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WATER RESOURCES SERVICE

Department of Lands, Forests and Water Resources

PRELIMINARY NOTES ON

GROUND WATER IN THE COMOX AREA

The Village of Comox intends to drill additional wells for water supply and has requested information from Water Resources Service, Department of Lands, Forests and Water Resources on potential well sites. The following notes are based on data available at this time.

This area is included in mapping by John Fyles in 1956-57 and covered by Geological Survey of Canada map 32-1960, Surficial Geology, Courtenay. The area to the north from Little River to Campbell River done by Fyles at the same time is covered by map 49-1959, Surficial Geology, Oyster River. A geologic report to go with the maps of this area has not yet been published. A well inventory was carried out in this area by the Geological Survey of Canada in 1960 or 1961. Most of the wells shown on the map are from this inventory.

The recent geologic history of this area is quite complex. It has been covered with ice of continental glaciers at least twice and the relative level of the sea to the land has fluctuated several times an amount of at least several hundred feet. As the ice of the continental glaciers advanced slowly from the north, it removed or at least re-arranged most of the unconsolidated material then forming the surface. Much of the material picked up by the ice was redeposited under the ice. This material is called till and in this area is a mixture of sand, silt and clay containing pebbles, cobbles and boulders. The material is usually very compact due to the loading by the thick ice. Till is often called hardpan or boulder clay. Deposits of till along with gravels deposited from melting ice are often called moraines.

Between glacial episodes there were long periods when climate was much like present day climate and during which sand, gravel and other sediments were deposited. These were of course over-ridden by later ice advances which modified these deposits and usually buried them under till and other glacial debris. It appears that following, or during the final part of each of the last two glacial episodes, the level of the sea rose several hundred feet above its present level causing the ice of the glaciers, which was probably by this time pretty thin, to float. This floating ice as it melted dropped a blanket of debris over the area which was flooded. These deposits which have been called glacio-marine deposits or stoney clay are composed of silt with lesser amounts of clay and sand with a few scattered pebbles and occasional boulders. The thickness of this material is quite variable as might be expected.

As the sea level fell relative to the land, probably quite slowly, wave action on the land as it emerged reworked various deposits of stoney clay, till, etc, producing a veneer of sandy gravelly material usually less than 5 feet thick which usually has a characteristic rusty brown colour.

From Fyles' report the various geologic formation occurring in the Comox area arranged in their relative positions are shown below with their geologic names:

Recent deposits	Shore and delta deposits and sand dunes
Vashon	Varied marine and glacio marine deposits Ground moraine deposits (mostly till)
Quadra sediments	Sand member Silty plant bearing member Marine stoney clay member

Lower members of the section are not exposed in this area.

The Quadra sediments were deposited during an interglacial period pro[illegible]bly immediately following glaciation. The Vashon deposits are associated with a later glacial episode, probably the most recent in this area.

The best aquifer in the Comox area is the sand member of the Quadra sediments.

In the area bounded by the Island Highway on the west and from Comox as far north as Little River, the lowest part of the section known from exposures or drilling is the silty member of the Quadra sediments. Drill holes do not penetrate far into this member as it is quite impermeable and forms the floor of the main aquifer which is the sand member of the Quadra in this area. The sand member is up to about 200 feet thick in this area and varies in grain size over the area from gravelly sand to extremely find sand.

These Quadra sediments are truncated and overlain by Vashon deposits which consist of till overlain by glacio-marine and marine deposits. The blanket of till generally conforms to the present topography indicating that the present topography was formed by erosion before the Vashon glacial episode. The till varies in thickness from 0 feet to a known thickness of over 160 feet. The sediments overlying the till vary from clay (probably stoney clay) to coarse gravel and over most of the area seem to be quite thin. An area of recent dune sand at least 40 ' thick in some places overlies the till along the beach northeast of Comox and southwest of Cape Lazo. This dune sand is a good aquifer in this part of the area.

The thin deposits of sand and gravel over the till were probably formed during the time when the till covered surface was emerging from beneath the sea following Vashon Glaciation. In places where till is not present, for instance the northeast facing slope near the Anderton Springs, the till was probably completely removed during this period of erosion.

The sand and gravel deposits over the till and the till itself are aquifers of very limited capacity and importance. Numerous shallow-dug wells in these deposits often go dry during dry periods.

As mentioned previously, the best aquifer is the sand member of Quadra sediments. This sand is usually saturated for some distance above the lower silty member which acts as a floor for the aquifer. The factors which determine the yield of this aquifer in this area are the saturated thickness of sand above the silty member and the grain size of the sand. In topographic low areas most or all of the sand was removed before deposition of the till. An example of this situation is directly west of Comox where a test hole (NO. 8) went through 165 feet of till directly into silts and clays. This hole produced no water. Most well records give only poor information about the grain size of the sand so this factor is often unknown. A zone of coarse sand and gravelly sand which makes for high yield in the aquifer is located in the vicinity of the corner of Anderton Road and Ryan Road just south of the Anderton Springs. Samples from wells drilled in and close to Comox show the sand there to be medium grained, quite capable of a good yield with properly constructed wells. Samples from two wells drilled by Comox Village at Hilton Springs show very fine sand in that area.

At least two large springs are located in this area. The best known is Anderton Spring north of the Corner of Anderton and Ryan Roads. This spring is estimated to flow about 300 gpm. Here there is no till, the sand exposed being either Quadra or a veneer of beach deposits over Quadra sand. The spring is caused by overflow of water moving northeastward from the higher recharge area to the southwest.

Wells were drilled by the RCAF at the spring to supply the Air Force Station. Use of these wells has apparently not diminished the flow of the spring.

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The Hilton Spring is north of Comox about at the common point on the boundary between District Lots 194, 195 and 217. It consists of four springs joined, according to the water rights map, by a ditch. The total flow of the springs is unknown but is at least 150 gpm. Conditional Water Licence No. 25765 on the springs for 150 acre feet of water is held by L. Smith. Here, the geologic situation is known from logs of two holes drilled near the northern most (?) spring by Comox Village. After the drilling of these holes, Mr. Jack Smith, the Village foreman, installed 2" pipes with well points in the holes to serve as observation wells.

In spite of the fact that these holes are only about 250 feet apart and were drilled by the same driller the logs do not agree entirely. A combined log is about as follows:-

0 - 24	Gravelly sandy till
24 - 35	Coarse loose brown sand with water
35 - 38	Till (?) or clay (?)
38 - 63	Fine Grey sand
63 - 91	Fine sand with clay
91 - 101	Very fine tight sticky sand.

The collars of these holes are at about the same elevation and both are about 15 feet to 20 feet above the elevation of the spring which is nearby. The situation here is quite different from that at the Anderton Spring where the aquifer is unconfined. Here the aquifer is confined by 24 feet or more of till at surface. The static levels of both observation wells are about 3 feet below surface or about 15 feet above the spring. This difference represents the loss in head of the water flowing upward through the till and the part of the aquifer between the well point and the bottom of the till. Thus the Hilton springs occur where water flows upward through leaks in the confining till. Wells drilled at the level of the springs or below them would almost certainly be flowing artesian wells. Large production wells drilled into the aquifer close to these springs could be expected to reduce the flow of the springs and interfere with the aforesaid water licence on the spring, thus it is inadvisable to drill here.

A number of artesian wells and springs are located along the northeast side of the Courtenay River Valley between Comox and Sandwick. The geologic conditions here are not well known. The water comes from gravels which may be local old river gravels of the Pre-Vashon Courtenay Valley.

The groundwater situation at Comox is fairly straight-forward. Enough information is now available from drilling by Comox and others to give some idea of the situation. Three holes drilled this summer by Island Well Drillers just north of the Comox Village Boundary have given good information where none was available before.

The data assembled here indicate that conditions for finding groundwater at Comox are generally favourable. The main problems are: determining the most favourable location for new wells, proper well construction in the sand which forms the aquifer, and avoiding areas where water quality is poor.

For the Village of Comox, geologically the most favourable place for a well is where it will encounter the maximum thickness of saturated permeable material suitable for well construction. This must be balanced against the cost of hooking the well up to the existing system. It goes without saying that an area where poor quality water is known to exist should be avoided. As far as we know the only poor quality (high iron content) water in this area is that at the Comox Golf Course well. The reason for this occurrence of bad water is not known and is impossible to predict. It is most likely that there is some organic material (peat, etc.) in the aquifer in the vicinity of the golf course.

The map shows the location of a number of wells in the Comox area. Wells are assigned numbers starting from 1 in each one mile block which has X and Y coordinates. This includes all the wells of which we have records in the area; the ones coloured red are those which we believe are significant. There may be others of which we have no record. Where logs are available these are shown by an abbreviation system as listed below.

Symbol	Material
T	till
S	sand
G	gravel
Slt	silt
Cl	clay

The number opposite each symbol indicates thickness in feet. A + sign indicates that the thickness is greater than the number shown; in other words the hole stopped before reaching the bottom of this material.

It must be kept in mind that these "logs" are an approximation depending on the quality of the log and the interpretation of the information. It is usually not difficult to define the till and the overlying marine veneer but it is quite difficult to define the bottom of the sand member of the Quadra which is the aquifer. Usually drilling was stopped after passing through only a few feet of the silts and clays below sand. In this case, the silt and clay may only be a thin interbed in the sand member and may not be part of the underlying silty member of the Quadra.

Two sections, A-A' and B-B' have been drawn to try to illustrate geologic conditions in the Comox area. Wells which fall close to the sections have been used as a basis for making the sections; these are shown. It is apparent that there is not enough information to construct these sections with any certainty except near the wells. The water level in the wells is shown also.

An attempt was made to draw a map with contours showing the water table; this is a very rough approximation and is included with this report. This indicates that recharge of ground water occurs in the high areas D-D and E-E.

If the Village of Comox decides to undertake further well drilling, it should be kept in mind that past experience indicates that the Quadra aquifer at Comox is all sand. Wells in sand must be properly constructed in order to have the maximum capacity and so that they will not pump sand. The capacity of wells in sand is limited by the ability of the water to flow through the fine material. It is not possible to estimate the capacity of wells under these conditions without having specific information about the aquifer characteristics namely the transmissibility and coefficient of storage. These characteristics can be estimated from pumping test data conducted by pumping from one well and observing the drawdown in a nearby observation well. This could be done at Comox using one of the present production wells as for instance No. 3 and using the number 5 test hole as an observation well. ~~In any case, it seems~~ quite likely that wells in this area will have limited capacity but this capacity is probably greater than that of the present wells if large diameter wells are constructed. Various techniques can be used to get the maximum capacity from wells in sand. In very fine sand a gravel packed well may be constructed; in this case, a large diameter well is drilled and a smaller size screen and pipe installed within the large casing. The space between the screen and the outer casing is filled with specially selected and sized gravel and the outside casing is pulled up as far as the top of the screen. The well is then surged to remove some sand around the gravel pack and additional gravel is added to the gravel pack to make up for the sand removed.

In any case, it seems advisable to construct wells at least 12" in diameter, Such wells and especially the screens are quite expensive but are certainly necessary to get increased capacity. Great care must be taken in collecting sand samples for size analysis in order to select the proper screen.

From the information assembled here the best place to drill a new production well would seem to be in the vicinity of Comox test hole No. 5 (Well 11 on map). Here the aquifer is known to be at least 39 feet thick and may be thicker if the silt at the bottom of the test hole is an interbed or lens in the sand; this should be checked by drilling a little deeper on a new hole. Here the water table is high enough to allow considerable drawdown in the well making for high capacity. The water quality is known to be good and the sand (from samples taken from test hole No. 5) is coarse enough for good well construction. A hole in this vicinity should be located not closer than about 150 feet from test hole no. 5 so that the test hole may serve as an observation well during a pumping test. Pumping tests on production wells should be run using a proper pump and at least one observation hole.

6th November, 1962

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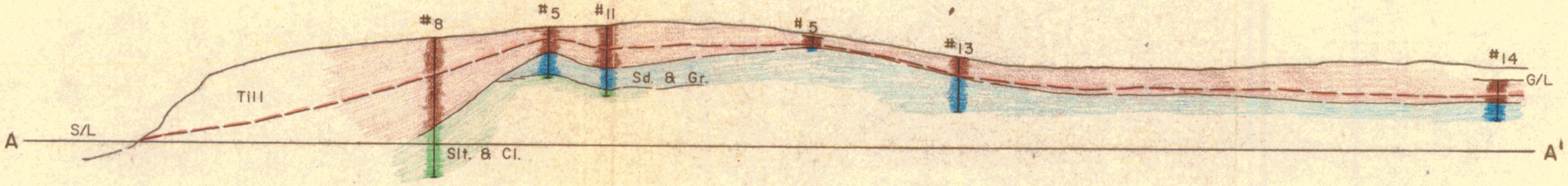
E. Livingston



SECTION A – A'

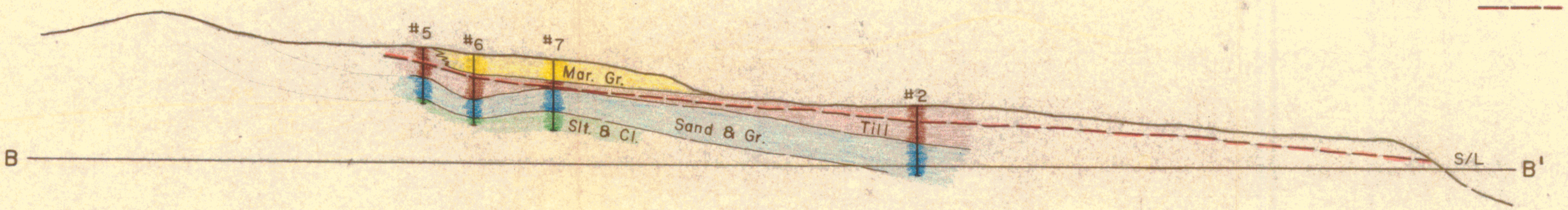
Marine Gravel

Till

Sand & Gravel

Silt & Clay

Water Table



SECTION B – B'

DEPARTMENT OF LANDS, FORESTS & WATER RESOURCES
WATER RESOURCES SERVICE

COMOX AREA GROUNDWATER

SCALE÷ HOR.: 1" = 1000'
VERT.: 1" = 200'

DATE÷ OCT. 1962

GEOLOGICAL ENG.

BRITISH COLUMBIA
DEPARTMENT OF LANDS, FORESTS, AND WATER RESOURCES
WATER RESOURCES SERVICE

TO ACCOMPANY REPORT ON
COMOX AREA GROUNDWATER

SCALE: VERT. ______ HOR. 1" = 1000'
DATE OCT '62
ENGINEER ______
FILE No. ______ DWG. No. ______

Dept L F & W Res.
Water Res Service
To accompany report
Prelim

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COMOX DISTRICT SHEET No. 1

SCALE: 1" = 1000'
WELL △