Ministry of Environment
and
Ministry of Agriculture and Fisheries

Soils of Southeast Vancouver Island Parksville, Qualicum Beach, Courtenay, and Port Alberni Areas

MOE Technical Report 30

ISSN 0840-9730

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SOILS OF SOUTHEAST VANCOUVER ISLAND PARKSVILLE, QUALICUM BEACH, COURTENAY, AND PORT ALBERNI AREAS

B.C. Soil Survey Report No. 57

J.R. Jungen, P.Ag., P.J. Christie, P.Ag., and J.P. Philp, P.Ag.
SURVEYS AND RESOURCE MAPPING BRANCH

Victoria, British Columbia
1989

Canadian Cataloguing in Publication Data

Jungen, J. R. (John Rodolphe), 1940-
Soils of southeast Vancouver Island

(MOE technical report, ISSN 0840-9730 ; 30)
(British Columbia soil survey, ISSN 0375-5886 ; report no. 57)

Co-published by the Ministry of Agriculture and Fisheries.
Bibliography: p.
ISBN 0-7726-0907-1

1. Soils - British Columbia - Vancouver Island. I. Christie, P. J. (Philip James), 1952- . II. Philp, J. P. (John Paul), 1953- . III. British Columbia. Ministry of Environment. IV. British Columbia. Ministry of Agriculture and Fisheries. V. Title. VI. Series: MOE technical report (1988) ; 30. VII. Series: British Columbia soil survey ; report no. 57.

S599.1.B7J863 1988 631.4'7'71134 C89-092039-7

PREFACE

In 1980, several provincial resource agencies requested that a detail soil survey be conducted along the southeast coastal lowlands of British Columbia. The area has a pleasant blend of land use activities including agriculture, forestry, urban/industrial development, tourism, hunting and commercial and recreational fishing based considerably on favorable soil and climate conditions and proximity to the sea.

Soil surveys have traditionally provided an environmental information base for land use decisions and management. This includes studies on productivity, suitability, soil limitations, soil improvement methods, and impact of land use in an area. Where are the best agricultural lands? What new crops can be grown? How much irrigation water is needed? Will soil erosion occur? Are there soils suitable for domestic disposal of septic tank effluent? Will flooding occur? How much wood can be produced? How suitable is the land for deer winter range? How do we manage the landscape to provide a diversity of activity that enriches the economic and social well being of the area without creating land use conflicts or environmental degradation. The information in this report and accompanying maps will help to answer these, and many other, questions.

Special Treasury Board funding provided the incentive to conduct the survey. This funding was administered through the Ministry of Agriculture and Fisheries, as part of the Agriculture Land Reserve Fine Tuning Program. The Surveys and Resource Mapping Branch provided project supervision and correlation, laboratory and cartographic services.

SUMMARY

Forty-seven individual soils are identified in the map area. In addition, twenty-four phases and/or variants of these soils were established. Soil names defined (Day et al, 1959) and (Jungen et al, 1985) were used where applicable.

The soils in the map area are mainly classified in the Podzolic or Brunisolic Soil Orders; the Alberni Valley and the Courtenay-Oyster River areas are dominated by Podzolic soils. Soils of the Organic, Regosolic, Gleysolic, and to very minor extent, Luvisolic orders also occur.

The map area consists of about 116,700 ha. Of this total, bedrock occupies 1900 ha, miscellaneous land types occupy 11,450 ha and various unnamed water bodies encompass 415 ha.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge all those who assisted in the field mapping; in particular R. Maxwell, A. Burdett, J. Fredericks, C. Hilliard, H. Quesnel, H. Hofmeyer, T. Hilborn, D. Clarke, and B. Petch.

H. Chuah, W. van Lierop, and staff, Soil Feed and Tissue Laboratory, Ministry of Agriculture and Fisheries, Kelowna, B.C., provided the physical and chemical analysis. L. Houston and staff, Thematic Mapping Unit, Surveys and Resource Mapping Branch, Ministry of Environment and Parks, Victoria, B.C., supplied the cartography. Special recognition is extended to H. Newman and Shannon Podgorenko for word processing of the manuscript and E. Dawson for computer programming.

A. Green, Agriculture Canada, Vancouver, is specially acknowledged for field correlation between this survey and the concurrent Gulf Islands survey. Special acknowledgement to Herb Luttenrding and Bob Louie, British Columbia, Ministry of Environment & Parks for their review of this report.

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HOW TO USE THE SOIL MAPS AND REPORT

Soil descriptions including general comments, landscape cross-sectional diagrams, landscape characteristics, photographs, typical profiles, and soil characteristics form the major part of this report. These soils are related to the separately published soil maps by the soil map legend.

The mapping is at survey intensity level 2 (A Proposed Mapping System for Canada, 1979) and is intended to guide planners and land users in making decisions at the level of individual land parcels and farm units. For more detailed projects on any given site, further intensive field studies will be required.

General information about the study area and its environmental characteristics is provided in Chapter 1, "General Description of the Area".

Chapter 2 explains the field procedures used in collecting field information for compilation of the report and maps.

Chapter 3 provides the guidelines used for preparing the soil descriptions.

Chapter 4 describes the soils identified in the study area.

Detailed soil profile descriptions for the map area are stored in the British Columbia Soil Information System (BCSIS) and are available at the following address:

B.C. Soils Survey
Ministry of Environment
Parliament Buildings
Victoria, British Columbia
V8V 1X4

Copies of this soil report and soil maps (see appendix B), as well as agriculture capability and other interpretive/derivative maps are available from:

MAPS B.C.
Ministry of Crown Lands
Parliament Buildings
Victoria, British Columbia
V8V 1X4

Interpretive maps available for the map area include:

1. Land Capability for Agriculture
2. Agricultural Soil Management Groups
3. Soil Drainage
4. Surface Soil Erosion Potential
5. Irrigation Water Requirement
6. Soils Affected by Flooding and/or Water Table
7. Soil Suitability for Septic Tank Effluent Absorption

INTRODUCTION

The initial soil survey of the east coast of Vancouver Island was completed in 1959 (Day et al, 1959). A reconnaissance biophysical soil survey for all of Vancouver Island, begun in the 1970's, did not resurvey major sections of the coastal plain, but rather incorporated the earlier information. These small scale surveys, while valuable for broad scale planning, were not designed to meet requirements for solving complex land use problems. Some of these requirements are: (1) more detailed agricultural capability ratings for updating or fine-tuning the Agricultural Land Reserves; (11) municipal and regional planning; (111) detailed technical soil information for the Ministries of Agriculture and Fisheries, Environment, Municipal Affairs, and the British Columbia Assessment Authority.

To meet these needs a soil survey of the Parksville, Qualicum Beach, Courtenay, and Alberni Valley areas at a scale of 1:20 000 was initiated in 1982 and field work was completed in 1985. Land classification was carried out in accordance with the Terrain Classification System 1976, Canadian System of Soil Classification, 1978, and Land Capability Classification for Agriculture in British Columbia, 1983. Further details on survey methods are discussed in Chapter 2.

The survey area includes parts of the eastern Vancouver Island coastal plain, from Nanoose Bay to Oyster River, the Alberni Valley, as well as isolated hills and lower slopes of adjacent mountains. The map area encompasses 116,700 ha and is bounded by Georgia Strait and the steep mountains terrain of the Vancouver Island Mountains. (Figure 1.2).

Preliminary soil and agriculture capability maps (scale 1:20 000) were produced at the end of each field season. Final soil and agricultural capability maps are available at a scale of 1:20 000. Field information was collected on standardized soil description forms, as outlined in Describing Ecosystems in the Field (Resource Analysis Branch, 1980). This information, along with laboratory analyses are entered in the British Columbia Soil Information System (BCSIS).

The report is divided into four chapters. Chapter One contains general information relevant to the area and describes briefly the geology, parent materials, climate, and vegetation. Chapter Two provides information on soil classification, field procedures and soil legend development. Chapter Three provides the guidelines and parameters used for describing the individual soils while Chapter Four presents the descriptions of the individual soils.

CHAPTER ONE
GENERAL DESCRIPTION OF THE AREA

1.1 LOCATION

The map area consists of approximately 103,000ha along the east coast of Vancouver Island and in the Alberni Valley (Figure 1.1). From Nanoose Harbour (49°15'00") to the Oyster River (49°54'00"), the study area extends approximately 100 km with a variable width of 2 to 10 km. The area consists of part of the Albernie Basin and Nanaimo is bounded by the Vancouver Island Mountains and by the Strait of Georgia.

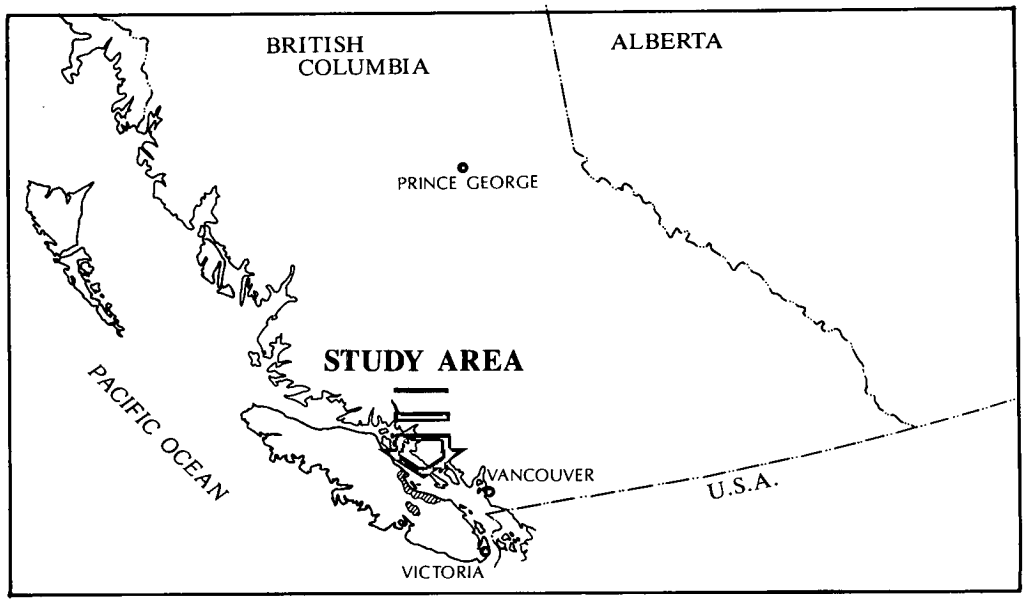


Figure 1.1 Location of the map area.

1.2 HISTORY AND PRESENT LAND USE

Nonaboriginal settlement in the survey area began during the mid-1800's. The main center developed at Nanaimo (located immediately south of the survey area) which is presently the largest city on Vancouver Island north of Victoria. Nanaimo was established by the Hudson's Bay Company in 1851 to allow exploitation of the local coal resources and became a major center of coal production during the late 19th and early 20th centuries. Settlement in the Port Alberni area was based on timber which was utilized for spars and lumber and, in 1861, a sawmill was built. In 1911, a rail connection between Nanaimo and Port Alberni was completed and a large permanent lumber industry developed. Settlement began in the Courtenay area in 1862 when English colonists took up land in the vicinity. Farming and logging were followed, in 1889, by coal-mining at Cumberland. In 1914 the Esquimalt and Nanaimo Railway was completed to Courtenay, and from that time on the area showed a steady development based on agriculture, forestry, and mining.

Present-day agricultural activities are dominated by livestock and dairy production. As a result, the largest proportion of agricultural land is used for pasture and forage crops. The largest concentration of farms is in the Courtenay area.

The map area includes parts of the Regional District of Nanaimo, Comox-Strathcona, and Alberni Clayoguot. The area is serviced with a good network of paved roads and streets. Scheduled ferry service to the mainland is available from Nanaimo and Comox. Scheduled airline service is available from Port Alberni, Comox, Campbell River, and Nanaimo.

1.3 PHYSIOGRAPHY

The study area lies within the Nanaimo Lowland (Figure 1.3), a narrow coastal plain bounded by the Georgia Depression to the east and the Vancouver Island Ranges to the west, and in the Alberni Basin (Holland, 1979).

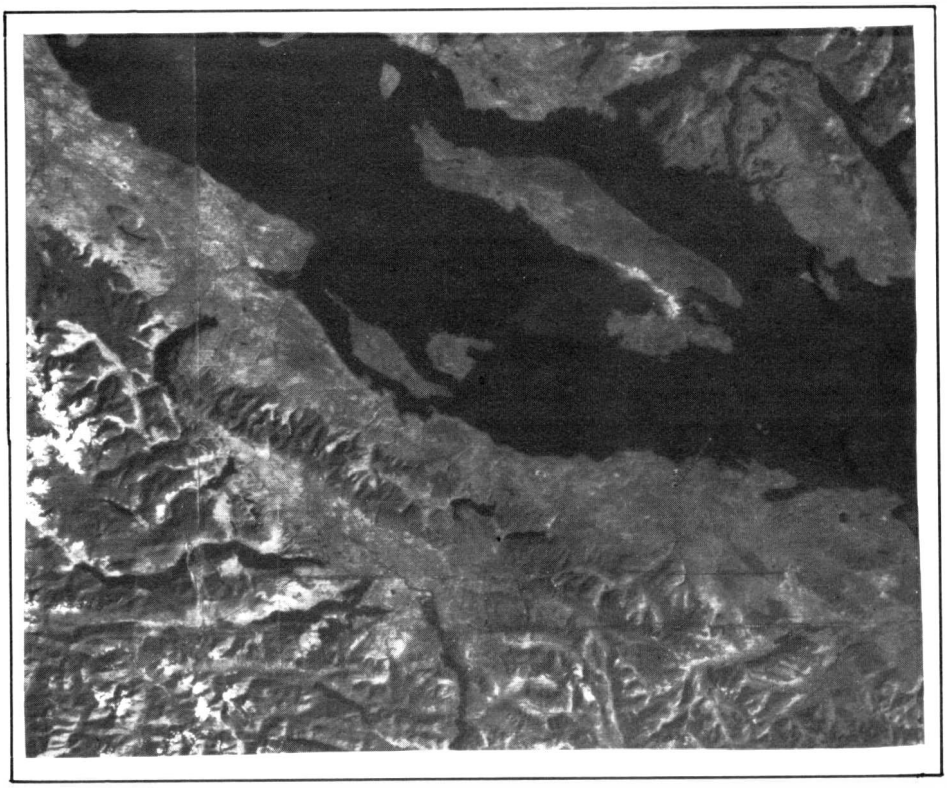


Plate 1.1 Physiography of the map area.

The Nanaimo Lowland is characterized by a series of generally low, northwest trending bedrock ridges, with narrow intervening valleys created by differential erosion of softer rock types. The Lowland is mostly overlain by various kinds of unconsolidated geologic deposits. The principal rivers draining the Lowland are the Englishman, Somass, Stamp, Qualicum, Puntledge, Tsolum, and Oyster, all of which have floodplains, deltas and estuaries along their lower reaches.

The Alberni Basin extends northwestward from Alberni Inlet and has a length of about 40 km and a width of 8 to 13 km. It is an area of low relief drained by the Ash, Stamp, Sproat, and Somass rivers into the Alberni Canal. It is sharply bounded on its eastern side by an abrupt fault-line scarp along the western front of the Beaufort Range. On the north, west, and south the 300 m contour marks, for the most part, its boundary with the surrounding mountainous terrain.

Most of the map area lies below 150 m asl. Fine marine sediment covers large areas below 100 m asl, particularly in the Courtenay and Port Alberni areas. Morainal deposits (glacial till) form the main material on the undulating and rolling landscapes above 130 m while gravelly fluvial, fluvioglacial and marine deposits are common along rivers, streams and seaward slopes.

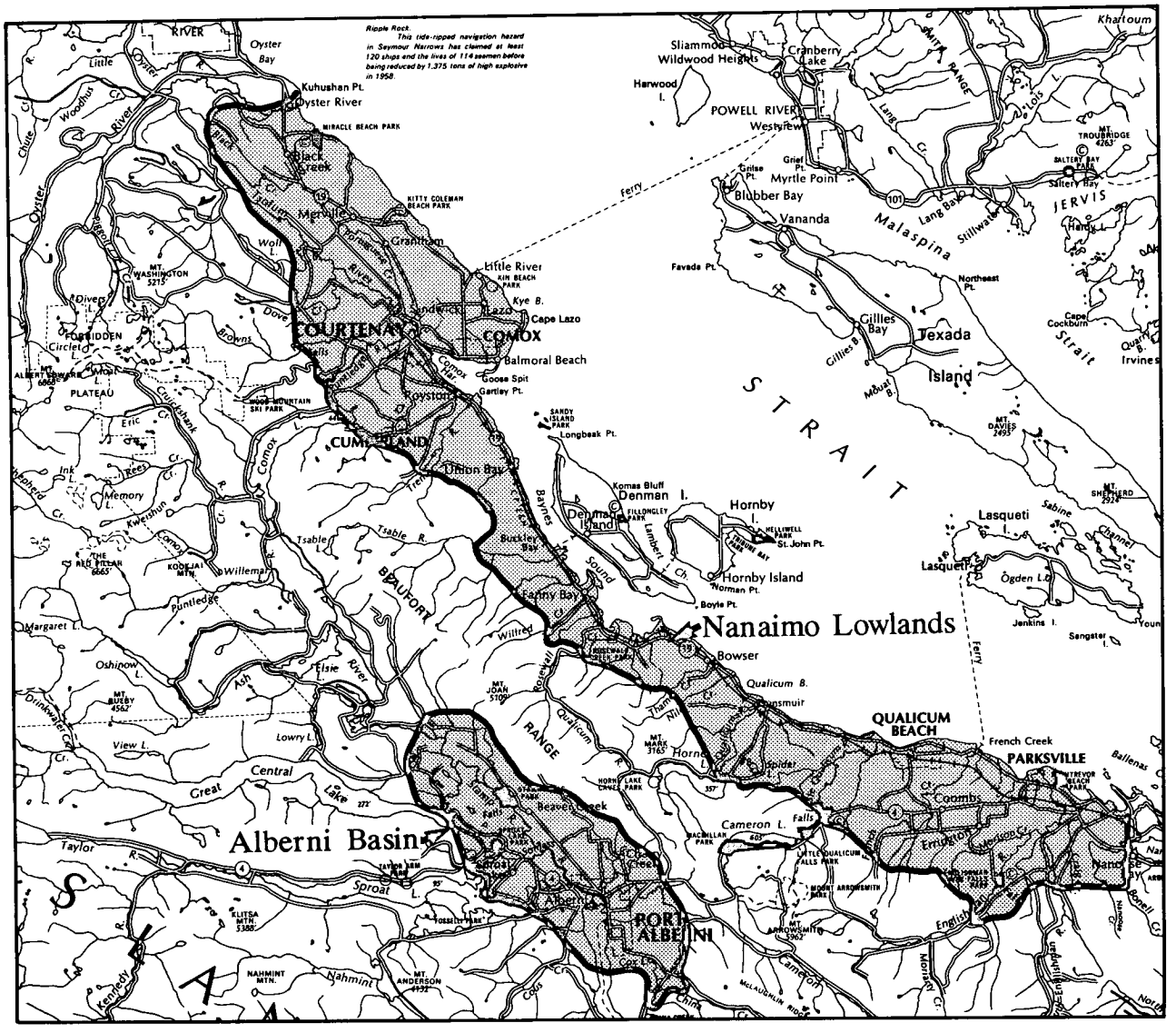


Figure 1.2 Physiography.

1.4 GEOLOGY

The study area falls almost exclusively within the Nanaimo Lowland and lower portion of the Alberni Basin (Holland, 1978) physiographic areas. The Nanaimo Lowlands are largely underlain by Upper Cretaceous sedimentary rocks of the Nanaimo Group and differential erosion has resulted in the present day ridge and swale topography. The ridges are underlain by hard sandstone and conglomerate, and the valleys by softer shale and siltstone. The Alberni basin is underlain by Upper Cretaceous sedimentary rocks as well. These have eroded more readily, and as a consequence lie at lower elevations than the older surrounding volcanic and intrusive rocks.

1.5 PLEISTOCENE HISTORY AND SURFICIAL DEPOSITS

(A) Glacial and Post-glacial Events

The landscape of southern Vancouver Island was considerably modified by glaciation during the Pleistocene epoch. The Fraser glaciation, the most recent major advance, has resulted in the most extensive surficial deposits. This event began with the advance of glacial ice from the mainland Coast Mountains down the Strait of Georgia and crossed southeastern Vancouver Island approximately 18,000 to 19,000 years ago (Alley and Chatwin, 1975).

Prior to the overriding of the study area by the Coast Mountain ice, local build up of valley glaciers within the Vancouver Island Mountains had occurred and these glaciers advanced down the valleys conforming to the local valley configuration. Coast Mountain ice subsequently covered most of Vancouver Island moving generally in a south-south easterly direction and radiating through low mountain passes to the west of the Island. During the downwasting stage of deglaciation, fluvioglacial materials were deposited along valley bottoms.

Coastal areas were influenced by isostatic effects. The land was depressed during glacial advance by the weight of the ice mass. When deglaciation occurred the land did not rebound immediately to its original position but rose gradually. This, together with eustatic rise in sea level, caused by the melting of glaciers allowed the sea to flood coastal locations. The land continued to rise relative to the sea resulting in a variety of marine landforms (eg. beaches, lag deposits) formed at successively lower elevations.

Post-glacial erosion has entrenched numerous creeks and rivers draining the map area and large deltiac estuary areas have formed.

(B) Surficial Deposits

Virtually all soils in the map area are developed in unconsolidated surficial deposits (soil parent materials). Five major genetic types of soil parent materials occur: morainal, marine, fluvial, colluvial, and organic. These materials are defined according to the Terrain Classification System (E.L.U.C., 1978) and are briefly described in the following paragraphs.

(i) Morainal (till) materials are deposited directly by glaciers, are usually poorly sorted, have little or no bedding, (Plate 1.2) and are compacted. These deposits most commonly occur above 130 m elevation throughout the study area. Two types of till are found in the map area. The more common type is coarse textured (silty sand or sand) and contains 40 to 70% coarse fragments. A fine textured till (sandy fines) is less common and occurs principally in the Courtenay and Alberni Valley areas. Below 130 m, the till is often covered by various marine desposits.

(ii) Marine sediments cover significant areas and were deposited during periods of marine submergence after deglaciation. These deposits occur most frequently in the Alberni Valley, Parksville Qualicum Beach, and in the Courtenay area below 100 m asl.

Fine textured marine deposits (sandy silt to clayey silt) (Plate 1.3) and blanket a considable area northwest of Courtenay and in the Alberni Valley. The material is very hard when dry and has a low hydraulic conductivity. Perched water tables often occur during the wet winter months, particularly in depressional sites, resulting in saturated soils. At depth, black manganese stains and bedding are sometimes evident.

Coarse textured marine deposits (sand, gravelly sand) originated as beaches or coastal sand bars prior to isostatic rebound. These materials vary in texture, both vertically and laterally and tend to occur on seaward slopes where exposure to wave action was greatest. They may overlie or grade laterally into fine marine deposits.

Other deposits have also been modified by marine submergence. For example, morainal deposits occurring below the limit of marine submergance sometimes have a surface lag deposit in which gravel and cobbles have been concentrated by wave action.

Plate 1.2 Example of morainal parent material.

Plate 1.3 Example of marine parent material.

(iii) Fluvial materials have been deposited by flowing water (Plate 1.4). In the map area, many of these materials were deposited by glacial meltwaters and are designated as fluvioglacial. The coarse textured fluvioglacial deposits (sand to sandy gravel) have a variety of surface expressions, in the form of old terraces, estuaries and deltas. The deltas are usually found at or below the limit of marine submergence and have characteristic foreset and topset bedding. Finer textured fluvioglacial materials (sandy silt to silty sand) are not common and occur only as a veneer or blanket over some coarser textured deltaic deposits.

Deposits of contemporary rivers and creeks also have a wide range of textures, varying from sandy silt to gravelly sand. Floodplains, low lying fluvial terraces, fans and active deltas are characteristic landforms of recent fluvial origin. Textures are generally finer (sandy silt, silty sand) in the surface sediments of currently active deltas and estuaries (e.g. Courtenay River delta).

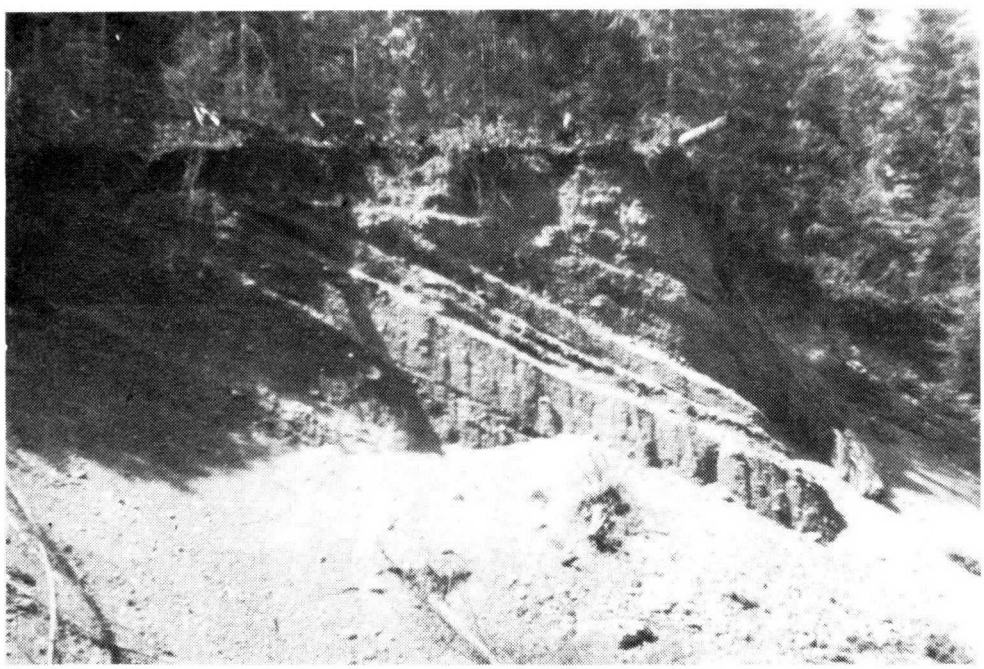


Plate 1.4 Example of fluvial parent material.

(iv) Colluvial deposits result from mass wastage and have reached their present position by gravity-induced movement (e.g. rockfalls, soil creep) (Plate 1.5). Such deposits are found only in the steepest parts of the map area and are of minor significance. Colluvium may occur in association with bedrock and/or morainal deposits, however colluvium can usually be distinquished by a predominance of angular coarse fragments.

Plate 1.5 Example of colluvial parent material.

(v) Organic materials result from the accumulation and decay of vegetative growth (Plate 1.6). Many organic deposits in the study area resulted from vegetative succession which caused infilling of shallow lake basins and vary greatly in depth. Generally, the organic materials are at an intermediate stage of decomposition. The most common botanical origin of the organic material is sedges, rushes and reeds, with aquatic peats of algal and animal origin occurring above the mineral contact.

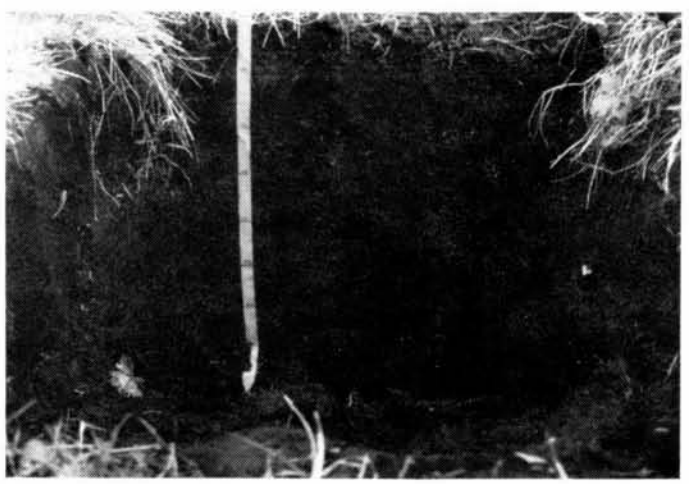


Plate 1.6 Example of organic parent material.

1.6 CLIMATE

The climate of the eastern coastal plain of Vancouver Island and the Alberni Valley is characterized by cool wet winters and mild dry summers. The Pacific Ocean and Georgia Strait play the dominant role in moderating the temperature, while the orographic effect of the Vancouver Island Mountains controls precipitation distribution on the eastern lowlands and the Alberni Valley (Tuller, 1979).

During winter the climate is controlled by moist maritime air masses originating in the north Pacific and flowing onto Vancouver Island. This easterly flow brings the frequent cyclonic storms responsible for the cloud and rain that dominate the area during the winter. Peak precipitation occurs in November, December and January (Figure 4.1); 80 to 85% of the mean annual precipitation falls during the period October through April. January mean daily air temperatures are about 1°C to 3°C. Given the prolonged periods of cloud cover and cool temperatures, little energy is available for evapotranspiration. This results in a climatic moisture surplus (precipitation minus potential evapotranspiration) for the period October through April, and consequently at the onset of the growing season most of the soils are either saturated, or at field capacity.

Occasionally during winter, intense high pressure ridges build over British Columbia, block the easterly flow, and allow out-flow of cold Arctic air from the major inlets of the mainland to spill onto Vancouver Island, bringing snow and freezing temperatures. Freezing temperatures do not persist for long however, for with the return of the moist maritime westerlies, temperatures rise above freezing.

Unlike the cloudy, wet winters, the summers are mild and dry. A weak easterly flow during summer allows the North Pacific high pressure cell to influence southwestern British Columbia, bringing warm, dry and cloudless weather to the area. In particular, the months of July and August are dominated by high pressure systems, resulting in mean monthly precipitation of only 17 mm and mean maximum temperatures of 23°C.

During May through September, empirically estimated potential evapotranspiration is 363 mm at Comox (Baier and Robertson, 1965), while precipitation is 189 mm. This results in an estimated climatic moisture deficit of 174 mm during the growing season. Therefore, in an average growing season, droughty conditions are experienced on most moderately well to rapidly drained soils. The resulting moisture stress is most evident during July and August.

Topography, proximity to the Strait of Georgia and latitude are the major influences on meso-scale climatic variation in the map area. Precipitation increases with latitude, and also with elevation. Comox, 85 km north of Nanaimo, receives approximately 11% more precipitation than Nanaimo does. Cumberland, at 160 meters asl and 10 km from the Strait of Georgia, receives approximately 20% more precipitation than Comox which is at sea level on the coast. The average annual precipitation at Comox is 1206 mm. The average annual precipitation at Port Alberni is 1842 mm. The east coastal plain of Vancouver Island is separated from the Alberni Valley by a mountain range and lies in the rain shadow of this range and hence receives approximately 30% less precipitation than the Alberni Valley. The temperature regime of the map area is fairly uniform (figure 4.1), with minor variations mainly attributable to the moderating influence of the Strait of Georgia.

The west and southeast coasts of Vancouver Island have the longest freeze-free periods in Canada (Tuller, 1979). East coastal locations such as Comox and Nanaimo may expect 180 frost-free days from mid April to late October, while inland locations such as Cumberland may expect a frost free period of approximately 148 days from May to October.

The long freeze-free periods of the area result in substantial accumulations of seasonal growing degree days (GDD) (Table 4.3). These GDD may be misleading for agricultural crop growth and adjustment using a more suitable thermal criterion is necessary (Colligado, 1978). Since the GDD are mostly accumulated from temperatures at the lower end of the scale (near the base temperature of 5°C), they should not be considered as Effective Growing Degree Days (EGDD) (Colligado, 1978). Effective Growing Degree Days determined for the Comox area are 965, based on the period 1941-1970 while the number of GDD for the same period are 1872.

The long freeze-free period and warm summer temperatures provide the southeast coastal plain of Vancouver Island with a very favorable climate for agriculture. Low precipitation during summer is the major climatic limitation. However, provided that water is available for irrigation, the area has a high climatic capability for agriculture.

1.7 NATIVE VEGETATION

The major portion of the map area lies within the Coastal Western Hemlock Zone; Douglas-fir subzone (Harcombe, 1982). This zone ranges from sea level to 900 m elevation between Nanaimo and Kelsey Bay, and lies above the Coastal grand fir - western red cedar zone in the south. The major macroclimatic feature influencing the zone is the rainshadow, with descending Pacific air masses drying with movement eastward. The zone is characterized by a climatic climax forest of western hemlock on deep, well drained sites. The long-lived coast Douglas-fir is the dominant seral species on most disturbed sites. The coast Douglas-fir subzone (sea level to 500 m) has been intensively disturbed and mature western hemlock is uncommon. Forest understories are dominated by salal, Oregon-grape, and mosses. Pacific madronne may be common on drier sites.

CHAPTER 2
SOIL CLASSIFICATION AND MAPPING METHODOLOGY

2.1 SOIL CLASSIFICATION

Soil is the naturally occurring unconsolidated mineral or organic material at the earth's surface which is able to support plant growth. The type of soil at a given location is the result of climate, organisms and topography acting on the parent material over time. Soils display a continuum of properties, reflecting the variation of these soil-forming factors.

Each soil is a three-dimensional, naturally occurring body having length, width and depth. The objective of a soil survey is to identify the different kinds of soil, to separate or classify them and to delineate their distribution on a map. Soils are classified on morphological characteristics observed in a vertical section (soil profile) and on the physical and chemical characteristics obtained by analysis of samples taken from representative basic soil units (pedons). Individual soil profiles are grouped (classified) according to categories of the soil classification employed. The resultant groups are then delineated on a soil map by boundaries which encompass areas of soil in the same group. Morphologic characteristics are discussed in the following section dealing with field methods.

During the process of developing a legend two taxonomic entities were used for naming soils; the soil family and the soil series. A soil family is a taxonomic entity within which from one to large number of series may be established. A soil series is a conceptual class that consists of a group of related pedons that have similar kinds and arrangements of horizons whose color, texture, structure, and consistance, thickness, reaction, and composition fall within a narrow range. Soil series names are usually place names occurring in the locality where the series is orginally classified. The series however is not restricted to that locality.

It was not always possible to separately delineate individual soil series, in particular, recent fluvial and/or marine terrain units were especially difficult to map because of complex drainage, texture, and stonines features. Therefore, the soil family was also used as a category for mapping.

Some soils are so intermixed that it was not possible to describe them using one soil name. In these cases, the map unit is a complex of two or more individual soils. In all such cases, the intermingling of the series and/or families is too intricate to be separated at the map scale used.

In addition to the soil series and families, phases, variants, and several miscellaneous land types are also recognized. The miscellaneous land types consist of non-soil areas and include coastal beaches, eroded scarps, recent alluvium, rock outcrop and man-made land.

Soil phases are variations within a soil series or other hierarchial category due to differences in stoniness, topography, depth of profile or other features which effect land use.

Soil variants are used when new soils are identified but occupy only minor areas. A new description of the soil is not warranted. These are usually classified as a variant of the established soil series or family which has most characteristics in common with the variant.

The first level of generalization above the soil series is the soil family. A soil family consists of a group of related soil series which fall within a range of differentiating criteria that is broader than that for soil series. The differentiating criteria include particle size distribution, drainage, permeability, reaction and consistence as well as others that have implications for land use.

The next level of generalization is the soil subgroup. A soil subgroup consists of a group of soils which have defined common soil horizons which reflect the environmental conditions under which the soils developed. Soil subgroups may be further grouped into soil great groups. Soil great groups consist of soils which have major soil horizons in common which reflect the strengh of the dominant soil forming process or processes. The broadest level of generalization is the soil order. A soil order is composed of groups of soils that have developed under broadly similar environmental conditions as expressed by the presence or absence of major, diagnostic soil horizons.

Soil classification provides a method of organizing information which is logical and useful. In The System of Soil Classification for Canada (1978), soil groupings are based on properties that indicate a similar mode of origin. The soil order is the highest level of generalization in this system. Of the nine orders, five occur in the study area:

(1) Soils of the humid forested regions containing significant amounts of amorphorus aluminum, iron, and/or organic matter (Podzolic order);
(2) Soils with weakly developed horizons (Brunisolic order);
(3) Young soils with little or no horizon development (Regosolic order);
(4) Soils which are influenced by periodic or long-term water saturation (Gleysolic order); and,
(5) Soils developed primarily from plant residues (Organic order).

Each soil order is subdivided into two to four Great Soil Groups according to the differing strengths of dominant soil-forming processes. Further subdivision into Soil Subgroups is on the basis of the kind and arrangement of soil horizons.

The following paragraphs generally describes the soil orders occurring in the map area, along with the great soil groups and soil subgroups within each soil order. (Also see Table 2.1).

Brunisolic Order

Brunisolic soils are a common soil order in the map area, occurring on virtually all parent materials. These soils have drainage classes ranging from imperfectly to rapidly drained, due to varying topographic positions and parent material texture. Soils of the Brunisolic order have sufficient horizon development to exclude them from the Regosolic order, but they lack the degree or kind of horizon development specified for soils of other orders. Their B horizons have insufficient accumulation of Fe, and Al, and organic matter to qualify as Podzolic B horizons.

Two Brunisolic great groups are represented in the map area: Dystric and Sombric. Both are acidic and the latter has a dark, organic matter-enriched surface (Ah) horizon 10 cm or more in thickness. Such Ah horizons may form naturally under grassy, open forests or under long term cultivation. Dystric Brunisol soils lack a well-developed mineral-organic surface horizon. They occur widely usually on parent materials of low base status and typically under forest vegetation.

Three subgroups occur in both great groups. Duric Dystric and Duric Sombric Brunisol soils contain strongly cemented (duric) subsoil horizons and occur mostly on coarse textured glacial till and some fluvioglacial deposits. Gleyed Dystric and Gleyed Sombric Brunisols are imperfectly drained, contain subsurface mottling and are most common on medium textured parent materials with a seasonally perched water table. In some areas small amounts of clay has accumulated in the lower B horizon by illuviation. Orthic Dystric and Orthic Sombric Brunisols occur on moderately well to rapidly drained parent materials.

Gleysolic Order

Gleysolic soils develop in the presence of excessive moisture that results in permanent or periodic reducing conditions. As a result, the gleyed subsoil is bluish-gray to greenish-gray and reddish-brown mottles usually occur in the profile. These soils occur where the watertable is high because of proximity to bodies of water (e.g. floodplains) or in depressional sites, or on materials with low hydraulic conductivity.

Humic Gleysol, Luvic Gleysol, and Gleysol great groups occur in the map area. Humic Gleysols are usually found in depressional sites on medium to fine textured parent materials. Organic matter accumulates in the Ah horizon and occasionally a surface veneer of peat is found. Luvic Gleysols are associated with Humic Gleysol soils but differ by having substantial clay accummulation in the B horizon. Two subgroups of the Gleysol Great Group are significant. The Orthic Gleysols have a mottled and gleyed B horizon, but lack a dark surface horizon. These soils are usually found on fine marine deposits and differ from the Gleyed Dystric Brunisols only in the decreased depth to distinct or prominent mottling. Rego Gleysols occur only on active floodplains or estuaries where continuing sedimentation restricts soil development to a juvenile stage.

Podzolic Order

Podzolic soils have acidic, yellowish red, illuvial B horizons in which amorphous material composed of humified organic matter combined with aluminum (Al) and iron (Fe) has accumulated. Formation of podzolic soils is promoted by cool temperatures, high precipitation, and coniferous vegetation which produces acidic organic matter accumulations on the soil surface.

Podzolic soils occur in the wetter zones of the map area and at higher elevations. In practice, Podzolic soils are difficult to distinguish in the field from Brunisolic soils because both display similar colours. Some profiles tentatively classified as Brunisolic have, after chemical analysis, met the requirements of the Podzolic Order because of high levels of extractable Al which has no effect on soil colour.

All Podzolic soils in the map area belong to the Humo-Ferric Great Group which is characterized by a Bf horizon in which Fe and Al, but little organic matter have accumulated. Distinct eluvial (Ae) horizons are not common in Podzolic soils in the study area, apparently because organic matter and Fe and Al released by weathering mask their appearance. Well defined Ae horizons occur mainly on coarse, rapidly drained fluvioglacial materials.

The most common Podzolic subgroup is Duric Humo-Ferric Podzol, characterized by a strongly cemented to indurated (duric) horizon below the Bf horizon. Duric horizons resemble the under

lying parent material in colour and are most common on glacial till (Plate 1.2). The cementing agents are believed to be Al, Fe, and Si (McKeague & Sprout, 1975). Three other Podzolic subgroups occur in the study area. These are Orthic Humo-Ferric Podzols which are well drained, without a duric horizon, Sombric Humo-Ferric Podzols which have dark, organic matter-enriched A horizon and have developed under open, grassy forests, and Gleyed Humo-Ferric Podzols which are imperfectly to poorly drained and have mottling in the subsoil.

Regosolic Order

Regosolic soils exist wherever active deposition or erosion interrupt soil development. These conditions occur on active floodplains or on steep, eroding slopes. Regosolic soils on recent fluvial deposits are of much greater extent and have a wide range of textures (silt loam to very gravelly sand).

The majority of Regosolic soil in the map area belong to the Regosol Great Group which is characterized by thin Ah horizons (less than 10 cm) and no B horizons. Humic Regosols have an organic matter four subgroups are recognized 'Orthic' which depict the central characteristics of the order and great groups, 'Cumulic' which are formed by repeated additions of fresh sediment separated by layers enriched with organic matter, 'Gleyed' (imperfectly drained) and 'Gleyed Cumulic'.

Organic Order

Organic soils are the least extensive of the five orders found in the map area. These soils occur in poorly or very poorly drained depressions where organic matter accumulates faster than it decomposes. Most of these Organic soils are at an intermediate or advanced degree of decomposition and respectively belong to the Mesisol and Humisol great groups.

Table 2.1
Relationship Between Soil Names, Soil Orders, Soils Great Groups, Subgroups,and Parent Material

SOIL NAME	(Symbol)	ORDER	SOIL GREAT GROUP	DOMINANT SUBGROUP	PARENT MATERIAL
Beaufort	(BF)	Brunisolic	Dystric Brunisol	Orthic	fluvial
Beddis	(BD)	Brunisolic	Dystric Brunisol	Orthic	marine, fluvial
Chemainus	(CH)	Brunisolic	Dystric Brunisol	Orthic	fluvial
Flewett	(FT)	Brunisolic	Dystric Brunisol	Orthic	fluvial
Galiano	(GA)	Brunisolic	Dystric Brunisol	Orthic	morainal over bedrock
Hillbank	(HT)	Brunisolic	Dystric Brunisol	Orthic	marine
Mexicana	(ME)	Brunisolic	Dystric Brunisol	Orthic	morainal
Maple Bay	(MY)	Brunisolic	Dystric Brunisol	Orthic	marine over bedrock
Qualicum	(QU)	Brunisolic	Dystric Brunisol	Orthic	fluvial, marine
Rumsley	(RY)	Brunisolic	Dystric Brunisol	Orthic	morainal, colluvial over bedrock
Salalakim	(SL)	Brunisolic	Dystric Brunisol	Orthic	morainal, colluvial over bedrock
Saturna	(ST)	Brunisolic	Dystric Brunisol	Orthic	morainal, colluvial over bedrock
Dashwood	(DW)	Brunisolic	Dystric Brunisol	Duric	marine, fluvial over morainal
Mill Bay	(MB)	Brunisolic	Dystric Brunisol	Duric	marine over morainal
Shawnigan	(SH)	Brunisolic	Dystric Brunisol	Duric	morainal
Deerholme	(DE)	Brunisolic	Dystric Brunisol	Duric	marine, fluvial over morainal
Brigantine	(BE)	Brunisolic	Dystric Brunisol	Gleyed	marine, fluvial
Fairbridge	(FB)	Brunisolic	Dystric Brunisol	Gleyed Eluviated	marine
Baynes	(BY)	Brunisolic	Dystric Brunisol	Gleyed	marine, fluvial
Kulleet	(KT)	Brunisolic	Dystric Brunisol	Gleyed	marine
Royston	(RN)	Brunisolic	Dystric Brunisol	Gleyed	morainal
Suffolk	(SF)	Brunisolic	Dystric Brunisol	Gleyed	marine over morainal
St. Mary	(SM)	Brunisolic	Dystric Brunisol	Gleyed	marine over morainal
Trincomali	(TR)	Brunisolic	Dystric Brunisol	Gleyed	marine over morainal
Puntledge	(PU)	Brunisolic	Sombric Brunisol	Gleyed	fluvial over marine
Denman Island	(DA)	Gleysolic	Humic Gleysol	Orthic	marine, fluvial
Koksilah	(KH)	Gleysolic	Humic Gleysol	Orthic	morainal
Kaptara	(KP)	Gleysolic	Humic Gleysol	Orthic	fluvial, marine
McLean Creek	(ML)	Gleysolic	Humic Gleysol	Orthic	marine
Parksville	(PA)	Gleysolic	Humic Gleysol	Orthic	marine
Tolmie	(TL)	Gleysolic	Humic Gleysol	Orthic	marine
Cowichan	(CO)	Gleysolic	Luvic Gleysol	Humic	marine
Crofton	(CF)	Gleysolic	Humic Gleysol	Orthic	fluvial
Corydon	(CR)	Gleysolic	Humic Gleysol	Rego	fluvial
Arrowsmith	(AR)	Organic	Mesisol	Typic	organic
Metchosin	(MT)	Organic	Humisol	Typic	organic

Table 2.1 (Continued)

SOIL NAME (Symbol)	ORDER	SOIL GREAT GROUP	DOMINANT SUBGROUP	PARENT MATERIAL
China Creek (CK)	Podzolic	Humo-Ferric Podzol	Orthic	morainal
Kye (KY)	Podzolic	Humo-Ferric Podzol	Orthic	marine, fluvial
Quennel (QL)	Podzolic	Humo-Ferric Podzol	Orthic	fluvial
Quinsam (QN)	Podzolic	Humo-Ferric Podzol	Duric	morainal
Alberni (AB)	Podzolic	Humo-Ferric Podzol	Gleyed	marine
Bowser (BO)	Podzolic	Humo-Ferric Podzol	Gleyed	marine
Illusion (IL)	Podzolic	Humo-Ferric Podzol	Gleyed	marine
Stamp (SP)	Podzolic	Humo-Ferric Podzol	Gleyed	morainal
Tsolum (TS)	Podzolic	Humo-Ferric Podzol	Gleyed	marine over morainal
Cassidy (CA)	Regosolic	Regosol	Cumulic	fluvial
Comiaken (CN)	Regosolic	Regosol	Cumulic	fluvial

2.2 FIELD PROCEDURES AND MAP COMPILATION

The survey intensity is Level 2, according to the guidelines of the Mapping Systems Working Group (1981). The publication map scale of 1:20 000 is typical for a survey at this intensity level. Field work involved at least one soil inspection in over 90% of map delineations, with boundaries frequently checked in cleared areas, or less frequently in forested areas. Boundary delineation was determined by aerial photograph interpretation, using landform characteristics, variation in slopes, tone and vegetation patterns. Ground truthing was used to improve accuracy of delineations on the pretyped aerial photographs and to determine boundaries that were not discernible through stereoscopic examination. Soil boundaries and thematic information were compiled on 1:20 000 scale aerial photographs.

Field observations recorded at inspection sites included: site position, terrain type, elevation, soil horizons and thickness, texture, drainage, coarse fragment content, and agriculture capability rating. Standardization of site information was made possible by using site and soil description forms as outlined in Describing Ecosystems in the Field (Resource Analysis Branch, 1980). Approximately 9100 inspections at this level of detail were conducted. One hundred and four representative soil profiles were described in detail and sampled for laboratory analysis. All these descriptions, along with supporting analytical data, are stored on computer file (British Columbia Soil Information System) and are available on request from the Surveys and Resource Mapping Branch, Ministry of Environment and Parks.

At all inspection sites, the agricultural capability rating was determined, according to methodology in Land Capability Classification For Agriculture in British Columbia (Kenk and Cotic, 1983). Soil and landscape observations made between inspection sites on foot traverses were also used in deriving agricultural capability ratings for individual map delineations.

Soil inspection pits were dug with a shovel or by a hand auger, usually to a depth of 100 cm. To enable more consistent estimates of coarse fragment content, a 2 mm mesh sieve was used to separate gravel and cobbles from the finer fraction. For organic soils, a specialized peat auger was used so that the entire control section (160 cm) could be observed.

2.3 SOIL LEGEND DEVELOPMENT

Soils occur in intricate patterns across the landscape. Each piece of the pattern, with a unique set of soil properties represents a mappable entity. This entity, which may consist of one or more soils, is presented on a soils map as a soil mapping individual. Each unique soil is discussed in an accompaning soil report. Prior to the survey it is not possible to determine the exact soil property ranges that will be used to define and delineate a particular soil (Mapping System Working Group 1981). This must be left to the correlator and surveyors as they gain more data during the soil survey. This process is known as soil legend development.

The initial information used for developing the legend for the current survey was obtained from Soil Survey of Southwest Vancouver Island and Gulf Islands, British Columbia (Day et al., 1959), (mapping scale 1:63 360), Soil Resources of Southern Vancouver Island (Jungen, 1985), (mapping scale 1:50 000) and Soils of Southeast Vancouver Island; Duncan-Nanaimo Area, (Jungen et al, 1985) (mapping scale 1:20 000).

These surveys provided sufficient information on groups of related soils and their associated landscape characteristics to develop a preliminary working legend. As the survey progressed repetitive types of soil sequences on similiar parent materials were observed and described.

In total, forty-seven soils, each with unique combinations of properties and which differed significantly with respect to their physical behavior and chemical composition, were identified and described in detail.

Specifically, the soils differ with respect to one or more of the following characteristics: genetic material, texture, drainage, toponomy (development), and type of bedrock (if it occurs at depths less than one metre). Each soil is given a local geographical name - that name represents a soil with a unique set of properties. Whenever possible, previously established names were used (Table 2.2). For example, Soil Survey Report No. 6 (Day et al., 1959), which used a 1:63 360 mapping scale, described the Shawnigan soils as having a relatively wide range of soil properties, suit able for that scale of mapping. The current soil survey, which uses a 1:20 000 mapping scale identified four separate groups within the original Shawnigan soil. Each new soil has sufficient differentiating characteristics and interpretive differences to warrant separation and each can be delineated at the new larger map scale.

Since the main objective of the soil maps is to provide as much interpretive value as possible, an "uncontrolled soil legend" was perceived to best provide that flexibility. This type of legend allows the soil surveyor the opportunity to describe each soil mapping individual in as much useful detail as required and also allows additions of new soils, as warranted.

After completing the field mapping, delineations were transferred from the working aerial photographs to a 1:20 000 scale base map. Soil boundaries were then edited and digitized. Soil name(s), slope, coarse fragments and percentage of each soil in each polygon were coded as were medal chemical and physical attributes for each soil (including phases and variants). These form the data base which the soil and all other derivitive maps were produced.

Digitized and computerized soil maps improve efficiency and provide a flexible data base from which much more than a soil map can be produced. With sufficient information on soils, climate, land capability, present land use, etc., various data can be extracted and manipulated to produce specific maps to meet user requirements (eg. surface soil erosion potential map).

Table 2.2
Relationships Between Soils Identified in Day et al. 1959 and Current Soil Survey

Soil Name (Day et al, 1959)	Current Soil Names*
Alberni	Alberni, Suffolk
Arrowsmith	Arrowsmith
Bowser	Brigantine, Bowser, Denman Island, Baynes
Cassidy	Cassidy
Chemainus	Chemainus, Crofton, Corydon, Comiaken, Flewett
Cowichan	Cowichan, McLean Creek
Dashwood	Dashwood, Trincomali, Tsolum, St. Mary
Fairbridge	Fairbridge, Hillbank, Mill Bay, Maple Bay, Illusion, Suffolk
Metchosin	Metchosin
Kye	Kye, Beddis, Deerholme
Parksville	Parksville
Puntledge	Puntledge
Qualicum	Qualicum, Quennell, Kaptara, Beaufort
Quinsam	Quinsam, Koksilah
Royston	Royston
Shawnigan	Shawnigan, Mexicana, Koksilah, Hollings
Stamp	Stamp, China Creek
Tolmie	Tolmie
Unnamed, shallow to bedrock soils	Saturna, Salalakim, Rumsley, Galiano

*Many of the soils identified by Day et al. 1959 are more narrowly defined by the current survey. The original Bowser soil, for example, has been subdivided into four unique soils which are named Brigantine, Denman Island, Bowser, and Baynes. The name Bowser has been retained in the current survey for continuity but the soil it now identifies has limits on its characteristics than are more restrictive than those originally defined by Day et al. 1959.

2.4 RELIABILITY

A number of practical problems, some of which are peculiar to the study area, influenced the rate of progress and accuracy of the mapping. Abrupt and unpredictable changes in soil texture occur as a result of past marine sedimentation and wave action and are not easily identified on aerial photographs. Second, although road access was generally good, dense forest cover in some areas caused uncertainties in accurately plotting inspection site locations and delineating boundaries. Third, the highly fragmented pattern of land use and property sizes influenced the rate of progress. Parcels of less than two hectares were not visited unless an inferred soil boundary crossing the parcel required checking.

The inherent complexity of the soil landscape was particularly great below 100 m. This area was influenced by marine activity (erosional and depositional) often resulting in abrupt changes in texture and coarse fragment content. Inspection density averaged about one inspection per 8 ha. Complex areas received greater attention (more inspections) than other areas. Forested upland and steep, shallow to bedrock areas have less inspections. It is important to understand the fact that the soils mapped in any one polygon will in all probability contain minor to significant inclusions of other soils.

The soil map indicates the soil surveyors analysis of the landscape through air photos interpretation and ground inspection information. The reliability or accuracy will vary, from one location to another and will depend on the experience and interpretive ability of the soil surveyor, the inherent complexity of the parent materials and landscape, and the intensity of detailed ground checking.

CHAPTER THREE
GUIDELINES FOR SOIL DESCRIPTIONS

3.1 INTRODUCTION

The guidelines provided in this chapter describe the criteria and parameters used for describing the soils in Chapter 4.

3.2 GUIDELINES TO SOIL DESCRIPTIONS

3.2.1 Landscape Picture and General Comments

Where available, landscape photographs are used to illustrate a typical setting in which each soil occurs. The general comments include a description of the main soil characteristics, topography, drainage, parent materials, and the typical location of the soil in the landscape. Also included are brief comments on the soils suitability (or limitations) for agricultural, urban and other uses.

3.2.2 Soil Landscape Cross Section

These diagrams depict the usual landscape position of the soil in relation to other soils and parent materials. The symbols used for parent materials are described in Table 3.1 and are extrac extracted from Terrain Classification System, Environment and Land Use Committee Secretariat, 1976.

3.2.3 Landscape Characteristics

Parent Material - defined according to the Terrain Classification System (E.L.U.C., 1976). See Table 3.1.

Topography - given as the slope classes outlined in Canadian System of Soil Classification, 1978. The classes are defined as follows:

Description	Percent slope
depressional or nearly level	0 to 0.5
very gently sloping or gently undulating	0.5 to 2
gently sloping or undulating	2+ to 5
moderately sloping or gently rolling	5+ to 9
strongly sloping or moderately rolling	9+ to 15
steeply sloping or strongly rolling	15+ to 30
very steeply sloping or hilly	30+ to 60
extremely sloping or very hilly	over 60

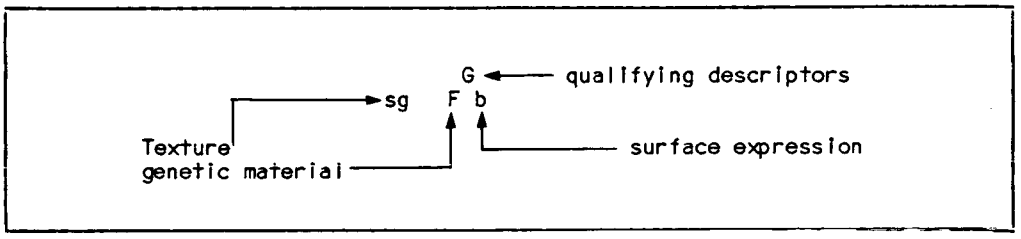
Elevation Range - given in meters above sea level.

Aspect - typical orientation of slopes on which the soil occurs.

Flood Hazard - described according to classes (no hazard, rare, may be expected, frequent, and frequent and irregular) as defined in Describing Ecosystems in the Field, R.A.B., 1980.

Table 3.1
Terrain Classification

Explanation of Letter Notation



Texture

Letter Symbol	Name
b	bouldery
k	cobbly
p	pebbly
s	sandy
s	silty
c	clayey
a	blocky
r	rubbly
g	gravelly
f	fine
m	mesic
h	humic

Genetic Material

Letter Symbol	Name
A	anthropogenic
C	colluvial
E	eolian
F	fluvial
L	lacustrine
M	morainal
O	organic
R	bedrock
W	marine
U	undifferentiated

Surface Expression

Letter Symbol	Name
b	blanket
f	fan
h	hummocky
l	level
m	subdued
v	ridged
s	steep
t	terraced
v	veneer

Qualifying Descriptors

Letter Symbol	Name
G	glacial
B	bog
F	fen
S	swamp

Flooding relates to river and stream overflow and not surface accumulation via high water-tables, seepage, and runoff. These are referred to as surface ponding and are not considered in this flood hazard assessment.

Vegetation - describes broadly some of the more typical native trees, shrubs and grasses. Mention is made of whether the soils are mostly in their native state or are cultivated.

3.2.4 Typical Soil Profile

A generalized soil profile diagram is provided for each soil, with major horizons indicated and briefly described according to CanSIS, 1978 and C.S.S.C., 1978.

3.2.5 Soil Characteristics

These tables summarize data obtained from field observations and laboratory analyses. Data for physical and chemical properties are presented as weighted means, along with the range of values measured and the number of samples analysed. The laboratory data are usually from the analyses of two or more representative profiles, often supplemented by additional samples from selected soil horizons or depths. If laboratory data are unavailable, estimated values are usually provided. Definitions for the soil characteristics described are as follows:

Depth to Bedrock - this term refers to the estimated average depth to solid bedrock. Where the bedrock is greater than 100 cm from the surface the symbol N/A (non applicable) is used.

Humus Form - this indicates the type of humus form that most commonly occurs under natural conditions defined as follows (R.A.B., 1980).

MOR - This humus form (also known as "raw humus") in non-zoogenous and is comprised of Of, Om, or L, F, and H horizons sharply delineated from the mineral soil It is usually strongly matted or compacted and often interwoven with fungal hyphae. Mors commonly occur on a variety of parent materials in coniferous forests were climate and edaphic conditions prevent rapid decomposition of organic matter and development of an active population of soil microfauna. They also occur in mixed or hardwood stands, and in wetland areas (excluding Organics).

MODER - This is primarily a zoogenous humus form comprised of partly decomposed plant remains (F horizon) which is not matted as in MOR humus. This F horizon is transitional to an Hl horizon made up of organic granules intermixed with loose mineral grains. Although incorporation of organic matter is intense, it is shallow as none of the organisms concerned with moder formation have important burrowing activity. Unlike zoomull humus forms, there is no evidence of a clay humus complex forming in moders.

Moders occur under mixed or hardwood forests, and under temperate coniferous forests where climate and edaphic conditions are not favourable for the development of mor or mull humus forms. Characteristically they occur in soils whose surface horizons contain little clay and are periodically droughty. The mixing of organic and mineral particles may be purely mechanical and caused by soil creep, although the action of micro-arthropods is the most common cause.

MULL - A zoogenous forest humus form consisting of an intimate mixture of well-humified organic matter and mineral soil that makes a gradual transition to the horizon underneath. It is distinguished by its crumb or granular structure. Due to the activity of the burrowing microfauna (mostly earthworms), partly decomposed organic debris does not accumulate as a distinct layer (F layer) as in mor and moder. The organic matter content is 5 to 25% and the C:N ratio is 10 to 30. Various subgroups can be distinguished by the morphology and chemical characteristics.

Solum Depth - the total thickness of upper horizons in which soil forming processes are active and in which most plant roots occur. It usually consists of A and B horizons.

Depth to, Thickness, and Type of Restricting Layer - the depth of soil to a root restricting layer; the thickness of the restricting layer; type of restricting layer includes cemented or other layers acting as barriers to plant roots (for example, duric horizons, Bt horizons, or compacted glacial till).

Rooting Depth - depth of soil available for plant rooting.

Coarse Fragment Class - a measure by volume of the content of coarse fragments 2.5 cm in diameter or greater in the upper less than 25 cm of mineral soil. The classes indicate the abundance of coarse gravels, cobbles and stones. These hinder cultivation, decrease water holding capacity and decrease the volume of soil available for rooting and nutrient uptake. Fine gravels less than 2.5 cm in diameter are not included. The classes are defined in Table 3.2.

Table 3.2
Coarse Fragment Classes

Class	Description
0	Coarse fragments greater than 2.5 cm in diameter are essentially absent.
1	Coarse fragments offer a only slight hinderance to cultivation. The total content of coarse fragments greater than 2.5 cm in diameter is less than 10% and/or the content of cobbles and stones is less than 1%.
2	Coarse fragments cause a significant interference with cultivation. The total content of coarse fragments greater than 2.5 cm in diameter varies from 11 to 20% and/or the content of cobbles and stones varies from 2 to 5%.
3	Coarse fragments are a serious handicap to cultivation. The total content of coarse fragments greater than 2.5 cm in diameter varies from 21 to 40% and/or the content of cobbles and stones varies from 6 to 15%.
4	Coarse fragments prevent cultivation until considerable picking has been done. The total content of coarse fragments greater than 2.5 cm in diameter varies from 41 to 60% and/or the content of cobbles and stones varies from 16 to 30%.
5	The abundance of coarse fragments makes impractical the application of improvement practices. The total content of coarse fragments is greater than 60% and/or the content of cobbles and stones is greater than 30%.

Depth to and Type of Watertable - the depth to the upper zone of periodic free water as indicated by matrix colours of low chroma or distint to prominent mottles of high chroma. Watertables are described according to their persistence, i.e. seasonal (usually during winter) or year- round, and their origin, i.e. whether perched (resulting from an underlying impermeable layer) or apparent (representing the true surface of the unconfined groundwater). For some soils the presence of a water table is unknown since soil pits were generally only dug about 1 m deep. In these cases the watertables are described as >1 m deep and of unknown type.

Soil perviousness - Soil perviousness refers to the soils ability to transmit water internally, and is inferred from soil characteristics such as structure, texture, porosity, cracks, organic matter content, and shrink-swell properties. It is closely related to measures of permeability, percolation rate, and infiltration rate, but these are reserved for actual measurements using standard techniques. Perviousness applies to the whole soil profile. Because of this, it is determined by the least permeable layer in the soil profile.
It is important to distinguish between soil drainage and perviousness. For example, a rapidly pervious soil could be receiving excessive seepage and thus be poorly drained. Three perviousness classes are defined:

a. Rapidly pervious - The capacity to transmit water vertically is so great that the soil will remain wet for no more than a few hours after thorough wetting. The horizons and soils have large and continuous or connecting pores and cracks that do not close with wetting.
b. Moderately pervious - The capacity to transmit water vertically is great enough that the soil will remain saturated for no more than a few days after thorough saturation. Most moderately pervious soils hold relatively large amounts of water against the force of gravity, and are considered to have good physical structure for rooting and supplying water to plants. Soil horizons may be single grained, granular, blocky, weakly platy or massive (but porous if continuous conducting pores or cracks are present which do not close with wetting).
c. Slowly pervious - The potential to transmit water vertically is so slow that the horizon or the soil will remain saturated for periods of a week or more after thorough wetting. The soil may be massive, blocky or platy, but connecting pores that conduct water when the soil is wet are few, and cracks or spaces among peds that may be present when the soil is dry, close with wetting. Even in positions accessible to plant roots, roots are usually few or absent and if present, they are localized along cracks when the soil is wet.

Soil Drainage - Defined in terms of (i) the actual moisture content in excess of field moisture capacity, and (ii) the extent of the period during which such excess water is present in the plant-root zone. It is recognized that permeability, level of groundwater, and seepage are factors affecting moisture status. However, because these are not easily observed or measured in the field, they cannot be used generally as criteria for drainage classes.

Soil profile morphology, particularly mottling and gleying, normally, but not always, reflects soil drainage. Topographic position and vegetation as well as other soil characteristics, are useful field criteria for assessing soil drainage classes.

The definitions of the soil drainage classes are underlined. As an additional guide, comments under each class, indicate some of the pertinent soil morphological features that are commonly, but not necessarily found.

a. Rapidly drained - The soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions. Soils are free from any evidence of gleying or mottling throughout the profile. Rapidly drained soils often occur on steep slopes.

b. Well drained - The soil moisture content does not normally exceed field capacity in a horizon (except possibly the C) for a significant part of the year. Soils are usually free from mottling in the upper 1 m, but may be mottled below this depth.

c. Moderately well drained - The soil moisture in excess of field capacity remains for a small but significant period of the year. Soils are often faintly mottled in the lower B and C horizons or below a depth of 0.7 m. The Ae horizon, if present, may be faintly mottled in fine-textured soils and in medium-textured soils that have a slowly permeable layer below the A and B horizons. In grassland soils the B and C horizons may be only faintly mottled and the A horizon may be relatively thick and dark.

d. Imperfectly drained - The soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods during the year. Soils are often distinctly mottled in the B and C horizons; the Ae horizon, if present, may be mottled. The matrix generally has a lower chroma than in the well drained soil on similar parent material. Soils are generally gleyed subgroups of mineral soil orders.

e. Poorly drained - The soil moisture in excess of field capacity remains in all horizons for a large part of the year. The soils are usually strongly gleyed. Except in high chroma parent materials, the B, if present, and upper C horizons usually have matrix chromas of 3 or less; prominent mottling may occur throughout. Soils are classified in the Gleysolic or Organic orders.

f. Very poorly drained - Free water remains at or within 30 cm of the surface most of the year. The soils are usually strongly gleyed. Subsurface horizons usually are of low chroma and yellowish to blueish hues. Mottling may be present within 30 cm or at depth in the profile. Soils are generally in the Gleysolic or Organic order; mineral soils are usually a peaty phase.

Depth to Salts - The depth to saline horizons indicated by electrical conductivity measurements. Soil is usually considered saline when electrical conductivity is 4 mS/cm or higher.

Soil Texture - Soil texture is an important physical property and is defined in terms of the size distribution of primary mineral particles (2 mm diameter or less) as determined by sieve and sedimentation analysis, or field estimation. Particle size separates consist of clay (<0.002 mm), silt (0.002-0.05 mm) and sand (0.05-2.0 mm). The texture classes are illustrated in Figure 3.1.

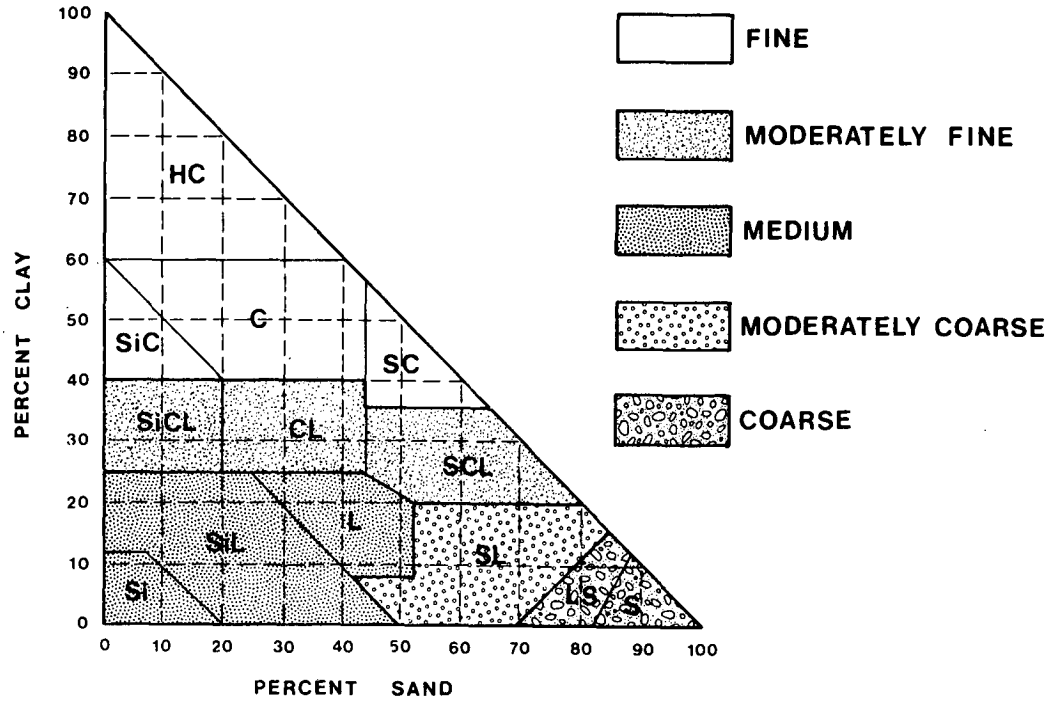


Figure 3.1 Soil texture classes. Percentages of clay and sand in the main textural classes of soil; the remainder of each class is silt.

The relative proportions of the particle size separates for various soil textures is as shown in Figure 3.1. Texture classes are modified by the prefix "gravelly", if 20 to 50% gravels by volume are present or "very gravelly" if gravels occupy 50 to 90% of the soil volume. Gravels are defined as coarse fragments less than 7.5 cm in diameter. Sand, loamy sand, and sandy loam textures can be further subdivided on the basis of the proportions of the various sand separates present.

The limits of the textural classes and subclasses are:

Sand - Sand is a soil material that contains 85% or more sand; the percentage of silt plus 1.5 times the percentage of clay does not exceed 15.

coarse sand - Coarse sand is a soil material that contains 25% or more very coarse and coarse sand, and less than 50% any other one grade of sand.

medium sand - Medium sand is a soil material that contains 25% or more very coarse, coarse, and medium sand, and less than 50% fine or very fine sand.

fine sand - Fine sand is a soil material that contains 50% or more fine sand or less than 25% very coarse, coarse, and medium sand and less than 50% very fine sand.

very fine sand - Very fine sand is a soil material that contains 50% or more very fine sand.

Loamy Sand - Loamy sand is a soil material that contains at the upper limit 85 to 90% sand, and the percentage of silt plus 1.5 times the percentage of clay is not less than 15; at the lower limit it contains not less than 70 to 85% sand, and the percentage of silt plus twice the percentage of clay does not exceed 30.

loamy coarse sand - Loamy coarse sand is a soil material that contains 25% or more very coarse and coarse sand and less than 50% any other one grade of sand.

loamy (medium) sand - Loamy sand is a soil material that contains 25% or more very coarse, coarse, and medium sand and less than 50% fine or very fine sand.

loamy fine sand - Loamy fine sand is a soil material that contains 50% or more fine sand or less than 25% very coarse, coarse, and medium sand and less than 50% very fine sand.

loamy very fine sand - Loamy very fine sand is a soil material that contains 50% or more very fine sand.

Sandy Loam - Sandy loam is a soil material that contains either 20% or less clay, with a percentage of silt plus twice the percentage of clay that exceeds 30, and 52% or more sand; or less than 7% clay, less than 50% silt, and between 43% and 52% sand.

coarse sandy loam - Coarse sandy loam is a soil material that contains 25% or more very coarse and coarse sand and less than 50% any other one grade of sand.

sandy loam (medium) - Sandy loam consists of 30% or more very coarse, coarse and medium sand, but less than 25% very coarse sand, and less than 30% very fine or fine sand.

fine sandy loam - Fine sandy loam is a soil material that contains 30% or more fine sand and less than 30% very fine sand or between 15 and 30% very coarse, coarse and medium sand.

very fine sandy loam - Very fine sandy loam is a soil material that contains 30% or more very fine sand or more than 40% fine and very fine sand, at least half of which is very fine sand, and less than 15% 15% very coarse, coarse, and medium sand.

Loam - Loam is a soil material that contains 7 to 27% clay, 28 to 50% silt, and less than 52% sand.

Silt loam - Silt loam is a soil material that contains 50% or more silt and 12 to 27% clay, or 50 to 80% silt and less than 12% clay.

Sandy clay loam - Sandy clay loam is a soil material that contains 20 to 35% clay, less than 28% silt, and 45% or more sand.

Clay loam - Clay loam is a soil material that contains 27 to 40% clay and 20 to 45% sand.

Silty clay loam - Silty clay loam is a soil material that contains 27 to 40% clay and less than 20% sand.

Sandy clay - Sandy clay is a soil material that contains 35% or more clay and 45% or more sand.

Silty clay - Silty clay is a soil material that contains 40% or more clay and 40% or more silt.

Clay - Clay is a soil material that contains 40% or more clay, less than 45% sand, and less than 40% silt.

Heavy clay - Heavy clay is a soil material that contains more than 60% clay.

3.2.5.1 Soil Physical Properties

These properties relate to the mechanical behavior of the soil. The physical data is presented as simple, weighted means, along with the range of values found and the number of samples analysed for each property.

Bulk Density - Bulk density is the mass of a unit volume (gm/cc^3) of dry soil and includes both pores and soil solids. Bulk density depends largely on texture, structure and degree of compaction. Generally, with higher bulk densities there is less pore space and development of structure. The addition of organic matter enhances soil structure development and decreases bulk density while compacting soils by traffic or tillage increases bulk density. For most soils, surface layers are likely to be less compact than subsoil layers.

Table 3.3 shows the approximate relationship between bulk density and soil texture. The type of taxonomic soil development, organic matter content and presence of coarse fragments can greatly change this relationship. For example, a loamy sand Bf horizon may have a bulk density much lower than 1.5-1.6 g/cm^3 due to well developed structure while if a large amount of coarse fragments are present, the bulk density will likely be substantially higher.

Table 3.3
Generalized Relationship Between Bulk Density and Soil Texture

Bulk Density	Soil Texture	Class
0.1-0.4 g/cm^3	peat	very low
<1.1 g/cm^3	heavy clay, clay	very low
1.1-1.2 g/cm^3	silty clay, clay, sandy clay	low
1.2-1.3 g/cm^3	clay loam, silty clay loam, sandy clay	moderately low
1.3-1.4 g/cm^3	loam, sandy clay loam, silt loam, silt	medium
1.4-1.5 g/cm^3	fine sandy loam, loam	medium high
1.5-1.6 g/cm^3	sandy loam, loamy sand	high
>1.6 g/cm^3	sand	very high

Available Water Storage Capacity (AWSC) - AWSC represents the amount of water which can be extracted from the soil by plants or is available for plant use. Quantitatively, it is the depth of water held in the soil between field capacity (1/3 atmosphere) and permanent wilting point (15 atmospheres) and is expressed in cm/m.

Table 3.4
Approximate Available Water Storage Capacity of Selected Soil Textures

Approximate AWSC (cm H_2O/m of soil)	Soil Texture*	Class
2.5 4.5	"pea" gravel very gravelly sand	very low
8.3 10.0	sand loamy sand	low
12.5 14.2 17.5	sandy loam fine sandy loam loam	moderate
20.0 20.0 20.8 22.0	clay loam clay silt loam organic	high

*Soil textures do not contain gravels or other coarse fragments except where indicated. Their presence will proportionately reduce the above AWSC values.

Type of Organic Material - The term applies to soils in the Organic Order. Three types of organic material are recognized based on the degree of decomposition: fibric (relatively undecomposed, with readily identifiable plant fragments); mesic (intermediate stage of decomposition); and, humic (advanced stage of decomposition).

Rubbed Fiber Content - This is a measure for determining the degree of decomposition of organic material. Fibric organic material contains more than 40% fiber, mesic material contains between 10 and 40% fiber and humic material contains less than 10% (McKeague, 1976).

von Post Scale - This empirical rating is a field assessment of the degree of organic material decomposition on a scale of 1 to 10: fibric (1 to 4), mesic (5 or 6), and humic (7 or greater) (The Canadian System of Soil Classification, 1978).

Pyrophosphate Index - This color test provides another measure of organic material decomposition: fibric (>5), mesic (3 to 5), and humic (<3) (The Canadian System of Soil Classification, 1978).

Coarse Fragments - These are soil particles greater than 2 mm in diameter. They are separated into two classes: those between 2 mm and 7.5 cm diameter are considered as gravels and those greater than 7.5 cm diameter are considered as cobbles and stones. Data given are average values based on visual estimates of relative volumes based on field sievings.

Percent Passing Sieves - This analysis refers to the percent of soil or gravel material which passes through specified sieve sizes and is used to determine the Unified soil classification. No. 4 sieves have mesh openings of 4.76 mm while No. 40 sieves have openings of 0.42 mm. Material passing the No. 200 sieve (0.074 mm mesh openings) is considered to be all silt and clay.

Percent Sand - as determined by particle size analysis.

Percent Clay - as determined by particle size analysis.

Atterberg Limits (Liquid Limit and Plastic Limit)

The engineering properties of soils vary with the amount of water present. Atterberg Limits measure the effect of moisture on the consistence of the material.

Atterberg limits are most commonly applied in the planning of road construction. Generally, soils with high liquid limits, such as clays, have poor engineering properties. A low plasticity index, on the other hand, indicates a granular soil with little or no cohesion or plasticity. Some silts and sandy soils are non-plastic (NP).

The liquid limit is the minimum percentage moisture content at which the soil-water mixture changes from a liquid to a plastic state, and represents the moisture content at which the soil will barely flow under an applied force.

The liquid limit varies widely and values as high as 80 to 100 are not uncommon with values of 40 to 60 more typical for clay soils. For silty soils, values of 25 to 50 can be expected, and are typical for medium to fine textured soils in this study area. The liquid limit test is not applicable for sandy soils; such soils are classified as "non-plastic" (NP).

The plastic limit is the minimum percentage moisture content at which the soil-water mixture changes from a plastic to a semi-solid state. It represents the minimum moisture at which puddling is possible and the maximum moisture content at which the soil is friable. It also generally indicates the point of maximum cohesion in the soil.

The plastic limits of silts and clays generally do not vary widely and range from 5 to 20. Normally, silty soils have the lower plastic limit. Sandy soils are "non-plastic" (NP).

The plasticity index is the arithmetic difference between the liquid and plastic limits and indicates the range of moisture content within which a soil material is in a plastic condition. Generally the greater the plasticity index, the greater are the plasticity, compressibility and volumetric change characteristics of the soil.

The plasticity index can be as high as 70 to 80 for very plastic clays. Commonly, clays will have P.I.'s between 20 and 40. Silty materials normally range in P.I. between 10 and 20. In quality evaluation for pavement materials, materials are sometimes restricted to

those with a liquid limit of 25 or less and a maximum P.I. of 6, i.e., a predominantly granular material. Plasticity index is an important parameter relating to tilth and workability of soil by tillage implements.

3.2.5.2 Soil Chemical Properties

The data presented are intended to give a general indication of the levels and variability of important soil chemical properties. They are suitable for general applications but are not sufficiently definitive for deriving site specific recommendations such as for fertilizer requirement of individual fields.

For determination of optimum fertilizer applications for individual farms or fields, it is advisable to have independent analyses and interpretations conducted, because of the variability found within the same soil, the effects of past and present management practices and the type of crop to be grown. The chemical values shown for most soils are based on analyses of undeveloped (forested) conditions. Tillage, crops and fertilizer applications can drastically alter these relationships. Soils under cultivation and cropping tend to become depleted of primary and secondary elements; phosphorous fixation occurs under acid conditions; bases and nitrates tend to be leached; and the tendency for acidification to occur is accelerated. Minor elements such as boron, manganese, copper, zinc, molybdenom, and selenium have not been included in the standard chemical analyses carried out on the soils of the map area.

The chemical data are presented as simple unweighted means, along with the range of values found and the number of samples analysed for each property.

Soil Reaction (ph)

Soil reaction of pH is expressed in values from zero to 14. A value of seven indicates neutrality; decreasing values below seven indicate increasing acidity, while increasing values above seven indicate increasingly alkalinity.

Soil pH was measured by two methods. The first utilized a glass electode in a 1:1 soil-water suspension for mineral soil samples and a 1:5 suspension for organic soil samples. The second method employed a 0.01M CaCl$_2$ solution instead of water. This latter method reduces the effect of varying concentrations of salts and approaches the pH of the soil solution under actual field conditions. Values by this method are usually about 0.5 pH unit less than in water determinations.

Plants vary in their ability to grow at different pH values. Nutrient availability to various plants at different pH values may vary significantly. In general, depending upon the type of crop to grown, soils with pH (H$_2$0) values between 5.5 and 6.0 normally require slight amounts of lime whereas soils with pH (H$_2$0) values between 5.0 and 5.5 require moderate amounts of lime, and soils with values between 4.5 and 5.0 may require high amounts of lime. The actual amounts of lime required are best determined by a lime requirement test.

The pH of surface and subsurface horizons of southeastern Vancouver Island soils is effected largely by the regional climate, soil mineralogy, especially aluminum content, texture, soil water relationships, organic matter content and soil management. The surface soil horizons are nearly always medium or strongly acid. The reaction classes of soil parent materials in the survey area are generally slightly or medium acid.

Table 3.5
Soil Reaction (pH)

Reaction Class	pH Values (0.01 M $CaCl_2$)
Extremely Acid	<4.5
Very Strongly Acid	4.6-5.0
Strongly Acid	5.1-5.5
Medium Acid	5.6-6.0
Slightly Acid	6.1-6.5
Neutral	6.6-7.3
Mildly Alkaline	7.4-7.8
Moderately Alkaline	7.9-8.4
Strongly Alkaline	>8.5

Conductivity (Salinity)

Salt content is usually measured on a saturated soil extract and the resultant electrical conductivity is expressed in millisiemens per centimeter (mS/cm). Salinity is not a common problem in the study area, being restricted to areas subject to tidal flooding. The following table is modified from U.S.S.L., Riverside, California; U.S.D.A., 1971).

Table 3.6
Conductivity (Salinity)

Salinity Classes	Conductivity (mS/cm)	Plant Growth Conditions
Non saline (NS)	<2	Salinity effects negligible. Soils free of excess salts; plant growth not inhibited.
Very weakly saline (VWS)	2-4	Yields of sensitive crops restricted. Soils have very slight amounts of excess salts; sensitive plants may show growth restrictions.
Weakly saline (WS)	4-8	Yields of many crops restricted. Soils are slightly affected by excess salt; growth of sensitive plants inhibited but some salt tolerant plants may not be.
Moderately saline (MS)	8-16	Most salt-tolerant crops have lower yields. Soils are moderately affected by exccess salt. Plant growth is very inhibited and few crops do well.
Strongly saline (SS)	>16	Only a few very salt tolerant plants survive and show low yields. Soils are strongly affected by excess salt.

Organic Carbon

The amount of organic carbon in soils is a measure of soil organic matter which results from the decomposition and incorporation of leaves, twigs, roots, mosses, seeds and other organic material. The amount of organic matter that accumulates is controlled by vegetation which in turn is related to precipitation, drainage and temperature. The amount of organic matter can vary from less than 1% to almost 100%. In cultivated soils organic matter maintenance is very important as it improves soil fertility and soil structure, promotes resistance to crusting, puddling and erosion, and increases aeration and friability as well as moisture holding capacity and cation exchange capacity. Organic matter content can be estimated by multiplying the percent organic carbon by 1.7.

The organic matter in soils can be maintained by frequent incorporation of green manures, crop residues, barnyard manure or other organic material. This helps to maintain adequate levels of soil fertility for crop production. In general the carbon content of mineral soils is highest at the surface and decreases with depth. Organic soils tend to have organic carbon content that remains relatively constant throughout the soil profile or increases slightly with increasing depth. Levels of organic carbon of less than 2% are considered low, 2% to 10% moderate, 10% to 30% high, while greater than 30% are very high.

Nitrogen

Nitrogen is a major plant nutrient required for growth. Nitrogen is utilized by plants mainly in the nitrate form which is easily lost from the soil by leaching, and in the ammonium form which is somewhat less subject to leaching. Soil organic matter and commercial fertilizers are the major nitrogen sources.

Microorganisms play an important role in the provision of nitrogen to plants. The ammonifying and nitrifying microorganisms convert nitrogen from soil organic matter into forms available for plant uptake. The amount released is influenced by drainage, temperature, and C:N ratio. Nitrogen-fixing bacteria, some of which are associated with roots of legumes (e.g. clover, alfalfa), convert atmospheric nitrogen into forms usable by plants.

In their undisturbed condition, forested soils in the study area have high nitrogen levels only in the surface organic layers and the uppermost mineral soil horizon. Nitrogen content decreases rapidly with depth.

For most crops, those soils having total nitrogen levels greater than 0.40% in the surface 25 cm are not likely to need much nitrogen fertilization for a few years. As most of these values vary widely from site to site, it is more useful to take individual soil fertility tests when devising a fertilization program. Surface soils with values of less than 0.25% total nitrogen will generally require fertilization.

Cation Exchange Capacity

The ability of soils to hold exchangeable cations is termed the cation exchange capacity which is expressed as milli-equivalents of cations required to balance the negative charge of 100 g of soil at pH 7.0. Exchange sites are mainly supplied by organic matter and clay minerals. Therefore, depending on the organic matter content and the type and amount of clay minerals present, the exchange capacities can range from less than 10 to over 100 milli-equivalents per 100 g of soil. The following values may be used as a guide to the relative levels of the exchange capacities of soils.

Table 3.7

Cation Exchange Capacity Classes

Class	Cation Exchange Capacity (Milli-equivalents/100 g)
Very Low (VL)	less than 5
Low (L)	5 - 10
Medium (M)	10 - 20
High (H)	20 - 60
Very High (VH)	more than 100

High cation exchange capacities generally occur in fine-textured soils and soils with high organic matter contents. Organic soils in the surveyed area have cation exchange capacities in the range of 100-200 milli-equivalents per 100 g, which reflect their very high organic matter content and high potential ability to hold nutrients. For mineral soils, exchange capacities are mostly high in the surface horizon, reflecting high organic matter contents, decreasing to medium and low in the subsoil. Coarse-textured, gravelly subsoils usually have very low cation exchange capacities.

Base Saturation

Base saturation is a most important property in soils. It is defined as the percentage of total cation exchange capacity occupied by the basic calcium, magnesium, sodium and potassium cations. Aluminum and hydrogen generally occupy that portion on the exchange complex that is not satisfied by these basic cations. The ease with which cations are absorbed by plants is related to the degree of base saturation. For any given soil the availability of basic cations increases with the degree of base saturation. For example, a soil with a base saturation of 80% would provide cations to growing plants far more easily than the same soil with a base saturation of 40% (Tisdale and Nelson 1966). The soils of the surveyed area normally have low base saturation, particularly in the upper strongly weathered horizons.

Exchangeable Cations

Calcium, magnesium, potassium, sodium, hydrogen, aluminum and hydroxyaluminum ions are the most abundant exchangeable cations. Their proportions vary from soil to soil depending on soil characteristics and past management practices. Aluminum and hydrogen ions are very abundant in most soils, but are not measured directly; rather, they are assumed to make up the remainder of the total cation exchange capacity that is not filled by the basic cations. For the soils of the study area, basic cations account for less than half of the cation exchange capacity.

Aluminum and hydrogen cations predominate in acid soils while calcium and magnesium are the most common in near neutral soils. Sodic and saline soils usually contain substantial proportions of exchangeable sodium, calcium and magnesium. Exchangeable calcium and magnesium, removed by crops and lost by leaching, are usually replaced by aluminum, resulting in a decrease in pH.

(I) Exchangeable Calcium (Ca)

Calcium is the dominant basic cation on the exchange complex. Calcium values of surface horizons in soils in the report area are generally greater than 4 meq/100 g although values <4 meq/100 g occur. Generally, the latter are coarse-textured soils with low cation exchange capacities and low organic matter contents. Exchangeable calcium levels below 2.5 meq/100 g are considered low and inadequate for many crops.

(II) Exchangeable Magnesium (Mg)

Magnesium levels are generally greater than 0.85 meq/100g in most of the A horizons of mineral soils in the survey area. Most subsoils and coarse-textured sands and loamy sands with low organic matter have lower values. Organic soils in the survey area in general have high levels of magnesium, above 1.7 meq/100 g. Soils with high magnesium levels require little or no magnesium fertilization while those with medium to low levels (<0.85 meq/100 g) may show beneficial effects from magnesium fertilizer. Fertilizer rates however, should be determined by individual soil tests and be related to the requirement of the desired crop. (H. Chuah, personal communication).

(III) Exchangeable Sodium (Na)

Sodium is a relatively loosely held ion on the exchange complex and is readily lost and replaced by other ions in the soil solution. The presence of sodium in large quantities, especially in fine-textured soils, is undesirable because of its detrimental effect on soil structure. Soils containing appreciable exchangeable Na cations tend to become dispersed, are less permeable to water, and have poor tilth. When Na cations occupy more than 10 to 20% of the cation exchange

capacity, the soil develops a poor physical condition, especially if the soluble salt content is low. Coarse-textured soils can tolerate a higher exchangeable sodium percentage than fine-textured soils before the physical condition deteriorates. Also, soils having a high organic matter content can tolerate a higher Na cation percentage than those without it.

Sodium is not considered an essential plant nutrient and becomes toxic to many crops if exchangeable sodium exceeds 25%. In the surveyed area, Na cations are the least abundant exchangeable cations, except in soils affected by tidal flooding and sea water seepage.

(iv) Exchangeable Potassium (K)

Exchangeable potassium exists in equilibrium with fixed forms of K in the soil. This equilibrium is disturbed when plants remove the exchangeable form and, to re-establish equilibrium, some fixed potassium is released. The maintenance of an adequate supply depends upon the reserve and rate of release.

Soils with less than 0.15 meq/100 g of exchangeable potassium are considered to have low levels, while values greater than 0.31 meq/100 g are considered high. Generally those soils with high to very high levels of potassium will require little or no potassium fertilization, whereas those with moderate to very low levels will require varying amounts as determined by individual soil tests and crop requirements.

Phosphorus

Phosphorus is a major nutrient element required for plant growth. Since plants can only utilize inorganic forms, the organic forms must be mineralized by microorganisms before plant uptake is possible. The proportion of phosphorus available for plant growth to the total present in the soil at any one time is generally small.

Available phosphorus levels below 10 ppm are low, while values over 40 ppm are considered high. Depending upon the crop to be grown, soils with moderately high to high available phosphorus levels will generally require little or no phosphorus fertilization, whereas those with medium to very low values will require varying amounts as determined by individual soil tests and crop requirements.

Sulfur

Sulfur is a minor but essential element for crop growth. Its content is generally low (<3 ppm) in most Vancouver Island mineral soils, but very high (>20 ppm) in organic soils.

Iron and Aluminum

Iron and aluminum content, as measured by the sodium pyrophosphate extraction technique, provides an important criterion in soil classification. For most of the soil textures in the study area, the Fe+Al content of the B horizon must be equal or greater than 0.6% for the soils to be classified in the Podzolic order. (Additional criteria apply; see: Canada Soil Survey Committee, 1978). Most B horizons in moderately well to rapidly drained soils in this study area have Fe+Al values of 0.4 to 1.0%.

3.2.6 Soil Phases and Variants

In addition to the 48 named soils described for the study area, phases and variants of these soils are also recognized. The complete lists of phase and variant symbols and their description are given below. Those phases and variants recognized for each soil are also indicated in each soil description in Chapter 4.

Soil Phases are variations of a defined soil and occur due to differences in stoniness, topography, depth of profile, depth to bedrock, and other features which affect the soils use and management. They are not sufficiently different from the defined soil to warrant identification of a separate soil. Table 3.8 lists all soil phases used in the report area.

Table 3.8
Description of Soil Phases

Phase Symbol	Description
co	Cobbly. Cobbles and stones occupy more than 20% of the soil volume.
dc	Moderately to strongly cemented horizon (duric) occurring below 100 cm from the surface.
fi	Fibric. A fibric layer >25 cm thick if present.
g	Gravelly. Between 20 and 50% of the soil volume is occupied by gravels.
l2	Shallow lithic. Bedrock occurs at depths between 50 and 100 cm of the soil surface.
l3	Very shallow lithic. Bedrock occurs at depths between 10 and 50 cm of the soil suface.
pt	Peaty. 15 to 40 cm of humic or mesic organic material occurs on the surface of the mineral soil.
r	Rubbly and/or blocky. More than 50% of the soil volume is occupied by coarse fragments greater than 25 cm in diameter.
sa	Saline phase.
vg	Very gravelly. Between 50 and 90% of the soil volume is occupied by gravels.
w	Strongly mottled. Moisture regime of the soil is wetter than the usual conditions for the soil. Prominent mottling within 50 cm of the surface. Seasonal perched water tables. Landscape position is not typical of Gleysolic soils.
wc	Weakly cemented horizons are present in the subsurface and/or subsoil.

Soil Variants are soils whose properties are believed to be sufficiently different from other known soils to justify identification of a new soil, but occupy over such a small area that definition of a new named soil is not justified. Exceptions were made with some Gleysolic soils (e.g. Koksilah) because of there significance to land use and management. Table 3.9 lists all variants in the report area.

Table 3.9
Description of Soil Variants

Symbol	Description
a	A or Ah horizon is sufficiently thick for the soil to be classified in the Sombric subgroup of the Podzolic or Brunisolic Orders.
	This classification gives a basis for predicting soil behavior as an engineering construction material. Eight of the 15 unified classes are coarse-grained and identified as GW, GP, GM, GC, SW, SP, SM, and SC. Fine-grained classes are indentified as ML, CL, L, MH, and OH. One class of organic soil is identified as Pt.
id	The soil is imperfectly drained and classified in the Gleyed subgroup of the appropriate soil order.
lo	10 to 50 cm of loam textured material occurs at the soil surface.
mc	Moderately cemented subsoil horizons are present.
md	Moderately well to well drained, e.g. Orthic Dystric Brunisol instead of Gleyed Dystric Brunisol.
pd	Poorly drained (Gleysolic).
pz	Podzolic. A Bf horizon is sufficiently thick of the soils to be classified as a podzol.
s	Shallow. 50 to 100 cm of surficial deposit overlying another of different origin, or a strongly contrasting change in texture.
so	Terric organic soils (mineral material occurs between 40 and 160 cm of surface).
sp	Sedimentary peat is present in the subsoil.
t	Taxadjuncts are soils that approximate, but do not quite meet the criteria of a taxonomic category. Specific classification given in the soil description section. (Used only for Organic soils in this map area).
vs	Very shallow. 10 to 50 cm of surficial deposit overlying another of different origin, or a strongly contrasting change in texture.

3.2.7 Inferred Soil Properties

The Unified System

The Unified classification system (Asphalt Institute, 1978; U.S.D.A, 1971) is based on 1) textural characteristics for those soils with a small amount of fines; and 2) on plasticity-compressibility characteristics for soils where fines affect their behaviour. The Unified classification is shown in Table 3.10.

This classification gives a basis for predicting soil behavior as an engineering construction material. Eight of the 15 Unified classes are coarse-grained and identified as GW, GP, GM, GC, SW, SP, SM and SC. Fine-grained classes are identified as ML, CL, L, MH, CH, and OH. One class of organic soil is identified as Pt.

American Association of State Highways Officials (AASHO) System

The AASHO system (Asphalt Institute, 1978) is based on the observed field performance of soils under highway pavement; it is widely used by highway engineers. In this system a soil is placed in one of seven groups (A-1 to A-7) on the basis of grain size distribution, liquid limit and plasticity index (as shown in Table 3.11). Group A-1 are gravelly soils of high bearing strength and are the best soils for subgrade while groups A-4 to A-7 are the poorest for subgrade. These latter groups are clay soils having low bearing strength when wet.

Table 3.10
Characteristics of the Unified Classification

UNIFIED SYMBOL	MATERIAL CHARACTERISTICS
GW	Well-graded gravels, gravel-sand mixtures, little or no fines
GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well-graded sands, gravelly sands, little or no fines
SP	Poorly-graded sands, gravelly sands, little or no fines
SM	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silty clays of low plasticity
MP	Inorganic silts, micaceous or diatomateous fine sandy or silty soils, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity, organic silts
Pt	Peat and other highly organic soils

Table 3.11

Classification of Soils and Soil-Aggregate Mixtures in the ASSHO System

General Classification	Granular Materials (35% or less passing 0.075 mm)							Silt-Clay Materials (More than 35% passing 0.075 mm)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, Percent Passing											
2.00 mm (No. 10)	50 max	---	---	---	---	---	---	---	---	---	---
0.425 mm (No. 40)	30 max	50 max	51 min	---	---	---	---	---	---	---	---
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of Fraction Passing of 0.425 mm (No. 40)											
Liquid Limit	---		---	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min
Usual Types of Significant Constituent Materials	Stone Fragments Gravel and Sand		Fine Sand	Silty or Clayey Gravel and Sand				Silty Soils		Clayey Soils	
General Rating as Subgrade	Excellent to Good							Fair to Poor			

Plasticity index of A-7-5 subgroup is equal to or less than LL. minus 30. Plasticity index of A-7-6 subgroup is greater than LL minus 30.

Suitability as a Source of:

Sand - The main purpose of this rating is to guide users to local sand sources. The rating indicates the probability of finding sand within the indicated depth range. Some depth ranges are shallow and therefore do not represent large quantities of sand. Depths of 100+ cm means that there is reasonable evidence of sand below 1 m.

Gravel - The main purpose of this rating is to guide users to local gravel sources. The rating indicates the probability of finding gravel within the indicated depth range. Some depth ranges are shallow (<1m total thickness) and therefore do not represent large quantities of gravel. Indicated depths of 100+ cm indicates that there is reasonable evidence of gravel extending below 1m.

Silt/Clay - The main purpose of this rating is to guide users to local sources of silt and/or clay. The rating indicates the probability of finding silt and/or clay within the indicated depth range. Some depth ranges are shallow and therefore do represent large quantities of silt and/or clay. Indicated depths of 100+ cm indicates that there is reasonable evidence of silt and/or clay deposits extending below 1 m.

Topsoil - The suitability ratings of this section indicate the advisability of selecting, stockpiling and using a specific soil as topsoil at a construction site. The supply of good topsoil is limited on Vancouver Island - the depth of topsoil tends to be thin and when this is stripped away irrepairable damage to the borrow area is anticipated. These suitability ratings, therefore, are recommended for use in subdivision/construction type areas and not on farmland. Factors considered for these ratings are, soil consistence, texture, percent coarse fragments, and conductivity.

CHAPTER FOUR
SOIL DESCRIPTIONS

4.1 INTRODUCTION

Chapter Four describes the characterisitics of the forty-seven individual soils and their phases and variants identified in the map area. Detailed individual soil profile descriptions and chemical and physical analyses are not included. These are available on request from the British Columbia Soil Information System (Surveys and Resource Mapping Branch, British Columbia Ministry of Environment and Parks, Victoria, British Columbia). Summarized physical and chemical data are presented as simple, unweighted means, along with the ranges of values found and the number of samples analysed.

The soils are arranged in alphabetical order and the soil map symbol is indicated in brackets after the soil name. The soil landscape picture indicates a typical landscape in which the soil occurs. The General Comments section includes information on parent materials, topography, soil texture, soil classification, drainage, as well as some comments on land use, agricultural and urban suitability and soil management considerations. A brief synopsis of the soils (Table 4.1) is included at the end of the chapter.

The soil landscape cross-section depicts the physiographic setting, relating the soil under discussion with commonly associated soils. The parent material is described according to the terminology of the Terrain Classification System (E.L.U.C., 1976). Table 3.1 should be used for reference.

The typical soil profile indicates the arrangements and usual depths of major soil horizons. These descriptions should assist map users in identifying the soil in the field.

ALBERNI SOILS (AB)

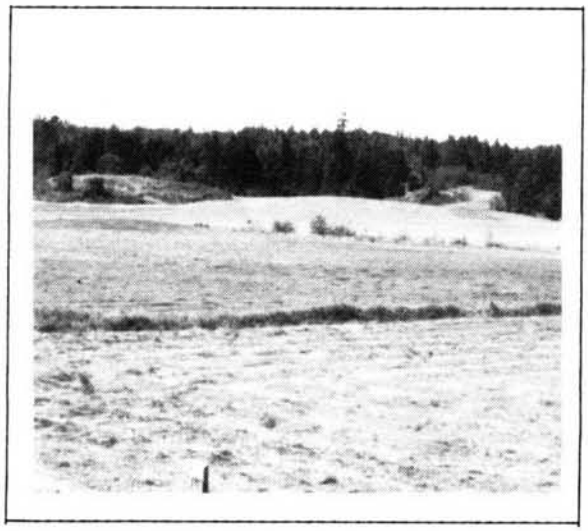


PLATE 4.1 : ALBERNI SOIL LANDSCAPE

GENERAL COMMENTS

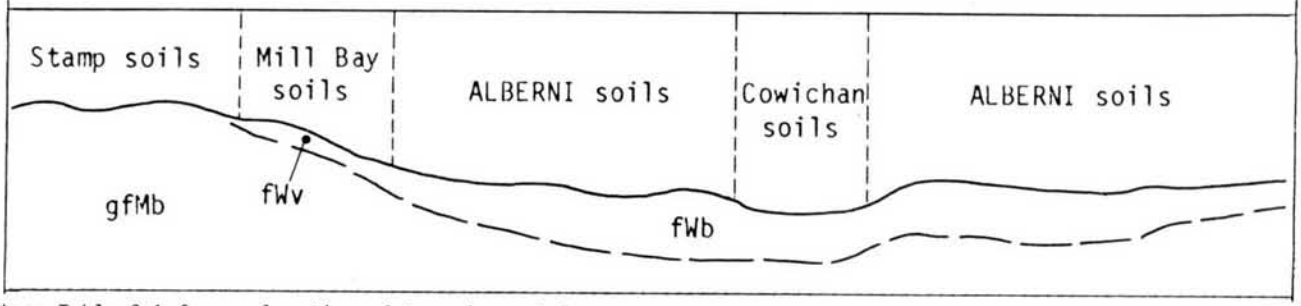
Alberni soils (3215ha) occur on nearly level to moderate slopes within the Alberni Valley. These soils have developed in fine-textured marine deposits, and are usually associated with Cowichan and Mill Bay soils. Alberni soils are imperfectly to moderately well drained and have a perched water table during the winter months.

Alberni soils have a dark reddish brown clay loam to silt loam surface horizon, over a friable, yellowish-red silty clay loam or clay loam subsurface. All horizons are stone free. The lower horizons are compact, slowly permeable silty clay or clay and exhibit blocky structure. These soils are classed as **Gleyed Dystric Brunisols** with subdominant inclusions of **Orthic Dystric Brunisols.**

Alberni soils are prime agricultural soils with hay production being the main present land use. They are suited to a wide variety of crops although the summer moisture deficit may restrict yield and irrigation is usually required for optimum yields. Because of their-yields high clay content Alberni soils should not be cultivated when wet since soil structure deterioration, surface crusting and puddling can result. The dense subsoil and the periodically perched water table may adversely affect some crops, especially overwintering perennials.

Urban and related uses are constrained by perched water tables and slow permeability.

ALBERNI SOIL LANDSCAPE CROSS SECTION*



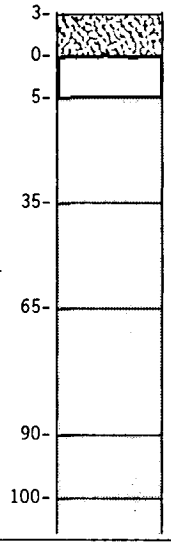
*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	silty clayey marine blanket
TOPOGRAPHY	:	2-15%, undulating
ELEVATION RANGE	:	0-80 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Substantial areas of Alberni soils have been cleared and cultivated mainly for pasture and hay production. Uncleared areas support mixed stands of second growth Douglas-Fir, western hemlock, wester red cedar, maple and alder. Bracken and other ferns, salal, Oregon grape and small trees form a dense understory.

TYPICAL ALBERNI SOIL PROFILE

DEPTH (cm)



LFH — Loose, forest litter; very strongly acid.

Ah — Dark reddish brown (5YR 3/3m) clay loam to silt loams; weak, medium, granular; very friable, very strongly acid.

Bfcc — Yellowish red (5YR 4/6m) silty clay loam or clay loam; weak to moderate, coarse, subangular blocky; friable; plastic; common, fine, concretions; very strongly acid.

Bm — Yellowish brown (10YR 5/4m) silty clay loam; moderate to weak, coarse, subangular blocky; friable to firm; very plastic; strongly acid.

Btjg — Dark grayish brown (10YR 5/2m) silty clay; many, medium, prominent mottles; strong, coarse, angular blocky; very firm; very plastic; medium acid.

CBg — Olive brown (2.5Y 4/4m) to greenish gray (5.0 BG 6/1) silty clay; few, medium, prominent mottles; strong, very coarse, pseudoangular blocky; extremely firm; very plastic; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Moder
SOLUM DEPTH (cm)	:	100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	75-100; compact lower horizons
ROOTING DEPTH (cm)	:	75-100
COARSE FRAGMENT CLASS	:	0
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	75-180; seasonal perched
PERVIOUSNESS	:	slow
SOIL DRAINAGE	:	imperfect to moderately well
SOIL TEXTURE	:	clay loam, silty clay loam, silty clay

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	2	0.9 (1.1-0.8)	Est.	1.1 (1.0-1.2)	2	1.3 (1.2-1.4)
AWSC (cm/m)	Est.	19 (17-21)	Est.	20 (18-22)	Est.	20 (18-22)
% COARSE > 7.5 cm	305	0	305	0	277	0
FRAGMENTS < 7.5 cm	306	2 (0-5)	306	2 (0-5)	278	1 (0-2)
% PASSING SIEVE 4.76 mm	2	100 (99-100)	2	100 (99-100)	2	100 (99-100)
0.5 mm	2	88 (85-93)	2	88 (84-93)	2	97 (95-99)
0.074 mm	2	80 (70-90)	2	84 (80-90)	2	94 (90-97)
% FINE SAND	2	2 (1-3)	2	2 (1-3)	2	1 (0-2)
% SAND	7	18 (9-27)	5	15 (6-24)	6	14 (3-25)
% CLAY	7	32 (24-40)	5	33 (28-38)	6	40 (31-49)
LIQUID LIMIT (%)	2	57 (55-59)	2	50 (45-55)	2	50 (43-57)
PLASTIC LIMIT (%)	2	51 (47-51)	2	41 (36-46)	2	38 (35-41)
PI	2	6	2	9		12

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	8	5.5 (5.4-5.6)	5	5.5 (5.4-5.6)	3	5.6 (5.3-5.9)
(pH) 1:2 $CaCl_2$	8	4.6 (4.5-4.7)	5	4.5 (4.3-4.7)	3	5.2 (4.6-5.8)
ORGANIC CARBON (%)	8	3.2 (4.1-2.3)	5	1.7 (1.3-2.1)	3	0.5 (0.4-0.6)
NITROGEN (%)	6	0.19 (0.14-0.24)	3	0.09 (0.08-0.10)	2	0.02 (0.01-0.03)
EXCHANGE CAPACITY (meq/100g)	7	30 (24-36)	4	28 (21-35)	3	34 (30-38)
BASE SATURATION (%)	6	16 (6-26)	3	29 (10-48)	3	73 (49-97)
EXCHANGEABLE CATIONS - Ca	6	3.8 (1.2-6.7)	3	6.5 (2.7-11.8)	3	17 (11-23)
(meq/100g) - Mg	6	1.3 (0.3-2.9)	3	3.0 (1.3-5.6)	3	7.6 (7.4-9.5)
- Na	6	0.04 (0.0-0.08)	3	0.09 (0.02-0.16)	3	0.2 (0.1-0.3)
- K	6	0.17 (0.09-0.25)	3	0.1 (0.05-0.15)	3	0.13 (0.10-0.16)
PHOSPHORUS (ppm)	6	19 (2-36)	2	3.4 (3.2-3.6)	3	2.5 (2.3-2.7)
% IRON	3	0.3 (0.2-0.4)	2	0.3 (0.2-0.4)		
% ALUMINUM	3	0.5 (0.4-0.6)	2	0.5 (0.4-0.6)		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
ABg	Gravelly phase; solum contains 20-50% gravel; usually found on slopes greater than 10%.
ABg12	Gravelly, shallow lithic phase; solum contains 20-50% gravel with bedrock occuring within 50-100 cm of the surface.
AB12	Shallow lithic phase; bedrock occurs within 50-100 cm of the surface.
ABs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
ABw	Strongly mottled phase; wetter moisture regime in profile as evidence by prominent mottling within 50 cm of the surface. Seasonal perched water tables present. Landscape position not typical of gleysolic soils.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS ALBERNI SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-25	MH, ML	A-5	unsuited	unsuited	good	fair
25-50	MH, ML	A-5	unsuited	unsuited	good	fair
50+	MH, ML	A-7	unsuited	unsuited	good	poor

ARROWSMITH SOILS (AR)

PLATE 4.2: ARROWSMITH SOIL LANDSCAPE

GENERAL COMMENTS

Arrowsmith soils (650ha) occur in very poorly drained depressional areas throughout the map area. These level soils have an apparent, year-round water table within 1 m of the soil surface and consist of dominantly mesic organic materials. At depth, normally greater than 160 cm, they are usually underlain by sedimentary peat which, in turn, overlays silts and clays.

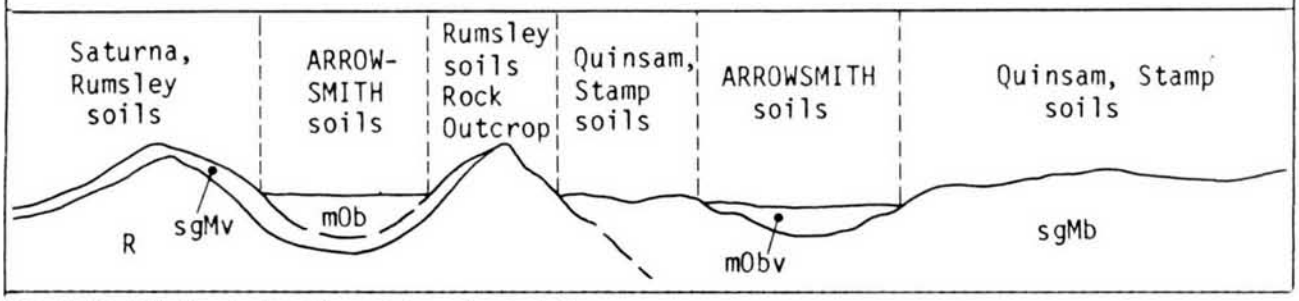
Arrowsmith soils are at an intermediate stage of decomposition and dominantly have dark brown, mesic material in the middle and bottom tiers. They are classified as Typic Mesisols, with significant inclusions of Humic Mesisols.

Arrowsmith soils are considered to be the most desirable organic soils for agricultural use as they have favorable tilth and permeability. Watertables should be maintained at the highest levels which still permit good crop growth and field trafficability. They should be maintained near the soil surface over the winter to prevent undue oxidation and subsidence.

Present land use includes vegetable production, forage crops and pasture. Adequate liming and fertilization are required to bring production to full potential.

Arrowsmith soils are severely constrained for urban and related uses by very low bearing strengths and high watertables.

ARROWSMITH SOIL LANDSCAPE CROSS SECTION*



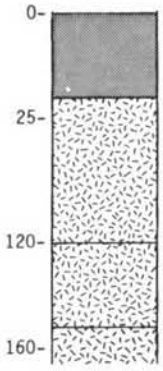
*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	organic
TOPOGRAPHY	:	level
ELEVATION RANGE	:	2-300 m asl
ASPECT	:	none
FLOOD HAZARD	:	may be expected
VEGETATION	:	Native vegetation includes a variety of water tolerant plants such as Labrador tea, hardhack, mosses, willow, skunk cabbage, sedges, and reeds as well as some stunted western red cedar and shore pine.

TYPICAL ARROWSMITH SOIL PROFILE

DEPTH (cm)



Oh — Black (10YR 2/1m), humic organic material; very strongly acid.

Om1 — Dark brown (10YR 3/3m), mesic organic material; very strong acid.

Om2 — Dark reddish brown (10YR 3/3m), mesic organic material; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Peatymor
SOLUM DEPTH (cm)	: >160
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: no restricting layer except for watertable
ROOTING DEPTH (cm)	: <160
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 25-100; apparent
PERVIOUSNESS	: moderate
SOIL DRAINAGE	: very poor
SOIL TEXTURE	: N/A

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-40 cm Mean (Range)	N	40-120 cm Mean (Range)	N	120-160 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(0.2-0.3)		(0.1-0.3)		(0.1-0.3)
AWSC (cm/m)	Est.	(20-40)	Est.	(10-30)	Est.	(10-30)
TYPE OF ORGANIC MATERIAL	Est.	Humic	Est.	Mesic	Est.	Mesic
RUBBED FIBRE CONTENT %	Est.	- (5-10)	Est.	- (10-40)	Est.	- (10-40)
VON POST SCALE	Est.	(8-10)	Est.	(5-7)	Est.	(4-6)
PYROPHOSPHATE INDEX	Est.	- (1-3)	Est.	- (3-5)	Est.	- (3-5)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-40 cm Mean (Range)	N	40-120 cm Mean (Range)	N	120-160 cm Mean (Range)
SOIL REACTION 1:1 H_2O	2	5.2 (4.8-5.4)	1	5.1	1	5.1
(pH) 1:2 $CaCl_2$	2	4.8 (4.4-5.2)	1	4.6	1	4.6
ORGANIC CARBON (%)	4	47 (45-52)	3	52	2	56 (52-60)
NITROGEN (%)	2	2.2 (2.0-2.4)	1	2.5	1	2.2
EXCHANGE CAPACITY (meq/100g)	2	137 (110-160)	1	160	1	160
BASE SATURATION (%)	2	37 (30-40)	1	32	1	35
EXCHANGEABLE CATIONS - Ca	2	42 (36-48)	1	40	1	43
(meq/100g) - Mg	2	8 (5-11)	1	11	1	12
- Na		0.3 (0.2-0.4)	1	0.13	1	0.14
- K	2	0.3 (0.3)	1	0.001	1	0.002
PHOSPHORUS (ppm)	2	29 (6-52)	1	0.9	1	0.6

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
ARfi	Fibric variant; these soils are composed largely of relatively undecomposed fibric organic material.
ARso	Shallow organic variant; these soils have less than 160 cm of organic material. They are classified as Terric Mesisol.
ARso,t	Shallow organic and taxajunct variant; these soils have less than 160 cm of organic material and contain more than 25 cm of humic organic material. They are classified as Terric Humic Mesisol.
ARt	Taxajunct variant; the solum contains more the 25 cm of humic organic material. They are classified as Humic Mesisol.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
ARROWSMITH SOILS*

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-160	PT	-	unsuited	unsuited	unsuited	poor

*good organic matter source

BAYNES SOILS (BY)

PLATE 4.3: BAYNES SOIL LANDSCAPE

GENERAL COMMENTS

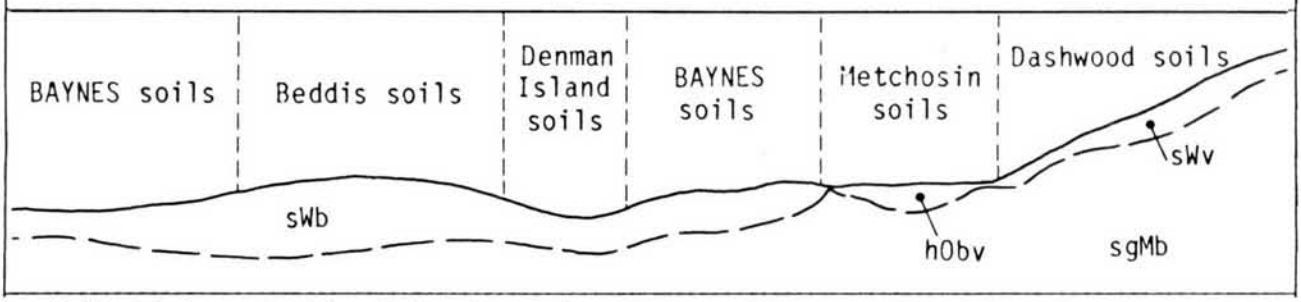
Baynes soils (2040ha) occur in depressional to gently sloping, sandy marine or fluvial landscapes, are imperfectly drained, and have seasonally perched watertables.

Baynes soils are stone-free with surface and subsoil textures of loamy sand to sand. Baynes sorts may contain strongly cemented iron clods. They are classified as **Gleyed Dystric Brunisols and Gleyed Humo-Ferric Podzols.**

Baynes soils, when drained are good sites for forest nursery, raspberry and strawberry production. Adequate drainage, irrigation and fertilization are necessary for production of a wide range of crops.

These soils are marginal for urban development due to the presence of seasonally high watertables. Drainage is recommended.

BAYNES SOIL LANDSCAPE CROSS SECTION*

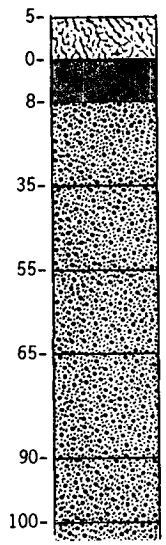


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy fluvial blanket, sandy marine blanket
TOPOGRAPHY	:	0-10%; depressional to gently sloping
ELEVATION RANGE	:	<130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Baynes soils support mainly second growth stands of Douglas fir, western red cedar, western hemlock, alder and maple. The understory is dominated by sword fern.

TYPICAL BAYNES SOIL PROFILE

DEPTH (cm)



LFH — Litter composed of raw and semidecomposed organic matter; extremely acid.

Ah — Dark grayish brown (10YR 4/2m) loamy sand or sandy loam; weak fine granular; loose; non-plastic; extremely acid.

Bm_1 — Yellowish red (5YR 4/6m) loamy fine sand to medium sand; weak, moderate to coarse, subangular blocky; loose; non-plastic extremely acid.

Bm_2 — Reddish yellow (5YR 7/3m) loamy fine sand to medium sand; weak, moderate to coarse, subangular blocky; loose; non-plastic; extremely acid.

Bmgj — Yellowish brown (10YR 5/4m) loamy sand to medium sand; weak, moderate to coarse, subangular blocky; loose; non-plastic; very strongly acid.
strongly acid.

Bg — Gray (10YR 5/1m) loamy sand to medium sand; weak, coarse, subangular blocky; loose; non-plastic; strongly acid.

BCg — Gray (5Y 6/1m); medium sand; weak, very coarse, subangular blocky; loose; non-plastic; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Moder
SOLUM DEPTH (cm)	: 110+
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: no restricting layer
ROOTING DEPTH (cm)	: 90+
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 60-180; seasonal perched
PERVIOUSNESS	: rapid
SOIL DRAINAGE	: imperfect
SOIL TEXTURE	: sandy loam to medium sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	2	1.0 (0.9-1.2)	Est.	1.2 (1.1-1.3)	Est.	1.4 (1.3-1.5)
AWSC (cm/m)	4	8 (7-10)	Est.	6 (4-7)	Est.	4 (3-6)
% COARSE > 7.5 cm	176	0	179	0	165	0
FRAGMENTS < 7.5 cm	180	4 (0-8)	183	4 (0-8)	169	3 (0-9)
% PASSING SIEVE 4.76 mm	3	97 (95-100)	2	97 (93-100)	2	99 (97-100)
0.5 mm	3	90 (83-97)	2	90 (86-93)	2	92 (89-94)
0.074 mm	3	13 (7-18)	2	11 (9-12)	2	7 (5-9)
% FINE SAND	3	30 (15-45)	Est.	30 (20-50)	2	33 (13-53)
% SAND	13	80 (70-90)	8	86 (76-92)	3	90 (84-94)
% CLAY	13	6 (3-9)	7	5 (3-7)	2	6 (3-9)
LIQUID LIMIT (%)	Est.	(0-20)	Est.	non plastic	Est.	non plastic
PLASTIC LIMIT (%)	Est.	(0-12)	Est.	non plastic	Est.	non plastic

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	17	5.2 (4.8-5.6)	7	5.1 (4.7-5.5)	2	5.5 (5.1-5.8)
(pH) 1:2 $CaCl_2$	16	4.6 (4.2-5.0)	62	4.6 (4.2-5.0)	2	4.9 (4.7-5.1)
ORGANIC CARBON (%)	16	3.0 (2.4-4.6)	6	2.3 (0.8-4.5)	2	0.7 (0.5-0.8)
NITROGEN (%)	10	0.16 (0.1-0.22)	1	0.06	1	0.03
EXCHANGE CAPACITY (meq/100g)	10	15 (10-20)	1	9	1	5.0
BASE SATURATION (%)	10	26 (5-55)	1	8	1	10
EXCHANGEABLE CATIONS - Ca	10	3.2 (0.4-6.7)	1	0.6	1	0.3
(meq/100g) - Mg	10	0.6 (0.2-1.2)	1	0.1	1	0.06
- Na	10	0.2 (0.04-0.4)	1	0.11	1	0.1
- K	10	0.09 (0.03-0.17)	1	0.02	1	0.02
PHOSPHORUS (ppm)	10	24.5 (5-56)	1	46	1	65
SULPHUR (ppm)	5	6.4 (4.0-8.6)	Est.	(4-10)	Est.	(5-15)
% IRON	12	0.5 (0.2-0.9)	6	0.5 (0.1-1.0)	1	0.4
% ALUMINUM	12	0.5 (0.2-0.8)	6	0.5 (0.2-0.9)	1	0.3

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITIION
BYa	Sombric variant (Gleyed Sombric Brunisol); usually the result of long term cultivation.
BYg	Gravelly phase; solum contains 20-50% gravel, usually in the fine gravel size (<2.5 cm).
BYlo	Loamy phase; the upper 20 to 50 cm is loam textured.
BYmc	Moderately cemented variant; moderate to strong cementation occurs in the subsoil. Soil classification is Duric Dystric Brunisol.
BYs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
BYs,wc	Shallow, weakly cemented variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface, and a cemented horizon occurs between 50-100 cm that is not sufficiently cemented to be a duric horizon.
BYwc	Weakly cemented variant; a cemented horizon occuring between 50-100 cm depth that is not sufficiently cemented to be a duric horizon.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS BAYNES SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-25 25-100+	SM SM	A-3,A-2-4 A-2-4	fair good	poor poor	unsuited unsuited	fair poor

BEAUFORT SOILS (BF)

PLATE 4.4: BEAUFORT SOIL LANDSCAPE

GENERAL COMMENTS

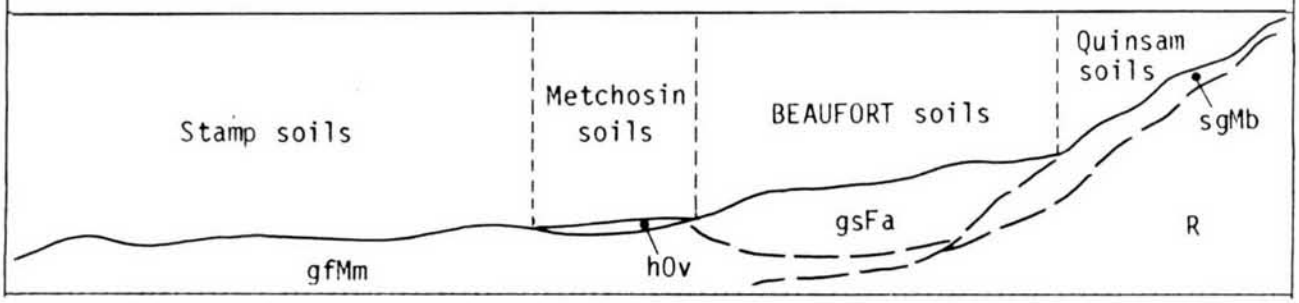
Beaufort soils (550ha) have developed on deep coarse-textured fluvial fans along the base of Beaufort Mountain range in the Alberni Valley. They occur on gentle to moderate slopes which are often channelled. The soils are well to rapidly drained and rapidly pervious, but significant subsoil seepage from the upland areas of the Beaufort range occurs well into the summer.

Beaufort soils have variable stratigraphy with textures ranging from very gravelly sandy loam to coarse sand. Coarse fragments are characteristically angular. Bands of gravel free sandy loam and silt loam occasionally occur below 70 cm. Soil classification is dominantly **Orthic Dystric Brunisol**, with lesser occurrences of Orthic Regosol.

Because of high gravel content and coarse textures Beaufort soils are droughty and generally unsuitable for most crops except hay and pasture. Present land use consists of hay and pasture. Irrigation is required from mid to late summer.

Beaufort soils have high load bearing strengths. Septic tank effluent disposal may contaminate the ground water due to mixing of effluent with subsurface water flow and through complete filtration of the effluent by the coarse-textured parent material.

BEAUFORT SOIL LANDSCAPE CROSS SECTION*

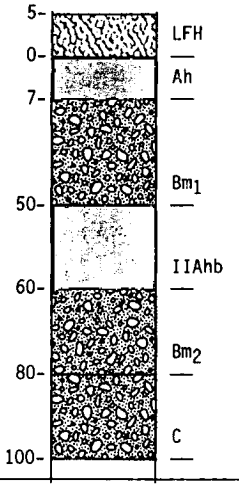


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy gravelly fluvial fans and aprons
TOPOGRAPHY	:	3-9%
ELEVATION RANGE	:	75-150 m asl
ASPECT	:	south, southwest, and west
FLOOD HAZARD	:	none
VEGETATION	:	The forest canapy consists of second growth Douglas fir, red ceder, maple and alder. The understory vegetation is usually fern and salmonberry. Cleared areas are used mainly for pasture and hay.

TYPICAL BEAUFORT SOIL PROFILE

DEPTH (cm)



Loose, litter of leaves, needles, twigs decomposed over partly organic matter; extremely acid.

Very dark brown (10YR 2.5/2m) very gravelly loamy sand to sandy gravel; single grained; loose; non-plastic; strongly acid.

Dark grayish brown (10YR 4/2m) very gravelly loamy coarse sand; single grained; loose; non-plastic; medium acid.

Strong brown (7YR 3/2m) sandy loam to loamy coarse sand; weak, medium, subangular blocky; very friable; non-plastic; medium to strongly acid.

Dark brown (10YR 3/3m) very gravelly loamy coarse sand to very gravelly sandy loam; single grained; loose; non-plastic; medium acid.

Grayish brown (10YR 5/2m) very gravelly coarse sand; single grained; loose; non-plastic; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Moder
SOLUM DEPTH (cm)	: 50-100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: no restricting layer
ROOTING DEPTH (cm)	: 100+ seepage
COARSE FRAGMENT CLASS	: 2
DEPTH TO AND TYPE OF WATERTABLE (cm)	: N/A
PERVIOUSNESS	: rapid
SOIL DRAINAGE	: well to rapid
SOIL TEXTURE	: very gravelly loamy sand, very gravelly sand, very gravelly sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	3	1.9 (1.8-2.0)	Est.	(1.8-2.0)	Est.	(1.9-2.1)
AWSC (cm/m)	Est.	(4-8)	Est.	(4-7)	Est.	(3-7)
% COARSE > 7.5 cm	30	1 (0-4)	30	2 (0-4)	28	2 (0-4)
FRAGMENTS < 7.5 cm	30	33 (23-43)	30	36 (27-45)	28	35 (27-43)
% PASSING SIEVE 4.76 mm	1	60	1	55 (	1	45
0.5 mm	1	10	1	6	1	15
0.074 mm	1	4	1	3	1	8
% FINE SAND	1	8	1	10	1	10
% SAND	1	87	1	85	1	71
% CLAY	1	2	1	1	1	7
LIQUID LIMIT (%)	Est.	0 non plastic	Est.	non plastic	1	38
PLASTIC LIMIT (%)	Est.	0 non plastic	Est.	non plastic	1	32

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	6.1	1	6.1	1	6.3
(pH) 1:2 $CaCl_2$	1	5.6	1	5.6	1	5.7
ORGANIC CARBON (%)	1	1.6	1	1.6	Est.	(0.2-3.0)
NITROGEN (%)	1	0.06	1	0.05	1	0.15
EXCHANGE CAPACITY (meq/100g)	1	12	1	12	1	25
BASE SATURATION (%)	1	64	1	64	1	75
EXCHANGEABLE CATIONS - Ca	1	6.8	1	7.3	1	13.5
(meq/100g) - Mg	1	0.6	1	0.5	1	0.9
- Na	1	0.01	1	0.01	1	0.01
- K	1	0.09	1	0.04	1	0.06
PHOSPHORUS (ppm)	1	7.5	1	6.4	1	8.6
% IRON	1	0.2 (0.2-0.5)				
% ALUMINUM	1	0.15 (0.1-0.5)				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
BFg	Gravelly phase; solum contains 20-50% gravel.
BFs	Shallow variant; different parent material or strongly contrasting texture within 50-100 cm of the surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
BEAUFORT SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	GW, GP	A-1-a	poor	good	unsuited	unsuited

BEDDIS SOILS (BD)

PLATE 4.5: BEDDIS SOIL LANDSCAPE

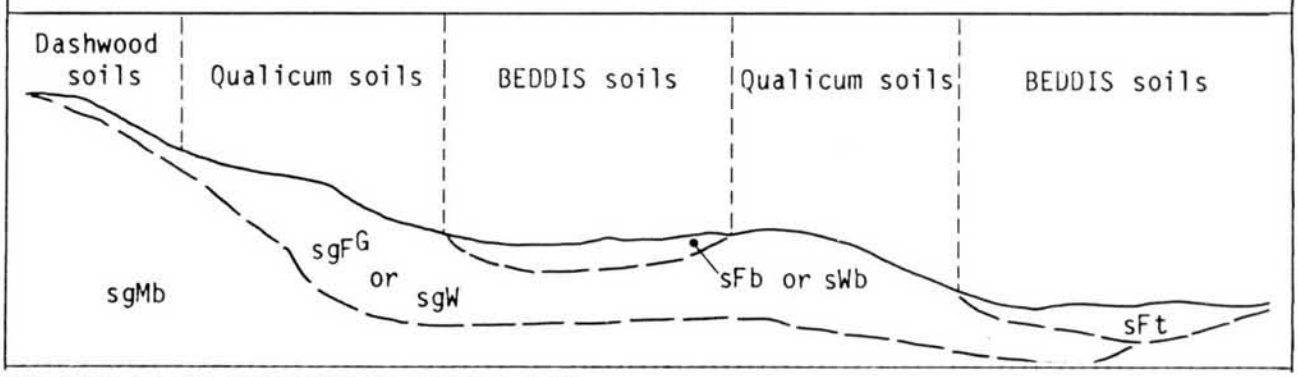
GENERAL COMMENTS

Beddis soils (3790ha) occur throughout the survey area on nearly level to steep slopes. Generally they are found on rapidly drained sandy fluvial terraces, post-glacial beaches and other marine deposits.

Beddis soils are stone-free with loamy sand or sandy loam surface horizons. The lower horizons are compact and are loamy sand or sand in texture. They are predominantly **Orthic Dystric Brunisols** although minor components of Orthic Humo-Ferric Podzols also occur.

Agriculturally, Beddis soils are droughty, however, with irrigation and fertilization most crops can be produced. Beddis soils are well suited for forest nursery operations, however, sloping areas are susceptible to surface erosion. In general, these soils are suitable for urban and related developments.

BEDDIS SOIL LANDSCAPE CROSS SECTION*



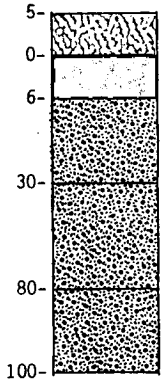
*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy fluvial blanket, sandy marine blanket, sandy flurial terraces
TOPOGRAPHY	:	0-30%; nearly level to strong slopes
ELEVATION RANGE	:	<130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation is mainly composed of second growth Douglas-fir, western red cedar and grand fir with occasional red alder and maple.

TYPICAL BEDDIS SOIL PROFILE

DEPTH (cm)



Loose, litter of leaves, needles, twigs and partly decomposed organic matter; very strongly acid.

Reddish brown (5YR 4/3m) and dark reddish brown (5YR 313m) loamy sand; moderate, medium, granular; very fariable; very strongly acid.

Dark brown (7.5YR 4/4m) loamy sand; weak, medium subangular blocky breaking to single grain; loose; very strongly acid.

Yellowish brown (10YR 5/6m) loamy sand; single grain; loose; very strongly acid.

Light brown (7.5YR 6/4m) loamy sand or sand; single grain; loose; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	moder or mull
SOLUM DEPTH (cm)	:	>100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	no restricting layer
ROOTING DEPTH (cm)	:	>90
COARSE FRAGMENT CLASS	:	0-1
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	N/A
PERVIOUSNESS	:	rapid to moderate
SOIL DRAINAGE	:	rapid to to well
SOIL TEXTURE	:	Loamy sand, sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	3	1.1 (0.9-1.3)	2	1.3 (1.2-1.4)	1	1.5
AWSC (cm/m)	Est.	(6-10)	Est.	(4-8)	10	4 (2-6)
% COARSE > 7.5 cm	328	0	328	0	295	0
FRAGMENTS < 7.5 cm	331	5 (0-10)	330	5 (0-10)	297	5 (0-11)
% PASSING SIEVE 4.76 mm	11	91 (84-98)	10	87 (76-98)	11	91 (83-99)
0.5 mm	11	72 (53-93)	10	70 (49-91)	11	67 (40-94)
0.074 mm	11	18 (8-30)	10	15 (6-24)	11	13 (2-24)
% FINE SAND	11	26 (10-42)	10	27 (10-37)	11	27 (6-48)
% SAND	30	82 (68-94)	17	86 (78-94)	13	90 (81-98)
% CLAY	30	4 (1-7)	17	4 (2-6)	13	3 (1-5)
LIQUID LIMIT (%)	10	13 (0-36)	9	4 (0-17)	9	6 (0-18)
PLASTIC LIMIT (%)	10	11 (0-32)	9	3 (0-12)	9	5 (0-15)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	27	5.4 (5.1-5.7)	16	5.8 (5.5-6.1)	10	6.6 (5.6-6.4)
(pH) 1:2 $CaCl_2$	28	4.9 (4.6-5.2)	16	5.2 (4.9-5.5)	10	5.5 (5.1-5.9)
ORGANIC CARBON (%)	21	1.7 (0.8-2.6)	10	0.9 (0.3-0.15)	6	0.4 (0.07-0.8)
NITROGEN (%)	14	0.08 (0.02-0.14)	6	0.03 (0.01-0.05)	5	0.01 (0.05-0.03)
EXCHANGE CAPACITY (meq/100g)	15	13 (7-20)	6	7 (3-11)	5	5 (2-12)
BASE SATURATION (%)	14	22 (12-32)	6	21 (16-27)	5	29 (26-34)
EXCHANGEABLE CATIONS - Ca	14	2.3 (0.3-5.8)	6	1.1 (0.1-2.0)	5	0.9 (0.1-2.0)
(meq/100g) - Mg	14	0.4 (0.1-0.7)	6	0.3 (0.1-0.5)	5	0.3 (0.1-0.5)
- Na	14	0.12 (0.02-0.25)	6	0.1 (0.07-0.14)	5	0.12 (0.09-0.15)
- K	14	0.14 (0.02-0.25)	6	0.1 (0.01-0.4)	5	0.08 (0.01-0.2)
PHOSPHORUS (ppm)	14	94 (5-200)	6	39 (5-87)	5	55 (35-75)
SULPHUR (ppm)	9	9.5 (6-13)	5	8 (3-13)	5	13 (8-18)
% IRON	15	0.2 (0.1-0.3)	9	0.1 (.01-0.3)		
% ALUMINUM	15	0.3 (0.2-0.4)	9	0.3 (0.2-0.5)		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
BDa	Sombric variant (Gleyed Sombric Brunisol); Organic matter accumulation is the upper horizon usually as a result of long term cultivation.
BDg	Gravelly phase; solum contains 20-50% gravel.
BDg,lo	Gravelly, loamy phase; solum contains 20-50% gravels, with a 20-50 cm loam textured surface.
BDg,mc	Gravelly phase, and moderately cemented variant; solum contains 20-50% gravels, and moderate to strong cementation occurs in the subsoil.
BDg,s	Gravelly phase, shallow variant; solum contains 20-50% gravels, which overlies a different parent material or strongly contrasting texture within 50-100 cm of the surface.
BDg,wc	Gravelly phase, weakly cemented variant; solum contains 20-50% gravels, and a cemented horizon occurs between 50-100 cm depth.
BDlo	Loamy phase; 20-50 cm of loam textured surface.
BDmc	Moderately cemented variant; moderate to strong cementation occurs in the subsoil.
BDmc,s	Moderately cemented, shallow variant; moderate to strong cementation occurs in the subsoil, and overlies a different parent material or strongly contrasting texture that occurs within 50-100 cm of the surface.
BDs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
BDs,wc	Shallow, weakly cemented variant; a different parent material or strongly contrasting texture occurs within 50-100 cm depth. The solum has a cemented horizon that is not sufficiently cemented to be a duric horizon.
BDvs	Very shallow variant; different parent material or strongly contrasting texture occurs within 10-50 cm of the surface.
BDwc	Weakly cemented variant; a cemented horizon occuring between 50-100 cm depth.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS BEDDIS SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	SM	A-2-4	good	poor	unsuited	poor-fair

BOWSER SOILS (BO)

PLATE 4.6: BOWSER SOIL LANDSCAPE

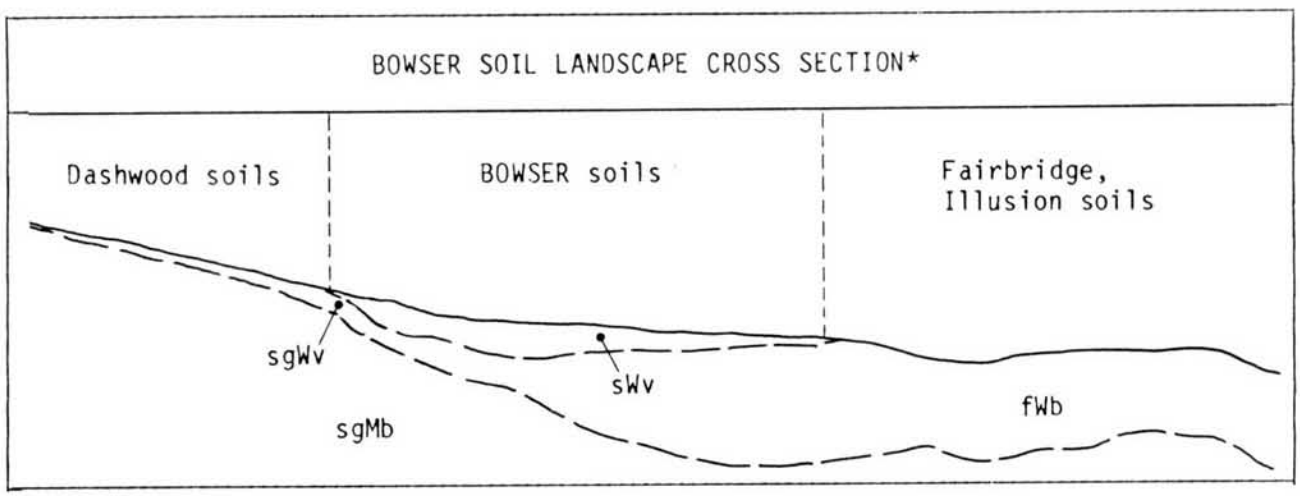
GENERAL COMMENTS

Bowser soils (1490ha) have developed on gently undulating landscapes below 130 m elevation. The parent materials are sandy fluvial or marine veneers underlain by silty marine deposits. Although not extensive, these soils occur throughout the survey area and are usually found in conjunction with Brigantine soils. Bowser soils are imperfectly to moderately poorly drained and have seasonally perched watertables.

Bowser soils are stone-free and have friable, sandy loam to loamy sand or sand surface and subsurface textures. The subsoil is either compact silt loam or interlayed silt loam and sands. Iron cemented clods and continuous cemented subsoils are common in some areas. They are predominantly classified as **Gleyed Humo-Ferric Podzols.** Inclusions of Gleyed Ortstein Humo-Ferric Podzols also occur.

Adequate drainage, irrigation and fertilization are necessary for good production of a wide range of crops.

Urban and related uses are constrained by high watertables during the winter and spring.

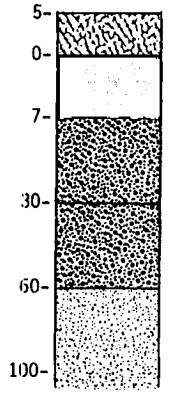


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy marine or fluvial veneer over sandy silt marine
TOPOGRAPHY	:	0-5% slopes; nearly level to moderate slopes
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Mainly second-growth stands of Douglas-fir, western red cedar, western hemlock,and red alder. The understory is dominated by sword fern.

TYPICAL BOWSER SOIL PROFILE



LFH — Loose, litter of leaves, needles, twigs over partly to well decomposed organic matter; very strongly acid.

Ah — Very dark brown (10YR 2/2m) loamy sand; moderate, medium, granular; very friable; extremely acid.

Bf — Yellowish red (5.0YR 4/6m) sandy loam; weak to moderate, medium subangular blocky; very friable; very strongly acid.

Bmgj — Light olive brown (2.5Y 5/4m) sandy loam; many, medium, prominent mottles; moderate, medium subangular blocky; very friable; very strongly acid.

IIBCg — Grayish brown (2.5Y 5/2m) silt loam; many, medium, prominent mottles; massive breaking to strong, medium, psuedo-angular blocky; firm; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: moder
SOLUM DEPTH (cm)	: >100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 70; compact or cemented subsoil
ROOTING DEPTH (cm)	: 70
COARSE FRAGMENT CLASS	: 0-1
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 70-150; seasonal perched
PERVIOUSNESS	: slow
SOIL DRAINAGE	: imperfect to moderately poor
SOIL TEXTURE	: sandy loam or loamy sand over silty clay loam or silt loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.0-1.2)	Est.	(1.2-1.4)	1	1.3
AWSC (cm/m)	5	10 (7-13)	3	9 (8-11)	Est.	21 (19-25)
% COARSE > 7.5 cm	112	0	112	0	102	0
FRAGMENTS < 7.5 cm	112	5 (0-10)	112	4 (0-10)	103	3 (0-6)
% PASSING SIEVE 4.76 mm	3	91 (82-97)	2	92 (85-99)	3	97 (94-100)
0.5 mm	3	82 (67-91)	2	81 (67-95)	3	95 (90-99)
0.074 mm	3	40 (26-54)	2	36 (30-42)	2	80 (65-97)
% FINE SAND	3	20 (14-28)	2	21 (16-26)	2	8 (1-15)
% SAND	10	66 (50-82)	7	68 (55-81)	4	39 (9-68)
% CLAY	10	8 (5-11)	7	8 (5-11)	4	8 (2-13)
LIQUID LIMIT (%)	3	17 (0-27)	2	18 (0-30)	1	36
PLASTIC LIMIT (%)	3	13 (0-23)	2	14 (0-26)	1	28

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	11	5.3 (5.0-5.6)	3	5.7 (5.3-6.1)	3	5.9 (5.7-6.1)
(pH) 1:2 $CaCl_2$	11	4.7 (4.5-4.9)	3	5.1 (4.6-5.6)	3	5.3 (5.2-5.4)
ORGANIC CARBON (%)	10	2.5 (1.4-3.6)	2	1.5 (0.4-3.0)	1	0.5
NITROGEN (%)	6	0.15 (0.05-0.25)	2	0.06 (0.02-0.1)	1	0.03
EXCHANGE CAPACITY (meq/100g)	6	17 (11-23)	2	10 (6-14)	1	16
BASE SATURATION (%)	6	16 (8-24)	2	10 (9-11)	1	37
EXCHANGEABLE CATIONS - Ca	6	2.1 (0.4-3.8)	2	0.8 (0.5-1.1)	1	4.0
(meq/100g) - Mg	6	0.5 (0.1-0.9)	2	0.07 (0.02-0.11)	1	2.0
- Na	6	0.2 (0.1-0.4)	2	0.08 (0.07-0.09)	1	0.2
- K	6	0.08 (0.03-0.13)	2	0.04 (0.02-0.06)	1	0.08
PHOSPHORUS (ppm)	6	40 (10-70)	2	13 (11-15)	1	10
SULPHUR (ppm)	5	8.7 (5.5-12)	2	7 (4-10)	1	5
% IRON	10	0.2 (0.1-0.3)	4	0.2 (0.1-0.3)		
% ALUMINUM	10	0.4 (0.3-0.5)	4	0.3 (0.2-0.4)		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
BOg	Gravelly phase; solum contains 20-50% gravels.
BOg,s	Gravelly phase, shallow variant; solum contains 20-50% gravels which overlies a different parent material or strongly contrasting texture within 50-100 cm of the surface.
BOg,wc	Gravelly phase, weakly cemented variant; solum contains 20-50% gravels, and has a weakly cemented horizon occuring between 50-100cm depth.
BOlo	Loamy phase; 20-50 cm of loam textured surface.
BOmc	Moderately cemented variant; moderate to strong cementation occurs in the subsoil.
BOmd	Moderately well to well drained variant; drier soil moisture regime.
BOs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
BOwc	Weakly cemented variant; a cemented horizon occuring between 50-100 cm depth that is not sufficiently cemented to be a duric horizon.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
BOWSER SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-65	SM	A-2-4	fair	poor	poor	good
65-100+	ML, CL	A-4,A-5	unsuited	poor	good	poor

BRIGANTINE SOILS (BE)

PLATE 4.7: BRIGANTINE SOIL LANDSCAPE

GENERAL COMMENTS

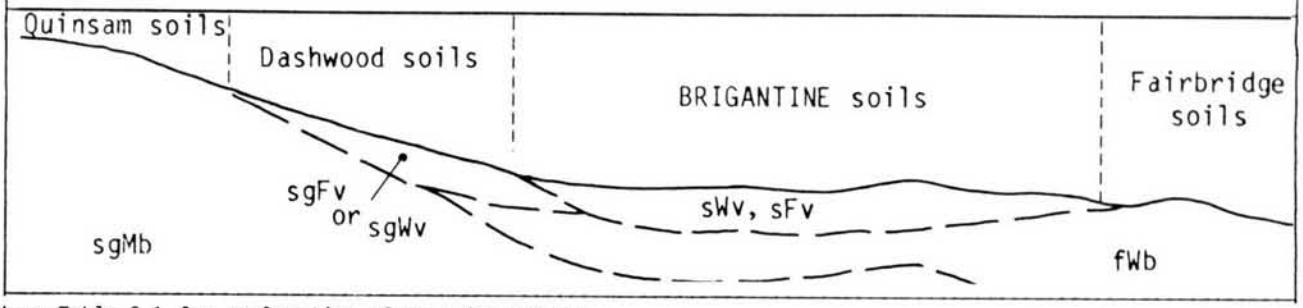
Brigantine soils (635ha) have developed on gently undulating, coarse-textured, fluvial, fluvioglacial and marine deposits overlying medium-textured marine deposits and occur between sea level and 100 m in elevation. Lateral seepage and/or seasonally perched watertables occur during the winter months.

Brigantine soils are imperfectly drained, stone-free and have sandy loam or loamy sand surface and subsurface textures. The surface horizons are very friable while the silty subsoil loam textured subsurface is very compact. Brigantine soils are classified as Gleyed Dystric Brunisols, and Gleyed Sombric Brunisols, depending on whether a dark organic mattered enriched surface horizon is present.

Adequate drainage, irrigation and fertilization are necessary for good production of a wide range of crops.

Urban and related uses are constrained by high watertables during winter and spring.

BRIGANTINE SOIL LANDSCAPE CROSS SECTION*

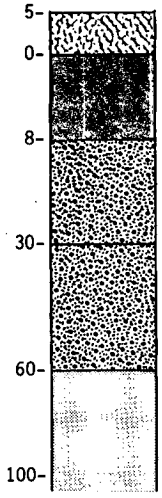


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy marine, fluvioglacial or fluvial veneer over fine silty marine
TOPOGRAPHY	:	1-15% slopes; nearly level to moderate slopes
ELEVATION RANGE	:	0-100 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Uncleared areas support second growth stands of Douglas-fir, western red cedar, western hemlock, and red alder. The understory is dominated by sword fern.

TYPICAL BRIGANTINE SOIL PROFILE



LFH — Loose, litter of leaves needles, twigs over partly decomposed organic matter; very strongly acid.

Ah — Dark brown (10YR 3/3m) sandy loam; moderate, medium, granular; very friable; very strongly acid.

Bm — Strong brown (7.5YR 4/6m) sandy loam; weak to moderate, medium subangular blocky; very friable; very strongly acid.

Bmgj — Olive brown (2.5Y 4/4m) sandy loam; common, medium, distinct mottles; moderate, medium, subangular blocky; very friable; very strongly acid.

IIBCg — Grayish brown (2.5Y 5/2m) silt loam; common, medium, distinct mottles; strong, medium, angular blocky; firm; very strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: moder
SOLUM DEPTH (cm)	: 115
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 70; compact BC horizon
ROOTING DEPTH (cm)	: 70
COARSE FRAGMENT CLASS	: 0-1
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 70-150; seasonal perched
PERVIOUSNESS	: slow
SOIL DRAINAGE	: imperfect
SOIL TEXTURE	: sandy loam or loamy sand over silty clay loam or silt loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	3	1.0 (0.9-1.1)	Est.	(1.0-1.2)	1	1.3
AWSC (cm/m)	Est.	(10-14)	Est.	(9-12)	Est.	(19-25)
% COARSE > 7.5 cm	50	0	48	0	42	0
FRAGMENTS < 7.5 cm	50	4 (1-10)	48	4 (0-8)	42	3 (0-7)
% PASSING SIEVE 4.76 mm	Est.	(86-98)	Est.	(85-99)	2	99 (98-100)
0.5 mm	Est.	(55-95)	Est.	(67-95)	2	92 (88-96)
0.074 mm	Est.	(26-54)	Est.	(30-42)	2	58 (44-72)
% FINE SAND	1	26	Est.	(16-26)	1	9
% SAND	1	61	3	72 (56-88)	1	26
% CLAY	1	9	3	7 (4-10)	1	15
LIQUID LIMIT (%)	1	32	Est.	(15-35)	1	28
PLASTIC LIMIT (%)	1	27	Est.	(15-25)	1	22

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	4.7	2	5.7 (5.5-5.9)	3	6.0 (5.9-6.2)
(pH) 1:2 $CaCl_2$	1	4.5	2	5.3 (5.0-5.5)	3	5.5 (5.3-5.8)
ORGANIC CARBON (%)	1	2.8	2	0.9 (0.5-1.3)	3	0.6 (0.3-0.7)
NITROGEN (%)	1	0.20	2	0.07 (0.03-0.10)	3	0.03 (0.01-0.05)
EXCHANGE CAPACITY (meq/100g)	1	17	2	11 (7-15)	3	18 (11-28)
BASE SATURATION (%)	1	33	2	56 (40-74)	3	72 (46-120)
EXCHANGEABLE CATIONS - Ca	2	1.0 (0.3-2.1)	2	4.4 (4.2-4.6)	2	4.4 (4.0-4.8)
(meq/100g) - Mg	2	0.9 (0.4-1.4)	2	1.3 (1.2-1.4)	2	1.3 (1.2-1.4)
- Na	2	0.2 (0.1-0.3)	2	0.20 (0.19-0.21)	2	0.3 (0.1-0.5)
- K	2	0.18 (0.14-0.24)	2	0.10 (0.07-0.12)	3	0.07 (0.04-0.12)
PHOSPHORUS (ppm)	2	37 (35-39)	1	10	3	5.8 (5.2-6.5)
SULPHUR (ppm)	1	8.4	1	9.3	2	9 (8-10)
% IRON	Est.	(0.1-0.4)	Est.	(0.05-0.2)		
% ALUMINUM	Est.	(0.1-0.4)	Est.	(0.1-0.3)		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
BEa	Sombric variant (Gleyed Sombric Brunisol); usually the result of long term cultivation.
BEg	Gravelly phase; solum contains 20-50% gravels.
BEg,mc	Gravelly phase, moderately cemented variant; solum contains 20-50% gravels, and moderate to strong cementation in the subsoil.
BElo	Loamy phase; 20-50 cm of loam textured surface.
BEmc	Moderately cemented variant; moderate to strong cementation occurs in the subsoil.
BEs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
BEwc	Weakly cemented variant; a cemented horizon occuring between 50-100 cm depth that is not sufficiently cemented to be a duric horizon.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS BRIGANTINE SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-65 65-100+	SM ML, CL	A-2-4 A-4,A-5	fair unsuited	poor poor	poor good	fair poor

CASSIDY SOILS (CA)

PLATE 4.8: CASSIDY SOIL LANDSCAPE

GENERAL COMMENTS

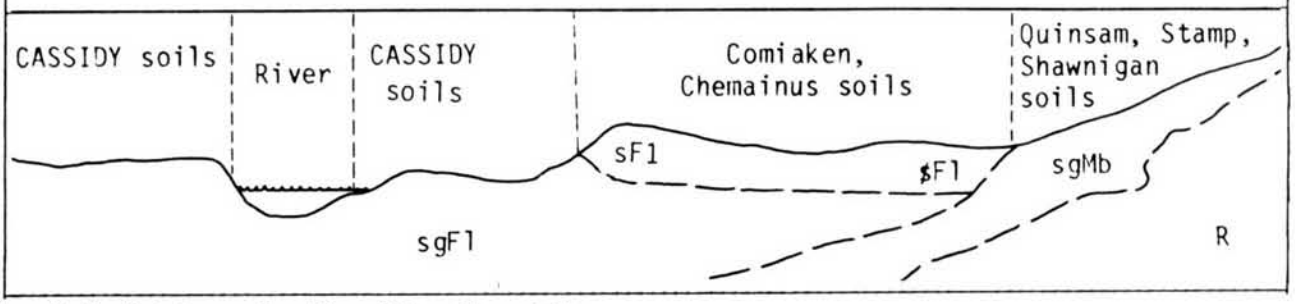
Cassidy soils (875ha) occur on very coarse-textured, level to gently sloping terraces and floodplains along the narrow river and stream valleys of the surveyed area. Generally associated with Comiaken and, to a lesser extent, Chemainus soils, Cassidy soils are rapidly drained with an apparent watertable usually at 1 to 5 m depth.

These soils are commonly very gravelly loamy sand or sandy loam texture and contain lenses of sand and gravel. Most Cassidy soils are classified as **Orthic Dystric Brunisols**, although **Orthic Regosols, Cumulic Regosols** and **Orthic Humic Regosols** also occur.

Due to their coarse textures and stoniness, Cassidy soils require substantial amounts of stonepicking, irrigation and fertilization. Consequently, they are of limited value for agriculture.

Urban and related uses are constrained due to susceptibility to flooding. Also septic tank effluent renovation may be incomplete because of coarse subsoil textures.

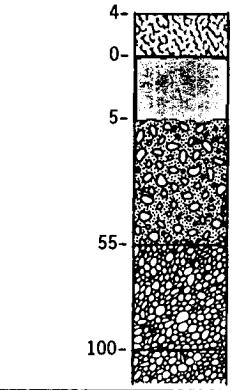
CASSIDY SOIL LANDSCAPE CROSS SECTION*



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy gravelly fluvial
TOPOGRAPHY	:	1-9%; nearly level to gentle slopes
ELEVATION RANGE	:	0-150 m asl
ASPECT	:	all
FLOOD HAZARD	:	may be expected
VEGETATION	:	The native vegetation consists of Douglas-fir, grand fir, western red cedar, red alder, and maple. The understory is dominated by salal, bracken, and swordfern.

TYPICAL CASSIDY SOIL PROFILE



Loose, litter of leaves, needles, twigs over partly to well decomposed organic matter; extremely acid.

Very dark brown (10YR 2/2m) gravelly sandy loam; moderate, fine to medium, subangular blocky or granular; very friable; non-sticky; non-plastic; strongly acid.

Dark grayish brown (10YR 4/2m) very gravelly loamy sand to very gravelly coarse sand; weak, fine to medium, subangular blocky to single grain; loose; non-sticky; non-plastic; strongly acid.

Very gravelly sand; single grain; loose; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	moder
SOLUM DEPTH (cm)	:	50-100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	no restricting layer
ROOTING DEPTH (cm)	:	50-100
COARSE FRAGMENT CLASS	:	1-4
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	100-500; apparent
PERVIOUSNESS	:	rapid
SOIL DRAINAGE	:	rapid
SOIL TEXTURE	:	very gravelly loamy sand, very gravelly sandy loam, very gravelly sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	3	1.4 (1.3-1.5)	Est.	(1.5-1.9)	Est.	(1.8-2.1)
AWSC (cm/m)	Est.	(4-8)	2	(1.5-3)	1	2
% COARSE > 7.5 cm	39	6 (1-12)	47	5 (0-10)	39	6 (1-12)
FRAGMENTS < 7.5 cm	39	32 (20-44)	47	35 (27-43)	39	32 (20-44)
% PASSING SIEVE 4.76 mm	1	57	2	36 (30-42)	Est.	(28-40)
0.5 mm	1	38	2	10 (4-16)	Est.	(6-12)
0.074 mm	1	9	2	2 (1-3)	Est.	(1-3)
% FINE SAND	1	8 (2-14)	2	9 (5-13)	1	7
% SAND	2	81 (70-92)	2	91 (89-94)	1	90
% CLAY	2	4 (2-7)	2	3 (2-4)	1	3
LIQUID LIMIT (%)	1	0	2	0	1	0
PLASTIC LIMIT (%)	1	0	2	0	1	0

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	5.7	1	6.1	1	6.2
(pH) 1:2 $CaCl_2$	1	5.4	1	5.4	1	5.3
ORGANIC CARBON (%)	2	3.6 (2.5-4.5)	1	0.7	1	0.2
NITROGEN (%)	1	0.1	1	0.04	1	0.01
EXCHANGE CAPACITY (meq/100g)	1	18	1	9.0	1	5
BASE SATURATION (%)	1	53	1	58	1	67
EXCHANGEABLE CATIONS - Ca	1	5.4	1	4.5	1	3.1
(meq/100g) - Mg	1	0.7	1	0.5	1	0.4
- Na	1	0.3	1	0.16	1	0.14
- K	1	0.09	1	0.07	1	0.07
PHOSPHORUS (ppm)	1	28	1	16	1	9
SULPHUR (ppm)	1	6	1	4.7	1	2.0
% IRON	1	0.3	1	0.2		
% ALUMINUM	1	0.2	1	0.2		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
CAco	Cobbly phase; surface soil horizon (0-25cm) contains more than 20% cobbles and or stones.
CAco,id	Cobbly phase, imperfectly drained variant; soil contains more than 20% cobbles and or stones, in the upper 25cm, and occurs on the wetter, lowest portions of the floodplain. Classified within gleyed subgroups of Dystric Brunisols and Regosols.
CAco,lo	Cobbly, loamy phase; surface soil horizon (0-25cm) contains more than 20% cobbles and or stones with 20-50 cm of loam textured surface layer.
CAg	Gravelly phase; solum contains 20-50% gravels.
CAg,lo	Gravelly, loamy phase; solum contains 20-50% gravels, with 20-50 cm of loam textured surface layer.
CAlo	Loamy phase; 20-50 cm of loam textured surface layer.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS CASSIDY SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	GW, GP	A-1-a	poor	good	unsuited	unsuited

CHEMAINUS SOILS (CH)

PLATE 4.9: CHEMAINUS SOIL LANDSCAPE

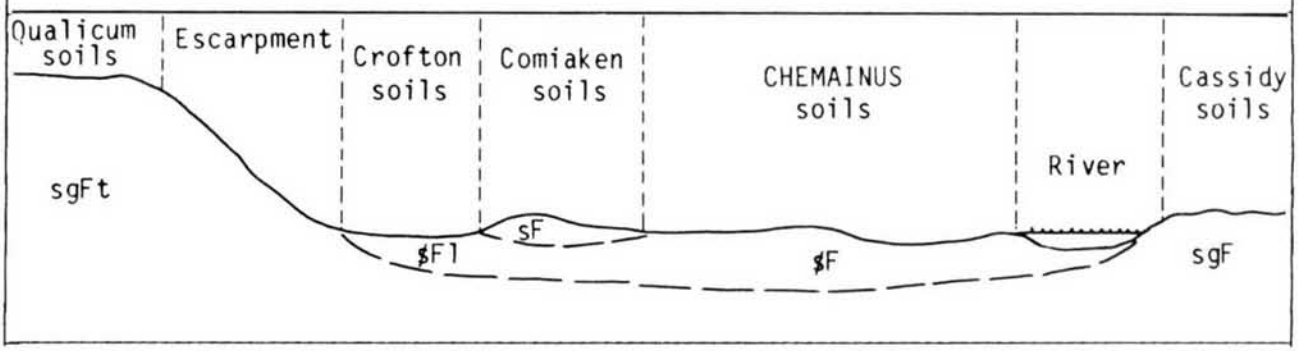
GENERAL COMMENTS

Chemainus soils (2875ha) occur on level to very gently sloping floodplains and low terraces along streams and rivers. They occur extensively along the Puntledge, Courtenay, Somass and Stamp rivers, and to a lesser extent along the Englishman and Qualicum rivers. These moderately well drained soils have formed in medium textured fluvial deposits that have apparent watertables at 1 to 2 m depth.

Chemainus soils have very dark brown silt loam to loam surface horizons and are dominantly classified as **Orthic Dystric Brunisols**, although Cumulic Regosols and Orthic Regosols occur on the more recent deposits.

Chemainus soils are some of the best suited agricultural soils in the survey area, principally because of their high water holding capacity, level topography, and proximity to irrigation water. The dominant land uses are pasture and hay production, but vegetables and small fruits are also grown. Chemainus soils are well suited for a wide range of crops, however irrigation is necessary for maximizing yields. Flooding can occur during the winter but generally is not a serious limitation to agriculture.

CHEMAINUS SOIL LANDSCAPE CROSS SECTION*



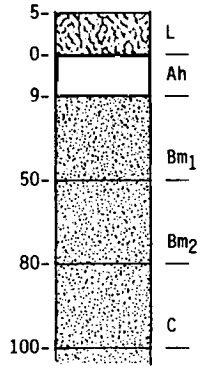
*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy silty fluvial level or terrace
TOPOGRAPHY	:	0-5%; level to very gently sloping
ELEVATION RANGE	:	5-150 m asl
ASPECT	:	none
FLOOD HAZARD	:	may be expected to frequent
VEGETATION	:	Chemainus soils are mostly cleared and cultivated. Uncleared areas support second growth Douglas-fir, grandfir, western hemlock, western red cedar, maple, and red alder with a wide variety of shrubs in the understory.

TYPICAL CHEMAINUS SOIL PROFILE

DEPTH (cm)



L — Loose, raw to slightly decomposed remains of leaves, needles, and wood; strongly acid.

Ah — Very dark brown (10YR 2/2 m) silt loam; moderate, medium, granular; friable; non-plastic; strongly acid.

Bm_1 — Dark yellowish brown (10YR 4/4 m) silt loam; weak to moderate, medium, angular blocky; friable; non-plastic; strongly acid.

Bm_2 — Light olive brown (2.5Y 5/4 m) silt loam; weak to moderate, fine to medium, angular blocky; friable; non-plastic; strongly acid.

C — Light yellowish brown (2.5Y 6/4m); silt loam, weak, medium, subangular block;y very friable; non-plastic; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: mull
SOLUM DEPTH (cm)	: 50-150
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: no restricting layer
ROOTING DEPTH (cm)	: 100+
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 100-300; apparent
PERVIOUSNESS	: moderate
SOIL DRAINAGE	: moderately well
SOIL TEXTURE	: fine sandy loam, loam, silt loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	2	1.0 (0.9-1.2)	1	1.2	2	1.1 (1.0-1.3)
AWSC (cm/m)	2	16 (13-19)	4	14 (12-16)	2	15 (13-17)
% COARSE > 7.5 cm	169	0	168	0	174	0
FRAGMENTS < 7.5 cm	170	1 (0-3)	169	1 (0-3)	174	1 (0-4)
% PASSING SIEVE 4.76 mm	7	94 (80-100)	6	99 (98-100)	3	100 (95-100)
0.5 mm	7	89 (69-100)	6	92 (83-99)	3	99 (95-100)
0.074 mm	7	63 (46-80)	6	64 (39-89)	3	64 (44-84)
% FINE SAND	7	14 (10-18)	6	12 (5-19)	3	22 (9-40)
% SAND	21	44 (26-56)	14	49 (29-69)	4	51 (30-70)
% CLAY	20	13 (9-17)	13	10 (6-14)	4	9 (7-11)
LIQUID LIMIT (%)	7	48 (35-61)	5	31 (8-54)	2	30 (25-35)
PLASTIC LIMIT (%)	7	35 (28-42)	5	23 (8-38)	2	24 (20-28)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	17	5.5 (5.0-6.0)	10	5.6 (5.3-5.9)	4	5.7 (5.5-6.1)
(pH) 1:2 $CaCl_2$	17	4.9 (4.5-5.3)	10	5.0 (4.7-5.3)	4	4.9 (4.7-5.1)
ORGANIC CARBON (%)	13	3.7 (2.3-5.3)	7	1.9 (1.6-2.2)	4	1.5 (1.0-2.0)
NITROGEN (%)	12	0.26 (0.16-0.36)	8	0.19 (0.07-0.35)	2	0.1 (0.05-0-15)
EXCHANGE CAPACITY (meq/100g)	12	24 (15-33)	8	22 (12-32)	2	15 (14-16)
BASE SATURATION (%)	12	36 (27-45)	8	40 (25-55)	2	31 (21-41)
EXCHANGEABLE CATIONS - Ca	12	7.1 (4.1-10.1)	8	7.4 (2.5-10.0)	2	3.8 (2.6-5.0)
(meq/100g) - Mg	12	1.2 (0.7-1.8)	8	1.5 (0.5-3.0)	2	0.8 (0.7-1.0)
- Na	12	0.1 (0.0-0.2)	8	0.14 (0.0-0.35)	2	0.04 (0.0-0.07)
- K	12	0.11 (0.06-0.16)	8	0.3 (0.03-1.9)	2	0.1 (0.05-0.16)
PHOSPHORUS (ppm)	12	20 (4-70)	6	11 (4-23)	2	4 (3-5)
SULPHUR (ppm)	6	8 (3-13)	3	5 (2-9)	1	3.5
% IRON	8	0.4 (0.1-0.7)	8	0.4 (0.1-0.7)	Est.	(0.1-0.2)
% ALUMINUM	8	0.4 (0.2-0.6)	8	0.3 (0.2-0.6)	Est.	(0.1-0.2)

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
CHg	Gravelly phase; solum contains 20-50% gravels.
CHg,id	Gravelly phase, imperfectly drained variant; solum contains 20-50% gravels and occurs on the wetter, lowest portions of the floodplain. Classified within gleyed subgroups of Dystric Brunisols and Regosols.
CHg,s	Gravelly phase, shallow variant; solum contains 20-50% gravels, and a different parent material or strongly contrasting texture within 50-100 cm of the surface.
CHid	Imperfectly drained variant; soils occur on the wetter, lowest portions of the floodplain. Classified in gleyed subgroups of Dystric Brunisols and Regosols.
CHid,pz	Imperfectly drained, podzolic variant; soils occur on the wetter, lowest portions of the floodplain. Classified as Gleyed Humo-Ferric Podzol.
CHid,s	Imperfectly drained, shallow variant; soils occur on the wetter, lowest portions of the floodplain, and overlies a different parent material or strongly contrasting texture within 50-100 cm of the surface. Classified as gleyed subgroups of Dystric Brunisols and Regosols.
CHpz	Podzolic variant; soils classified as Orthic Humo-Ferric Podzols. Reddish brown colours (5YR 5/4) are common.
CHs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
CHvs	Very shallow variant; different parent material or strongly contrasting texture occurs within 10-50 cm of the surface. Usually a coarse textured fluvial deposit.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS CHEMAINUS SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	ML	A-4,A-5	poor	poor	fair	good

CHINA CREEK SOILS (CK)

PLATE 4.10: CHINA CREEK SOIL LANDSCAPE

GENERAL COMMENTS

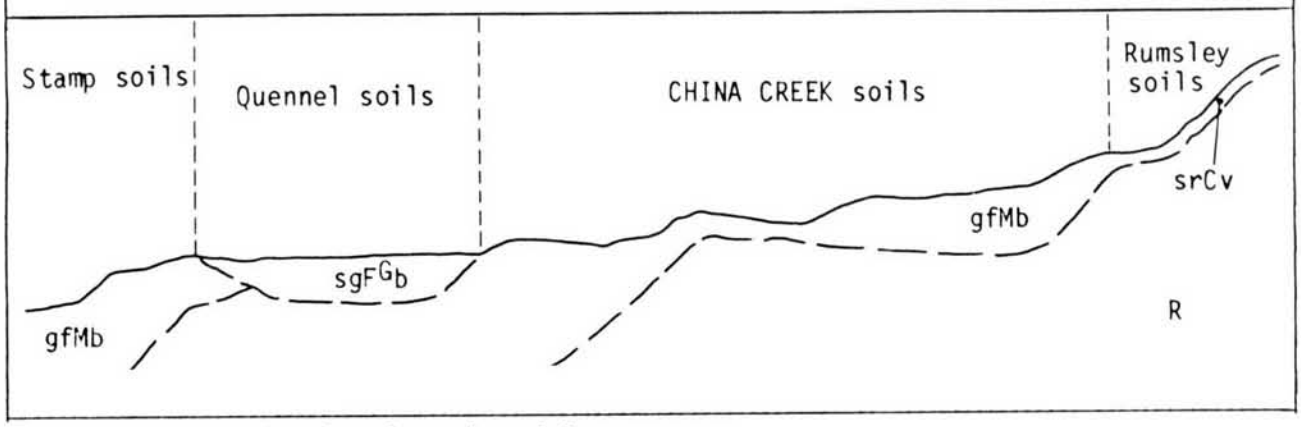
China Creek soils (430ha) have developed in gravelly, fine textured morainal deposits which are partially derived from underlying sedimentary shales and siltstones. They occur near or above 150 m on gentle to strong slopes in the south eastern portion of the Alberni Valley. These are moderately well to well drained.

China Creek soils have moderately pervious, very friable, gravelly loam to sandy loam surface horizons, overlying massive gravelly loam parent material at about 80 cm depth. They are classified as Orthic Humo-Ferric Podzols.

China Creek soils are considered marginal for agricultural use due to stoniness, aridity and steep slopes. They occur in small areas isolated by sedimentary rock outcrops which interfere with agricultural use. Most areas are presently under forest cover.

These soils are suitable for urban and related uses as bearing capacity is high and excess wetness or flooding problems do not exist.

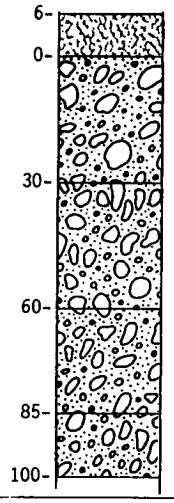
CHINA CREEK SOIL LANDSCAPE CROSS SECTION*



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	gravelly fine morainal
TOPOGRAPHY	:	6-30%; gentle to strong slopes
ELEVATION RANGE	:	150+ m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Second growth Douglas-fir, hemlock, cedar and alder. The understory is dominated by salal, with sword fern and Oregon grape.

TYPICAL CHINA CREEK SOIL PROFILE



LFH — Loose, litter of leaves, needles, and wood and partly to well decomposed organic matter; very strongly to extremely acid.

Bf_1 — Yellowish red (5YR 4/6m) gravelly loam to gravelly sandy loam; weak, medium, subangular blocky; very friable; non-plastic; very strongly to strongly acid.

Bf_2 — Yellowish brown (10YR 5/8m) gravelly sandy loam or gravelly loam; weak, medium, subangular blocky; very friable; non-plastic; strongly to very strongly acid.

Bmgj — Light olive brown (2.5Y 5/6m) gravelly loam to gravelly sandy loam; few fine mottles; weak to moderate, fine, suangular blocky, very friable; non-plastic; strongly to very strongly acid.

BCgj — Olive (5Y 5/4m) gravelly loam; few fine mottles; massive; firm; slightly plastic; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: mor
SOLUM DEPTH (cm)	: 90
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 80; slowly pervious parent material
ROOTING DEPTH (cm)	: 80
COARSE FRAGMENT CLASS	: 3-2
DEPTH TO AND TYPE OF WATERTABLE (cm)	: N/A
PERVIOUSNESS	: moderately
SOIL DRAINAGE	: moderately well to well
SOIL TEXTURE	: gravelly loam to gravelly sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.4-1.6)	Est.	(1.4-1.7)	Est.	(1.5-1.9)
AWSC (cm/m)	Est.	(9-13)	Est.	(10-14)	Est.	(12-16)
% COARSE > 7.5 cm	25	6 (3-9)	25	6 (2-10)	23	5 (1-9)
FRAGMENTS < 7.5 cm	25	23 (19-27)	25	23 (19-27)	23	21 (15-27)
% PASSING SIEVE 4.76 mm	1	81	1	79	1	76
0.5 mm	1	54	1	53	1	59
0.074 mm	1	33	1	32	1	38
% FINE SAND	1	11	1	14	1	15
% SAND	1	48	1	54	1	50
% CLAY	1	15	1	10	1	9
LIQUID LIMIT (%)	Est.	(25-42)	Est.	(15-39)	Est.	(20-44)
PLASTIC LIMIT (%)	Est.	(20-30)	Est.	(16-26)	Est.	(18-30)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	5.3	1	6.0	1	6.0
(pH) 1:2 $CaCl_2$	1	5.1	1	5.0	1	5.0
ORGANIC CARBON (%)	1		1	1.9	1	0.8
NITROGEN (%)	1	0.28	1	0.09	1	0.03
EXCHANGE CAPACITY (meq/100g)	1	24	1	16	1	11
BASE SATURATION (%)	1	10	1	14	1	19
EXCHANGEABLE CATIONS - Ca	1	1.1	1	1.9	1	1.8
(meq/100g) - Mg	1	1.1	1	0.18	1	0.22
- Na	1	0.14	1	0.05	1	0.07
- K	1	0.08	1	0.03	1	0.01
PHOSPHORUS (ppm)	1	35	1	9	1	15
% IRON	1	0.8	1	0.4		
% ALUMINUM	1	0.6	1	0.6		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
CKco	Cobbly phase; surface soil horizon (0-25cm) has greater than 20% cobbles and or stones.
CK12	Shallow lithic phase; bedrock occurs within 50-100 cm of the surface.
CKmc	Moderately cemented variant; moderate cementation occurs in the subsoil.
CKvg	Very gravelly phase; solum has greater than 50% coarse fragments by volume.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
CHINA CREEK SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	SM, SC	A-4	unsuited	poor	poor	unsuited

COMIAKEN SOILS (CN)

PLATE 4.11: COMIAKEN SOIL LANDSCAPE

GENERAL COMMENTS

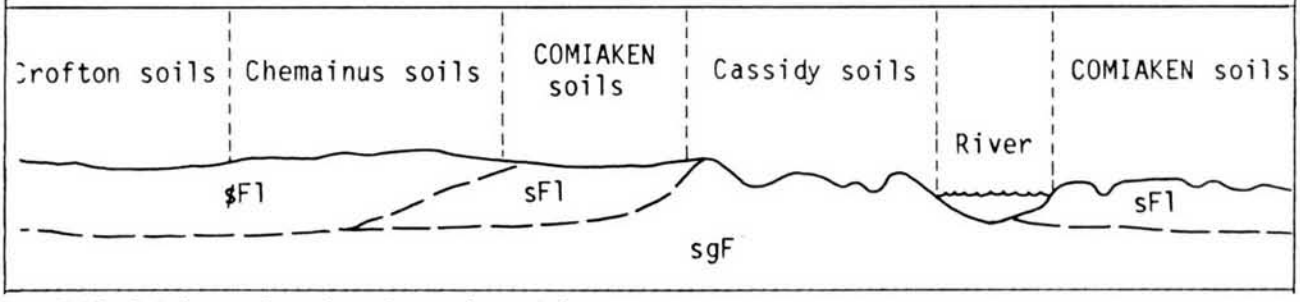
Comiaken soils (1000ha) occur on level to intensively channeled floodplains. They are usually associated with Cassidy and Chemainus soils. The major areas occur along the Puntledge, Courtenay, Stamp and Somass Rivers. They are generally developed in the sandy fluvial materials associated with levees, point bar deposits and channels. Comiaken soils are well to rapidly drained and generally have an apparent water table at about 2 m for most of the year.

Comiaken soils are rapidly permeable with generally loamy sand or sandy loam textures although interlayered lenses of silt or sand are common. They are dominantly classified as **Orthic Dystric Brunisols** with minor occurrences of Cumulic Regosols and Orthic Regosols.

Uncontrolled flooding or the channeled topography generally restrict land uses to seasonal pasture and woodlots. With dyking, levelling and irrigation these soils can support a wide range of crops.

Urban and related uses on these soils are not recommended because of the flood hazard.

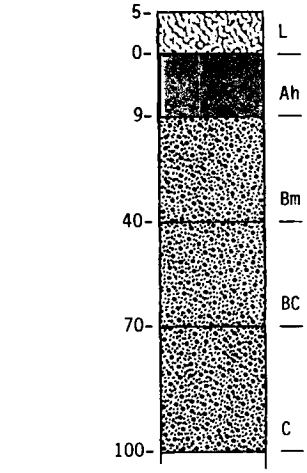
COMIAKEN SOIL LANDSCAPE CROSS SECTION*



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy fluvial level or channeled
TOPOGRAPHY	:	0-5%; level to very gentle slopes
ELEVATION RANGE	:	0-200 m asl
ASPECT	:	none
FLOOD HAZARD	:	frequent
VEGETATION	:	The native vegetation consists of black cottonwood, red alder with minor willow, vine and bigleaf maple, and grand-fir.

TYPICAL COMIAKEN SOIL PROFILE



L — Loose, raw to slightly decomposed remains of leaves, needles, and twigs.

Ah — Very dark grayish brown (10YR 3/2m) very fine sandy loam; weak, moderate, subangular blocky; friable; strongly acid.

Bm — Yellowish brown (10YR 5/4m) sandy loam; weak, moderately coarse, subangular blocky; strongly acid.

BC — Light yellowish brown (10YR 6/4m) loamy sand; single grain; loose; strongly acid.

C — Pale brown (10YR 6/4m) loamy sand; single grain; loose; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Moder
SOLUM DEPTH (cm)	: 0-50
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: no restricting layer
ROOTING DEPTH (cm)	: 80
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 100-300; apparent
PERVIOUSNESS	: rapid
SOIL DRAINAGE	: rapid
SOIL TEXTURE	: loamy sand, sandy loam, sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	3	1.1 (1.0-1.2)	3	1.2 (1.0-1.4)	2	1.2 (1.0-1.4)
AWSC (cm/m)	Est.	(8-12)	Est.	(7-11)	Est.	(7-10)
% COARSE > 7.5 cm	56	0	58	0	52	0
FRAGMENTS < 7.5 cm	58	4 (0-10)	60	4 (0-11)	53	6 (0-15)
% PASSING SIEVE 4.76 mm	1	100	1	99	Est.	(95-100)
0.5 mm	1	96	1	98	Est.	(90-100)
0.074 mm	1	30	1	34	Est.	(15-35)
% FINE SAND	Est.	(20-40)	1	40	Est.	(20-40)
% SAND	4	60 (43-77)	3	75 (60-90)	5	72 (60-84)
% CLAY	4	6 (4-8)	3	4 (2-6)	3	5 (4-7)
LIQUID LIMIT (%)	Est.	(0-20)	Est.	0	Est.	0
PLASTIC LIMIT (%)	Est.	(0-14)	Est.	0	Est.	0

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	5	6.0 (5.7-6.3)	3	6.2 (5.9-6.5)	3	6.2 (5.9-6.5)
(pH) 1:2 $CaCl_2$	5	5.4 (5.2-5.6)	3	5.5 (5.1-5.9)	3	5.5 (5.1-5.9)
ORGANIC CARBON (%)	5	1.4 (0.6-2.2)	3	1.2 (0.8-2.1)	3	1.1 (0.6-2.0)
NITROGEN (%)	4	0.08 (0.03-0.14)	2	0.08 (0.05-0.1)	2	0.07 (0.04-0.1)
EXCHANGE CAPACITY (meq/100g)	4	12 (6-18)	2	15 (12-18)	2	14 (11-16)
BASE SATURATION (%)	4	51 (20-80)	2	72 (60-84)	2	72 (60-85)
EXCHANGEABLE CATIONS - Ca	4	5.8 (1.0-11.0)	2	9 (5-13)	2	8.7 (5.6-11.9)
(meq/100g) - Mg	4	1.4 (0.1-2.8)	2	1.4 (1.1-1.7)	2	1.4 (1.1-1.6)
- Na	4	0.11 (0.04-0.19)	2	0.2 (0.1-0.3)	2	0.16 (0.1-0.2)
- K	4	0.13 (0.09-0.17)	2	0.07 (0.06-0.08)	2	0.07 (0.06-0.07)
PHOSPHORUS (ppm)	4	32 (5-70)	2	4.1 (3.1-5.1)	2	3.9 (3.5-4.3)
SULPHUR (ppm)	4	12 (4-20)	2	11.2 (5-17)	2	9.7 (4.1-15)
% IRON	2	0.3 (0.2-0.4)				
% ALUMINUM	2	0.2 (0.1-0.3)				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
CNg	Gravelly phase; solum contains 20-50% gravels.
CNg,lo	Gravelly, loamy phase; solum contains 20-50% gravels, with 20-50 cm of loam textured surface.
CNg,pz	Gravelly phase, podzolic variant; soil contains 20-50% gravels and is classified as Orthic Humo-Ferric Podzol.
CNg,s	Gravelly phase, shallow variant; solum contains 20-50% gravels, and a different parent material or strongly contrasting texture within 50-100 cm of the surface.
CNid	Imperfectly drained variant; soils occur on the wetter, lowest portions of the floodplain. Classified in gleyed subgroups of Dystric Brunisols and Regosols.
CNid,pz	Imperfectly drained, podzolic variant; soils occur on the wetter, lowest portions of the floodplain. Classified Gleyed Humo-Ferric Podzol.
Cnlo	Loamy phase; 20-50 cm of loam textured surface.
CNlo,pd	Loamy phase, poorly drained variant; 20-50 cm of loam textured surface. Soils occur on the lowest, wettest portions of the floodplain and are classified as Gleysols.
CNpd	Poorly drained variant; soils occur on the lowest, wettest portion of the floodplain and are classified as Gleysols.
CNpd,pt	Poorly drained variant, peaty phase; soils occur on the lowest, wettest portion of the floodplain, and have 10-40 cm of organic material over the mineral soil. Classification is Gleysolic.
CNpd,vs	Poorly drained, very shallow variant; soils occur on the lowest, wettest portion of the floodplain, and have a different parent material or strongly contrasting texture within 10-50 cm of the surface. Soils are classified as Gleysols.
CNpz	Podzolic variant; soils classified as Orthic Humo-Ferric Podzols.
CNs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
CNvs	Very shallow variant; different parent material or strongly contrasting texture occurs within 10-50 cm of the surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS COMIAKEN SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	SM, SW	A-3 A-2	good	poor	unsuited	poor

CORYDON SOILS (CR)

PLATE 4.12 CORYDON SOIL LANDSCAPE

GENERAL COMMENTS

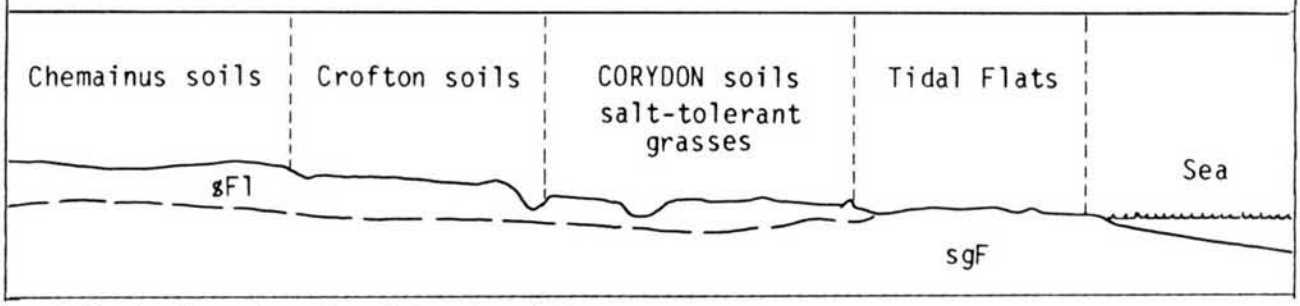
Corydon soils (250ha) occur on level deltaic areas and are usually associated with the Crofton and Chemainus floodplain soils. The major areas of occurrence are on the Somass and Courtenay Rivers. These poorly drained soils are frequently flooded by sea water and support only salt tolerant vegetation. They have a year-round watertable within 1 m of the surface. Corydon soils have developed from silty to sandy fluvial materials.

Surface horizons are dark greyish brown silt loams. Lower horizons are highly variable ranging in texture from silt loam to sand with occasional interlayered gravel lenses. Corydon soils are dominantly classified as **Rego Humic Gleysol**; saline phase, although saline phases of Orthic Humic Gleysols also occur.

Agricultural use is restricted by the need for major reclamation measures (e.g. dyking, drainage, irrigation) to remove flooding and salinity problems. After reclamation and with irrigation a variety of field crops can be grown. The tide lands on which these and associated soils occur have significant value as wildlife habitat.

Urban and related uses are not recommended for Corydon soils. Variable and usually low soil bearing strengths would require that special foundations be considered while excavations and septic tanks should not be considered due to high watertables and flooding. The saline soil conditions will likely cause severe corrosion of uncoated steel and other unprotected underground installations.

CORYDON SOIL LANDSCAPE CROSS SECTION*



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	silty fluvial level
TOPOGRAPHY	:	0-2%; level
ELEVATION RANGE	:	0-2 m asl
ASPECT	:	none
FLOOD HAZARD	:	frequent
VEGETATION	:	Native vegetation consists mainly of salt tolerant grasses, shrubs, and sedges.

TYPICAL CORYDON SOIL PROFILE

L — Loose, litter of leaves, needles, and twigs; very strongly acid.

Ahs — Very dark grayish brown (10YR 3/3m) loam; strongly saline; massive; friable, non-sticky, non-plastic; strongly acid.

Cgs1 — Dark greenish grey (5GY 4/1m) silt loam; many, medium, prominent mottles; strongly saline; massive; friable; non-sticky, non-plastic; very strongly acid.

Cgs2 — Olive brown (2.5 4/4m) sandy loam; many, medium, prominent mottles; strongly saline; massive; loose, non-sticky, non-plastic; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	mull
SOLUM DEPTH (cm)	:	0-30
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	root restriction due to salinity
ROOTING DEPTH (cm)	:	40-60
COARSE FRAGMENT CLASS	:	0
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	0-90; apparent
PERVIOUSNESS	:	moderate
SOIL DRAINAGE	:	poor to very poor
SOIL TEXTURE	:	silt loam, loam, sandy loam, loamy sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(0.9-1.2)	Est.	(1.0-1.2)	Est.	(1.0-1.2)
AWSC (cm/m)	Est.	(14-22)	Est.	(18-22)	Est.	(8-12)
% COARSE > 7.5 cm	5	0	5	0	5	0
FRAGMENTS < 7.5 cm	5	13 (0-33)	5	17 (0-37)	5	22 (7-37)
% PASSING SIEVE 4.76 mm	Est.	(95-100)	1	100	1	80
0.5 mm	Est.	(90-100)	1	98	1	53
0.074 mm	Est.	(55-85)	1	86	1	38
% FINE SAND	Est.	(2-12)	1	6	1	6
% SAND	3	37 (24-60)	2	30 (24-36)	1	61
% CLAY	3	14 (8-20)	2	16 (14-18)	1	11
LIQUID LIMIT (%)	Est.	(30-55)	Est.	(35-65)	1	22
PLASTIC LIMIT (%)	Est.	(14-22)	Est.	(30-50)	1	19

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	5.3	1	4.9	1	5.7
(pH) 1:2 $CaCl_2$	1	4.6	1	4.4	1	5.4
CONDUCTIVITY mS/cm	1	32	1	34	1	16
ORGANIC CARBON (%)	1	5.3	1	6.8	1	1.4
NITROGEN (%)	1	0.21	1	0.39	1	0.09
EXCHANGE CAPACITY (meq/100g)	1	34	1	44	1	16
BASE SATURATION (%)	1	135	1	130	1	144
EXCHANGEABLE CATIONS - Ca	1	4.5	1	5.0	1	2.6
(meq/100g) - Mg	1	11.4	1	14.0	1	6.1
- Na	1	29.0	1	36.4	1	12.8
- K	1	1.5	1	2.0	1	1.0
PHOSPHORUS (ppm)	1	11	1	22	1	18
SULPHUR (ppm)	1	600	1	1640	1	332

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
CRpt	Peaty phase; 10-40 cm of humic or mesic organic material on the mineral soil surface.
CRpt,vs	Peaty phase, very shallow variant; 10-40 cm of humic or mesic organic material occurs over the mineral soil, and a strongly contrasting texture occurs within 10-50 cm of the surface. Usually a very gravelly sandy fluvial deposit.
CRs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
CRvs	Very shallow variant; different parent material or strongly contrasting texture occurs within 10-50 cm of the surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS CORYDON SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-60	ML	A-4,A-5	poor	unsuited	good	poor
60-100+	SM	A-4	poor	poor	fair	poor

COWICHAN SOILS (CO)

PLATE 4.13: COWICHAN SOIL LANDSCAPE

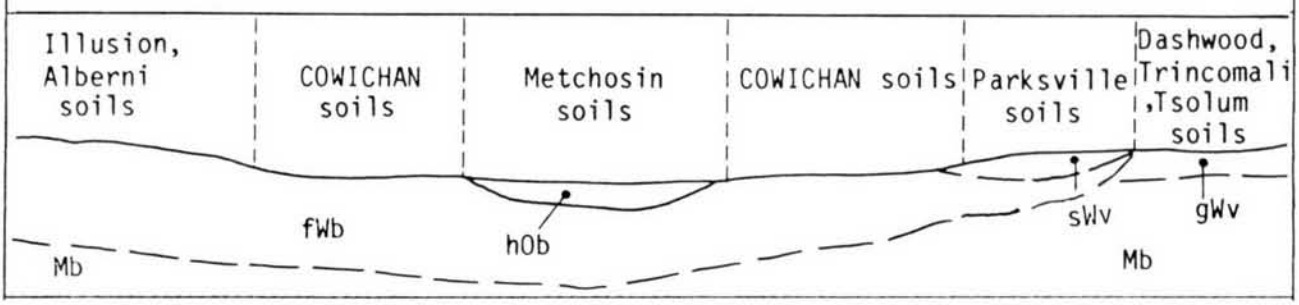
GENERAL COMMENTS

Cowichan soils (4760ha) occur below elevations of about 130 m. They occupy depressional to level areas in generally undulating fine textured marine sediments, and are usually associated with Fairbridge soils. Cowichan soils are poorly drained and have a perched water table within 1.5 m or less of the surface throughout most of the year. These soils have a black, organic matter-enriched surface horizon which is silt loam or silty clay loam in texture. The underlying strongly gleyed, greenish grey horizons have higher clay contents and are very sticky when wet. They are dominantly classified as **Orthic Humic Gleysols** and **Humic Luvic Gleysols.**

Cowichan soils contain excess moisture during the spring which causes trafficability problems and planting delays. Winter ponding often kills or injures perennial crops as well. Both these limitations have historically restricted agricultural use to hay production or pasture. Many farmers have increased the range and production of crops by installing artificial drainage. Drainage lines must be closely spaced due to the slow soil permeability.

Urban and related uses are severely constrained by high watertables, susceptibility to surface ponding, generally low bearing strengths and slow permeability.

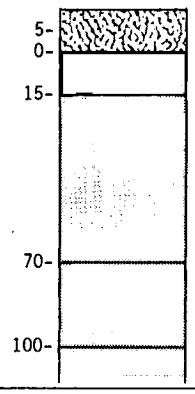
COWICHAN SOIL LANDSCAPE CROSS SECTION*



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	fine marine blanket
TOPOGRAPHY	:	0-3% slopes; level to very gentle slopes
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard (surface ponding occurs during heavy rains, however)
VEGETATION	:	Substantial areas of Cowichan soils are cleared and cultivated, mainly for hay and forage production. Uncleared areas support red alder, willow, maple, western red cedar, and western hemlock including an understory of moisture loving plants such as skunk cabbage.

TYPICAL COWICHAN SOIL PROFILE



Loose, now to slightly decomposed litter of leaves, needles, and twigs; strongly acid.

Very dark brown (10YR 2/2m) silt loam; weak, fine to medium, granular; very friable; sticky; plastic; strongly acid.

Yellowish brown (10YR 5/4m) silty clay loam or silt loam; many, fine, prominent mottles; coarse, subangular blocky; very firm, very sticky, very plastic; medium acid.

Greenish gray (5G7 5/1m) silty clay loam; many coarse, prominent mottles; massive to moderate to strong, medium, subangular blocky; very firm, very sticky, very plastic; slightly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: mull
SOLUM DEPTH (cm)	: 105
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 35-90; 55; compact subsoil
ROOTING DEPTH (cm)	: 40-60
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 0-150; perched
PERVIOUSNESS	: slow
SOIL DRAINAGE	: poor
SOIL TEXTURE	: silt loam, silty clay loam, silty clay

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	12	0.9 (0.7-1.1)	12	1.2 (0.9-1.5)	1	1.5
AWSC (cm/m)	17	20 (10-30)	15	17 (10-26)	14	13 (10-17)
% COARSE > 7.5 cm	370	0	368	0	338	0
FRAGMENTS < 7.5 cm	375	1 (0-2)	372	1 (0-4)	343	1 (0-4)
% PASSING SIEVE 4.76 mm	16	93 (86-100)	14	98 (96-100)	13	97 (90-100)
0.5 mm	16	86 (73-99)	14	96 (92-100)	13	94 (84-100)
0.074 mm	16	72 (54-90)	14	86 (75-97)	13	81 (63-98)
% FINE SAND	16	8 (2-15)	14	5 (0-11)	13	7 (1-16)
% SAND	23	24 (9-38)	24	17 (4-30)	24	18 (3-33)
% CLAY	23	25 (18-32)	24	31 (23-39)	24	29 (18-40)
LIQUID LIMIT (%)	15	55 (30-85)	14	50 (42-68)	13	43 (33-53)
PLASTIC LIMIT (%)	15	43 (23-63)	14	34 (19-49)	13	27 (22-33)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-20 cm Mean (Range)	N	20-70 cm Mean (Range)	N	70-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	22	5.3 (4.9-5.7)	18	6.1 (5.6-6.6)	6	6.6 (6.0-7.2)
(pH) 1:2 $CaCl_2$	22	4.8 (4.5-5.1)	18	5.5 (5.0-6.0)	6	5.9 (5.3-6.5)
ORGANIC CARBON (%)	22	5.1 (1.0-10)	18	1.6 (0.5-3.5)	6	0.5 (0.3-0.7)
NITROGEN (%)	21	0.3 (0.1-0.5)	18	0.09 (0.03-0.18)	6	0.02 (0.01-0.03)
EXCHANGE CAPACITY (meq/100g)	21	35 (20-50)	18	29 (20-38)	6	25 (18-32)
BASE SATURATION (%)	21	41 (27-55)	18	74 (65-95)	6	97 (85-110)
EXCHANGEABLE CATIONS - Ca	21	9.4 (4.4-13.4)	18	14 (9-19)	6	16 (11-21)
(meq/100g) - Mg	21	3.3 (1.9-4.7)	18	7 (3.5-11)	6	8 (5-11)
- Na	21	0.2 (0.1-0.3)	18	0.3 (0.1-0.5)	6	0.3 (0.1-0.4)
- K	21	0.2 (0.1-0.3)	18	0.15 (0.06-0.24)	6	0.14 (0.09-0.2)
PHOSPHORUS (ppm)	21	14 (2-30)	18	4.3 (1-15)	6	2.8 (1.6-4.0)
SULPHUR (ppm)	14	27 (2-80)	13	19 (3-60)	2	8.0 (6-10)

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
COg	Gravelly phase; solum contains 20-50% gravel.
COg,lo	Gravelly, loamy phase; solum contains 20-50% gravels, with 20-50 cm of loam textured surface.
COg,pt	Gravelly, peaty phase; solum contains 20-50% gravels, and has 10-40 cm of humic or mesic organic material over the mineral soil.
COg,s	Gravelly phase, shallow variant; solum contains 20-50% gravels, and a different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
COlo	Loamy phase; 20-50 cm of loam textured surface.
COlo,s	Loamy phase, shallow variant; soil has 20-50 cm of loam textured surface, and a different parent material of strongly contrasting texture occurs within 50-100 cm of the surface.
COpt	Peaty phase; 10-40 cm of humic or mesic organic material occurs over the mineral soil.
COpt,s	Peaty phase, shallow variant; 10-40 cm of humic or mesic organic material occurs over the mineral soil, and a different parent material or strongly contrasting texture occurs within 50-100 cm of the mineral surface.
COs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS COWICHAN SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-25 25-100+	ML, MH ML, MH	A-7 A-7	unsuited unsuited	unsuited unsuited	fair good	fair poor

CROFTON SOILS (CF)

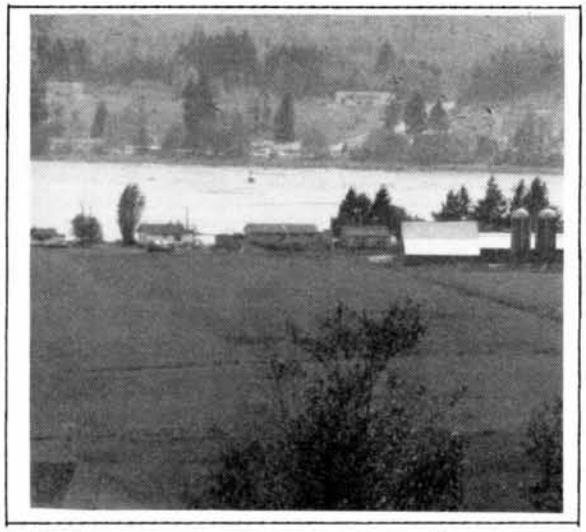


PLATE 4.14: CROFTON SOIL LANDSCAPE

GENERAL COMMENTS

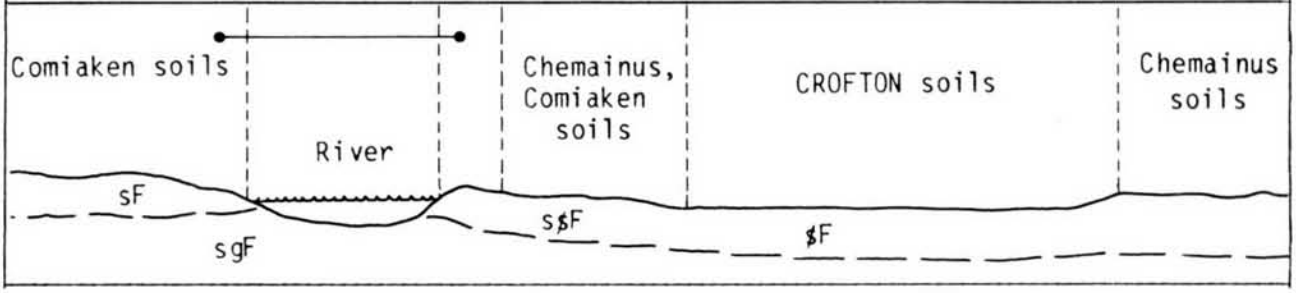
Crofton soils (1200ha) are found on level to depressional areas on recent floodplains and deltas. The largest areas occur on the floodplains of the Courtenay, Somass and Stamp rivers where they are associated with Chemainus soils. They are poorly drained with a year-round water table fluctuating between 0 and 2 m. The parent materials are fluvial deposits with predominantly medium textures.

Crofton soils have very dark brown organic matter-enriched surface horizons with silt loam textures. Most Crofton soils are classified as **Orthic Humic Gleysols**, but Rego Humic Gleysols also occur.

Pasture and hay production are the predominant present uses. However, potential exists for a wide range of crops if flood control, drainage, and irrigation systems are installed. In the improved state Crofton soils are considered prime agricultural land.

Crofton soils are poorly suited for urban and related uses because of high watertables and frequency of flooding.

CROFTON SOIL LANDSCAPE CROSS SECTION*



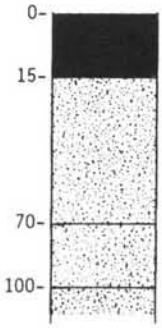
*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	silty fluvial level
TOPOGRAPHY	:	0-2%; nearly level
ELEVATION RANGE	:	0-30 m asl
ASPECT	:	none
FLOOD HAZARD	:	frequent
VEGETATION	:	Significant areas of Crofton soils are cleared and under cultivation. Uncleared areas support black cottonwood, red alder, maple, western red cedar and a variety of shrubs.

TYPICAL CROFTON SOIL PROFILE

DEPTH (cm)



Ah — Very dark brown (10YR 2/2m) silt loam; weak, medium, granular; friable; strongly acid.

Bg — Grayish brown (10 YR 5/2m) silt loam; many, fine, prominent mottles; weak, medium, subangular blocky; very friable; slightly plastic; strongly acid.

Cg — Grayish brown (10YR 5/2m) fine sandy loam to silt loam; common, fine, prominent mottles; massive; slightly plastic; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: mull
SOLUM DEPTH (cm)	: 70
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: no restricting layer
ROOTING DEPTH (cm)	: 100
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 0-150; apparent
PERVIOUSNESS	: moderate
SOIL DRAINAGE	: poor
SOIL TEXTURE	: fine sandy loam, loam, silt loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	2	1.0 (0.9-1.1)	2	1.3 (1.2-1.4)	Est.	(1.2-1.4)
AWSC (cm/m)	3	20 (17-23)	3	22 (14-30)	Est.	(17-23)
% COARSE > 7.5 cm	73	0	73	0	70	0
FRAGMENTS < 7.5 cm	73	1 (0-4)	73	1 (0-4)	70	2 (0-7)
% PASSING SIEVE 4.76 mm	3	99 (98-100)	3	99 (98-100)	2	99 (98-100)
0.5 mm	3	96 (91-100)	3	95 (90-100)	2	98 (95-100)
0.074 mm	3	83 (63-97)	3	77 (58-98)	Est.	80 (60-95)
% FINE SAND	3	7 (1-13)	3	10 (2-18)	Est.	10 (3-17)
% SAND	6	24 (8-40)	5	28 (10-46)	3	21 (6-36)
% CLAY	6	25 (13-37)	5	22 (10-34)	3	24 (10-40)
LIQUID LIMIT (%)	3	53 (43-63)	2	51 (31-71)	2	68 (40-90)
PLASTIC LIMIT (%)	3	39 (36-42)	2	39 (25-53)	2	47 (27-67)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-20 cm Mean (Range)	N	20-70 cm Mean (Range)	N	70-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	6	5.3 (4.7-5.9)	3	5.3 (5.0-5.6)	2	6.0 (5.5-6.5)
(pH) 1:2 $CaCl_2$	6	4.7 (4.2-5.2)	4	5.0 (4.9-5.1)	2	5.5 (5.0-6.0)
ORGANIC CARBON (%)	5	7.6 (3-15)	3	2.5 (1.0-4.0)	1	0.6
NITROGEN (%)	5	0.47 (0.1-0.9)	2	0.2 (0.1-0.3)	1	0.02
EXCHANGE CAPACITY (meq/100g)	5	46 (17-75)	2	33 (20-45)	1	15
BASE SATURATION (%)	5	41 (31-51)	2	51 (45-56)	1	75
EXCHANGEABLE CATIONS - Ca	5	12 (5-19)	2	12 (7-17)	1	8.0
(meq/100g) - Mg	5	4.3 (2.3-6.3)	2	4 (3-5)	1	3.0
- Na	5	0.6 (0.1-1.3)	2	0.4 (0.3-0.5)	1	0.4
- K	5	0.2 (0.1-0.4)	2	0.1 (0.1-0-2)	1	0.1
PHOSPHORUS (ppm)	5	17 (1-45)	2	2 (1-3)		
SULPHUR (ppm)	4	21 (13-30)	2	18 (9-27)		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
CFg	Gravelly phase; solum contains 20-50% gravel.
CFg,s	Gravelly phase, shallow variant; solum contains 20-50% gravels which overlies sandy or gravelly fluvial deposits within 50-100 cm of the surface.
CFpt	Peaty phase; 10-40 cm of humic or mesic organic material occurs over the mineral soil.
CFpt,s	Peaty phase, shallow variant; 10-40 cm of humic or mesic organic material occurs over the mineral soil; sandy or gravelly fluvial deposit occur within 50-100 cm of the mineral surface.
CFpt,vs	Peaty phase, very shallow variant; 10-40 cm of humic or mesic organic material occurs over the mineral soil, and a strongly contrasting texture occurs within 10-50 cm of the surface. Usually a very gravelly sandy fluvial deposit.
CFs	Shallow variant; sandy or gravelly fluvial parent material occurs within 50-100 cm of the surface.
CFvs	Very shallow variant; sandy or gravelly fluvial parent material occurs within 10-50 cm of the surface. Usually a coarse textured fluvial deposit.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS CROFTON SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	ML, MH	A-7	poor	unsuited	good	fair

DASHWOOD SOILS (DW)

PLATE 4.15: DASHWOOD SOIL LANDSCAPE

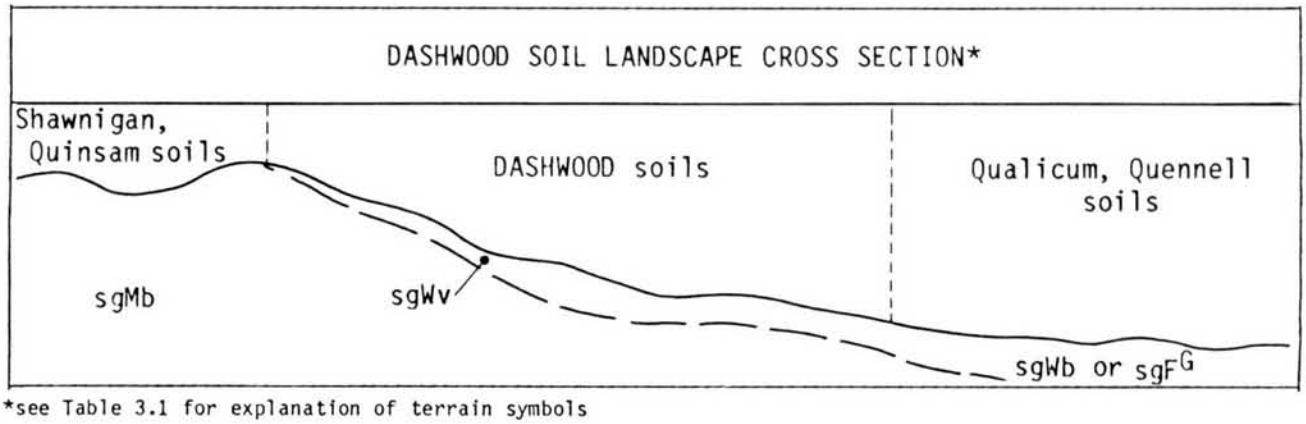
GENERAL COMMENTS

Dashwood soils (5690ha) are found on very gently to strongly sloping areas. They occur throughout the study area and are generally associated with Qualicum or Deerholme soils. They have developed in well to moderately well drained, coarse-textured fluvial, fluvioglacial or marine deposits which overlie very compact morainal deposits.

The highly permeable upper horizons are characterized by high coarse fragment contents of mostly gravel size with a loamy sand to sand matrix. The underlying till generally occurs at 60 to 100 cm depth and has a strongly cemented upper 20 to 30 cm that is gravelly to very gravelly sandy loam and has very low permeability. Dashwood soils are dominantly classified as **Duric Dystric Brunisols** although some Duric Humo Ferric Podzols are also included.

Dashwood soils are of limited use for agriculture due to coarse textures, low moisture holding capacity and poor fertility in the upper horizons. Irrigation, fertilization and stone picking may improve their suitability although most remain marginal for agriculture.

Dashwood soils are moderately suited for urban and related uses due to their upland location and high bearing strength although lateral movement of water along the relatively impermeable till contact can lead to excess water in some lower slope areas. In general interceptor ditches (or drain lines) may be required to control spring and winter seepage. Septic tank absorption fields are severely constrained by the coarse textures and strongly cemented subsoil.

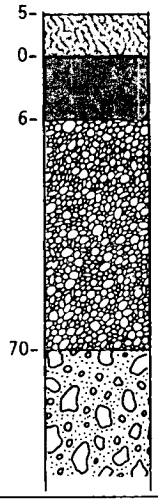


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy gravelly marine or fluvial veneer over sandy gravelly morainal
TOPOGRAPHY	:	5-20% slopes, often seaward sloping
ELEVATION RANGE	:	1-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists mainly of second growth stands of Douglas-fir and western hemlock, while the understory is dominated by salal.

TYPICAL DASHWOOD SOIL PROFILE

DEPTH (cm)



Loose, litter of leaves, needles, and twigs over partly to well decomposed organic matter; very friable humus; extremely acid.

Brown (10YR 4/3m) very gravelly loamy sand; weak, fine, subangular blocky breaking to single-grain; very friable; strongly acid.

Brown (7.5YR 4/4m) very gravelly loamy sand; weak, fine, sub angular blocky breaking to single-grain; very friable; medium acid.

Grayish brown (10YR 5/2m) very gravelly sandy loam; massive; extremely firm; indurated to strongly cemented; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: moder
SOLUM DEPTH (cm)	: 90
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 75-125; 25; duric Horizon
ROOTING DEPTH (cm)	: 75-125
COARSE FRAGMENT CLASS	: 2-4
DEPTH TO AND TYPE OF WATERTABLE (cm)	: N/A
PERVIOUSNESS	: slow to moderate
SOIL DRAINAGE	: well to moderately well
SOIL TEXTURE	: very gravelly loamy sand over very gravelly sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	2	1.6 (1.4-1.7)	2	1.7 (1.5-1.9)	3	1.8 (1.6-2.0)
AWSC (cm/m)	Est.	(4-7)	Est.	(4-7)	4	7 (5-9)
% COARSE > 7.5 cm	284	8 (4-12)	281	8 (4-12)	226	6 (2-10)
FRAGMENTS < 7.5 cm	284	30 (24-36)	281	28 (21-35)	226	25 (16-34)
% PASSING SIEVE 4.76 mm	5	58 (44-72)	3	61 (49-73)	4	59 (48-70)
0.5 mm	5	36 (24-48)	3	33 (17-50)	4	35 (25-45)
0.074 mm	5	17 (10-24)	3	12 (8-16)	4	18 (13-23)
% FINE SAND	5	13 (10-16)	3	11 (9-16)	4	15 (13-17)
% SAND	19	73 (62-85)	6	77 (70-84)	5	68 (62-74)
% CLAY	19	7 (4-10)	6	6 (4-8)	5	6 (4-8)
LIQUID LIMIT (%)	5	31 (10-45)	2	14 (0-28)	3	29 (26-32)
PLASTIC LIMIT (%)	5	26 (11-35)	2	13 (0-26)	3	26 (22-30)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	75-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	23	5.6 (5.2-6.0)	6	5.8 (5.5-6.1)	4	5.8 (5.5-6.1)
(pH) 1:2 $CaCl_2$	25	4.9 (4.5-5.3)	7	5.1 (4.8-5.4)	4	5.1 (4.7-5.5)
ORGANIC CARBON (%)	24	2.3 (1.3-3.3)	6	1.6 (0.4-2.8)	4	0.7 (0.2-1.2)
NITROGEN (%)	8	0.09 (0.05-0.13)	4	0.07 (0.02-0.15)	4	0.03 (0.01-0.05)
EXCHANGE CAPACITY (meq/100g)	8	14 (11-17)	4	13 (9-17)	4	13 (11-15)
BASE SATURATION (%)	8	28 (16-40)	4	25 (5-45)	4	38 (4-70)
EXCHANGEABLE CATIONS - Ca	8	2.8 (1.3-4.1)	4	2.0 (0.8-3.2)	4	3.3 (0.01-6.6)
(meq/100g) - Mg	8	0.6 (0.3-0.9)	4	0.6 (0.3-0.9)	4	1.4 (0.2-2.9)
- Na	8	0.1 (0.01-0.2)	4	0.19 (0.01-0.4)	4	0.13 (0.07-0.2)
- K	8	0.2 (0.1-0.3)	4	0.1 (0.02-0.18)	4	0.14 (0.04-0.28)
PHOSPHORUS (ppm)	8	45 (10-80)	4	33 (10-60)	4	20 (2-40)
SULPHUR (ppm)	7	8 (4-12)	2	7 (5-9)	3	5.0 (4-6)
% IRON	24	0.3 (0.2-0.4)	5	0.2 (0.1-0.3)		
% ALUMINUM	24	0.4 (0.3-0.5)	5	0.3 (0.1-0.5)		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
DWco	Cobbly phase; soil has greater than 20% cobbles and or stones.
DWg	Gravelly phase; solum contains 20-50% gravels.
DWg,id	Gravelly phase, imperfectly drained variant; solum contains 20-50% gravels, and occurs on seepage sites and wetter portions of the landscape.
DWid	Imperfectly drained variant; soils occur on seepage sites and on wet, low portions of the landscape.
DWwc	Weakly cemented variant; a cemented horizon occuring between 50-100 cm depth that is not sufficiently cemented to be a duric horizon.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS DASHWOOD SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-75	GW, GP	A-1-a	poor	good	unsuited	unsuited
75-100+	SM, GM	A-1-b	poor	fair	unsuited	unsuited

DEERHOLME SOILS (DE)

PLATE 4.16: DEERHOLME SOIL LANDSCAPE

GENERAL COMMENTS

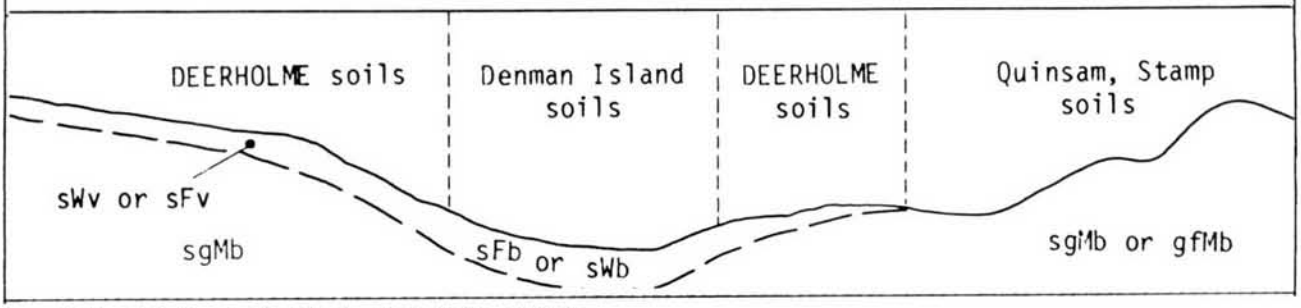
Deerholme soils (410ha) occupy mid-slope areas in nearly level to moderately sloping landscapes and are usually associated with Dashwood or Denman Island soils. Although not very extensive they occur throughout the surveyed area. Deerholme soils are moderately well to well drained. They have developed in shallow (<1 m) sandy fluvial, fluvioglacial or marine deposits overlying gravelly sandy loam morainal deposits. The upper 20 to 50 cm of the morainal material is typically moderately to strongly cemented.

Moderately permeable loamy sand or sandy loam surface horizons overlie massive, slowly permeable gravelly sandy loam horizons. The soils are classified as dominantly **Duric Dystric Brunisols** with minor inclusions of Duric Humo-Ferric Podzols.

Deerholme soils are restricted agriculturally by summer droughtiness which is due to the low water storage capacity in the sandy surface. With irrigation and fertilization a wide range of crops can be grown. Forest productivity is high due to availability of moisture at depth.

Deerholme soils are moderately suited for urban and related uses due to their upland location and high bearing strength although lateral movement of water along the relatively impermeable till contact can lead to excess water in some lower slope areas. In general, interceptor ditches (or drain lines) may be required to control spring and winter seepage.

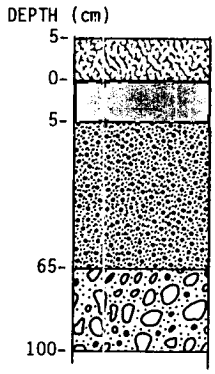
DEERHOLME SOIL LANDSCAPE CROSS SECTION*



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy marine or fluvial veneer over gravelly sandy morainal
TOPOGRAPHY	:	0-15% slopes; nearly level to moderate slopes
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation is mainly composed of second growth Douglas-fir, western red cedar, grand fir, and red alder.

TYPICAL DEERHOLME SOIL PROFILE



LFH — Loose, litter of needles and twigs.

Ah — Dark reddish brown (5YR 2.5/2m) loamy sand; weak to moderate, medium, granular; very friable; strongly acid.

Bm — Strong brown (7.5YR 4/6m) loamy sand; weak, fine, subangular blocky; very friable; very strongly acid.

IIBCc — Light yellowish brown (10YR 6/4m) gravelly sandy loam; massive; very firm; strongly cemented; very strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Moder
SOLUM DEPTH (cm)	:	70-100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	60, 50; duric horizon
ROOTING DEPTH (cm)	:	60
COARSE FRAGMENT CLASS	:	0-1
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	seasonal perched watertables may occur in some areas
PERVIOUSNESS	:	moderate to rapid
SOIL DRAINAGE	:	well
SOIL TEXTURE	:	sandy loam, loamy sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(0.9-1.3)	Est.	(1.2-1.4)	Est.	(1.6-2.0)
AWSC (cm/m)	Est.	(7-11)	Est.	(4-8)	Est.	(5-9)
% COARSE > 7.5 cm	48	1 (0-3)	49	1 (0-3)	36	2 (0-5)
FRAGMENTS < 7.5 cm	48	8 (2-14)	49	8 (2-14)	36	10 (3-17)
% PASSING SIEVE 4.76 mm	Est.	(84-98)	Est.	(76-98)	Est.	(50-70)
0.5 mm	Est.	(53-93)	Est.	(49-91)	Est.	(25-55)
0.074 mm	Est.	(8-30)	Est.	(6-24)	Est.	(13-27)
% FINE SAND	Est.	(12-24)	Est.	(10-20)	Est.	(5-15)
% SAND	2	72 (60-84)	Est.	(68-92)	Est.	(55-75)
% CLAY	2	7 (4-10)	Est.	(2-8)	Est.	(4-12)
LIQUID LIMIT (%)	Est.	(0-30)	Est.	(0-15)	Est.	(24-32)
PLASTIC LIMIT (%)	Est.	(0-24)	Est.	(0-10)	Est.	(22-30)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	4.7	1	4.7	Est.	(5.4-6.3)
(pH) 1:2 $CaCl_2$	1	4.6	1	4.6	Est.	(4.6-5.5)
ORGANIC CARBON (%)	1	1.7	Est.	(0.3-1.5)	Est.	(0.2-0.8)
NITROGEN (%)	Est.	(0.4-1.2)	Est.	(0.01-0.03)	Est.	
EXCHANGE CAPACITY (meq/100g)	Est.	(10-18)	Est.	(7-17)	Est.	(7-17)
BASE SATURATION (%)	Est.	(10-30)	Est.	(10-25)	Est.	(20-50)
EXCHANGEABLE CATIONS - Ca	Est.	(0.5-5)	Est.	(0.5-3)	Est.	(1-4)
(meq/100g) - Mg	Est.	(0.1-1.0)	Est.	(0.1-0.5)	Est.	(0.1-1.0)
- Na	Est.	(0.01-0.5)	Est.	(0.01-0.5)	Est.	(0.01-0.2)
- K	Est.	(0.01-0.5)	Est.	(0.01-0.5)	Est.	(0.1-0.4)
PHOSPHORUS (ppm)			Est.	(10-90)	Est.	(2.3-2.7)
% IRON	1	0.3				
% ALUMINUM	1	0.6				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
DEg	Gravelly phase; solum contains 20-50% gravels.
DEg,id	Gravelly phase, imperfectly drained variant; solum contains 20-50% gravels and occurs on seepage sites and wetter portions of the landscape.
DEid	Imperfectly drained variant; soils occur on seepage sites and on wet, low portions of the landscape.
DEt	Taxadjunct variant; soil taxonomy change. Soil dominantly classified as Duric Humo-Ferric Podzol.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS DEERHOLME SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-65 65-100+	SM SM, GM	A-3,A-2 A-2,A-4	good poor	poor poor	unsuited unsuited	fair-poor poor

DENMAN ISLAND SOILS (DA)

PLATE 4.17: DENMAN ISLAND SOIL LANDSCAPE

GENERAL COMMENTS

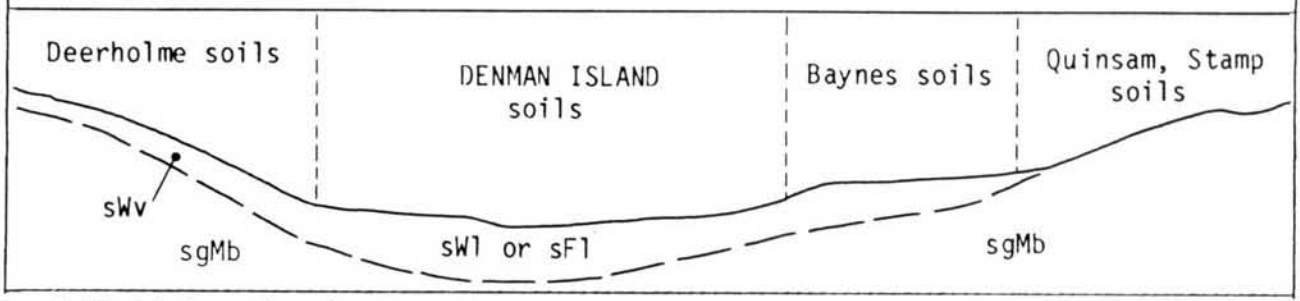
Denman Island soils (1400ha) are found in depressional areas and seepage receiving sites in sandy marine or fluvial landscapes. These soils are poorly drained and seasonal watertable have a perched seasonal watertable.

Denman Island soils are stone-free and generally have a organic matter enriched surface. The have sandy loam or loamy sand textures and normally have at depth underlying impermeable layer of either compacted moraine or bedrock. These soils are classified as dominantly **Orthic Humic Gleysols** with minor inclusions of Orthic Gleysols.

Most Denman Island soils are presently under forest cover. They are limited for agriculture by perched winter and spring watertables. When improved by drainage and irrigation these soils have the potential to grow a wide range of crops.

Denman Island soils are not recommended for urban and related uses because of seasonal high watertables and seepage.

DENMAN ISLAND SOIL LANDSCAPE CROSS SECTION*

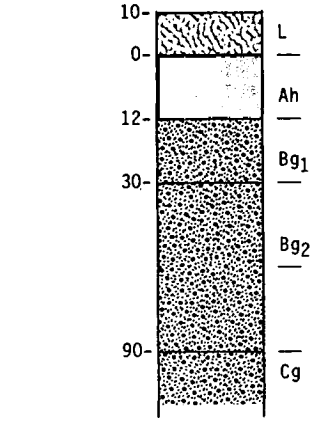


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy fluvial or marine
TOPOGRAPHY	:	2 to 10 percent; nearly level to gentle slopes
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists of red alder, willow, maple and western red cedar with an understory of moisture loving plants that include skunk cabbage and devils club.

TYPICAL DENMAN ISLAND SOIL PROFILE



L — Loose, raw to slightly decomposed litter of leaves, needles, and wood; very strongly acid.

Ah — Very dark grayish brown (10YR 3/2m) sandy loam; moderate, medium, granular; friable; very strongly acid.

Bg1 — Light olive brown (2.5Y 5/4m) sand, or loamy sand; many, coarse, prominent mottles; fine, medium subangular blocky; very friable; very strongly acid.

Bg2 — Light olive brown (2.5Y 5/4m) loamy sand, sand; common, coarse prominent mottles; single grain; very friable; very strongly acid.

Cg — Olive gray (5Y 5/2m) loamy sand or sand; common, medium, prominent mottles; single grain; very friable; very strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: mull
SOLUM DEPTH (cm)	: 90
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: no restricting layer within 1 meter of the surface
ROOTING DEPTH (cm)	: 100+
COARSE FRAGMENT CLASS	: 0-1
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 30-90+; seasonal perched
PERVIOUSNESS	: rapid
SOIL DRAINAGE	: poor to very poor
SOIL TEXTURE	: loamy sand, sand, sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	3	1.1 (0.9-1.2)	1	1.4	1	1.4
AWSC (cm/m)	Est.	(8-15)	Est.	(8-12)	Est.	(7-11)
% COARSE > 7.5 cm	101	0	103	0	99	0
FRAGMENTS < 7.5 cm	103	2 (0-6)	105	2 (0-6)	101	2 (0-6)
% PASSING SIEVE 4.76 mm	2	83 (68-97)	2	87 (76-98)	1	76
0.5 mm	2	71 (50-90)	2	74 (54-93)	1	55
0.074 mm	2	19 (12-27)	2	20 (10-30)	1	30
% FINE SAND	2	18 (14-22)	2	18 (14-22)	1	15
% SAND	6	70 (58-82)	4	72 (52-92)	3	80 (69-91)
% CLAY	5	8 (6-10)	2	3 (1-5)	2	1 (0-3)
LIQUID LIMIT (%)	2	13 (0-26)	2	13 (0-25)	1	25
PLASTIC LIMIT (%)	2	11 (0-22)	2	11 (0-20)	1	21

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	5	5.2 (4.4-6.0)	1	5.9	1	5.9
(pH) 1:2 $CaCl_2$	5	4.6 (4.0-5.2)	1	4.9	1	4.9
ORGANIC CARBON (%)	5	2.7 (2.3-3.1)	1	0.4	1	0.4
NITROGEN (%)	4	0.18 (0.1-0.26)	1	0.02	1	0.02
EXCHANGE CAPACITY (meq/100g)	4	16 (14-18)	1	5	1	4
BASE SATURATION (%)	4	30 (23-37)	1	25	1	23
EXCHANGEABLE CATIONS - Ca	4	3.3 (2.7-3.9)	1	0.8	1	0.6
(meq/100g) - Mg	4	1.0 (0.7-1.3)	1	0.3	1	0.2
- Na	4	0.3 (0.2-0.5)	1	0.14	1	0.08
- K	4	0.1 (0.02-0.2)	1	0.01	1	0.01
PHOSPHORUS (ppm)	4	16 (8-24)	1	17	1	17
SULPHUR (ppm)	1	7.9	1	2.7	1	3.9
% IRON	2	0.5 (0.4-0.6)				
% ALUMINUM	2	0.5 (0.3-0.8)				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
DAg	Gravelly phase; solum contains 20-50% gravels.
DAg,lo	Gravelly, loamy phase; solum contains 20-50% gravels and a 20-50 cm loam textured surface layer.
DAg,s	Gravelly phase, shallow variant; contains 20-50% gravels, which overlies a different parent material or strongly contrasting texture within 50-100 cm of the surface.
DAlo	Loamy phase; 20-50 cm of loam textured surface.
DAlo,pt	Loamy, peaty phase; 20-50 cm of loam textured surface and 10-40 cm of organic material over the mineral soil.
DApt	Peaty phase; 10-40 cm of organic material over the mineral soil.
DApt,s	Peaty phase, shallow variant; 10-40 cm of organic material over the mineral soil and a different parent material or strongly contrasting texture within 50-100 cm of the surface.
DAs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
DAwc	Weakly cemented variant; a cemented horizon occuring between 50-100 cm depth that is not sufficiently cemented to be a duric horizon.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS DENMAN ISLAND SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	SM	A-2-4	good	poor	unsuited	poor

FAIRBRIDGE SOILS (FB)

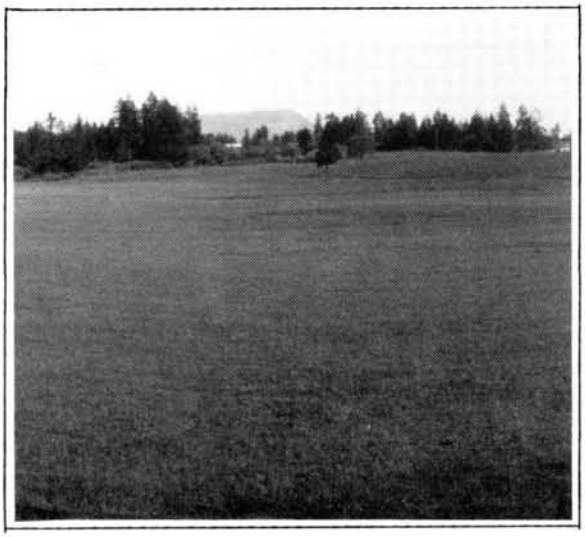


PLATE 4.18: FAIRBRIDGE SOIL LANDSCAPE

GENERAL COMMENTS

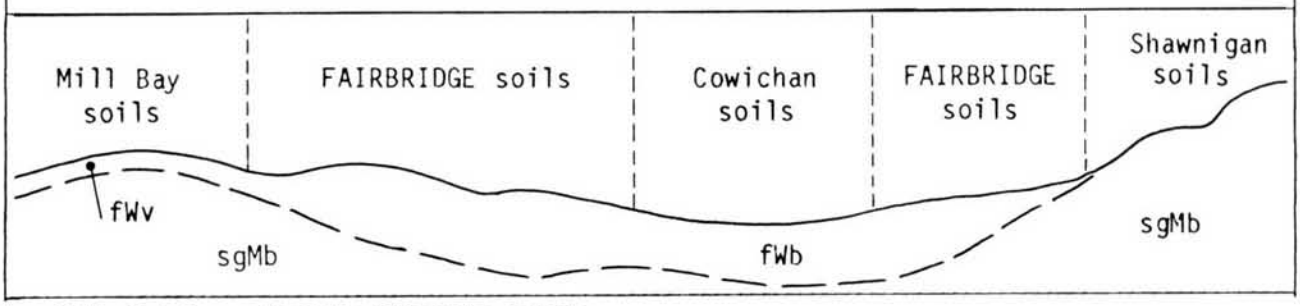
Fairbridge soils (800ha) occur below elevations of about 100 m. They occupy nearly level to moderate slopes within generally undulating areas of medium-textured deposits and are usually associated with Cowichan and Hillbank soils. These soils are limited to the eastern coastal plain of Vancouver Island. Fairbridge soils are imperfectly to moderately well drained and have a perched watertable during the winter months.

Fairbridge soils have a dark yellowish brown surface horizon which contains many concretions. All horizons are stone-free and silt loam or silty clay loam in texture. The lower horizons are very compact and slowly permeable. The seasonally perched watertable causes prominent mottling in the lower horizons. These soils are dominantly classified as **Gleyed Eluviated Dystric Brunisols** with subdominant inclusions of Gleyed Dystric Brunisols.

Fairbridge soils are considered prime agricultural land with dairying and hay production being the main present land uses. They are suitable for a wide range of crops but irrigation and fertilization are required for optimal yields. Soil moisture content should be carefully observed prior to cultivation since structure deterioration, increased surface erosion, and surface crusting and puddling can result if soil is cultivated when wet. Perched watertables during winter months may adversly affect some perennial crops.

Urban and related uses are constrained by perched watertables, slow permeability and generally low bearing strengths.

FAIRBRIDGE SOIL LANDSCAPE CROSS SECTION*

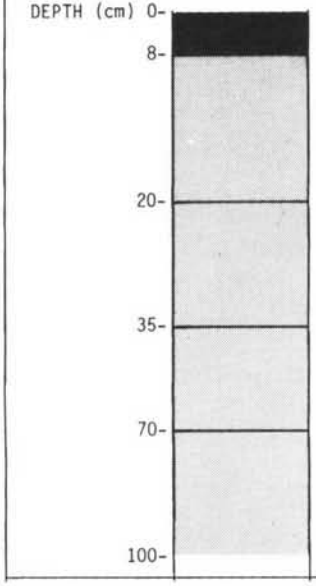


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	silty marine blanket
TOPOGRAPHY	:	2-15%, undulating
ELEVATION RANGE	:	0 to 100 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Substantial areas of Fairbridge soils are cleared and cultivated mainly for pasture and hay production. Uncleared areas support mixed stands of second growth Douglas-fir, western red cedar, red alder, maple, and grand fir. The understory consists of a variety of shrubs usually dominated by salal.

TYPICAL FAIRBRIDGE SOIL PROFILE



Ahe	Dark yellowish brown (10YR 4/4m) silt loam; weak, fine to medium, subangular blocky to weak to moderate, very fine to fine subangular blocky; very friable, slightly sticky, slightly plastic; abrupt smooth boundary; medium acid; few, fine, spherical durinodes throughout matrix.
$Bmcc_1$	Strong brown (7.5YR 5/6m) silt loam; weak to moderate, medium, subangular blocky; very friable, slightly sticky, slightly plastic; gradual, smooth boundary; strongly acid common, fine, spherical durinodes throughout matrix.
$Bmcc_2$	Light yellowish brown (2.5Y 6/4m) silt loam; moderate, medium, subangular blocky; soft, very friable, slightly sticky, plastic; gradual, wavy boundary; strongly acid; common, fine, spherical durinodes throughout matrix.
Bmgj	Pale yellow (2.5Y 7/4m) silt loam; common, medium, distinct mottles; moderate, medium to coarse, subangular blocky; slightly hard, sticky, plastic; diffuse, wavy boundary; strongly acid.
Bgj	Yellowish brown (10YR 5/4m) silt loam; common, fine, prominent mottles; massive to moderate, fine to medium, angular blocky; firm, plastic; gradual, smooth boundary; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Moder
SOLUM DEPTH (cm)	: 100-130
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 70-100; compact lower horizons
ROOTING DEPTH (cm)	: 70-100
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 70-180; seasonal perched
PERVIOUSNESS	: slow
SOIL DRAINAGE	: imperfectly
SOIL TEXTURE	: silt loam, silty clay loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	4	1.0 (0.9-1.1)	3	1.2 (1.1-1.3)	Est.	1.5 (1.4-1.6)
AWSC (cm/m)	Est.	20 (18-22)	Est.	18 (16-20)	Est.	17 (15-19)
% COARSE > 7.5 cm	163	0	161	0	154	0
FRAGMENTS < 7.5 cm	164	2 (0-5)	162	2 (0-5)	155	2 (0-5)
% PASSING SIEVE 4.76 mm	11	92 (86-99)	8	91 (78-100)	7	94 (82-100)
0.5 mm	11	83 (73-93)	8	86 (73-99)	7	91 (79-100)
0.074 mm	11	64 (50-79)	8	61 (49-73)	7	67 (51-83)
% FINE SAND	11	11 (3-17)	8	13 (8-18)	7	13 (7-19)
% SAND	18	29 (13-45)	11	37 (23-50)	9	28 (15-43)
% CLAY	16	21 (15-27)	9	17 (10-24)	9	20 (13-27)
LIQUID LIMIT (%)	9	41 (30-52)	8	31 (21-41)	7	30 (25-35)
PLASTIC LIMIT (%)	9	31 (24-38)	8	25 (15-30)	7	22 (19-25)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	17	5.4 (5.0-5.8)	9	5.7 (5.4-6.0)	2	5.5 (5.3-5.8)
(pH) 1:2 $CaCl_2$	17	4.9 (4.5-5.3)	9	5.0 (4.7-5.3)	2	4.8 (4.3-5.3)
ORGANIC CARBON (%)	12	2.7 (1.0-5.0)	9	0.9 (0.2-2.0)	2	0.9 (0.3-1.5)
NITROGEN (%)	16	0.3 (0.1-0.5)	9	0.09 (0.02-0.2)	2	0.03 (0.02-0.05)
EXCHANGE CAPACITY (meq/100g)	15	28 (20-40)	8	19 (8-30)	1	26
BASE SATURATION (%)	15	30 (20-40)	8	49 (34-70)	1	75
EXCHANGEABLE CATIONS - Ca	15	6.4 (3-9)	8	5.9 (3.3-8.5)	1	13
(meq/100g) - Mg	15	1.6 (0.8-2.4)	8	2.3 (2.0-3.3)	1	6.0
- Na	15	0.1 (0.05-0.2)	8	0.1 (0.05-0.2)	1	0.3
- K	15	0.3 (0.1-0.5)	8	0.25 (0.05-0.5)		0.2
PHOSPHORUS (ppm)	10	41 (5-100)	8	11 (3-20)	1	11
SULPHUR (ppm)	10	11 (3-25)	8	8 (2-14)	1	4.7
% IRON	8	0.5 (0.3-0.7)	1	0.2		
% ALUMINUM	8	0.4 (0.2-0.4)	1	0.2		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
FBg	Gravelly phase; solum contains 20-50% gravels.
FBg,lo	Gravelly, loamy phase; solum contains 20-50% gravels, with 20-50 cm of loam textured surface.
FBlo	Loamy phase; 20-50 cm of loam textured surface.
FBw	Strongly mottled phase; wetter moisture regime in profile as evidence by prominent mottling within 50 cm of the surface. Landscape position not typical of Gleysolic soils.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
FAIRBRIDGE SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-50	ML, CL	A-4	poor	unsuited	good	good
50-100+	ML, CL	A-4	poor	unsuited	good	fair-poor

FLEWETT SOILS (FT)

PLATE 4.19: FLEWETT SOIL LANDSCAPE

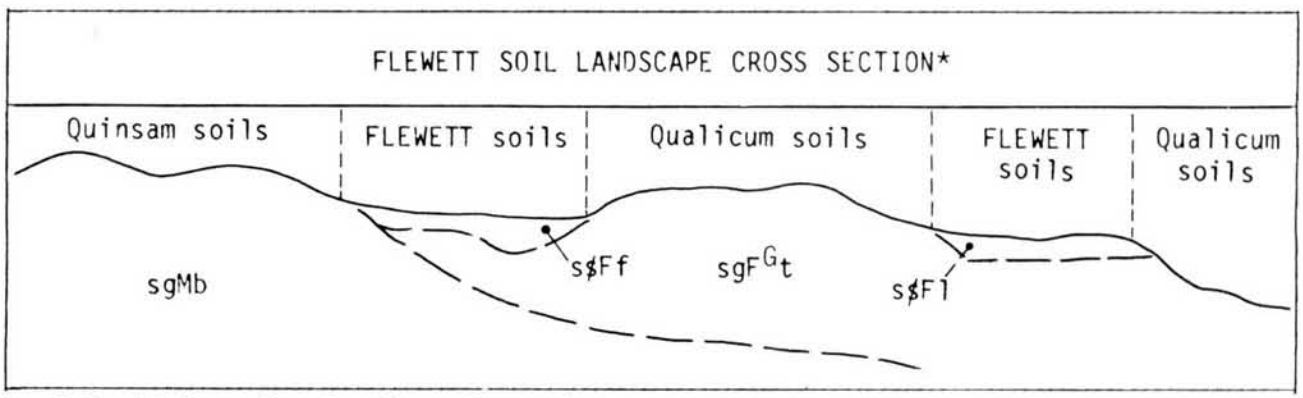
GENERAL COMMENTS

Flewett soils (60ha) are found on level to very gently sloping terraces and fluvial fans. They are minor in extent and are generally associated with Qualicum or Quennell soils. They are well drained and not affected by flooding. The parent materials are non-stony, sandy fluvial or fluvioglacial deposits.

Flewett soils have dark reddish brown to yellowish brown fine sandy loam, loam or silt loam surface horizons. Most Flewett soils have coarser textures at depth. They are classified as **Orthic Dystric Brunisols.**

Flewett soils are considered desirable for agriculture principally because of their textures, negligible slopes, and absence of coarse fragments. Present land uses are pasture and hay production, although these soils are well suited to growing a wide range of crops such as vegetables, berries and some tree fruits. Irrigation is necessary for optimizing yields.

Flewett soils have no limitations for urban and related uses.



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy silty fluvial, or fluvioglacial
TOPOGRAPHY	:	0-5%
ELEVATION RANGE	:	20-200 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Substantial areas of Flewett soils are cleared and cultivated. Uncleared areas support Douglas-fir, grand fir, western red cedar and red alder.

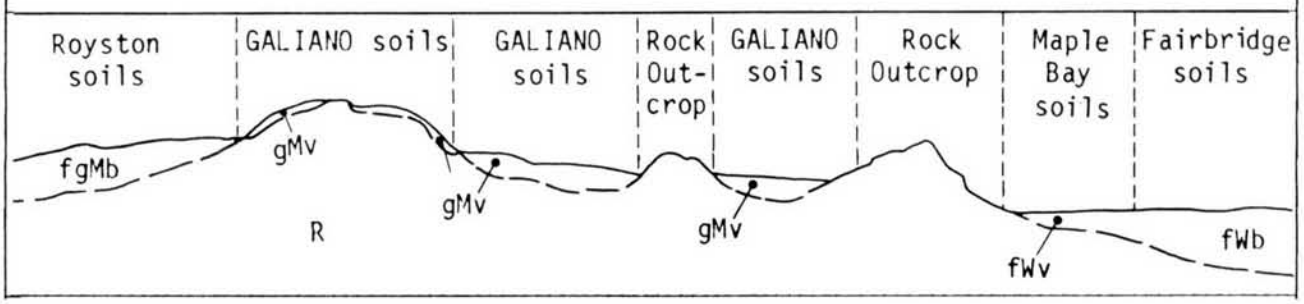
GALIANO SOILS (GA)

PLATE 4.20: GALIANO SOIL LANDSCAPE

GENERAL COMMENTS

Galiano soils (320ha) have developed on coarse to medium textured morainal or colluvial veneers overlying shale or siltstone bedrock. The soft, easily-weathered bedrock does not produce stoniness, rockiness, or slope limitations for agriculture that are as severe as those for other shallow to bedrock soils. Galiano soils are well to moderately well drained usually forested or used for pasture. They are classified as **Orthic Dystric Brunisols**; lithic phase, with lesser occurrences of Orthic Humo-Ferric Podzols; lithic phase. Limitations for urban development are not as severe as for other shallow to bedrock soils. The topography is generally more moderate, medium to fine surface textures and the permeable paralithic subsoil pose only moderate limitations for excavations and service installations.

GALIANO SOIL LANDSCAPE CROSS SECTION*

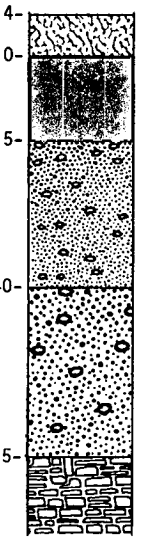


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	gravelly fine morainal veneer or fine rubbly colluvial veneer over siltstone or shale
TOPOGRAPHY	:	0-15% slopes (subdued, bedrock-controlled topography)
ELEVATION RANGE	:	0-200 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists of semi-open stands of Douglas-fir, lodgepole pine, arbutus, some western red cedar and western hemlock. The understory is usually dominated by salal.

TYPICAL GALIANO SOIL PROFILE



LF — Loose litter of leaves, needles, and twigs over semi decomposed organic matter; medium acid.

Ahe — Dark grayish brown (10YR 4/2m) gravelly loam; moderate, fine, granular; friable; very strongly acid.

Bm — Yellowish brown (10YR 4/2m) gravelly loam; moderate, medium to coarse, subangular blocky; friable; very strongly acid.

BC — Pale brown (10YR 6/3m) gravelly loam; very fine to fine, subangular blocky; friable to firm; very strongly acid.

R — Shale or siltstone bedrock

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	50-100
HUMUS FORM	:	Moder
SOLUM DEPTH (cm)	:	50-100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	50-100; bedrock
ROOTING DEPTH (cm)	:	50-100
COARSE FRAGMENT CLASS	:	0-3
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	N/A
PERVIOUSNESS	:	moderate
SOIL DRAINAGE	:	well to moderately well
SOIL TEXTURE	:	gravelly loam to gravelly sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-70 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.2-1.5)	Est.	(1.4-1.6)	Est.	(1.8-2.0)
AWSC (cm/m)	Est.	(7-13)	Est.	(7-13)	Est.	(5-9)
% COARSE > 7.5 cm	11	4 (1-7)	10	4 (1-7)	4	4 (1-7)
FRAGMENTS < 7.5 cm	11	27 (20-35)	10	25 (16-34)	4	31 (15-50)
% PASSING SIEVE 4.76 mm	Est.	(80-95)	Est.	(70-95)	Est.	(65-90)
0.5 mm	Est.	(70-90)	Est.	(65-85)	Est.	(55-75)
0.074 mm	Est.	(45-65)	Est.	(40-60)	Est.	(35-55)
% FINE SAND	Est.	(4-12)	Est.	(4-12)	Est.	(3-9)
% SAND	Est.	(40-60)	Est.	(40-50)	Est.	(40-56)
% CLAY	Est.	(8-22)	Est.	(8-16)	Est.	(7-15)
LIQUID LIMIT (%)	Est.	(18-40)	Est.	(16-36)	Est.	(14-34)
PLASTIC LIMIT (%)	Est.	(14-30)	Est.	(15-25)	Est.	(14-24)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	Mean (Range)
SOIL REACTION 1:1 H_2O	Est.	(5.1-5.5)	Est.	(5.2-5.6)		
(pH) 1:2 $CaCl_2$	Est.	(4.7-4.9)	Est.	(4.8-5.0)		
ORGANIC CARBON (%)	Est.	(0.8-1.4)	Est.	(0.2-0.8)		
NITROGEN (%)	Est.	(0.01-0.2)	Est.	(0.01-0.05)		
EXCHANGE CAPACITY (meq/100g)	Est.	(15-25)	Est.	(15-20)		
BASE SATURATION (%)	Est.	(40-60)	Est.	(60-80)		
EXCHANGEABLE CATIONS - Ca	Est.	(3-9)	Est.	(5-11)		
(meq/100g) - Mg	Est.	(2.0-4.0)	Est.	(2.0-4.0)		
- Na	Est.	(0.2-0.4)	Est.	(0.1-0.4)		
- K	Est.	(0.3-0.9)	Est.	(0.3-0.7)		
PHOSPHORUS (ppm)	Est.	(3-10)	Est.	(3-10)		
% IRON	Est.	(0.2-0.4)	Est.	(0.1-0.3)		
% ALUMINUM	Est.	(0.1-0.3)	Est.	(0.1-0.3)		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITIONIPTION
GA13	Very shallow lithic phase; shale or siltstone bedrock occurs within 50 cm of the surface.
GAr	Rubbly/blocky phase; the solum contains >50% angular cobbles and stones, usually derived from local bedrock.
GAvg	Very gravelly phase; the solum contains >50% gravel sized coarse fragments.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS GALIANO SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-75	ML, SM	A-4	poor	poor	poor	poor

HILLBANK SOILS (HT)

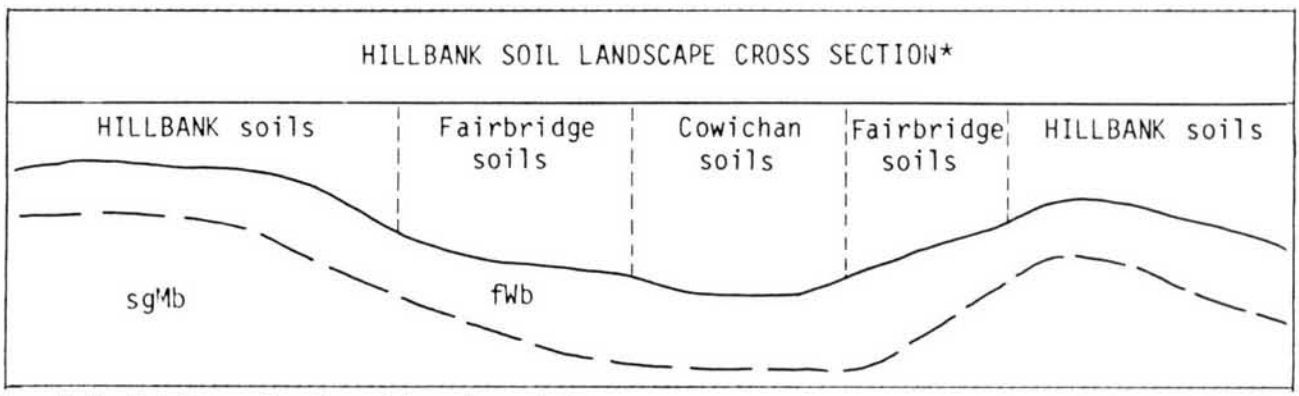
PLATE 4.21: HILLBANK SOIL LANDSCAPE

GENERAL COMMENTS

Hillbank soils (125ha) occur below elevations of about 130 m. They occupy very gentle to strong slopes within undulating silty marine landscapes and are usually associated with Fairbridge soils. Most of these soils are mapped as secondary components in Fairbridge - Hillbank complexes. They are moderately well drained. Hillbank soils have dark yellowish brown organic matter-enriched loam surface horizons that contain many concretions. The lower horizons are lighter brown with silt loam textures. Faint mottling sometimes occurs below 50 cm depth. Hillbank soils are classified as **Orthic Dystric Brunisols** with inclusions of Orthic Humo-Ferric Podzols and Eluviated Dystric Brunisols.

Most Hillbank soils are used for hay and pasture. With supplemental irrigation they are considered quality agricultural soils suitable for a wide range of crops.

Hillbank soils are moderately suited for urban and related uses. Low bearing strength, slow perviousness and susceptibility to erosion can cause problems.

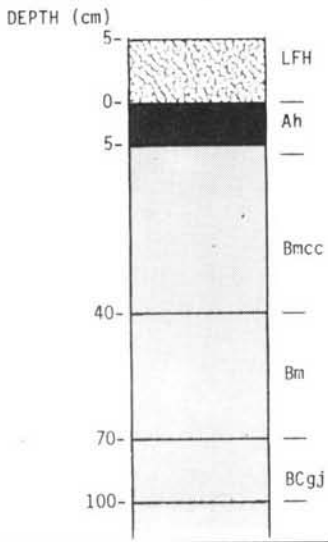


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	silty to sandy silty marine blanket
TOPOGRAPHY	:	5-20%; very gentle to strong slopes
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation on Hillbank soils consists of Douglas-fir, western red cedar, grand fir, red alder and maple. The understory is dominated by salal.

TYPICAL HILLBANK SOIL PROFILE



Loose, litter of leaves, needles and twigs over partly to well decomposed organic matter; strongly acid.

Dark brown (7.5YR 3/2m) loam; weak to moderate, medium, granular; friable; strongly acid.

Dark yellowish brown (10YR 4/5m) loam; moderate, medium, subangular blocky; friable, slightly sticky, slightly plastic; spherical concretions throughout matrix; medium acid.

Yellowish brown (10YR 5/4m) loam to silt loam; moderate, medium, subangular blocky; friable; slightly plastic; medium acid.

Light yellowish brown (10YR 6/4m) silt loam; few, medium, distinct mottles; massive to moderate, medium angular blocky; firm; plastic; slightly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Mull
SOLUM DEPTH (cm)	: >100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 80; compact lower horizons
ROOTING DEPTH (cm)	: 80
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: N/A
PERVIOUSNESS	: slow
SOIL DRAINAGE	: moderately well
SOIL TEXTURE	: loam, silt loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	1	1.1	Est.	(1.3-1.5)	1	1.6
AWSC (cm/m)	Est.	(17-21)	Est.	(15-19)	Est.	(16-20)
% COARSE > 7.5 cm	57	0	57	0	55	0
FRAGMENTS < 7.5 cm	57	3 (0-7)	57	3 (0-7)	55	3 (0-7)
% PASSING SIEVE 4.76 mm	2	97 (95-100)	2	100 (98-100)	2	98 (96-100)
0.5 mm	2	80 (71-89)	2	97 (93-100)	2	88 (76-96)
0.074 mm	2	58 (51-65)	2	70 (60-80)	2	71 (65-77)
% FINE SAND	2	13 (6-20)	2	15 (13-17)	2	7 (4-11)
% SAND	7	42 (22-62)	4	36 (16-56)	3	36 (30-42)
% CLAY	7	12 (6-18)	4	16 (7-25)	3	20 (15-25)
LIQUID LIMIT (%)	Est.	(25-47)	2	(25-35)	2	34 (24-44)
PLASTIC LIMIT (%)	Est.	(18-30)	2	(24-28)	2	29 (20-38)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	75-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	4	5.2 (4.8-5.6)	2	5.4 (5.3-5.5)	2	5.8 (5.5-6.1)
(pH) 1:2 $CaCl_2$	4	4.7 (4.5-4.9)	2	4.9 (4.8-5.0)	2	5.3 (5.0-5.6)
ORGANIC CARBON (%)	3	2.2 (1.2-3.2)	2	1.0 (0.5-2.0)	2	0.4 (0.3-0.5)
NITROGEN (%)	2	0.3 (0.1-0.5)	2	0.06 (0.04-0.08)	2	0.02 (0.01-0.02)
EXCHANGE CAPACITY (meq/100g)	2	23 (15-30)	2	22 (12-32)	2	23 (15-35)
BASE SATURATION (%)	2	20 (15-30)	2	51 (40-60)	2	70 (50-90)
EXCHANGEABLE CATIONS - Ca	2	3.0 (2-4)	2	7.0 (5-10)	2	14 (8-20)
(meq/100g) - Mg	2	1.0 (0.05-1.5)	2	3.0 (2-4)	1	2
- Na	2	0.2 (0.1-0.3)	2	0.2 (0.1-0.3)	1	0.2
- K	1	0.1	2	0.6 (0.3-0.8)	1	0.2
PHOSPHORUS (ppm)	1	36	2	21 (13-30)	1	15
% IRON	1	0.3				
% ALUMINUM	1	0.2				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
HTg	Gravelly phase; solum contains 20-50% gravel.
HTg,12	Gravelly, shallow lithic phase; solum contains 20-50% gravels, and bedrock occurs within 50-100 cm of the surface.
HT12	Shallow lithic phase; bedrock occurs within 50-100 cm of the surface.
HTs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
HTt	Taxadjunct variant; soil taxonomy change.
HTwc	Weakly cemented variant; a weakly cemented horizon occuring between 50-100 cm depth that is not sufficiently cemented to be a duric horizon.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS HILLBANK SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	ML, SM	A-4	poor	unsuited	good	good-fair

ILLUSION SOILS (IN)

PLATE 4.22: ILLUSION SOIL LANDSCAPE

GENERAL COMMENTS

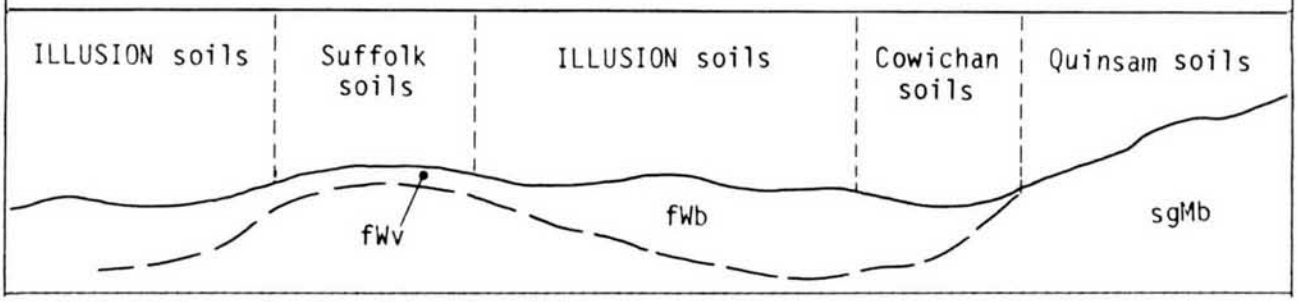
Illusion soils (1665ha) generally occur in the north western portion (higher preciptation) of the report area below 130 meters elevation and are associated with Cowichan and Puntledge soils. They have developed on nearly level to undulating marine landscapes, which are medium to fine textured. These soils are imperfectly drained, and have a perched water table during the winter months.

The surface horizons tend to be a dark brown organic matter enriched silt loam or loam that are moderately pervious, stone free and contain a high percentage of concretions. The lower horizons are a slowly permeable reddish yellow to yellowish brown fine sandy loam, silt loam or silty clay loam. Illusion soils are classified as **Gleyed Humo-Ferric Podzols.**

Much of the Illusion soils area have been cleared and generally support productive pasture and hay crops. The introduction of irrigation and drainage would enable these soils to be highly productive for a wide range of crops.

Illusion soils have a moderate to low suitability for urban and related developments due to high seasonal watertables and slowly permeable subsoils.

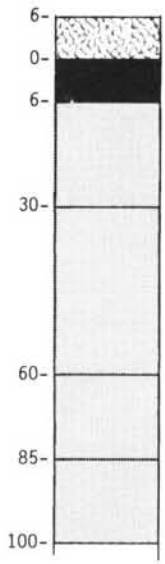
ILLUSION SOIL LANDSCAPE CROSS SECTION*



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	silt loam or loam marine veneer over medium or firm textured marine
TOPOGRAPHY	:	0-8% slopes; nearly level to undulating topography
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	majority of area is cleared and cultivated; forested areas consist of Douglas Fir, maple and alder

TYPICAL ILLUSION SOIL PROFILE



LFH — Loose, litter of leaves, needles, and twigs over partly to well decomposed organic matter; extremely acid.

Ah — Dark reddish brown (5YR 3/2m) loam; weak to moderate, medium granular; friable; strongly acid.

Bfcc — Reddish brown (5YR 4/4m) loam; moderate, medium, subangular blocky; very friable; slightly sticky; slightly plastic; abrupt, smooth boundary; strongly acid; many fine sperical concretions.

Bfgj — Strong brown (7.5YR 4/6m) loam to silt loam; moderate, medium, subangular blocky; very friable; slightly sticky; slightly plastic; diffuse wavy boundary; strongly acid.

Bg — Light gray (10YR 7/2m) silt loam; common, medium, distinct mottles; moderate, medium, subangular blocky; friable; slightly sticky; slightly plastic; medium acid.

BCg — Gray (5Y 6/1m) silty clay loam; common, medium, prominent mottles; medium, medium to coarse, angular blocky; very firm; sticky; plastic; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Mull
SOLUM DEPTH (cm)	: 100-130
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 70-100; compact lower horizons
ROOTING DEPTH (cm)	: 70-100
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 70-180; seasonal perched
PERVIOUSNESS	: slow
SOIL DRAINAGE	: imperfect
SOIL TEXTURE	: loam, fine sandy loam, silt loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.0-1.2)	Est.	(1.1-1.3)	1	1.3
AWSC (cm/m)	15		1	13	1	15
% COARSE > 7.5 cm	7	0	7	0	7	0
FRAGMENTS < 7.5 cm	7	2 (0-4)	7	1 (0-2)	7	1 (0-2)
% PASSING SIEVE 4.76 mm	1	69	1	68	1	77
0.5 mm	1	47	1	45	1	65
0.074 mm	1	31	1	32	1	34
% FINE SAND	1	12	1	10	1	20
% SAND	1	48	1	43	1	58
% CLAY	1	9	1	14	1	14
LIQUID LIMIT (%)	Est.	(15-35)	Est.	(15-35)	Est.	(25-35)
PLASTIC LIMIT (%)	Est.	(14-22)	Est.	(17-22)	Est.	(19-25)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	5.3	1	5.4	1	5.6
(pH) 1:2 $CaCl_2$	1	4.7	1	5.0	1	5.1
ORGANIC CARBON (%)	1	3.3	1	2.1	1	1.1
NITROGEN (%)	1	0.16	1	0.1	1	0.04
EXCHANGE CAPACITY (meq/100g)	1	31	1	25	1	24
BASE SATURATION (%)	1	28	1	38	1	75
EXCHANGEABLE CATIONS - Ca	1	6.4	1	6.8	1	12.5
(meq/100g) - Mg	1	2.0	1	2.4	1	4.9
- Na	1	0.2	1	0.2	1	0.3
- K	1	0.09	1	0.08	1	0.08
PHOSPHORUS (ppm)	1	18	1	21	1	6
% IRON	1	0.5	1	0.4		
% ALUMINUM	1	0.7	1	0.5		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
INg	Gravelly phase; solum contains 20-50% gravel.
INmd	Moderately well to well drained variant; drier soil moisture regime, with predominantly Orthic Humo-Ferric Podzol soil development.
INw	Strongly mottled phase; wetter moisture regime in profile as evidenced by prominent mottling within 50 cm of the surface. Landscape position not typical of gleysolic soils.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
ILLUSION SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-50	ML, SM	A-2-4	poor	unsuited	good	good
50-100+	ML, MH	A-4	poor	unsuited	good	fair

KAPTARA SOILS (KP)

PLATE 4.23: KAPTARA SOIL LANDSCAPE

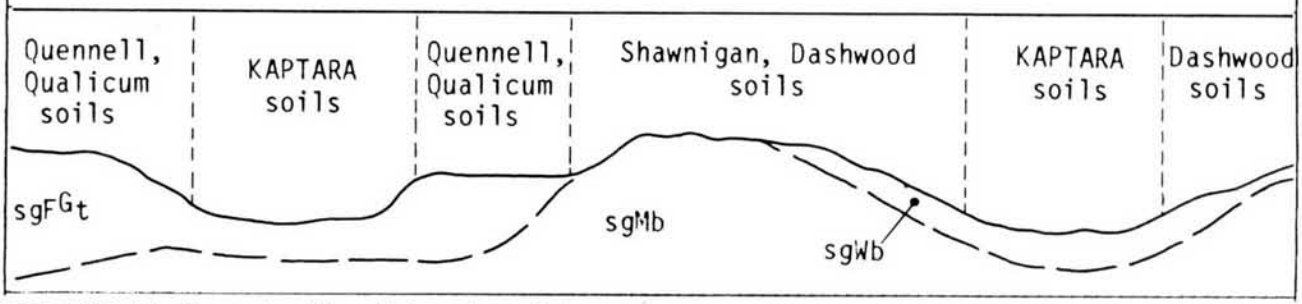
GENERAL COMMENTS

Kaptara soils (865ha) have developed on deep, coarse-textured fluvial and fluvioglacial landforms. They also occur on coarse-textured marine deposits. Kaptara soils are very minor in extent and occur in small areas associated with more extensive areas of Qualicum and Quennel soils. These poorly drained soils normally occur in seepage locations or where an underlying impermeable layer restricts drainage and causes a perched watertable.

Kaptara soils have dark, organic matter-enriched surfaces and very gravelly loamy sand textures. They are classified as **Orthic Humic Gleysols**, with lesser occurrences of Orthic Gleysols.

Kaptara soils are marginal for agricultural uses and unsuitable for urban uses due to coarse-textures and wetness.

KAPTARA SOIL LANDSCAPE CROSS SECTION*



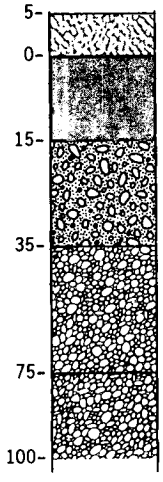
*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy gravelly fluvial, glaciofluvial or marine
TOPOGRAPHY	:	0-15%; level to depressional
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists of red alder, maple, western red cedar, willow, with an understory dominated by moisture loving plants such as skunk cabbage.

TYPICAL KAPTARA SOIL PROFILE

DEPTH (cm)



Loose litter of leaves, needles, and twig over well decomposed organic matter; very strongly acid.

Very dark brown (10YR 2/2m) gravelly loam; moderate, medium granular; very friable; very strongly acid.

Brown (7.5YR 4/4m) very gravelly sandy loam; weak, coarse, subangular blocky breaking to single grain; very friable; very strongly acid.

Olive gray (5Y 4/2w) very gravelly loamy sand; common, medium, prominent mottles; weak, medium, subangular blocky breaking to single-grain; nonsticky.

Olive gray (5Y 4/2w) very gravelly sand; common, medium, prominent mottles; moderate, medium angular blocky breaking to single-grained; nonsticky; discontinuous, moderate cementation.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Mull
SOLUM DEPTH (cm)	:	80-110
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	80-100; 20-30; moderately cemented horizon
ROOTING DEPTH (cm)	:	80
COARSE FRAGMENT CLASS	:	2-3
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	30-100; perched
PERVIOUSNESS	:	rapid to moderate
SOIL DRAINAGE	:	poor to very poor
SOIL TEXTURE	:	very gravelly sand loam over very gravelly loam sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.6-1.8)	Est.	(1.8-2.0)	Est.	(2.0-2.15)
AWSC (cm/m)	Est.	(7-11)	Est.	(6-10)	Est.	(4-6)
% COARSE > 7.5 cm	35	3 (0-7)	33	4 (0-10)	22	3 (0-6)
FRAGMENTS < 7.5 cm	35	28 (18-38)	33	33 (27-40)	22	33 (25-40)
% PASSING SIEVE 4.76 mm	Est.	(35-55)	Est.	(35-75)	1	63
0.5 mm	Est.	(15-35)	Est.	(15-35)	1	32
0.074 mm	Est.	(3-8)	Est.	(3-8)	1	12
% FINE SAND	Est.	(3-15)	Est.	(5-10)	1	8
% SAND	1	65 (60-80)	1	74	1	78
% CLAY	1	8 (3-10)	1	10	1	5
LIQUID LIMIT (%)		0		0	1	25
PLASTIC LIMIT (%)		non plastic		non plastic	1	21

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-20 cm Mean (Range)	N	20-70 cm Mean (Range)	N	70-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	5.7	1	5.5	1	5.4
(pH) 1:2 $CaCl_2$	1	4.9	1	4.8	1	4.8
ORGANIC CARBON (%)	1	8.6	1	0.7	1	0.4
NITROGEN (%)	1	0.6	1	0.04	1	0.02
EXCHANGE CAPACITY (meq/100g)	1	47	1	11	1	8.2
BASE SATURATION (%)	1	37	1	58	1	66
EXCHANGEABLE CATIONS - Ca	1	15	1	5	1	3.8
(meq/100g) - Mg	1	3.2	1	1.6	1	1.4
- Na	1	0.17	1	0.12	1	0.2
- K	1	0.15	1	0.04	1	0.04
PHOSPHORUS (ppm)	1	5.3	1	1.8	1	3.0
SULPHUR (ppm)	1	37	1	3.0	1	4.2

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
KPco	Cobbly phase; soil has greater than 20% cobbles and or stones.
KPg	Gravelly phase; solum contains 20-50% gravel.
KPg,pt	Gravelly, peaty phase; solum contains 20-50% gravels, and has 10-40 cm of humic or mesic organic material over the mineral soil.
KPg,s	Gravelly phase, shallow variant; solum contains 20-50% gravels, which overlies a different parent material or strongly contrasting texture within 50-100 cm of the surface.
KPg,vs	Gravelly phase, very shallow variant; solum contains 20-50% gravels, which overlies a different parent material or strongly contrasting texture within 10-50 cm of the surface.
KPlo	Loamy phase; 20-50 cm of loam textured surface.
KPlo,pt	Loamy, peaty phase; 20-50 cm of loam textured surface, and has 10-40 cm of humic or mesic organic material over the mineral soil.
KPmc	Moderately cemented variant; moderate cementation occurs in the subsoil.
KPpt	Peaty phase; 10-40 cm of humic or mesic organic material occurs over the mineral soil.
KPpt,s	Peaty phase, shallow variant; 10-40 cm of humic or mesic organic material occurs over the mineral soil, and a different parent material or strongly contrasting texture occurs within 50-100 cm of the mineral surface.
KPs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS KAPTARA SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	GW, GP	A-1-a	poor	fair	unsuited	unsuited

KOKSILAH SOILS (KH)

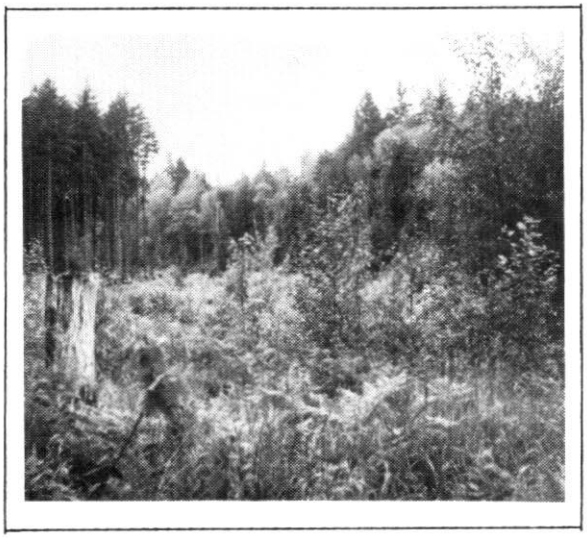


PLATE 4.24: KOKSILAH LANDSCAPE

GENERAL COMMENTS

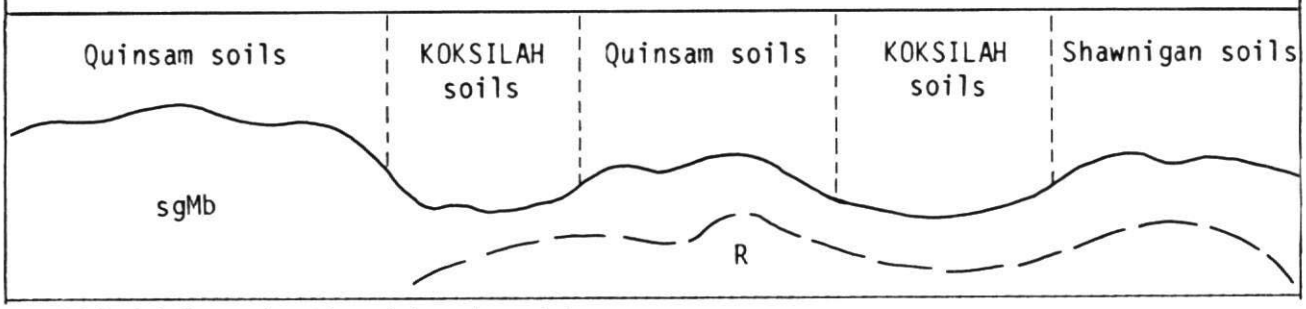
Koksilah soils (170ha) occur in low-lying seepage receiving sites on coarse-textured morainal deposits. They are very limited in extent and are found in association with extensive areas of Shawnigan and Quinsam soils. They are poorly drained with a perched water-table for much of the year. They have developed in sandy gravelly morainal materials and are often very cobbly and stony. The subsoil is strongly cemented.

Characteristically, they have an organic matter enriched surface horizon and gravelly to very gravelly loam, sandy loam or loamy sand textures. They are classified as dominantly **Orthic Humic Gleysols,** although minor areas of Orthic Gleysols also occur.

Koksilah soils are generally unsuitable for agriculture due to their coarse textures, poor drainage and distribution (ie. scattered across non-agricultural landscapes in small pockets).

Koksilah soils are also unsuitable for urban and related uses due to wetness.

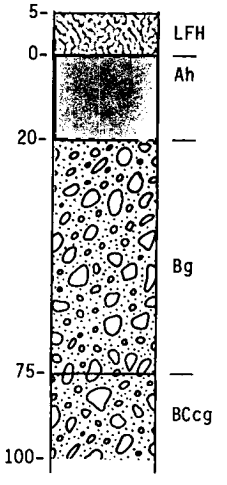
KOKSILAH SOIL LANDSCAPE CROSS SECTION*



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy gravelly morainal blanket
TOPOGRAPHY	:	less than 9%; level to gentle slopes
ELEVATION RANGE	:	100+ m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists of red alder, maple, western red cedar, and willow, with an understory dominated by moisture loving plants such as skunk cabbage.

TYPICAL KOKSILAH SOIL PROFILE



Loose litter of leaves, needles and twigs over well decomposed organic matter.

Very dark brown (10YR 2/2m) gravelly loam; moderate, medium, granular; very friable; very strongly acid.

Olive gray (5Y 4/2w) very gravelly sandy loam; common, medium, prominent mottles; weak, medium, subangular blocky breaking to single-grained; nonsticky; strongly acid.

Olive gray (5Y 4/2w) very gravelly sandy loam; common, medium, prominent mottles; massive; very firm; non sticky; continuous strong cementation; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Mull
SOLUM DEPTH (cm)	:	80-100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	75-125; 20-30; moderately cemented horizon
ROOTING DEPTH (cm)	:	75
COARSE FRAGMENT CLASS	:	2-3
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	30-100; seasonal perched
PERVIOUSNESS	:	slow
SOIL DRAINAGE	:	poor
SOIL TEXTURE	:	very gravelly sandy loam, loam or loamy sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.3-1.6)	Est.	(1.6-1.8)	Est.	(1.7-2.0)
AWSC (cm/m)	4	30 (24-39)	Est.	(6-14)	Est.	8 (5-12)
% COARSE > 7.5 cm	10	5 (2-8)	9	5 (2-8)	4	3 (0-6)
FRAGMENTS < 7.5 cm	10	26 (16-36)	9	27 (20-35)	4	22 (7-36)
% PASSING SIEVE 4.76 mm	Est.	(50-75)	Est.	(55-75)	1	72
0.5 mm	Est.	(40-65)	Est.	(35-55)	1	59
0.074 mm	Est.	(20-40)	Est.	(20-40)	1	33
% FINE SAND	Est.	(5-15)	Est.	(5-15)	1	17
% SAND	Est.	(50-60)	1	55	1	52
% CLAY	Est.	(5-15)	1	8	1	14
LIQUID LIMIT (%)					1	23
PLASTIC LIMIT (%)					1	18

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-20 cm Mean (Range)	N	20-70 cm Mean (Range)	N	70-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	5.5	1	6.2	1	7.1
(pH) 1:2 $CaCl_2$	1	4.8	1	5.3	1	6.0
ORGANIC CARBON (%)	1	8.2	1	0.8	1	0.1
NITROGEN (%)	1	0.7	1	0.07	1	0.01
EXCHANGE CAPACITY (meq/100g)	1	58	1	17	1	13
BASE SATURATION (%)	1	17	1	45	1	81
EXCHANGEABLE CATIONS - Ca	1	7.0	1	5.2	1	7.6
(meq/100g) - Mg	1	2.1	1	2.0	1	2.8
- Na	1	0.4	1	0.2	1	0.15
- K	1	0.2	1	0.08	1	0.11
PHOSPHORUS (ppm)	1	20	1	13	1	2
SULPHUR (ppm)	1	7	1	3.3	1	2

SOIL PHASES/VARIANTS	
SOIL SYMBOL	SOIL DESCRIPTION
KHco	Cobbly phase; soil has greater than 20% cobbles and or stones.
KHpt	Peaty phase; 10-40 cm of humic or mesic organic material occurs over the mineral soil.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
KOKSILAH SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	GM, GW SM	A-2-4	poor	poor	poor	unsuited

KULLEET SOILS (KT)

PLATE 4.25: KULLEET SOIL LANDSCAPE

GENERAL COMMENTS

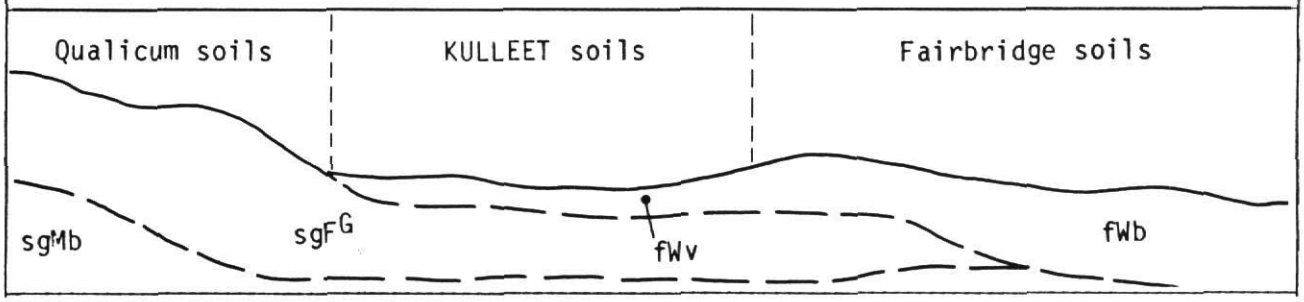
Kulleet soils (330ha) occur below elevations of about 130 m on gently undulating marine landscapes. These soils have developed in silty marine parent materials which overlay coarse textured marine or fluvial deposits. Kulleet soils are minor in extent. They are imperfectly drained.

The upper horizons are stone-free, silt loam or silty clay loam, contain many concretions and are mottled below 50 cm due to seasonal saturation from heavy winter rains. These are underlain by gravelly sandy loam or gravelly loamy sand. Kulleet soils are classified as **Gleyed Dystric Brunisols;** however, minor areas of Gleyed Humo-Ferric Podzols also occur.

Kulleet soils are suitable for a wide range of crops however supplemental irrigation and fertilization are required for optimal yields.

Kulleet soils are moderately suited for urban and related uses but have some restrictive features such as seasonal wetness.

KULLEET SOIL LANDSCAPE CROSS SECTION*

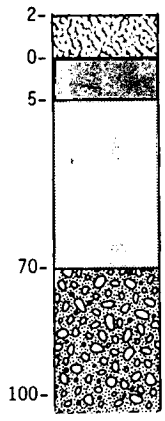


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	silty marine overlying sandy gravelly fluvial
TOPOGRAPHY	:	2-15%
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists of second growth Douglas-fir, grand fir, western red cedar, and red alder.

TYPICAL KULLEET SOIL PROFILE

DEPTH (cm)



LF — Loose litter of leaves, needles, and twigs over partly decomposed organic matter; strongly acid.

Ah — Very dark brown (10YR 2/2m) silt loam; weak, fine, granular; medium acid.

Bgj — Yellowish brown (10YR 5/6m) silt loam; common, medium, faint mottles; moderate, medium, subangular blocky breaking to weak, fine, subangular blocky; very friable; very strongly acid.

IIBCg — Light yellowish brown (10YR 6/4m) gravelly loamy sand; many, medium, prominant (7.5YR 5/8m) mottles; single-grain; very friable; very strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Moder
SOLUM DEPTH (cm)	:	80-120
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	80; abrupt texture change gravelly coarse texture
ROOTING DEPTH (cm)	:	80
COARSE FRAGMENT CLASS	:	0
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	70-180; seasonal perched
PERVIOUSNESS	:	slow to moderate
SOIL DRAINAGE	:	imperfect
SOIL TEXTURE	:	silt loam, overlying gravelly sandy loam or gravelly loamy sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	1	1.0	1	1.1	1	1.4
AWSC (cm/m)	1	20	1	18	1	6
% COARSE > 7.5 cm	36	0	36	0	35	0
FRAGMENTS < 7.5 cm	36	2 (0-5)	36	5 (0-14)	35	7 (0-20)
% PASSING SIEVE 4.76 mm	1	99	1	99	1	58
0.5 mm	1	91	1	96	1	37
0.074 mm	1	70	1	74	1	13
% FINE SAND	1	8	1	9	1	5
% SAND	2	34 (32-36)	3	37 (33-40)	2	68 (60-75)
% CLAY	2	18 (11-24)	3	14 (8-20)	2	8 (8-9)
LIQUID LIMIT (%)	1	42	1	33	1	22
PLASTIC LIMIT (%)	1	33	1	25	1	20

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	5.2	1	5.7	1	5.9
(pH) 1:2 $CaCl_2$	1	4.6	1	5.1	1	5.2
ORGANIC CARBON (%)	1	4.0	1	2.4 (0.4-1.0)	1	1.0
NITROGEN (%)	1	0.2	1	0.1 (0.03-0.05)	1	0.05
EXCHANGE CAPACITY (meq/100g)	1	40	1	25 (10-18)	1	13
BASE SATURATION (%)	1	14	1	8 (25-35)	1	5
% IRON	Est.	(0.2-0.5)	Est.	(0.1-0.4)		
% ALUMINUM	Est.	(0.1-0.4)	Est.	(0.1-0.4)		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
KTg	Gravelly phase; solum contains 20-50% gravel.
KTmd	Moderately well to well drained variant; drier soil moisture regime.
KTpd	Poorly drained variant; Soils occur on the lowest, wettest portion of the landscape and are classified as Gleysols.
KTpd,vs	Poorly drained, very shallow variant; Soils occur on the lowest, wettest portion of the landscape, and have a different parent material or strongly contrasting texture within 10-50 cm of the surface. Soils are classified as Gleysols.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
KULLETT SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-50	ML	A-4	poor	poor	good	fair
50-100+	SM, GM	A-4,A-2	fair	fair	poor	unsuited

KYE SOILS (KY)

PLATE 4.26: KYE SOIL LANDSCAPE

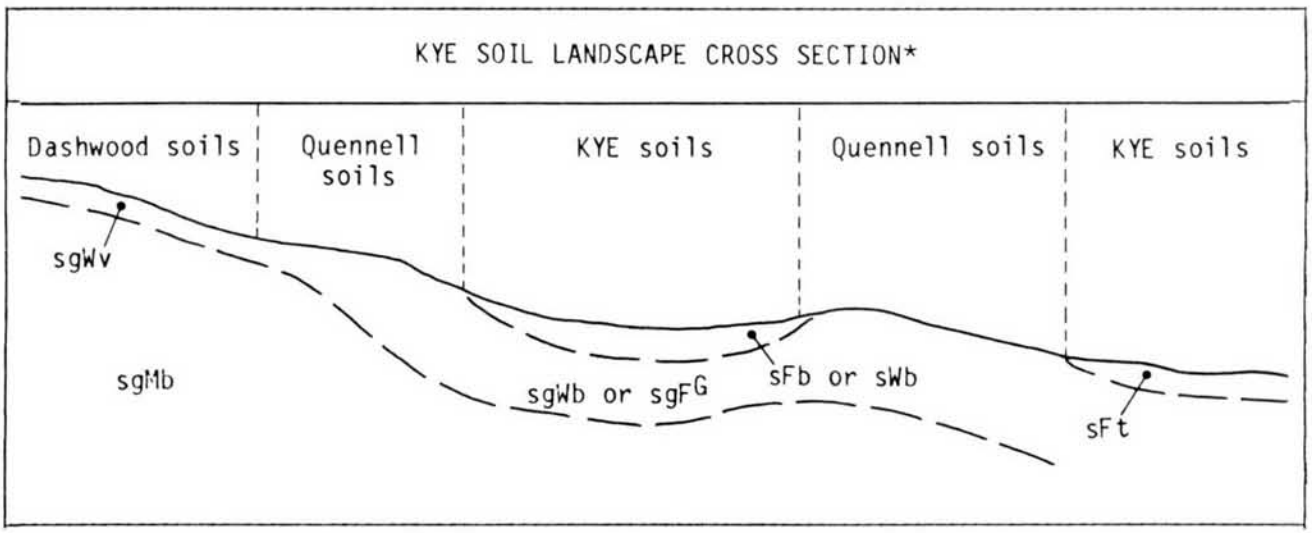
GENERAL COMMENTS

Kye soils (2435ha) have formed on sandy post-glacial marine, fluvial and eolian deposits. These well to rapidly drained soils are found on nearly level to moderate slopes within a gently undulating landscapes.

Kye soils are stone-free with loamy sand or sandy loam surface horizons. At depth, textures tend to become more sandier and soil structure is often compacted or weakly cemented. Kye soils are classified as **Orthic Humo-Ferric Podzols.**

During the summer Kye soils are very droughty, but can support a wide range of crops with adequate irrigation and fertilizer. On sloping lands these soils have a relatively high soil erosion potential.

In general, these soils are suitable for urban related developments, however, septic tank contamination of the ground water systems could occur due to incomplete filtration of septic tank effluent by the coarse-textured soil and parent material.

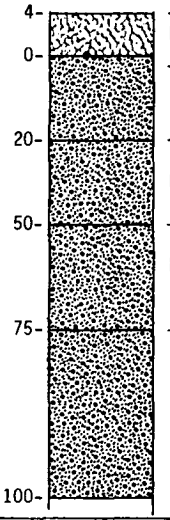


*see Table 3.1 for explanation for terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy marine or fluvial blanket
TOPOGRAPHY	:	0-6%; nearly level to gently rolling slopes
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	forested areas consist of second growth Douglas-fir, grand fir, alder, and, maple. The understory is mainly salal and oregon grape.

TYPICAL KYE SOIL PROFILE



LFH — Loose litter of needles and twigs over partly to well decomposed organic matter; extremely acid.

Bf_1 — Strong brown (7.5YR 5/7m); medium sand to fine sandy loam; weak; medium, subangular blocky, loose, non-plastic; very strongly to extremely acid.

Bf_2 — Dark brown (7.5YR 4/4m); medium sand to fine sandy loam; weak to moderate, medium to coarse, subangular blocky; loose, non-plastic; very strongly acid.

Bm — Dark yellowish brown (10YR 4/4m); medium sand to fine sandy loam; moderate to weak, medium to fine, subangular blocky; loose, non-plastic; very strongly acid.

BC — Yellowish brown (10YR 5/8m); medium sand to fine sandy loam; weak, fine, subangular blocky; loose, non-plastic; very strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	MOR
SOLUM DEPTH (cm)	:	110
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	no restricting layer
ROOTING DEPTH (cm)	:	100+
COARSE FRAGMENT CLASS	:	0
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	N/A
PERVIOUSNESS	:	rapid to moderate
SOIL DRAINAGE	:	rapid to well
SOIL TEXTURE	:	loamy sandy, sandy loam, sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	3	1.35 (1.33-1.38)	3	1.27 (1.24-1.31)	3	1.3 (1.25-1.32)
AWSC (cm/m)	3	7 (6-8)	2	5 (4-7)	Est.	(4-8)
% COARSE > 7.5 cm	60	0	59	0	59	0
FRAGMENTS < 7.5 cm	60	6 (0-10)	59	6 (0-10)	59	6 (0-12)
% PASSING SIEVE 4.76 mm	3	92 (82-100)	3	93 (84-100)		
0.5 mm	3	63 (55-73)	3	67 (58-83)		
0.074 mm	3	16 (10-24)	3	19 (4-29)		
% FINE SAND	3	19 (14-23	3	19 (18-19)	1	12
% SAND	3	83 (74-91)	3	79 (65-97)	Est.	(75-90)
% CLAY	3	3 (1-3)	3	2 (0-4)	1	4
LIQUID LIMIT (%)	Est.	0	Est.	0	Est.	0
PLASTIC LIMIT (%)	Est.	non plastic	Est.	non plastic	Est.	non plastic

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	4	5.5 (5.3-5.7)	3	5.5 (5.3-5.7)	1	5.3
(pH) 1:2 $CaCl_2$	4	4.8 (4.7-4.9)	3	4.7 (4.6-4.8)	1	4.7
ORGANIC CARBON (%)	4	2.2 (2.0-2.4)	3	2.2 (1.9-2.5)	1	2.4
NITROGEN (%)	3	0.09 (0.06-0.12)	3	0.09 (0.06-0.12)	1	0.05
EXCHANGE CAPACITY (meq/100g)	3	14 (12-16)	3	15 (12-18)	1	14
BASE SATURATION (%)	3	6 (2-10)	3	6 (2-10)	1	4
EXCHANGEABLE CATIONS - Ca	3	0.7 (0.2-1.2)	3	0.7 (0.2-1.2)	1	0.5
(meq/100g) - Mg	3	0.1 (0.01-0.2)	3	0.1 (0.01-0.2)	1	0.03
- Na	3	0.03 (0.01-0.05)	3	0.03 (0.01-0.05)	1	0.1
- K	3	0.04 (0.02-0.06)	3	0.04 (0.02-0.06)	1	0.03
PHOSPHORUS (ppm)	3	35 (21-47)	3	38 (20-50)	1	27
% IRON	2	0.2				
% ALUMINUM	2	0.4				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
KYg	Gravelly phase; solum contains 20-50% gravels.
KYg,s	Gravelly phase, shallow variant; solum contains 20-50% gravels and different parent material or strongly contrasting texture, usually gravelly or very gravelly sand, occurs within 50-100 cm of the surface.
KYmc	Moderately cemented variant; moderate cemention occurs in the subsoil.
KYs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
KYE SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	SM, SP	A-1-b A-2-4	good	poor	unsuited	poor

MAPLE BAY SOILS (MY)

PLATE 4.27: MAPLE BAY SOIL LANDSCAPE

GENERAL COMMENTS

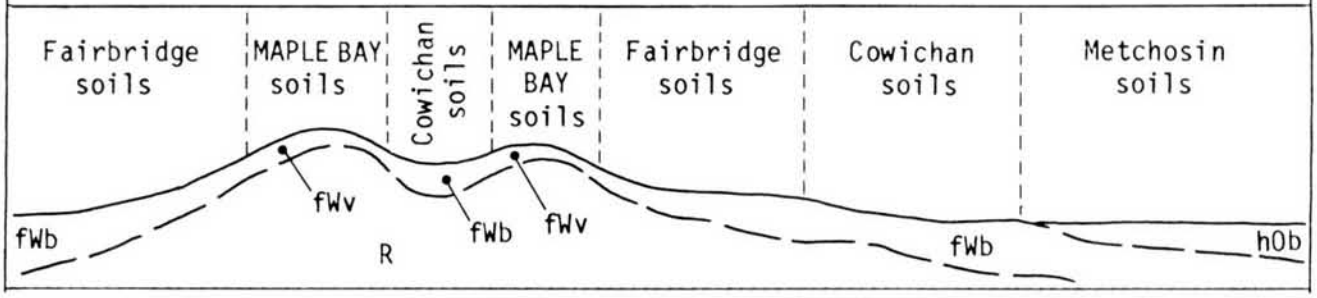
Maple Bay soils (36ha) occur below elevations of about 130 m. They occupy very gentle to strong slopes within undulating landscapes and are usually associated with Illusion or Fairbridge soils and are very limited in area. Maple Bay soils are well to moderately well drained. They have developed in shallow, silty marine sediments overlying shale, siltstone or claystone bedrock.

These soils have a thin, dark brown, organic matter-enriched, silt loam surface horizon underlain by brown to yellowish brown silt loam. These soils are classified as **Orthic Dystric Brunisol**; lithic phase.

Maple Bay soils have slight to moderate limitations to agriculture and are suitable for a wide range of crops. Structure deterioration, erosion, crusting and puddling can result if the soil is cultivated when wet. Supplemental irrigation is required for optimal yields. Although the proximity of the soft bedrock to the surface may interfere with cultivation, the main limitation is from topography.

Maple Bay soils are only moderately suited for urban and related uses due to shallow depth to bedrock.

MAPLE BAY SOIL LANDSCAPE CROSS SECTION*

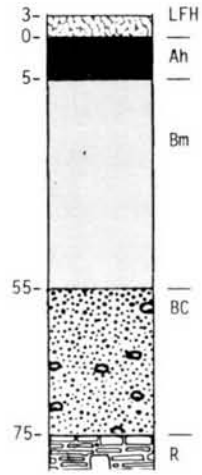


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	fine marine veneer over shale or siltstone bedrock
TOPOGRAPHY	:	5-30%; very gentle to strong slopes
ELEVATION RANGE	:	10-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists mainly of Douglas-fir with minor inclusions of grand fir, maple, red alder, and lodgepole pine. The understory is dominated by salal.

TYPICAL MAPLE BAY SOIL PROFILE



Loose litter of leaves, needles, and twigs over partly to well decomposed organic matter; very strongly acid.

Dark brown (10YR 3/2m) loam; weak to moderate, fine to medium, grandular; friable; very strongly acid.

Strong brown (7.5YR 4/6m) silt loam; weak to moderate, fine to medium, subangular blocky; friable; extremely acid.

Yellowish brown (10YR 5/6m) silt loam; massive; firm; extremely acid.

Shale or siltstone bedrock.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: 50-100
HUMUS FORM	: Moder
SOLUM DEPTH (cm)	: 50-100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 50-100; bedrock
ROOTING DEPTH (cm)	: 50-100
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: N/A
PERVIOUSNESS	: moderate
SOIL DRAINAGE	: well to moderately well
SOIL TEXTURE	: silt loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(0.9-1.1)	Est.	(0.9-1.1)		1.2
AWSC (cm/m)	Est.	(15-20)	Est.	(15-20)		14 (12-18)
% COARSE > 7.5 cm	5	0	5	0		0 (0-8)
FRAGMENTS < 7.5 cm	5	3 (0-10)	5	3 (0-10)		15 (10-30)
% PASSING SIEVE 4.76 mm	Est.	(90-100)	Est.	(85-100)		70 (60-80)
0.5 mm	Est.	(80-95)	Est.	(70-90)		50 (40-60)
0.074 mm	Est.	(70-90)	Est.	(60-80)		40 (30-50)
% FINE SAND	Est.	(8-15)	Est.	(8-15)		10 (5-20)
% SAND	Est.	(20-30)	Est.	(20-30)		30 (20-40)
% CLAY	Est.	(10-20)	Est.	(15-25)		10 (5-15)
LIQUID LIMIT (%)	Est.	(30-50)	Est.	(30-50)		
PLASTIC LIMIT (%)	Est.	(25-40)	Est.	(25-40)		

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	Mean (Range)
SOIL REACTION 1:1 H_2O	Est.	(5.1-5.5)	Est.	(5.0-5.4)		
(pH) 1:2 $CaCl_2$	Est.	(4.6-5.0)	Est.	(4.5-4.9)		
ORGANIC CARBON (%)	Est.	(1-3)	Est.	(1.0-2.0)		
NITROGEN (%)	Est.	(0.05-0.2)	Est.	(0.02-0.07)		
EXCHANGE CAPACITY (meq/100g)	Est.	(15-25)	Est.	(17-27)		
BASE SATURATION (%)	Est.	(20-30)	Est.	(20-40)		
EXCHANGEABLE CATIONS - Ca	Est.	(2-5)	Est.	(2-6)		
(meq/100g) - Mg	Est.	(0.5-3.0)	Est.	(0.5-3.0)		
- Na	Est.	(0.1-0.3)	Est.	(0.1-0.3)		
- K	Est.	(0.1-0.5)	Est.	(0.1-0.6)		
% IRON	Est.	(0.1-0.4)				
% ALUMINUM	Est.	(0.2-0.4)				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
MYg	Gravelly phase; solum contains 20-50% gravel.
MY13	Very shallow lithic phase; shale or siltstone bedrock occurs within 50 cm of the surface. The phase most frequently occurs on hill and ridge crests.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS MAPLE BAY SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-70	ML, CL	A-4	poor	poor	fair	fair

McLEAN CREEK SOILS (ML)

Plate 4.28: MCLEAN CREEK SOIL LANDSCAPE

GENERAL COMMENTS

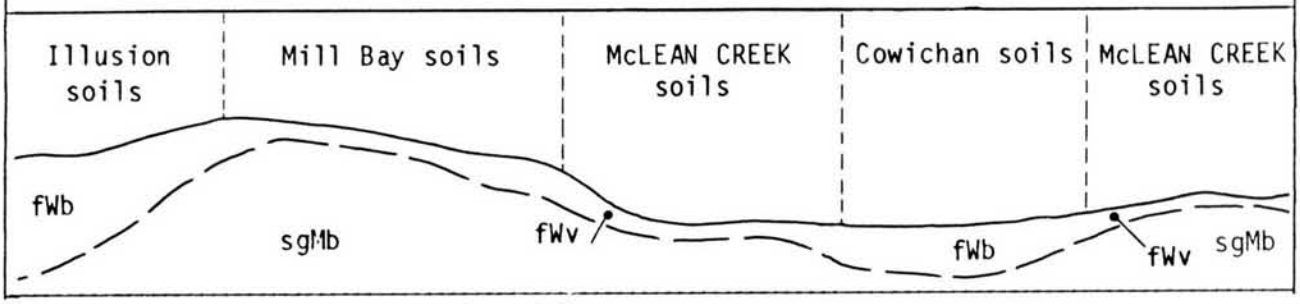
McLean Creek soils (1815ha) occur between 0 and 130 m above sea level on gently sloping to depressional sites. They are poorly drained and consist of a fine marine veneer overlying a sandy gravelly morainal material. McLean Creek soils have a seasonally perched water table.

Surface horizons are stone free and range in texture from silt loam to silty clay loam. Surface horizons are underlain by moderately to strongly cemented gravelly, sandy loam or loam glacial till with 30-50% coarse fragments. Soils are classified as **Orthic Humic Gleysols**, with lesser occurrences of Orthic Gleysols.

McLean Creeks soils will support a wide range of crops when they are improved by drainage. However, stones and cemented subsoil often to within 60 cm of the surface, can impede installation of internal drainage. The dominant landuse for these soils is hay and pasture. Care must be taken not to work these soils when wet since structural damage including crusting and formation of an impermeable layer may result.

McLean Creek soils are not suited for urban and related uses due to high water tables.

McLEAN CREEK SOIL LANDSCAPE CROSS SECTION*

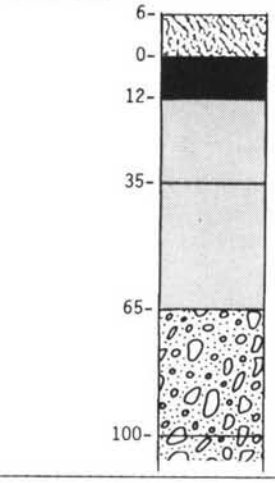


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	fine marine veneer over gravelly morainal blanket
TOPOGRAPHY	:	2-5%; very gently sloping to depressional
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	none
VEGETATION	:	Native vegetation consists of red alder, maple, western red cedar and willow; the understory is dominated by moisture loving plans.

TYPICAL McLEAN CREEK SOIL PROFILE



Loose litter of leaves, needles, and twigs over partly to well decomposed organic matter;

Black (10YR 2/1m) silt loam; moderate, fine, granular; very friable; slightly sticky; slightly plastic; smooth boundary; strongly acid.

Yellowish brown (10YR 5/4m) silty clay loam; common, medium, prominent mottles; moderate, medium, subangular blocky; firm; sticky; plastic; diffuse irregular boundary; strongly acid.

Greyish brown (2.5Y 5/2m) clay loam; many, fine, prominent mottles; weak, medium, subangular blocky; very firm; very sticky; very plastic; medium acid.

Light olive brown (2.5Y 5/4m) gravelly sandy loam; common, medium, prominent mottles massive; firm; continous medium to strong cementation medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Mull
SOLUM DEPTH (cm)	: 90
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 65-90; 20-40; moderately to strongly cemented horizon
ROOTING DEPTH (cm)	: 65
COARSE FRAGMENT CLASS	: 0-1
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 30-90; seasonal perched
PERVIOUSNESS	: slow
SOIL DRAINAGE	: poor
SOIL TEXTURE	: silt loam or silty clay loam over gravelly sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	1.3 (1.2-1.4)	Est.	1.4 (1.3-1.5)	Est.	1.7 (1.6-1.9)
AWSC (cm/m)	Est.	22 (18-24)	Est.	20 (18-22)	Est.	15 (10-20)
% COARSE > 7.5 cm	132	0.5 (0-1)	131	0.5 (0-2)	99	1 (0-3)
FRAGMENTS < 7.5 cm	132	4 (0-8)	131	4 (0-10)	100	6 (0-15)
% PASSING SIEVE 4.76 mm	2	99 (99-100)	2	93 (86-100)	1	74
0.5 mm	2	96 (95-97)	2	89 (79-99)	1	54
0.074 mm	2	90 (89-91)	2	83 (70-96)	1	29
% FINE SAND	2	2 (2-3)	2	3 (1-5)	1	18
% SAND	5	20 (10-32)	4	14 (6-22)	5	34 (15-60)
% CLAY	5	28 (18-38)	4	34 (27-44)	5	24 (12-40)
LIQUID LIMIT (%)	2	38 (30-45)	2	45 (39-50)	1	22
PLASTIC LIMIT (%)	2	30.6 (25-36)	2	30 (27-32)	1	16

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-20 cm Mean (Range)	N	20-70 cm Mean (Range)	N	70-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	5	5.4 (5.0-5.8)	2	5.7 (5.6-5.8)	1	6.2
(pH) 1:2 $CaCl_2$	5	4.8 (4.5-5.1)	2	5.1 (5.0-5.2)	1	5.6
ORGANIC CARBON (%)	5	4.6 (1.0-8.2)	1	1.3	1	0.6
NITROGEN (%)	5	0.34 (0.1-0.6)	1	0.07	1	0.02
EXCHANGE CAPACITY (meq/100g)	5	36 (18-54)	1	30	1	29
BASE SATURATION (%)	5	33 (16-50)	1	71	1	100
EXCHANGEABLE CATIONS - Ca	5	8.9 (1.5-19)	1	15	1	22
(meq/100g) - Mg	5	2.9 (0.5-5.5)	1	5.9	1	8
- Na	5	0.2 (0.1-0.3)	1	0.08	1	0.11
- K	5	0.15 (0.05-0.25)	1	0.12	1	0.11
PHOSPHORUS (ppm)	5	10 (1-20)	1	1.9	1	0.3
SULPHUR (ppm)	3	80 (2-200)				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
MLpt	Peaty phase; surface horizon consists of 10-40 cm of humic or mesic organic material over mineral soil.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS McLEAN CREEK SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-65 65-100+	ML, MH SM, SC	A-7 A-2-4	unsuited poor	unsuited poor	good poor	fair unsuited

METCHOSIN SOILS (MT)

PLATE 4.29: METCHOSIN SOIL LANDSCAPE

GENERAL COMMENTS

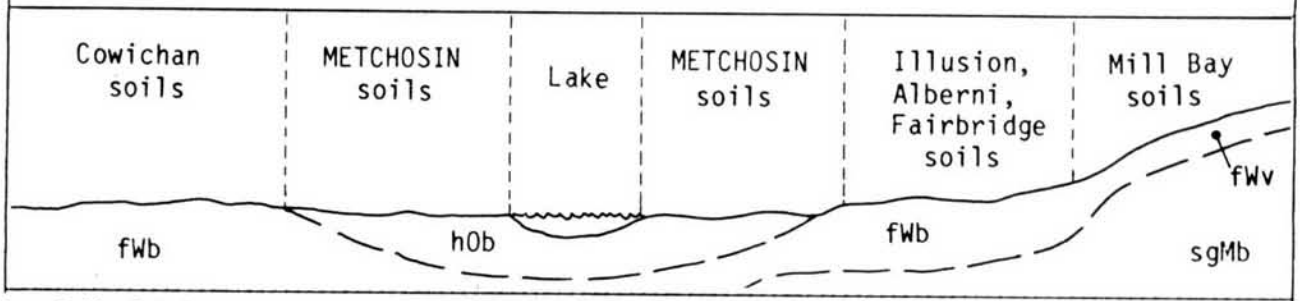
Metchosin soils (3150ha) occur in very poorly drained depressional areas. They are moderately to rapidly pervious and have very high water holding capacity. The watertable is at or near the surface for most of the year but can retreat considerably in the late summer and fall.

These organic soils are well decomposed with dominantly dark brown to black humic material in the middle and bottom tiers. They are level to nearly level with greater than 160 cm depth to mineral materials and are classified as **Typic Humisols.**

With adequate watertable control and maintenance, Metchosin soils have good potential for a variety of agricultural crops such as vegetables, forages and blueberries. The watertable should be controlled at the highest level which permits good crop growth and field trafficability. The watertable should be raised close to the surface over the winter to prevent oxidation of organic matter and reduce the rate of subsidence. Deep draining will cause excessive subsidence.

Urban and related uses are not recommended. Very low bearing capacity and high watertables make road and building construction difficult and expensive. Septic tank effluent disposal is impractical due to high watertables.

METCHOSIN SOIL LANDSCAPE CROSS SECTION*

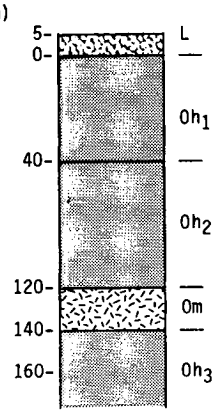


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	organic
TOPOGRAPHY	:	level to nearly level
ELEVATION RANGE	:	2-200 m
ASPECT	:	none
FLOOD HAZARD	:	high watertable
VEGETATION	:	Native vegetation includes a variety of water tolerant plants such as Labrador tea, hardhack, willow, skunk cabbage, sedges and reeds.

TYPICAL METCHOSIN SOIL PROFILE



Loose non-compact litter; strongly acid.

Black (10YR 2/1m), well decomposed organic material; moderate fine, granular; strongly acid.

Black (10YR 2/1m), well decomposed organic material; strongly acid.

Partially decomposed organic material; extremely acid.

Black (10YR 2/1m), well decomposed organic material; very strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	N/A
SOLUM DEPTH (cm)	:	>160
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	no restricting layer
ROOTING DEPTH (cm)	:	20-50
COARSE FRAGMENT CLASS	:	0
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	0-100; apparent or perched
PERVIOUSNESS	:	moderate
SOIL DRAINAGE	:	very poor
SOIL TEXTURE	:	N/A

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	6	0.36 (0.3-0.42)	1	0.35	1	0.15
AWSC (cm/m)	1	47	1	60	1	45
% COARSE > 7.5 cm	48	0	48	0	52	0
FRAGMENTS < 7.5 cm	48	0	48	0	52	1 (0-5)
TYPE OF ORGANIC MATERIAL		humic		humic		humic
RUBBED FIBRE CONTENT %		<10		<10		<10
von POST SCALE		7-10		7-10		7-10

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-40 cm Mean (Range)	N	40-120 cm Mean (Range)	N	120-160 cm Mean (Range)
SOIL REACTION 1:1 H_2O	3	4.7 (4.6-4.8)	5	4.7 (4.4-5.0)	3	4.6 (4.2-5.0)
(pH) 1:2 $CaCl_2$	3	4.2 (4.0-4.4)	5	4.1 (3.6-4.6)	3	4.2 (3.8-5.1)
ORGANIC CARBON (%)	4	39 (20-55)	6	37 (20-55)	3	30 (17-44)
NITROGEN (%)	3	2.0 (1-3)	5	1.4 (0.8-2.0)	3	0.8 (0.1-1.8)
EXCHANGE CAPACITY (meq/100g)	3	96 (45-130)	5	91 (60-120)	3	68 (40-60)
BASE SATURATION (%)	3	23 (14-38)	5	29 (12-46)	3	40 (20-60)
EXCHANGEABLE CATIONS - Ca	3	15 (12-18)	5	19 (10-28)	3	18 (15-21)
(meq/100g) - Mg	3	2.0 (1.0-3.0)	5	2.9 (1.0-4.7)	3	2.6 (1.0-4.2)
- Na	3	0.3 (0.1-0.4)	5	0.4 (0.1-0.7)	3	0.3 (0.2-0.4)
- K	3	0.4 (0.1-0.9)	5	0.14 (0.05-0.23)	3	0.1 (0.01-0.2)
PHOSPHORUS (ppm)	3	13 (7-21)	5	4.6 (2.6-6.6)	3	3.8 (1.5-5.1)

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
MTsa,so	Saline, shallow organic variant; these soils have 40 to 160 cm of organic material over the mineral soil, and they occur on estuary locations affected by seawater.
MTso	Shallow organic variant; these soils have 40 to 160 cm of organic material over the mineral soil. They are classified as Terric Humisols.
MTso,t	Shallow organic, taxadjunct variant; these soils have 40 to 160 cm of organic material and contain 25 to 40 cm of mesic organic material within the control section. They are classified as Terric Mesic Humisols.
MTt	Taxajunct variant; the solum contain 25 to 40 cm mesic organic material within the control section and/or the bottom tier. They are classified as Mesic Humisols.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS METCHOSIN SOILS*						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-160	PT	-	unsuited	unsuited	unsuited	fair

*good organic matter source

MEXICANA SOILS (ME)

PLATE 4.30: MEXICANA SOIL LANDSCAPE

GENERAL COMMENTS

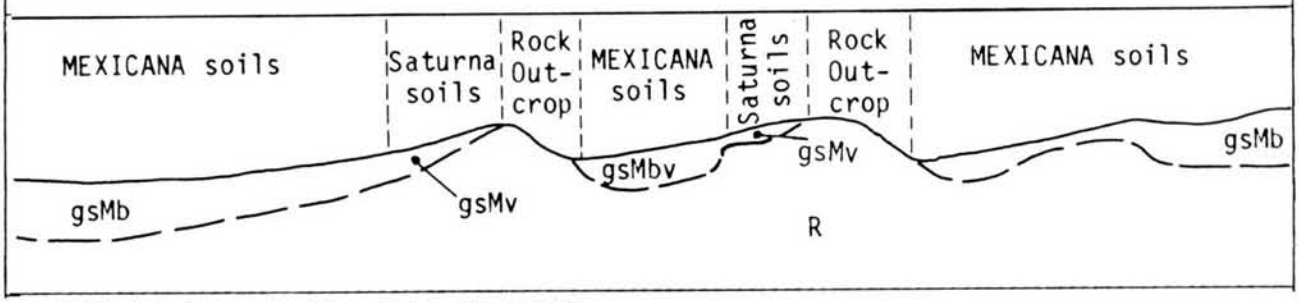
Mexicana soils (3340ha) generally are found on very gentle to strong slopes which are controlled by the underlying sedimentary bedrock. Mexicana soils have developed in gravelly, moderately coarse morainal materials which are usually derived from the underlying sedimentary bedrock as evidenced by the common occurrence of sandstone fragments.

These soils have brown friable gravelly loam or sandy loam surface horizons overlying light brown massive gravelly sandy loam at about 100 cm depth. They are classified as **Orthic Dystric Brunisols** with significant occurrences of Orthic Humo-Ferric Podzols.

Mexicana soils are considered marginal for agricultural use due to stoniness and aridity. They often occur in small areas isolated by conglomerate or sandstone ridges which interfere with agricultural use. Most areas are presently under forest cover.

Mexicana soils are suitable for urban and related uses as bearing capacity is high and there are no wetness or flooding problems.

MEXICANA SOIL LANDSCAPE CROSS SECTION*

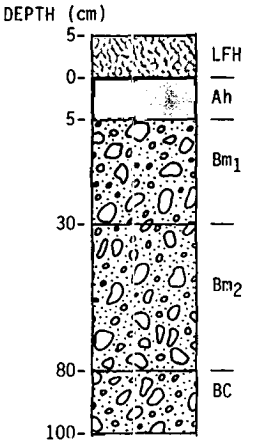


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	gravelly sandy morainal
TOPOGRAPHY	:	2-30%; very gentle to strong slopes
ELEVATION RANGE	:	0-150 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists mainly of Douglas-fir with minor inclusions of lodgepole pine, western hemlock, and arbutus. The understory is dominated by salal.

TYPICAL MEXICANA SOIL PROFILE



Loose litter of leaves, needles, and twigs over partly to well decomposed organic matter; strongly acid.

Dark brown (7.5YR 3/2m) gravelly loam; moderate, medium, granular; friable; medium acid.

Brown (7.5YR 4/4m) gravelly sandy loam; weak, fine, subangular blocky; friable; strongly acid.

Dark yellowish brown (10YR 4/4m) gravelly sandy loam; weak, fine, subangular blocky; friable; strongly acid.

Yellowish brown (10YR 5/6m) gravelly sandy loam; weak, fine, subangular blocky; fine; very strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Moder
SOLUM DEPTH (cm)	:	100-120
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	no restricting layer with 1 m of the surfaces
ROOTING DEPTH (cm)	:	75-100
COARSE FRAGMENT CLASS	:	2-4
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	N/A
PERVIOUSNESS	:	moderate
SOIL DRAINAGE	:	moderately well to well
SOIL TEXTURE	:	gravelly loam or sandy loam, gravelly loamy sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	1	1.6 (1.6-1.8)	1	1.7 (1.6-1.9)	Est.	(1.6-1.9)
AWSC (cm/m)	3	12 (11-15)	2	13 (11-15)	2	9 (8-10)
% COARSE > 7.5 cm	98	5 (1-9)	98	5 (1-9)	86	5 (1-9)
FRAGMENTS < 7.5 cm	98	23 (18-28	98	23 (18-28)	86	21 (14-28)
% PASSING SIEVE 4.76 mm	1	65	1	65	2	87 (84-90)
0.5 mm	1	56	1	56	2	75 (70-80)
0.074 mm	1	33	1	33	2	38 (36-40)
% FINE SAND	1	18	1	18	Est.	20 (18-22)
% SAND	10	50 (40-60)	6	48 (38-58)	3	50 (36-63)
% CLAY	10	15 (10-20)	6	17 (12-23)	3	14 (8-16)
LIQUID LIMIT (%)	1	26	1	25	2	23 (20-27)
PLASTIC LIMIT (%)	1	22	1	22	2	18 (16-20)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	75-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	10	5.3 (4.9-5.7)	5	5.3 (4.9-5.7)	2	5.9 (5.4-6.5)
(pH) 1:2 $CaCl_2$	10	4.6 (4.3-4.9)	5	4.6 (4.3-5.0)	2	5.3 (4.6-5.9)
ORGANIC CARBON (%)	10	2.2 (1.2-3.2)	5	1.7 (1.0-2.5)	2	0.4 (0.2-0.7)
NITROGEN (%)	7	0.09 (0.06-0.12)	4	0.08 (0.04-0.12)	1	0.01
EXCHANGE CAPACITY (meq/100g)	7	19 (14-24)	4	18 (12-24)	1	10
BASE SATURATION (%)	7	18 (8-28)	4	16 (5-40)	1	80
EXCHANGEABLE CATIONS - Ca	7	2.4 (0.7-4.0)	4	0.13 (0.05-0.18)	1	5.7
(meq/100g) - Mg	7	0.5 (0.2-0.8)	4	0.5 (0.3-0.7)	1	1.5
- Na	7	0.12 (0.06-0.18)	4	0.9 (0.5-0.13)	1	0.24
- K	7	0.13 (0.06-0.2)	4	0.9 (0.5-0.13)	1	0.06
PHOSPHORUS (ppm)	7	27 (5-50)	4	8 (3-13)	1	4.0
SULPHUR (ppm)	5	7.5 (2.5-13.0)	3	3.8 (2-6)	1	4.0
% IRON	7	0.4 (0.2-0.6)				
% ALUMINUM	7	0.5 (0.3-0.7)				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
MEco	Cobbly phase; soil has >20% cobbles and or stones.
MEco,vg	Cobbly, very gravelly phase; soil has greater than 20% cobbles and or stones, and total coarse fragments is >50%.
MEid	Imperfectly drained variant; soils occur on seepage sites and on wet, low portions of the landscape, classification is Gleyed Dystric Brunisols.
MEmc	Moderately cemented variant; moderate cementation occurs in the subsoil.
MEmc,vg	Moderately cemented variant, very gravelly phase; soil contains >50% coarse fragments with a strongly to moderately cemented subsoil.
MEs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
MEs,vg	Shallow variant, very gravelly phase; soil has >50% gravels with a different parent material or strongly contrasting texture occuring within 50-100 cm of the surface.
MEvg	Very gravelly phase; soil has >50% coarse fragments by volume. These soils usually have >50% coarse fragments.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS MEXICANA SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	SM	A-2-4 A-4	poor	fair	poor	unsuited

MILL BAY SOILS (MB)

PLATE 4.31: MILL BAY SOIL LANDSCAPE

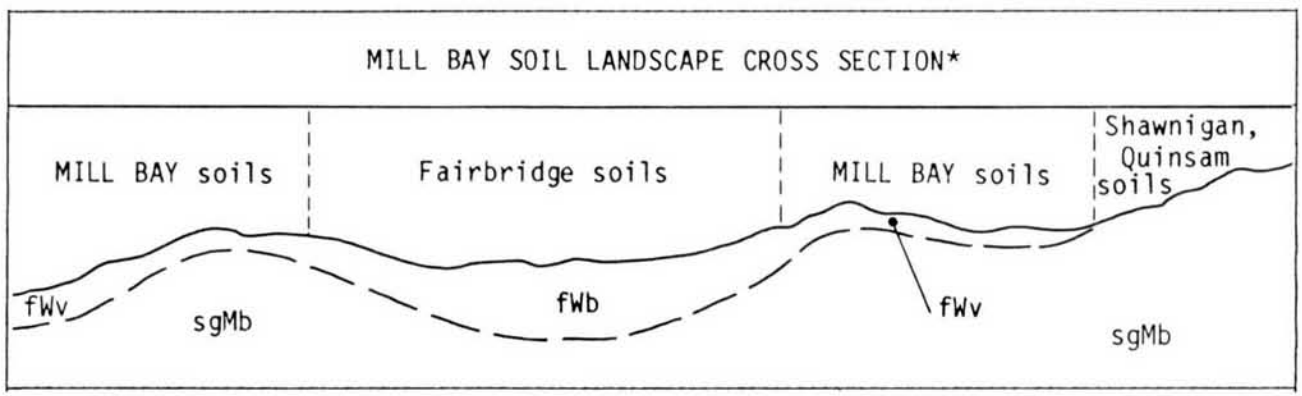
GENERAL COMMENTS

Mill Bay soils (1555ha) occur between sea level and 130 m in elevation on gently undulating landscapes throughout the survey area. These soils are moderately well to imperfectly drained with a perched watertable during the winter. They have developed in stratified parent materials that consist of fine marine veneer overlying gravelly sandy moraine.

Mill Bay soils have stone-free, upper horizons that contain many concretions and have silt loam or loam texture. These are underlain by a gravelly sandy loam horizon that is moderately to strongly cemented. These soils are classified as **Duric Dystric Brunisols**, with small inclusions of Duric Humo-Ferric Podzols.

Dairying and forage production are the predominant present land uses, however an increased range of crops is possible with supplemental irrigation and fertilization. A perched watertable during winter and the presence of a root restricting duric horizon will adversely affect some perennial crops. Soil structure deterioration, erosion, crusting and puddling can result if the soil is cultivated when wet.

Mill Bay soils have moderate to high bearing strengths, however, septic tank effluent disposal is impeded by cemented subsoils.

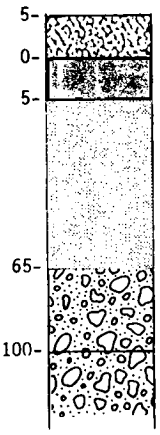


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	fine marine veneer over gravelly sandy moraine
TOPOGRAPHY	:	1-15% slopes, often gently undulating; level to moderate slopes
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Native vegetation consists mainly of stands of second growth Douglas-fir associated with grand fir, western red cedar, red alder and occasional western hemlock. The understory consists of a variety of shrubs usually dominated by salal.

TYPICAL MILL BAY SOIL PROFILE

DEPTH (cm)



LF — Loose litter of leaves, needles, and twigs over partly decomposed organic matter; strongly acid.

Ah — Very dark grayish brown (10YR 3/2m) loam or silt loam; weak, fine, granular; friable; medium acid.

Bm — Yellowish brown (10YR 5/6m) silt loam; moderate, medium, subangular blocky breaking to weak, fine, subangular blocky; very friable; very strongly acid.

IIBCc — Grayish brown (2.5Y 5/2m) gravelly sandy loam; massive; extremely firm; strong cementation; strongly acid.

IICB — Light brownish gray (2.5Y 6/2m); gravelly sandy loam; massive; firm; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Moder
SOLUM DEPTH (cm)	: 90
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 50-100; 5-25 cm; duric horizon
ROOTING DEPTH (cm)	: 50-100
COARSE FRAGMENT CLASS	: 0-1 above morainal contact; 3-4 in morainal material
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 90-200+; seasonal perched
PERVIOUSNESS	: slow
SOIL DRAINAGE	: moderately well to imperfect
SOIL TEXTURE	: silt loam over gravelly sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	3	0.9 (0.8-1.1)	3	1.1 (1.0-1.2)	2	1.7 (1.4-1.9)
AWSC (cm/m)	4	19 (16-22)	4	15 (12-18)	Est.	(10-15)
% COARSE > 7.5 cm	77	0.5 (0-2)	74	0.5 (0-2)	60	1 (0-3)
FRAGMENTS < 7.5 cm	77	6 (0-12)	74	7 (0-14	60	9 (0-20)
% PASSING SIEVE 4.76 mm	7	91 (82-99)	7	87 (77-97)	7	77 (65-80)
0.5 mm	7	80 (68-92)	7	74 (60-90)	7	60 (40-80)
0.074 mm	7	58 (48-68)	7	55 (30-80)	7	42 (20-65)
% FINE SAND	7	13 (8-18)	7	10 (4-16)	7	12 (5-19)
% SAND	11	38 (25-50)	8	42 (20-60)	8	47 (27-67)
% CLAY	11	19 (14-24)	8	18 (12-24)	8	14 (9-20)
LIQUID LIMIT (%)	7	45 (25-65)	7	34 (26-38)	7	28 (22-40)
PLASTIC LIMIT (%)	7	34 (20-48)	7	26 (20-30)	7	21 (17-28)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	13	5.5 (5.2-5.8)	10	5.9 (5.5-6.3)	1	6.2
(pH) 1:2 $CaCl_2$	14	4.8 (4.5-5.1)	11	5.2 (4.8-5.6)	2	5.3 (5.1-5.5)
ORGANIC CARBON (%)	14	3.2 (1-5)	11	1.2 (0.6-1.8)	2	0.8 (0.2-1.4)
NITROGEN (%)	11	0.15 (0.05-0.25)	10	0.06 (0.02-0.1)	1	0.01
EXCHANGE CAPACITY (meq/100g)	12	24 (12-36)	11	18 (13-23)	2	15 (12-20)
BASE SATURATION (%)	11	41 (25-55)	10	53 (30-70)		(50-90)
EXCHANGEABLE CATIONS - Ca	11	8.3 (2.4-15)	10	7.1 (4.8-12.5)	1	8.7
(meq/100g) - Mg	11	2.3 (0.5-5.0)	10	2.8 (1.0-5.0)	1	3.8
- Na	11	0.16 (0.06-0.26)	10	0.15 (0.1-0.2)	1	0.12
- K	11	0.2 (0.1-0.3)	10	0.14 (0.06-0.22)	1	0.07
PHOSPHORUS (ppm)	11	21 (5-40)	10	8 (2-16)	1	8
SULPHUR (ppm)	11	11 (8-15)	10	7 (5-10)	1	5
% IRON	9	0.4 (0.2-0.6)				
% ALUMINUM	9	0.4 (0.1-0.7)				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
MBg	Gravelly phase; solum contains 20-50% gravel.
MBs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of surface.
Mbwc	Weakly cemented variant; a cemented horizon occuring between 50-100 cm depth that is not sufficiently cemented to be a duric horizon.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS MILL BAY SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-75 75-100+	ML, MH SM, SC	A-4 A-2-4	unsuited poor	unsuited poor	good poor	good unsuited

PARKSVILLE SOILS (PA)

PLATE 4.32: PARKSVILLE SOIL LANDSCAPE

GENERAL COMMENTS

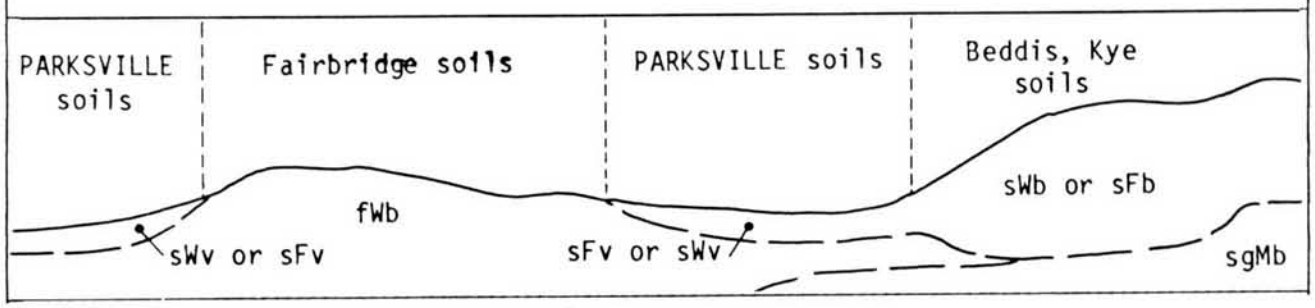
Parksville soils (1805ha) are minor in extent and are found on level to depressional sites on marine landscapes in association with Cowichan and Fairbridge soils. They are poorly drained with seasonal perched watertables at 15 to 100 cm depth. They have developed in non-stony, sandy fluvial or sandy marine veneers that are underlain by fine marine material. Parksville soils are distinguished from Tolmie soils by a thicker (greater than 30 cm) sandy overlay verses Tolmie soils which have less than 30 cm of sand veneer.

Characteristically they have a dark brown or black organic matter-enriched surface horizon which grades into a light brown to grey, prominantly mottled silty loam to silty clay at depths below 40 cm. These soils are classified as **Orthic Humic Gleysols**, with minor occurrences of Orthic Gleysols.

Present land use is mainly hay and pasture as spring planting of other crops is often impractical due to wet soil conditions. With irrigation and drainage Parksville soils can be used for growing a wide range of crops.

Urban and related uses are not recommended due to winter ponding.

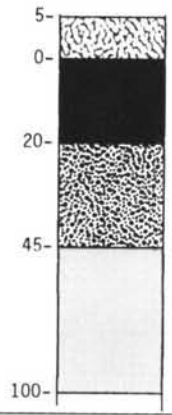
PARKSVILLE SOIL LANDSCAPE CROSS SECTION*



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy marine or fluvial veneers overlying fine marine
TOPOGRAPHY	:	depressional to very slightly sloping
ELEVATION RANGE	:	less than 130 m asl
ASPECT	:	none
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists of red alder, willow, maple, and western red cedar, including an understory of moisture loving plants such as skunk cabbage.

TYPICAL PARKSVILLE SOIL PROFILE



L — Loose litter of leaves, needles, and twigs; strongly acid.

Ah — Black (10YR 2/1m) sandy loam; weak, medium, subangular blocky; very friable, non-sticky, non-plastic; strongly acid.

Bg — Light olive brown (2.5Y 5/4m) sandy loam or loamy sand; many, medium, distinct mottles; weak, coarse, angular blocky to single grain; friable, non-sticky, non-plastic; medium acid.

IIBg — Light brownish gray (2.5Y 6/2m) silt loam; many, medium, prominent mottles; medium, coarse, angular blocky; firm, sticky, plastic; slightly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Mull
SOLUM DEPTH (cm)	:	>100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	60-100; compact lower horizons
ROOTING DEPTH (cm)	:	60
COARSE FRAGMENT CLASS	:	0
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	15-100; seasonal perched
PERVIOUSNESS	:	slow to moderate
SOIL DRAINAGE	:	poor
SOIL TEXTURE	:	sandy loam or loamy sand over silty loam, silty clay loam, or silty clay

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	1	1.3	2	1.6	1	1.3
AWSC (cm/m)	Est.	(5-20)	2	14 (5-20)	1	16
% COARSE > 7.5 cm	106	0 (0-1)	106	0 (0-1)	93	0
FRAGMENTS < 7.5 cm	107	2 (0-5)	107	2 (0-6)	93	2 (0-6)
% PASSING SIEVE 4.76 mm	2	93 (86-100)	2	97 (95-100)	2	99 (98-100)
0.5 mm	2	89 (78-100)	2	96 (92-100)	2	96 (95-97)
0.074 mm	2	43 (35-50)	2	30 (10-50)	2	88 (87-89)
% FINE SAND	Est.	(15-25)	2	32 (29-35)	1	4
% SAND	3	54 (35-70)	3	64 (44-86)	6	23 (9-38)
% CLAY	3	14 (6-27)	3	11 (5-18)	6	24 (19-29)
LIQUID LIMIT (%)	2	21 (19-23)	2	11 (0-22)	1	58
PLASTIC LIMIT (%)	2	17 (15-19)	2	10 (0-20)	1	30

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-20 cm Mean (Range)	N	20-55 cm Mean (Range)	N	55-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	4	5.1 (4.6-5.7)	2	6.6 (6.1-7.1)	2	7.0 (6.8-7.4)
(pH) 1:2 $CaCl_2$	4	4.5 (4.0-5.0)	2	5.7 (5.2-6.3)	2	6.3 (6.0-6.6)
ORGANIC CARBON (%)	4	3.0 (2.0-4.0)	2	0.3 (0.2-0.4)	2	0.2 (0.2)
NITROGEN (%)	4	0.2 (0.1-0.3)	2	0.02 (0.01-0.03)	2	0.02 (0.01-0.03)
EXCHANGE CAPACITY (meq/100g)	4	19 (10-28)	2	7.0 (4-9)	2	25 (19-31)
BASE SATURATION (%)	4	37 (15-50)	Est.	(40-100)	Est.	(50-100)
EXCHANGEABLE CATIONS - Ca	4	4.1 (2.7-5.3)	2	3.6 (1.5-5.8)	2	16 (12-20)
(meq/100g) - Mg	4	1.4 (0.6-2.2)	2	2.4 (0.6-4.2)	2	12 (8-16)
- Na	4	0.19 (0.09-0.29)	2	0.3 (0.1-0.5)	2	0.6 (0.5-0.7)
- K	4	0.1 (0.06-0.14)	2	0.04 (0.02-0.05)	2	0.15 (0.09-0.2)
PHOSPHORUS (ppm)	4	22 (12-32)	2	9 (3-14)	2	2 (1-3)
SULPHUR (ppm)	3	7 (5-9)	2	5 (4-6)	2	4.5 (4.4-4.6)

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
PAg	Gravelly phase; solum contains 20-50% gravel.
PAlo	Loamy phase; 20-50 cm of loam textured surface.
PApt	Peaty phase; 10-40 cm of humic or mesic organic material occurs over the mineral soil.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
PARKSVILLE SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-50	SW	A-2-4	fair	poor	poor	fair
50-100+	ML, MH	A-7	poor	poor	good	poor

PUNTLEDGE SOILS (PU)

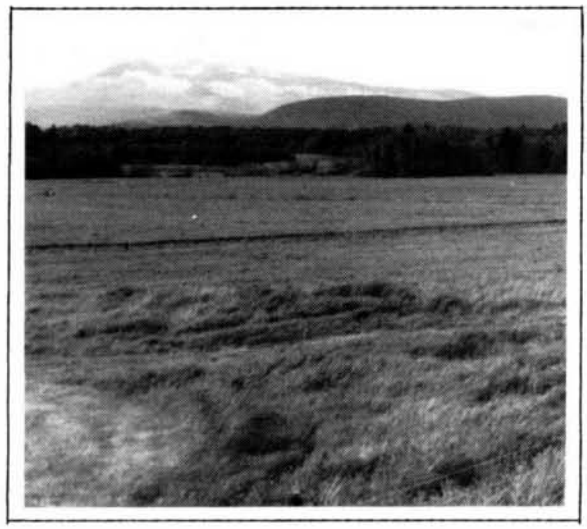


PLATE 4.33: PUNTLEDGE SOIL LANDSCAPE

GENERAL COMMENTS

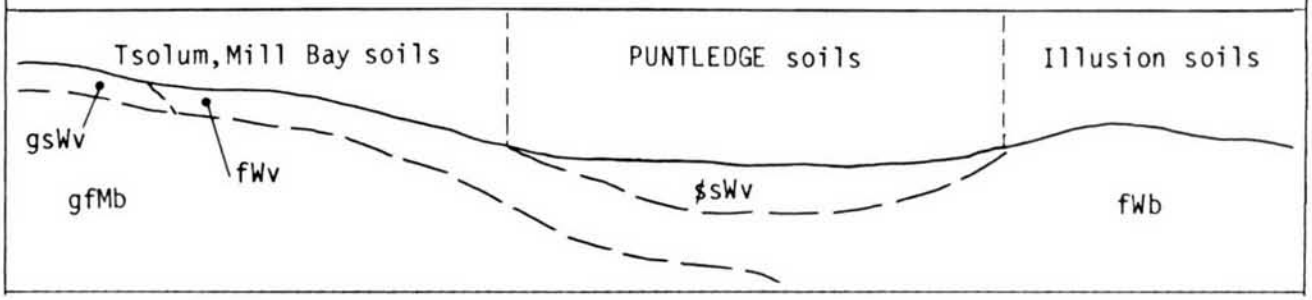
Puntledge soils (685ha) occur principally in the Comox Valley between sea level and 100 m in elevation. Usually associated with level to undulating landscapes, these soils have developed on medium to fine textured marine or fluvial deposits, underlaid by fine textured marine. Puntledge soils are imperfectly to moderately well drained and may have a perched water table during wet winter months.

Puntledge soils have a dark yellowish brown silt loam to fine sandy loam surface and subsoil texture. Upper horizons are moderately pervious and stone-free. The lower horizons consist of permeable marine clays, which are silt loam in texture. These soils are dominantly classified as **Gleyed Sombric Brunisols** with significant inclusions of Gleyed Sombric Humo-Ferric Podzols.

Most of the Puntledge soils have been cleared and are considered prime for agriculture with hay, feed-crops and pasture being the most dominant present land use. Although the water holding capacity and permeability is favourable, drainage and irrigation is required to obtain a high level of crop production. Perched water tables during the winter months may adversely affect some perennial crops.

Urban and related uses are only moderately suitable because of the potential for high water tables in the winter.

PUNTLEDGE SOIL LANDSCAPE CROSS SECTION*

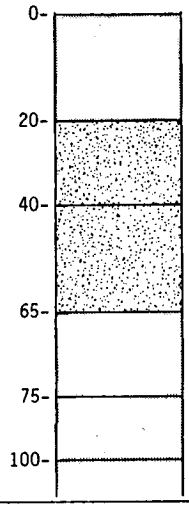


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	silt loam to fine sandy loam fluvial or marine veneer, over silty clay marine 0-10%
TOPOGRAPHY	:	slopes; nearly level to gently undulating slopes
ELEVATION RANGE	:	0-100 m asl
ASPECT	:	all
FLOOD HAZARD	:	none
VEGETATION	:	Most areas are cleared and cultivated. Remaining forests support Douglas fir, grand fir, cedar, alder and maple.

TYPICAL PUNTLEDGE SOIL PROFILE



Dark reddish brown (5YR 2/2m) loam to fine sandy loam; weak to moderate, coarse, subangular blocky; friable; slightly plastic; very strongly to extremely acid.

Dark yellowish brown (10YR 4/4m) loam to fine sandy loam; weak to moderate, medium to coarse, subangular blocky; friable, slightly plastic; very strongly acid.

Yellowish brown (10YR 5/6m) loam to fine sandy loam; weak to moderate, coarse, subangular blocky; friable, slightly plastic; very strongly acid to strongly acid.

Grayish brown (2.5Y 5/4m) silt loam; common, medium, distinct mottles; moderate, medium, subangular blocky; firm, slightly sticky; slightly plastic; medium acid.

Light olive brown (2.5Y 5/4m) silt loam; many, medium, prominent mottles; moderate, medium, subangular blocky; very firm; slightly sticky; slightly plastic; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Mor
SOLUM DEPTH (cm)	:	100+
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	60; dense, compact parent material
ROOTING DEPTH (cm)	:	60
COARSE FRAGMENT CLASS	:	0
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	60-170; seasonal perched
PERVIOUSNESS	:	slow
SOIL DRAINAGE	:	imperfect
SOIL TEXTURE	:	silt loam or fine sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	1	0.95	Est.	1.3 (1.2-1.4)	1	1.4 (1.3-1.5)
AWSC (cm/m)	2	14 (11-17)	Est.	12 (10-15)	Est.	18 (16-22)
% COARSE > 7.5 cm	73	0 (0-0.5)	74	0 (0-0.5)	72	0
FRAGMENTS < 7.5 cm	73	2 (0-5)	74	1 (0-4)	73	1 (0-2)
% PASSING SIEVE 4.76 mm	1	100	Est.	100 (98-100)	1	100
0.5 mm	1	98	Est.	99 (98-100)	1	99
0.074 mm	1	60	Est.	50 (40-60)	1	39
% FINE SAND	1	23	Est.	40 (25-50)	Est.	30 (15-50)
% SAND	7	47 (30-65)	6	54 (30-75)	3	28 (10-55)
% CLAY	7	10 (7-13)	6	7 (1-15)	3	16 (8-24)
LIQUID LIMIT (%)	1	55	Est.	50 (45-55)	Est.	40 (25-50)
PLASTIC LIMIT (%)	1	50	Est.	45 (40-50)	Est.	30 (25-40)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	7	4.7 (4.4-5.1)	2	5.2 (5.1-5.2)	1	5.8
(pH) 1:2 $CaCl_2$	7	4.3 (4.1-4.5)	2	4.6 (4.5-4.7)	1	5.1
ORGANIC CARBON (%)	7	4.9 (2.9-6.9)	2	2.8 (2.2-3.5)	1	0.4
NITROGEN (%)	6	0.3 (0.1-0.5)	1	0.15	1	0.02
EXCHANGE CAPACITY (meq/100g)	6	26 (18-34)	1	19	1	16
BASE SATURATION (%)	6	12 (7-19)	1	27	1	100
EXCHANGEABLE CATIONS - Ca	6	2.3 (1.0-3.6)	1	4.0	1	11.7
(meq/100g) - Mg	6	0.5 (0.2-0.8)	1	0.8	1	3.7
- Na	6	0.14 (0.08-0.20)	1	0.18	1	0.3
- K	6	0.09 (0.06-0.11)	1	0.02	1	0.03
PHOSPHORUS (ppm)	6	29 (6-70)	1	17	1	8
% IRON	1	1.0	1	0.9		
% ALUMINUM	1	0.9	1	1.0		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
PUg	Gravelly phase; solum contains 20-50% gravels.
PUs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
PUNTLEDGE SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-60	SM, ML	A-5	poor	unsuited	poor	good
60-100+	MH, ML	A-5,A-6	poor	unsuited	fair	fair

QUALICUM SOILS (QU)

PLATE 4.34: QUALICUM SOIL LANDSCAPE

GENERAL COMMENTS

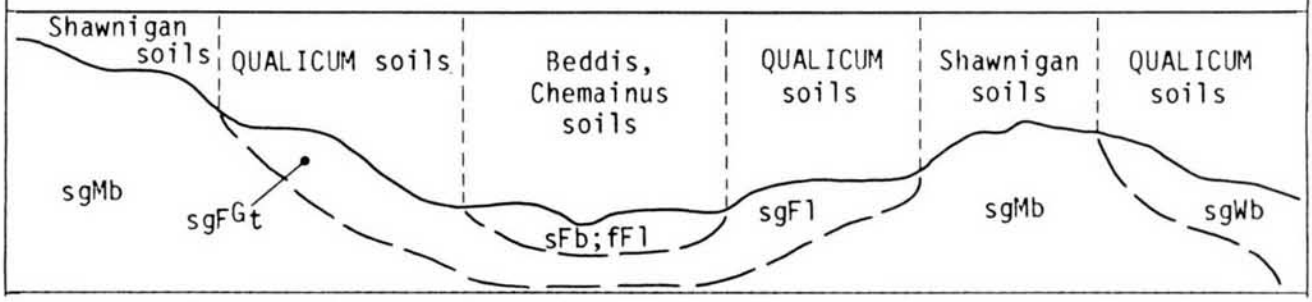
Qualicum soils (7820ha) have developed on deep coarse-textured fluvial and fluvioglacial deposits associated with all major streams and rivers in the survey area. They also occur on deep, coarse-textured marine deposits. Qualicum soils are rapidly drained, rapidly permeable, and generally do not have a water-table within 3 m of the surface.

Qualicum soils have very gravelly loamy sand textures with discontinuous weakly cemented horizons sometimes present at 60 cm to 100 cm depth. They are classified as Orthic Dystric Brunisols.

Qualicum soils vary from marginal to unsuitable for agriculture. The high coarse fragment content and sandy textures result in aridity, stoniness and fertility limitations.

Urban and related uses are recommended where care is taken to avoid contamination of the groundwater which could occur due to incomplete filtration of septic tank effluent by the coarse-textured soil and parent material. Areas where Qualicum soils occur generally have economically significant gravel deposits.

QUALICUM SOIL LANDSCAPE CROSS SECTION*

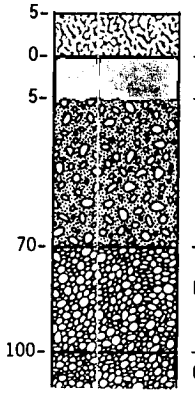


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy gravelly fluvial, glaciofluvial, or marine blanket
TOPOGRAPHY	:	0-40% (terraced, hummocky, ridged, subdued)
ELEVATION RANGE	:	10-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists mainly of Douglas-fir and lodgepole pine with minor inclusions of western hemlock, grand fir, and arbutus. The understory is dominated by salal.

TYPICAL QUALICUM SOIL PROFILE



Loose litter of needles and twigs over partly decomposed organic matter; strongly acid.

Very dark grayish brown (10YR 3/2m) very gravelly loamy sand; weak, fine to medium, granular; very friable; strongly acid.

Dark yellowish brown (10YR 4/4m) very gravelly loamy sand; weak, fine to medium, subangular blocky; very friable; strongly acid.

Light yellowish brown (10YR 6/4m) very gravelly sand; massive; firm; weakly cemented; strongly acid.

Grayish brown (10YR 5/2m) very gravelly sand; single-grain; loose; very strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Mor
SOLUM DEPTH (cm)	: 100+
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 60-100; discontinuous weakly cemented horizon
ROOTING DEPTH (cm)	: 40-100+
COARSE FRAGMENT CLASS	: 3-4
DEPTH TO AND TYPE OF WATERTABLE (cm)	: N/A
PERVIOUSNESS	: rapid
SOIL DRAINAGE	: rapid
SOIL TEXTURE	: very gravelly sand, very gravelly loamy sand, very gravelly sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.5-2.0)	Est.	(1.7-2.0)	Est.	(1.8-2.1)
AWSC (cm/m)	4	6 (4-8)	3	4 (3-5)	Est.	(2-6)
% COARSE > 7.5 cm	288	6 (2-10)	291	6 (2-10)	240	6 (1-10)
FRAGMENTS < 7.5 cm	288	31 (25-38)	291	32 (25-40)	240	30 (20-40)
% PASSING SIEVE 4.76 mm	5	44 (34-54)	3	43 (34-52)	2	38 (37-38)
0.5 mm	5	18 (13-25)	3	17 (15-21)	2	14 (10-18)
0.074 mm	5	6 (5-7)	3	2 (2-3)	2	2 (1-3)
% FINE SAND	5	9 (3-15)	3	10 (6-14)	2	10 (6-14)
% SAND	16	81 (70-90)	8	84 (74-94)	3	83 (65-94)
% CLAY	16	5 (2-8)	8	5 (1-9)	3	6 (3-12)
LIQUID LIMIT (%)	4	11 (0-30)	3	0 non plastic	1	0 non plastic
PLASTIC LIMIT (%)	4	9 (0-30)	3	0 non plastic	1	0 non plastic

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	19	5.5 (5.1-5.9)	10	5.7 (5.5-5.9)	4	5.6 (5.1-5.9)
(pH) 1:2 $CaCl_2$	19	4.8 (4.4-5.2)	10	5.0 (4.6-5.4)	4	5.0 (4.9-5.1)
ORGANIC CARBON (%)	16	1.8 (0.8-2.8)	8	1.4 (0.5-2.4)	4	1.2 (0.3-2.5)
NITROGEN (%)	10	0.04 (0.02-0.06)	5	0.04 (0.02-0.05)	3	0.02 (0.01-0.04)
EXCHANGE CAPACITY (meq/100g)	10	11 (6-16)	5	8 (6-10)	3	6 (4-8)
BASE SATURATION (%)	10	16 (10-22)	5	16 (9-22)	3	20 (14-26)
EXCHANGEABLE CATIONS - Ca	10	1.3 (0.6-2.0)	5	1.0 (0.4-1.6)	3	1.0 (0.4-1.6)
(meq/100g) - Mg	10	0.3 (0.1-0.5)	5	0.17 (0.09-0.25)	3	0.2 (0.1-0.3)
- Na	10	0.14 (0.03-0.3)	5	0.1 (0.05-0.15)	3	0.12 (0.08-0.15)
- K	10	0.08 (0.03-0.15)	5	0.05 (0.04-0.06)	3	0.05 (0.04-0.06)
PHOSPHORUS (ppm)	10	49 (15-100)	5	21 (13-30)	3	29 (10-50)
SULPHUR (ppm)	9	8.0 (3-13)	5	6.8 (3-11)	2	10 (8-12)
% IRON	16	0.2 (0.1-0.4)	9	0.2 (0.1-0.4)		
% ALUMINUM	16	0.3 (0.1-0.5)	9	0.3 (0.1-0.5)		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
QUco	Cobbly phase; soil has >20% cobbles and or stones.
QUco,id	Cobbly phase, imperfectly drained variant; soil has >20% cobbles and or stones, and occurs in seepage sites where drainage is restricted. Classification is Gleyed Dystric Brunisol.
QUco,md	Cobbly phase, moderately well to well drained variant; soil has >20% cobbles and or stones, and occurs in lower, wetter sites than the typical rapidly drained sites.
QUco,s	Cobbly phase, shallow variant; soil has >20% cobbles and or stones, and a different parent material or strongly contrasting texture within 50-100 cm of the surface.
QUg	Gravelly phase; solum contains 20-50% gravel.
QUg,id	Gravelly phase, imperfectly drained variant; solum contains 20-50% gravel, and occurs in seepage sites where drainage is restricted. Classification is Gleyed Dystric Brunisol.
QUg,lo	Gravelly, loamy phase; solum contains 20-50% gravels, and moderate to strong cementation occurs in the subsoil.
QUg,s	Gravelly phase, shallow variant; solum contains 20-50% gravels, and a different parent material or strongly contrasting texture within 50-100 cm of the surface.
QUid	Imperfectly drained variant; soil occurs in seepage sites where drainage is restricted. Classification is Gleyed Dystric Brunisol.
QUid,s	Imperfectly drained, shallow variant; soil occurs in seepage sites where drainage is restricted, and has different parent material or strongly contrasting texture within 50-100 cm of the surface.
QUlo	Loamy phase; 20-50 cm of gravelly loam textured surface.
QUmc	Duric variant; moderate to strong cementation occurs in the subsoil. Classification is Duric Dystric Brunisol.
QUs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS QUALICUM SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	GW, GP	A-1-a	poor-fair	good	unsuited	unsuited

QUENNELL SOILS (QL)

PLATE 4.35: QUENNELL SOIL LANDSCAPE

GENERAL COMMENTS

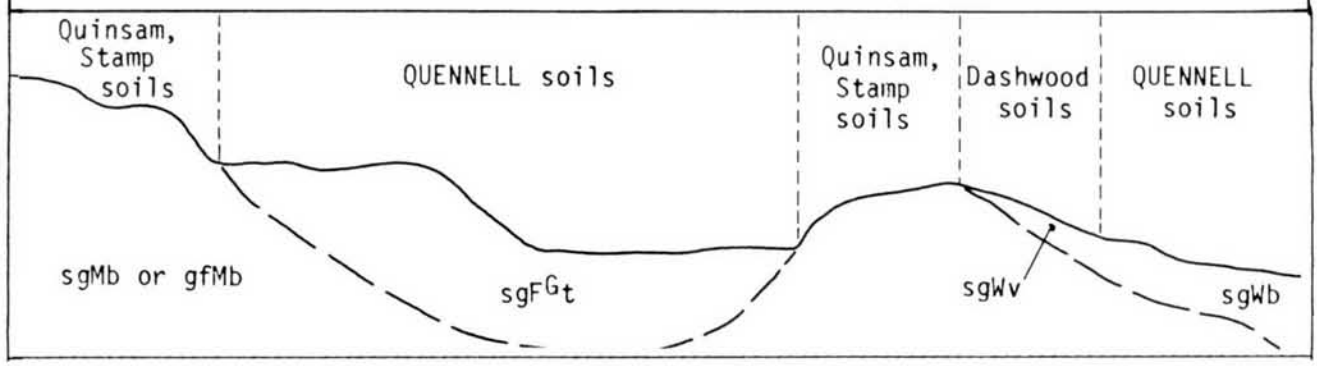
Quennell soils (10,905ha) have developed on deep, coarse-textured fluvial and fluvioglacial deposits associated with all major streams and rivers in the survey area. They also occur on coarse-textured marine deposits. Quennell soils are rapidly drained, rapidly permeable, and generally do not have a watertable within 3 m of the surface.

Characteristically, Quennell soils have very gravelly loamy sand textures with discontinuous weakly cemented horizons sometimes present at 60 cm to 100 cm depth. They are classified as Orthic Humo-Ferric Podzols.

Quennell soils vary from marginal to unsuitable for agriculture. The high coarse fragment content and sandy textures result in aridity, stoniness and fertility limitations.

Urban and related uses are recommended where care is taken to avoid contamination of the groundwater which could occur due to incomplete filtration of septic tank effluent by the coarse-textured soil and parent material. Areas where these soils occur generally have economically significant gravel deposits.

QUENNELL SOIL LANDSCAPE CROSS SECTION*

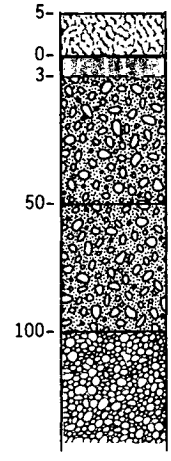


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	gravelly sandy fluvial or glaciofluvial
TOPOGRAPHY	:	0-40% (terraced, hummocky, subdued); level to gentle slopes with minor areas of very strong slopes
ELEVATION RANGE	:	130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists mainly of Douglas-fir with minor inclusions of lodgepole pine and western hemlock. The understory is dominated by salal.

TYPICAL QUENNELL SOIL PROFILE

DEPTH (cm)



Loose litter of needles and twig over partly decomposed organic matter; strongly acid.

Dark grayish brown (10YR 4/2m) very gravelly loamy sand; weak, medium, subangular blocky to single-grain ; friable; strongly acid.

Strong brown (7.5YR 4/6m) very gravelly loamy sand; weak, fine, subangular blocky to single-grain; soft, very friable; clear, wavy boundary; medium acid.

Grayish brown (10YR 5/2m) very gravelly sand; weak, fine, subangular blocky to single-grain; soft, very friable; medium acid.

Very dark grayish brown (2.5YR 3/2m) very gravelly sand, massive to single-grain; non sticky, non plastic; discontinuous weak cementation; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Mor
SOLUM DEPTH (cm)	:	100+
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	60-200; 25; discontinuous weakly cemented layer
ROOTING DEPTH (cm)	:	60-100
COARSE FRAGMENT CLASS	:	3-5
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	N/A
PERVIOUSNESS	:	rapid
SOIL DRAINAGE	:	rapid
SOIL TEXTURE	:	very gravelly sand, very gravelly loamy sand, very gravelly sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	2	1.6 (1.5-1.7)	1	1.8	Est.	2.0 (1.9-2.1)
AWSC (cm/m)	9	7 (4-12)	7	4 (3-6)	5	7 (1-15)
% COARSE > 7.5 cm	423	6 (1-11)	413	6 (1-12)	355	6 (0-11)
FRAGMENTS < 7.5 cm	423	32 (26-38	413	32 (25-40)	355	30 (20-40)
% PASSING SIEVE 4.76 mm	11	58 (34-82)	10	56 (34-78)	7	54 (27-80)
0.5 mm	11	32 (10-55)	10	23 (12-35)	7	31 (5-60)
0.074 mm	11	17 (3-55)	10	4 (2-8)	7	15 (5-45)
% FINE SAND	11	10 (0-20)	10	11 (3-25)	7	10 (2-20)
% SAND	29	80 (70-90)	18	87 (68-94)	9	85 (65-96)
% CLAY	26	5 (2-8)	16	4 (2-6)	8	4 (2-6)
LIQUID LIMIT (%)	6	13 (0-35)	5	0 non plastic	2	0 non plastic
PLASTIC LIMIT (%)	6	10 (0-26)	5	0 non plastic	2	0 non plastic

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	27	5.5 (5.2-5.8)	16	5.1 (4.8-5.4)	7	5.8 (5.5-6.1)
(pH) 1:2 $CaCl_2$	30	4.9 (4.6-5.2)	17	5.0 (4.7-5.3)	7	5.3 (4.9-5.7)
ORGANIC CARBON (%)	25	2.5 (0.8-6.0)	14	1.7 (1.0-2.4)	5	0.6 (0.2-1.2)
NITROGEN (%)	11	0.15 (0.02-0.4)	5	0.08 (0.03-0.13)	3	0.02 (0.01-0.02)
EXCHANGE CAPACITY (meq/100g)	6	14 (10-20)	6	10 (6-15)	3	6 (5-7)
BASE SATURATION (%)	6	13 (5-20)	5	15 (9-19)	3	24 (16-36)
EXCHANGEABLE CATIONS - Ca	6	1.4 (0.4-2.0)	5	1.3 (1.0-1.6))	3	1.1 (0.6-1.4)
(meq/100g) - Mg	11	0.8 (0.1-2.4)	5	0.3 (0.2-0.4)	3	0.3 (0.1-0.4)
- Na	11	0.1 (0.02-0.2)	5	0.1 (0.05-0.15)	3	0.09 (0.06-0.12)
- K	11	0.1 (0.05-0.2)	5	0.08 (0.04-0.12)	3	0.07 (0.02-0.12)
PHOSPHORUS (ppm)	12	50 (10-90)	5	38 (18-58)	3	32 (13-50)
SULPHUR (ppm)	6	7 (5-9)	2	4.9 (3.5-5.8)	3	5.9 (3.4-8.4)
% IRON	30	0.3 (0.2-0.4)	15	0.3 (0.1-0.5)	4	0.1 (0.1-0.2)
% ALUMINUM	30	0.4 (0.2-0.6)	15	0.4 (0.2-0.6)	4	0.2 (0.1-0.3)

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
QLco	Cobbly phase; soil has >20% cobbles and or stones.
QLco,mc	Cobbly phase, moderately cemented variant; soil has >20% cobbles and or stones, with moderate cementation occuring in the subsoil.
QLg	Gravelly phase; the upper horizons contain 20-50% gravel. The usual condition for Quesnel soils is coarse fragment contents in excess of 50%.
QLg,id	Gravelly phase, imperfectly drained variant; soil contains 20-50% gravel, and occurs in seepage sites where drainage is restricted. Classification is Gleyed Humo-Ferric Podzol.
QLg,mc	Gravelly phase, moderately cemented variant; solum contains 20-50% gravels, and moderate cementation occurs in the subsoil.
QLg,s	Gravelly phase, shallow variant; solum contains 20-50% gravels, which overlies a different parent material or strongly contrasting texture within 50-100 cm of the surface.
QLid	Imperfectly drained variant; occurs in seepage sites where drainage is restricted. Classification is Gleyed Humo-Ferric Podzol.
QLid,lo	Imperfectly drained variant, loamy phase; soil has 20-50 cm of loam textured surface, and occurs in seepage sites where drainage is restricted.
QLid,s	Imperfectly drained, shallow variant; soil has different parent material or strongly contrasting texture within 50-100 cm of the surface, and occurs in seepage sites where drainage is restricted.
QLl2	Shallow lithic phase; bedrock occurs within 50-100 cm of the surface.
QLmc	Moderately cemented variant; moderate to strong cementation occurs in the subsoil.
QLmc,s	Moderately cemented, shallow variant; moderate to strong cementation occurs in the subsoil, along with a different parent material or strongly contrasting texture that occurs within 50-100 cm of surface.
QLs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS QUENNELL SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	GW, GP	A-1-a	poor-fair	good	unsuited	unsuited

QUINSAM SOILS (QN)

PLATE 4.36: QUINSAM SOIL LANDSCAPE

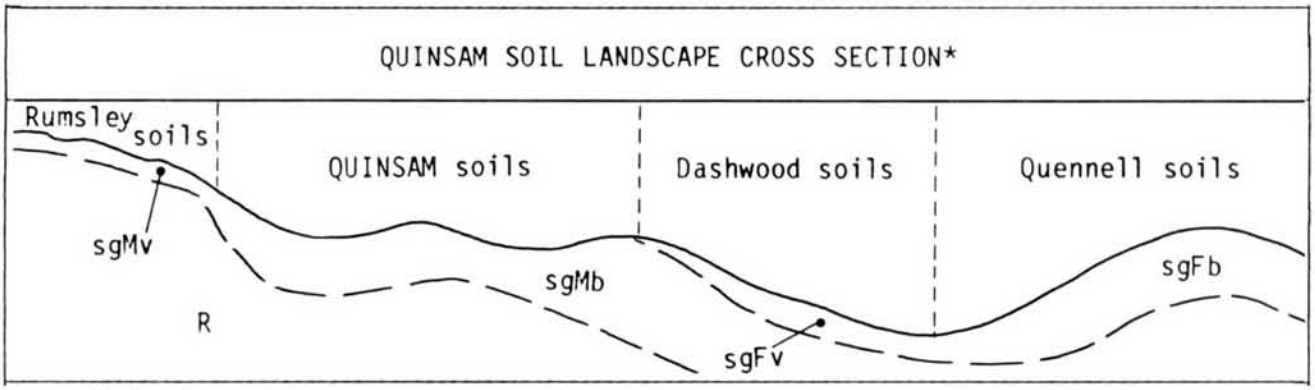
GENERAL COMMENTS

Quinsam soils (7405ha) occur on gentle to very strong slopes near or above 100 m elevation. The most extensive areas occur at higher elevations along the western edge of the survey area where they are associated with shallow soils over bedrock such as Rumsley or Saturna. They are moderately well drained with some lateral water movement during rainy periods. They have developed in sandy gravelly morainal materials and are often very strong.

The upper horizons are strong brown, very friable and have gravelly sandy loam textures. These grade into a mottled and strongly cemented horizon at 70 to 100 cm depth. Quinsam soils are classified as **Duric Humo-Ferric Podzols.**

Most Quinsam soils are under forest cover but some have been converted into pasture and hay production. Low fertility, aridity, stoniness and some steep slopes are the main restrictions to agricultural use.

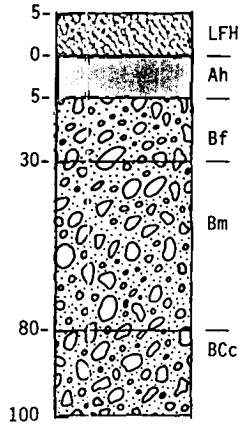
Quinsam soils have high bearing strengths but septic tank effluent disposal is impeded by the cemented subsoils.



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy gravelly morainal blanket
TOPOGRAPHY	:	5-40%; gentle to very strong slopes
ELEVATION RANGE	:	100+ m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists mainly of Douglas-fir, western hemlock, western red cedar, alder, with an understory dominated by salal.

TYPICAL QUINSAM SOIL PROFILE



Loose litter of leaves, needles, and twigs over partly to well decomposed organic matter; strongly acid.

Dark brown (10YR 3/3m) very gravelly sandy loam; very strongly acid.

Strong brown (7.5YR 4/6m) very gravelly sandy loam; weak, fine, subangular blocky; very friable; very strongly acid.

Strong brown (7.54YR 5/6m) very gravelly sandy loam; weak, fine, subangular blocky; very friable; strongly acid.

Light yellowish brown (2.5Y 6/4m) gravelly or very gravelly sandy loam; common, medium, distinct mottles; massive; extremely firm; strongly cemented; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Moder
SOLUM DEPTH (cm)	:	95
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	70-120, 10-60; cemented layer
ROOTING DEPTH (cm)	:	70-90
COARSE FRAGMENT CLASS	:	3-5
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	perched watertable during rainy period
PERVIOUSNESS	:	slow
SOIL DRAINAGE	:	moderately well to well
SOIL TEXTURE	:	very gravelly sandy loam; very gravelly loamy sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	1	1.4	1	1.7	2	2.2 (2.0-2.4)
AWSC (cm/m)	8	11 (9-13)	6	10 (8-12)	5	9 (7-11)
% COARSE > 7.5 cm	271	9 (5-13)	266	9 (5-13)	203	8 (4-12)
FRAGMENTS < 7.5 cm	271	27 (22-33)	266	28 (23-33)	203	25 (18-32)
% PASSING SIEVE 4.76 mm		59 (40-78)	5	60 (50-70)	3	70 (56-86)
0.5 mm		39 (26-51)	5	36 (24-48)	3	50 (42-63)
0.074 mm		22 (26-51)	5	22 (12-34)	3	26 (23-30)
% FINE SAND	5	16 (12-20)	5	15 (8-22)	3	18 (15-20)
% SAND	16	55 (42-68)	10	53 (33-73)	7	65 (52-78)
% CLAY	16	12 (6-18)	10	13 (4-22)	7	8 (4-12)
LIQUID LIMIT (%)	3	31 (25-37)	3	18 (0-28)	2	23 (22-24)
PLASTIC LIMIT (%)	3	26 (22-30)	3	15 (0-25)	2	20 (19-22)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	75-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	18	5.5 (5.1-5.9)	10	5.6 (5.2-6.0)	5	4.9 (4.5-5.3)
(pH) 1:2 $CaCl_2$	21	4.8 (4.4-5.2)	11	4.8 (4.4-5.2)	5	5.6 (5.2-6.0)
ORGANIC CARBON (%)	17	2.5 (1.0-4.0)	8	1.7 (0.9-2.5)	4	0.6 (0.2-1.0)
NITROGEN (%)	8	0.12 (0.03-0.2)	4	0.05 (0.03-0.07)	4	0.03 (0.01-0.04)
EXCHANGE CAPACITY (meq/100g)	10	18 (11-25)	4	14 (11-17)	4	11 (6-16)
BASE SATURATION (%)	8	21 (3-40)	4	24 (10-40)	4	22 (10-50)
EXCHANGEABLE CATIONS - Ca	8	2.9 (0.05-5.5)	4	0.09 (0.02-0.2)	4	2.2 (0.05-5.0)
(meq/100g) - Mg	8	1.0 (0.01-2.5)	4	0.6 (0.0-1.7)	4	0.8 (0.01-3.0)
- Na	8	0.4 (0.02-1.0)	4	0.8 (0.01-2.0)	4	0.08 (0.04-0.15)
- K	8	0.1 (0.01-0.2)	4	0.8 (0.01-2.0)	4	0.07 (0.01-0.18)
PHOSPHORUS (ppm)	8	46 (15-80)	4	40 (10-100)	4	45 (10-90)
SULPHUR (ppm)	5	11 (4-27)	2	7 (5-10)	2	7 (4-10)
% IRON	22	0.3 (0.2-0.4)	8	0.3 (0.2-0.4)	2	0.05
% ALUMINUM	22	0.4 (0.2-0.6)	8	0.4 (0.2-0.6)	2	0.2

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
QNco	Cobbly phase; soil has >20% cobbles and or stones.
QNco,s	Cobbly phase, shallow variant; soil has >20% cobbles and or stones, and a differnt parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
QNdc	Deep cemented phase; a strongly cemented horizon occurs below 100 cm.
QNg	Gravelly phase; solum contains 20-50% gravel. The usual gravel content of these soils is >50%.
QNg,id	Gravelly phase, imperfectly drained variant; soil contains 20-50% gravel, and occurs in sepage sites where drainage is restricted.
QNg,wc	Gravelly phase, weakly cemented variant; solum contains 20-50% gravels, and has a cemented horizon occuring between 50-100 cm depth that is not sufficiently cemented to be a duric horizon.
QNid	Imperfectly drained variant; soil occurs in seepage sites where drainage is restricted.
QNlo	Loamy phase; soil has 20-50 cm of loam textured surface.
QNs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
QNwc	Weakly cemented variant; a cemented horizon occuring between 50-100 cm depth that is not sufficiently cemented to be a duric horizon. Classification is Orthic Humo-Ferric Podzol.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS QUINSAM SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	GM, SM, GW	A-1-b	poor	fair-poor	unsuited	unsuited

ROYSTON SOILS (RN)

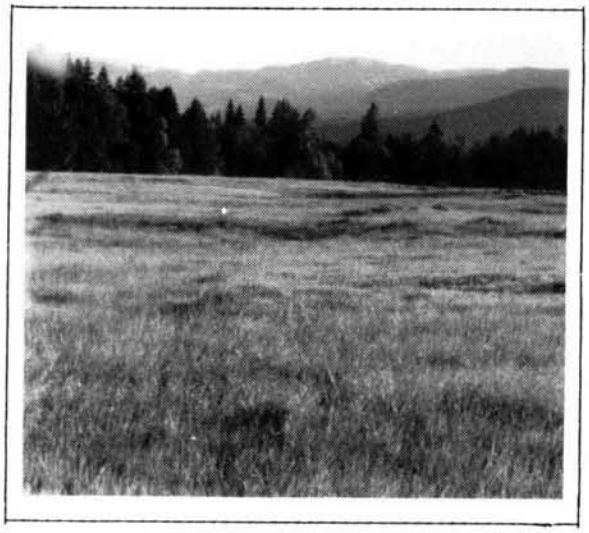


PLATE 4.37: ROYSTON SOIL LANDSCAPE

GENERAL COMMENTS

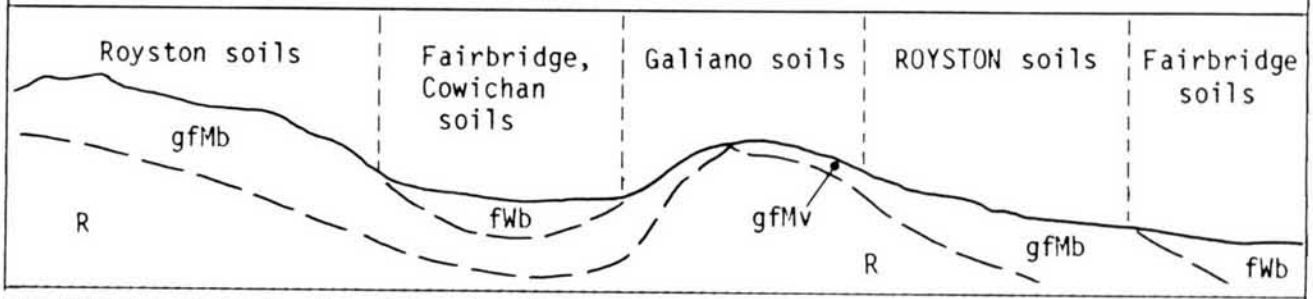
Royston soils (4520ha) occur on gently to steeply sloping areas near or above 50 m elevation. They occur from Qualicum Beach northward, with extensive areas found between Fanny Bay and Royston. Royston soils have developed in moderately stony, medium-textured morainal deposits which are partially derived from sedimentary bedrock formations. These soils are imperfectly drained and have seasonal perched watertables and lateral seepage over the unweathered compact parent material during rainy periods.

Royston soils are characterized by gravelly loam or gravelly clay loam (Alberni Valley area) textures with a mottled horizon overlying a very compact horizon at 1 m. Royston soils are classified as **Gleyed Dystric Brunisol** with inclusions of Gleyed Humo-Ferric Podzols.

Most Royston soils presently support productive forests. Agriculturally, they are restricted by stoniness and topography. When improved they are useful for a wide range of crops where topography permits.

Royston soils have high bearing strengths but septic tank effluent disposal is impeded by the slowly permeable subsoil.

ROYSTON SOIL LANDSCAPE CROSS SECTION*

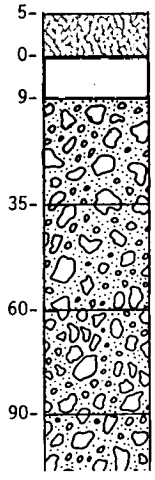


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	gravelly fine morainal blanket
TOPOGRAPHY	:	very gentle to strong slopes
ELEVATION RANGE	:	usually higher than 50 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Native vegetation consists of Douglas-fir with minor inclusions of western red cedar, alder and maple.

TYPICAL ROYSTON SOIL PROFILE

DEPTH (cm)



Loose litter of leaves, needles, and twigs over to well decomposed organic matter; very strongly acid.

Black (10YR 2/1m) gravelly loam; fine and medium, granular; very friable; very strongly acid.

Dark brown (7.5YR 3/4m) gravelly loam; weak to moderate, medium, subangular blocky; friable; strongly acid.

Dark yellowish brown (10YR 3/4m) gravelly loam; weak, medium, subangular blocky; friable; slightly plastic; strongly acid.

Light yellowish brown (10YR 6/4m) gravelly loam; many, medium, distinct mottles; moderate, medium, subangular blocky; firm; slightly plastic; strongly acid.

Yellowish brown (10YR 5/4m) gravelly loam; many, medium, distinct mottles; massive; very firm; strongly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Mull
SOLUM DEPTH (cm)	: 80-100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 60-100; compact lower horizons
ROOTING DEPTH (cm)	: 80
COARSE FRAGMENT CLASS	: 3-1
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 80-180; seasonal perched
PERVIOUSNESS	: slow
SOIL DRAINAGE	: imperfect
SOIL TEXTURE	: gravelly loam, gravelly clay loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.4-1.7)	Est.	(1.4-1.8)	1	1.8
AWSC (cm/m)	2	17 (14-20)	2	14 (13-16)	2	13 (10-16)
% COARSE > 7.5 cm	171	6 (2-10)	171	6 (2-9)	146	5 (2-8)
FRAGMENTS < 7.5 cm	171	19 (13-25)	171	19 (13-25)	146	17 (11-23)
% PASSING SIEVE 4.76 mm	2	82 (77-87)	2	76 (68-82)	2	59 (39-79)
0.5 mm	2	74 (64-84)	2	63 (60-67)	2	41 (26-56)
0.074 mm	2	57 (47-67)	2	44 (40-48)	2	23 (10-36)
% FINE SAND	2	10 (7-13)	2	13 (10-16)	2	14 (12-16)
% SAND	8	42 (30-55)	7	44 (34-54)	6	47 (37-57)
% CLAY	8	20 (12-28)	7	19 (12-26)	6	18 (10-26)
LIQUID LIMIT (%)	2	82 (77-87)	2	76 (68-82)	2	59 (39-79)
PLASTIC LIMIT (%)	2	74 (64-84)	2	63 (60-67)	2	41 (26-56)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	5	5.4 (5.1-5.7)	2	5.7 (5.5-5.8)	1	6.1
(pH) 1:2 $CaCl_2$	5	4.7 (4.4-5.0)	2	4.9 (4.7-5.0)	1	5.3
ORGANIC CARBON (%)	5	2.1 (1.2-3.0)	2	1.6 (0.5-2.7)	1	0.3
NITROGEN (%)	2	0.08 (0.03-0.12)	1	0.03	1	0.02
EXCHANGE CAPACITY (meq/100g)	2	32 (20-44)	1	16	1	21
BASE SATURATION (%)	2	36 (30-40)	1	58	1	76
EXCHANGEABLE CATIONS - Ca	2	9.2 (4.9-13)	1	6.1	1	10.4
(meq/100g) - Mg	2	2.3 (2.0-2.5)	1	3.0	1	5.1
- Na	2	0.12 (0.09-0.15)	1	0.16	1	0.25
- K	2	0.14 (0.11-0.16)	1	0.07	1	0.1
PHOSPHORUS (ppm)	2	6 (5-7)	1	4.7	1	5.3
SULPHUR (ppm)	2	5 (4-6)	1	4.0	1	4.5
% IRON	4	0.6 (0.4-0.8)	1	0.6		
% ALUMINUM	4	0.4 (0.2-0.6)	1	0.7		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
RNco	Cobbly phase; soil has >20% cobbles and or stones.
RNco,pd	Cobbly phase, poorly drained variant; soil has >20% cobbles and or stones, and occurs in seepage sites and depressional areas. Classification is Orthic Humic Gleysol.
RNmc,s	Moderately cemented shallow variant; moderate to strong cementation occurs in the subsoil, along with a different parent material or strongly contrasting texture that occurs within 50-100 cm of the surface.
RNmd	Moderately well to well drained variant; drier soil moisture regime.
RNmd,vs	Moderately well to well drained, very shallow variant; drier soil moisture regime with a different parent material or strongly contrasting texture within 10-50 cm of the surface.
RNmd,wc	Moderately well to well drained, weakly cemented variant; soil has a drier moisture regime, and a cemented horizon occurs between 50-100 cm depth that is not sufficiently sufficiently cemented to be a duric horizon.
RNpd	Poorly drained variant; occurs in seepage sites and depressional areas. Classification is Orthic Humic Gleysol.
RNpd,pt	Poorly drained variant, peaty phase; occurs in seepage sites and depressional areas with 10-40 cm of humic or mesic organic material over the mineral soil. Classification is Orthic Humic Gleysol.
RNpd,vg	Poorly drained variant, very gravelly phase; occurs in seepage sites and depressional areas, and has greater than 50% coarse fragment content.
RNs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.
RNs,vg	Shallow variant, very gravelly phase; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface, and the solum contains >50% coarse fragments.
RNvg	Very gravelly phase; soil has >50% coarse fragments by volume. These soils usually have <50% coarse fragments.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS ROYSTON SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	GM, SM, GW	A-1-b	poor	poor	poor	unsuited

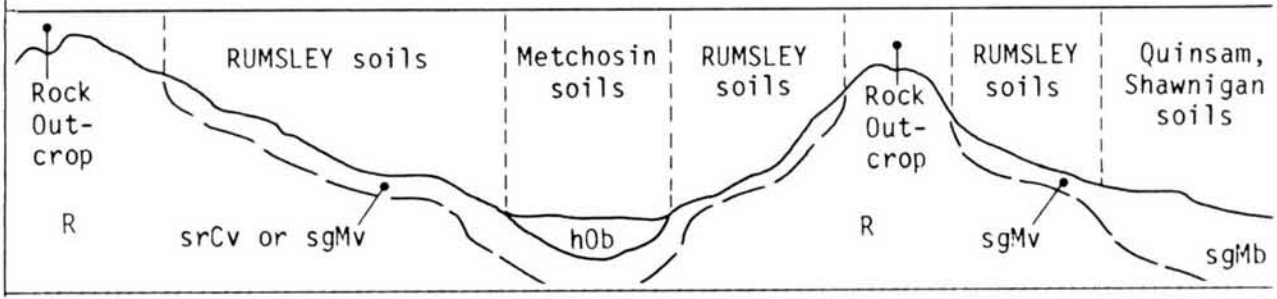
RUMSLEY SOILS (RY)

PLATE 4.38: RUMSLEY SOIL LANDSCAPE

GENERAL COMMENTS

Rumsley soils (3515ha) have developed on gently very strongly sloping veneers of coarse-textured colluum or morainal material overlying volcanic or intrusbedrock. Outcrops of bedrock are commonly found association with Rumsley soils. Their classificat ranges from **Orthic Dystric Brunisol: lithic phase Orthic Humo-Ferric Podzol: lithic phase.** A high coa fragment content, shallow soil depth and steep slopes serious constraints on agricultural use. Most Rums soils remain under forest cover. Rumsley soils generally not suitable for urban development because shallowness to bedrock and steep slopes which seriou effect service installations and effluent disposal.

RUMSLEY SOIL LANDSCAPE CROSS SECTION*



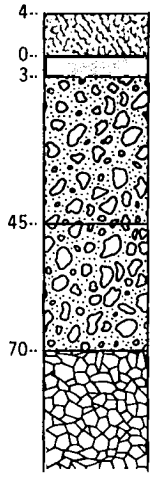
*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy gravelly morainal or sandy rubbly colluviual veneers over subdued volcanic or intrusive bedrock
TOPOGRAPHY	:	3-50%; gentle to extreme slopes
ELEVATION RANGE	:	0-250 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Native vegetation consists mainly of Douglas-fir with minor inclusions of western red cedar, western hemlock, and arbutus. The understory is dominated by salal.

TYPICAL RUMSLEY SOIL PROFILE

DEPTH (cm)



LF — Loose litter of needles and twigs over partly decomposed organic matter; strongly acid.

Ah — Black (5YR 2.5/1m) gravelly sandy loam; moderate, fine, granular; friable; medium acid.

Bf — Reddish brown (5YR 4/4m) gravelly sandy loam; weak, fine, subangular blocky; friable; medium acid.

Bm — Brown (7.5YR 4/5m) very gravelly sandy loam; weak, fine to medium, subangular blocky; friable; medium acid.

R — Bedrock.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	50-100
HUMUS FORM	:	Mor
SOLUM DEPTH (cm)	:	50-100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	50-100; volcanic or intrusive bedrock
ROOTING DEPTH (cm)	:	50-100
COARSE FRAGMENT CLASS	:	3-5
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	N/A
PERVIOUSNESS	:	rapid
SOIL DRAINAGE	:	well to rapid
SOIL TEXTURE	:	gravelly or very gravelly sandy loam, gravelly or very gravelly loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-75 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	1.6 (1.4-1.8)	Est.	1.7 (1.5-1.9)	Est.	1.8 (1.6-2.0)
AWSC (cm/m)	Est.	9 (5-13)	Est.	8 (4-12)	Est.	4 (2-6)
% COARSE > 7.5 cm	36	12 (3-20)	32	10 (5-15)	18	10 (5-15)
FRAGMENTS < 7.5 cm	36	26 (21-31)	32	27 (23-31)	18	25 (18-32)
% PASSING SIEVE 4.76 mm	1	22	1	46	Est.	30 (20-40)
0.5 mm	1	8	1	23	Est.	10 (5-20)
0.074 mm	1	6	1	12	Est.	8 (4-12)
% FINE SAND	Est.	6 (3-10)	Est.	8 (4-12)	Est.	8 (4-12)
% SAND	4	60 (54-66)	3	65 (58-72)	1	70
% CLAY	4	8 (6-10)	3	6 (3-9)	1	2
LIQUID LIMIT (%)	Est.	non plastic	1	non plastic	Est.	non plastic
PLASTIC LIMIT (%)	Est.	non plastic	1	non plastic	Est.	non plastic

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	Mean (Range)
SOIL REACTION 1:1 H_2O	2	5.4 (5.2-5.7)	Est.	5.5 (5.0-6.0)		
(pH) 1:2 $CaCl_2$	2	4.6 (4.2-5.0)	Est.	4.9 (4.6-5.5)		
ORGANIC CARBON (%)	1	2.9	Est.	1.0 (0.5-2.0)		
NITROGEN (%)	Est.	0.08 (0.05-0.1)	Est.	0.05 (0.02-0.08)		
EXCHANGE CAPACITY (meq/100g)	Est.	15 (10-20)	Est.	12 (8-15)		
BASE SATURATION (%)	Est.	12 (10-15)	Est.	8 (5-12)		
EXCHANGEABLE CATIONS - Ca	Est.	1.4 (0.1-5.0)	Est.	0.8 (0.1-0.2)		
(meq/100g) - Mg	Est.	0.2 (0.1-0.4)	Est.	0.1 (0.05-0.2)		
- Na	Est.	0.1 (0.01-0.2)	Est.	0.05 (0.01-0.1)		
- K	Est.	0.1 (0.01-0.2)	Est.	0.05 (0.01-0.1)		
PHOSPHORUS (ppm)	Est.	25 (5-50)				
SULPHUR (ppm)	Est.	2 (1-3)				
% IRON	4	0.3 (0.1-0.5)				
% ALUMINUM	4	0.5 (0.3-0.7)				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
RYco	Cobbly phase; soil has >20% cobbles and or stones.
RYg	Gravelly phase; solum contains 20-50% gravel.
RYg,13	Gravelly, very shallow lithic phase; solum contains 20-50% gravel, and volcanic or intrusive bedrock occurs within 50 cm of the surface.
RY13	Very shallow lithic phase; volcanic or intrusive bedrock occurs within 50 cm of the surface.
RY13,r	Very shallow lithic, rubbly/blocky phase; volcanic or intrusive bedrock occurs within 50 cm of the surface, and the solum has >50% rubbly/blocky material by volume.
RYlo	Loamy phase; 20-50 cm of loam textured surface.
RYr	Rubbly/blocky phase; solum has >50% rubbly/blocky material by volume.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS RUMSLEY SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-75	GM, SM	A-1-b	poor	poor	unsuited	unsuited

ST. MARY SOILS (SM)

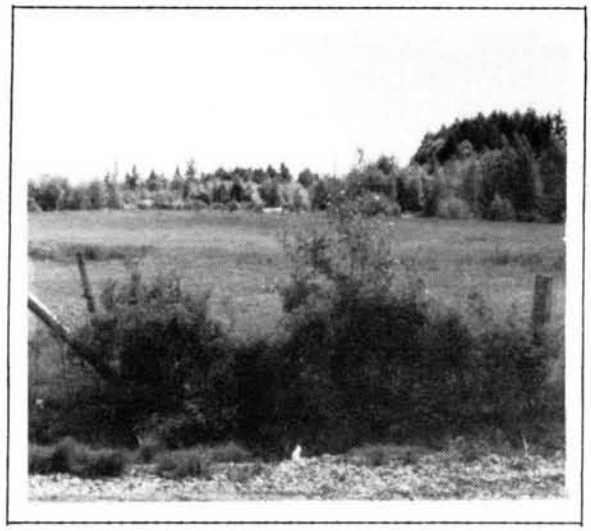


PLATE 4.39: ST. MARY SOIL LANDSCAPE

GENERAL COMMENTS

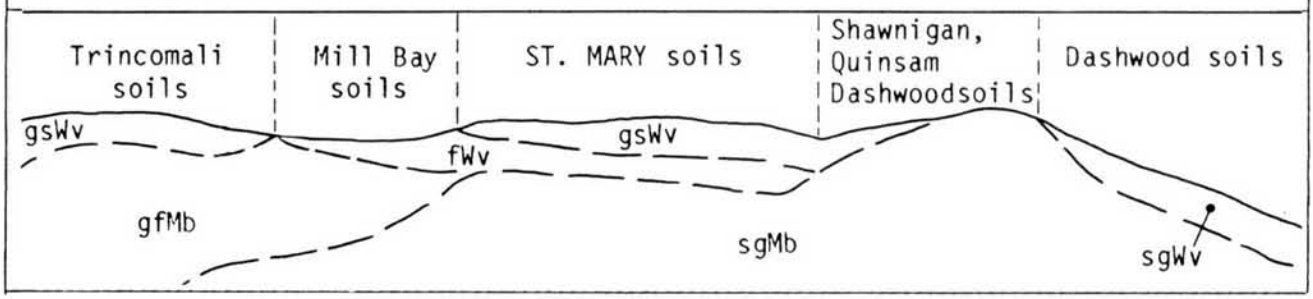
St. Mary soils (1895ha) occur on undulating morainal landscapes, predominantly in the Comox Valley. The stratified parent materials consist of a gravelly sandy marine or fluvial veneer over a 20-40 cm deposit of sandy fine marine which in turn is underlain by gravelly sandy till. These imperfectly drained soils have a perched water table during the winter months.

St. Mary soils have gravelly sandy loam or gravelly loamy sand surface texture overlying a stone free loam horizon. The underlying impervious till has a gravelly sandy loam texture and is compacted or in some areas cemented. These soils are classified as Gleyed Dystric Brunisols and Gleyed Humo-Ferric Podzols.

The dominant land use on these soils is forestry. Cleared areas are in pasture and hay crops. Irrigation and drainage are required to increase agricultural production, however, because of the variable stratigraphy and the underlying compact till agricultural management on these soils is difficult.

St. Mary soils have a high bearing capacity for urban and related uses, however, the perched water tables during the winter restricts the efficient operation of septic tank effluent filter fields.

ST. MARY SOIL LANDSCAPE CROSS SECTION*

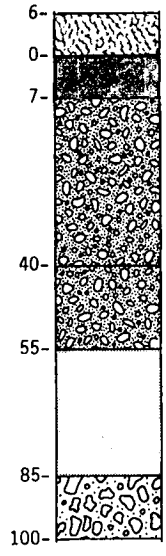


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	gravelly sandy marine or fluvial veneer, over sandy fine marine, over gravelly sandy morainal
TOPOGRAPHY	:	5-15%; gentle to moderate slopes
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Second growth Douglas fir, western red cedar, red alder, maple and grand fir. The understory is dominated by sword fern.

TYPICAL ST.MARY SOIL PROFILE

DEPTH (cm)



LFH — Loose litter of leaves, needles, and twigs over partly to well decomposed organic matter; extremely acid.

Ah — Dark reddish brown (5YR 2.5/2m) gravelly sandy loam; weak, medium, granular; very friable; non-sticky; non-plastic; strongly acid.

Bf — Dark reddish brown (2.5YR 3/4m) gravelly sandy loam; weak, fine to medium, subangular blocky; very friable; non-sticky; non-plastic; strongly acid.

Bm — Dark yellowish brown (10YR 4/4m) gravelly sandy loam; weak, fine to medium, subangular blocky; friable; non-sticky; non-plastic; medium acid.

IIBCg — Olive brown (2.5Y 4/6m) loam; many, medium, prominent mottles; moderately, medium, subangular blocky; firm; slightly sticky; slightly plastic; medium acid.

IIICBg — Dark grey (5Y 4/1m) gravelly sandy loam or loam; massive; very firm; non-sticky; slightly plastic; slightly acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Mull
SOLUM DEPTH (cm)	:	85
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	70; 30-50; compact or cemented
ROOTING DEPTH (cm)	:	70
COARSE FRAGMENT CLASS	:	2-3
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	70-180; seasonal perched
PERVIOUSNESS	:	slow
SOIL DRAINAGE	:	imperfect
SOIL TEXTURE	:	sandy loam to loamy sand/loam/sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.4-1.6)	Est.	(1.4-1.8)	Est.	(1.5-1.9)
AWSC (cm/m)	2	9 (7-11)	1	8	1	11
% COARSE > 7.5 cm	121	4 (2-8)	120	4 (2-8)	97	2 (0-4)
FRAGMENTS < 7.5 cm	121	20 (12-28)	121	18 (10-26)	99	9 (2-16)
% PASSING SIEVE 4.76 mm	1	65	1	65	1	82
0.5 mm	1	37	1	37	1	63
0.074 mm	1	12	1	12	1	46
% FINE SAND	1	8	1	8	1	13
% SAND	5	65 (56-74)	3	66 (52-88)	2	44 (40-50)
% CLAY	5	11 (8-14)	3	12 (9-15)	2	17 (15-19)
LIQUID LIMIT (%)	Est.	(25-45)	Est.	(23-43)	1	30
PLASTIC LIMIT (%)	Est.	(26-30)	Est.	(25-30)	1	24

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-40 cm Mean (Range)	N	40-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	6	5.3 (5.0-5.6)	1	5.6	1	5.9
(pH) 1:2 $CaCl_2$	6	4.7 (4.4-5.0)	1	4.8	1	5.2
ORGANIC CARBON (%)	6	3.5 (3.0-5.0)	1	1.2	1	0.6
NITROGEN (%)	3	0.2 (0.05-0.4)	1	0.08	1	0.04
EXCHANGE CAPACITY (meq/100g)	3	23 (11-35)	1	18	1	21
BASE SATURATION (%)	3	26 (21-31)	1	26	1	63
EXCHANGEABLE CATIONS - Ca	3	4.4 (1.7-7.4)	1	3.3	1	9.0
(meq/100g) - Mg	3	1.4 (0.4-2.0)	1	1.2	1	3.7
- Na	3	0.3 (0.05-0.6)	1	0.18	1	0.3
- K	3	0.1 (0.05-0.15)	1	0.03	1	0.06
PHOSPHORUS (ppm)	3	11 (5-20)	1	6.8	1	2.8
SULPHUR (ppm)	2	4.4 (2.2-6.5)	1	2.3	1	4.4
% IRON	4	0.6 (0.3-0.9)	1	0.5	1	0.3
% ALUMINUM	4	0.7 (0.5-0.9)	1	0.5	1	0.2

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
SMco	Cobbly phase; soil has greater than 20% cobbles and or stones.
SMco,pd	Cobbly phase, poorly drained variant; soil has greater than 20% cobbles and or stones, and occurs in seepage sites and depressional areas. Gleysolic soil development exists.
SMlo	Loamy phase; 20-50 cm of loam textured surface.
SMmd,vg	Moderately well to well drained variant, very gravelly phase; a drier soil moisture regime, with greater than 50% coarse fragments by volume in the solum.
SMpd	Poorly drained variant; found in seepage sites and depressional areas. Gleysolic soil development exists.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS ST. MARY SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-65 65-100+	SW, SC GM, SM	A-2, A-4 A-1-b	poor poor	poor poor	poor poor	poor poor

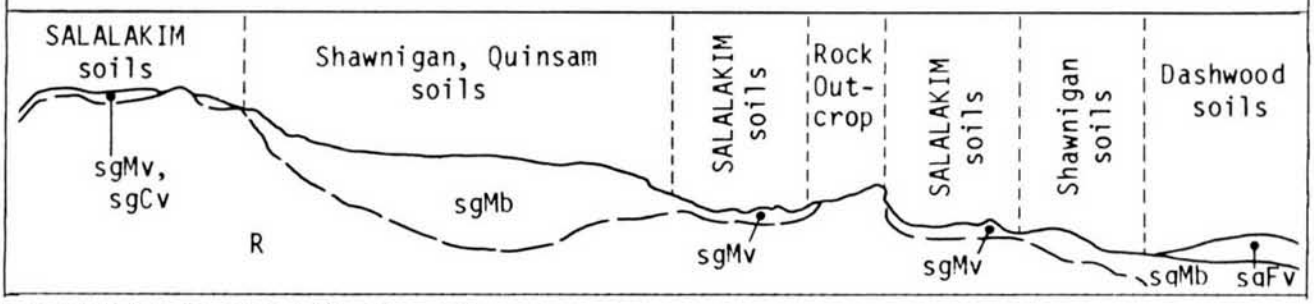
SALALAKIM SOILS (SL)

PLATE 4.40: SALALAKIM SOIL LANDSCAPE

GENERAL COMMENTS

Salalakim soils (105ha) have developed in a veneer of coarse-textured morainal and colluvial deposits overlying conglomerate bedrock. The classification of these soils ranges from **Orthic Dystric Brunisol lithic phase** to **Orthic Humo-Ferric Podzol; lithic phase.** The main limitation to agriculture and other uses are steep slopes and shallowness to the resistant conglomerate bedrock. Depth to bedrock varies considerably over small distances. Salalakim soils are generally not suitable for urban development because of shallowness to bedrock and steep slopes, both of which seriously affect service installations and effluent disposal.

SALALAKIM SOIL LANDSCAPE CROSS SECTION*

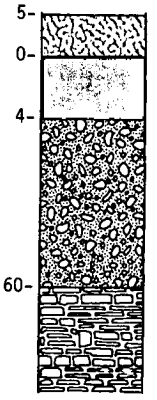


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy gravelly morainal or colluvial veneer over conglomerate bedrock
TOPOGRAPHY	:	10-50%; moderate to extreme slopes
ELEVATION RANGE	:	50-200 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists of Douglas-fir, arbutus, and lodgepole pine.

TYPICAL SALALAKIM SOIL PROFILE

DEPTH (cm)



LF — Loose litter of leaves, needles, and twigs over partly decomposed organic matter; strongly acid.

Ahe — Very dark grayish brown (10YR 3/2m) very gravelly sandy loam; weak, fine, subangular blocky breaking to single grained; loose; strongly acid.

Bm — Brown (7.5YR 4/5m) very gravelly loamy sand; moderate, medium, subangular blocky breaking to weak, fine, subangular blocky; loose; strongly acid.

R — Conglomerate bedrock.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	50-100
HUMUS FORM	:	Moder
SOLUM DEPTH (cm)	:	50-100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	50-100; conglomerate bedrock
ROOTING DEPTH (cm)	:	50-100
COARSE FRAGMENT CLASS	:	3-4
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	N/A
PERVIOUSNESS	:	rapid
SOIL DRAINAGE	:	rapid
SOIL TEXTURE	:	very gravelly loamy sand; very gravelly sandy loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-60 cm Mean (Range)	N	Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.5-1.9)	Est.	(1.6-2.0)		
AWSC (cm/m)	Est.	(2-6)	Est.	(2-5)		
% COARSE > 7.5 cm	5	7 (2-14)	5	7 (2-14)		
FRAGMENTS < 7.5 cm	5	26 (14-38)	5	26 (14-38)		
% PASSING SIEVE 4.76 mm	Est.	(40-60)	Est.	(20-40)		
0.5 mm	Est.	(10-20)	Est.	(5-15)		
0.074 mm	Est.	(3-8)	Est.	(3-8)		
% FINE SAND	Est.	(3-9)	Est.	(4-12)		
% SAND	Est.	(60-80)	Est.	(70-90)		
% CLAY	Est.	(2-8)	Est.	(2-8)		
LIQUID LIMIT (%)	Est.	non plastic	Est.	non plastic		
PLASTIC LIMIT (%)	Est.	non plastic	Est.	non plastic		

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-60 cm Mean (Range)	N	Mean (Range)
SOIL REACTION 1:1 H_2O	Est.	(5.1-5.8)	Est.	(5.7-6.1)		
(pH) 1:2 $CaCl_2$	1	5.0	Est.	(5.2-5.6)		
ORGANIC CARBON (%)	1	2.2	Est.	(0.5-2.0)		
NITROGEN (%)	Est.	(0.04-0.1)	Est.	(0.02-0.08)		
EXCHANGE CAPACITY (meq/100g)	Est.	(10-20)	Est.	(10-16)		
BASE SATURATION (%)	Est.	(10-20)	Est.	(10-30)		
EXCHANGEABLE CATIONS - Ca	Est.	(0.2-1.8)	Est.	(0.4-1.2)		
(meq/100g) - Mg	Est.	(0.1-0.4)	Est.	(0.05-0.2)		
- Na	Est.		Est.	(0.05-0.15)		
- K	Est.	(0.1-0.3)	Est.	(0.03-0.1)		
% IRON	1	0.2				
% ALUMINUM	1	0.4				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
SLg	Gravelly phase; solum contains 20-50% gravel.
SL13	Very shallow lithic phase; conglomerate bedrock occurs within 50 cm of the surface.
SL13,r	Very shallow lithic, rubbly/blocky phase; conglomerate bedrock occurs within 50 cm of the surface, and the solum has >50% rubbly/blocky material by volume.
SLr	Rubbly/blocky phase; solum has >50% rubbly/blocky material by volume.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS SALALAKIM SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-60	GP, GW	A-1-a	poor	fair	unsuited	unsuited

SATURNA SOILS (ST)

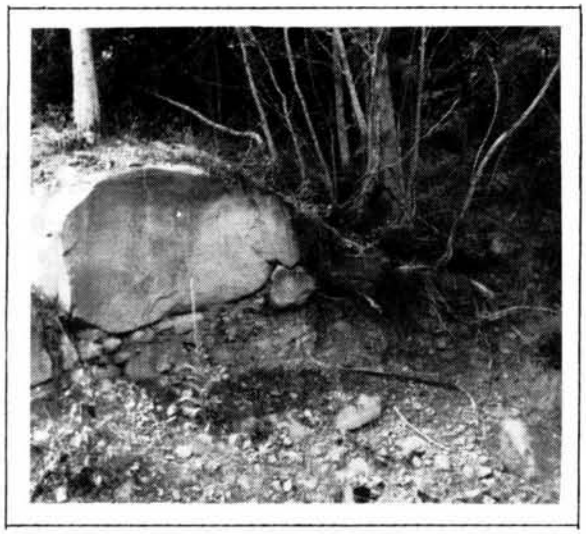
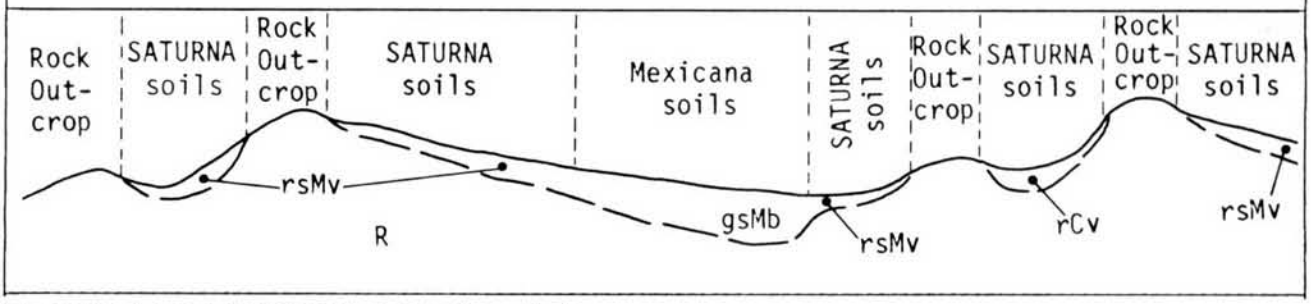


PLATE 4.41: SATURNA SOIL LANDSCAPE

GENERAL COMMENTS

Saturna soils (2595ha) have developed in a veneer of coarse-textured morainal or colluvial deposits overlying gently to very strongly sloping, ridged sandstone bedrock. They are classified as **Orthic Dystric Brunisols; lithic phase** or **Orthic Humo-Ferric Podzol; lithic phase.** A high coarse fragment content, shallow soil depth, and steep slopes are serious constraints for agricultural use. Most Saturna soils remain under forest cover. Saturna soils are generally not suitable for urban development because of shallowness to bedrock and steep slopes which seriously affect service installations and effluent disposal.

SATURNA SOIL LANDSCAPE CROSS SECTION*



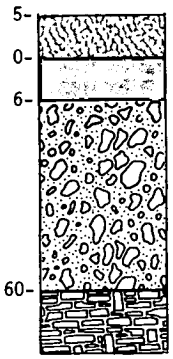
*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy gravelly morainal or sandy rubbly colluvial veneer over subdued or ridged sandstone bedrock
TOPOGRAPHY	:	5-40%; gentle to very strong slopes
ELEVATION RANGE	:	0-200 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists mainly of Douglas-fir, lodgepole pine and occasional arbutus. The understory is dominated by salal.

TYPICAL SATURNA SOIL PROFILE

DEPTH (cm)



Loose litter of leaves needles and twigs over partly decomposed organic matter; extremely acid.

Black (7.5YR 2/0m) very gravelly sandy loam; weak, medium, subangular blocky to weak, medium, granular; very friable; non sticky, non-plastic; very extremely acid.

Yellowish brown (10YR 5/4m) very gravelly sandy loam; weak, medium, subangular blocky to single-grained; very friable, slightly sticky, non-plastic; abrupt, smooth boundary; extremely acid.

Rock (Sandstone)

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	50-100
HUMUS FORM	Moder
SOLUM DEPTH (cm)	50-100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	50-100; sandstone bedrock
ROOTING DEPTH (cm)	50-100
COARSE FRAGMENT CLASS	3-5
DEPTH TO AND TYPE OF WATERTABLE (cm)	N/A
PERVIOUSNESS	moderate to rapid
SOIL DRAINAGE	moderately well to rapid
SOIL TEXTURE	very gravelly sandy loam, very gravelly loamy sand, very gravelly loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.5-1.8)	Est.	(1.5-2.0)		
AWSC (cm/m)	Est.	(4-7)	Est.	(3-6)		
% COARSE > 7.5 cm	46	7 (2-13)	43	7 (2-13)		
FRAGMENTS < 7.5 cm	46	29 (19-39)	43	31 (21-41)		
% PASSING SIEVE 4.76 mm	Est.	(50-70)	Est.	(40-60)		
0.5 mm	Est.	(45-55)	Est.	(25-45)		
0.074 mm	Est.	(20-30)	Est.	(15-25)		
% FINE SAND	Est.	(10-20)	Est.	(9-17)		
% SAND	Est.	(45-65)	1	49		
% CLAY	Est.	(8-18)	1	16		
LIQUID LIMIT (%)	Est.	non plastic	Est.	non plastic		
PLASTIC LIMIT (%)	Est.	non plastic	Est.	non plastic		

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-60 cm Mean (Range)	N	Mean (Range)
SOIL REACTION 1:1 H_2O	2	4.7 (4.4-4.9)	1	4.4		
(pH) 1:2 $CaCl_2$	2	4.1 (3.8-4.4)	1	3.8		
ORGANIC CARBON (%)	2	1.8 (1.5-2.5)	1	1.6		
NITROGEN (%)	Est.	(0.1-0.2)	1	0.07		
EXCHANGE CAPACITY (meq/100g)	Est.	(15-35)	1	19		
BASE SATURATION (%)	1	12 (10-20)	1	9		
EXCHANGEABLE CATIONS - Ca	1	0.9	1	0.9		
(meq/100g) - Mg	1	0.4	1	0.4		
- Na	1	0.14	1	0.15		
- K	1	0.2	1	0.2		
PHOSPHORUS (ppm)	1	49	1	49		
% IRON	1	0.4	1	0.2		
% ALUMINUM	1	0.6	1	0.3		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
STco	Cobbly phase; soil has >20% cobbles and or stones.
STco,13	Cobbly, very shallow lithic phase; soil has >20% cobbles and or stones, and sandstone bedrock occurs within 50 cm of the surface.
STg	Gravelly phase; solum contains 20-50% gravel. These soils normally have >50% gravel.
ST13	Very shallow lithic phase; sandstone bedrock occurs within 50 cm of the surface.
ST13,r	Very shallow lithic, rubbly/blocky phase; sandstone bedrock occurs within 50 cm depth, and the solum has >50% rubbly/blocky material by volume.
STlo	Loamy phase; 20-50 cm of loam textured surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS SATURNA SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-60	SM, GM	A-1-b A-2-4	poor	poor	unsuited	poor

SHAWNIGAN SOILS (SH)

PLATE 4.42: SHAWNIGAN SOIL LANDSCAPE

GENERAL COMMENTS

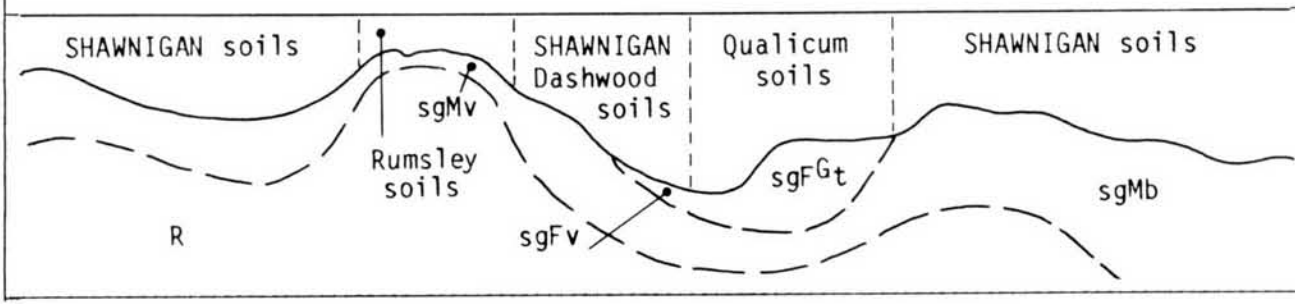
Shawnigan soils (3775ha) occur on gentle to very strong slopes near or above 100 m elevation. The most extensive areas are adjacent to the mountain slopes where they are associated with shallow soils over bedrock such as Rumsley or Saturna. They are moderately well drained with some lateral water movement during rainy periods. They have developed in sandy gravelly morainal materials and are often very stony.

The upper horizons are yellowish brown, very friable and have gravelly sandy loam texture. These grade into a mottled and strongly cemented horizon at 70 to 100 cm depth. Shawnigan soils are classified as **Duric Dystric Brunisols.**

Most Shawnigan soils are under forest cover but some have been converted into pasture and hay production. Aridity, stoniness and adverse topography are the main restrictions to agricultural use.

Shawnigan soils have high bearing strengths but septic tank effluent disposal is impeded by the relatively shallow depth to cemented horizons.

SHAWNIGAN SOIL LANDSCAPE CROSS SECTION*



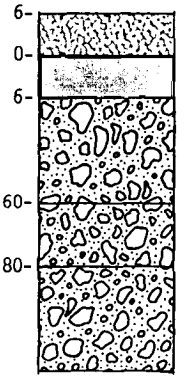
*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	sandy gravelly morainal blanket
TOPOGRAPHY	:	5-40%; gentle to very strong slopes
ELEVATION RANGE	:	100+ m asl, minor areas below 100 m
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	The native vegetation consists mainly of Douglas-fir with minor inclusion of western red cedar, grand fir, maple, red alder including an understory dominated by salal.

TYPICAL SHAWNIGAN SOIL PROFILE

DEPTH (cm)



LFH — Loose litter of leaves, needles, and twigs over partly to well decomposed organic matter; strongly acid.

Ah — Dark brown (10YR 3/3m) very gravelly sandy loam; weak to moderate, medium, granualar very friable; medium acid.

Bm_1 — Dark yellowish brown (10YR 4/6m) very gravelly sandy loam; weak, fine to medium, subangular blocky; very friable; medium acid.

Bm_2 — Yellowish brown (10YR 5/4m) very gravelly sandy loam; weak, moderate, subangular blocky; very friable; strongly acid.

BCc — Yellowish brown (10YR 5/4m) and light olive gray (5Y6/2m) very gravelly sandy loam; massive; very firm; strongly acid; strongly cemented.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Moder
SOLUM DEPTH (cm)	: 90
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 70-110; 30-60; duric horizon
ROOTING DEPTH (cm)	: 70-110
COARSE FRAGMENT CLASS	: 3-5
DEPTH TO AND TYPE OF WATERTABLE (cm)	: N/A
PERVIOUSNESS	: slow
SOIL DRAINAGE	: moderately well to well
SOIL TEXTURE	: gravelly or very gravelly sandy loam, gravelly or very gravelly loamy sand

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.6-1.9)	Est.	(1.7-2.1)	Est.	(1.9-2.3)
AWSC (cm/m)	4	11 (9-14)	2	10 (7-13)	2	9 (7-11)
% COARSE > 7.5 cm	175	8 (4-12)	165	8 (4-12)	108	7 (3-11)
FRAGMENTS < 7.5 cm	175	29 (24-34)	165	30 (25-35)	108	28 (21-35)
% PASSING SIEVE 4.76 mm	3	68 (53-73)	2	68 (60-76)	2	66 (60-72)
0.5 mm	4	53 (43-63)	2	51 (43-59)	2	50 (46-54)
0.074 mm	3	30 (25-35)	2	32 (25-39)	2	27 (25-29)
% FINE SAND	4	15 (13-17)	2	17 (14-20)	2	19 (16-23)
% SAND	10	60 (49-70)	2	51 (46-57)	2	61 (58-65)
% CLAY	10	10 (7-13)	2	10 (7-13)	2	8 (6-10)
LIQUID LIMIT (%)	3	32 (25-41)	2	28 (24-32)	2	24 (22-26)
PLASTIC LIMIT (%)	3	25 (22-32)	2	21 (20-23)	2	21 (20-22)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	75-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	15	5.5 (5.3-5.7)	4	5.9 (5.7-6.1)	2	6.2
(pH) 1:2 $CaCl_2$	16	4.9 (4.5-5.2)	3	5.0 (4.8-5.2)	1	5.4
ORGANIC CARBON (%)	9	2.4 (1.4-3.4)	1	1.1	Est.	(0.1-1.0)
NITROGEN (%)	5	0.13 (0.06-0.2)	1	0.05	Est.	(0.01-0.03)
EXCHANGE CAPACITY (meq/100g)	9	16 (13-19)	1	12	Est.	(8-14)
BASE SATURATION (%)	5	31 (20-42)	1	34	Est.	(20-40)
EXCHANGEABLE CATIONS - Ca	5	4.0 (2.0-6.0)	1	2.7	Est.	(1.0-4.0)
(meq/100g) - Mg	5	0.7 (0.4-1.0)	1	0.8	Est.	(0.1-2.0)
- Na	5	0.1 (0.05-0.15)	1	0.07	Est.	(0.01-0.15)
- K	5	0.3 (0.2-0.4)	1	0.4	Est.	(0.01-0.15)
PHOSPHORUS (ppm)	5	100 (20-200)	1	77	Est.	
SULPHUR (ppm)	5	10 (5-15)	1	7.9	Est.	
% IRON	10	0.3 (0.2-0.4)	1	0.2		
% ALUMINUM	10	0.3 (0.2-0.4)	1	0.4		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
SHg	Gravelly phase; solum contains 20-50% gravel.
SHg,id	Gravelly phase, imperfectly drained variant; solum contains 20-50% gravel, and occurs in seepage sites where drainage is restricted.
SHg,lo	Gravelly, loamy phase; solum contains 20-50% gravels with 20-50 cm of loam textured surface.
SHid	Imperfectly drained variant; occurs in seepage sites where drainage is restricted.
SHlo	Loamy phase; 20-50 cm of loam textured surface.
SHs	Shallow variant; different parent material or strongly contrasting texture occurs within 50-100 cm of the surface.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
SHAWNIGAN SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	GM, GW, SM	A-1-b	poor	fair-poor	poor	poor

STAMP SOILS (SP)

PLATE 4.43: STAMP SOIL LANDSCAPE

GENERAL COMMENTS

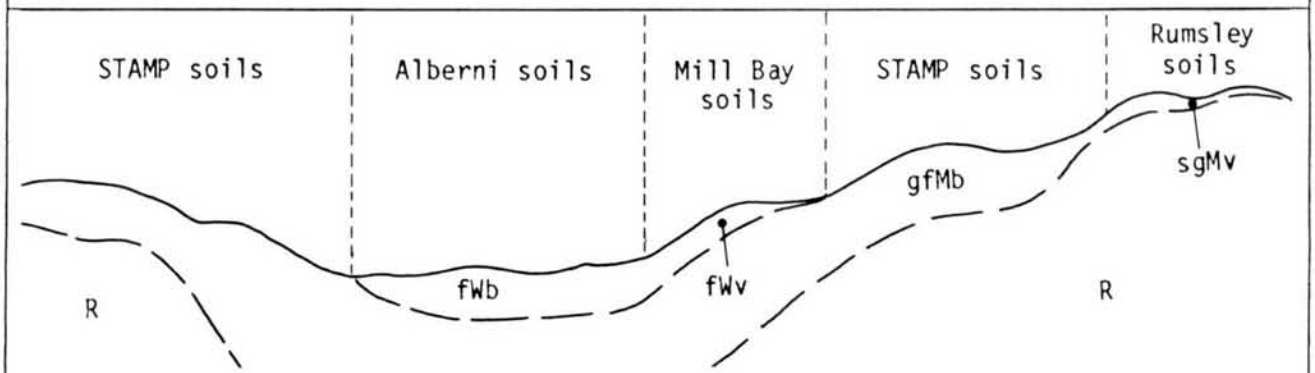
Stamp soils (5955ha) occur exclusively in the Alberni Valley on gentle to very strong slopes, and generally in upland locations. They have developed from a clay loam glacial till which contains moderate amounts of gravel and stones. These soils are imperfect to moderately well drained, with either a perched water table or with water moving laterally over the compact parent material during the wet season.

Stamp soils consist of a friable, gravelly loam, and have a moderately pervious surface layer which is underlain by an impervious, mottled, clay loam parent material. They are classified as **Gleyed Humo-Ferric Podzols** with lesser occurrences of Orthic Humo-Ferric Podzols.

The present use of Stamp soils is mainly for forestry with only minor areas being used for agriculture. The variable topography and inherent stoniness discourages agricultural development. The loam textures have a high moisture holding capacity, however, soil moisture deficiencies still occur during dry periods.

Stamp soils have high bearing strength, however septic tank effluent disposol is impeded by the slowly pervious subsoils.

STAMP SOIL LANDSCAPE CROSS SECTION*

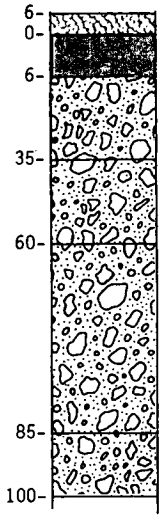


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	gravelly fine morainal
TOPOGRAPHY	:	6-40%; gentle to very strong slopes
ELEVATION RANGE	:	50-200 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Second growth Douglas fir, hemlock, cedar and alder. The understory is dominated by salal, with sword fern and Oregon grape.

TYPICAL STAMP SOIL PROFILE

DEPTH (cm)



Loose litter of leaves, needles, and twigs over partly to well decomposed organic matter; extremely acid.

Dark reddish brown (5YR 2/2m) gravelly loam; weak to moderate, medium, granular; friable; non-sticky; non-plastic; very strongly acid.

Yellowish red (5YR 4/6m) gravelly loam; weak, fine, subangular blocky; friable; slightly sticky; non-plastic; very strongly acid.

Strong brown (7.5YR 4/6m) gravelly loam; weak, fine, subangular blocky; friable; slightly sticky; non-plastic; strongly acid.

Yellowish brown (10YR 5/6m) gravelly loam; moderate, medium, subangular blocky; friable; slightly sticky; slightly plastic; strongly acid.

Dark grayish brown (2.5Y 4/2m) gravelly clay loam; massive; sticky; plastic; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Moder
SOLUM DEPTH (cm)	:	100
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	75; slowly pervious parent material
ROOTING DEPTH (cm)	:	75
COARSE FRAGMENT CLASS	:	2-3
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	80-180; seasonal perched
PERVIOUSNESS	:	slow
SOIL DRAINAGE	:	imperfect to moderately well
SOIL TEXTURE	:	gravelly loam to gravelly clay loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	1	1.3 (1.1-1.5)	3	1.5 (1.4-1.6)	3	1.8 (1.7-2.0)
AWSC (cm/m)	3	14 (12-16)	3	14 (12-16)	3	11 (9-13)
% COARSE > 7.5 cm	265	5 (2-8)	270	5 (2-8)	235	4 (1-7)
FRAGMENTS < 7.5 cm	265	22 (18-26)	270	22 (18-26)	235	20 (14-26)
% PASSING SIEVE 4.76 mm	2	72 (70-74)	2	82 (80-84)	2	71 (63-79)
0.5 mm	2	52 (49-55)	2	68 (64-72)	2	57 (47-67)
0.074 mm	2	40 (37-43)	2	53 (48-58)	2	42 (33-51)
% FINE SAND	2	9 (8-10)	2	9 (7-11)	2	12 (10-14)
% SAND	9	44 (37-52)	8	41 (34-48)	6	42 (35-49)
% CLAY	9	17 (13-21)	8	19 (13-25)	6	20 (14-26)
LIQUID LIMIT (%)	Est.	35 (30-40)	2	41 (38-45)	1	37
PLASTIC LIMIT (%)	Est.	29 (26-33)	2	38 (35-41)	1	25

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	75-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	8	5.4 (5.3-5.5)	6	5.4 (5.3-5.5)	5	5.6 (5.2-6.0)
(pH) 1:2 $CaCl_2$	8	4.6 (4.5-4.7)	6	4.6 (4.4-4.8)	5	4.8 (4.3-5.3)
ORGANIC CARBON (%)	8	2.6 (1.0-3.7)	6	1.6 (1.3-1.9)	5	1.0 (0.8-1.2)
NITROGEN (%)	5	0.13 (0.08-0.18)	5	0.07 (0.06-0.08)	5	0.05 (0.04-0.06)
EXCHANGE CAPACITY (meq/100g)	5	22 (16-28)	5	19 (17-21)	5	18 (16-20)
BASE SATURATION (%)	5	10 (6-14)	5	18 (8-28)	5	43 (10-80)
EXCHANGEABLE CATIONS - Ca	5	1.7 (0.05-3.0)	5	2.4 (0.7-4.1)	5	6 (1-12)
(meq/100g) - Mg	5	0.4 (0.1-0.7)	5	0.9 (0.3-1.2)	5	2.1 (0.5-3.8)
- Na	5	0.06 (0.01-0.1)	5	0.07 (0.05-0.1)	5	0.1 (0.08-0.12)
- K	5	0.15 (0.1-0.2)	5	0.1 (0.08-0.12)	5	0.07 (0.05-0.09)
PHOSPHORUS (ppm)	5	10 (5-15)	5	6 (4-8)	4	10 (1-30)
% IRON	7	0.3 (0.2-0.4)	5	0.3 (0.2-0.4)	1	0.2
% ALUMINUM	7	0.6 (0.5-0.7)	5	0.5 (0.4-0.6)	1	0.2

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
SPco	Cobbly phase; soil has greater than 20% cobbles and or stones.
SP12	Shallow lithic phase; bedrock occurs within 50-100 cm of the surface.
SPvg	Very gravelly phase; solum has greater than 50% coarse fragments by volume.
SPwc	Weakly cemented variant; a cemented horizon occuring between 50-100 cm depth that is not sufficiently cemented to be a duric horizon.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS STAMP SOILS						
SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-100+	SM, SC	A-4, A-5	poor	poor	poor	poor

PLATE 4.44: SUFFOLK SOIL LANDSCAPE

GENERAL COMMENTS

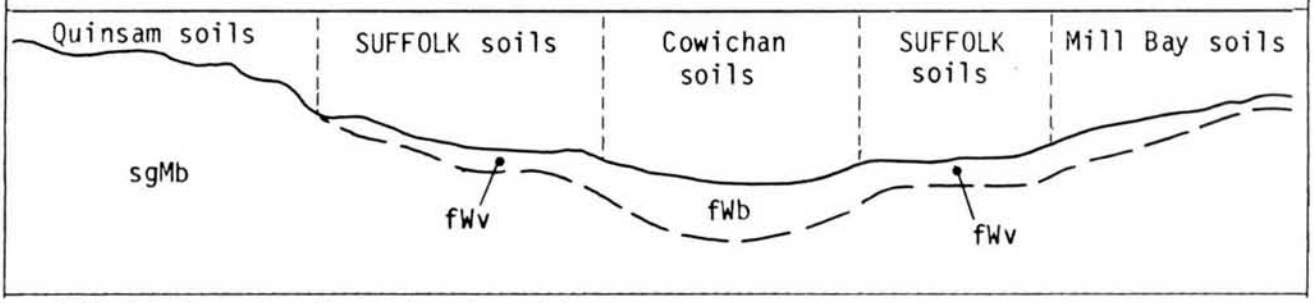
Suffolk soils (630ha) occur between sea level and 130 meters asl on gently undulating landscapes predominantly in the Comox Valley. These imperfectly drained soils have a perched water table during the winter months. They have developed in stratified parent materials that consist of a moderate to slowly pervious fine marine veneer, underlain by gravelly sandy morainal deposits.

Suffolk soils have stone free surface horizons that vary from loam to silt loam in texture. The underlying till is a gravelly sandy loam, compact, and occasionally cemented. These soils are classified as **Gleyed Dystric Brunisols**, with significant occurrences of Gleyed Humo-Ferric Podzols.

Pastures and hay crops are the dominant agricultural land uses, however, an increased range of crops is possible with drainage, irrigation and fertilization. The installation of drainage lines could be hindered where the underlying till is cemented and close to the surface. Perenial crops may be affected by a perched water table during winter.

Suffolk soils have moderate to high bearing strengths, however, septic tank effluent disposal is impeded by high water tables during winter and the slowly pervious surface layer.

SUFFOLK SOIL LANDSCAPE CROSS SECTION*

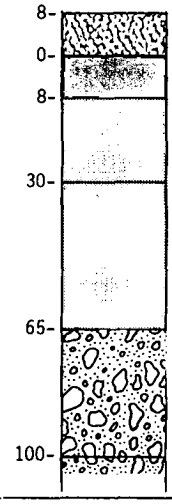


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	fine marine veneer over gravelly sandy till
TOPOGRAPHY	:	1-15% slopes; gently undulating
ELEVATION RANGE	:	0-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	none
VEGETATION	:	Forests consist mainly of second growth Douglas fir, western red cedar, red alder, maple, and grand fir. However, most areas of Suffolk soils are cleared and cultivated mainly for pasture and hay production.

TYPICAL SUFFOLK SOIL PROFILE

DEPTH (cm)



LFH — Loose litter of leaves, needles, and twigs over partly to well decomposed organic matter; extremely acid.

Ah — Dark brown (10YR 3/3m) loam; weak, medium, subangular blocky; friable; slightly sticky; slightly plastic; very strongly acid.

Bm_1 — Dark brown (7.5YR 4/4m) loam; weak to moderate, coarse, subangular block; friable; slightly sticky; plastic; strongly acid.

Bm_2 — Yellowish brown (10YR 5/4m) silt loam; weak to moderate, coarse, subangular blocky; friable; sticky; plastic; strongly acid.

IIBCg — Light brownish gray (10YR 6/2m) gravelly sandy loam; massive; firm; slightly plastic; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Moder
SOLUM DEPTH (cm)	:	90
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	75; 30-50; compact, dense parent
ROOTING DEPTH (cm)	:	75
COARSE FRAGMENT CLASS	:	0
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	60-180; seasonal perched
PERVIOUSNESS	:	slow
SOIL DRAINAGE	:	imperfect
SOIL TEXTURE	:	loam to silt loam over gravelly sandy loam or gravelly loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.1-1.3)	Est.	(1.2-1.6)	Est.	(1.6-2.0)
AWSC (cm/m)	Est.	(14-18)	Est.	(13-17)	2	10 (7-12)
% COARSE > 7.5 cm	57	0	57	0	48	2 (1-4)
FRAGMENTS < 7.5 cm	57	5 (2-8)	57	6 (2-10)	48	9 (3-15)
% PASSING SIEVE 4.76 mm	2	87 (84-90)	2	88 (85-91)	2	82 (78-88)
0.5 mm	2	73 (70-76)	2	76 (74-78)	2	65 (60-70)
0.074 mm	2	60 (50-70)	2	62 (56-68)	2	47 (42-53)
% FINE SAND	2	8 (4-11)	2	8 (4-12)	2	10 (6-14)
% SAND	3	30 (16-40)	3	38 (22-54)	3	45 (32-58)
% CLAY	3	20 (9-34)	3	16 (8-26)	3	16 (10-22)
LIQUID LIMIT (%)	2	51 (49-52)	1	45	2	35 (30-40)
PLASTIC LIMIT (%)	2	45 (44-46)	1	35	2	31 (29-33)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-65 cm Mean (Range)	N	65-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	4	5.3 (5.0-5.6)	1	5.3	1	5.6
(pH) 1:2 $CaCl_2$	4	4.8 (4.6-4.9)	1	4.8	1	5.0
ORGANIC CARBON (%)	2	3.4 (3.0-3.8)	1	2.1	1	0.5
NITROGEN (%)	1	0.13 (0.1-0.2)	1	0.12	1	0.02
EXCHANGE CAPACITY (meq/100g)	1	21	1	20	1	15
BASE SATURATION (%)	1	20	1	21	1	76
EXCHANGEABLE CATIONS - Ca	1	3.5	1	3.2	1	8
(meq/100g) - Mg	1	0.7	1	0.7	1	3.2
- Na	1	0.18	1	0.19	1	0.2
- K	1	0.11	1	0.05	1	0.05
PHOSPHORUS (ppm)	1	11	1	9	1	8.4
% IRON	1	0.4				
% ALUMINUM	1	0.7				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
SFg	Gravelly phase; solum contains 20-50% gravel.
SFg,pz	Gravelly phase, podzolic variant; solum contains 20-50% gravels. Soil is classified as Gleyed Humo-Ferric Podzol.
SFpz	Podzolic variant; soil is classified as Gleyed Humo-Ferric Podzol

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
SUFFOLK SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-65	SM, ML, MH	A-4	poor	unsuited	fair	fair
65-100+	SM, ML	A-4	poor	poor	poor	unsuited

TOLMIE SOILS (TL)

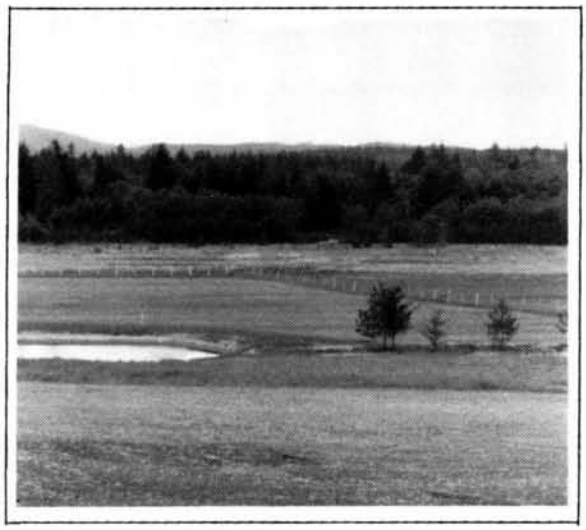


PLATE 4.45: TOLMIE SOIL LANDSCAPE

GENERAL COMMENTS

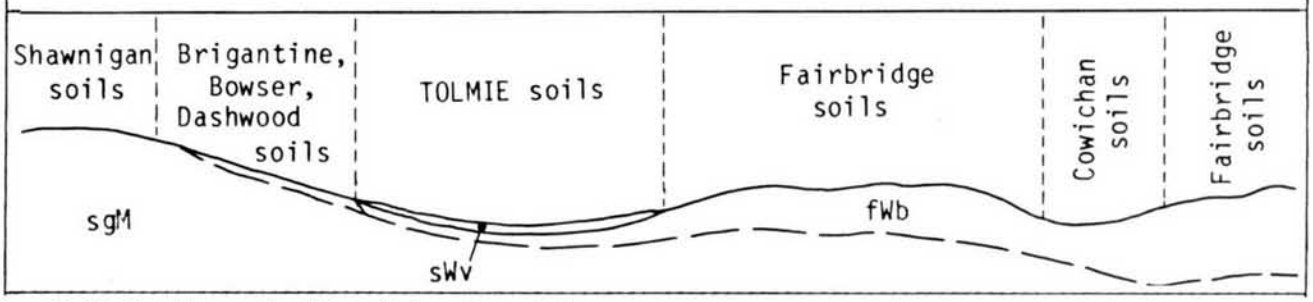
Tolmie soils (455ha) are found in depressional areas of marine landscapes in association with Brigantine, Bowser, Cowichan and Fairbridge soils. They are minor in extent but are scattered throughout the surveyed area. They are poorly drained with seasonal perched watertables at 15 to 100 cm depth. They have developed in non-stony, sandy fluvial or sandy marine material that is underlain by silty marine material. They often have thin sandy layers at depth as well. Tolmie soils are distinquished from Parksville soils by a thinner (>30 cm) sandy overlay and usually having sandy layers at depth.

Characteristically, they have a dark brown organic matter-enriched surface loam or sandy loam horizon which grades into a lighter brown to grey prominent mottled silt loam at depth. These soils are classified as **Orthic Humic Gleysols,** although minor areas of Orthic Gleysols also occur.

Present land use is mainly hay and pasture as spring planting of other crops is often impractical due to wet soil conditions. With drainage and irrigation Tolmie soils can be used for growing a wide range of crops. Closely spaced drainage lines are required due to slow soil permeability.

Urban and related uses are not recommended due to flooding and winter ponding.

TOLMIE SOIL LANDSCAPE CROSS SECTION*

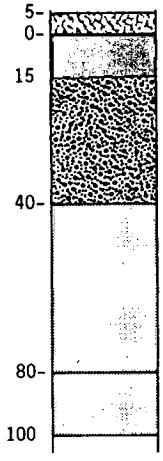


*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	sandy marine or fluvial overlying fine marine
TOPOGRAPHY	:	level to very gently sloping
ELEVATION RANGE	:	less than 100 m
ASPECT	:	N/A
FLOOD HAZARD	:	rare
VEGETATION	:	Uncleared areas support red alder, willow, maple, western red cedar and western hemlock, including an understory of moisture loving plants such as skunk cabbage.

TYPICAL TOLMIE SOIL PROFILE

DEPTH (cm)



Loose non-compact litter; medium acid.

Very dark brown (10YR 2/2m) loam; moderate, medium, granular; friable; strongly acid.

Dark yellowish brown (10YR 4/4m) fine sandy loam; many, fine, prominent mottles; weak to moderate, medium, subangular blocky; very friable; medium acid.

Grayish brown (2.5Y 5/2m) silt loam; many, medium, prominent mottles; weak, medium, prismatic breaking to moderate, coarse, angular blocky; firm, slightly sticky, slightly plastic; medium acid.

Greenish gray (5GY 5/1m) silty clay loam; massive breaking to pseudo-angular blocky; very firm, sticky, plastic; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Mull
SOLUM DEPTH (cm)	: 80
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 60; compact subsoil
ROOTING DEPTH (cm)	: 60
COARSE FRAGMENT CLASS	: 0
DEPTH TO AND TYPE OF WATERTABLE (cm)	: 15-100; seasonal perched
PERVIOUSNESS	: slow
SOIL DRAINAGE	: poor to very poor
SOIL TEXTURE	: sandy loam or loam over silt loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-50 cm Mean (Range)	N	50-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.0-1.5)	Est.	(1.3-1.5)	Est.	(1.3-1.5)
AWSC (cm/m)	Est.	(12-23)	Est.	(16-24)	Est.	(16-24)
% COARSE > 7.5 cm	27	0 (0-1)	27	0	24	0
FRAGMENTS < 7.5 cm	27	3 (0-7)	27	3 (0-6)	24	2 (0-5)
% PASSING SIEVE 4.76 mm	Est.	(95-100)	Est.	(95-100)	Est.	(95-100)
0.5 mm	Est.	(70-90)	Est.	(85-95)	Est.	(90-100)
0.074 mm	Est.	(5-20)	Est.	(10-40)	Est.	(90-100)
% FINE SAND	Est.	(10-20)	Est.	(5-15)	Est.	(3-10)
% SAND	3	45 (30-60)	2	26 (24-29)	1	22
% CLAY	3	18 (13-25)	2	25 (23-27)	1	29
LIQUID LIMIT (%)	Est.	(18-25)	Est.	(30-50)	Est.	(30-55)
PLASTIC LIMIT (%)	Est.	(15-20)	Est.	(20-35)	Est.	(20-35)

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-30 cm Mean (Range)	N	30-75 cm Mean (Range)	N	75-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	4	5.7 (5.3-6.1)	2	5.7	Est.	(5.7-6.5)
(pH) 1:2 $CaCl_2$	4	5.0 (4.6-5.4)	2	5.2	Est.	(5.2-6.0)
ORGANIC CARBON (%)	4	3.6 (2.7-4.5)	1	0.5	Est.	(0.01-0.2)
NITROGEN (%)	3	0.25 (0.2-0.3)	2	0.03 (0.01-0.05)	Est.	(0.01-0.03)
EXCHANGE CAPACITY (meq/100g)	3	16 (12-20)	2	14 (12-16)	Est.	(12-20)
BASE SATURATION (%)	3	65 (40-100)	2	70 (60-80)	Est.	(80-100)
EXCHANGEABLE CATIONS - Ca	3	7.1 (5.1-9.1)	2	7.0 (5-9)	Est.	(8-12)
(meq/100g) - Mg	3	2.4 (1.7-3.1)	2	3.0 (1-4)	Est.	(2-5)
- Na	3	0.3 (0.01-0.6)	2	0.1 (0.01-0.2)	Est.	(0.1-0.5)
- K	3	0.1 (0.03-0.17)	2	0.1 (0.01-0.2)	Est.	(0.01-0.2)
PHOSPHORUS (ppm)	3	14 (9-19)	1	2		
SULPHUR (ppm)	1	18	1	7		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
TLg	Gravelly phase; solum contains 20-50% gravel.
TLg,pt	Gravelly, peaty phase; solum contains 20-50% gravel, and has 10-40 cm of humic or mesic organic material over the mineral soil.
TLpt	Peaty phase; 10-40 cm of humic or mesic organic material occurs over the mineral soil.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
TOLMIE SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-30	SM	A-4	poor	poor	poor	fair
30-100+	ML, MH, CH	A-6, A-7	poor	unsuited	good	poor

TRINCOMALI SOILS (TR)

PLATE 4.46: TRINCOMALI SOIL LANDSCAPE

GENERAL COMMENTS

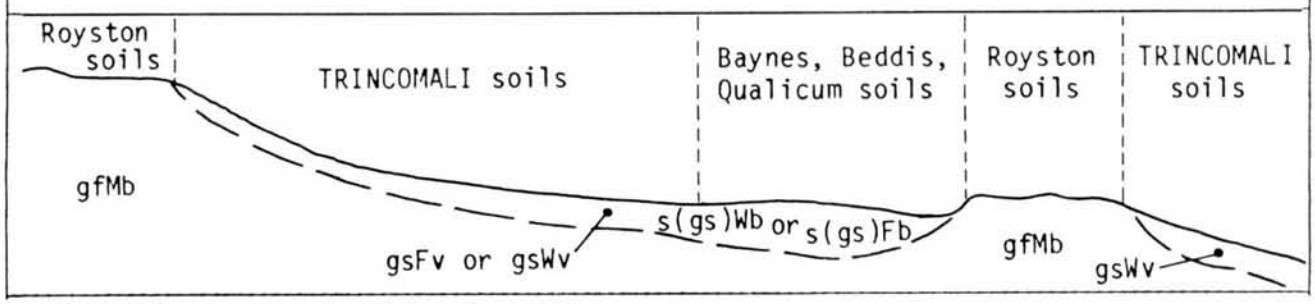
Trincomali soils (505ha) are found on gentle to strongly sloping landscapes. They have developed in areas of shallow, coarse textured fluvial, fluvioglacial or marine deposits overlaying gravelly, medium or moderately fine textured till. The soil is moderately well drained, however water may move laterally over the compact subsoil during wet periods.

The surface horizons are rapidly permeable and are characterized by a gravelly loamy sand or gravelly sand texture. The underlying till has a gravelly loam to gravelly clay loam texture with faint mottling at the till contact. Trincomali soils are dominantly classified as **Orthic Dystric Brunisols** with significant inclusions of Gleyed Dystric Brunisols.

Trincomali soils have marginal agricultural use. Subsequently only small areas have been cleared which are being used for grazing. Stoniness, moisture deficits and steep slopes are the major agricultural limitations.

Trincomali soils are moderately well suited for urban and related uses because of the high bearing strengths of the surface horizons. However, septic tank effluent disposal is not recommended due to the coarse surface textures and shallow depth to the impervious till.

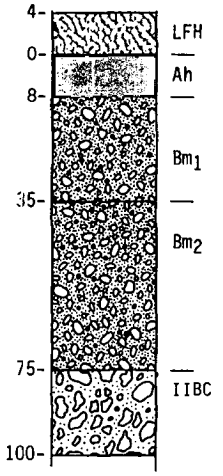
TRINCOMALI SOIL LANDSCAPE CROSS SECTION*



*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS		
PARENT MATERIAL	:	gravelly sandy fluvial, glaciofluvial or marine veneer over gravelly fine morainal
TOPOGRAPHY	:	5-30%; gentle to strong slopes
ELEVATION RANGE	:	30-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Second growth Douglas fir and grand fir. The understory is made up of salal, bracken and Oregon grape.

TYPICAL TRINCOMALI SOIL PROFILE



Loose litter of leaves, needles, and twigs over partly to well decomposed organic matter; extremely acid.

Dark brown (7.5YR 3/2m) gravelly sandy loam; weak to moderate, fine, granular; friable; non-sticky; non-plastic; very strongly acid.

Brown (7.5YR 4/2m) gravelly loamy sand; weak, fine, subangular blocky; loose; non-sticky; non-plastic; strongly acid.

Yellowish brown (10YR 5/6m) gravelly loamy sand; single grain; loose; non-sticky; non-plastic; strongly acid.

Dark yellowish brown (10YR 4/4m) gravelly loam; massive; very firm; slightly sticky; slightly plastic; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	: N/A
HUMUS FORM	: Moder
SOLUM DEPTH (cm)	: 80
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	: 75; compact, subsoil
ROOTING DEPTH (cm)	: 75
COARSE FRAGMENT CLASS	: 2-3
DEPTH TO AND TYPE OF WATERTABLE (cm)	: N/A
PERVIOUSNESS	: slow
SOIL DRAINAGE	: moderately well to imperfect
SOIL TEXTURE	: gravelly loamy sand to gravelly sand, over gravelly loam to gravelly clay loam

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	75-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	5	1.6 (1.4-1.8)	2	1.7 (1.5-1.9)	1	1.9
AWSC (cm/m)	Est.	(6-10)	Est.	(5-15)	Est.	(10-20)
% COARSE > 7.5 cm	173	5 (0-9)	173	5 (0-9)	142	3 (0-6)
FRAGMENTS < 7.5 cm	173	21 (15-27)	173	21 (15-27)	142	16 (8-24)
% PASSING SIEVE 4.76 mm	1	65	1	60	1	75
0.5 mm	1	45	1	40	1	65
0.074 mm	1	25	1	25	1	53
% FINE SAND	1	16	1	16	1	9
% SAND	1	82	2	70 (55-85)	1	40
% CLAY	1	6	2	10 (7-14)	1	24
LIQUID LIMIT (%)	1	52	1	52	1	23
PLASTIC LIMIT (%)	1	46	1	46	1	16

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	75-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	3	5.2 (4.6-5.8)	1	5.8	1	6.2
(pH) 1:2 $CaCl_2$	3	4.7 (4.3-5.1)	1	5.1	1	5.4
ORGANIC CARBON (%)	3	2.9 (1.7-4.0)	1	1.7	1	0.5
NITROGEN (%)	3	0.14 (0.07-0.2)	1	0.07	1	0.03
EXCHANGE CAPACITY (meq/100g)	3	19 (14-24)	1	17	1	14
BASE SATURATION (%)	3	24 (21-27)	1	19	1	50
EXCHANGEABLE CATIONS - Ca	3	3.3 (2.9-3.7)	1	2.7	1	5.0
(meq/100g) - Mg	3	0.7 (0.6-0.8)	1	0.3	1	2.0
- Na	3	0.2 (0.1-0.3)	1	0.12	1	0.03
- K	3	0.2 (0.1-0.5)	1	0.03	1	0.3
PHOSPHORUS (ppm)	3	40 (5-70)	1	8	1	5
SULPHUR (ppm)	2	4.6 (2-7)	1	3	1	4
% IRON	Est.	(0.2-0.4)				
% ALUMINUM	Est.	(0.2-0.4)				

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
TRco	Cobbly phase; soil has greater than 20% cobbles and or stones.
TRco,lo	Cobbly, loamy phase; soil has greater than 20% cobbles and or stones, and 20-50 cm of loam textured surface.
TRlo	Loamy phase; 20-50 cm of loam textured surface.
TRlo,vg	Loamy, very gravelly phase; solum has 20-50 cm of loam textured surface, and greater than 50% coarse fragments by volume.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
TRINCOMALI SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-75	SW, SM	A-1-b	poor	fair	unsuited	unsuited
75-100+	SM, SC	A-4	poor	poor	poor	unsuited

TSOLUM SOILS (TS)

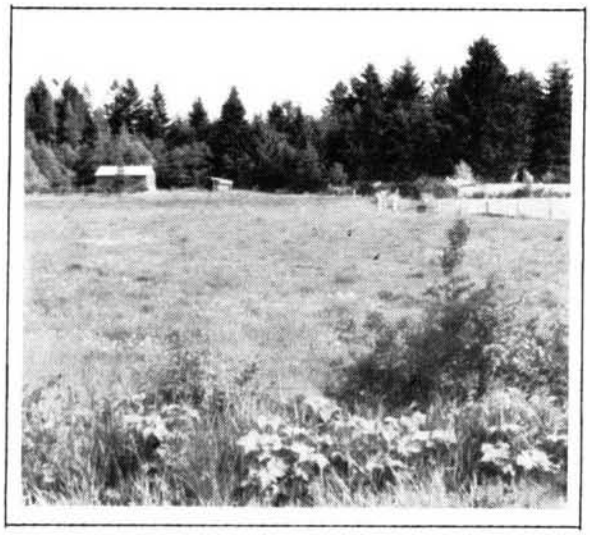


PLATE 4.47: TSOLUM SOIL LANDSCAPE

GENERAL COMMENTS

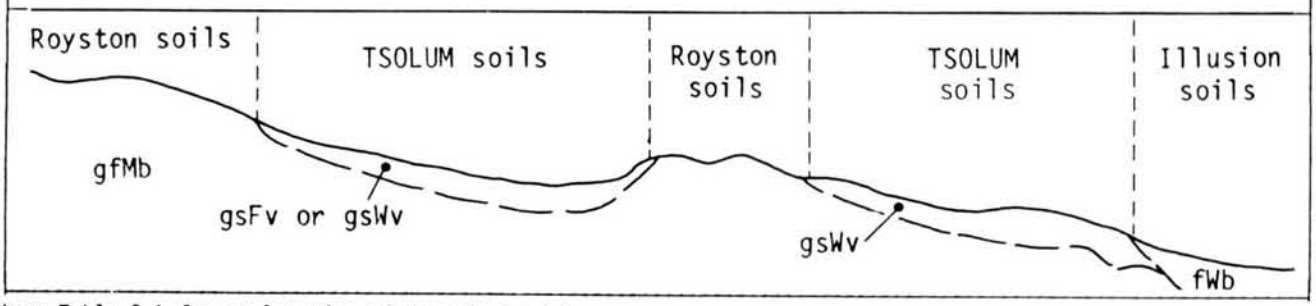
Tsolum soils (2495ha) are found predominantly in the Comox Valley and northward to Oyster River. They occur on rolling to steeply undulating, gravelly, medium or moderately fine, glacial till, which is overlain by a shallow, coarse-textured fluvial, fluvioglacial or marine deposit. The soil is imperfectly drained, and has a perched water table during the wet winter months.

The surface horizons are rapidly permeable and are characterized by a gravelly loamy sand to gravelly sand texture. The underlying till has a gravelly loam or gravelly clay loam texture with prominant mottling at the till contact. Tsolum soils are classified as **Gleyed Humo-Ferric Podzols**, with lesser inclusions of Orthic Humo-Ferric Podzols.

Tsolum soils have marginal agricultural use, stoniness, severe moisture deficits during summer and drainage problems in the spring are some of the limitations. Forest production on these soils, conversely, is high due to the favourable conditions of a seasonally perched water table.

Tsolum soils are moderately well suited for urban and related uses because of the high bearing strengths of the surface horizons. However, septic tank effluent disposal is not recommended due to the coarse surface textures, seasonal water table and shallow depth to the impervious till.

TSOLUM SOIL LANDSCAPE CROSS SECTION*



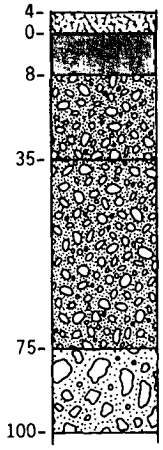
*see Table 3.1 for explanation of terrain symbols

LANDSCAPE CHARACTERISTICS

PARENT MATERIAL	:	gravelly sandy fluvial, glaciofluvial or marine veneer over gravelly fine morainal
TOPOGRAPHY	:	5-30%; gentle to strong slopes
ELEVATION RANGE	:	30-130 m asl
ASPECT	:	all
FLOOD HAZARD	:	no hazard
VEGETATION	:	Second growth Douglas fir, western red cedar, alder, maple and grand fir. The understory is dominated by sword fern.

TYPICAL TSOLUM SOIL PROFILE

DEPTH (cm)



Loose litter of leaves, needles, and twigs over partly to well decomposed organic matter; extremely acid.

Dark brown (10YR 3/3m) gravelly sandy loam; weak, fine granular loose; non-sticky; non-plastic; strong acid.

Dark red (2.5YR 3/6m) gravelly loamy sand; weak, fine, subangular blocky; loose; non-sticky; non-plastic; strong acid.

Brown (7.5YR 4/2m) gravelly loamy sand; common, medium, faint mottles; single grain; loose; non-sticky; non-plastic; strongly acid.

Yellowish brown (10YR 5/4m) gravelly loam; many, medium, distinct mottles; massive; very firm; slightly sticky; slightly plastic; medium acid.

SOIL CHARACTERISTICS

DEPTH TO BEDROCK (cm)	:	N/A
HUMUS FORM	:	Moder
SOLUM DEPTH (cm)	:	80
DEPTH, THICKNESS AND TYPE OF RESTRICTING LAYER (cm)	:	75; compact, subsoil
ROOTING DEPTH (cm)	:	75
COARSE FRAGMENT CLASS	:	2-3
DEPTH TO AND TYPE OF WATERTABLE (cm)	:	60-180; seasonal perched
PERVIOUSNESS	:	slow
SOIL DRAINAGE	:	imperfect to moderately well
SOIL TEXTURE	:	gravelly loamy sand or gravelly sandy loam over gravelly loam or gravelly clay form

SOIL PHYSICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	75-100 cm Mean (Range)
BULK DENSITY (g/cm^3)	Est.	(1.4-1.8)	Est.	(1.5-1.9)	Est.	(1.7-2.1)
AWSC (cm/m)	Est.	(6-10)	Est.	(5-15)	Est.	(10-20)
% COARSE > 7.5 cm	9	5 (2-8)	9	5 (2-8)	9	3 (1-5)
FRAGMENTS < 7.5 cm	9	20 (15-23)	9	20 (15-23)	9	15 (10-20)
% PASSING SIEVE 4.76 mm	Est.	(50-75)	Est.	(50-75)	Est.	(60-85)
0.5 mm	Est.	(35-60)	Est.	(30-55)	Est.	(50-75)
0.074 mm	Est.	(20-35)	Est.	(20-35)	Est.	(40-60)
% FINE SAND	Est.	(8-16)	Est.	(8-15)	Est.	(5-15)
% SAND	Est.	(50-75)	Est.	(55-85)	Est.	(35-55)
% CLAY	Est.	(6-10)	Est.	(7-14)	Est.	(6-30)
LIQUID LIMIT (%)	1	52	1	52	1	23
PLASTIC LIMIT (%)	1	46	1	46	1	16

SOIL CHEMICAL PROPERTIES	No. of Samples N	0-25 cm Mean (Range)	N	25-75 cm Mean (Range)	N	75-100 cm Mean (Range)
SOIL REACTION 1:1 H_2O	1	4.8	1	4.8	1	5.6
(pH) 1:2 $CaCl_2$	1	4.4	1	4.4	1	5.3
ORGANIC CARBON (%)	1	3.7	1	2.0	1	1.0
NITROGEN (%)	1	0.15	1	0.13	1	0.06
EXCHANGE CAPACITY (meq/100g)	1	18	1	18	1	14
BASE SATURATION (%)	1	25	1	25	1	66
EXCHANGEABLE CATIONS - Ca	1	3.3	1	3.3	1	6.9
(meq/100g) - Mg	1	0.9	1	0.9	1	2.5
- Na	1	0.2	1	0.2	1	2.5
- K	1	0.06	1	0.06	1	0.5
% IRON	1	0.4	1	0.4		
% ALUMINUM	1	0.4	1	0.4		

SOIL PHASES/VARIANTS	
SOIL SYMBOL	DEFINITION
TSco	Cobbly phase; soil has greater than 20% cobbles and or stones.
TSco,vg	Cobbly, very gravelly phase; soil has greater than 20% cobbles and or stones, and greater than 50% coarse fragments by volume.
TSvg	Very gravelly phase; solum has greater than 50% coarse fragments by volume.

INFERRED SOIL PROPERTIES AND INTERPRETATIONS
TSOLUM SOILS

SOIL DEPTH (cm)	UNIFIED TEXTURE SYMBOL	AASHO TEXTURE SYMBOL	SUITABILITY AS A SOURCE OF			
			SAND	GRAVEL	SILT/CLAY	TOPSOIL
0-75	SW, SM	A-1-b	poor	fair	unsuited	unsuited
75-100+	SM, SC	A-4	poor	poor	poor	unsuited

MISCELLANEOUS LAND TYPES

Miscellaneous land types consist of naturally occuring or man-made components of the landscape but are considered not to be "soil" as defined in this report. They, however, are mappable and five different land types are classified in the map area.

(CB) **Active Coastal Beaches:** The Coastal Beach land type consists of sandy and gravelly beach areas subject to active tidal action.

(ER) **Eroded Scarp:** The Eroded Scarp land type consists of unconsolidated parent material on steep erosional scarps.

(NP) **Indian Middens:** Shells and organic debris deposits near beaches and estuary areas.

(MD) **Made Land:** The Made Land type consists of areas which are man-made or so severely man-modified that the original characteristics of the soil have been destroyed. Made land areas have been separated into seven categories, (MD_1 to MD_7) as defined below.

(MD_1) **Urban and Transportation:** Commerical and residential areas, paved roads, and airports.

(MD_2) **Gravel Pits:** Sites where quantities of bedrock have been removed from the site - may be suitable for other uses after gravel resource is exhausted.

(MD_3) **Open Pit Mines and Quarries:** Sites where quantities of bedrock have been removed from the site - may be suitable for other uses after mining ceases - major reclamation project probably required.

(MD_4) **Waste Rock Dumps:** Sites where waste rock or slag from mining activities have been deposited - may be suitable for other uses after mining ceases.

(MD_5) **Woodwaste:** Sites where sawdust and woodwaste have been deposited.

(MD_6) **Land Filling, Levelling:** Sites where material has been redistributed and/or brought in from other sites to create a suitable landscape for the designated use - housing, paving, etc. is minor.

MD_7) **Garbage Dumps** Sites used for the disposal of garbage and other waste materials - may be suitable for uses after extensive filling and reclamation.

(RA) Recent Alluvium: The Recent Alluvium land type is composed of gravel and sand bars, spits and other similar deposits in or adjacent to rivers and streams. They are usually inundated except during low water and are generally unvegetated. Their shape, size and location may be altered from year to year by erosion and subsequent redeposition.

(RO) Rock Outcrop: The Rock Outcrop land type is common in the map area, particularly at the higher elevations. It consists of areas of exposed bedrock or bedrock areas with less than 10 cm of mineral or organic soil on the rock surface. Topgraphically, Rock Outcrop areas are usually very to extremely sloping or hilly to very hilly; slope gradients are mostly greater than 30 percent. Rock Outcrops are separated into five categories (RO_1, to RO_5) as defined below.

(RO_1) Sandstone: Associated with Saturna and Bellhouse soils.

(RO_2) Siltstone, Shale: Associated with Galiano soil.

(RO_3) Conglomerate: Associated with Salalakim soil.

(RO_4) Volcanics: Associated with Rumsley soil.

(RO_5) Intrusives: Associated with Rumsley soil.

(SS_1) Steep Slopes: Coarse textured soils located in gullies and on other steep terrain with slopes in excess of 45%.

(SS_2) Steep Slopes: Medium and fine textured soils located in gullies and on other steep terrain with slopes in excess of 45%.

(WA);(W) Water: Water bodies, small lakes which are not indentified on the base maps.

Table 4.1
Brief Synopsis of the Soils

NAME	MOST COMMON SOIL TAXONOMY	DESCRIPTION
Alberni (AB)	Gleyed Dystric Brunisol	Imperfectly to moderately well drained soils developed in fine-textured marine deposits. Alberni soils have yellowish red to reddish brown upper horizons and usually have distinct or prominent mottles at depths between 50 and 100 cm.
Arrowsmith (AR)	Typic Mesisol (Humic Mesisol)	Deep, moderately decomposed organic soils with dark brown mesic material in the middle and bottom tiers.
Baynes (BY)	Gleyed Dystric Brunisol	Imperfectly drained, yellowish red soils developed in coarse-textured sandy marine and/or fluvial deposits. Distinct to prominent mottles occur at depths between 50 and 100 cm.
Beaufort (BF)	Orthic Dystric Brunisol (Orthic Regosol)	Well to moderately well drained gravelly coarse-textured fluvial fan deposits.
Beddis (BD)	Orthic Dystric Brunisol (Orthic Humo-Ferric Podzol)	Formally included in Kye soils*. Rapidly-drained, yellowish brown soils developed in coarse-textured (sandy), fluvial, marine, and/or eolian deposits. Minor inclusions of Orthic Sombric Brunisol (cultivated fields).
Bowser (BO)	Gleyed Humo-Ferric Podzol	Imperfectly-drained, brown to reddish brown soils developed in coarse-textured, sandy fluvial or marine deposits which are underlain by medium-textured marine materials. Minor areas of Gleyed Sombric Humo-Ferric Podzol.
Brigantine (BE)	Gleyed Dystric Brunisol (Gleyed Sombric Brunisol)	Imperfectly-drained soils developed in gravelly coarse-textured fluvial, fluvio-glacial and/or marine deposits overlying medium-textured marine materials.
Cassidy (CA)	Orthic Dystric Brunisol (Cumulic Regosol, Orthic Regosol, Orthic Humic Regosol)	Rapidly-drained soils developed on very gravelly coarse-textured fluvial deposits. The Regosol soils on the youngest, lowest areas within the floodplain.
Chemainus (CH)	Orthic Dystric Brunisol (Cumulic Regosol, Orthic Regosol)	Moderately well drained, dark yellowish brown soils developed on medium-textured, deep, fluvial deposits. Includes some Orthic Sombric Brunisols.
China Creek (CK)	Orthic Humo-Ferric Podzol	Moderately well to well drained, yellowish red to yellowish brown soils developed in deep, moderately coarse and medium textured morainal deposits.

*Day et al., 1959

Table 4.1 (Continued)

NAME	MOST COMMON SOIL TAXONOMY	DESCRIPTION
Comiaken (CN)	Orthic Dystric Brunisol (Cumulic Regosol)	Rapidly-drained soils developed in coarse-textured (sandy) recent fluvial deposits. Inclusions of Cumulic Humic Regosols, Orthic Regosols and Orthic Humic Regosols also occur.
Corydon (CR)	Rego Humic Gleysol; saline phase (Ortho Humic Gleysol; saline phase)	Poorly drained saline soils developed in medium-textured deltaic deposits which are underlain at variable depths by gravels. Includes saline phases of Orthic Humic Gleysols and Orthic Gleysols. Occur in the tidal zone of estuaries.
Cowichan (CO)	Orthic Humic Gleysol; Humic Luvic Gleysol	Poorly drained soils with dark coloured surface horizons and mottled and gleyed subsurfaces developed in deep medium and moderately fine marine deposits. Occur below 130 m elevation in level to depressional areas.
Crofton (CF)	Orthic Humic Gleysol (Rego Humic Gleysol)	Poorly-drained soils developed in medium-textured fluvial deposits underlain at variable depths by gravels. Includes small areas of Orthic Humic Gleysols, Orthic Gleysols and Rego Gleysols.
Dashwood (DW)	Duric Dystric Brunisol (Duric Humo-Ferric Podzol)	Well and moderately well drained, yellowish brown soils developed in very coarse-textured (gravelly) fluvial, fluvioglacial, or marine deposits underlain by moralnal materials usually at depths between 50 and 100 cm. An indurated horizon is present in the upper part of the moraine deposit.
Deerholme (DE)	Duric Dystric Brunisol (Duric Humo-Ferric Podzol)	Well and moderately well drained, yellowish brown soils developed in coarse-textured (sandy), fluvial or fluvio-glacial deposits underlain by moralnal materials at depths betwen 50 and 100 cm. An indurated horizon is present in the upper part of the moralnal material.
Denman Island (DA)	Orthic Humic Gleysol (Orthic Gleysol)	Poorly drained soils developed in deep, sandy marine or fluvial deposits. Normally found in moisture receiving locations where underlying impermeable moralnal material restricts permeability.
Fairbridge (FB)	Gleyed Eluviated Dystric Brunisol (Gleyed Dystric Brunisol)	Imperfectly drained soils developed in medium-textured, level to undulating marine deposits below 130 m elevation. The soils have strong brown colored surfaces and distinct to prominent mottling at depths between 50 and 100 cm.
Flewett (FT)	Orthic Dystric Brunisol	Well drained, medium-textured soils with dark yellowish brown surfaces developed on fluvial terraces. Textures usually are coarser with depth.

Table 4.1 (Continued)

NAME	MOST COMMON SOIL TAXONOMY	DESCRIPTION
Galiano (GA)	Orthic Dystric Brunisol; lithic phase (Orthic Humo-Ferric Podzol; lithic phase)	Well and moderately well drained, medium-textured soils with yellowish brown surfaces developed in shallow morainal or colluvial deposits overlying siltstone or shale bedrock.
Hillbank (HT)	Orthic Dystric Brunisol (Eluviated Dystric Brunisol) (Orthic Humo-Ferric Podzol)	Moderately well drained soils with yellowish brown surfaces developed in silty marine deposits. Faint mottles at depths between 50-100 cm. Hillbank soils usually occur in association with Fairbridge soils and are found on hilltops, ridges and other well drained locations.
Illusion (IN)	Gleyed Humo-Ferric Podzol	Imperfectly drained soils developed in medium textured marine deposits. Illusion soils have red to reddish brown surface horizons and distinct to prominent mottles at depths between 50 and 100 cm.
Kaptara (KP)	Orthic Humic Gleysol (Orthic Gleysol)	Poorly drained soils of minor extent that have developed in coarse textured (gravelly) fluvial, fluvioglacial or marine deposits. Normally found in seepage locations where underlying impermeable layers restricts percolation.
Koksilah (KH)	Orthic Humic Gleysol (Orthic Gleysol)	Poorly drained, very dark brown to black surfaced soils developed in deep, course-textured morainal materials. They are very limited in extent and occupy depressional sites in undulating to rolling landscapes. Percolation is restricted by the compact subsoil.
Kulleet (KT)	Gleyed Dystric Brunisol (Gleyed Humo-Ferric Podzol)	Imperfectly drained soils with yellowish brown surface horizons developed in medium textured deposits overlying coarse-textured marine and/or fluvial materials.
Kye (KY)	Orthic Humo-Ferric Podzol	Rapidly drained soils with brown to strong brown surface horizons developed in coarse-textured (sandy) fluvial, marine and/or eolian deposits.
Maple Bay (MY)	Orthic Dystric Brunisol: Lithic Phase Brunisol)	Moderately well and well drained medium-textured soils with yellowish brown surface horizons developed in silty marine parent material that overlies siltstone or shale at depths of less than 1 m.
McLean Creek (ML)	Orthic Humic Gleysol (Orthic Gleysol)	Poorly drained soils with dark colored surface horizons and prominently mottled and gleyed subsurface horizons developed in shallow medium and moderately fine-textured marine materials which overlie morainal deposits. McLean Creek soils occur in level to depressional areas below 100 m asl.

Table 4.1 (Continued)

NAME	MOST COMMON SOIL TAXONOMY	DESCRIPTION
Metchosin (MT)	Typic Humisol	Deep, well-decomposed organic soils with dark brown to black humic material in the middle and bottom tiers.
Mexicana (ME)	Orthic Dystric Brunisol (Orthic Humo-Ferric Podzol)	Well drained, yellowish brown soils developed in deep deposits of moderately coarse-textured morainal material. Discontinuous, weakly cemented horizons are present in the subsoil.
Mill Bay (MB)	Duric Dystric Brunisol (Duric Humo-Ferric Podzol)	Moderately well to imperfectly drained, medium textured soils with yellowish brown upper horizons. Parent material consists of 50 to 100 cm of medium-textured marine materials overlying morainal deposits. The upper part of the morainal material is indurated.
Parksville (PA)	Orthic Humic Gleysol (Orthic Gleysol)	Poorly drained soils developed in coarse-textured (sandy), fluvial, fluvio-glacial and/or marine materials, 30 to 100 cm thick, that overlie silty marine deposits.
Puntledge (PU)	Gleyed Sombric Brunisol (Gleyed Sombric Humo-Ferric Podzol)	Imperfectly drained, medium-textured fluvial materials overlying moderately fine-textured marine deposits. Puntledge soils have yellowish brown surface horizons and distinct to prominent mottles at depths between 50 and 100 cm.
Qualicum (QU)	Orthic Dystric Brunisol	Rapidly drained, yellowish brown soils developed in very coarse-textured (gravelly), deep (at least 150 cm), fluvial, fluvio-glacial, and/or marine materials. They may contain discontinuous, weakly cemented subsoil horizons.
Quennell (QL)	Orthic Humo-Ferric Podzol	Rapidly-drained, reddish brown soils developed in very coarse textured (gravelly), deep (at least 150 cm), fluvial, fluvio-glacial, and/or marine materials. May contain discontinuous weakly cemented subsoil horizons.
Quinsam (QN)	Duric Humo-Ferric Podzol	Moderately well drained, brown to reddish brown soils developed in deep, coarse-textured morainal deposits. Found on rolling to steeply sloping terrain at the higher elevations in the climatically wetter portions of the report area. A duric horizon usually occurs between 50 and 100 cm of the surface.

Table 4.1 (Continued)

NAME	MOST COMMON SOIL TAXONOMY	DESCRIPTION
Royston (RN)	Gleyed Dystric Brunisol (Gleyed Humo-Ferric Podzol)	Imperfectly drained, yellowish brown soils developed in deep, medium-textured, compact moralnal deposits associated with shale and/or siltstone bedrock.
Rumsley (RY)	Orthic Dystric Brunisol; Lithic Phase Orthic Humo-Ferric Podzol; Lithic Phase	Well drained soils with reddish brown surface horizons developed in shallow (10 to 100 cm thick) moralnal or colluvial deposits overlying intrusive and extrusive bedrock.
St. Mary (SM)	Gleyed Dystric Brunisol (Gleyed Humo-Ferric Podzol)	Imperfectly drained soils developed in coarse over medium-textured marine overlying coarse-textured moralnal deposits. Distinct to prominent mottles occur at depths between 50 and 100 cm.
Salalakim (SL)	Orthic Dystric Brunisol; lithic phase (Orthic Humo-Ferric Podzol; lithic phase)	Rapidly drained soils with brown surface horizons developed in shallow (10 to 100 cm thick) colluvial or moralnal deposits overlying conglomerate bedrock.
Saturna (ST)	Orthic Dystric Brunisol; lithic Phase (Orthic Humo-Ferric Podzol; lithic phase)	Rapidly drained soils with yellowish brown surface horizons developed in shallow colluvial, moralnal (10 to 100 cm thick) and to a minor extent, marine deposits overlying sandstone bedrock.
Shawnigan (SH)	Duric Dystric Brunisol	Moderately well to well drained yellowish brown soils developed in deep, coarse-textured, compact moralnal deposits. Rolling to undulating topography. An indurated horizon occurs at depths between 50 and 100 cm.
Stamp (SP)	Gleyed Humo-Ferric Podzol (Orthic Humo-Ferric Podzol)	Imperfect to moderately well drained soils developed in moderately fine-textured moralnal deposits.
Suffolk (SF)	Gleyed Dystric Brunisol (Gleyed Humo-Ferric Podzol)	Imperfectly drained soils developed in medium-textured marine materials overlying moderately coarse to coarse-textured moralnal deposits. Suffolk soils have yellowish red surface horizons and distinct to prominent mottles at depths between 50 and 100 cm.
Tolmie (TL)	Orthic Humic Gleysol (Orthic Gleysol)	Poorly drained, very dark brown to black surfaced soils developed in shallow (10 to 30 cm thick), sandy veneers overlying medium-textured gravelly) fluvial, fluvio-glacial, or marine deposits overlying medium-textured moralnal materials usually at depths between 50 and 100 cm.

Table 4.1 (Continued

NAME	MOST COMMON SOIL TAXONOMY	DESCRIPTION
Trincomali (TR)	Orthic Dystric Brunisol Gleyed Dystric Brunisol	Moderately well to imperfectly drained, yellowish red soils developed in coarse-textured (gravelly) fluvial, fluvio-glacial, or marine deposits overlying medium-textured moralnal materials usually at depths between 50 and 100 cm.
Tsolum (TS)	Gleyed Humo-Ferric Podzol (Orthic Humo-Ferric Podzol)	Imperfect to moderately well drained, red to dark red soils developed in coarse-textured (gravelly), fluvial, or fluvio-glacial deposits overlying medium-textured moralnal materials usually at depths between 50 and 100 cm.

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GLOSSARY

AASHO, classification, soil engineering - The official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway Officials.

aeolian - Material deposited by wind; includes loess and dune sand.

acid soil - A soil material having a pH of less than 7.0.

aggregate - Sand, gravel and other similar mineral material suitable for use in construction (i.e. for road surfaces, concrete, pavement).

aggregate, soil - A group of soil particles cohering, in such a way that they behave mechanically as a unit.

alluvium - A general term for all deposits of rivers and streams.

anthropogenic - Man-made, or strongly man-modified, soil materials.

ancient marine landscapes - Lands that reemerged from the ocean after being depressed below sea level during glaciation.

arable soil - Soil suitable for plowing and cultivation.

aspect - A measure of orientation of a slope by means of compass points.

association, soil - A sequence of soils of about the same age, derived from similar parent materials, and occuring under similar climatic conditions but having different characertistics due to variation in relief and in drainage.

Atterberg Limits (Plastic Limits) - The range of water content over which a soil exhibits plastic behaviour. The Lower Atterberg Limit is the water content at which the soil is not plastic when worked and crumbles on application of pressure. The Upper Atterberg Limit is the water content at which the soil changes from plastic to flow behaviour.

available nutrient - The portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.

available soil water - The portion of water in a soil that can be readily absorbed by plant roots; generally considered to be the water held in the soil up to approximately 15 atmospheres tension.

bar - A unit of pressure equal to one million dynes per square centimeter.

base saturation - The extent to which the adsorption complex of a soil is saturated with exchangeable cations other than hydrogen and aluminum. It is expressed as a percentage of the total cation exchange capacity.

beach deposits - Sediments that are modified in their degree of sorting, or surface relief, or both, by the action of waves in forming beaches.

bearing capacity - The average load per unit area that is required to rupture a supporting soil mass.

bedrock - The solid rock that underlies soil and the regolith, or that is exposed at the surface.

blanket - A mantle of unconsolidated material thick enough to mask minor irregularities in the underlying rock or other deposits, but which still conforms to the general underlying topography.

bog - An area covered, or filled with, peat material which generally consists of undecomposed to moderately deccomposed mosses.

boulders - Rock fragments over 60 cm (2 ft) in diameter. In engineering practice boulders are greater than 20 cm (8 inches) in diameter.

bulk density, soil - The mass of dry soil per unit bulk volume is determined before the soil is dried to constant weight at 105°C.

capability class, soil - A rating that indicates the general capability of a soil for some use such as agriculture, forestry, recreation, or wildlife. It is a grouping of subclasses that have the same relative degree of limitation or hazard. The limitation or hazard becomes progressively greater from Class 1 to Class 7.

capability subclass, soil - A grouping of soils that have similar kinds of limitations and hazards. It provides information on the kind of management difficulty, conservation problem or limitation. The class and subclass together provide information about the degree and kind of limitation for land-use planning, and for the assessment of conservation needs.

carbon-nitrogen ratio (C/N ratio) - The ratio of the weight of organic carbon to the weight of total nitrogen in a soil or in an organic material.

category - A grouping of related soils defined at approximately the same level of abstraction. In the Canadian soil classification the categories are order, great group, subgroup, family, and series.

cation exchange - The interchange of a cation in solution and another cation on the surface of any surface-active material such as clay colloid or organic colloid.

cation exchange capacity (CEC) - A measure of the total amount of exchangeable cations that can be held by a soil. It is expressed in milliequivalents per 100 g of soil.

cemented-indurated - Having a hard, brittle consistence because the particles are held together by cementing substances such as humus, calcium carbonate, or the oxides of silicon, iron, and aluminum. The hardness and brittleness persist even when the soil is wet.

channelled (ridge and swale) - Characteristic ridge and swale topography (0-10% slopes common). Often a pattern or series of closely spaced curvilinear ridges and swales. A poorly integrated drainage pattern may be evident connecting swales.

chroma - The relative purity, strength, or saturation of a colour. It is directly related to the dominance of the determining wavelength of light. It is one of the three variables of colour. See also **Munsell colour system; hue;** and **value, colour.**

classification, soil - The systematic arrangement of soils into categories on the basis of their characteristics. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed differences in specific properties.

clay - (i) As a particle term: a size fraction less than 0.002 mm in equivalent diameter, or some other limit (geologist and engineers). (ii) As a rock term: a natural, earthy, fine grained material that developes plasticity with a small amount of water. (iii) As a soil term: a textural class in which the soil materials contain 40 percent or more of clay. (iv) As a soil separate: a material usually consisting largely of clay material but commonly also of amorphous free oxides and primary minerals.

clay films (skins) - Coatings of oriented clays on the surface of soil peds and mineral grains.

clay loam - Soil material that contains 27% to 40% clay and 20% to 45% sand.

clay mineral - Finely crystaline hydrous aluminum silicates and hydrous magnesium silicates with phyllosilicate structure.

clayey - Containing large amounts of clay, or having properties similar to those of clay.

climatic moisture deficit - The negative difference between precipitation and the potential evapotranspiration from May 1st to September 30th.

climatic moisture surplus - The positive difference between precipitation and the potential evapotranspiration from May 1st to September 30th.

climax - A plant community of the most advanced type capable of development under, and in dynamic equilibrium with, the prevailing environment.

clod - A compact, coherent mass of soil produced by digging or plowing. Clods usually slake easily with repeated wetting and drying.

coarse fragments - Rock or mineral particles greater than 2.0 mm in diameter.

coarse texture - The texture exhibited by sands, loamy sand, and sandy loams except very fine sandy loam. A soil containing large quantities of these textural classes.

cobble - Rounded or partially rounded rock or mineral fragment 7.5 to 25 cm (3 to 10 inches) in diameter. In engineering practice, cobbles are greater than 7.5 cm (3 inches) but less than 20 cm (8 inches) in diameter.

colluvium - Loose material accumulated on and at the foot of slopes by the various processes of mass movement (gravity). Highly variable textures depending on source material (often boulder-sized material). Unsorted to crudely stratified.

colour, soil - Soil colours are compared with a Munsell colour chart. The Munsell system specifies the relative degrees of the three simple variables of colour; hue, value and chroma. For example: 10YR 6/4 means a hue 10YR, a value of 6, and a chroma of 4. See also **Munsell colour system; hue;** and **value, colour.**

complex, soil - A mapping unit used in detailed and reconnaissance soil surveys where two or more defined soil units are so intimately intermixed geographically that it is impractical, because of the scale used, to separate them.

compaction soil - The packing together of soil particles by forces exerted at the soil surface resulting in increased soil density.

concretion - A mass or concentration of a chemical compound, such as calcium carbonate or iron oxide, in the form of a grain or nodule of varying size, shape, hardness, and color, found in soil and in rock. The term is sometimes restricted to concentrations having concentric fabric. The composition of some concretions is unlike that of the surrounding material.

conductivity, electrical - A physical quantity that measures the readiness with which a medium transmits electricity. It is expressed as the reciprocal of the electric resistance (ohms) or mS per cm at 25°C of a conductor which is one cm long with a cross sectional area of one square cm. It is used to express the concentration of salt in irrigation water or soil extracts.

consistence - (i) The resistance of a material to deformation or rupture. (ii) The degree of cohesion or adhesion of the soil mass. Terms used for describing consistence at various soil mositure contents are:

wet soil - nonsticky, slightly sticky, sticky, and very sticky; nonplastic, slightly plastic, plastic, and very plastic.

moist soil - loose, very friable, friable, firm, and very firm; compact, very compact, and extremely compact.

dry soil - loose, soft, slightly hard, hard, very hard, and extremely hard.

cementation - weakly cemented, strongly cemented, and indurated.

creep, soil - The slow, continuous downslope movement of mantle materials as the result of long-term application of gravitational stress. It occurs in varying degrees in association with most other types of soil mass movements but dominates as a major process in itself on slopes covered with deep, cohesive soils.

degradation, soil - The changing of soil to a more highly leached and more highly weathered condition, usually accompanied by morphological changes such as the development of an eluviated, light-coloured (Ae) horizon.

delta - A fluvial or glaciofluvial deposit which is a relatively level (0-25% slopes) usually triangular shaped form occurring at the mouth of a stream as it enters a lake or ocean. May have numerous presently occupied or abandoned channels which appear as an integrated drainage pattern.

deposit - Material left in a new position by a natural transporting agent such as water, wind, ice, or gravity, or by the activity of man.

drainage, soil - (1) The rapidity and extent of the removal of water from the soil by runoff and flow through the soil to underground spaces. (2) As a condition of the soil, it refers to the frequency and duration of periods when the soil is free of saturation.

dunes - Wind-built ridges and hills of sand.

duric - A soil horizon that is strongly cemented and usually has an abrupt upper boundary and a diffuse lower boundary. Cementation is usually strongest near the upper boundary. Air-dried clods do not slake when immersed in water.

ecology - The study of the relationship between living organisms and their environment.

eluviation - The transportation of soil material in suspension or in solution within the soil by the downward or lateral movement of water.

eolian deposit - Sand, or silt, or both, deposited by the wind, See also loess and dunes.

erosion - The group of processes whereby surficial or rock materials are loosened, or dissolved and removed from any part of the earth's surface. It includes the processes of weathering, solution, corrosion and transportation.

evapotranspiration - The combined loss of soil water from a given area during a specific period of time by evaporation from the soil surface and transpiration from plants.

exchange capacity - The total ionic charge of the adsorption complex that is active in the adsorption of ions.

fan - Fluvial deposits which are level to steeply sloping (0-50%) fan-like form occurring where a stream runs out onto a level plain or meets a slower stream. Fans are often marked by variegated current scars, abandoned and presently occupied channels. Noticeable slope towards the fan toe or apron.

fen - An area covered by peat material which generally consists of well to moderately decomposed sedge and reed vegetation.

fertility, soil - The status of a soil with respect to the amount and availability of elements necessary for plant growth.

fibric layer - A layer of organic soil material containing large amounts of weakly decomposed fiber whose botanical origin is readily identifiable.

field capacity - The percentage of water remaining in the soil 2 or 3 days after the soil has been saturated and free drainage has practically ceased. The percentage may be expressed in terms of weight or volume.

fine texture - Consisting of or containing large quantities of the fine fractions, particularly of silt and clay. It includes all the textural classes of clay loams and clays: clay loam, sandy clay loam, silty clay loam, sandy clay, silty clay, and clay. Sometimes it is subdivided into clayey texture and moderately fine texture.

firm - A term describing the consistence of a moist soil that offers distinctly noticeable resistance to crushing, but can be crushed with moderate pressure between the thumb and forefinger.

floodplain - The land bordering a stream or river built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

fluted - Level to gently irregular topography (0-25% slopes) marked by shallow, straight parallel troughs.

fluvial, deposits - Materials laid down by recent streams and rivers. Variable textures (few boulders or coarse fragments). Moderately well to well sorted and moderately well to well stratified.

fluvioglacial, deposits - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and may occur in the form of outwash plains, deltas, kames, eskers, and kame terraces.

friable - Soil aggregates that are soft and easily crushed between thumb and forefinger.

genesis, soil - The mode of origin of the soil, especially the processes or soil-forming factors responsible for the development of the solum from unconsolidated parent material.

geomorphology - The study of landforms as they relate to geologic composition and history.

glacial till (ablation) - Materials deposited directly by ice with some modification and transportation by glacial meltwater. Variable textures (often stony and bouldery). Poorly sorted and partially stratified.

glacial till (basal) - Materials deposited by ice directly without intervening transportation by water. Variable textures (most often heterogeneous mixture of sands, silts and clays - some often stony and bouldery). Unsorted and unstratified.

gleyed soil - An imperfectly or poorly drained soil in which the material has been modified by reduction or alternating reduction and oxidation. These soils have lower chromas or more prominent mottling or both in some horizons than the associated well-drained soils.

gleysation - A soil-forming process, operating under poor drainage conditions, which results in the reduction of iron and other elements and in gray colours, and mottles.

gleysolic - An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas, or prominent mottling, or both, in some horizons.

gravel - Rock fragments 2 mm to 7.5 cm in diameter.

gravelly - Containing appreciable or significant amounts of gravel. The term is used to describe soils or lands.

great group - A category in the Canadian system of soil classification. It is a taxonomic group of soils having certain morphological features in common and a similar pedogenic environment.

groundwater - Water that is passing through or standing in the soil and the underlying strata. It is free to move by gravity.

horizon, soil - A layer of soil or soil material approximately parallel to the land surface, it differs from adjacent genetically related layers in properties such as colour, structure, texture, consistence, and chemical, biological and mineralogical composition. A list of the designations and properties of soil horizons may be found in the Canadian System of Soil Classification, 1978.

organic horizons - May be found at the surface of mineral soils or at any depth beneath the surface in buried soils or overlying geolcgic deposits. They contain more than 30% organic matter. Two groups of these layers are recognized:

O - An organic layer or layers developed under poorly drained conditions, or under conditions of being saturated most of the year or on wet soils that have been artificially drained.

Of - Fibric layer. An orgnic layer which is the least decomposed of all the organic soil materials. It has large amounts of well-preserved fiber that is readily identifiable as to botanical origin.

Om - Mesic layer. An organic layer which is intermediate in decomposition between the less decomposed fibric and the more decomposed humic materials. This material has intermediate values for fiber content, bulk density and water content. The material is partly altered both physically and biochemically.

Oh - Humic layer. An organic layer which is the most decomposed of all the organic soil materials. It has least amount of plant fiber, the highest bulk density values and the lowest saturated water content. This material is relatively stable having undergone considerable change from the fibric state primarily because of oxidation and humification.

L, F, and H - These are organic horizons that developed primarily from the accumulation of leaves, twigs, and woody materials with or without a minor component of mosses. Usually they are not saturated with water for prolonged periods.

L - An organic layer characterized by the accumulation of partly decomposed organic matter.

F - An organic layer characterized by the accumulation of partly decomposed organic matter. The original structures are discernible with difficulty. Fungi mycelia are often present.

H - An organic layer characterized by an accumulation of decomposed matter in which the original structures are indiscernible.

master mineral horizons and layers - Mineral horizons are those that contain less than 30 percent organic matter.

A - A mineral horizon formed at or near the surface in the zone of removal of materials in solution and suspension and/or maximum accumulation of organic matter. Included are: (1) horizons in which organic matter has accumulted as a result of biologic activity (Ah); (2) horizons that have been eluviated of clay, iron, aluminum, and/or organic matter (Ae); (3) horizons having characteristics of (1) and (2) above but transitional to underlying B or C (AB or A and B); (4) horizons markedly disturbed by cultivation or pasture (Ap).

B - A mineral horizon or horizons characterized by one or more of the following: An enrichment in silicate clay, iron, aluminum or humus, alone or in combination (Bt, Bf, Bhf and Bh); Significant accumuations of exchangeable sodium (Bn), relative uniform browing due to oxidation of iron (Bm), and mottling and gleying of structurally altered material associated with periodic reduction (Bg).

C - A mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting (1) the process of gleying, and (2) the accumulation of calcium and magnesium carbonates and more soluble salts (Cca, Csa, Cg and C).

R - Underlying unconsolidated bedrock, such as granite, sandstone, limestone, etc. The boundary between the R layer and any overlying unconsolidated material is called a lithic contact.

lower case suffixes

b - Buried soil horizon.

c - A cemented (irreversible) pedogenic horizon.

ca - A horizon with secondary carbonate enrichment where the concentration of lime exceeds that present in the unenriched parent material. It is more than four inches thick and if it has a $CaCO_3$ equivalent of less than 15%, it should have at least 5% $CaCO_3$ equivalent than the parent material. If it has more than 15% $CaCO_3$ equivalent, it should have 1/3 more $CaCO_3$ equivalent than IC.

cc - Cemented (irreversible) pedogenic concretions.

e - A horizon enriched with hydrated iron. It usually has a chroma of 3 or more. It is higher in colour value by one or more units when dry than an underlying B horizon.

f - A horizon enriched with amorphous material, principally Al and Fe combined with organic matter. It usually has a hue of 7.5YR near the upper boundary and becomes yellower with depth. When moist the chroma is higher than 3 or the value is 3 or less. It contains at least 0.6% pyrophosphate-extractable Al + Fe in textures finer than sand and 0.4% in sands (coarse sand, sand, fine sand, and very fine sand). The ratio of pyrophosphate-extractable Al +Fe to clay (<0.002 mm) is more than 0.005 and organic C exceeds 0.5%. Pyrophosphate-extractable Fe is at least 0.3%, or the ratio of organic C to pyrophosphate-extractable Fe is less than 20, or both are true. It is used with B alone (Bf), with B and h (Bhf), with B and g (Bfg), and with other suffixes. These criteria do not apply to Bgf horizons. The following f horizons are differentiated on the basis of the organic C content:

Bf - 0.5-5% organic C

Bhf - more than 5% organic C.

No minimum thickness is specified for a Bf or a Bhf horizon. Thin Bf and Bhf horizons do not qualify as podzolic B horizons as defined later in this chapter.

Some Ah and Ap horizons contain sufficient pyrophosphate-extractable Al + Fe to satisfy this criterion of f but are designated Ah or Ap.

g - A horizon characterized by gray colours and/or prominent mottling indicative of permanent or periodic intense reduction. Chromas of the matrix are generally one or less.

h - A horizon enriched with organic matter. When used with A alone, (Ah) it refers to the accumulation of organic matter and must contain less than 30% organic matter. It must show one Munsell unit of value darker than the horizon immediately below or have one percent more organic matter than the IC. When used with A and e it refers to an Ah horizon which has been degraded as evidenced, under natural conditions, by streaks and plotches and often by platy structure.

j - Used as a modifier of e, g, n and t to denote an expression of, but failure to meet the specified limits to the suffix it modifies.

k - Presence of carbonate as indicated by visible effervescence with dilute HCL.

m - A horizon slightly altered by hydrolysis, oxidation, or solution, or all three, to give a change in colour or structure, or both. It has:

1) Soil structure rather than rock structure comprising more than half the volume of all subhorizons.

2) Some weatherable minerals.

3) Evidence of alteration in one of the following forms:
   a) Stronger chromas and redder hues than the underlying horizons.
   b) Evidence of the removal of carbonates.

4) Illuviation, if evident, is too slight to meet the requirements of a textural B or a podzolic B.

5) No cementation or induration and lacks a brittle consistence when moist.

p - A layer disturbed by man's activities, i.e. by cultivation and/or pasturing. To be used only with A.

s - A horizon with salts including gypsum which may be detected as crystals or veins, or as surface crusts of salt crystals, or by stressed crop growth, or by the presence of salt tolerant plants.

sa - A horizon with secondary enrichment of salts more soluble than calcium and magnesium carbonates; the concentration of salts exceeds that present in the unenriched parent material. The horizon is 10 cm or more thick. The conductivity of the saturation extract must be at least 4 mmhos/cm and must exceed that of the C horizon by at least one-third.

t - A horizon enriched with silicate clay. It is used with B alone (Bt, Btg, etc.).

horizon boundary - Horizon boundaries are indicated by distinctness and form. The distinctness of a horizon boundary depends partly on the degree of contrast with the adjacent lower horizon and partly on the thickness of any transition zone between them.

hue - The aspect of colour that is determined by the wavelengths of light, and changes with the wavelength. Munsell hue notations indicate the visual relationship of a colour to red, yellow, green, blue, or purple, or an intermediate of these hues. See also **Munsell colour system, chroma,** and **value, colour.**

humus - That more or less stable fraction of the soil organic matter remaining after most of the added plant and animal residues have decomposed.

humus form - A group of soil horizons located at or near the surface of a pedon, which have formed from organic residues, either separate from, or intermixed with mineral materi als. See also mull; moder; and mor.

ice contact - Fluvioglacial deposits laid down along the margins of glaciers.

igneous rock - Rock formed by the cooling and solidification of magma. It has not been changed appreciably since its formation.

illuvial horizon - A soil horizon in which material carried from an overlying layer has been precipitated from solution or deposited from suspension.

illuviation - The process of depositing soil material removed from one horizon in the soil to another, usually from an upper to a lower horizon in the soil profile. Illuviated substances include silicate clay, hydrous oxides of iron and aluminum, and organic matter.

impeded drainage - A condition that hinders the movement of water by gravity through soils.

impervious - Resistant to penetration by fluids or roots.

inclusion - Soil types found within a mapping unit which are not extensive enough to be mapped separately or as part of a soil complex.

Indurated layer - A soil layer that has become hardened, generally by cementation of soil particles.

Infiltration - The downward entry of water into the soil.

Infiltration rate - A soil characteristic determining or describing the maximum rate at which water can enter the soil under specified conditions, including the presence of excess water.

Inorganic soil - A soil made up mainly of mineral particles; a soil containing less than 17% organic carbon.

Irrigation - The artificial application of water to the soil for the benefit of growing crops.

kame - An irregular ridge or hill of stratified glacial drift deposited by glacial meltwater.

Kettle - Depression left after the melting of a mass of glacier ice buried in drift.

lacustrine deposits - Sediments that have settled from suspension in bodies of standing fresh water and are later exposed by lowering the water level or by up-lifting of the land.

land - The solid part of the earth's surface or any part thereof. A tract of land is defined geographically as a specific area of the earth's surface. Its characteristics embrace all reasonably stable, or predictably cyclic, attributes of the biosphere vertically above and below this area, including those of the atmosphere, the soil, and the underlying geology, the hydrology, the plant and animal populations, and the results of past and present human activity, to the extent that these attributes exert a significant influence on the present and future use of land by man.

land classification - The arrangement of land units into various categories based on the properties of the land or its suitability for some particular purpose.

landforms - The various shapes of the land surface resulting from a variety of actions such as deposition or sedimentation (eskers, lacustrine basins), erosion (gullies, canyons), and earth crust movements (mountains).

landscape - All features such as fields, hills, forests, and water that distinguish one part of the earth's surface from another part. Usually it is the portion of land or territory that the eye can see in a single view, including all its natural characteristics.

leaching - The removal from the soil of materials in solution.

levee - A natural or artificial embankment along a river or stream.

liquid limit (upper plastic limit, Attenberg limit) - The water content corresponding to an arbitrary limit between the liquid and plastic states of consistence of a soil. The water content at which a pat of soil cut by a groove of standard dimensions will flow together for a distance of 12 mm under the impact of 25 blows in a standard liquid limit apparatus.

lithic layer - Bedrock under the control section of a soil. In Organic soils, bedrock occurring within a depth of between 10 cm and 160 cm from the surface, while in mineral soils it occurs between 10 and 100 cm of the surface.

loamy - Intermediate in texture and properties between fine-textured and coarse-textured soils. It includes all textural classes having "loam" or "loamy" as a part of the class name, such as clay loam or loamy sand.

loess - Material transported and deposited by wind and consisting of predominantly silt sized particles.

Luvisolic - An order of soils that have eluvial (Ae) horizons, and illuvial (Bt) horizons in which silicate clay is the main accumulation product. The soils developed under forest or forest-grassland transition in a moderate to cool climate.

map, soil - A map showing the distribution of soil mapping units related to the prominent physical and cultural features of the earth's surface.

mapping unit, soil - Any delineated area shown on a soil map that is identified by a letter, symbol or number. A mapping unit may be a soil unit, a miscellaneous land type, or a complex of soil units.

marine limit - The boundary between marine influenced areas of land and those which were not submerged below sea level.

medium texture - Intermediate between fine-textured and coarse-textured soils. It includes the following textural classes: very fine sandy loam, loam, silt loam, and silt.

meltwater channel - An incised flat bottomed channel often appearing over-sized for the present stream which occupies it - sidewalls (10-60% slopes); channel bottom (0-10%).

mesic layer - A layer of organic material at a stage of decomposition between that of the fibric and humic layers.

metamorphic rock - Rock derived from pre-existing rocks, but differing from them in physical, chemical, and mineralogical properties as a result of natural geological processes, principally heat and pressure, originating within the earth. The pre-existing rocks may have been igneous, sedimentary, or another form of metamorphic rock.

milliequivalent (me) - One thousandth of the weight of clay or organic colloid that has a combining power equal to 1 gram-atomic weight of hydrogen. The atomic or formula weight divided by valence/1000.

mineral soils - A soil consisting predominantly of, and having its properties determined predominantly by, mineral matter. It contains less than 17% organic carbon except that an organic surface layer if present may be up to 40 cm thick.

miscellaneous land type - A mapping unit for areas of land that have little or no natural soil.

moder - A zoogenous forest humus form made up of plant remains partly disintegrated by the soil fauna (F layer), but not matted as in raw humus. It is transitional to a zone of spherical or cylindrical microejections of arthropods that is permeated by loose mineral particles in its lower part and often throughout. Incorporation of organic matter is shallow and the mixing of organic and mineral particles is purely mechanical.

moderately coarse texture - Consisting predominantly of coarse particles. In soil textural classification, it includes all the sandy loams exept very fine sandy loam.

moderately fine texture - Consisting predominantly of intermediate-sized soil particles with or without small amounts of fine or coarse particles. In soil textural classification, it includes clay loam, sandy clay loam, and silty clay loam.

moraine (glacial till) - The materials transported beneath, beside, on, within and in front of a glacier; deposited directly from the glacier and usually not modified by any intermediate agent.

mor - This humus form (also known as "raw humus") is non-zoogenous and is comprised of Of, Om, Oh, or L, F, and H horizons sharply delineated from the mineral soil. It is usually strongly matted or compacted and often interwoven with fungal hyphae. Mors commonly occur on a variety of parent materials in coniferous forests where climatic and edaphic conditions prevent rapid decomposition of organic matter and development of an active population of soil microfauna. They also occur in mixed or hardwood stands, and in wetland areas (excluding Organics).

morphology, soil - (I) The physical constitution, particularly the structural properties, of a soil profile and exhibited by the kinds, thickness, and arrangement of the horizons in the profile, and by the texture, structure, consistence, and porosity of each horizon. (II) The structural characteristics of the soil or any of its parts.

mottles - Spots or streaks, apparent in soil matrix. Colours are usually yellow, red, or orange. They are described in terms of abundance (few, common, many), size (fine, medium, coarse) and contrast (faint, distinct, prominent). Mottling in soils indicates poor aeration and lack of good drainage.

mottling - Formation of presence of mottles in the soil.

mull - A zoogenous forest humus form consisting of an intimate mixture of well-humified organic matter and mineral soil that makes a gradual transition to the horizon underneath. It is distinguished by its crumb or granular structure, and because of the activity of the burrowing microfauna, partly decomposed organic debris does not accumulate as a distinct layer (F layer) as in mor and moder.

Munsell colour system - A colour designation system specifying the relative degrees of the three simple variables of colour: hue, value, and chroma.

Order, soil - The highest category in the Canadian system of soil classification. All the soils of Canada have been divided into nine orders: Chernozemic, Solonetzic, Luvisolic, Podzolic, Brunisolic, Regosolic, Gleysolic, Organic, and Cryosolic. All the soils within an order have one or more characteristics in common.

Organic - An order of soils that have developed dominantly from organic deposits. The majority of Organic soils are saturated for most of the year, unless artificially drained, but some of them are not usually saturated for more than a few days. They contain 17% or more organic carbon.

organic matter, soil - The organic fraction of the soil; including plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population.

ortstein - (I) An indurated layer in the B horizon of Podzols in which the cementing material consists of illuviated sesquioxides and organic matter. (II) As a subgroup of Podzolic soils, Ortstein indicates a Bhfc or Bfc horizon that is strongly cemented, occurs over at least one-third of the exposure, and is at least 2.5 cm thick.

outwash, glacial - Sediments washed out by flowing water beyond a glacier and laid down in thin forset beds as stratified drift. Particle size may range from boulders to silt.

pans - Horizons or layers in soils that are strongly compacted, indurated, or very high in clay content.

parent material - The unaltered or essentially unaltered mineral or organic material from which the soil profile develops by pedogenic processes.

peat - Unconsolidated soil material consisting largely of undecomposed, or only slightly decomposed, organic matter.

ped - A unit of soil strucure such as a prism, block, or granule, which is formed by natural processes, in contrast with a clod, which is formed artificially.

pedogenic - Of or referring to the genesis (formation and development) of soil; used mainly when discussing the kind, strength and distribution of soil horizons in a soil profile.

pedology - Those aspects of soil science dealing with the origin, morphology, genesis, distribution, mapping, and taxonomy of soils, and classification in terms of their use.

perched water table - A water table due to the "perching" of water on a relatively impermeable layer at some depth within the soil. The soil within or below the impermeable layer is not saturated with water.

percolation (of soil water) - The downward movement of water through soil.

permeability, soil - The ease with which gases and liquids penetrate or pass through a bulk mass of soil or a layer of soil. Because different soil horizons vary in permeability, the specific horizon should be designated.

perviousness - The potential of a soil to transmit water internally, as inferred from soil characteristics.

pH, soil - The intensity of acidity or alkalinity, expressed as the logarithm of the reciprocal of the H+ ion concentration. pH 7 is neutral, lower values indicate acidity and higher values alkalinity.

phase, soil - A subdivision of a soil type of other unit of classification having characteristics that affect the use and management of the soil, but that do not vary sufficently to differentiate it as a separate type.

plain - A flat to gently undulating surface form (0-10% slopes). Slopes are most often simple and have variable drainage pattern depending on texture of material.

plastic limit (Attenberg limit) - (i) The water content corresponding to an arbitrary limit between the plastic and semi-solid states of consistency of a soil. (ii) The water content at which a soil will just begin to crumble when rolled into a thread approximately 3 mm in diameter.

plasticity index - The numerical difference betwen the liquid and the plastic limit. The plasticity index gives the range of moisture contents within which a soil exhibits plastic properties.

platy - Consisting of soil aggregates that have developed predominantly along the horizontal axes; laminated; flaky.

Podzolic - An order of soils having podzolic B horizons (Bh, Bhf, or Bf) in which amorphous combinations of organic matter (dominantly fulvic acid), Al, and usually Fe are accumulated. The sola are acid and the B horizons have a high pH-dependent charge. The great groups in the order are Humic Podzol, Ferro-Humic Podzol, and Humo-Ferric Podzol.

pore space - The total space not occupied by soil particles in a bulk volume of soil.

profile, soil - A verticle section of the soil through all its horizons and extending into the parent material.

reaction, soil - The degree of acidity or alkalinity of a soil, which is usually expressed as a pH value.

regolith - The unconsolidated mantle of weathered rock and soil material overlying solid rock.

Regosolic - An order of soils having no horizon development or development of the A and B horizons insufficient to meet the requirements of the other soil orders.

relief - The difference in elevations or irregularities of the land surface when considered collectively.

runoff - The portion of the total precipitation on an area that flows away through stream channels. Surface runoff does not enter the soil. Groundwater runoff or seepage flow from groundwater enters the soil before reaching the stream.

saline - A nonalkali soil that contains enough soluble salts to interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 mS/cm, the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5.

sand - a soil particle between 0.05 and 2.0 mm in diameter. The textural class name for any soil containing 87% or more of sand and not more than 10% of clay.

scarp - A steep, precipitous slope of some extent along the margin of a plateau, mesa, terrace, or bench.

sedimentary rock - A rock formed from materials deposited from suspension or precipitated from solution and usually more or less consolidated. The principal sedimentary rocks are sandstones, shales, limestones, and conglomerates.

seepage - (i) The escape of water downward through the soil. (ii) The emergence of water from the soil along an extensive line of surface in contrast to a spring where the water emerges from a local spot.

series, soil - The second category in the Canadian system of soil classification. This is the basic unit of soil classification, consisting of soils which are essentially alike in all major profile characteristics except the texture of the surface.

silt - Soil mineral particles ranging between 0.05 and 0.002 mm in equivalent diameter. Soils of the silt textural class contain 80% silt and less than 12% clay.

site - In ecology, an area described or defined by its biotic, climatic and soil conditions as related to its capacity to produce vegetation. An area sufficiently uniform in biotic, climatic, and soil conditions to produce a particular kind of vegetation.

slump - A deep-seated, slow moving rotational failure occurring in plastic materials resulting in vertical and lateral displacement.

soil - The unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. Soil has been subjected to and influenced by genetic and environmental factors of: parent material, climate (including moisture and temperature effect), macro and micro organisms, and topography, all acting over a period of time.

soil forming factors - The variable, usually interrelated natural agencies that are responsible for the formation of soil. The factors are: parent material, climate, organisms, relief, and time.

soil texture - The relative proportions of the various soil separates in a soil as described by the classes of soil texture. The names of textural soil classes may be modified by adding suitable adjectives when coarse fragments are present in substantial amounts.

solum - The upper horizons of a soil in which the parent material has been modified and within which most plant roots are confined. It consists usually of A and B horizons.

stones - Rock fragments 25 cm in diameter if rounded, and 38 cm along the greater axis if flat.

stratified materials - Unconsolidated gravels, sand, silt and clay arranged in strata or layers.

structure, soil - The combination or arrangement of primary soil particles into secondary particles, units, or peds. The peds are characterized and classified on the basis of size, shape, and degrees of distinctness into classes, types and grades.

subgroup, soil - A category in the Canadian system of soil classification. These are subdivisions of the soil great groups.

subsoil - A general term for the layer of soil (or surficial geologic deposit) which, in the context of this report, underlies the surface and subsurface soil layers. It begins about 50 cm below the surface and continues downward for about 75 to 100 cm.

subsurface soil - A general term used in this report for the approximately 20 to 30 cm thick layer of soil underlying the surface soil.

surface soil - The uppermost part of the soil that is ordinarily moved in tillage, or its equivalent in uncultivated soils in this report if refers to the upper 15 to 20 cm of the soil.

telluric seepage - Seepage moving through the soil on a plane more or less parallel to the land surface and often above a restricting area; the waters are usually oxygenated.

terrace - Relatively level (0-5% slopes) flat surface which is terminated by an abrupt change in slopes on one or more sides. Often occurs in sequence on valley walls or paired on opposite sides of a valley.

terric layer - An unconsolidated mineral substratum underlying organic soil material.

tidal flats - Areas of nearly flat, often barren mud periodically covered by tidal waters. Normally these materials have an excess of soluble salt. A miscellaneous land type.

till - See glacial till.

topography - The shape of the ground surface such as hills, mountains or plains. The soil slopes may be smooth or irregular. The slope classes are defined in Chapter 3.1.3.

type, soil - A unit in the natural system of soil classification; a subdivision of a soil series consisting of or describing soils that are alike in all characteristics including the texture of the A horizon.

Unified soil classification system (engineering) - A classification system based on the identification of soils according to their particle size, gradation, plasticity index and liquid limit. It is employed in schemes to predict soil behavior as an engineering construction material.

value, colour - The relative lightness of colour, which is approximately a function of the square root of the total amount of light.

variant, soil - A soil whose properties are believed to be sufficiently different from other known soils to justify a new name, but comprising such a limited geographic area that creation of a new named soil is not justified.

water holding capacity - The ability of a soil to hold water. The water-holding capacity of sandy soils is usually considered to be low, while that of clayey soils is high.

water table - Elevation at which the pressure in the water is zero with respect to atmospheric pressure.

weathering - The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

APPENDIX A
CLIMATE DATA

(from Environment Canada)

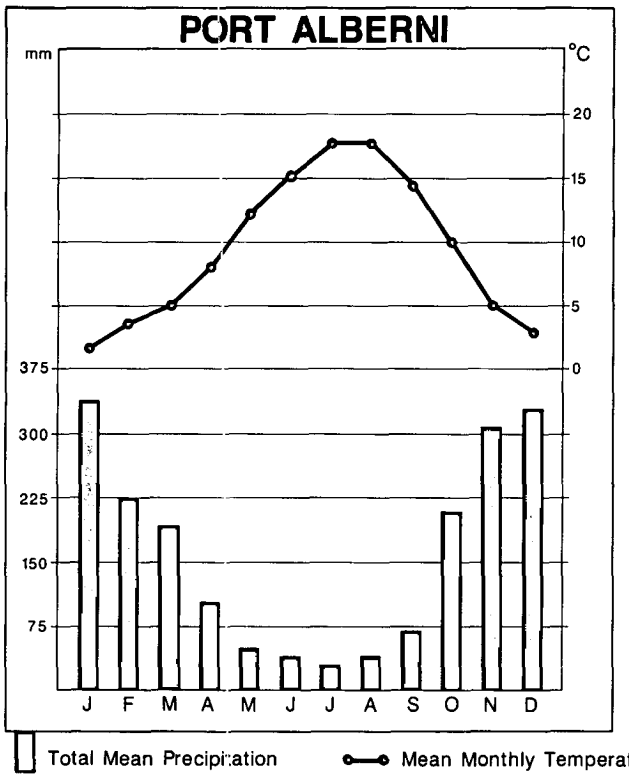
Table 4.2
Temperature and Precipitation Means for Selected Stations

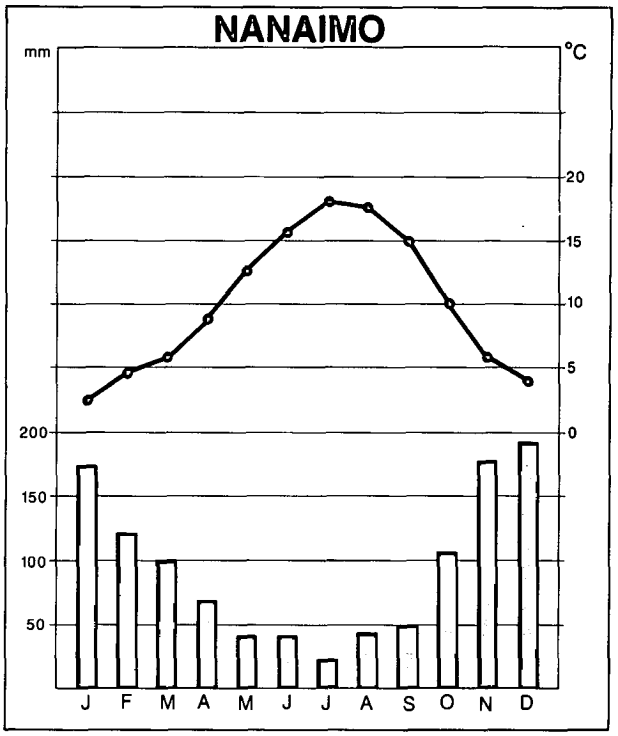
MONTH	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR
PORT ALBERNI													
DAILY TEMP. (°C)	1.6	3.6	5.0	8.1	12.2	15.2	17.8	17.8	14.7	10.1	5.2	2.8	9.8
TOTAL PRECP.(mm)	341	225	192	104	48	38	29	39	69	209	308	329	1928
NANAIMO													
DAILY TEMP. (°C)	2.6	4.5	5.7	8.8	12.5	15.5	18.0	17.7	14.9	10.1	5.7	3.9	10.0
TOTAL PRECP.(mm)	174	123	100	60	42	43	24	45	49	107	168	193	1126
COMOX													
DAILY TEMP. (°C)	2.2	4.0	5.0	8.0	11.8	15.0	17.4	17.0	13.7	9.2	5.3	3.7	9.4
TOTAL PRECP.(mm)	193	125	112	57	37	35	29	44	52	128	192	213	1215
CUMBERLAND													
DAILY TEMP. (°C)	0.9	3.1	4.3	7.6	11.2	14.0	16.9	16.4	13.9	9.0	4.6	2.2	8.7
TOTAL PRECP.(mm)	256	139	145	73	56	45	36	46	61	173	247	291	1579

(from Environment Canada)

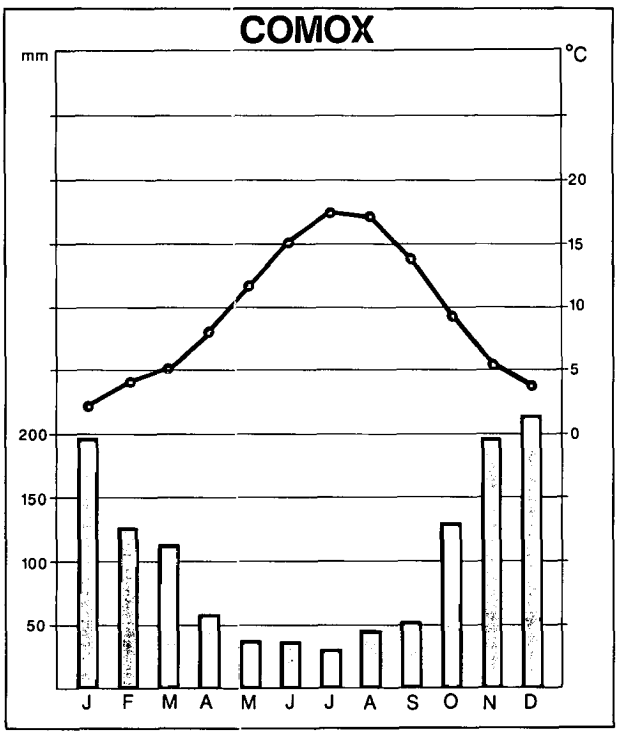
Table 4.3
Frost Free Days for Selected Stations

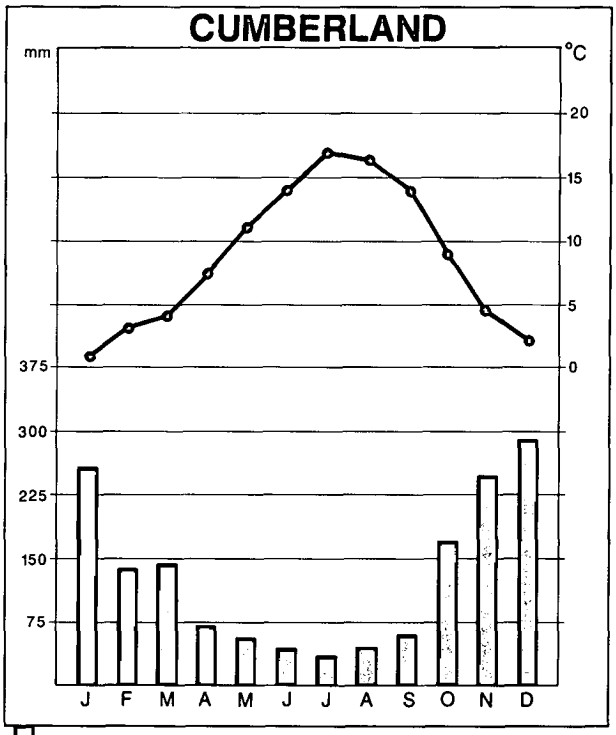
STATION	PERIOD OF RECORD (YR)	FROST FREE DAYS
Port Alberni	21	169
Nanaimo	26	181
Comox	27	180
Cumberland	29	148





Total Mean Precipitation — Mean Monthly Temperature





Total Mean Precipitation — Mean Monthly Temperatu

Figure 4.1 Mean Monthly Temperatures and Precipitation for Four Selected Stations

APPENDIX B
MAP INDEX

Figure 4.2 Mapsheets for the Report Area