HC-HAT CREEK 75(10)B

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HYDROELECTRIC DESIGN DIVISION

CIVIL DEPARTMENT

MEMORANDUM ON HAT CREEK EXPLORATION PROGRAM PROGRESS REPORT

Prepared by: P. T. McCullough

JULY 1975

TABLE OF CONTENTS

List of Figures

List of Tables

SUMMARY

Exploration for coal in Hat Creek Valley has been divided into 2 stages. The first stage and the early part of the second was restricted to the No. 1 Openpit. Reserves for a thermal plant were increased from 388,613,000 short tons to 566,887,000 short tons. Of the latter reserve 478,624,000 is proven or probable. Assuming a 25° pit slope decreased the reserves available to the plant to 420,528,000 short tons. In changing from a 45° slope to a 25° slope the waste and overburden to coal ratio increased from 1.07:1.00 to 2.64:1.00.

Exploration in the southern part of the valley was initiated to determine if there was a more favorable openpit site. To aid in localizing the drill program gravity and magnetometer surveys were completed over the whole valley. These surveys indicated that the most favorable area in the southern part of the valley (designated No. 2 Openpit) lies along a narrow belt in the east and central parts of the valley. Subsequent drilling has located coal zones in excess of 1600 feet thick in this area.

Coal reserves at No. 2 Openpit site are estimated at 1.5 billion tons. The main zone is open to the north and at depth, however a fault appears to terminate the main zone between 20,000S and 28,000S; faults also appear to restrict the zone on the east and west. Based on gravity and diamond drill information the main zone is approximately 18,000 feet long, but is less pronounced to the north and south; it is approximately 2,500 feet wide, and greater than 1,900 feet deep. Exploration in this zone and in other parts of the gravity anomaly is continuing.

A mining consultant to be retained shortly will help evaluate which of the two sites found to date is more favorable.

Geological mapping has indicated that the dominant geological structure is a synform which has been offset by a number of gravity and perhaps strike-slip faults.

Under Stage 3 a possible pit site would be drilled in detail. Stage 3A would correlate geological structure whereas Stage 3B would explore continuity of grade and thickness and study slope stability. It is estimated that 30,000 feet of drilling would be required for 3A and 20,000 feet for 3B. A rotary drill test program would be initiated to help reduce costs. "In situ" permeability and static piezometric pressures should be measured; geological mapping, core logging, surface geophysical, and borehole geophysical programs should continue.

HAT CREEK EXPLORATION PROGRAM - PROGRESS REPORT

INTRODUCTION

B.C. Hydro is studying the coal potential of Upper Hat Creek Valley. Coal fired thermal power generation from Hat Creek Valley appears to be an economical means of meeting the projected electrical energy load growth of 8.6 per cent per annum. The advantages of Hat Creek power are the following:

1. It can be brought on line quickly.
2. It requires less capital expenditure than alternate sources of power.
3. It is closer to lower mainland customers than potential hydroelectric sites.

Upper Hat Creek Valley is located 17 miles southwest of Cache Creek, B.C. and is accessible by paved and gravel road from Cache Creek.

Exploration to date is divided into 2 stages. The first stage and part of the second involved drilling to establish the potential of the previously known deposit (No. 1 Openpit). The second stage emphasized exploration of the whole valley south of the No. 1 Openpit. Because of the success of Stage 2 it was extended under the heading Stage 2B.

The area involved in Stage 1 is approximately 5 square miles. The area involved in Stages 2 and 2B is approximately 45 square miles. To concentrate the drilling programs on the more favorable areas geological mapping, thermal infrared imagery, induced polarization, vertical loop electromagnetic, gravimetric and total field magnetic surveys were tested. Of these techniques geological mapping, gravimetric, and total field magnetic surveys have proved the most useful and are continuing.

REGIONAL GEOLOGY

Reconnaissance geological mapping of Upper Hat Creek Valley was begun last fall by Dolmage-Campbell and Associates. B.C. Hydro, Geotechnical Section, and Dolmage-Campbell are continuing this program within the valley and in the surrounding area (Figure 1). The purpose of this mapping is to determine the regional geological structure which in turn aids in interpreting structural data from Hat Creek Valley.

Mapping, diamond drill core logging, and geophysical information have indicated the following geological section (youngest to oldest):

A. volcanic rocks: vesicular basalt, dacite, rhyolite, lahar.

B. sedimentary rocks (Coldwater beds):

lake deposits (>1,200') -	(i)	siltstone, claystone
swamp deposits (>1,600') -	(i)	coal
	(ii)	siltstone, claystone, with minor conglomerate and sandstone; commonly carbonaceous (may be absent).
	(iii)	coal
river deposits (>4,500'?)	(i)	sandstone, siltstone, conglomerate, with minor shale and claystone.

C. marble and volcanic rocks

The rocks of Upper Hat Creek Valley are deformed into a synform (Figure 2), resembling an elongate trough, which has been dissected and tilted by successive faults. In the No. 1 Openpit the synform plunges south at 25°. Little information is available regarding the plunge in the south, but it appears to be less than 25°.

The main faults are post-depositional and possibly syn-depositional gravity faults. The latter may be responsible for the extreme thickness of coal; movement on these syn-depositional faults may have been such that the rate of subsidence was equal to the rate of peat accummulation, therefore the environment under which peat formed was maintained for a long time.

EXPLORATION METHODS

During the period September 4 through September 11, 1974 a ground geophysical test program was conducted to determine which of the 4 systems: induced polarization - resistivity, total field magnetism, vertical loop electromagnetism, and/or gravity would respond to the coal measures in Hat Creek Valley. The test survey was conducted on line 9,000N by McPhar Geophysics (Figure 1). It was concluded that there was no conductor that was detectable by a vertical loop electromagnetic survey; similarly induced polarization and resistivity were of no value because of the lack of a chargeable source (sulphide minerals) and low resistivity of the sedimentary rocks respectively. The results of the gravity survey, which measures disturbances of the Earth's gravity, were judged inconclusive. The magnetometer, which measures disturbances in the Earth's magnetic field, proved useful as a mapping tool and a magnetometer survey was completed over the bottom of the valley by December, 1974.

Subsequently in April and May, 1975 a review of the data from the gravity test line by B.C. Hydro geophysicists revealed that gravity would be useful in detecting thick sequences of coal. The contract for a test survey of 30 line-miles centred at line 15,000S was awarded to C. Agar and Associates (Figure 1). Work commenced on May 29, 1975. The initial results substantiated results on test line 9,000N; near surface, thick coal sequences are readily detectable by gravimeter; detection of deeper coal requires more sophisticated interpretation and data processing, some of which has been completed. As a result of this test the survey was extended over the entire valley.

The gravity survey has been completed from line 18,000N to 48,000S (Figure 1), generally on 4,000 foot line spacing. Gravimetric relief on a simple Bouguer gravity plot is as much as 38 milligals with gradients of as much as 1 milligal per 200 feet. Such gravimetric relief is extreme. Gravity as low as 442 milligals indicates significant near surface coal. Preliminary gravity modelling by B. C. Hydro geophysists indicates a zone of near surface coal 2,500 feet wide extending north northwest along the old Hat Creek road between 6,000S and 21,000S. This site is designated No. 2 Openpit. The zone is 101 feet to 888 feet from surface and is greater than 1,600 feet thick. No drill hole in this area has encountered the base of the coal zone with certainty. The zone is bounded by steeply dipping north northwest trending faults on the east and west. An easterly trending fault has resulted in the block to the south being dropped down thereby cutting off the zone.

The gravity data is being processed to determine:

1. The amount of the anomaly due to coal.

2. A model that approximates the shape of the coal zone.

The gravity anomaly is less pronounced south of 20,000S. The reduction is due to:

1. thinner vertical apparent coal thickness (i.e. less angle of dip),

2. possible thinning of the coal zone,

3. and/or greater depth to the top of the coal.

Synchronously with the gravity survey a magnetometer survey was conducted by B.C. Hydro geologists. The grid lines went beyond those of the initial McPhar survey. The proton precession magnetometer detects local rock magnetism which modifies the Earth's magnetic field. The magnetometer has been useful in differentiating two volcanic members, Coldwater sedimentary rock, and possible marble. The magnetic and gravity data will also be used to estimate the depth to the crystalline basement underlying the Coldwater beds and in formulating a geological model for the valley.

DIAMOND DRILL PROGRAM

Drilling conditions are difficult due to caving and/or squeezing of drill holes. Most drill holes cave soon after or during drilling. Stage 1 ended on Nov. 1, 1974; Stage 2 ended May 15, 1975. Forty-six diamond drill holes and 4 rotary holes were drilled in rock during Stages 1 and 2 (Figure 1). To date in Stage 2B 11 diamond drill holes have been completed. For drill holes to date direct costs have ranged between $15.00 and $22.00 per foot depending on:

1. weather conditions,
2. road conditions,
3. distance from camp,
4. drilling conditions.

Recently direct costs have been ranging from $17.00 to $18.00 per foot.

In drilling in the No. 1 Openpit a rotary drill test program was attempted to assess its advantages. Costs were comparable to diamond drilling, however there is a significant loss of structural and other geological information in rotary drilling. There is a rotary drill that was unavailable at the time of the test program that may be available for detailed drilling of a pit site. It is hoped that this drilling method can significantly reduce costs.

BOREHOLE GEOPHYSICAL LOGGING

Borehole geophysical logging techniques that have been used at Hat Creek are gamma ray, bulk density, caliper, resistance, neutron, and self potential (SP) logs. Gamma ray measures the natural radioactivity of the formations, neutron indicates radiation reflected from or induced in the formations as a consequence of bombarding the formations with neutrons emitted from a source contained in the sonde. The SP log records naturally occurring potential differences between a surface electrode and an electrode in the column of mud. Resistivity measures the electrical resistivity of the beds. Bulk density is measured by recording gamma rays absorbed in the surrounding rock; rays reaching the detector vary as the inverse of the density of the rock. The caliper log measures the diameter of the hole. Of these gamma ray, bulk density, caliper, and resistance logs have proven particularly useful in correlation between drill holes and in interpretation of zones of caving.

In utilizing drill core and geophysical logs there is a continuing emphasis on locating unique marker horizons and possible repetition of rock layers. No evidence of repetition has been found to account for thicknesses in excess of 1,600 feet of coal, a condition that is to date unique.

The use of borehole geophysical logs will be enhanced in defining geological contacts and in correlation if rotary drilling proves practical in detailed drilling of a pit site. New Coal Act regulations have made borehole logging mandatory; the requirement may be waived at the discretion of the Chief Gold Commissioner.

NO. 1 OPENPIT

INTRODUCTION AND GEOLOGY

Pre-1974 the geological structure was believed to be a series of westerly dipping beds indicative of the east flank of a syncline.

The purpose of the drilling in 1974-1975 was to outline near surface coal around the known deposit without regard for the possible resource of the valley and to define the structure of the No. 1 Openpit.

As a result of recent drilling it is concluded that the geological structure of the No. 1 Openpit is an asymmetric syncline with an adjacent faulted anticline on the east. The zone extends possibly as far south as the Trig fault where it appears to be down-dropped on the south side (Figure 1). East of the Mag fault the coal has been down-dropped resulting in the possiblity of an extensive zone of deep coal. This zone could be tested with additional drilling in the No. 1 Openpit. Section 9,000N is representative of the No. 1 Openpit (Figure 2). The coal zone has an apparent thickness on this section of 1,460 feet. The coal is concentrated in the central zone with thinner coal on each flank.

DIAMOND DRILLING AND COAL RESERVES

Pre-1974 diamond drilling outlined 388,613,000 short tons of coal of subituminous B grade at approximately 6,000 Btu's/lb. and 28% ash. A summary of drill results is listed in Table 1.

Drilling in Stage 1 and the first part of Stage 2 is summarized in Table 2. The results show significantly less coal intersected in relation to the footage drilled than the previous program; this is due to an attempt in the latter program to outline the margins of the deposit.

The 1974-1975 drilling in No. 1 Openpit increased the total coal reserve available to the powerhouse to 566,887,000 short tons of similar grade to that above. If 45° pit walls are assumed the waste and overburden to coal ratio is 1.07:1.00. However with the possibility that 45° pit walls could not be maintained a new estimate was made based on 25° pit walls and a maximum depth to 2,000 feet elevation. Reserves in all categories are 420,528,000 short tons with a waste and overburden to coal ratio of 2.64:1.00.

ANALYSES

The analytical results from the No. 1 Openpit have been processed on B.C. Hydro's computer.

The mean ash and calorific values for 1957-1959 and 1974-1975, weighted for core length, are as follows:

	Moisture(%)	Ash(%)	Gross Btu/lb.
samples below 44% ash	20.00	25.72	6266
samples above 44% ash	20.00	50.36	2785
all samples	20.00	28.09	5931

Twenty percent is used as a best estimate of moisture at this time.

Sulphur content as determined is 0.37% which is possibly .04% low due to rounding-off effects in the computer. The fuel ratio (fixed carbon: volatile matter) is lower in the 1957-1959 holes (0.813) than in the recent drilling (0.979); the difference is probably due to analytical technique.

The Hardgrove grindability index for 1974-1975 drilling at 20% moisture is the following:

	Hardgrove Index	
Product	Mean	Range
25% ash	42	37-47
31% ash	48	45-53

The Hardgrove grindability index is a measure of the energy required to pulverize the coal; the higher the index the lower the energy expended in pulverizing the sample.

The means for ultimate analyses of 53 composite samples from 1974-1975 drill holes dry, at 20% moisture, at 25% ash (20% moisutre) and at 31% ash (20% moisture) are as follows:

	Dry(%)	20% Moisture(%)	25% Ash(%)	31% Ash(%)
Carbon	43.50	34.80	37.72	33.62
Hydrogen	3.39	2.71	2.94	2.62
Nitrogen	1.06	0.85	0.92	0.82
Chlorine	0.03	0.02	0.02	0.02
Oxygen	14.92	11.94	12.93	11.51
Sulphur	0.51	0.41	0.41	0.41
Ash	36.59	29.27	25.00	31.00
Moisture	0.00	20.00	20.00	20.00

The unweighted average for all samples on which ultimate analyses have been obtained is summarized below:

Constituent	Oxide	Average of all samples (%)
Phosphorus	P_2O_5	0.24
Silica	SiO_2	54.33
Iron	Fe_2O_3	7.40
Alumina	Al_2O_3	28.80
Titanium	TiO_2	0.83
Lime	CaO	2.66
Magnesium	MgO	1.40
Sulphur	SO_3	1.88
Potassium	K_2O	0.53
Sodium	Na_2O	1.12
Undetermined		0.91

Additional samples with high ash content (approximately 10% carbonaceous material) are being analyzed, so these sections could be included in the reserves as technology improves.

SOUTHERN EXPLORATION

INTRODUCTION

Stage 2 drilling and valley exploration were initiated to locate a site or sites in the southern part of Upper Hat Creek Valley that are potentially more favorable than the No. 1 Openpit (Figure 1). Stage 2 diamond drilling south of No. 1 Openpit was regulated by 4 factors:

1. areas of low magnetics,
2. accessibility to lease-held land where most of the holes were drilled,
3. accessibility during the winter and during spring break-up,
4. favorable drill results.

GEOLOGY

The geology in and around Hat Creek is not well understood due in large part to the paucity of outcrops. Duffell and McTaggart (1952) of the Geological Survey of Canada mapped the area south of Ambusten Creek (Figure 1) as volcanic rock. Subsequent magnetometer surveying has indicated that the area is underlain by sedimentary rocks and therefore has coal potential. Geological mapping is continuing by the B. C. Department of Mines, Dolmage-Campbell, and B.C. Hydro.

The dominant geological structure is a partial synform as in No. 1 Openpit. The synform is terminated by faults on the east and west. Beds, on the east flank, trend 150° to 170° and dip 30° west; on the west flank it is expected the strike is similar, but the dip is approximately 45° east (?). The Coldwater beds on line 15,000S appear to be thick based on gravity and diamond drilling (Figure 2).

Because of the magnetometer survey the basement volcanic rocks are believed to dip consistently to the west. The western margin of the basin is defined by volcanic rocks and the eastern margin by marble giving the valley an effective width of 2 1/2 miles. The valley length, south of the No. 1 Openpit, is 10 miles.

Overlying the Coldwater beds is a lahar (volcanic mudflow) of the Kamloops group which forms small outliers that dot the valley.

The valley forms a down-dropped fault block flanked by extensive volcanic rocks. The westernmost fault acts as a channelway for groundwater which derives from the mountains on the west; these mountains are in excess of 6,500 feet high. The result is artesian flow which in turn results in quicksand and drilling difficulties on the west side of the valley.

Fortunately due to favorable access conditions and magnetics drilling in Stage 2 was concentrated on the east side of the valley where subsequent drilling and gravity surveys have indicated all the near surface coal in the south part of the valley is concentrated. The drilling results are summarized in Table 3.

STAGE 2B

Stage 2B was initiated to explore the area around DDH-75-62 in which there was 1,475 feet of coal and coaly sedimentary rocks, to explore the remainder of the valley south of No. 1 Openpit, and to define the geological structure of the southern part of the valley. With these goals in mind a fence of holes DDH-75-66, 67, 71, 69 and 65 were drilled to test the structure (Table 4). The drilling has indicated a synform as described previously. The gravity survey indicated that drilling should be localized on the east side of the valley. Drill holes 75-65, 69, 70, 68, 73, 74, and 77 were drilled to test the area around DDH-75-62. A number of sites (A through D) are located to continue to test this area. Diamond drill holes 59, 72, 75, and 76 were drilled to test the south end of the valley with particular emphasis on the area around DDH-75-57. Sites E, F, and G are to test the gravity low in other parts of the valley; the weaker gravity response at these latter sites in relation to line 15,000S is in part due to the flatter dip of the beds which results in a lower density contrast affecting the gravimeter.

To date only the area between 6,000S and 21,000S (No. 2 Openpit) appears to have that potential. Additional drilling is recommended in this area.

DIAMOND DRILLING AND COAL RESERVES

Diamond drilling in Stage 2 and Stage 2B has indicated a large coal reserve 101 to 888 feet below surface. To date 6 holes have penetrated this zone (DDH75-60, 62, 68, 73, 74 and 77). Only DDH75-73 may have penetrated through the coal zone; the remaining drillholes ended in coal. The zone appears to consist of 2 main seams 450 to 500 feet and 850 feet thick. These seams are separated by a zone of mixed coal, siltstone and claystone.

It is estimated the coal zone is 2,500 feet wide, greater than 1,900 feet thick (apparent thickness), and approximately 18,000 feet long. The total estimated reserve to 1620 elevation (approximate depth of penetration of the drill holes) is 1.5 billion tons. Only thick units of waste have been excluded from this figure however at least 5 of the 6 holes were still in coal when they had to be abandoned. The gravity results were used to project between drill holes and to determine the southern, eastern, and western limits; the northern limit was arbitrarily taken at half the distance between DDH-75-77 and a proposed drill hole on line 6,000S. The gravity anomaly continues to line 6000S. A factor of 21.6 cu. ft. per ton was used in conversion from volume to weight.

Gravity results indicate there is considerable deep coal west of the block considered in the reserve; the top of this coal zone could be as deep as 2000 feet (Figure 4). A small block of coal is possible on the east side of the main zone. The coal zone extends to the south of DDH-75-60, but it is not of so high a grade.

Additional deep coal is concentrated near DDH-75-57. There is a significant thickness of waste between the upper and lower coal seams (Figure 3). Overburden in this area is very thick. Gravity results indicate the coal does not reach the surface.

Subsequent drilling in Stage 2B is expected to add to the reserve north of DDH-75-77.

The resource of Upper Hat Creek Valley based on drilling and gravity to date and exclusive of the No. 1 and No. 2 Openpit deposits is estimated at 2 billion tons of deep coal.

Analyses of core samples is continuing; results of Stage 2 drilling should be available shortly.

Stage 2B should be completed by the third week of August.

STAGE 2C

Drilling in Stage 2B has outlined approximately 1.5 billion short tons of coal, however the margins are not well defined. To make an effective decision on whether to develop Openpit No. 1 or Openpit No. 2 these margins must be known; it is therefore recommended that additional drilling be undertaken around the No. 2 Openpit. Four drill holes, including two in progress, will be used to test the north-south extension of the gravity anomaly. Another four holes will be drilled on the west side of the anomaly and four on the east side, the latter including one hole in progress.

These holes together with two additional holes in the south between DDH-75-56 and DDH-75-57 should complete both the exploration of Hat Creek Valley and the investigation of Openpit No. 2.

The result of this additional 15,000 feet of diamond drilling is a drill hole density of approximately 4 drill holes per square mile along the line of the deposit. Of these holes a number (4 to date) had to be abandoned before reaching the desired depth. The 15,000 feet being proposed includes 1,000 feet at an unspecified location to drill any unexpected extension.

It is anticipated Stage 2C could be completed between October 1 and 15.

RECOMMENDED STAGE 3 PROGRAM

The purpose of Stage 3 is:

A. to correlate individual beds for further interpretation of the geological structure,

B. to ensure continuity of grade and thickness and to study stability of pit margins.

Stage 3 is therefore naturally divisible into a geological section 3A and a mining engineering section 3B.

Geological and borehole geophysical correlations have been made on some sections in the No. 1 Openpit area and between some sections in the No. 2 Openpit area. Stage 3A would enlarge on these correlations until there is confidence in projections along and between sections. It is estimated that this stage would require about 30,000 feet of drilling. A rotary drill test program would be initiated to try to reduce costs. The drilling program would be detailed by a mining consultant to be retained shortly. Geological mapping, core logging, surface geophysical (gravity and possibly magnetometer), and borehole geophysical programs would accompany the drilling. Engineering studies on slope stability would be initiated during this stage.

Stage 3B would involve detailing of stability problems. Further holes, which need not penetrate the entire coal zone, would be drilled to further outline areas more susceptible to initial open pit mining with regard to accessibility, grade, and thickness. As much as 20,000 feet of drilling may be needed for this stage. The amount would depend on the results of Stage 3A.

As part of Stage 3 "in situ" permeability and static piezometric pressures should be measured in new drill holes with sufficient density to ensure a thorough knowledge of hydrogeological conditions. Resulting stand-by time would have it effect of slowing drilling significantly. No allowance has been made for powerplant site investigations, water line and reservoir investigations, or Hat Creek diversion; these studies would have to be done simultaneously with Stage 3, but would be budgeted separately.

TABLE 1

Results of Drilling 1957 and 1959 [1]

Hole No.	Hole Length	Over-burden	Depth to coal [2]	Total Coal/ Total Rock [3]	Comments [4]
57-8	1118	58	58	966/984	In coal zone
9	1074.5	89	182.5	804.5/965.5	1 zone
10	542	65	134	284/398	1 zone
11	421	147	147	239/239	3 zones, in zone
12	674	10	76	385/664	3 zones, in zone
13	652	86	177	273/474	In coal zone
14	654	75	75	579/579	In coal zone
15	545	93	390	155/452	In coal zone
59-16	1301	39	39	858/1272	In coal zone
17	1190	46	54	834/863	In coal zone
18	936	50	53	738/886	In coal zone
19	835	23	23	365/368	In coal zone
20	732	66	66	608/608	In coal zone
21	422	200	200	176/182	In coal zone
22	785	80	80	489/489	In coal zone

1 - All measurements are in feet.

2 - Refers to distance from collar to top of coal.

3 - Figures are approximate; total coal includes thin intervening waste horizons; total rock excludes overburden. Refers to total coal and rock to the bottom of the main coal zone; thin, isolated, deep layers are excluded.

4 - In coal zone: indicates the hole ended in coal or interbedded claystone.
Through coal: indicates the hole went through coal into the underlying beds.
Below coal : indicates the hole was collared below the coal.
Above coal : indicates the hole was not sufficiently deep to encounter coal.

TABLE 2

Results of Stage 1 and Stage 2

No. 1 Openpit Drilling

Hole No.	Hole Length	Over-burden	Depth to Coal	Total Coal/ Total Rock	Comments
74-23	1355	231	286	419/561	Through coal
24	386	210	-	-	Above coal
25	2072	98	123	1229/1346	Through coal
26	1522	59	59	649/1453	2 zones in coal
27	1501	420	-	-	Above coal
28	1469	373	-	-	
29	1359	383	585	112/857	Below coal
30	1099	151	-	-	Below coal
31	664	222	-	-	Below coal
32	1750	304	-	-	Below coal
33	1386	227	-	-	Above coal
34	998	110	-	-	Above coal
35	932	390	-	-	Below coal
36	967	302	-	-	Below coal
37A	2186	166	726	1154/2001	Through coal
38	2095	4	192	1018/1259	Through coal
39	1441.5	33	33	406/406	Through coal
40	1318.5	92	-	-	Below coal
41	357	170	170	187/187	In coal zone
42	532	46	408	59/487	In coal zone
43	1525	91	182	310/401	Through coal
44	2318	165	606	1502/1875	3 zones, through co
45	1151	90	147	52/119	Through coal
46	1813	38	59	930/1502	Through coal
47	1004	145	812	7/758	Below coal
48	1747	195	500	440/1453	Many zones
75-49	1277.5	130	-	-	Above coal
50	1002	70	158	366/454	Through coal
51	1616	168	1064	343/1239	Through coal
52	1004	80	256	244/569	2 zones, through co
53	999	74	451	223/613	Through coal

TABLE 2 (Cont'd)

Results of Stage 1 and Stage 2

No. 1 Openpit Drilling

Hole No.	Hole Length	Over-burden	Depth to coal	Total Coal/ Total Rock	Comments
RH-1	960	55	-	-	Below coal
2	1060	107	-	-	Below coal
3	1168	55	-	-	Above coal
4	1460	45	125	320/399	Through coal

TABLE 3

Results of Stage 2 Exploratory Drilling

Hole No.	Hole Length	Over-burden	Depth to Coal	Total Coal/ Total Rock	Comments
75-54	1000	35	-	-	Above coal
55	1000	93	-	-	Above coal
56	590	422	570	19/178	In coal zone
57	1548	369	369	679/1151	In coal zone
58	643	160	-	-	Volcanic rock
59	1488	40	831	162/1417	In coal zone
60	1940	253	888	598/1314	In coal zone
61	1320	160	658	230/945	In coal zone
62	1678	150	150	1475/1528	In coal zone
63	1000	250	-	-	Above coal
64	487	210	-	-	Above coal
64A	549	192	-	-	Above coal

TABLE 4

Results of Stage 2B Exploratory Drilling

Hole No.	Hole Length	Over-burden	Depth to Coal	Total Coal/ Total Rock	Comments
75-65	740	150	-	-	Above coal
66	135	111	-	-	Below coal
67	715	71	-	-	Below coal
68	1843	140	326	1420/1803	In coal zone
69	1338	110	-	-	Above coal
70	1280	100	-	-	Above coal
71	1001	255	-	-	Above coal
72	886	172	-	-	Above coal
73	1940	125	125	1484/1773	Through coal
74	2240	275	275	1916/1965	In coal zone
75	398	260	-	-	Above coal
76		92		-	Above coal, drilling
77		101	101	-	In zone, drilling

RECENT

OVERBURDEN - Includes Recent (?) or Late Tertiary (?) Volcanic rubble.

TERTIARY

VOLCANICS - Basalts, Agglomerates Evidently overlie sedimentary strata unconformably.

SEDIMENTARY ROCKS - Poorly Indurated Siltstone, Sandstone, Conglomerate & Coal.

CRETACEOUS

SPENCES BRIDGE GROUP - Volcanics

MT. LYTTON BATHOLITH - Granodiorite - Diorite

PERMIAN (?)

CACHE CREEK GROUP - Greenstone & Metasediments

CACHE CREEK GROUP - Marble Canyon Limestone.

AREA UNDERLAIN BY COAL

STRUCTURE

80 ATTITUDE OF BEDDING

FAULT

INFERRED FAULT - Strong evidence - Weak evidence

T VOLCANIC DEPOSITS OF POSSIBLE RECENT AGE.

DRILL HOLE

○ NO COAL

◑ LOWER COAL NEAR SURFACE OR MINOR COAL.

● MAJOR COAL

128 ①

DOLMAGE CAMPBELL & ASSOCIATES LTD. CONSULTANTS VANCOUVER, CANADA	
B.C. HYDRO & POWER AUTHORITY VANCOUVER, CANADA	
HAT CREEK PROJECT EXPLORATORY DRILLING 1974 - 1975	
SCALE: 1" = 2000'	1975 FIG. 1

128 (2)

DOLMAGE CAMPBELL & ASSOCIATES LTD CONSULTANTS
VANCOUVER, CANADA

B.C. HYDRO & POWER AUTHORITY
VANCOUVER, CANADA

HAT CREEK PROJECT

SECTION 9000'N

SCALE: Hor. 1" : 400' Vert. 1" : 400' | JAN. 1, 1975 | FIG. 2


20,000' N
10,000' N
0'
10,000' S
20,000' S
30,000' S
40,000' S
50,000' S
NORTH
SOUTH
Nº 1 OPENPIT
Nº 2 OPENPIT
4000'
3000'
2000'
HIGHWAY JUNCTION
WEST TERMINAL
DRY LAKE FAULT ?
FINNEY CR. FAULT
MEDICINE CR. FAULT
74-33
75-54
75-63
75-62
75-68
75-73
75-60
75-61
75-56
75-57
75-58
Fault zone
?
SCALES
FEET
0
2000
4000
6000
8000
FEET
0
500
1000
LEGEND
OVERBURDEN
TERTIARY
VOLCANICS
COLDWATER BEDS
COAL
MIXED COAL & SHALE ETC.
PRE-TERTIARY
MARBLE CANYON (Limestone)
FAULT
75-61
DIAMOND DRILL HOLE
128
③
DOLMAGE CAMPBELL & ASSOCIATES LTD. CONSULTANTS
VANCOUVER, CANADA
B.C. HYDRO & POWER AUTHORITY
VANCOUVER, CANADA
HAT CREEK PROJECT
GEOLOGICAL LONGITUDINAL SECTION
UPPER HAT CREEK VALLEY
APPROX. CENTRELINE OF VALLEY - BEARING 354°
SCALE HOR. 1" = 2000' VERT. 1" = 500'
JULY, 1975
FIG 3


5000'
4000'
3000'
2000'
10,000' E
HAT CREEK
ROAD
ROAD
75-66
Vol
75-67
Fault zone
Ss
Bas
Ss & Cg (Detritus)
Cg (Ss
Ss (Cg)
75-71
Cl
Ss
Si
75-69 (950'N)
Cl
75-68 (1450'S)
75-62 (200'N)
Si
Carb. Si
Coal & Si
Carb. Si
C.Si
Si (Ss)
Ss & Si
Carb. Si
Coal & Si
Coal & Si
C.Si & Cl
75-64A (2300'N)
75-64 (2230'N)
Cl
75-65 (1300'N)
Si
Cg, Ss
Fault zone /
Si
Coal
Cg, Ss
Coal
Cg, Ss
Cg, Ss
Marble ?
Cl
Coal
LEGEND
Cl Claystone
Si Siltstone
Ss Sandstone
Cg Conglomerate
Vol Volcanic
Bas Basalt
128 (4)
DOLMAGE CAMPBELL & ASSOCIATES LTD CONSULTANTS
VANCOUVER, CANADA
B.C. HYDRO & POWER AUTHORITY
VANCOUVER, CANADA
HAT CREEK PROJECT
SECTION 15,000'S
SCALE: Hor. 1" : 400' Vert. 1" : 400'
JULY 1975
FIG. 4