Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

MEMORANDUM

To: Mr. A.P. Kohut, Head
Senior Geological Engineer
Groundwater Section
Water Management Branch

Date: October 25, 1982

File: 0273896-1

Re: Cariboo Nursery - Groundwater Assessment and Recommendations

At the request of Mr. R.K. Natsuhara, Director of Technical Services Branch, Ministry of Forests, an office study was undertaken of the groundwater prospects for the above site. The peak daily water demand is 501,000 U.S. gallons in July. Mr. J. Morgan suggests a well yield of 350 US gpm or 175 US gpm, with a reservoir, would be adequate for the site. The study involved examining available well log data, geologic reports, and air photographs of the site area with these requirements in mind. This memorandum summarizes the prospects for groundwater supply and outlines a test drilling program and associated costs for this work.

GEOLOGIC SETTING

The Cariboo Nursery is situated on a terrace on the east bank of the Fraser River, 20 miles south of Quesnel, B.C. (see Figure 1). Based on an air photograph study and geologic reports by Farstad and Laird (1954), Kohut (1979), Livingston (1963), and Tipper (1971), a surficial geology map of the site area has been prepared (see Figure 2). The site is underlain by terraced fluvial deposits comprising mostly of sand and gravel. Some gravel pits have been burrowed in these deposits. According to Livingston (1963), the terrace deposits at Australian Creek are likely underlain by till, glaciolacustrine, interglacial silt, and older till deposits which overly bedrock. Well log information near the nursery site point to similar findings (see Figures 3 and 4). The maximum thickness of the unconsolidated deposits at the site is unknown but is at least 370 feet based on well log information. The terrace, which extends along the Fraser River, is bounded to the east by 600 foot slopes which rise to the upland plateau.

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The whole region is underlain by poorly consolidated but folded and faulted Tertiary bedrock of conglomerate, sandstone, greywacke, shale, lignite; minor breccia, tuff, and basalt (Tipper, 1959).

GROUNDWATER CONDITIONS

Available well log information of the site area is listed in Table 1; the well locations and approximate well water level elevations are shown in Figure 3. Three of the wells, the Cariboo Oil and Gas Co. Ltd., Kersley Oil and Gas Co., and G.S.C. wells are oil/gas or resource exploration wells. These are the only wells that are completed into bedrock. All other wells are completed into unconsolidated deposits. Some of these shallow wells are reported to yield 'sufficient' quantities of water for the intended use. The Westcoast Transmission well (3), Cariboo Game Farm well, Department of Highways well, and Darrone Ranch well - all significant producers are near the Cariboo Nursery site.

From well logs, both the Cariboo Game Farm and Department of Highways wells and probably the Darrone Ranch well are completed into the same aquifer at elevation 1,350 feet. The extent or trend of this aquifer is not certain. Figure 4 is a vertical cross-section looking north across the nursery site showing the aquifer and the probable water level configuration. From this figure, the water level at the nursery site appears to be about 250 feet below the ground and the aquifer is situated about 370 feet below the ground. The surface terraced fluvial deposit at the site area would appear to be free draining and non-saturated.

Water quality is reportedly hard but good.

Recharge for the aquifer appears to be from the upland areas to the east and from infiltration of precipitation falling on the site area itself. The significance of recharge from upstream of the Fraser River is unknown although the aquifer may be in hydraulic continuity with the river regime.

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SUMMARY AND RECOMMENDATIONS

In summary, all of the water wells in the site area are completed into unconsolidated deposits. Some of these wells yield 'sufficient' quantities of water for the intended use. The groundwater is hard but good. Prospects for a 175 US gpm or 350 US gpm well are encouraging in light of the fact that other wells of similar capacity are located nearby. It would be desirable to try to complete a well to the same aquifer from which the Cariboo Game Farm and Department of Highways wells are tapping.

TEST DRILLING PROGRAM

A test drilling program is recommended for the Cariboo Nursery site (test drill site 'A' on Figure 3). The program includes drilling a telescoping well (10 inch diameter to 200 feet and 8 inch diameter to 450 feet) to a depth of 450 feet at a cost of $54,100 excluding costs for engineering supervision (see Table 2). The purpose of test drilling is primarily to intercept the aquifer and other water bearing zones at depth but also to determine geology and obtain aquifer samples. The greater depth of this proposed well as compared to the two nearby wells allows for greater penetration into the aquifer to give more available drawdown. Drilling should not be continued into bedrock as the quantity and quality of this water is likely to be inadequate. If bedrock is reached before the 450 foot depth, drilling should be stopped. The well should be properly screened and developed. Well interference between the proposed well and the nearby Cariboo Game Farm and Department of Highways wells is a possibility and will depend on how closely the proposed well is located with respect to these wells.

If it is possible to drill a test well off the nursery property to the south near the Darrone Ranch (test drill site 'B' on Figure 3), the test drilling cost would be reduced to $27,400 (see Table 3). At site 'B', drilling through 200 feet of the unconsolidated deposits would be eliminated.

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Prior to any test drilling, a site visit should be made by a groundwater engineer to verify the local geology, check local groundwater conditions (including the possibility of pollution and well interference), and assess site accessiblity for drill rigs. Test drilling, well design, and pump testing should be carried out under the supervision of a groundwater engineer.

REFERENCES

Farstad, L. and D.G. Laird.1954. Soil Survey of the Quesnel , Nechako, Francois Lake, and Bulkley-Terrace Areas in Central Interior Of British Columbia. Report No. 4 of the British Columbia Soil Survey, Canada Department of Agriculture.

Kohut, A.P. 1979. Proposed Irrigation Schemes Kersley - Alexandria Area near Quesnel. Unpublished memorandum. Ministry of the Environment, Groundwater Section, Victoria.

Livingston, E. 1963. Groundwater Possibilities at Australian Creek, B.C. Open file. Ministry of Environment, Groundwater Section, Victoria.

Tipper H.W. 1971. Surficial Geology, Quesnel, British Columbia, Map 1290A. Geological Survey of Canada, Ottawa.

Tipper, H.W. 1959. Geology, Quesnel, Cariboo District, British Columbia, Map 12-1959. Geological Survey of Canada, Ottawa.

Mike Wei

M. Wei
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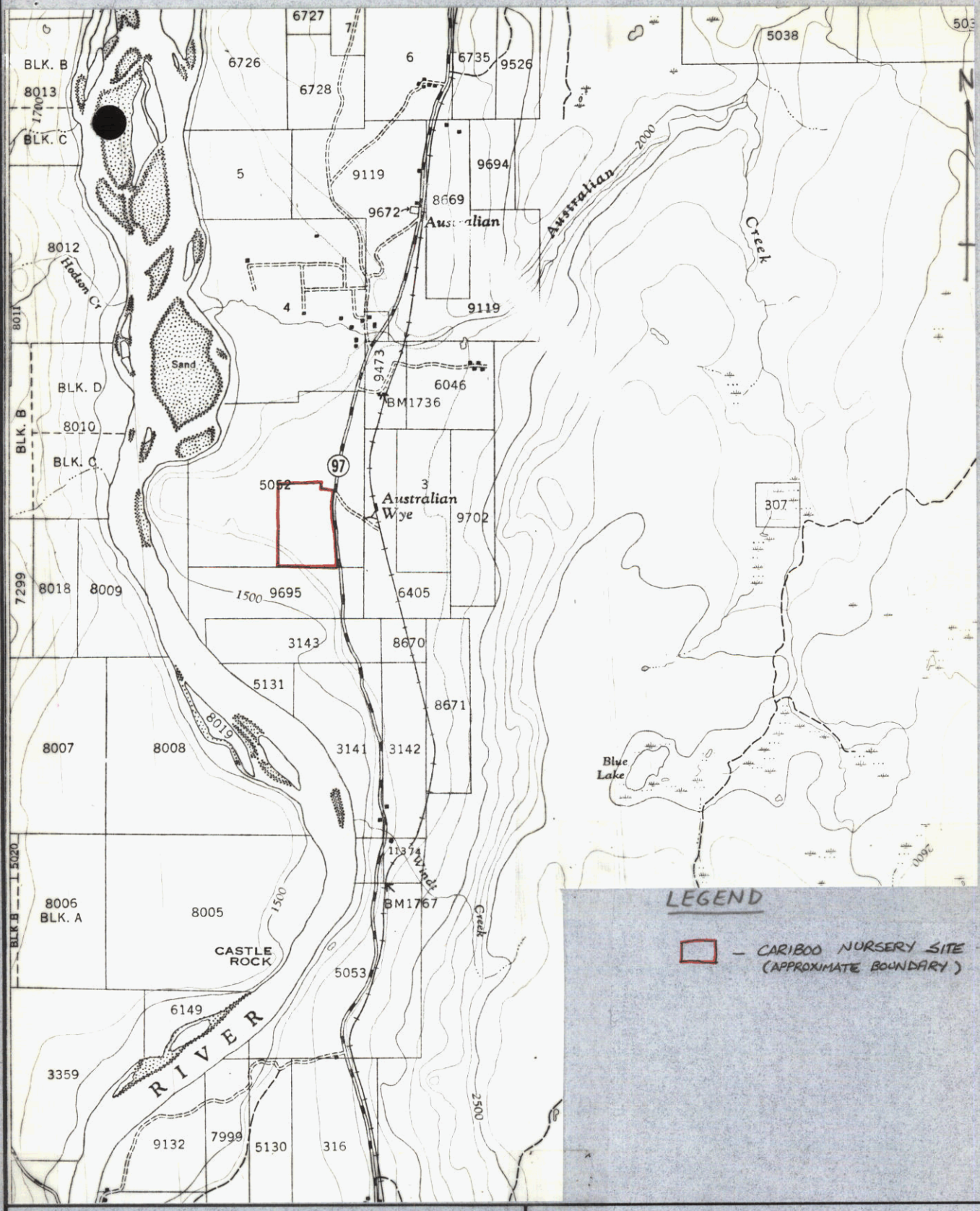
Groundwater Section
Water Management Branch

CARIBOO NURSERY, QUESNEL, B.C.



Province of British Columbia
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WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON
CARIBOO NURSERY – GROUNDWATER PROSPECTS

SCALE: VERT. —
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DATE
OCT. '82

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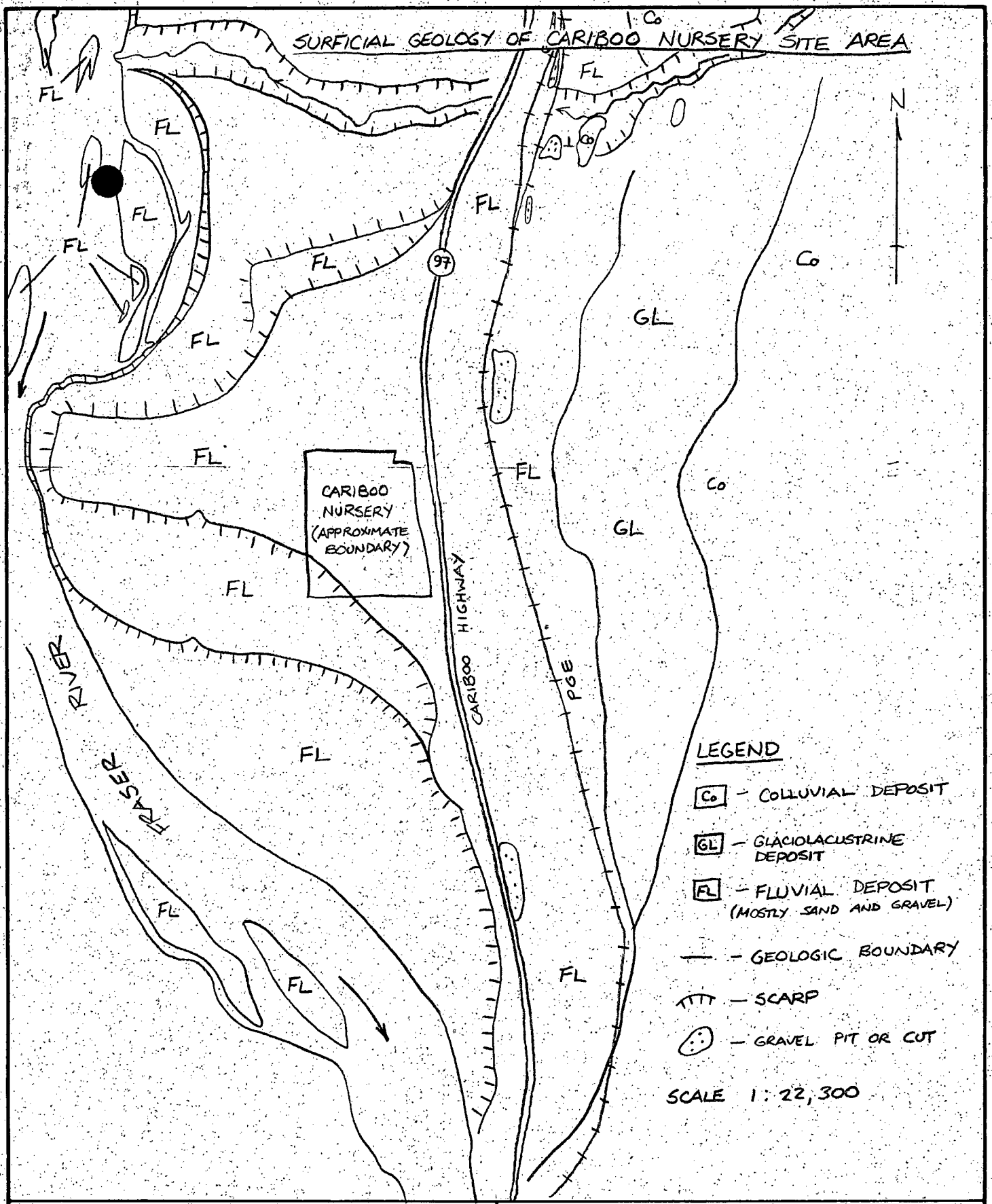
FILE No. 93B9 W½ DWG. No. FIGURE 1

BCIL 7673-M.E.



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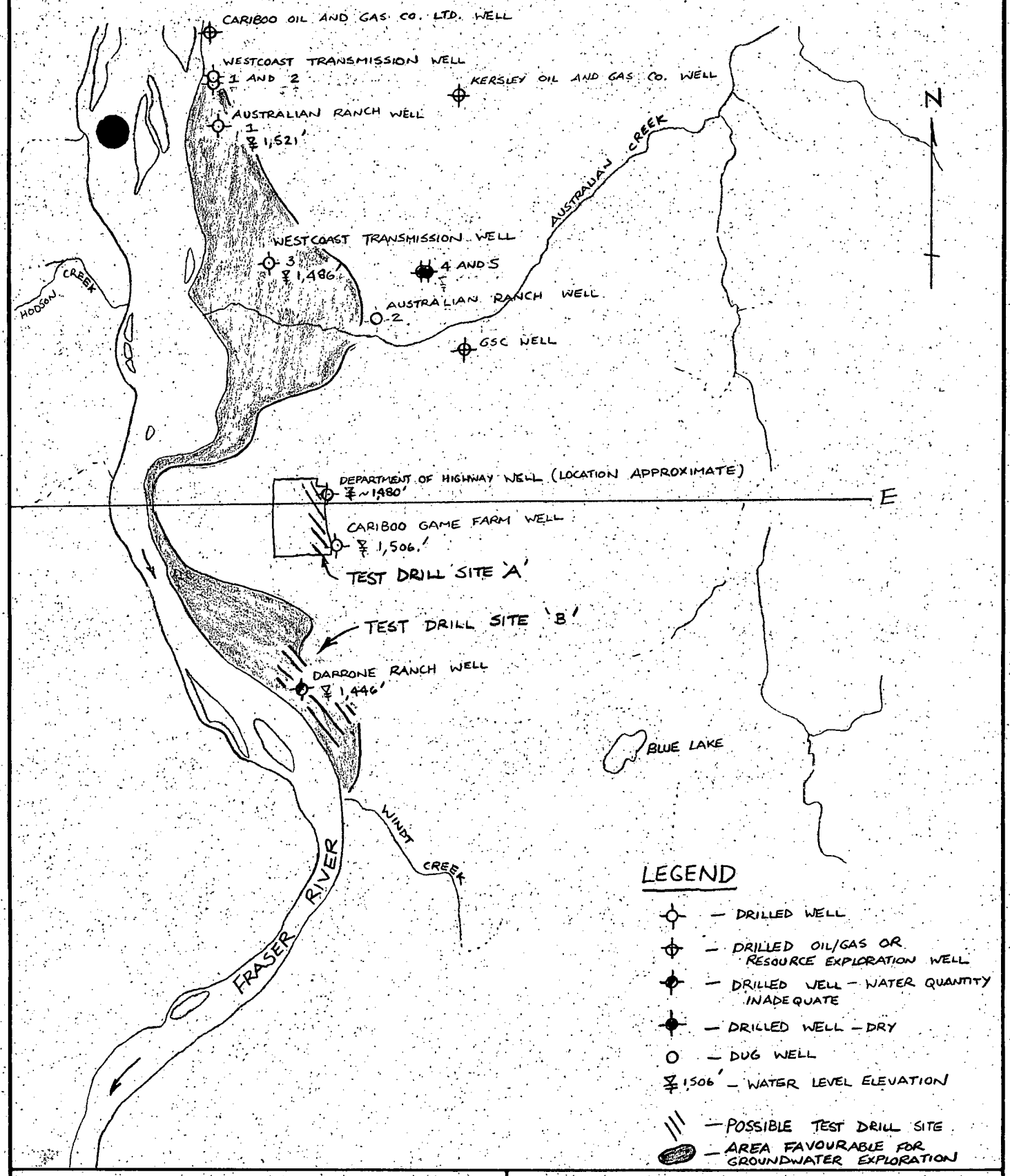
FILE No. 93B9W 1/2 DWG. No. FIGURE 2

BCIL 7673-M.E.

WELL LOCATIONS AND WELL WATER LEVELS, CARIBOO NURSERY AREA



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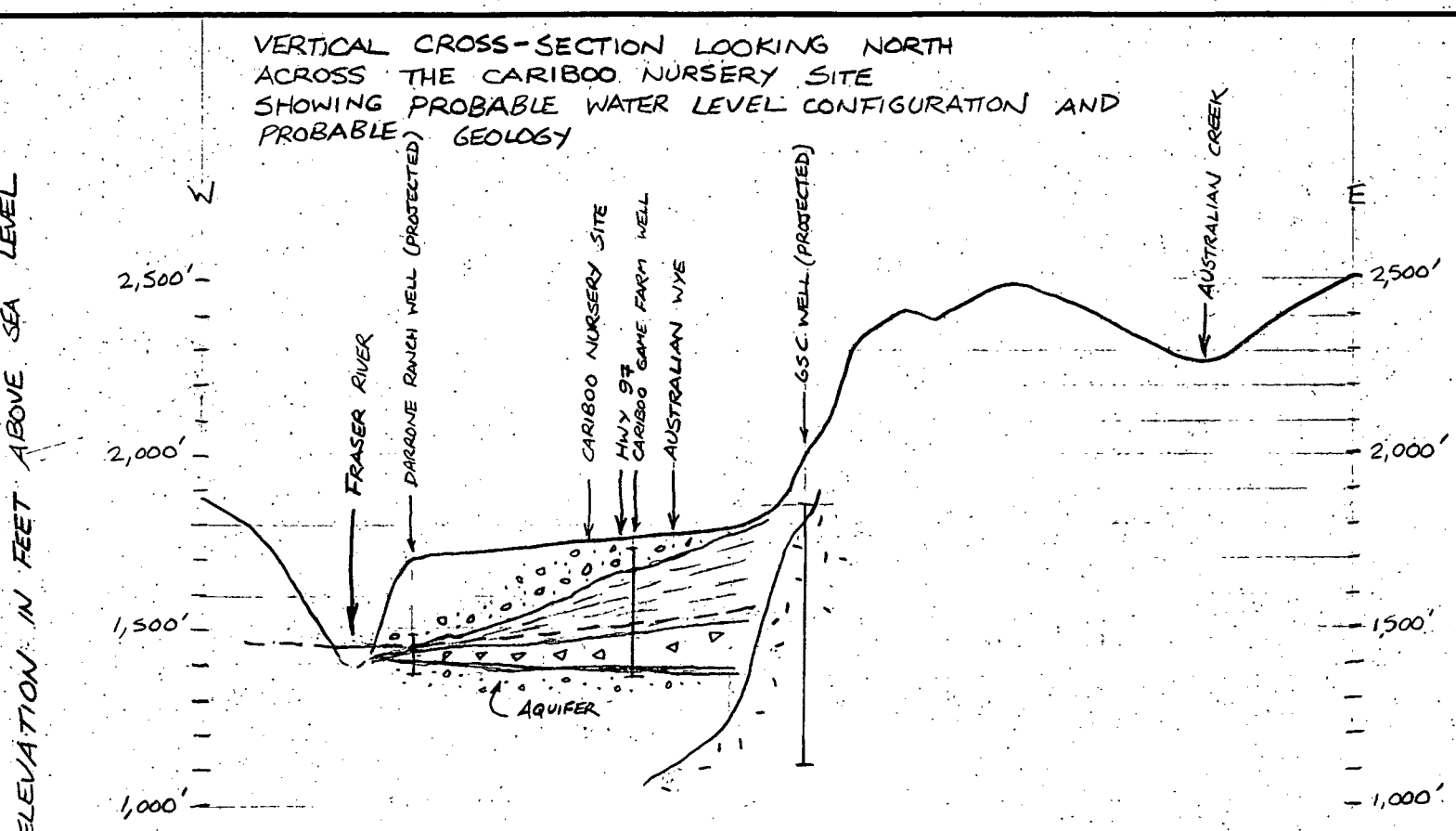
FILE No. 93B9 N½ DWG. No. FIGURE 3

BCIL 7673-M.E.

VERTICAL CROSS-SECTION LOOKING NORTH ACROSS THE CARIBOO NURSERY SITE SHOWING PROBABLE WATER LEVEL CONFIGURATION AND PROBABLE GEOLOGY



LEGEND

- — — — ASSUMED WATER LEVEL
- I — WELL
- ——— INTERPRETED GEOLOGIC CONTACT

VERTICAL EXAGGERATION | 8.2 X

- SAND AND GRAVEL
- CLAY / SILT
- TILL
- BEDROCK

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FILE No. 93B9 W½ DWG. No. FIGURE 4

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TABLE 1

Summary of Well Log Information, Cariboo Nursery Area, 1982

Owner	Reference	Method of Well Construction	Depth of Well (ft)	Diameter of Well (in)	Screened Interval (ft)	Depth to Water (ft)	Approximate Water Level Elevation (ft)	Reported Yield (gpm)	Water Quality	Note
1. Cariboo Oil & Gas Co. Ltd.	Z9, X11, Y24	Rotary	1,605		-			-	-	Oil Well
2. Westcoast Transmission										
(1)	Z9, X11, Y24	Drilled	50		-					
(2)	Z9, X11, Y24	Drilled	60		-					
(3)	Z9, X11, Y13	Drilled	84			64	1,486	200	Hard	
(4)	Z9, X12, Y18	Drilled	200		-	-	-	Dry		
(5)	Z9, X12, Y18	Drilled	300		-	-	-	Dry		
3. Australian Ranch										
(1)	Z9, X11, Y24	Cabletool	110	6		29	1,521	8	pH = 7.4 Total Hardness = 239 ppm Fe = 1 ppm Hard	
(2)	Z9, X12, Y7	Dug	25		-	Varies	-			
4. Kersley Oil & Gas Co.	Z9, X12, Y19	Rotary	1,380	10.5	-			-	-	Oil Well
5. G.S.C.	Z9, X12, Y7	Drilled	708		-			-	-	Coal Exploration Well
6. Cariboo Game Farm	Z9, X11, Y1	Drilled	370	6 5/8	343-363	223.7	1,506.3	40	Good	Potentially up to 500 gpm yield reported
7. Ministry of Highways	Z9, X11, Y1	Air Rotary	378	6		270	1,480	30	Good	
8. Darrone Ranch	Z8, X11, Y36	Cabletool	120	6 & 12		34	1,446			Well abandoned

TABLE 2

Test Drilling Costs, Cariboo Nursery, Site 'A'

Mobilization and demobilization	$	1,000.
Drilling (450') 10" diameter hole with casing (200 ft), cabletool method @ $70/ft.....	$	14,000.
8 " diameter hole with casing (250 ft), @ $60/ft).....	$	15,000.
Drive shoes 10" and 8"	$	573.
Screen (30') 8" diameter @ $105/ft	$	3,150.
Casing (overlap) 8" diameter, 200 ft @ $19/ft....	$	3,800.
Hourly work (40 hours) @ $100/hour	$	4,000.
Authorized Standby (16 hours) @ $60/hour	$	960.
Pump test (24 hours pumping, 3 hours recovery, 27 hours total)		
Mobilization and demobilization	$	1,000.
Install and remove pump	$	1,800.
Hourly rate pumping 24 hours @ $50/hour ...	$	1,200.
Hourly rate recovery 3 hours @ $50/hour ..	$	150.
Rent of discharge pipe (350') @ $1/foot	$	350.
Sub-total	$	46,983.
plus 15% Contingencies	$	7,047.
TOTAL COST	$	54,030.

TABLE 3

Test Drilling Costs, Cariboo Nursery, Site 'B'

Mobilization and demobilization	$	1,000.
Drilling (200') 8" diameter hole with casing, cabletool method @ $60/ft.....	$	12,000.
Drive shoe 8"	$	208.
Screen (30') 8" diameter @ $105/ft	$	3,150.
Hourly work (20 hours) @ $100/hour	$	2,000.
Authorized Standby (16 hours) @ $60/hour	$	960.
Pump test (24 hours pumping, 3 hours recovery, 27 hours total)		
Mobilization and demobilization	$	1,000.
Install and remove pump	$	1,800.
Hourly rate pumping 24 hours @ $50/hour ...	$	1,200.
Hourly rate recovery 3 hours @ $50/hour ..	$	150.
Rent of discharge pipe (350') @ $1/foot	$	350.
Sub-total	$	23,818.
plus 15% Contingencies	$	3,573.
TOTAL COST	$	27,391.