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Province of British Columbia | Ministry of Environment and Parks | WATER MANAGEMENT BRANCH

MEMORANDUM

To: Mr. Don Peterson
Fish and Culture Section
Recreational Fisheries Branch

Date: April 11, 1988

Our File: 92 0 14 #1 new.

Re: Assessment of Groundwater at Hanceville

As requested by Mr. R.A.H. Sparrow a preliminary assessment of groundwater conditions has been completed for the above area. A spring on the TH ranch at Hanceville has been reported to have diminished in flow from 5450 L/min in 1981 to 2800 L/min in 1986. Comments were requested on the suitability of the area for groundwater and whether flows would be expected to fluctuate for this type of spring. This memorandum summarizes the known groundwater conditions based on a review of available geologic mapping, available hydrologic reports, air photograph interpretation and a one day field reconnaissance completed in October 1987. Prospects for developing groundwater supplies in addition to the spring (Hanceville Spring) on the TH ranch are discussed and recommendations are provided on a program for proving up additional groundwater sources of supply.

LOCATION AND CLIMATE

Hanceville is situated along the north bank of the Chilcotin River approximately 70 km west of Williams Lake (Figures 1 and 2). The area receives between 336 and 464 mm of precipitation annually, based on records (Environment Canada, 198-) for stations at Alexis Creek and Big Creek situated 17 km northwest and 14 km south of Hanceville respectively.

GEOLOGY

The Chilcotin River valley at Hanceville lies within a large glacial melt water channel bounded by cutbanks and terraces (Tipper, 1971). Available bedrock mapping (Tipper, 1963) indicates the Chilcotin River valley at Hanceville is underlain by poorly consolidated Tertiary sedimentary rocks including buff to grey siltstone, diatomite, clay and silty sand, course reddish brown conglomerate and minor ash beds (Figure 1). Triassic limestones are reported to underlie the valley downstream of Hanceville and Tertiary plateau lavas comprised of olivine basalts, andesite and related tuffs and breccias are mapped on the upland areas north and east of the community.

Unconsolidated deposits overlying bedrock and comprised of morainal, glaciofluvial, lacustrine and slope/landslide deposits were observed in the field. The distribution of these deposits based upon field observations and air photograph interpretation are shown in Figure 3. Much of the upland area north of Hanceville Spring is underlain by morainal deposits of glacial

M.WEI, M. ZUBEL
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till with sand and gravel, overlying Tertiary basalt lavas. These lavas are exposed west and southeast of Hanceville Spring. A series of glaciofluvial terraces underlain by sand and gravel and lacustrine silt occur along the valley between elevations of 2150 to 2250 feet. Slope deposits and landslide complexes including disturbed morainal, glaciofluvial and Tertiary bedrock materials occur adjacent to the Chilcotin River and also along the upland south of Highway 20. Alluvial deposits of sand and gravel with boulders occur within the floodplain of the Chilcotin River. Records from two water wells drilled to the west of Hanceville Spring indicate up to 68 feet of sand and clay may be encountered in drilling through the glaciofluvial terraces. A schematic geologic cross section showing the possible relationship between the unconsolidated and bedrock deposits is shown in Figure 4. Landslide deposits along the Chilcotin River are likely the result of the presence of weakly consolidated Tertiary bedrock deposits of siltstone and clay, downcutting of the Chilcotin River and groundwater discharge from the glaciofluvial deposits and more permeable bedrock units on the upland.

GROUNDWATER CONDITIONS

Hanceville Spring discharges from two distinct points (east and west springs less than 50 feet apart) near the toe of the morainal upland in a gully underlain by glacial till and large boulders of basalt lava (Figure 3 and 4). Nearby exposures of Tertiary basalt lavas to the west and the presence of small springs issuing from the lavas suggest that Hanceville Spring is also discharging from the basalt lavas. The recharge area for the springs likely includes the immediate area above underlain by morainal deposits and the high upland plateau to the north underlain by Tertiary lava deposits (Figure 4). The high upland is relatively extensive and dissected by numerous meltwater channel features which may focus groundwater recharge during periods of upland runoff. Groundwater within the lavas likely moves through joints/fracures and along scoriaceous or brecciated zones between successive lava flows.

Groundwater also discharges from the glacial fluvial deposits and contributes to slope instability along the Chilcotin River. Southeast of Hanceville Spring (Figure 3) a good flow (approx. 0.5 cfs) was observed from coarse sand and gravel deposits at the toe of the glaciofluvial terrace. The presence of several springs in the vicinity of the TH ranch property suggest that prospects for developing groundwater supplies in addition to Hanceville Spring are encouraging. Test-well drilling and aquifer testing would be required to investigate the prospects further.

DISCREPANCY IN SPRING FLOW RATES, 1981 AND 1986

Apart from possible errors in flow measurements, the discrepancy between the flow rates of Hanceville Spring measured in 1981 and 1986, might be due to a number of other possible factors which could include for example the following:

1. Climatic effects
2. Disturbance of geologic conditions due to slope instability
3. Man's activities in the recharge area.

Comments on each of these factors are given below:

1. Climatic Effects

Precipitation data available for the station at Alexis Creek indicates that the region has received below normal precipitation every year since 1980 (Figure 5 and Table 1). Precipitation data from Big Creek for the same period is incomplete. The cumulative effects of this extended period of below normal precipitation could have significantly reduced the recharge to the aquifer supplying Hanceville Spring. Depending upon whether the nature of flow within the lavas is along fractures or interflow zones, it is possible that the discharge at Hanceville Spring could vary significantly over the long term. Continued monitoring of the discharge intermittently over a number of years would be required to determine any long-term variations and the reliability of supply. Flow monitoring during 1986 (pers. comm. W. Klopp, 1986) showed very little flow variation during the year.

2. Disturbance of Geologic Conditions due to Slope Instability

As the slopes below the glaciofluvial deposits are actively moving and being affected by groundwater discharge, it is possible that mass earth movements could cause either a sudden lowering or build-up of hydraulic head above the slide area thereby affecting the flow of Hanceville Spring. Exposure of aquifer materials for example following a landslide and subsequent draining could lower the hydraulic head in areas upslope and reduce the discharge of Hanceville Spring. Alternatively, the discharge of Hanceville Spring might increase if a groundwater discharge area downslope became covered by low permeability deposits; preventing or reducing groundwater discharge from the lower point.

Air photographs taken prior to and after 1981 were examined to determine whether or not any detectable mass earth movements occurred after 1981 in the area downslope of Hanceville Spring. The series of air photographs examined for 1975 (BC7709) and 1987 (BC 87061) however showed no discernible land changes downslope of Hanceville Spring since 1975.

3. Man's Activities in the Recharge Area

It is possible that some of man's activities in the recharge area after 1981 could have contributed to changes in the flow of Hanceville Spring. Logging activities for example evident in the 1987 air photographs and associated road construction and possible stream diversion practices could have altered local groundwater recharge conditions on the upland. Field surveys and discussions with Ministry of Forestry officials would be required to assess whether any significant modifications to surface drainage systems may have taken place.

GROUNDWATER QUALITY

Results of analyses of two samples taken from Hanceville Spring in 1981 and 1987 respectively are shown in Table 2. These analyses indicate that the water has not changed significantly in the last 6 years and is of the magnesium-calcium bicarbonate type with moderately low mineralization (TDS = 264 mg/L). Temperature of the groundwater measured on October 28, 1987 was between 10.8 and 11.0°C. Other springs in the vicinity showed temperatures in the range 10.8 and 12°C and electrical conductivities at these temperatures in the range 200 to 295 μmhos/cm. These groundwater temperatures are 5 to 10°C greater than the mean annual air temperature suggesting that the groundwater follows a relatively deep flow system or is preferentially recharged during the summer months. The moderately low mineralization of Hanceville Spring suggests the groundwaters are not exceptionally old and probably originate from a relatively shallow and relatively local groundwater flow system. Further sampling and analyses including natural stable isotopes (O^{18} and HD) and radioactive isotope (Tritium) may indicate further the relative age and probable flow history of the groundwater.

SUMMARY AND RECOMMENDATIONS

The source of Hanceville Spring is most likely discharge from Tertiary basalt lavas which are recharged by infiltration of precipitation and surface runoff on the upland north of the spring. Precipitation has been below normal every year during the period 1981 to 1986 inclusive in the vicinity of Hanceville. Apart from possible errors in flow measurements, the cummulative effects of this precipitation deficiency and possibly man's activities in the recharge area may have contributed to a decrease in the flow of Hanceville Spring. Continued long-term flow monitoring over a number of years may be required to confirm this. The glaciofluvial terrace downslope of Hanceville Spring is subject to slope failure which could affect the location of any proposed hatchery facilities and sites for the disposal of waste water. The presence of several springs in the vicinity of the TH ranch property suggest that prospects for developing groundwater supplies in addition to Hanceville Spring are encouraging. Test-well drilling and aquifer testing would be required to investigate these prospects further.

Further studies would be necessary to determine with greater certainty, the availability and reliability of groundwater supplies at Hanceville and the suitability of the site for a fish hatchery. The following are recommended for consideration:

1. Continued monitoring of the flow of Hanceville Spring and reviewing the flow measurement techniques utilized to date to ensure accuracy of future measurements.

2. Additional sampling of groundwaters from Hanceville Spring and also neighbouring discharge sites and submission for standard laboratory and isotope (O^{18}, HD and Tritium) analyses. Estimated laboratory costs for these analyses based on 5 sampling sites are $2000.00.

3. Completion and testing of three 8-inch diameter test wells to depths of 150 feet to determine the feasibility of pumping large quantities of groundwater from the basalt lavas and/or the glaciofluvial deposits. Estimated costs for this work would be $50,000 including engineering supervision based on all test holes being completed with screens and pump tested.

4. Completion of an initial geotechnical study to determine the site suitability of the area for hatchery construction and waste disposal considerations. Results of 3 above could augment this latter study.

REFERENCES

Environment Canada. 198-. Canadian Climate Normals, 1951-1980. British Columbia. Atmospheric Environment Service.

Tipper, H.W. 1963. Geology, Taseko Lakes, British Columbia Geol. Surv. of Canada Map 29-1963.

Tipper, H.W. 1971. Glacial Geomorphology and Pleistocene History of Central British Columbia. Geol. Surv. of Canada. Bulletin 196.

A.P. Kohut

A. Kohut
Acting Head
Groundwater Section
Water Management Branch

Apr 18, 1988

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AES:W2439

Table 1

Summary of Annual Precipitation Data, Alexis Creek

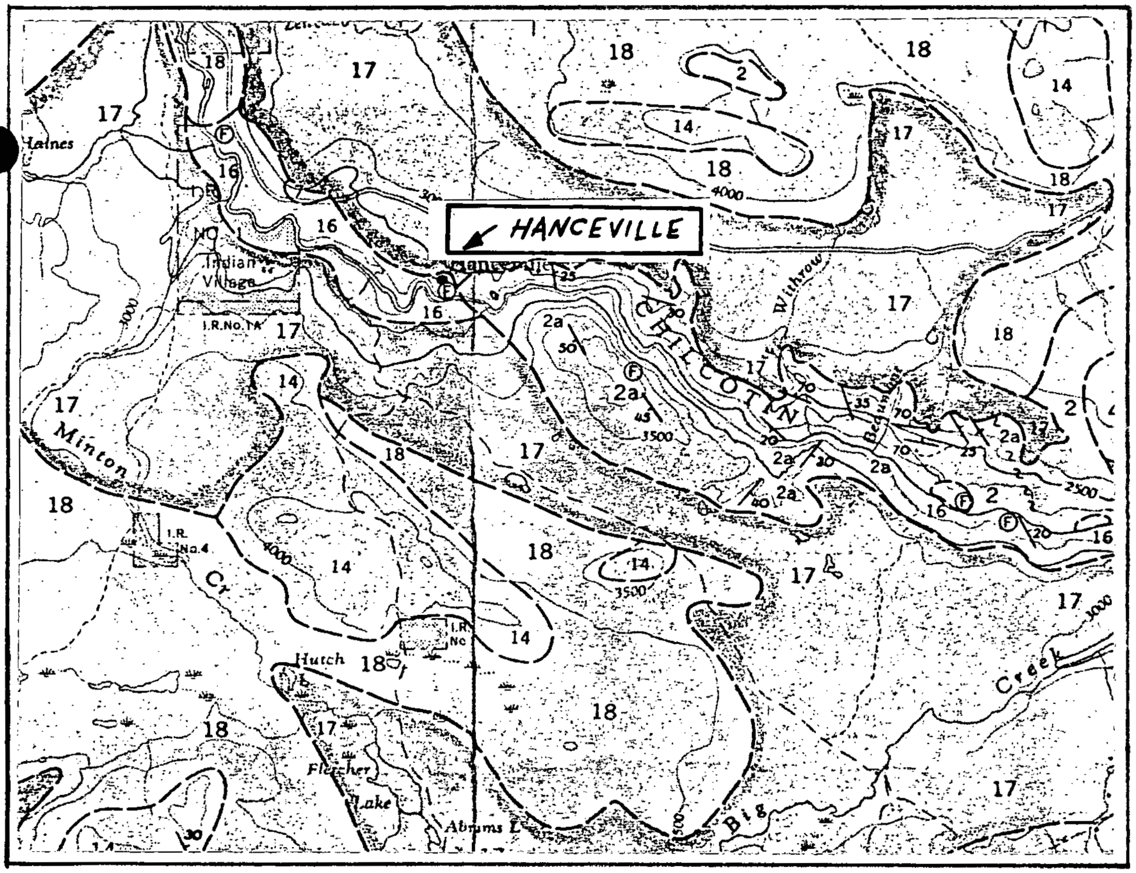
YEAR	Precipitation (mm)	Difference From Normal	% OF NORMAL 464.1 mm
1980	447.9	16.2	97
1981	295.4	168.7	64
1982	401.0	63.1	86
1983	320.5	143.6	69
1984	320.3	143.8	69
1985	219.5	244.6	47
1986	296.7 (March data missing)	<167.4	>64

Table 2

Summary of water quality analyses, Hanceville Spring (TH Spring)

Parameter	Sampling Dates and Results 04/14/81	28/10/87
pH	8.4	8.1
Residue Filterable	264	264
Specific Conductivity	437	455
Alkalinity	232	233
Hardness $CaCO_3$	214	203
Chloride	0.9	0.9
Ammonia	0.007	<0.005
Nitrate	0.27	-
Nitrite	0.005	-
Nitrate plus Nitrate (N)	-	0.28
Phosphorus	0.039	0.003
Sulphate	5.7	6.9
Carbon:organic	1.0	-
Calcium	37	37.3
Magnesium	29.6	26.7
Sodium	14.3	14.6
Cadmium	<0.0005	<0.01
Copper	<0.001	<0.01
Iron	<0.1	<0.01
Lead	<0.001	<0.1
Manganese	<0.02	<0.01
Mercury	0.00008	-
Zinc.	<0.005	<0.01

Note: All analyses expressed in mg/L except pH (relative units) and conductivity (µmhos/cm).



LEGEND

TERTIARY

UPPER MIOCENE AND (?) YOUNGER

17	Olivine basalt, andesite, and related tuffs and breccias

MIDDLE OR UPPER MIOCENE

16	Buff to grey siltstone, diatomite, clay and silty sand; coarse reddish brown conglomerate; minor ash beds

TRIASSIC

MIDDLE OR UPPER TRIASSIC

2	Limestone, basalt, and related tuffs and breccias; argillite greywacke, conglomerate; 2a, massive limestone

BEDROCK GEOLOGY

FROM TIPPER (1963).

Province of British Columbia
Ministry of Environment
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TO ACCOMPANY REPORT ON

GROUNDWATER CONDITIONS AT HANCEVILLE

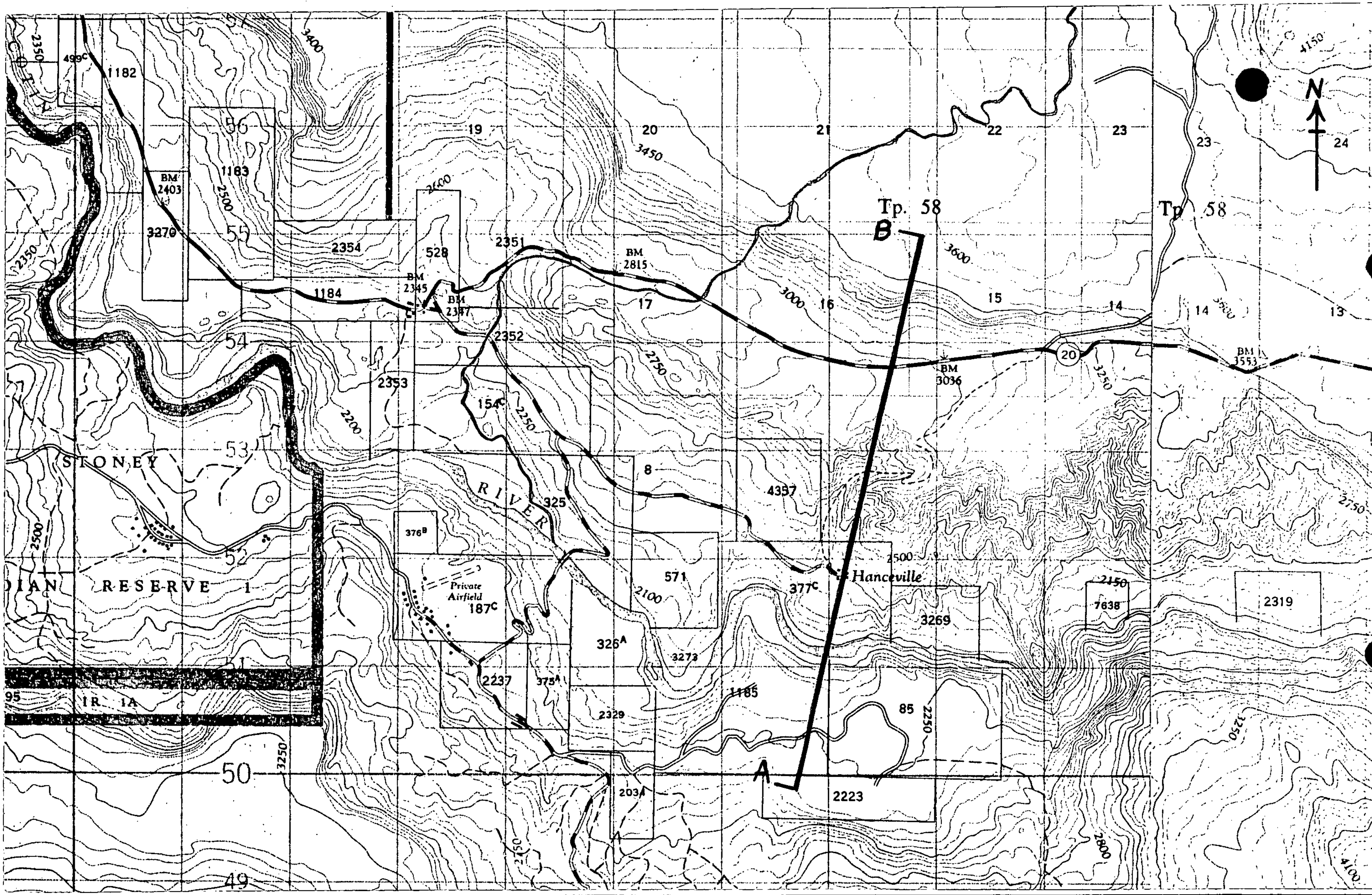
SCALE: VERT. —
HOR. 1" = 4 MILES

DATE JAN 88

APK ENGINEER

FILE No. 92014 DWG. No. FIG. 1

VAN CAL 15712



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TO ACCOMPANY REPORT ON

GROUNDWATER AT HANCEVILLE

SCALE: VERT.

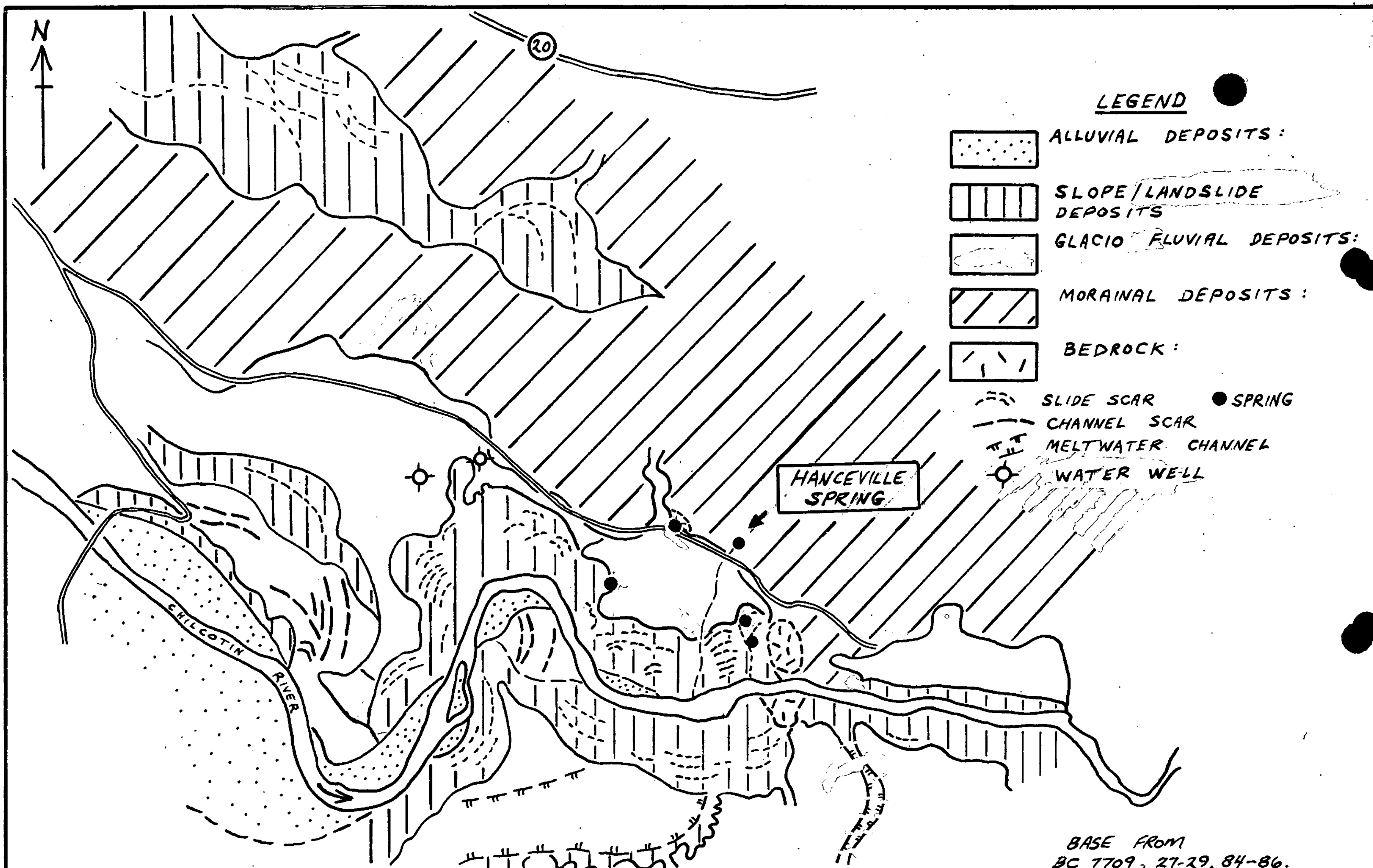
HOR. 1:50000

DATE JAN. 1988

APK ENGINEER

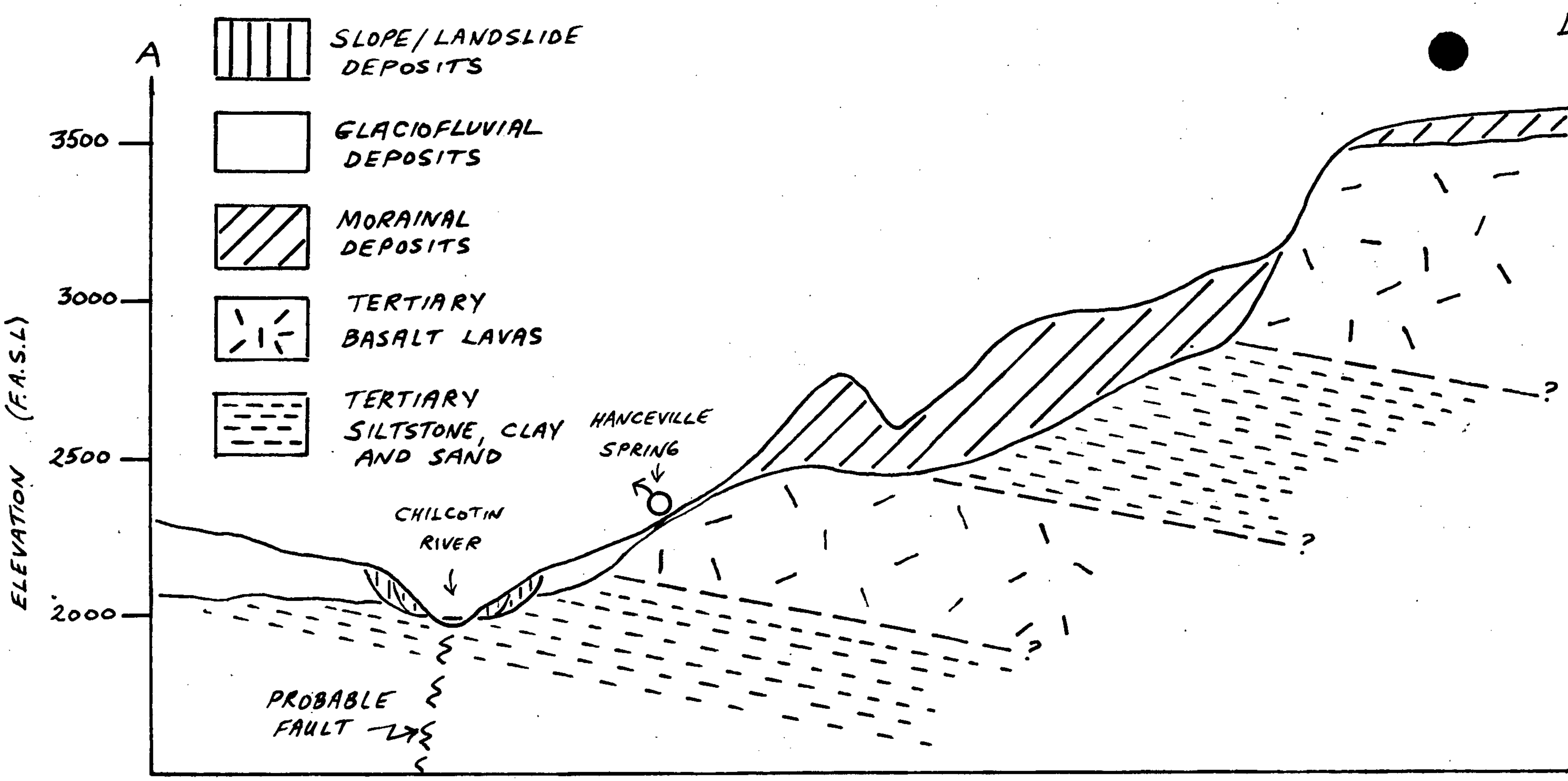
FILE No. 92014 DWG. No. FIG. 2

BCIL 7674-M.E.



Province of British Columbia Ministry of Environment WATER MANAGEMENT BRANCH	TO ACCOMPANY REPORT ON GROUNDWATER AT HANCEVILLE	SCALE: VERT. — HOR. 1:25000 — DATE JAN. 1988 APK ENGINEER FILE No. 92 0 14 DWG. No. FIG. 3.

BCIL 7674-M.E.

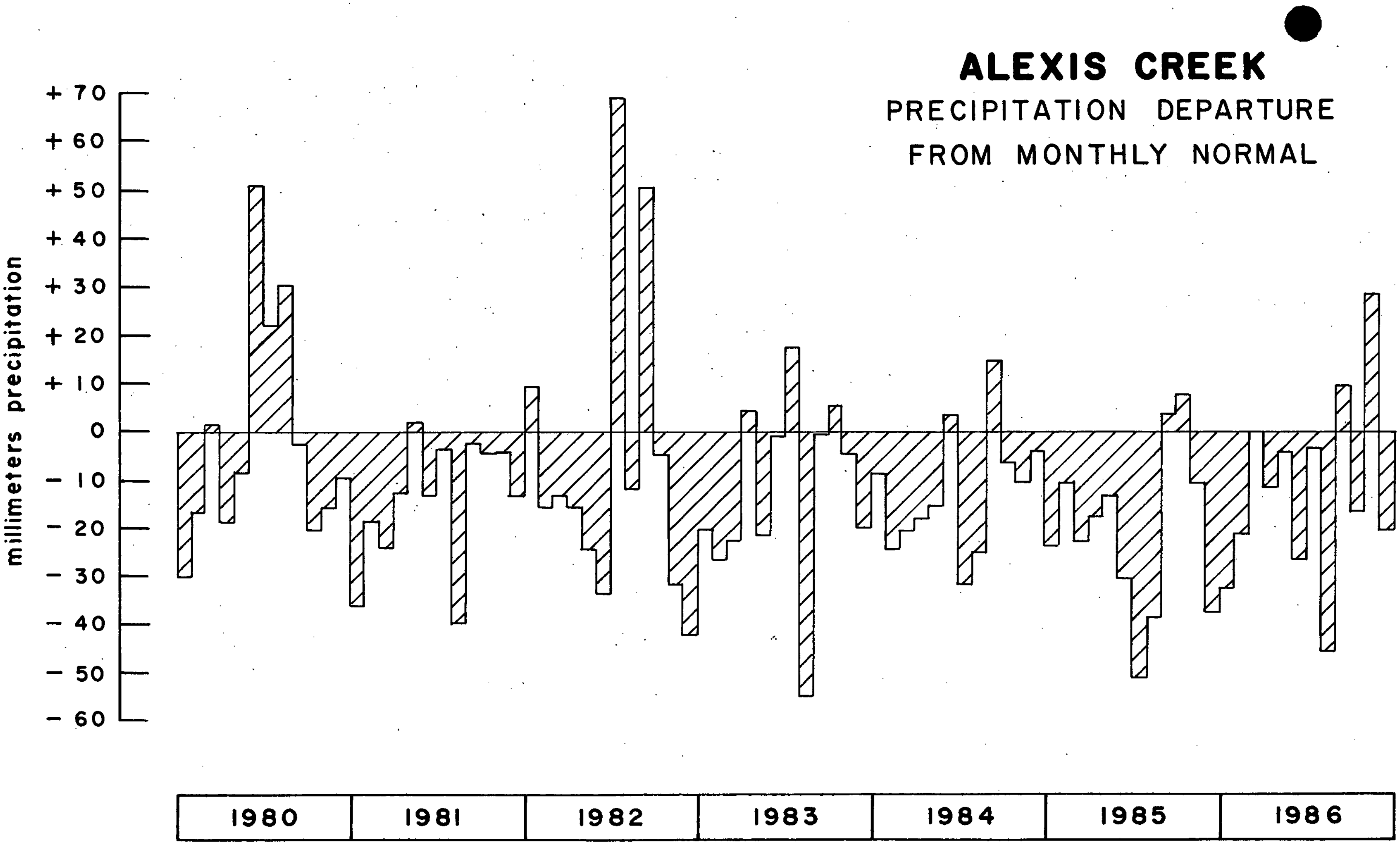


SCHEMATIC GEOLOGIC CROSS SECTION LOOKING WEST
(LOCATION OF SECTION SHOWN IN FIGURE 2)

NOTE: BEDROCK GEOLOGY IS INFERRED AND MAY BE MORE STRUCTURALLY COMPLEX.

Province of British Columbia Ministry of Environment WATER MANAGEMENT BRANCH	TO ACCOMPANY REPORT ON GROUNDWATER AT HANCEVILLE	SCALE: VERT. 1" ≃ 500' HOR. 1:25000	DATE JAN. 1988
		APK ENGINEER	
		FILE No. 92 0 14	DWG. No. FIG. 4.

BCIL 7674-M.E.



Province of British Columbia Ministry of Environment WATER MANAGEMENT BRANCH	TO ACCOMPANY REPORT ON GROUNDWATER AT HANCEVILLE	SCALE: VERT. —— HOR. ——	DATE JAN. 1988
		APK ENGINEER	
		FILE No. 92014	DWG. No. FIGURE 5

BCIL 7674-M.E.