REGIONAL GROUNDWATER POTENTIAL FOR SUPPLYING IRRIGATION WATER: 1984

Qualicum River to Union Bay

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Ministry of Agriculture and Food

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ACKNOWLEDGEMENTS

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INTRODUCTION

Since July 1980, the Ministry of Agriculture in conjunction with the Agricultural Land Commission have been involved in a detailed assessment of the agricultural capability of the east coast of Vancouver Island. An analysis of the hydrological data was identified as an important requirement in the above assessment with groundwater being a major component.

This report, accompanying maps and cross sections provides a discussion and analysis of developed and potential aquifers, for the areas between Qualicum River and Union Bay, based on presently available groundwater and geologic data. The map sheets which cover the study area include 92F.037, 046, 047 and 056 (1:20,000 scale). These map sheets are identified as Figures 1, 2, 3 and 4.

The hydrogeological information, thematically presented on the map sheets and cross-sections are based on the tabulated data from over 180 water well records, water well location maps (both on file with the Groundwater Section, Ministry of Environment) and published surficial geology maps and reports (Fyles, 1963; Muller and Atchison, 1971).

Tabulated data from water well records (e.g., aquifer characteristics, depth to bedrock, etc.) and coal exploration test holes (depth to bedrock, thickness of overburden, etc.) were transferred to water well location maps which were used as a working base. Surficial geology units and glacial features (e.g., abandoned channels) which were considered hydrogeologically significant in terms of groundwater potential were transferred to these same maps. A synthesis of this data was then transferred to the final 1:20,000 scale base maps.

PHYSIOGRAPHY

The three major geomorphic features of the study area are the result of structural, erosional and depositional processes. These features are the eastern face of the Insular Mountain Belt with elevations to 500 metres; an undulating coastal lowland, rising from sea level to approximately 200 metres and averaging 6 kilometers wide; and a 300 metre high bench located between Chef and Waterloo Creeks separating the lowlands from the adjacent mountains.

BEDROCK GEOLOGY

According to Muller (1977), Vancouver Island is the main component of the Insular Belt, the westernmost major tectonic subdivision of the Canadian Cordillera. The study area contains Paleozoic rocks (a limestone formation of the Sicker Group), Lower Mesozoic rocks (a volcanic formation of the Vancouver Group) and Upper Mesozoic rocks consisting of cyclical upward fining sequences of conglomerate, sandstone, shale and coal of non-marine or near deltaic origin, suceeded by marine sandstone, shale or thin bedded and graded shale-siltstone sequences from the Nanaimo Group (Muller, 1977). The coastal lowlands are principally underlain by the Nanaimo Group.

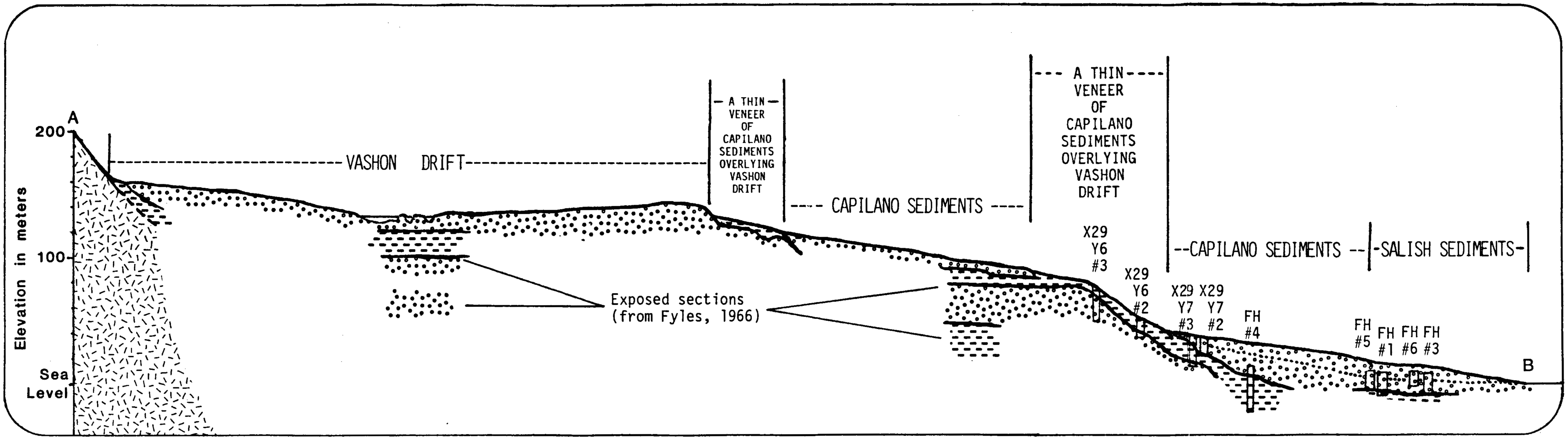
UNCONSOLIDATED DEPOSITS

Most of the unconsolidated materials found in the study area may be attributed to the regimen and wasting of glacial ice during the Late Pleistocene. Though some of the unconsolidated deposits are the result of older glacial (Dashwood Drift) and interglacial (Mapleguard and Cowichan Head Sediments) activity, the majority of the deposited sediments are from the Fraser Glaciation. The Fraser Glaciation probably represents the same geologic-climatic time period as the Classical Late Wisconsin Glaciation of the mid-continent region (Alley and Chatwin, 1979). Fyles (1963) has mapped the unconsolidated sediments at surface within the study area at a scale of 1:63,360.

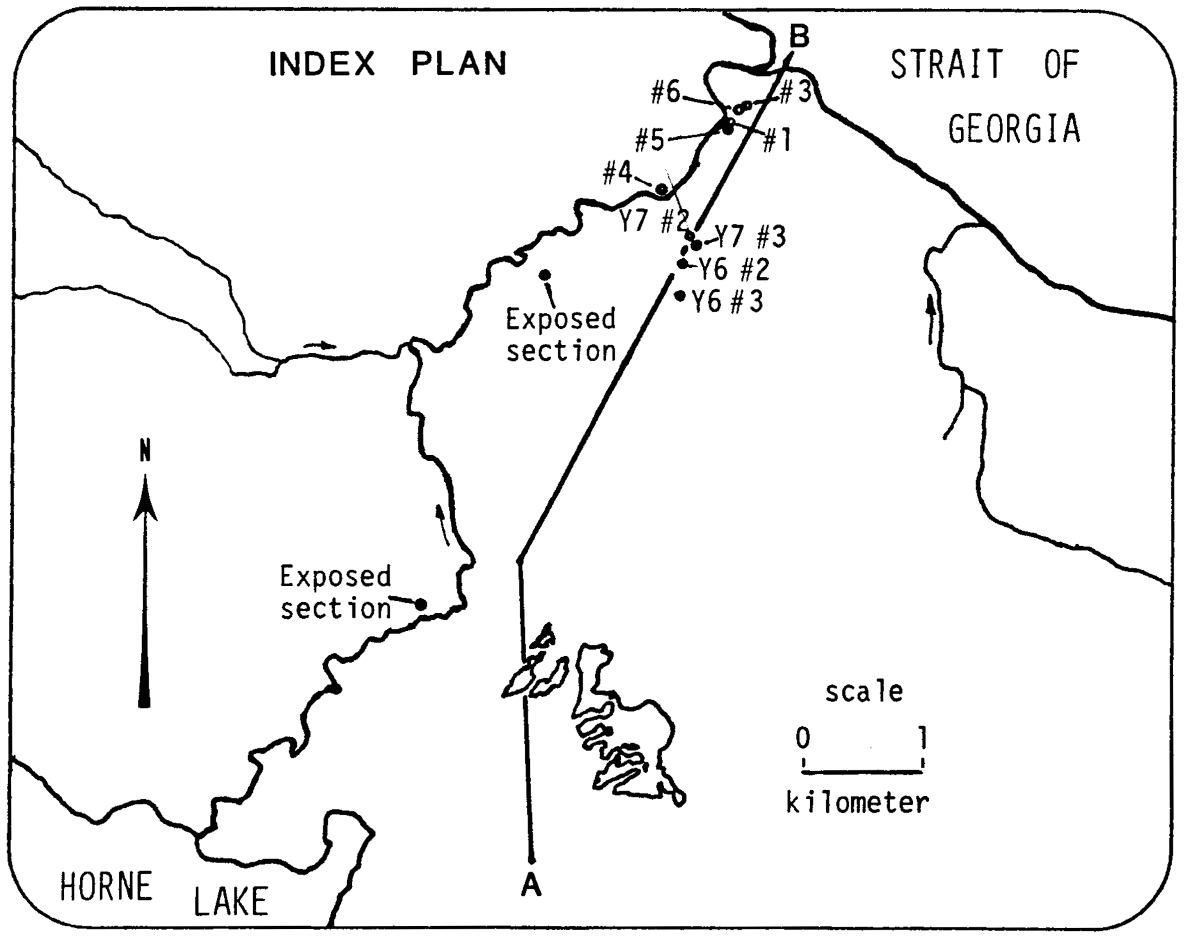
A stratigraphic framework of unconsolidated sediments and a chronology of Late Pleistocene environments in the study area, is shown in Figure 5. The thickness and vertical variation of the unconsolidated sediments within the study area is shown by cross sections in Figures 6, 7, 8, and 9.

YEARS BEFORE PRESENT (Not to Scale)	CLIMATIC UNITS	GEOLOGIC UNITS	ENVIRONMENT	STRATIGRAPHY
Present				
5,000	HOLOCENE	SALISH SEDIMENTS	FLUVIAL	Gravel, sand, silt, clay, peat; alluvial fan deposits; blocks and rubble; peat and muck
10,000		CAPILANO SEDIMENTS	MARINE AND GLACIO-MARINE GLACIO-LACUSTRINE	Silt, clay, stony clay, sandy gravel generally underlain by clay; stony gravel, stony loam Sand and gravel, laminated silty and clay
15,000	FRASER GLACIATION	VASHON DRIFT	GLACIO-FLUVIAL GLACIAL	Gravel, sand and silty forming ice-contact deltas Grey till, sand to clayey texture
20,000		QUADRA SAND	GLACIO-FLUVIAL	Sand, gravel and silt
25,000				
30,000	OLYMPIA NON-GLACIAL INTERNAL	COWICHAN HEAD FORMATION	FLUVIAL ESTURINE MARINE	Silt, gravel, sand, peat, peaty soil, and driftwood Clay, stony clay, silt containing marine shells, local basal laminated clay and silt
60,000				
	SALMON SPRINGS GLACIATION	DASHWOOD DRIFT	GLACIO-MARINE GLACIAL	Grey till, silty to sandy texture contains silty and gravel lenses
?	PUYALLUP NON-GLACIAL INTERVAL	MAPLEGUARD SEDIMENTS	FLUVIAL LACUSTRINE	Sand, silt, minor clay and gravel

Figure 5. CLIMATIC GEOLOGIC UNITS, STRATIGRAPHY AND LATE PLEISTOCENE ENVIRONMENTS OF THE STUDY AREA after Clague (1981, 1977 & 1976) Alley & Chatwin (1979), Armstrong et al (1965) & Halstead (1966)



GEOLOGIC CROSS SECTION



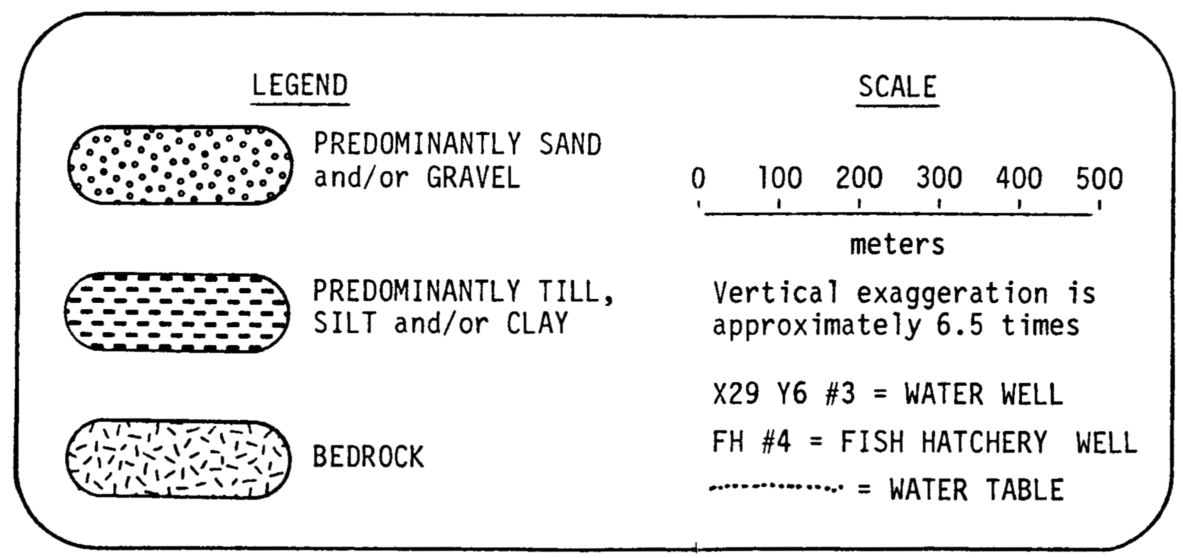
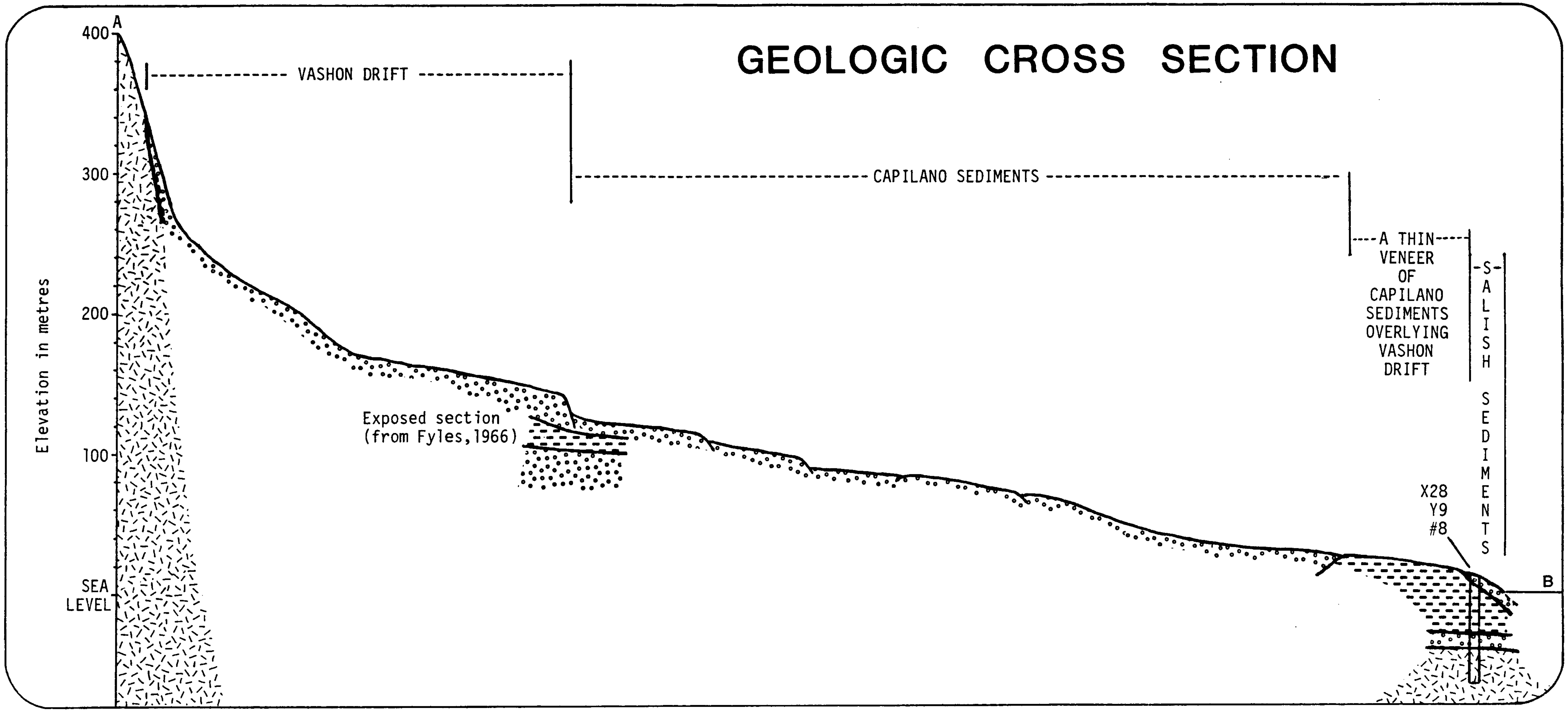
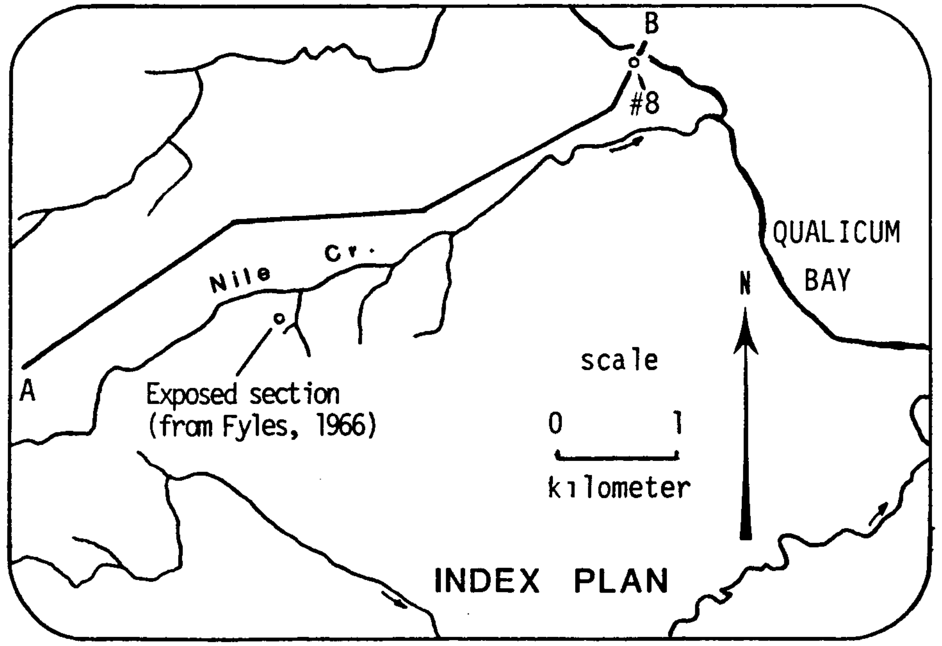


Figure 6


GEOLOGIC CROSS SECTION
A
B
400
300
200
100
SEA LEVEL
Elevation in metres
VASHON DRIFT
CAPILANO SEDIMENTS
A THIN VENEER OF CAPILANO SEDIMENTS OVERLYING VASHON DRIFT
SALISH SEDIMENTS
Exposed section (from Fyles, 1966)
X28
Y9
#8


B
#8
QUALICUM BAY
Nile Cr.
N
A
Exposed section (from Fyles, 1966)
scale
0
1
kilometer
INDEX PLAN

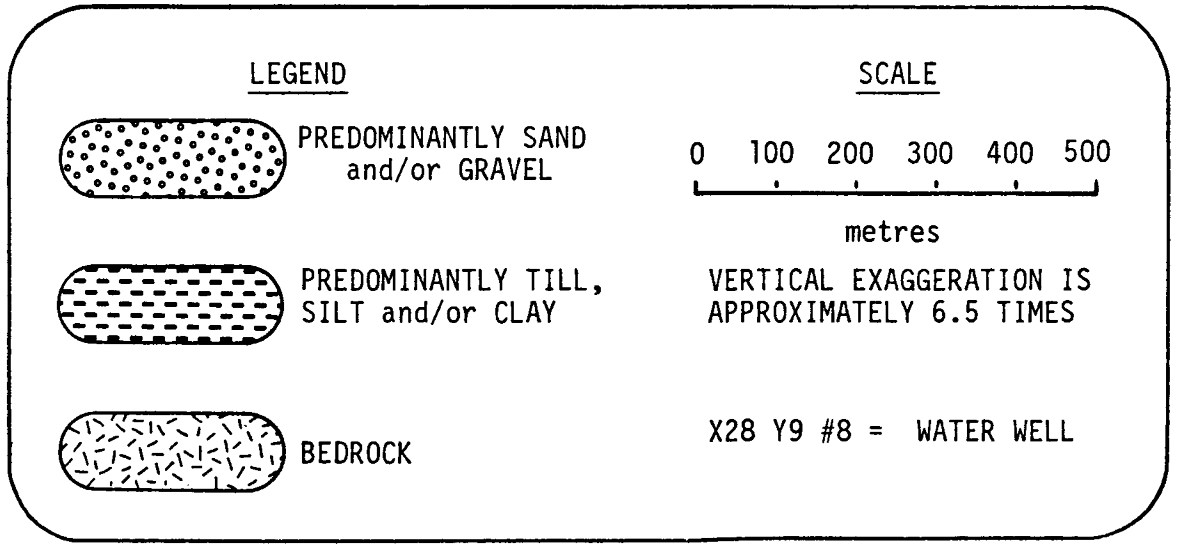

LEGEND
PREDOMINANTLY SAND and/or GRAVEL
PREDOMINANTLY TILL, SILT and/or CLAY
BEDROCK
SCALE
0 100 200 300 400 500
metres
VERTICAL EXAGGERATION IS APPROXIMATELY 6.5 TIMES
X28 Y9 #8 = WATER WELL

Figure 7

GEOLOGIC CROSS SECTION

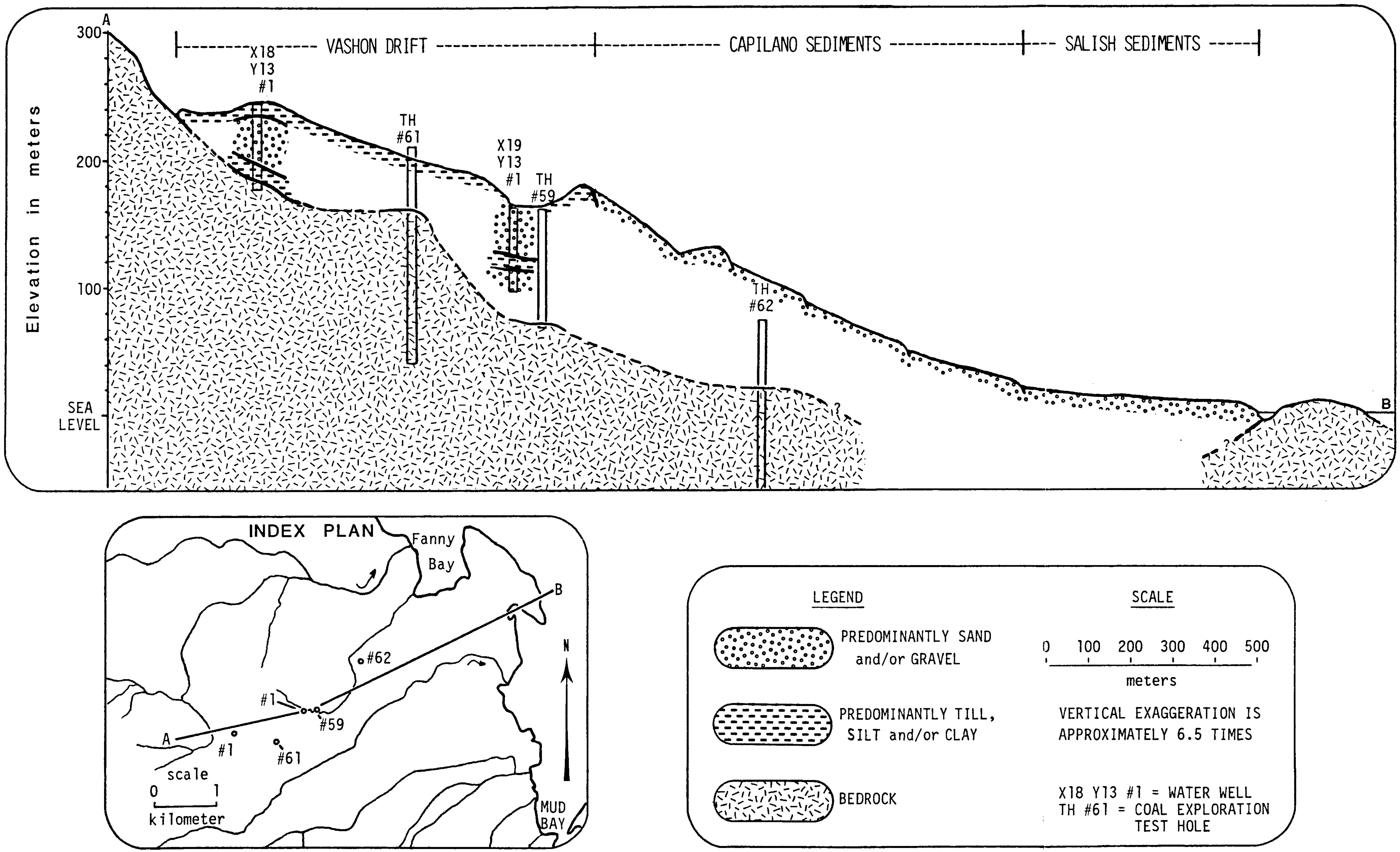
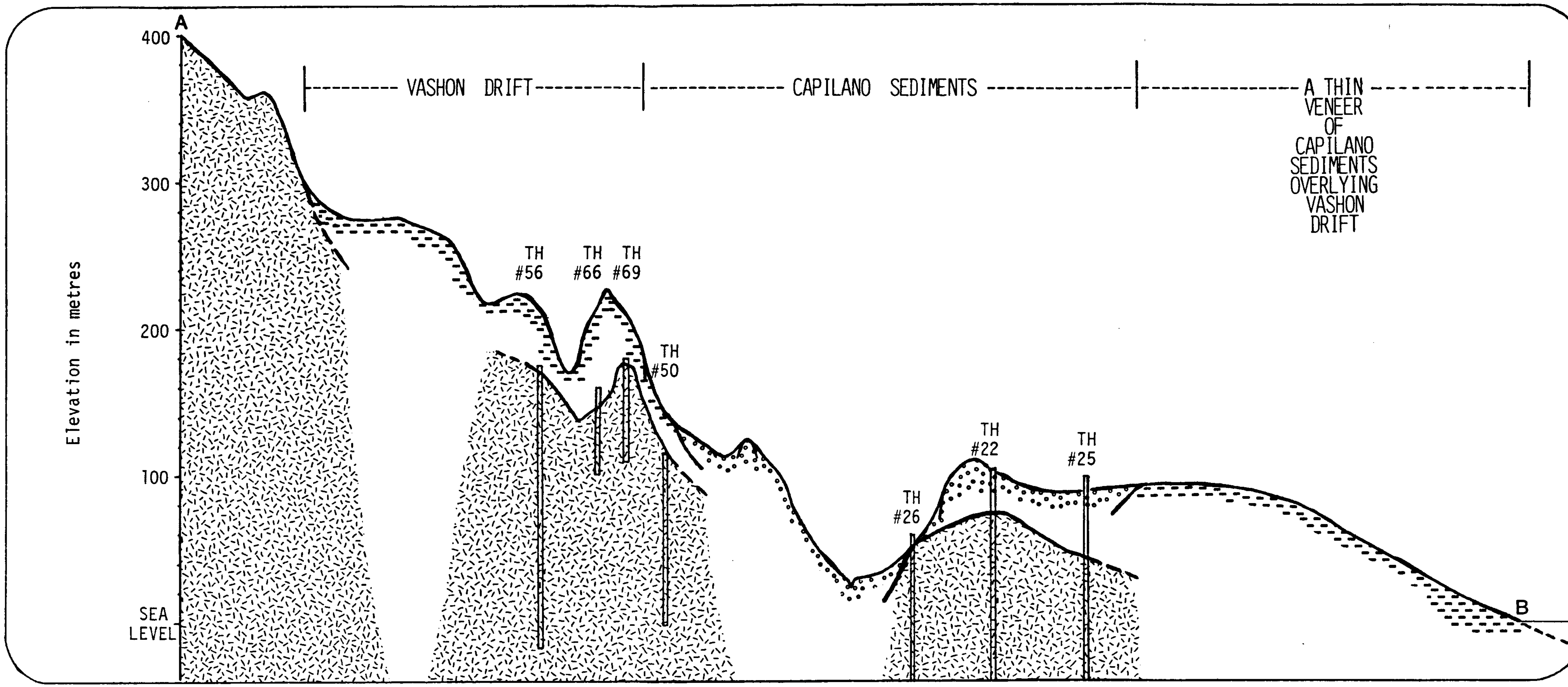
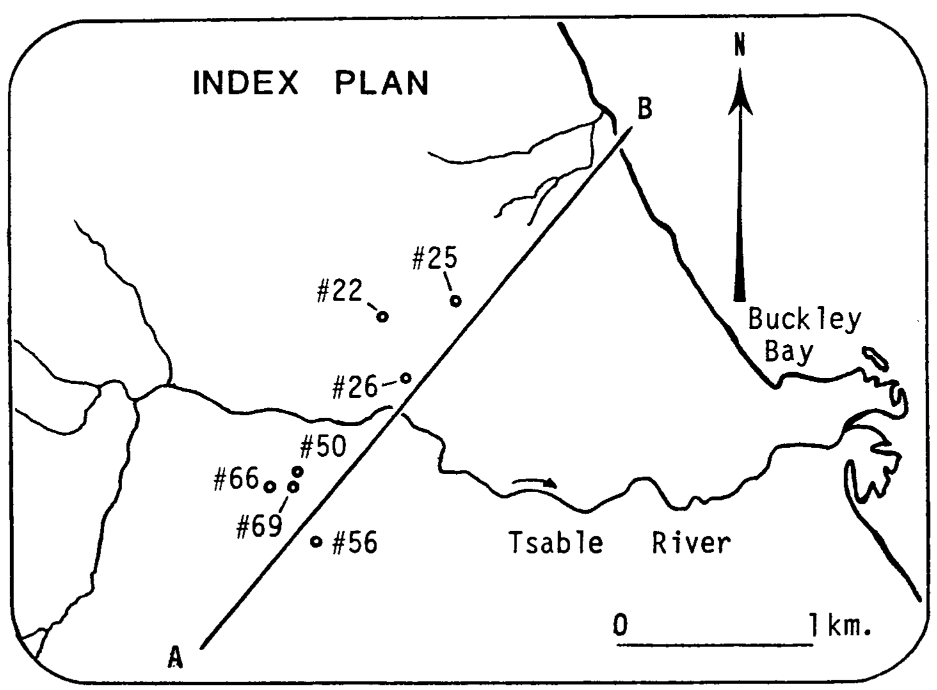


Figure 8



GEOLOGIC CROSS SECTION



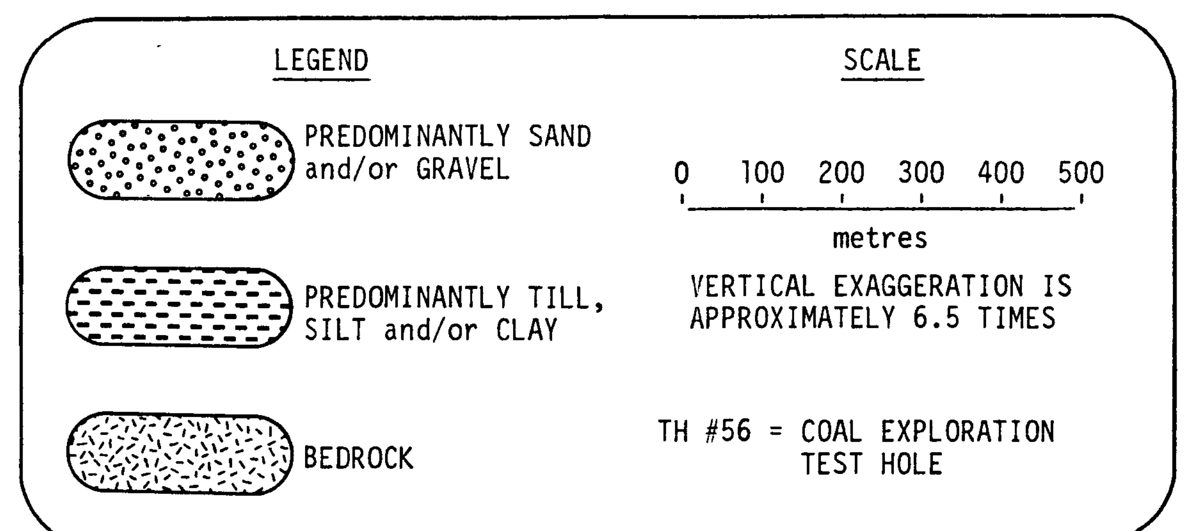


Figure 9

GROUNDWATER POTENTIAL

Bedrock

Groundwater within the bedrock can be found in fractures, along bedding plane partings, in the inter-flow zones of lava, in the inter-granular openings in the rock, and in the case of limestone, in the channels formed by the dissolution of the rock by water. Water wells drilled on Vancouver Island, indicate fractures, bedding plane partings and solution channels are probably the main sources of groundwater from the bedrock.

The possibility of obtaining adequate supplies of groundwater for irrigation purposes from these sources are generally considered to be poor. Only 4 of 10 water well logs reporting wells completed in bedrock provided yields. These yields were sufficient only for domestic purposes.

Examples of bedrock aquifers capable of yielding sufficient supplies of groundwater for irrigation purposes can be found in the Mill Bay and Saanich regions of southern Vancouver Island where well yields up to 16 L/s have been obtained. It is not known if comparable high yielding bedrock aquifers exist in the study area. To identify such aquifers would require detailed geologic mapping, aerial photograph analysis, and possibly geophysical investigations, as well as test drilling. These procedures can be both time-consuming and expensive.

Unconsolidated Deposits

Most of the groundwater used on Vancouver Island comes from unconsolidated deposits which receive water from infiltration of either precipitation or surface water sources. The amount of water obtainable from these materials, depends on the permeability of the aquifer material, the thickness and extent of the aquifer, the rate of aquifer recharge and on well construction.

The unconsolidated deposits which are hydrogeologically significant in terms of groundwater potential for irrigation purposes are primarily comprised of sand and/or gravel. The deposits which fall into this category are listed and discussed below:

1) The shore, deltaic, fluvial and alluvial deposits of the Salish Sediments. These deposits range up to 10 metres in thickness. Thickness of any sand and/or gravel deposits 0.5 metres or greater are considered significant in terms of groundwater potential. The primary target for groundwater exploration would be the fluvial deposits near present day stream channels and deltas.

2) Terraced fluvial deposits which include deltaic, channel, floodplain and alluvial fan deposits along with some marine and/or glacio-marine deposits of the Capilano Sediments. These deposits are related to former sea, river and lake levels significantly higher or lower ($\pm$6 metres) than the present levels (Fyles, 1963). These deposits range up to 20 metres in thickness and 1800 metres across. The deltaic terraces would be primary target areas for groundwater exploration.

3) The glaciofluvial deposits which include hummocky knob and kettle, ridged, esker, terrace and pitted terrace, kame terrace, kame delta and ice contact alluvial fan deposits of the Vashon Drift. These deposits are often found resting upon the ground moraine of the Vashon Drift. Usually located within a couple of miles of the mountain slopes, these deposits may range up to 1.5 kilometers wide and 5.5 kilometers long. One ice-contact delta, known as the Spider Lake Terrace (Fyles, 1963), covers approximately 10 square kilometers and locally may exceed 15 metres in thickness. The kame terraces and kame deltas would be primary target areas for groundwater exploration.

Lenses of sand and/or gravel are associated with the ground moraine deposits of the Vashon Drift. Though these lenses are potential aquifers their location and viability must be confirmed by drilling, which can be both expensive and time consuming.

4) The glaciofluvial deposits of the Quadra Sediments (Fyles, 1963) known as the Quadra Sand (Clague, 1977). The groundwater potential of this geologic unit merits an expanded understanding of its distribution and origin.

Quadra Sand is found throughout much of the southern portion of the study area, usually below the 100 metre elevation level. Comprised predominantly of sand with minor silt and gravel these deposits locally exceed 75 metres in thickness. Overlain by glacial sediments (mainly till) of the Fraser Glaciation and underlain by sediments of the Olympia Interglacial period the current theory on the origin of Quadra Sand is summarized by Clague (1977) below:

> "The sand was deposited, in part, as distal outwash aprons at successive positions in front of and perhaps along the margins of glaciers moving from the Coast Mountains into the Georgia Depression and Puget Lowland during Late Wisconsin time. After deposition at a site, but before burial by ice, the sand was dissected by meltwater and the eroded detritus was transported farther down the basin to sites where aggradation continued."

The inferred distribution of Quadra Sand is shown in Figure 10. The extensiveness of these deposits, their thickness and locally proven yields of 6 L/s make the Quadra Sand a primary target for groundwater exploration.

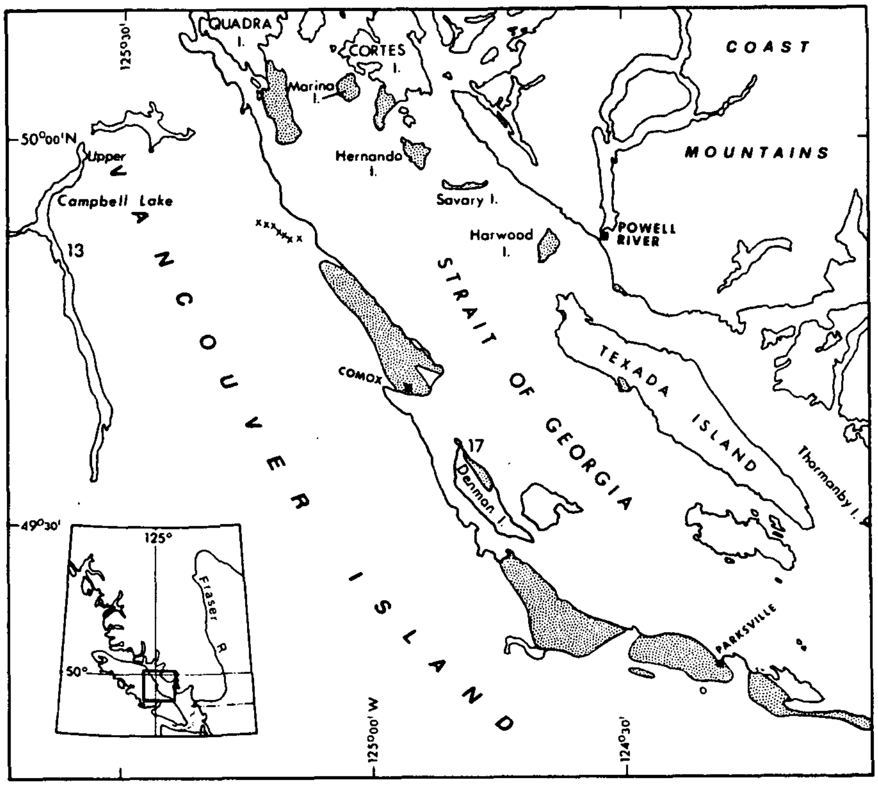


Figure 10. Inferred Distribution of Quadra Sand and Cowichan Head Formation (after Clague, 1977)

5) A gravel and sand deposit found beneath glacial drift of the Fraser Glaciation but whose relationship to Quadra Sand is unknown. Found in the northern portion of the study area, thicknesses of 75 metres have been observed (Fyles, 1963). The most extensive of these deposits are located between Rosewall and Cowie Creek. One borehole between Waterloo and Rosewall Creeks showed 134 metres of predominantly sand and gravelly materials. Though there is a lack of groundwater data for this geologic unit the composition, areal extent and thickness of this deposit make it a primary target area for groundwater exploration.

6) Sandy deposits (fluvial?) from the Mapleguard Sediments. The Mapleguard sediments are found underlying Dashwood Drift which underlies Olympia interglacial sediments. One twenty metre thick exposure of Mapleguard Sediments revealed a 3.5 metre thick bed of sand (Fyles, 1963). Under the proper conditions these deposits could form a viable aquifer. The location of Mapleguard Sediments, however, are known to exist only (at present) in a few localities.

The following is a summary of groundwater data from water well records in the study area. Many of these wells probably were completed in one or more of the deposits just described.

Forty-seven water well records show thickness of unconsolidated materials ranging from 0 to 146 metres and averaging 20 metres. Sixty-eight coal exploration testholes show thickness of unconsolidated material, ranging from 0 to 93 metres and averaging 14 metres. The water wells were generally located below 100 metres in elevation in thicker unconsolidated materials than the coal exploration test holes which were located on the hillsides at an average elevation of 219 metres in generally thinner unconsolidated materials.

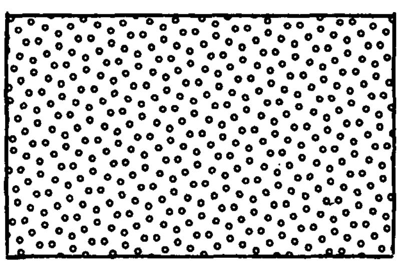
Eighty-five water well records which showed wells completed in sand and/or gravel, ranged in depth from 1 to 147 metres and averaged 10 metres. The apparent depth to the top of a sand and/or gravel aquifer, based on 31 water well records, ranged from 1 to 81 metres with 11 being the average. By removing the two well logs which showed the two deepest aquifers, the depth to the top of a sand and/or gravel aquifer ranged from 1 to 26 metres with 7 being the average.

Thirty-two water well records showed apparent aquifer thicknesses ranging from 0.3 to 18 metres with about 4 metres being the average. Twenty-one well records show well yields that are reported to range from less than 0.1 L/s to greater than 25 L/s with about 5 L/s being the average. Five litres per second is significant when considering irrigation requirements.

The following is a description and the limitations of each component shown on the 1:20,000 scale base maps.

Available data from other hydrogeological studies show yields up to 38 L/s have been obtained. A study by Zubel (1979) indicated seven river/stream (Qualicum, Chef, McNaughton, Rosewall, Waterloo and Tsable) basins containing aquifers with the potential of supplying over 32 L/s of water to one or more potential wells. This study also identified 7 test drill sites adjacent to various stream channels. Other test drill sites probably exist elsewhere away from stream channels. The few 24 hour pump tests available on file showed specific capacity ratings up to 60 L/s/metre of drawdown. These ratings are significant in terms of groundwater potential.

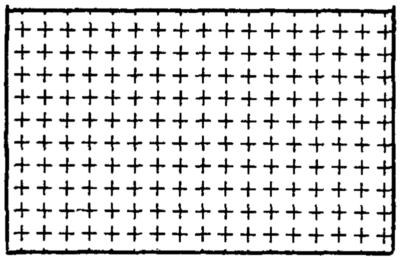
EXTENT OF DEVELOPED AND POTENTIAL AQUIFERS



AREA A: Area A outlines the surficial extent of unconsolidated deposits primarily comprised of sand and/or gravels. Area A outlines areas where there is a high probability of locating water-bearing sand and/or gravel aquifers but does not imply the existence of water-bearing sand and/or gravel aquifers. In some areas for example the sand and gravel deposits may be very thin and dry throughout their entire thickness.

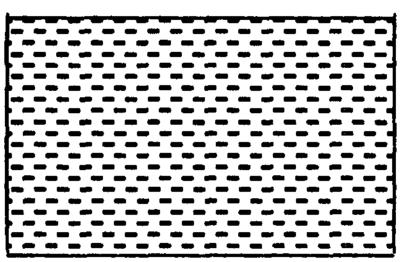
Area A outlines potential unconfined aquifers at surface, it does not show distribution at depth. This is especially relevant to the Quadra Sand and possibly to some pre-Fraser Glaciation unconsolidated sediments (e.g., Mapleguard sediments) which may underlie younger deposits (marine clays for example) in the region.

The surficial geology units which make up Area A were transferred first from 1:63,360 scale mapping to 1:12,000 scale water well location maps, and then to 1:20,000 scale cadastral maps. Minor boundary errors may exist therefore on the larger scale mapping.



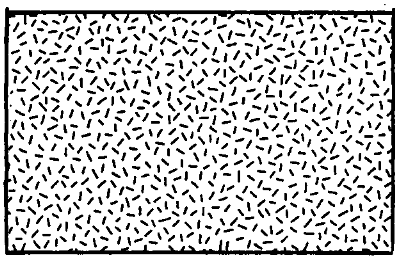
AREA B: Area B outlines regions where sand and/or gravel aquifers (greater than 0.5 metres in thickness) have been identified at depth based on water well lithology records. These aquifers may be either confined or unconfined. Figure 6 graphically shows water wells X29 Y6 #2 and X29 Y7 #3 constructed in a confined aquifer and water wells FH#5, FH#1, FH#6 and FH#3 constructed in an unconfined aquifer. Water well X29 Y6 #2 also happens to be a flowing artesian well.

The boundaries of Area B were arbitrarily set at a 100 metre radius from a data point (water well) which identified a sand and/or gravel aquifer greater than 0.5 metres in thickness. Where two wells, located within 400 metres of each other, show similar lithologies and the geomorphology of the area was homogeneous, Area B was extended between the two wells.



AREA C: Area C outlines areas where the unconsolidated deposits at surface (predominantly tills, silts and/or clays) are generally unsuitable as aquifer materials due to their low permeability. However, suitable aquifer materials may and do exist at depth as evidenced in many regions of Area C where site specific data are available. The geologic cross-sections in Figures 6, 7, and 8 graphically display this geologic situation. Where ground moraine deposits have been mapped in Area C, locally there may be sand and/or gravel deposits found at surface or in lenses at depth. Also, older geologic units (e.g., Quadra Sand) that are significant aquifers may be overlain by the marine and moraine deposits found in Area C. Productive aquifers may be found in these older geologic units.

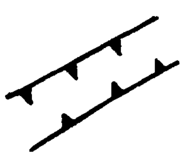
The boundaries of Area C were also transferred from Fyles (1963) surficial geology maps (1:63,360 scale). Minor boundary errors therefore may exist on the larger scale mapping.



AREA D: Area D was identified where bedrock is located at or near ground surface and/or where well logs indicate bedrock aquifers. The boundaries for Area D were also arbitrarily set at 100 metre radius from a data point (e.g., bedrock well or rock outcrop). This distance was extended to 400 metres between data points if water well lithology and the surface morphology so warranted.

▲ Water wells where yields greater than 3 L/s have been reported. Where these wells are found in Area B these areas show the highest potential for obtaining groundwater supplies to meet irrigation requirements.

△ Water wells where yields between 1 and 3 L/s are reported. These areas also show high potential for obtaining irrigation supplies of groundwater.



Abandoned channel or meltwater channel. A glacial feature which may be a target area for groundwater exploration. Significant deposits of sand and/or gravel may be associated with these features in some instances.

WATER QUALITY

Water quality based on 6 laboratory analyses of groundwaters from unconsolidated aquifers is favourable for irrigation purposes. These 6 analyses show groundwaters are either the calcium bicarbonate type or the calcium-magnesium bicarbonate type based on equivalents per million (epm) percentages. Six analyses is very sparse for so large an area. More analyses (from wells completed in both unconsolidated materials and bedrock) would provide a more complete understanding of natural water quality within the study area.

Two of the characteristics of an irrigation water that appear to be the most important in determining its quality are the total concentrations of soluble salts and the relative proportion of sodium to other cations (Richards, 1969).

The total concentrations of soluble salts can be expressed in terms of its electrical conductivity is often measured in micromhos/cm at 25°C. The higher the concentration of soluble salts and minerals the higher the conductivity. High salt concentrations in irrigation water can result in saline conditions even where drainage is satisfactory. The electrical conductivity of the 6 samples was reported in 3 of the samples and calculated in the other 3. The calculation was done by dividing the Total Dissolved Solids (TDS) readings by 0.7. The electrical conductivity values ranged from 51 to 183 micromhos/cm. Conductivity readings of irrigation water less than 250 micromhos/cm are considered to be low-saline waters. According to Richards (1969), these waters can be used for irrigation with most crops with little likelihood that soil salinity will develop. Some leaching is required, but this occurs under normal irrigation practices except in soils of extremely low permeability.

The relative proportion of sodium to other cations (usually calcium and magnesium) in groundwaters may make some waters undesirable for some crops. This relationship is usually expressed as the sodium absorption ratio (SAR) where $SAR = Na^{+}/\sqrt{(Ca^{++} + Mg^{++})/2}$ and can be used for identifying the suitability of groundwaters for irrigation purposes. The formula applies where all concentrations are expressed in epm. Applying the SAR formula to the six lab analyses revealed the sodium hazard level as being low to very low from the groundwaters of these unconsolidated aquifers. Bedrock aquifers, however, may contain higher levels of sodium relative to calcium and magnesium as was the case reported in one coastal bedrock well just south of the study area.

Another important characteristic of irrigation waters are the concentrations of boron and other elements that may be toxic. The 6 lab analysis did not test for boron but the low Total Dissolved Solids (TDS) determinations (ranging from 50 to 128 mg/L) indicate probable low concentrations of most chemical constituents.

Brackish waters were only found in one coastal bedrock well in the study area. This well was partly backfilled and a freshwater zone closer to the ground surface was utilized.

CONCLUSIONS

On a regional basis, there is potential for locating groundwater supplies capable of meeting irrigation requirements in the coastal plain region of the study area. The largest groundwater reserves in the area are contained in recent alluvial deposits, terraced fluvial and deltaic deposits, and in Quadra and other sediments beneath Vashon Drift.

Though there is a paucity of well log information available in the study area, suitable geologic deposits indicate the potential availability of groundwater for irrigation purposes. Surficial geology maps indicate the extensive deposits of sand and/or gravel found at surface. Geologic cross-sections show substantial thicknesses of potential aquifer deposits. An abnormally high base flow in Nile Creek (pers. comm. J.S. Madison, Ministry of Environment, 1984) and substantial contributions to the flow of Qualicum River, Chef Creek, Waterloo Creek, Wilfred Creek and others (Fyles, 1963) during the period of summer drought also point to groundwater's role as a major fresh water supply source.

This report is regional in scope and identifies areas which have the potential to supply irrigation water. It does not provide a quantitative assessment of water availability for a site specific location. To provide such an assessment, more accurate delineation of aquifer boundaries and estimation of groundwater recharge, movement, aquifer parameters and withdrawal rates would be required on a site specific basis.

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Province of British Columbia — Ministry of Environment

MAPPING CONTROL: FEDERAL GOV'T.
DATUM OF ELEVATIONS: GEODETIC
AIR PHOTOGRAPHY: B.C. & FEDERAL
DATE OF PHOTOGRAPHY: 1976-81
U.T.M. GRID: ZONE 10 (1975)
SHORELINE AS AT DATE OF PHOTOGRAPHY

BASE COMPLETED:
BASE SOURCE: PHOTOGRAMMETRIC
REVISION DATE:
LATEST PLAN No.:
LAND DISTRICTS: ALBERNI, CAMERON & NEWCASTLE
LAND TITLE DIST.: VICTORIA

DIST. LOT & TP. SEC.
SUBDIVISION LOT

TRIANGULATION STATION WITH ELEVATION
SURVEYED CONTROL POINT WITH ELEVATION
BENCH MARK
AIR PHOTO CENTRE
SURVEYED LOT TIE

BUILDING
CONTOURS & ELEVATION
APPROX. CONTOUR — DEPRESSION
WOODED AREA — SCRUB
SWAMP — TREED SWAMP
CULTIVATED — ORCHARD

ROADS — PAVED — GRAVEL
ROUGH — TRAIL
RAILWAY
POWER LINE — ON POLE — ON TOWER
FENCE
FLUME

SCALE : 1:20000
METRES
CONTOUR INTERVAL METRES

PLANIMETRIC
NEG. No. 214920
CADASTRAL
DIGITAL

SEE INDEX 92F
PROJECT No. 81-023P-C

92F.037

PROVINCE OF BRITISH COLUMBIA — MINISTRY OF ENVIRONMENT

MAPPING CONTROL: FEDERAL GOV'T.
DATUM OF ELEVATIONS: GEODETIC
AIR PHOTOGRAPHY: B.C. & FEDERAL
DATE OF PHOTOGRAPHY: 1976-81
U.T.M. GRID: ZONE 10 (1975)
SHORELINE AS AT DATE OF PHOTOGRAPHY

BASE COMPLETED:
BASE SOURCE: PHOTOGRAMMETRIC
REVISION DATE:
LATEST PLAN No.:
LAND DISTRICTS: NANAIMO & NEWCASTLE
LAND TITLE DIST.: VICTORIA

DIST. LOT & TP. SEC.
SUBDIVISION LOT

TRIANGULATION STATION WITH ELEVATION
SURVEYED CONTROL POINT WITH ELEVATION
BENCH MARK
AIR PHOTO CENTRE
SURVEYED LOT TIE

BUILDING
CONTOURS & ELEVATION
APPROX. CONTOUR
WOODED AREA
SWAMP
CULTIVATED

DEPRESSION
SCRUB
TREED SWAMP
ORCHARD

ROADS — PAVED, ROUGH — GRAVEL, TRAIL
RAILWAY
POWER LINE — ON POLE — ON TOWER
FENCE
FLUME

SCALE : 1:20000
METRES
CONTOUR INTERVAL 20 METRES

PLANIMETRIC
NEG. No. 214915
CADASTRAL
DIGITAL

SEE INDEX 92F
PROJECT No. 81-023P-C

92F.046

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENVIRONMENT

MAPPING CONTROL: FEDERAL GOV'T.
DATUM OF ELEVATIONS: GEODETIC
AIR PHOTOGRAPHY: B.C. & FEDERAL
DATE OF PHOTOGRAPHY: 1976-81
U.T.M. GRID: ZONE 10 (1975)
SHORELINE AS AT DATE OF PHOTOGRAPHY

BASE COMPLETED:
BASE SOURCE: PHOTOGRAMMETRIC
REVISION DATE:
LATEST PLAN No.:
LAND DISTRICTS: NANAIMO & NEWCASTLE
LAND TITLE DIST.: VICTORIA

DIST. LOT & TP. SEC.
SUBDIVISION LOT

TRIANGULATION STATION WITH ELEVATION
SURVEYED CONTROL POINT WITH ELEVATION
BENCH MARK
AIR PHOTO CENTRE
SURVEYED LOT TIE

BUILDING
CONTOURS & ELEVATION 500
APPROX. CONTOUR
DEPRESSION
WOODED AREA
SCRUB
SWAMP
TREED SWAMP
CULTIVATED CULT
ORCHARD ORCH

ROADS PAVED GRAVEL
ROUGH TRAIL
RAILWAY
POWER LINE ON POLE ON TOWER
FENCE
FLUME

SCALE : 1:20000
200 0 200 400 600 800
METRES
CONTOUR INTERVAL 20 METRES

PLANIMETRIC
NEG. No. 214921
CADASTRAL
DIGITAL

SEE INDEX 92F
PROJECT No. 81-023P-C
92F.047

Province of British Columbia | Ministry of Environment

MAPPING CONTROL: FEDERAL GOV'T.
DATUM OF ELEVATIONS: GEODETIC
AIR PHOTOGRAPHY: B.C. & FEDERAL
DATE OF PHOTOGRAPHY: 1976-81
U.T.M. GRID: ZONE 10 (1975)
SHORELINE AS AT DATE OF PHOTOGRAPHY

BASE COMPLETED:
BASE SOURCE: PHOTOGRAMMETRIC
REVISION DATE:
LATEST PLAN No.:
LAND DISTRICTS: NANAIMO, NELSON & NEWCASTLE
LAND TITLE DIST.: VICTORIA

DIST. LOT & TP. SEC.
SUBDIVISION LOT

TRIANGULATION STATION WITH ELEVATION
SURVEYED CONTROL POINT WITH ELEVATION
BENCH MARK
AIR PHOTO CENTRE
SURVEYED LOT TIE

BUILDING
CONTOURS & ELEVATION
APPROX. CONTOUR
WOODED AREA
SWAMP
CULTIVATED
DEPRESSION
SCRUB
TREED SWAMP
ORCHARD

ROADS PAVED / ROUGH / GRAVEL / TRAIL
RAILWAY
POWER LINE ON POLE / ON TOWER
FENCE
FLUME

SCALE : 1:20000
200 0 200 400 600 800 METRES
CONTOUR INTERVAL 20 METRES

PLANIMETRIC NEG. No. 214916
CADASTRAL DIGITAL
CONTOUR SCRIBECOAT

SEE INDEX 92F
PROJECT No. 81-023P-C

92F.056