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4th December,

64

Ground Water Investigations for a Water Supply
for a Proposed Correctional Institute near
Saltair, Vancouver Island.

0239013

INTRODUCTION

At the request of Mr. Leach, a geological reconnaissance was made of several proposed diversion dam sites on Banon Creek in connection with a scheme for a surface water supply for the proposed Correctional Institute near Saltair. Two 1-day Field Trips (30th September and 6th October, '64) were made to Banon Creek area. The results of these field trips are included in my memo of 20th October '64 file #0239013. Included in this memo were some brief notes on ground water possibilities on Banon Creek, but it was suggested that if a ground water source was to be considered for the proposed Correctional Institution then further field work would be required.

A geological reconnaissance and ground water investigation was later made of the general area surrounding the proposed Correctional Institution (see location map) and the results of that investigation are included in this present memo. The general area covered by this field investigation can be reduced to three main areas of interest.

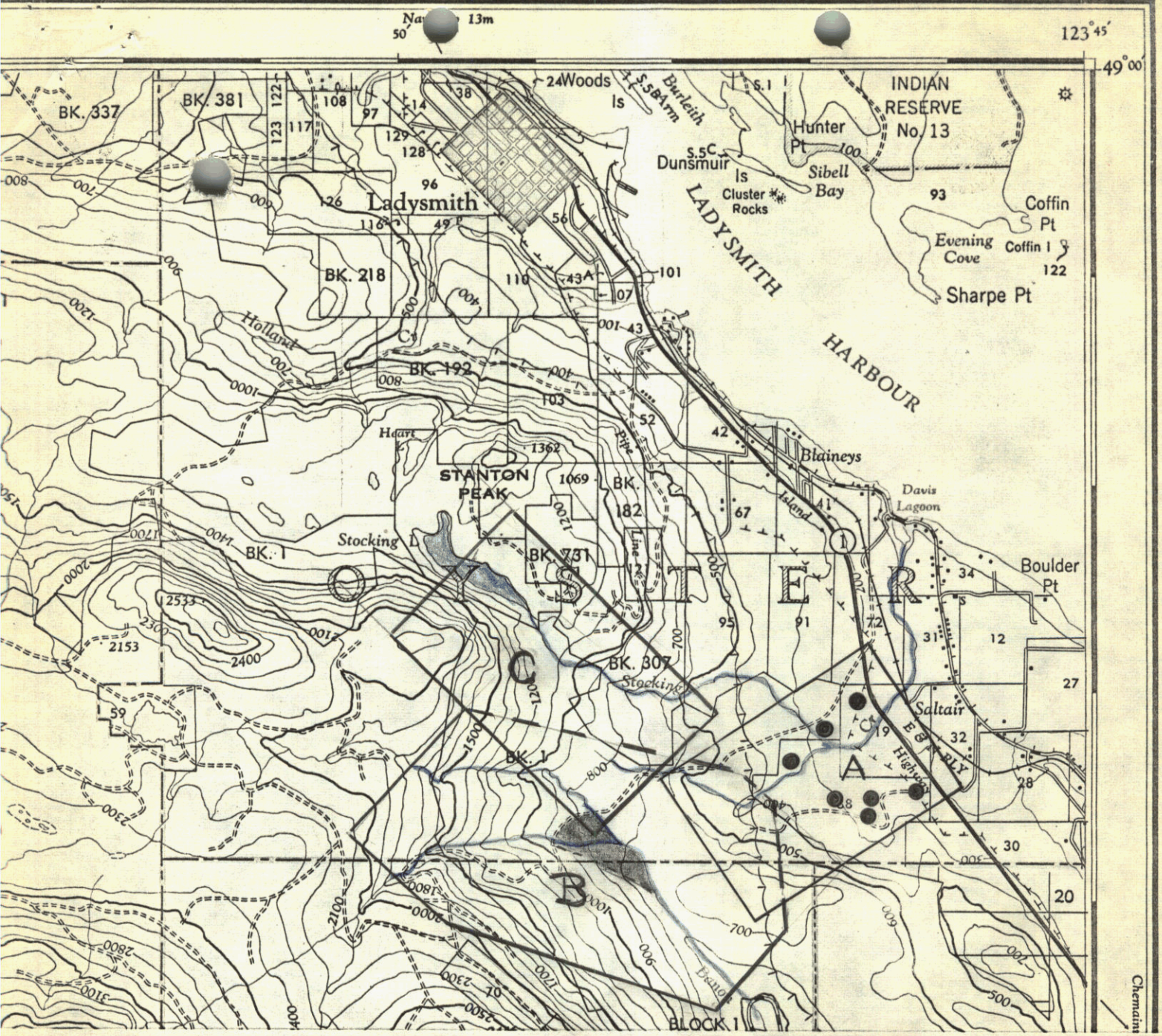
- Area A: - situated in the locality to the north and east of the proposed building site for the institution (see figure A)
- Area B: - situated immediately up and downstream from the junction of the North and South Forks of Banon Creek (see Figure B)
- Area C: - situated immediately downstream from Stocking Lake (see Figure C)

It has been estimated that the Institution will require approximately 120 g.p.m. for domestic use and 300 g.p.m. to supply irrigation needs.

GEOLOGY AND GROUND WATER POSSIBILITIES

General

Stocking Lake at elevation 1168 feet (see Figure C) is separated from the coast by a prominent ridge. This ridge is composed of Sicker Group volcanics, which are covered by a veneer of till. Stocking Creek (Davis Creek) drains out of Stocking Lake and follows a south easterly course down the west flank of this ridge until it emerges out into the coastal section and eventually empties into Davis Lagoon.



KEY MAP Scale 1:50,000

Banon Creek, north fork, lies south of Stocking Lake and approximately 3 miles south of the Village of Ladysmith. The two forks of the creek descend rather abruptly from the upland areas. In the area of the junction of the two forks is a small alluvial fan which may constitute ground water zone. (See Figure B) Below the junction of the two forks, the creek does not take a direct route out to the sea, but it continues in a southerly direction parallel to the coast along the western boundary of a prominent low ridge. As mentioned in my previous memorandum, it is possible that this feature is a moraine ridge deposited along the margin of moving ice, and this ridge has subsequently prevented the creek taking a more direct route to the sea.

The access road from the Island Highway to Banon Creek follows an "embayment" which forms a break in the ridges of Sicker Group volcanics to the north and south. Fairly flat lying Cretaceous sandstones (Nanaimo Group) have been laid down in this embayment and the relief in this area is noticeably less than that in the volcanic ridges to the north and south. Till is known to blanket much of the area and in many localities it is in direct contact with bedrock at shallow depth.

The relatively small cost of a ground water investigation, compared to existing schemes for surface water supply for the proposed institution, make it worth while to explore the ground water possibilities of this area by a limited number of test holes. The embayment area for example may possibly contain beneath the till, deposits of glacial sands and gravel, or alternatively a buried channel may exist from a former pre-glacial drainage pattern now abandoned. Immediately downstream from Stocking Lake (see Figure C) there is an area of sub-till silts, sands and gravels showing bedding. The considerable weathering of individual grains in this deposit would possibly indicate a pre-glacial age for this deposit. There is a possibility then, that since sub-till deposits exist here, they may also be found nearer the institution site and could, under favourable conditions, constitute a source of ground-water.

PROPOSED EXPLORATORY DRILLING PROGRAM

General

Details of cost estimates for this proposed exploratory program are given in Appendix 2.

It has been recommended that a start be made with test drilling at Area A because it is closer to the proposed building site for the institution than Banon Creek, Area B.

The drilling program has been divided into 3 parts.

Firstly a relatively cheap rotary drilling program of seven holes at Area A. (see Figure A for location of test hole sites) The estimated cost of this phase of the program, including access routes to the sites, is: \$2,370.00

Secondly if the rotary drilling results indicate sufficient deposits of sand and gravel below the glacial till then a follow-up program could be carried out using cable tool drilling equipment. It is suggested that an 8 inch test hole be drilled and a

pumping test also run. The cost of this hole is estimated at \$1,966.00. The total cost of the combined programs at Area A is estimated at \$4,336.00.

Alternatively if the rotary drilling program gave negative results then a cable-tool drilling program could be undertaken on the alluvial fan at Banon Creek. (Figure B) Three test hole sites have been selected here and these holes could be drilled and pump tests carried out on any successful holes for an estimated \$7,488.00.

In summary then, the estimated cost of the rotary drilling program at Area A and the cable tool drilling at Banon Creek, is estimated at \$9,858.00, while the estimated cost of the full program is \$11,824.00.

Details of Test Drilling Program at Area A. (see Figure A)

At Area A, seven rotary test hole sites have been selected. These sites are located away from bedrock in areas where the depth of overburden may be greater, and where the possibility of finding sands and gravels below the till may also be greater. (see Figure A)

Sites #1 and #2 are accessible from Watts Road, but some work may be required on the track leading into the site itself if there should be wet conditions just prior to the move in. Sites #3, #4, #5 and #6 will require access routes to be cleared along the old logging roads on to which these sites are located.

It is suggested that the access road from the proposed building site for the institution be extended down towards test hole site #3. Swampy conditions may be encountered in providing access routes to test hole sites #'s 5 & 6.

Access to test hole site #7 would be best accomplished by way of the New Island Highway and then south along the old pole line.

Water is available at site #1 and is fairly close to site #2. However, it will have to be carted into the other sites.

It may become necessary to relocate some of the later test hole sites, depending on the interpretation of the information in the first holes to be drilled.

Details of Test Drilling Program at Area B. (See Figure B)

If Area A is unsuccessful then it is suggested that 3 cable tool test holes be drilled at Area B on Banon Creek. Approximate locations of the three test holes are shown in Figure B. The depth to bedrock in these holes may not be very great but 100 feet has been allowed for in each hole in the cost estimates. Information obtained from the first test hole however, could make it desirable to relocate the subsequent sites.

A new route could be constructed to the test drilling area from the Banon Creek access road, from a point about 600 feet from the North Fork crossing (see Figure B). Another alternative more expensive access route, could be made along the proposed pipe line route.

J.C.F.

J.C. Foweraker
Geologist

Appendix 1: DETAILS OF GEOLOGY AND GROUND WATER POSSIBILITIES
(See also cost estimates in Appendix 2)

Area A (See figure A)

This area is situated in the "embayment" between Sicker Group volcanics to the north and south, and the area contains considerable rock outcrop despite the more subdued relief of this area. Rock outcrop is exposed along the transmission line (see Figure A) and also along the western end of the access road (Watts Road) and where Davis Creek crosses the old Nanaimo Duncan Utilities Pole Line. To the north of Watts Road (and north of the Geological boundary between the Nanaimo and Sicker Groups) are found outcrops of volcanic rock. At the south west corner of Figure 1, where the institution buildings are to be located, 6 test holes were drilled with a power auger down to bedrock in fractured sandstone of the Nanaimo Group. In all cases bedrock was encountered between 3½ and 7 feet below the surface. This is not surprising in view of the topography at this location and the presence of broken angular pieces of silty sandstone found nearby on the transmission line access road. Further details of these test holes are given in Appendix 3. It is apparent also that glacial till blankets the general area, and exposures of till are found in many places.

The possibilities of finding a suitable aquifer in sub-till sands and gravels may be small, and the search for these deposits should be concentrated away from areas of known outcrop. Sand and gravels have been reported below till in wells to the east of the Institution Site but the yield has always been low - a few gallons per minute; possibly in these cases the gravels were actually within the till and not below it.

Area B (See Figure B)

From the aerial photographs the low-level diversion site on the south fork of Banon Creek (Site #15) is near the top of an alluvial fan which spreads out downstream from this point, (see shaded area on Figure B) and this fan may possibly yield a ground-water supply.

A traverse was made down the north fork of Banon Creek from the old logging bridge on the access road, to a point below the fan area at (A), see figure B. Several exposures of till were encountered on the left side of the creek upstream from the fork junction near the point (X), in figure B. The creek has at this point exposed on the left bank a compact and hard till, 3-4 feet thick, which is overlain by a five-foot thick bed of boulder gravel loosely cemented with sand.

About 300 feet downstream from this exposure, there is a 30-foot high bank on the left side of the creek consisting of till overlain by sand. The till contains some boulders 1-2 feet in diameter but the overall appearance is of a fine-grained till, very compact. Further exposures were noted on the left side of the creek above the fork junction. No exposures of bedrock or till were found immediately west of the creek in the fan area.

At the point Y in Figure B, Sicker Group volcanic rock is exposed where the creek cuts into the western toe of a prominent spur. Upstream from (A) in Figure B

where the valley first narrows, there is a 10-foot exposure of hard and compact till above river level. The valley floor at (A) narrows to about 45 feet and volcanic rock is exposed in the creek bottom and left valley side. Locality (A) was mentioned in an earlier memo as a possible low-level site for a diversion dam. However, soil and overburden of undetermined thickness covers most of both valley side slopes, and depth to bedrock is not known, but is probably only a veneer.

The thickness of the possible Banon Creek ground-water zone near its center may not be very great, possibly less than 75 feet. This is suggested by bedrock outcropping immediately up and downstream of the fan area. Lenses of impervious materials exist in the fan alluvium which appears to be of a heterogeneous nature.

The observation made by Mr. Leach and Mr. Sorokoski that the discharge of the north fork was noticeably less near the downstream end - the end where the creek enters the alluvial fan area - could indicate that the creek is replenishing a ground-water reservoir in this area.

Area C (See Figure C)

Evidence of sands and gravels below till is found at the eastern end of Stocking Lake. These deposits formed prior to the last ice advance may be restricted to the area shown on Figure C. An abandoned channel runs down the south west side of this area.

There is however, some evidence from aerial photographs that a terrace remnant may exist further along to the south east of this point, but this would require further field investigation. Bedrock outcrops further up this slope on the survey traverse line between Stocking Lake and Banon Creek. Bedrock is also found further downstream in the bed of Stocking Creek, particularly on the east side of the Creek. On the west side are some poor exposures of silty sand and gravel with till boulders. The relationship of this material to the till was not resolved.

Further details of the sub-till deposits below Stocking Lake will be discussed in a separate memo on the Stocking Lake Dam Site Investigation. The sub-till deposits at Stocking Lake might constitute a ground-water zone, but it is understood that due to their location they are not to be considered at this time.

J.C.F.

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Geologist

JCF/dr

COST ESTIMATES
GROUND WATER INVESTIGATIONS

1. BANON CREEK

	<u>Unit</u>	<u>Quant.</u>	<u>Unit Cost</u>	<u>Total Cost</u>
(A)				
a) Access route (using existing road into Banon Creek) See photo 5001 : 145 ↕	Per Mile	0.3	5000	1,660.00
culvert and fill on route				500.00
b) Allow for temporary crossing of Banon Creek				500.00
c) Clearing at site				100.00
d) Transporting crew & equipment to site				200.00
e) Drill and case 3-8 inch holes (each 100' max. depth) (Cable tool Rig)	lin. ft.	300	9.00	2700.00
f) Installing screen, developing well & pumping tests for 2 wells	per hr.	120	12.00	1,440.00
g) Screen rental 2 wells	-	-	-	100.00
h) Removal of casing 3 holes	per hr.	24	12.00	288.00
				<u>\$ 7,488.00</u>

Alternatively (B)

↕ Alternative access route to site via suggested pipe line route (see photo 5001 : 144)	per mile	0.65	5000	3,250.00
Cost of B - H above				+ 5,328.00
				<u>\$ 8,578.00</u>

2. INSTITUTION SITE AREA

	<u>Unit</u>	<u>Quant.</u>	<u>Unit Cost</u>	<u>Total Cost</u>
(A) <u>ROTARY DRILLING</u>				
a) Access routes to 7 sites (using existing roads where possible) and clearing of sites by D8 Cat.	per hr.	35	\$22.00	\$770.00
b) Transporting crew and equipment to site.				\$200.00
c) Drilling 7 holes by Rotary Machine to a maximum depth of 100 ft.	lin. ft.	700	\$ 2.00	\$1,400.00
				<u>\$2,370.00</u>
(B) <u>FOLLOW UP TO ROTARY DRILLING IF RESULTS WARRANT FURTHER EXPLORATION BY CABLE TOOL</u>				
a) Transporting crew and equipment to site.				\$200.00
b) Drill and case 1-8 inch hole, 100 feet deep.	lin. ft.	100	\$ 9.00	\$900.00
c) Installing screen, developing well and pumping test.	per hr.	60	\$12.00	\$720.00
d) Screen rental				\$ 50.00
e) Removal of casing	per hr.	8	\$12.00	\$ 96.00
				<u>\$1,966.00</u>
Cost of 2 (A) and (B)				<u>\$4,336.00</u>

<u>Total Cost of Rotary Drilling</u> and <u>Cost of Banon Creek.</u>	(1(A) + 2(A)) \$2,370.00 + \$7,488.00	<u>\$9,858.00</u>
<u>Total Cost of Full Program</u>	\$7,488.00 + \$4,336.00	<u>\$11,824.00</u>

J. C. V.

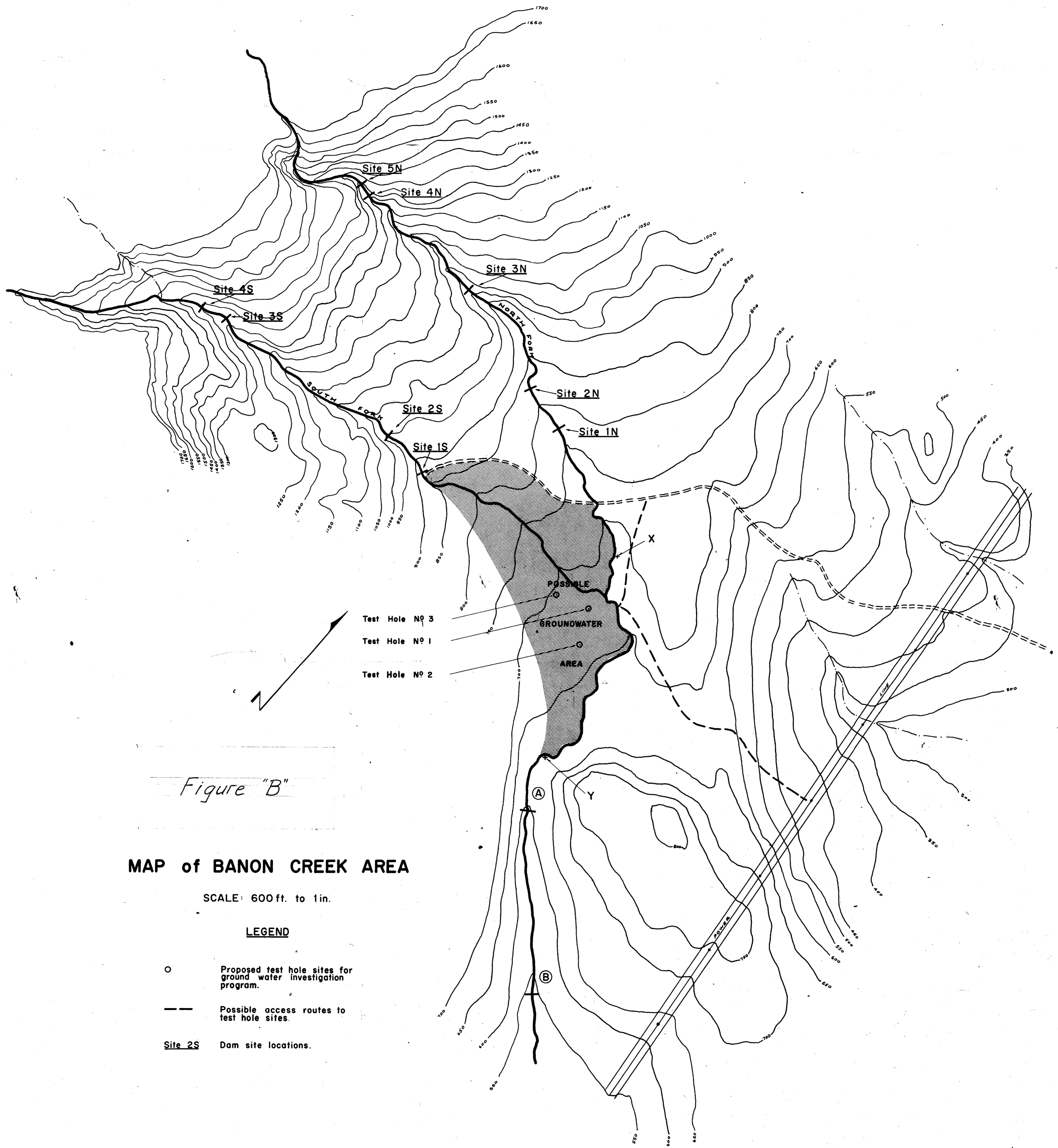


Figure "B"

MAP of BANON CREEK AREA

SCALE: 600 ft. to 1 in.

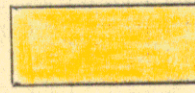

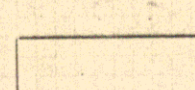



LEGEND

- Proposed test hole sites for ground water investigation program.
- Possible access routes to test hole sites.
- Site 2S Dam site locations.

Figure "A"
Saltair Institutional Site

Map showing proposed Test Hole Sites for Ground Water Investigation, and some additional Geological information.

Legend

-  Terraced Fluvial Deposits
 -  Ground Moraine Deposits: fill, lenses of gravel, sand, silt.
 -  Older Deposits
 -  Nanaimo Group: sandstone, siltstone, silty sandstone, shale, conglomerate, etc.
 -  Sicker Group: pyroclastic rocks, etc.
 -  Proposed Test Hole Sites using rotary drilling equipment
- Scale 1 inch to 200 feet

