GOVERNMENT OF BRITISH COLUMBIA

MEMORANDUM

TO Mr. V. Raudsepp
Chief Engineer
Water Investigations Branch

FROM E. Livingston, Chief, Groundwater Division

June 28th 1967

SUBJECT Test Well at Mile 80, Cariboo Highway

OUR FILE 0239014A
YOUR FILE

In my memo to you dated April 11th (file 0183613) which proposed certain projects for the 1967/68 fiscal year, I proposed as Item 6, a test well in the Tertiary lava flows of the Cariboo Plateau where, except for small domestic wells, groundwater resources are practically unknown. In this memo, I proposed pump testing the inter-flow breccia zones individually by isolating them with some sort of packers. After giving the matter further thought, we decided that a standard pump test using a moveable current meter in the hole would be a more practical and inexpensive way to determine the proportion of water coming into the well from multiple zones.

Letters inviting bids were sent out on April 24th, 1967 and the contract was awarded to Pacific Water Wells of Nanaimo on May 12th on the basis of a bid dated April 26th. Drilling started about May 16th on Crown land on the west side of the Cariboo Highway approximately at Mile 80. The location is shown on a map on file 0242686A with a memo dated May 12th from D. Borthwick, Superintendent of Lands, authorizing the right of entry to the drilling site. The drilling was completed by about June 7th and the pump test completed on June 17th.

Dr. Foweraker who started work on the investigation of groundwater resources of an area from about 93 Mile House to Williams Lake, looked after the job and the pump test. He will prepare notes concerning the detailed log of the well and analysis of the pumping test upon completion of the field work on the area mentioned above. The purpose of the memo is to report on the general results of the work and its probable significance.

The overburden consisting of till, was 40 feet thick. The hole was cased to 40 feet with eight-inch casing and the hole in the rock drilled eight inches in diameter to 500 feet. The static level is about 17 feet

Drilling was entirely in flows probably entirely basalt or more specifically, olivine basalt. A number of loose broken zones were encountered and at least one of these contained coarse sediments with cobble size stones some of which were not basalt. In the broken zones, much bright red and salmon pink rock was encountered and the drilling progress was quite rapid. In the massive rock occurring presumably at the centre of the flows, progress was slow some times only about one foot per hour. Drilling was complicated by the tendency of fragments of rock to fall into the hole behind the tools so that drilling jars had to be used. A bailer was jammed in the hole in the same way but it was

Card made

June 30/67

July 6/67

fished out successfully. The driller bailed at each new broken zone but after passing the first few zones, water entered the hole rapidly enough so that further increases in water could not be determined.

When the hole was completed, the Contractor declined to put his test pump into the rock hole below the 40-foot casing because of the possibility that it might become jammed in the hole by rock falling in from above. Since the static level was high, only 17 feet, we decided to try a pumping test with the pump set at about 40 feet and equipped with a 20-foot length of "tail pipe" (suction pipe) below the pump. Since this four-inch pipe was smooth, there was little chance that it would become stuck.

The pump which was designed to fit in six-inch diameter pipe, was damaged in shipment from the Langley shop of the Contractor. The pump was repaired by the driller. In being repaired, the pump was apparently overheated damaging one of the rubber bearings resulting in severe vibration when the pump was first started up.

The current meter, a miniature Ott propeller type meter, was enclosed in a three-foot long light steel cage for protection and to maintain its axial centre position in the hole. It was hung on heavy nylon fish line to which the signal wire was taped at intervals. A small ohm-meter was used to indicate the contact at the current meter instead of the usual headphones and battery. This arrangement worked very well. The current meter was equipped with a foam plastic float to minimize the load on the line. The current meter was rested on the bottom of the hole while the pump was installed and then brought up as high as possible while the pump was started to avoid any stones or rock fragments which might be loosened by the pumping. Unfortunately, the initial severe vibration of the pump apparently chafed the fish line and wire against the side of the hole and the meter was lost down the hole but only after a number of observations had been made showing that the current meter was working.

The pumping rate was increased in several steps up to about 183 Imperial gallons per minute (220 gallons per minute (U.S.)). At this rate, the drawdown increased to about 44 feet when the pump performance dropped because of excessive suction lift so the rate was reduced to 146 U.S. gallons per minute at which there was a slight decrease in drawdown. On the basis of this preliminary pumping, we decided to place the pump deeper in the hole inside of thin wall six-inch casing to remove the hazard of sticking.

The current meter was fished out of the hole; the cage was severely damaged but the meter was intact. A new cage was made for the meter and a pump test run at 146 gallons per minute Imperial. The drawdown after 24 hours was about 27 feet and it was not increasing a perceptible amount. The recovery to static level was carefully observed; it took several days to reach static level.

During the first four-hour preliminary test, the water was quite sandy with occasional slugs of sand. After this part of the test when the current meter was fished out of the hole, some rock debris was found in the bottom of the hole. During the longer test, the water was quite sandy at times, but cleared completely for the last four hours of the test. The current meter readings during the long test indicated that most of the water was coming from the bottom of the hole during the early part of the test and that the proportion of water from the upper part of the hole increased with time. This evidence along with the sand being pumped, indicates to me that the well was developing during the pump test. The sand contains red and salmon pink grains, probably baked clay minerals and one of the zeolites, both characteristic of the brecciated inter-flow zones.

These preliminary data suggest the following:

a] the Tertiary flow rocks of this area and probably also other areas are capable of supplying water to high capacity wells. Water occurs in inter-flow breccias.

b] there is no indication that water is restricted to the uppermost flows. In fact, the current meter data indicate that the lowest zone could supply most of the water to the well. The capacity of the well can probably be increased by deeper drilling.

c] wells of this type are inexpensive to drill but the tendency of the inter-flow zones to cave may necessitate certain precautions in placing pumps and other equipment in the well. Additional experience may show that such caving may occur only in new wells.

d] the water table in these rocks is high in areas of low relief.

e] water quality is good.

If statements [a], [b], [c] and [e] are valid in general for the Tertiary flow rocks of B.C., such areas probably represent the largest reserve of good quality ground water in this Province. Indications are that it can be rather easily and cheaply developed by using moderate to high capacity wells.

Unfortunately, most of the areas of the Province underlain by such rocks are plateaux with a high enough elevation so that large resources of good quality ground water are of little economic importance at this time.

Most of the above, based on data from one test well, must be classed as rather wild speculation. If, however, it is considered to be of economic interest, it is not difficult to carry out further investigation by drilling other test wells.

E. Livingston

E. Livingston, Chief
Groundwater Division

EL/ls

Log of Test Well, Mile 80, Cariboo Highway

0 - 33	Till
33 - 42	Weathered (?) rock (brick red)
42 - 71	Basalt, hard
71 - 78	Brick red breccia zone
78 - 103	Basalt hard greenish brown 90-103
103 - 114	Brick red breccia zone
114 - 143	Basalt, hard (bailer was jammed by a rounded boulder @ 133 so at least one of the upper inter-flow zones contains coarse gravel)
143 - 149	Brick red breccia zone
149 - 171	Basalt, very slow drilling
171 - 181	Inter-flow zone. 171-173 described as brick red; 173-181 described as hard green till probably old sediment which escaped baking to red colour.
181 - 208	Basalt, very slow drilling
208 - 210	Brick red breccia zone
210 - 224	Basalt, hard
224 - 227	Brick red breccia zone.
227 - 248	Basalt, hard, brown 230-242
248 - 251	Described as "Sticky till" perhaps fault gouge
251 - 275	Basalt, blocky 251-255
275 - 295	Inter-flow zone 275-286 brick red; 268-295 described as "till-like material"
295 - 315	Basalt, hard
315 - 326	Basalt, black and red; 315-316 blocky
326 - 354	Basalt, hard
354 - 365	Greenish, basalt with "sticky layers" perhaps fault zone
365 - 394	Basalt 374-381 chocolate brown, remainder greenish
394 - 415	Inter-flow zone? 394-397 described brown, soft, sticky. 401-408 described as "green till-like very sticky"; 408-415 described as "sticky brown rock"
415 - 460	Basalt with brown zones and "sticky" layers; 421-424 softer brown; 435-439 sticky brown; 448-450 sticky brown; 458-460 described as "till".
460- 498	Similar to 415-460; 474-476-1/2 brown "fault"; 481-486 very sticky brown caving; 494-495 brown "fault". at 498 soft but very slow drilling.
498	Bottom.