factors for more intensive 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. Most Trincomali soils are under natural forest.

Map units

Trincomali soils occur as the dominant soil in the Trincomali (TR) map unit. Trincomali is a minor soil or unmentioned inclusion in some delineations of the Brigantine (BE), St. Mary (SM), Saturna (ST), and Saturna-Qualicum (ST-QU) map units. They also occur in one delineation each of the following map units: BD, BH, FB, GA, PA-TL, QU, RO, and ST-BE.

Trincomali map unit (TR)

The Trincomali (TR) map unit consists dominantly (78%; 60-100%) of the moderately well-drained Trincomali soils. The map unit includes, on average, 22% (up to 40%) of other soils. The other soils may be one or a combination of the following minor soils: Saturna (ST), Qualicum (QU), and Mexicana (ME), of which the first two (ST and QU) occur most commonly. Unmentioned inclusions of other soils may occur in a very few places. Inclusions of Qualicum soils are the least limiting soils for use interpretations for the map unit.

Landform and occurrence

The Trincomali landscape consists of shallow beach, terrace, or outwash deposits over till, usually near or at the shoreline or along drainageways. Trincomali map unit (TR) occurs on gently to moderately sloping (6-15%) topography but, in some places, on steeper slopes (16-30%). Inclusions of Saturna soils occur in areas shallow to bedrock, whereas the compact till is absent in areas with Qualicum soil inclusions. Other inclusions occur scattered within the map unit.

Distribution and extent

The Trincomali map unit in the survey area has 16 small- to medium-sized delineations, of which 9 occur on Valdes Island. One extremely large delineation was mapped on the eastside of Kuper Island. Six delineations are imperfectly drained (TRid), and two have deep overlay materials (TRd). This map unit represents an area of 509.9 ha (4.5% of total map area).

SUMMARY OF AREAL EXTENT OF MAP UNITS

When the map units are grouped by origin of parent materials and/or parent material textures of the dominant soils, some general comparisons can be made about the distribution of these groups of map units for each map sheet and for the total surveyed area (Table 8).

Table 8. Distribution of map units in survey area by parent materials

Dominant soils	Map units	Area occupied by map sheet: Galiano Is (ha)	Galiano Is (%)	Valdes Is (ha)	Valdes Is (%)	Thetis Is Kuper Is (ha)	Thetis Is Kuper Is (%)	Total distribution in survey area (ha)	Total distribution in survey area (%)
1 Shallow colluvial and glacial drift over bedrock (within 1 m)	BH, GA, HA, SL, ST, ST-BE ST-QU	4302	71	1543	55	1001	40	6846	60
2 Rock	RO, RO-BH, RO-ST	903	15	533	19	234	9	1670	15
3 Shallow over compact glacial till (within 1 m)	ME, SM, SU, TR	85	1	253	9	461	18	799	7
4 Deep, moderately fine- to fine-textured marine materials	CO, FB, TL	150	2	86	3	437	17	673	6
5 Deep, coarse- to moderately coarse-textured materials	BD, BY, QU	67	1	109	4	77	3	253	2
6 Coarse to moderately coarse over deep, moderately fine- to fine-textured marine materials	BE, BE-TL, PA, PA-TL	496	8	254	9	284	11	1034	9
7 Organic and anthropogenic materials	MT, NT	47	1	16	1	23	1	86	1
Summary:									
1,2,3 Shallow soils and rock		5290	87	2329	83	1696	67	9315	82
4,5,6,7 Deep soils		760	12	465	17	821	32	2046	18

Note: The remaining area on each map sheet and for total survey area consists of land types such as CB, MD, TF, and W.

PART 5. LAND USE INTERPRETATIONS

The 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 soil survey, 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, can be determined only 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 demand for residental development it is important to know the constraints or limitations that the soil-landscape properties of each map unit impose on septic tank effluent absorption. Soil characteristics, more than any other factor, determine the success or failure of septic tank absorption field performance. 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 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 not only limit the thickness of material available for effluent treatment but also 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: This property, although not major for determing effluent disposal, is nevetheless an important factor that influences 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 9. 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 9. The slight constraint class does not list subclass limitations.

The typical constraint classes for effluent absorption in columns 4 and 5 of Table 9 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 estimated 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 9.

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 9 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, 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 9. Constraint classes and soil and landscape limitations for septic tank effluent absorption

Map unit		Typical constraint class			Variation due to slope			Variation due to soil properties		
Symbol	Name	Slope class*	Constraint class	Soil limitations	Slope class*	Constraint class	Soil limitations	Soil phase*	Constraint class	Soil limitations
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
BD	Beddis	6	Severe	Ts^{8†}-Tgw^{2†}	4 5 8-9	Moderate Moderate Very severe	SW^{8}-GSW^{2} STW^{8}-GST^{2} T	BDl,g	Severe	RTg
BE	Brigantine	4,3	Severe^{8}-very severe^{2}	DW^{8}-Wd^{2}	5 6	Severe^{8}-very severe^{2} Severe^{8}-very severe^{2}	DWt^{8}-Wd^{2} DTW^{8}-Wd^{2}	BEd BEd,g BEg BEl	Severe Severe Severe Severe	Wd Wdg DWg RW
BE-TL	Brigantine-Tolmie	3,4	Severe^{6}-very severe^{4}	DW^{6}-Wd^{4}	5	Severe^{6}-very severe^{4}	DWt^{6}-Wd^{4}	BEg-TL BEg-TLg	Severe^{6}-very severe^{4} Severe^{6}-very severe^{4}	DWg^{6}-W^{4} DWg^{6}-W^{4}
BH	Bellhouse	4,5	Very severe	R	6	Very severe	Rt			
BY	Baynes	3,4	Severe	W	5 6	Severe Severe	Wt TW	BYg	Severe	Wg
CO	Cowichan	2,3	Very severe	Ws				Col	Very severe	Wrs
FB	Fairbridge	3	Severe^{8}-very severe^{2}	SW^{8}-Ws^{2}	4,5	Severe^{8}-very severe^{2}	SW^{8}-Ws^{2}	FBl FBw	Severe^{8}-very severe^{2} Very severe	RSW^{8}-Wrs^{2} Ws

Table 9. Constraint classes and soil and landscape limitations for septic tank effluent absorption (continued)

Map unit		Typical constraint class			Variation due to slope			Variation due to soil properties		
Symbol	Name	Slope class*	Constraint class	Soil limitations	Slope class*	Constraint class	Soil limitations	Soil phase*	Constraint class	Soil limitations
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
GA	Galiano	3-4	Severe^{8}- very severe^{2}	Rg^{8}-R^{2}	5	Severe^{8}- very severe^{2}	Rgt^{8}-R^{2}	GAsl	Very severe	R
					6	Severe^{8}- very severe^{2}	RTg^{8}-Rt^{2}	GAsl,vg	Very severe	Rg
					7,8	Very severe	Tr			
HA	Haslam	4	Severe^{8}- very severe^{2}	Rg^{8}-R^{2}	3	Severe^{8}- very severe^{2}	Rg^{8}-R^{2}	HAsl	Very severe	R
					5	Severe^{8}- very severe^{2}	Rgt^{8}-R^{2}	HAl	Severe^{8}- very severe^{2}	Rg^{8}-R^{2}
					6	Severe^{8}- very severe^{2}	RTg^{8}-Rt^{2}	HAvg	Severe^{8}- very severe^{2}	GR^{8}-R^{2}
					7	Very severe	TR^{8}-RT^{2}			
ME	Mexicana	4	Severe	DW	5	Severe	Dtw	MEid	Severe	DW
					6	Severe	DTw			
					7	Very severe	Td	MEl	Severe	RW
MT	Metchosin	1	Very severe	W				MTso	Very severe	WD
NT	Neptune	2,3	Moderate	GS				NTl	Severe	Rgs
PA	Parksville	2,3	Very severe^{8} severe^{2}	WD8-DW2				PAd	Very severe^{8}- severe^{2}	W^{8}-DW^{2}
								PAl,si	Very severe^{8}- severe^{2}	Wr^{8}-RW^{2}

Table 9. Constraint classes and soil and landscape limitations for septic tank effluent absorption (continued)

Map unit		Typical constraint class			Variation due to slope			Variation due to soil properties		
Symbol	Name	Slope class*	Constraint class	Soil limitations	Slope class*	Constraint class	Soil limitations	Soil phase*	Constraint class	Soil limitations
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
PA-TL	Parksville-Tolmie	2-3	Very severe	Wd^6-W^4	4,5	Very severe	Wd^6-W^4			
QU	Qualicum	4	Moderate^8-severe^2	GSW^8-Dgw^2	5	Moderate^8-severe^2	GTW^8-Dtw^2	QUid	Severe	Wgs^8-Dgw^2
					6	Severe	Tgw^8-DTw^2	QUl	Severe	Rgw^8-Dgw^2
					7	Very severe	T^8-Td^2			
RO	Rock	3,4,5	Very severe	R	6	Very severe	Rt			
					7,8,9,10	Very severe	RT			
RO-BH	Rock-Bellhouse	6	Very severe	Rt	2,3,4,5	Very severe	R			
					7,8	Very severe	RT			
RO-ST	Rock-Saturna	6	Very severe	Rt	2,3,4,5	Very severe	R			
					7,8,9	Very severe	RT			
SL	Salalakim	5	Very severe	R	6	Very severe	Rt			
					7	Very severe	RT			
SM	St. Mary	3,4,5	Severe	DW^8-Dgw^2				SMg	Severe	DWg^8-Dgw^2

Table 9. Constraint classes and soil and landscape limitations for septic tank effluent absorption (continued)

Map unit		Typical constraint class			Variation due to slope			Variation due to soil properties		
Symbol	Name	Slope class*	Constraint class	Soil limitations	Slope class*	Constraint class	Soil limitations	Soil phase*	Constraint class	Soil limitations
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
ST	Saturna	3,4	Severe^{8}-very severe^{2}	Rg^{8}-R^{2}	5	Severe^{8}-very severe^{2}	Rgt^{8}-R^{2}	STsl	Very severe	R
					6	Severe^{8}-very severe^{2}	RTg^{8}-Rt^{2}	STl	Severe^{8}-very severe^{2}	Rg^{8}-R^{2}
					7,8,9	Very severe	Tr^{8}-RT^{2}	STd	Moderate	GR
								STvg	Severe^{8}-very severe^{2}	GR^{8}-R^{2}
ST-BE	Saturna-Brigantine	3,4	Severe	Rg^{6}-DW^{4}	5	Severe	Rgt^{6}-DWt^{4}	STsl-BEd,g	Very severe^{6}-severe^{4}	R^{6}-Wdg^{4}
					6	Severe	RTg^{6}-DTW^{4}	STsl-BEg	Very severe^{6}-severe^{4}	R^{6}-DWg^{4}
					7	Very severe	RT^{6}-Tdw^{4}	ST-BEd	Severe	Rg^{6}-Wd^{4}
								ST-BEg	Severe	Rg^{6}-DWg^{4}
ST-QU	Saturna-Qualicum	3,4	Severe^{6}-moderate^{4}	Rg^{6}-GSW^{4}	5	Severe^{6}-moderate^{4}	Rgt^{6}-GTW^{4}	STsl-QU	Very severe^{6} moderate^{4}	R^{6}-GSW^{4}
					6	Severe	RTg^{6}-Tgw^{4}	STsl-QUl	Very severe^{6}-severe^{4}	R^{6}-Rgw^{4}
					7	Very severe	RT^{6}-T^{4}	ST-QUl	Severe	Rg^{6}-Rg,w^{4}
								ST-QUl,id	Severe	Rg^{6}-RWg^{4}
SU	Suffolk	2,3,4	Severe^{8}-very severe^{2}	DWs^{8}-Wd^{2}	5	Severe^{8}-very severe^{2}	DWt^{8}-Wd^{2}	SUd,pd	Very severe	W
								SUd,w	Very severe	W
								SUpd	Very severe	Wd
TL	Tolmie	2,3	Very severe	W	4,5	Very severe	W	TLl	Very severe	Wr

Table 9. Constraint classes and soil and landscape limitations for septic tank effluent absorption (continued)

Map unit		Typical constraint class			Variation due to slope			Variation due to soil properties		
Symbol	Name	Slope class*	Constraint class	Soil limitations	Slope class*	Constraint class	Soil limitations	Soil phase*	Constraint class	Soil limitations
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
TR	Trincomali	5	Severe^{8}-moderate^{2}	Dtw^{8}-GTW^{2}	3,4	Severe^{8}-moderate^{2}	Dgw^{8}-GSW^{2}	TRd	Moderate	DTW^{8}-GTW^{2}
					6	Severe	DTw^{8}-Tgw^{2}	TRid	Severe	DWg
					7	Very severe	Td^{8}-T^{2}			

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

or variant is indicated in columns 9, 10, and 11 of Table 9. 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 9 are intended to be used as a guide only. They are not specific to individual map delineations. For the assessment of a particular site for a septic tank field or the land capability rating for agriculture, a detailed on-site investigation is recommended.

Results of Table 9 indicate that, for the survey area, none of the map units has a slight constraint rating for effluent absorption. However, delineations of the Beddis (BD) map unit consisting of dominantly sandy loam instead of loamy sand soils have slight limitations for effluent absorption on slopes of less than 10%. The Neptune (NT), Qualicum (QU), Saturna deep (STd), Suffolk deep (SUd), and Trincomali deep (TRd) map units on moderate slopes (10-15%) all have moderate limitations for effluent absorption. All other map units occurring in the survey area, including the foregoing map units on steeper topography (>15%), fall into the severe and very severe constraint classes for septic tank effluent absorption.

LAND CAPABILITY FOR AGRICULTURE

Land in the agricultural land reserve accounts for almost 20% of the total surveyed area. With increasing pressures on land for uses 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 and/or the intensity of management inputs required to maintain crop production. Class 1 soils are considered to have no limitations for crop production. As the class level increases from one to seven, the level of management input increases and the range of suitable crops decreases. Class 7 soils are considered to have no potential either for natural grazing or for 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 climatic characteristics; improvable by irrigation.

D UNDESIRABLE SOIL STRUCTURE AND/OR LOW PERVIOUSNESS: Soils are difficult to till, require special management for seedbed preparation, pose trafficability problems, have insufficent aeration, absorb and distribute water slowly, and/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/OR ROCKINESS: Bedrock near the surface and/or rock outcrops 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 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 agriculture capability, climatic limitations are evaluated first and, if no limitations result from soil or landscape characteristics, then the regional climate determines the land capability for agriculture class.

For the survey area, the climatic moisture deficit (CMD) is the limiting climatic condition for agriculture capability. Potential evaporation data are not available for the survey area. For Saltspring Island, which is nearby in the same climatic regime, the CMD was calculated at 203-234 mm during the growing season (Coligado 1979). This regime 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 agriculture capability are listed for each map unit in Table 10. 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 10.

The typical land capability for agriculture ratings in columns 4 and 5 of Table 10 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 estimated mean value is used. Column 4 gives the

Table 10. Land capability ratings for agriculture

Map unit		Typical capability class			Variation due to slope			Variation due to soil properties		
Symbol (1)	Name (2)	Slope class* (3)	Unimproved rating (4)	Improved rating (5)	Slope class* (6)	Unimproved rating (7)	Improved rating (8)	Soil phase* (9)	Unimproved rating (10)	Improved rating (11)
BD	Beddis	6	4Ta^{8†}-4APT^{2†}	4T^{8}-4Tpa^{2}	4 5 8,9	3Apt8-4AP2 3ATp^{8}-4APt^{2} 7T	2APT8-3APt2 3Tap^{8}-3APT^{2} 7T	BDl,g	4ATr	4Tar
BE	Brigantine	4	3Adt^{8}-4W^{2}	2ADT^{8}-2ADW^{2}	3 5 6	3Ad^{8}-4W^{2} 3ATd^{8}-4W^{2} 4Ta^{8}-4W^{2}	2AD^{8}-2ADW^{2} 3Tad^{8}-2ADW^{2} 4T^{8}-2ADW^{2}	BEg	4Ap^{8}-4W^{2}	3APt^{8}-2ADW^{2}
BE-TL	Brigantine-Tolmie	3	3A^{6}-4W^{4}	2A^{6}-2DW^{4}	4 5	3Atw^{6}-4W^{4} 3AT^{6}-4W^{4}	2AT^{6}-2DW^{4} 3Ta^{6}-2DW^{4}	BEg-TL	4Ap^{6}-4W^{4}	3APt^{6}-2DW^{4}
BH	Bellhouse	4	4APR^{8}-7R^{2}	4PRt^{8}-7R^{2}	3 5 6	4APR^{8}-7R^{2} 4ART^{8}-7R^{2} 5Tpr^{8}-7R^{2}	4PRa^{8}-7R^{2} 4PRT^{8}-7R^{2} 5Tpr^{8}-7R^{2}	BHsl	5Rap^{8}-7R^{2}	5Rap^{8}-7R^{2}
BY	Baynes	4	3At	2AT	3 5 6	3A 3AT 4Ta	2A 3Ta 4T	BYg	4A	3Ap
CO	Cowichan	2-3	4W	2DW	4	4W	2DTW	COl COpt COpt,sn	4W 5W 6Nw	2DRW 3DW 6N

Table 10. 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)
FB	Fairbridge	3	$3Ad^{8}-4W^{2}$	$2D^{8}-2DW^{2}$	4	$3Adt^{8}-4W^{2}$	$2DT^{8}-2DW^{2}$	FBl	$3Ar^{8}-4W^{2}$	$2DR^{8}-2DW^{2}$
					5	$3ATd^{8}-4W^{2}$	$3Td^{8}-2DW^{2}$	FBw	$3Wd^{8}-4W^{2}$	$2D^{8}-2DW^{2}$
GA	Galiano	3	$3AP^{8}-7R^{2}$	$2P^{8}-7R^{2}$	4	$3APt^{8}-7R^{2}$	$2PT^{8}-7R^{2}$	GAsl	$5R^{8}-7R^{2}$	$5R^{8}-7R^{2}$
					5	$3APT^{8}-7R^{2}$	$3Tp^{8}-7R^{2}$	GAsl,vg	$5Rap^{8}-7R^{2}$	$5Rap^{8}-7R^{2}$
					6	$5T^{8}-7R^{2}$	$5T^{8}-7R^{2}$			
					7,8,9	$7T^{8}-7RT^{2}$	$7T^{8}-7RT^{2}$			
HA	Haslam	4	$4Pa^{8}-7R^{2}$	$4Pa^{8}-7R^{2}$	3	$4Pa^{8}-7R^{2}$	$4Pa^{8}-7R^{2}$	HAsl	$5Rp^{8}-7R^{2}$	$5R^{8}-7R^{2}$
					5	$4Pat^{8}-7R^{2}$	$4Pat^{8}-7R^{2}$	HAl	$4Pa^{8}-7R^{2}$	$4Pa^{8}-7R^{2}$
					6	$5Tp^{8}-7R^{2}$	$5T^{8}-7R^{2}$	HAvg	$5AP^{8}-7R^{2}$	$5AP^{8}-7R^{2}$
					7,8,9	$7T^{8}-7RT^{2}$	$7T^{8}-7RT^{2}$			
ME	Mexicana	4	3APd	2APD	5	3APT	3APT	MEl	3APr	3APr
					6	4Tap	4T			
					7	7T	7T			
MT	Metchosin	1	O5W	O3W	2	O5W	O3W	MTso	O5W	O3Wd
NT	Neptune	3	4AP	3AP	2	4AP	3AP	NTl	4AP	3APr
					4	4AP	3APt			
PA	Parksville	2-3	$4W^{8}-3Ad^{2}$	$2ADW^{8}-2AD^{2}$				PAd,pt	5W	3W
								PAl,si	$4W^{8}-3Ar^{2}$	$2DR^{8}-2AR^{2}$
								PApt	5W	3Wd

Table 10. 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)
PA-TL	Parksville-Tolmie	2-3	4W	2ADW^6-2DW^4	4 5	4W 4Wt	2ADT^6-2DTW^4 3Tad^6-3Tdw^4	PAlo-TL PAlo-TLpt	4W 4W^6-5W^4	2DW 2DW^6-3Wd^4
QU	Qualicum	4	4AP	3APt	5 6 7	4APt 5Tap 7T	3APT 5T 7T	QUl	4AP	3APr
RO	Rock	7,8,9,10	7RT	7RT	3,4 5 6	7R^8-4AP^2 7R^8-4APt^2 7R^8-5Tap^2	7R^8-4Pa^2 7R^8-4Pat^2 7R^8-5Tp^2			
RO-BH	Rock-Bellhouse	6	7R^6-5RTp^4	7R^6-5RTp^4	2,3,4,5 7,8	7R^6-4APR^4 7RT^6-7T^4	7R^6-4PRr^4 7RT^6-7T^4	RO-BHsl RO-BHsl,vg	7R^6-5RTp^4 7R^6-5ART^4	7R^6-5RTp^4 7R^6-5ART^4
RO-ST	Rock-Saturna	6	7R^6-5RTp^4	7R^6-5RTp^4	2,3,4,5 7,8,9	7R^6-4APR^4 7RT^6-7T^4	7R^6-4PRa^4 7RT^6-7T^4	RO-STsl RO-STvg	7R^6-5RTp^4 7R^6-5APT	7R^6-5RTp^4 7R^6-5ATp^4
SL	Salalakim	5	4APr^8-7R^2	4Par^8-7R^2	6 7	5Tap^8-7R^2 7T^8-7RT^2	5Tp^8-7R^2 7T^8-7RT^2	SLsl	5Rap^8-7R^2	5Rp^8-7R^2
SM	St. Mary	3	3Ad	2AD	4 5	3Adt 3ATd	2ADT 3Tad	SMg	4AP	3APd

Table 10. 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
ST	Saturna	4	4APr^{8}-7R^{2}	4Par^{8}-7R^{2}	3	4APr^{8}-7R^{2}	4Par^{8}-7R^{2}	STsl	5Rap^{8}-7R^{2}	5Rp^{8}-7R^{2}
					5	4Apt^{8}-7R^{2}	4Pat^{8}-7R^{2}	STl	4APr^{8}-7R^{2}	4Par^{8}-7R^{2}
					6	5Tap^{8}-7R^{2}	5Tp^{8}-7R^{2}	STd	4APt^{8}-7R^{2}	4Pat^{8}-7R^{2}
					7,8,9	7T^{8}-7RT^{2}	7T^{8}-7RT^{2}	STvg	5AP^{8}-7R^{2}	5AP^{8}-7R^{2}
ST-BE	Saturna-Brigantine	4	4APr^{6}-3At^{4}	4Par^{6}-2AT^{4}	3	4APr^{6}-3A^{4}	4Par^{6}-2A^{4}	STsl-BEd,g	5Rap^{6}-4Ap^{4}	5Rp^{6}-3APt^{4}
					5	4APt^{6}-3AT^{4}	4PTa^{6}-3Ta^{4}	STsl-BEg	5Rap^{6}-4Ap^{4}	5Rp^{6}-3APt^{4}
					6	5Tap^{6}-5T^{4}	5Tpr^{6}-5T^{4}	ST-BEg	4APr^{6}-4Ap^{4}	4Par^{6}-3APt^{4}
					7	RT^{6}-T^{4}	RT^{6}-T^{4}			
ST-QU	Saturna-Qualicum	4	4APr^{6}-4AP^{4}	4Par^{6}-3AP^{4}	3	4APr^{6}-4AP^{4}	4Par^{6}-3AP^{4}	STsl-QU	5Rap^{6}-4AP^{4}	5Rp^{6}-3AP^{4}
					5	4APt^{6}-4APt^{4}	4Pat^{6}-3APT^{4}	STsl-QUl	5Rap^{6}-4AP^{4}	5Rp^{6}-3APr^{4}
					6	5Tap	5Tpr^{6}-5T^{4}	ST-QUl	4APr^{6}-4AP^{4}	4Par^{6}-3APr^{4}
					7	RT^{6}-T^{4}	RT^{6}-T^{4}	ST-QUl,id	4APr^{6}-4AP^{4}	4Par^{6}-3APr^{4}
SU	Suffolk	2,3	3Ad^{8}-4W^{2}	2D^{8}-2DW^{2}	4	3Adt^{8}-4W^{2}	2DT^{8}-2DW^{2}	Sud,pd	4W	2DW
					5	3ATd^{8}-4W^{2}	3Td^{8}-2DW^{2}	SUd,w	3W	2D
								SUpd	4W	2DW
TL	Tolmie	2,3	4W	2DW	4	4W	2DTW	TLg	4PW	3Pdw
					5	4Wt	3Tdw	TLid,l	3Ar	2DR
								TLpt	5W	3DW
								TLl	4W	2DRW
								TLsn	6Nw	6N

Table 10. Land capability ratings for agriculture (concluded)

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)
TR	Trincomali	5	4AP†	4Pa†	3,4	4AP	4Pa			
					6	4APT	4Tap			
					7	7T	7T			

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

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 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 frequently limiting minor soil is assumed to be 20%. In some delineations, the proportion of minor soils varies from this assumed proportion. For the foregoing two examples, the proportions are represented by superscripts for the ratings in Table 10.

For some delineations, land capability for agriculture may differ from the typical land 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 10 indicate the variations from the typical rating that result from 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 10. 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 kinds of variations could not be shown in the table.

The ratings in Table 10 are to be used as a guide only. They are not specific to individual map delineations. For the assessment of a particular site for a septic tank field or the land capability rating for agriculture, a detailed on-site investigation is recommended.

Land capability for agriculture ratings in Table 10 show that map units with soils that have the least degree of limitation for agricultural crop production generally occur below the 100-m contour either on gently sloping terrain or in valley bottoms. Most of these soils have developed on deep marine deposits with a low coarse fragment content. Some of these map units represent the following soils: Baynes, Beddis, Brigantine, Crofton, Cowichan, Fairbridge, Parksville, and Tolmie. Similar soils with compact till occurring between 50 and 100 cm from the surfaces (St. Mary and Suffolk) fall into the same category.

Soils of map units with more severe limitations for agricultural crop production are generally found at higher elevations and on more steeply sloping terrain. Most of these soils are shallow to bedrock or to compact till and they usually have a high percentage of coarse fragments. That these soils are difficult or impossible to improve is indicated by the fact that improved ratings (Table 10) are the same as the unimproved ratings. Bellhouse, Galiano, Haslam soil complex, Salalakim, and Saturna soils frequently occur in these map units that are rated low in land capability for agriculture. 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 maps of soil texture, slope, or drainage. Such maps can be made because the original boundaries and map unit symbols are stored in a computer as part of the Canada soil information system (CanSIS).

Soil maps are drafted by the Cartography Section in the Land Resource Research Centre of Agriculture Canada, Ottawa. As part of the cartographic procedure, the soil maps are digitized, and the locations of the map unit boundaries and their symbols are entered into the computer. The associated legend is 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 might be required. The procedure involves replacing the original map unit symbol by a new symbol that indicates the type of soil parent material. The same boundaries are retained, with the exception of those that have the same new symbols on either side. In this instance the boundary is deleted. No new boundaries are added.

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

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APPENDIXES

APPENDIX 1. NAMES OF COMMON PLANTS

Table 1.1 Names of common plants[1] observed on Galiano, Valdes, Thetis, and Kuper islands (after Clement 1981)

Common name[2]	Botanical name
Trees	
bigleaf maple	Acer macrophyllum
coast Douglas fir	Pseudotsuga menziesii var. menziesii
Garry oak	Quercus garryana
grand fir	Abies grandis
lodgepole pine	Pinus contorta var. latifolia
Pacific madrone	Arbutus menziesii
poison-oak	Toxicodendron diversilobum
red alder	Alnus rubra
Rocky Mountain juniper	Juniperus scopulorum
shore pine	Pinus contorta var. contorta
western hemlock	Tsuga heterophylla
western red cedar	Thuja plicata
western yew	Taxus brevifolia
willows	Salix spp.
Shrubs	
baldhip rose	Rosa gymnocarpa
bristly Nootka rose	Rosa nutkana
coastal black gooseberry	Ribes divaricatum
common gorse	Ulex europaeus
common Saskatoon	Amelanchier alnifolia
cutleaf evergreen blackberry	Rubus laciniatus
dull Oregon-grape	Mahonia nervosa
hairy honeysuckle	Lonicera hispidula
hardhack	Spiraea douglasii
Indian-plum (only on Thetis Is.)	Oemleria cerasiformis
oceanspray	Holodiscus discolor ssp. discolor
Oregon boxwood	Paxistima myrsinites
Pacific trailing blackberry	Rubus ursinus ssp. macropetalus
red-flowering current	Ribes sanguineum var. sanguineum
red huckleberry	Vaccinium parvifolium
salal	Gaultheria shallon
salmonberry	Rubus spectabilis
Scotch broom	Cytisus scoparius
western flowering dogwood	Cornus nuttallii
western snowberry	Symphoricarpos occidentalis

[1] Common plants are those that were encountered frequently during the course of the survey.

[2] Common and botanical names are after Taylor and MacBryde (1977).

Table 1.1 (concluded)

Herbs

Alaska brome grass	*Bromus sitchensis*
Alaska rein orchid	*Platanthera unalascensis*
American glasswort	*Salicornia virginica*
American skunk-cabbage	*Lysichiton americanum*
American stinging nettle	*Urtica dioica*
blue grasses	*Poa* spp.
broad-leaved starflower	*Trientalis latifolia*
broad-leaved stonecrop	*Sedum spathulifolium*
buttercup	*Ranunculus* spp.
California oat grass	*Danthonia californica*
common cat's-ear	*Hypochoeris radicata*
common dandelion	*Taraxacum officinale*
common foxglove	*Digitalis purpurea*
common horsetail	*Equisetum arvense*
common lady fern	*Athyrium filix-femina*
common pearly everlasting	*Anaphalis margaritacea*
common yarrow	*Achillea millefolium*
Cooley's hedge-nettle	*Stachys cooleyae*
early hair grass	*Aira praecox*
entire-leaved gumweed	*Grindelia integrifolia*
fireweed	*Epilobium augustifolium*
greater plantain	*Plantago major*
nodding onion	*Allium cernuum*
northern twinflower	*Linnaea borealis*
orchard grass	*Dactylis glomerata*
Pacific oenanthe	*Oenanthe sarmentosa*
red fescue	*Festuca rubra*
rose campion	*Lychnis coronaria*
scouring-rush	*Equisetum hyemale*
seashore salt grass	*Distichlis spicata*
sedges	*Carex* spp.
slender cudweed	*Gnaphalium microcephalum* var. *thermale*
sweet vernal grass	*Anthoxanthum odoratum*
tansy ragwort	*Senecio jacobaea*
thistles	*Cirsium* spp.
Wallace's selaginella	*Selaginella wallacei*
western bracken	*Pteridium aquilinum pubescens*
western fescue	*Festuca occidentalis*
western sword fern	*Polystichum munitum*
yerba buena	*Satureja douglasii*
Yorkshire fog	*Holcus lanatus*

APPENDIX 2. PROFILE DESCRIPTIONS AND ANALYTICAL DATA OF THE SOILS

This appendix is an alphabetical listing of profile descriptions and accompanying analytical data for most of the soils in the survey area. To best represent typical 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).

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BAYNES SOIL

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

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

PROFILE DESCRIPTION

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

ANALYTICAL DATA

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

BEDDIS SOIL

Location: 250 m east of picnic shelter at north end of large field on B.C. Provincial park, Sidney Island
Landform: blanket of marine deposits
Topography: crest of convex, very gentle slopes (4%)
Parent materials: coarse-textured marine deposit
Present land use: forested; primarily coast Douglas fir with understory of 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; 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 (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ah	5.2	4.6	0.26	18	0.2	0.2	18.4	8.1	2.1	0.5	0.5	61	79	7	16	5	0.11
Bm	4.9	1.5	0.07	20	0.3	0.3	7.0	2.0	0.5	0.1	0.2	40	79	8	19	2	0.13
Bfj	5.1	0.9	0.04	20	0.2	0.2	5.9	1.8	0.5	0.1	0.3	45	87	4	12	1	0.08
BC	5.3				0.1	0.1	2.4	1.1	0.3	0.1	0.2	66	96	1	4	0	0.05
Bcj	5.3						2.6	1.2	0.3	0.1	0.2	71	95	7	4	1	0.05
C1	5.5						2.5	1.6	0.7	0.1	0.2	100+	94	4	5	1	0.05
Cc	5.5						3.1	1.8	0.8	0.0	0.3	95	92	5	7	1	0.05
C2	5.4						4.7	2.6	1.3	0.1	0.4	92	87	4	9	4	0.05

BELLHOUSE SOIL

Location: southeast of T.V. Tower on Mount Warburton Pike, Saturna Island
Landform: colluvial veneer overlying sandstone bedrock
Topography: very strong slopes (44%), upper slope position, smooth microtopography
Parent materials: channery, sandy loam, colluvial materials over sandstone bedrock
Present land use: natural grasses with scattered coast Douglas fir
Remarks: profile is typical for Bellhouse soil, although deeper than generally found in survey area

Longitude: 123°10'15"W
Latitude: 48°46'35"N
Elevation: 475 m
Drainage: well
Perviousness: moderately
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 (%)
Ah	0-15	black (7.5 YR 2/0)	very dark gray (10 YR 3/1)	sandy loam	strong	fine to medium	granular	soft	very friable	none	2
AB	15-33	black (10 YR 2/1)	very dark grayish brown (10YR 3/2)	channery sandy loam	weak to moderate	fine to medium	angular blocky	slightly hard	very friable	none	25
Bm	33-59	very dark grayish brown (10YR 3/2)	dark yellowish brown (10YR 4/4)	sandy loam	weak	medium to coarse	angular blocky	slightly hard	very friable	none	15
C	59-82	dark yellowish brown (10YR 4/4)	yellowish brown (10YR 5/6)	channery sandy loam	weak	medium to coarse	angular blocky	slightly hard	very friable	none	43
R	82+										

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	5.3	4.6	0.29	16	0.1	0.1	26.2	12.3	4.4	0.7	0.1	67	62	3	28	9	0.15
AB	5.2	2.2	0.18	12	0.2	0.2	21.6	8.4	3.3	0.5	0.1	57	66		26	8	0.17
Bm	4.9	1.1	0.09	12	0.1	0.2	16.4	6.1	1.9	0.2	0.2	51	67		25	8	0.21
C	4.3	0.9	0.08	11	0.1	0.2	19.6	7.8	2.2	0.1	0.4	54	62		30	8	0.26

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	Color		Texture	Structure			Consistence		Mottles	Coarse fragments
	(cm)	moist	dry		grade	class	kind	moist	wet		(%)
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, western bracken, western sword fern
Remarks: representative of "wetter" sites where Fairbridge soils occur; generally 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 (%)	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				
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) consisting 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 to 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: generally classified as Orthic Dystric Brunisol; only a few Mexicana soils have well-developed Bt horizon; mottling is noticeable only when 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, yellowh 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 typical 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 (cm)	Color moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse fragments (%)
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 Fe (%)	Oxalate Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ap	5.3	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 moist	Color dry	Texture	Structure grade	Structure class	Structure kind	Consistence dry	Consistence moist	Mottles	Coarse fragments (%)
Lf	3-0										
Ah	0-9	very dark grayish brown (10YR 3/2)	dark brown (10YR 3/3)	very gravelly sandy loam	moderate	medium	granular	loose	friable	none	56
Bm1	9-45	olive brown (2.5Y 4/4)	yellowish brown (10YR 5/4)	gravelly loamy sand	very weak	medium	subangular blocky	soft	very friable	none	30
Bm2	45-65	olive brown (2.5Y 4/4)	light yellowish brown (2.5Y 6/4)	gravelly sand	moderate	medium	subangular blocky	slightly hard	friable	none	29
BC	65-100+	light olive brown (2.5Y 5/4)	pale yellow (2.5Y 7/4)	gravelly sandy loam	very weak	medium	angular blocky	slightly hard	friable	none	43

ANALYTICAL DATA

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

SALALAKIM SOIL

Location: Gowland 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: east side of clearcut block restocked with lodgepole pine, Valdes Island
Landform: colluvial and glacial drift veneer over sandstone bedrock, rolling landscape
Topography: very gentle slopes (4%), strongly mounded microtopography
Parent materials: channery, sandy loam to channery loamy sand, colluvial and glacial drift materials <100 cm deep over sandstone bedrock
Present land use: forested; coast Douglas fir, Pacific madrone, and salal
Remarks: very shallow lithic phase; very thin Ae horizon may be present

Longitude: 123°41'5"W
Latitude: 49°06'50"N
Elevation: 85 m
Drainage: rapidly
Perviousness: rapidly
Effective rooting depth: 50 cm
Classification: Orthic Dystric Brunisol

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color		Texture	Structure			Consistence		Mottles	Coarse fragments (%)
		moist	dry		grade	class	kind	dry	moist		
L	8-6										
FH	6-0										
Bm1	0-10	brown to dark brown (7.5YR 4/4)	yellowish brown (10YR 5/4)	channery loamy sand	weak	medium medium	subangular blocky	soft	very friable	none	40
Bm2	10-45	brown to dark brown (7.5YR 4/4)	yellowish brown (10YR 5/6)	channery sandy loam	weak		subangular blocky	loose	very friable	none	75
R	45+			sandstone bedrock	fractured						

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 (meq/100 g soil)	Base sat. (%)	Particle size distribution Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
L																	
FH	4.6	36.6	0.88	42													
Bm1	4.8	0.6	0.03	20	0.1	0.2	6.8	1.0	0.1	0.4	0.1	23	79	11	19	2	0.24
Bm2	4.7	1.4	0.05	28	0.1	0.3	8.6	1.7	0.2	0.2	0.1	25	70	14	26	4	0.28

ST. MARY SOIL

Location: in treed area north of school house on North road, Thetis Island
Landform: shallow marine deposits overlying till blanket; topography controlled by underlying sandstone and shale bedrock
Topography: moderately sloping (13%), moderately mounded microtopography
Parent materials: coarse marine veneer over shallow, fine, marine over coarse till deposits
Present land use: second-growth forest; dominantly western red cedar with coast Douglas fir, red alder, and bigleaf maple; understory of western sword fern and salal
Remarks: thin clay films occur on peds of the IIBg horizon; root mat occurs along vertical cracks in the IIICg horizon; glacial till deeper than usual (deep phase); coarse fragment content higher than usual (gravelly phase)

Longitude: 123°40'33"W
Latitude: 48°59'6"N
Elevation: 14 m
Drainage: imperfect
Perviousness: slow
Effective rooting depth: 50 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. (%)
L-F-H	3-0										
Bm1	0-35	strong brown (7.5YR 4/6)	yellowish brown (10YR 5/6)	gravelly sandy loam	moderate	medium	granular	very friable			30
Bm2	35-50	dark brown (7.5Y 3/4 to 4/4)	brownish yellow (10YR 6/6)	gravelly sandy loam	moderate	medium	granular	very friable			40
IIBg	50-65	light yellowish brown (2.5Y 6/4)	pale yellow (2.5Y 7/4)	loam	weak	coarse	subangular blocky	friable		com.fine,dist. brownish yellow (10YR 6/8)	15
IICg	65-110	olive (5Y 5/3)	light yellowish brown (2.5Y 6/4)	silty clay	moderate	coarse	angular blocky	firm		com.fine,prom. strong brown (7.5YR 5/6)	0
IIICg	110+	gray to light gray (5Y 6/1)	pale yellow (2.5Y 7/4)	gravelly sandy loam	moderate	medium	pseudo platy	firm		com.fine.prom. yellowish red (5YR 4/6)	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)
L-F-H																	
Bm1	4.8	1.2	0.08	15	0.3	0.2	13.8	4.4	1.0	0.2	0.1	41	58	10	33	9	0.26
Bm2	5.0	1.2	0.06	20	0.3	0.2	13.3	4.8	1.4	0.2	0.1	49	55	10	31	14	0.23
IIBg	4.8	0.5	0.03	17	0.1	0.1	9.9	5.0	1.6	0.1	0.1	69	46	10	42	12	0.34
IICg	4.9						28.8	15.3	5.8	0.2	0.3	75	4	2	53	43	0.28
IIICg	5.0						13.8	8.4	2.6	0.1	0.2	82	53	12	42	5	0.44

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 typical 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. (%)	Particle size distribution 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, rose, and blackberry
Remarks: water table at 105 cm (82/05/14); Ae horizon not typical for Tolmie soil

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

PROFILE DESCRIPTION

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

ANALYTICAL DATA

Horizon	pH in $CaCl_2$	Organic C (%)	Total N (%)	C:N ratio	Pyrophos. Fe (%)	Pyrophos. Al (%)	Oxalate Fe (%)	Oxalate Al (%)	Cation exchange CEC (meq/100 g soil)	Ca	Mg	K	Na	Base sat. (%)	Total sand (%)	Very fine sand (%)	Silt (%)	Clay (%)	Soil erosion (K value)
Ah	4.1	7.4	0.75	10	0.2	0.2	0.3	0.2	33.5	10.6	2.4	0.1	0.3	38	16	6	51	33	0.27
Aegj	5.1	0.6	0.06	10	0.0	0.1	0.1	0.1	12.7	7.8	2.5	0.0	0.2	83	20		58	22	0.46
IIBg	5.1	0.2	0.02	10	0.0	0.0	0.1	0.0	4.7	3.2	1.0	0.0	0.1	91	76		21	4	0.21
IIIBg	6.3	0.2	0.02	10	0.1	0.1	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 is slower than typical profile, which is reflected in nontypical vegetation species

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

PROFILE DESCRIPTION

Horizon	Depth (cm)	Color 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	Mg	K	Na	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 3. SOIL MOISTURE DATA FOR THE SOIL PROFILES

Appendix 3 includes data on available water storage capacity (AWSC) and the Atterberg limits of the mineral soils for the same profiles as in Appendix 2.

The available water storage capacity 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 atmosphere) and permanent wilting point (15 atmospheres). AWSC has been determined for about the top 50 cm of the soil.

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

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

Table 3.1 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	Ah	0-15	7	-	-	-
	AB	15-33	5	-	-	-
	Bm	33-59	5	-	-	-
	C	59-82	-	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	16	-	-	-
	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 3.1 (concluded)

Soil	Horizon	Depth (cm)	AWSC (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)
Mexicana	Ah	0-4	14	-	-	-
	Bm	4-23	7	-	-	-
	BA	23-50	7	-	-	-
	BC	95-130	-	20	16	4
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	Bm1	0-10	5	-	-	-
	Bm2	10-45	7	NP	NP	NP
St. Mary	Bm1	0-35	11	-	-	-
	Bm2	35-50	12	-	-	-
	IIBg	50-65	12	-	-	-
	IICg	65-110	13	45	25	20
	IIICg	110+	11	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	-	-	-
	IIICg	85-105+	-	46	21	25
	IIICg	at 225	-	51	25	26
Trincomali	Ah	0-4	15	-	-	-
	Bf	4-12	8	-	-	-
	Bm1	12-50	10	-	-	-
	IIBCgj	60-65	-	NP	NP	NP
	IICg	65-80	-	NP	NP	NP
	IICcg	80-100+	-	NP	NP	NP

*Nonplastic.