BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HAT CREEK PROJECT

British Columbia Hydro and Power Authority - Thermal Division - Hat Creek Project - Final Report - Bulk Sample Program - August 1978

ENVIRONMENTAL IMPACT STATEMENT REFERENCE NUMBER: 46

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HAT CREEK PROJECT

FINAL REPORT

BULK SAMPLE PROGRAM

August 1978

Thermal Division

HAT CREEK PROJECT - BULK SAMPLE PROGRAM REPORT

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SECTION 1.0 - SUMMARY

The 1977 Bulk Sample Program and burn tests were carried out in order to confirm the viability of the tentative coal quality cut-off point for powerplant fuel, and to provide other performance data.

The program was also then used as a pilot scale exercise for the proposed Hat Creek Project encompassing as many as possible of the aspects of the full project from mining to power generation. Each phase of the program was designed to provide information to confirm the practicality of the project as a whole. To this end, participation by suppliers, consultants and specialist research teams was included to provide as much data as possible to assist in the optimum design of mine and powerplant, and in evaluation of possible environmental impacts.

The program began with the excavation of two trenches at Hat Creek: progressed through the performance of numerous mining, handling and storage tests on site and culminated in the performance of a burn test at the Battle River powerplant of Alberta Power Ltd. The larger of the two trenches (A) is 274 m long, 90 m wide, 24 m deep and provided coal near the tentative minimum powerplant quality. The other (B) is 90 m long, 48 m wide, 9 m deep and was cut to obtain some of the higher quality coal. The excavation work began on 5 May 1977 and by 18 July, 6350 tonnes of coal had been mined and crushed in preparation for shipment to Alberta. Between 15 July and 17 August this 6350 tonnes was transported by rail to Battle River and the burn test took place between 5 August and 31 August.

The excavation of the two trenches by Cariboo West Contracting Ltd. under the control of B.C. Hydro not only accomplished the prime objective of obtaining the 6350-tonne sample but also provided information with respect to the mining and geological characteristics of the coal and overburden. Both trenches were geologically mapped under the supervision of Dolmage Campbell and Associates and this provided information helpful in interpreting diamond drill hole data obtained from the work done by Coates Enterprises. The assumption was verified that both the overburden and in-situ materials can be removed by machine without blasting except for isolated pockets of boulders. However, the economic advantages and disadvantages of blasting will require further study.

Geotechnically, the 60° slope pit walls appear to be stable but conclusions cannot be drawn until 12 months of weathering (over winter and spring run-off) have taken place.

Temperature monitoring of stockpiles indicated that the Hat Creek coal is similar to other western coals in that it is quite reactive and accordingly subject to spontaneous combustion unless stored in properly compacted stockpiles.

Information on the hardness of the coal was provided from the drop-tests and by the crushing operation carried out by B.C. Hydro. It was found that pieces of coal can be hard and difficult to break immediately after excavation, but on exposure to the atmosphere become quite friable in a short time.

The excavation work was treated as a pilot scale mining operation and accordingly the data from it is being used by Cominco-Monenco to assist in development of the project mining plan.

The burn tests and other tests at Battle River provided valuable performance data to assist in finalizing the coal quality cut-off point and some of the basic parameters of plant design.

The Burn Test demonstrated that a typical Hat Creek coal of low quality can be handled, transported, pulverized and burned in a commercial scale powerplant. The test fuel ranged in value from 10 400 kJ/kg (38 percent ash) to 14 000 kJ/kg (25 percent ash) at a moisture of 20 percent. There were no significant handling problems even though 5 cm of rain fell on the Battle River stockpile in the 10 days or so of testing. The Hat Creek fuel required less power to grind than the normal Battle River coal and its combustion characteristics appeared similar although it was slightly less stable at lower loads. No noticeable fouling occurred within boiler convective zones although a certain amount of deposit build-up, which was manageable, did occur on the furnace walls. Ash removal and handling was the greatest problem due to the fact that the test unit had been designed to handle a much smaller percentage of ash.

Environmental activities at the site of the Bulk Sample excavations were coordinated by a resident field scientist from Acres Consulting Services, who was also responsible for monitoring various environmental parameters and for the initiation of a preliminary reclamation program. Samples of ground water, etc. collected by Acres were analysed by Beak Consultants Limited. Noise monitoring during the program was the responsibility of Aero Acoustic Systems Ltd. and the air quality in the Hat Creek area was monitored by B.C. Hydro.

Results are consistent in confirming that impacts were restricted to the immediate areas of the trenches and related areas of waste and coal storage. There were no project-related alterations to air or water quality (with particular reference to Hat Creek itself) and the noise impact was not a major issue, with the local residents. During the transportation phase covers were effective in eliminating dust problems.

With respect to the community impact of the Bulk Sample Program, the concerns expressed by groups throughout the period were few in number and generally comments were limited to inquiries of a factual nature. At the outset a certain concern was expressed with respect to the possible impact on the local traffic by the truck transportation of coal from Hat Creek to Ashcroft. However, these impacts did not materialize and no traffic complications occurred. In general the information provided through the Public and Community Relations Program appeared adequate to satisfy local interest levels.

SECTION 2.0 - INTRODUCTION

Approval for the Hat Creek Bulk Sample Program was obtained from the B.C. Hydro Management Committee on 15 March 1977. The main reasons for the program were:

1. *The burning of low quality coal at or near the proposed low cut-off* point for boiler fuel in a commercial scale plant would:

    a. Greatly increase knowledge of the coal.

    b. Provide data necessary for steam generator and other power-plant equipment design.

    c. Confirm the practicality of the proposed fuel quality cut-off point.

    d. Enable field readings of products of combustion to be assessed and compared to theoretical values and allow realistic assessment of the characteristics of the coal, the ash and the clay.

2. A large amount of mining and coal preparation and handling informa-*tion could be gained by: exposing sections of the coal deposit*, mining the test coal, preparing it for shipment and shipping it.

Preliminary information on Hat Creek fuel has been derived earlier from exploratory drilling, laboratory analysis of core samples, small scale burn tests in a pilot furnace and limited washability tests. The burn tests were carried out by the Canadian Combustion Research Laboratory in 1976 on some raw coal samples and on some coal which had been upgraded by Birtley Engineering (Canada) Ltd. The project objectives for the 1976 coal tests were to evaluate the feasibility of burning various qualities of Hat Creek coal by means of conventional pulverized fuel fired technology; to determine the effects on combustion performance of reducing the coal's ash content by washing and to make a first assessment of possible design parameters for a utility-scale steam generator to burn Hat Creek coal. Prior to testing Hat Creek coal, test runs were made with coal from Sundance, Alberta as currently burned in a large powerplant. The Hat Creek results were then compared to Sundance results. All three samples of raw Hat Creek coal showed stable flames but the high clay and moisture content of the poorer raw samples (below tentative powerplant fuel cut-off) made handling difficult. The three samples of washed Hat Creek coals produced hotter and more stable flames and handling, drying and reactivity were improved. The fly ash showed high resistivity but the electrostatic precipitator collected efficiently. These CCRL tests indicated that coals with a higher heating value of 14 000 kJ/kg at 20 percent H_2O or more could be successfully burned on a full scale plant although provision would have to be made for the large quantities of ash produced. The 1977 burn tests at Battle River provided an opportunity to re-confirm these CCRL findings.

The three main information sections for this report are Mining, Burn Test and Environmental. The mining section includes data given on: slope stability, spontaneous combustion tendencies of the coal, material density and geology. The powerplant section includes information on: coal handling, pulverizer performance, combustion characteristics, fouling data, electrostatic precipitator performance and ash handling. Environmental aspects covered include the dusting potential during excavation and storage, the potential for water contamination from the coal and associated wastes, methods of land reclamation, and the aspects of a Trace Element study conducted during the burn tests.

SECTION 3.0 - MINING

3.1 OBJECTIVES

The main objective was to obtain 6350 tonnes of Hat Creek coal for the burn test at the Battle River powerplant. However, this trenching operation was also designed to gain the following information for use in mining design:

1. Performance of excavation equipment within the overburden, waste rock material and coal.

2. Exposure of the coal beds for sampling and petrological and mineralogical examination.

3. Geotechnical information - pit slope stability, drainage characteristics, strength of ground materials.

4. Spontaneous combustion characteristics of the coal.

5. Hardness of the coal (difficulty in coal crushing).

6. Density of overburden material and coal.

7. Geological interpretation of the excavations for comparison with diamond drill hole information.

8. Waste dump and coal dump stacking and compaction strengths.

9. Vegetation tests for reclamation information.

3.2 SITE SELECTION

The site selection for the test excavation was based on the following criteria: it was desired to obtain 6350 tonnes of coal with an approximate calorific value of 12 800 kJ/kg on a 20 percent moisture basis (or 16 000 kJ/kg on a dry basis). This heating value was selected because it was believed that for the full-scale project this would be the lowest grade of fuel that would be burned on a continuous basis. Another criterion, due to the variability of the fuel quality throughout the deposit, was to examine and test coal from different geological zones. Accordingly, it was desired to obtain saturated coal, i.e. coal from below the water table. Finally, owing to economic and environmental reasons, the test excavations had to be severely limited in size and depth.

In order to satisfy these criteria two locations were selected, Trenches A and B. Diamond drill hole information indicated that Trench A should yield the correct heating value without being very deep. However, this trench would not supply saturated coal, since it was above the water table, and in addition there was a certain amount of concern as to whether the heating value of the coal from it would be high enough. Therefore, Trench B, also being shallow, was selected since it would yield coal that was below the water table and in addition would yield coal of a higher heating value in case Trench A coal was too poor in quality. Also, Trench B was in a different geological zone which would add to fulfilling the criteria of examining and testing coal. Accordingly, the site selection of Trenches A and B satisfied the engineering requirements and yet kept the ecological disturbance to a minimum.

Fig. 1 indicates the location of the trenches within the Hat Creek Valley.

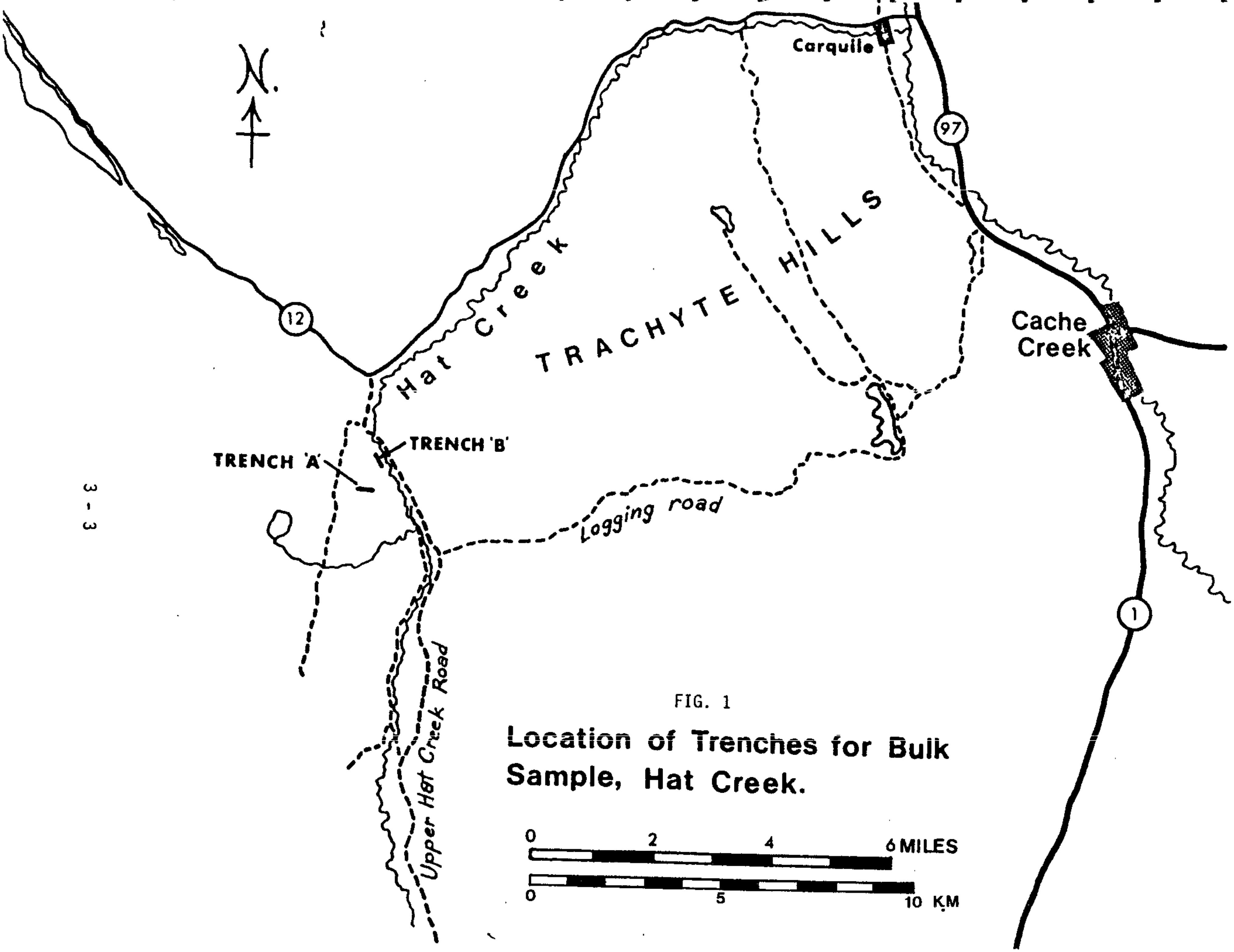

FIG. 1

Location of Trenches for Bulk Sample, Hat Creek.

3.3 METHOD

The topsoil and overburden were removed by means of scrapers and bulldozers.

The topsoil, and samples of each of the subsurface materials were segregated from the main body of the overburden and placed in special dump sites to be used for reclamation purposes and growth tests. This main body of overburden from Trench A (121 640 BCM*) was placed on a waste dump pile of three terraces with slopes ranging from 26° to 40°, while the overburden from Trench B (34 630 BCM) was placed in an existing depression in an area adjacent to the trench. Baked clay from Trench A was used as surfacing material for local site roads.

A Poclain hydraulic shovel was used to excavate the coal in both trenches. Trench A consisted of three benches and two berms, with bench slopes at 60°. Trench B has two benches and one berm, the bench slope also being 60°. In order to complete excavation, water had to be pumped from Trench B to a natural basin 180 m distant.

The top of the water table in Trench B lies approximately 6 m below the surface and about 1.2 m below the water level in Hat Creek. It remained at the same level even though a heavy daily withdrawal of water took place well into the winter months of 1977/1978, by water trucks to supply the many drilling rigs.

After excavation the coal was fractured to minus 4.75 cm by a Bradford breaker, which fractures the coal by continuously rotating and dropping it until the particles pass through 4.75 cm diameter holes.

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* BCM = bank cubic metre.

3.3 METHOD - (Cont'd)

The following table gives the pertinent data for both trenches:

	Trench A	Trench B
Overall dimensions	274 m x 90 m x 24 m deep	90 m x 48 m x 9 m
Overburden removed	121 640 bank cubic metres	34 650 bank cubic metres
Coaly waste*	55 583 bank cubic metres	1259 bank cubic metres
Coal	15 673 bank cubic metres	5964 bank cubic metres

3.4 RESULTS

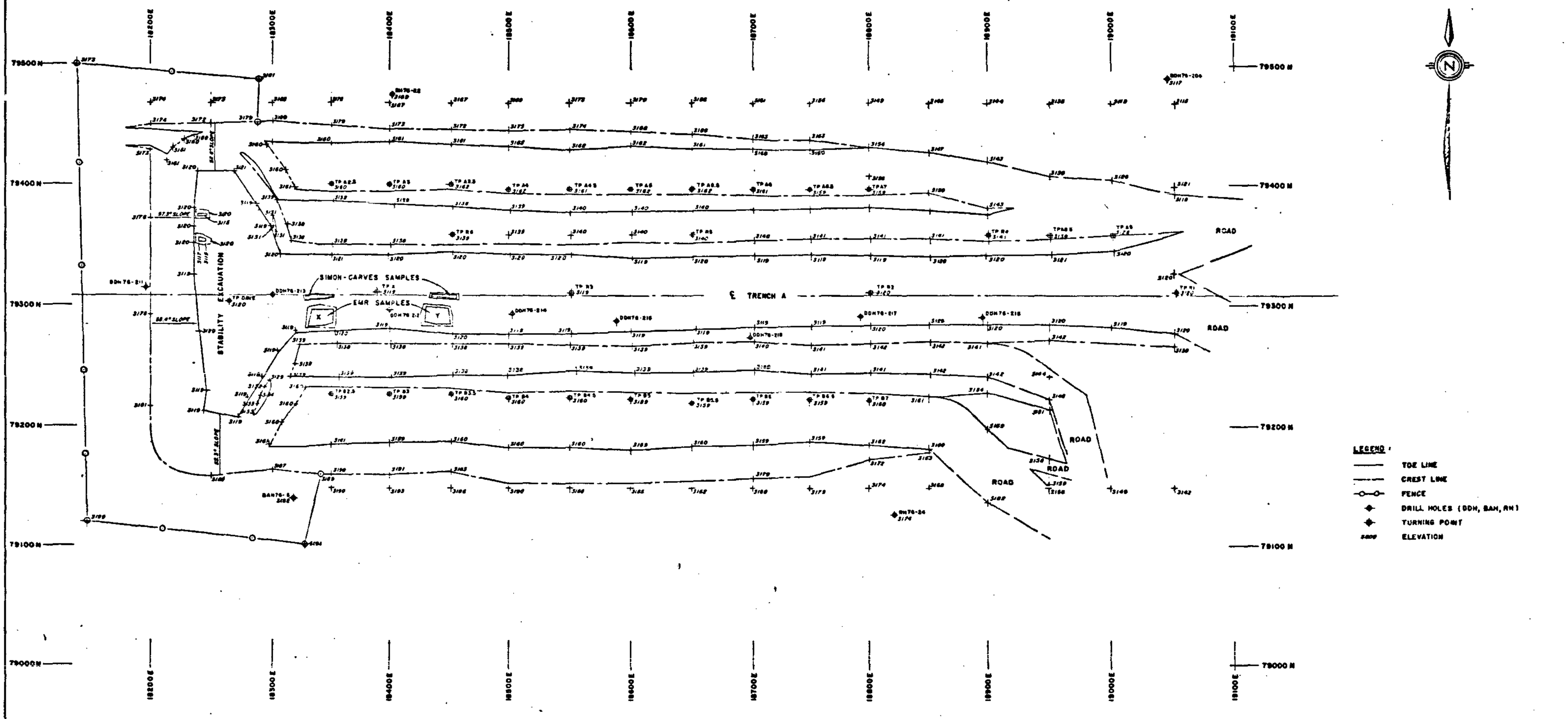
(a) Excavation Data

(i) Trench A

Trench A was excavated parallel to Section P at holes 211 to 218 and 190 (refer to Fig. 2) in the burnt zone and coal of A and/or B zones. The materials and pit were dry as the excavation was above the water table.

The trench, excluding the extension for slope stability, was a maximum of 274 m long, 90 m wide and 24 m deep. The excavation consisted of removing the surficial and coaly waste materials down to the 3160 level, then two 20 foot benches in the burnt zone and coal down to the 3120 level. Berms were left on the 3160 and 3140 benches; the walls on each bench were sloped to 60^{0}. Four dumps were established, three for

* Low grade coal, approximately 7000 kJ/kg.



SCALE IN FEET

REVISION	DATE	DESCRIPTION	DRAWN	APPD

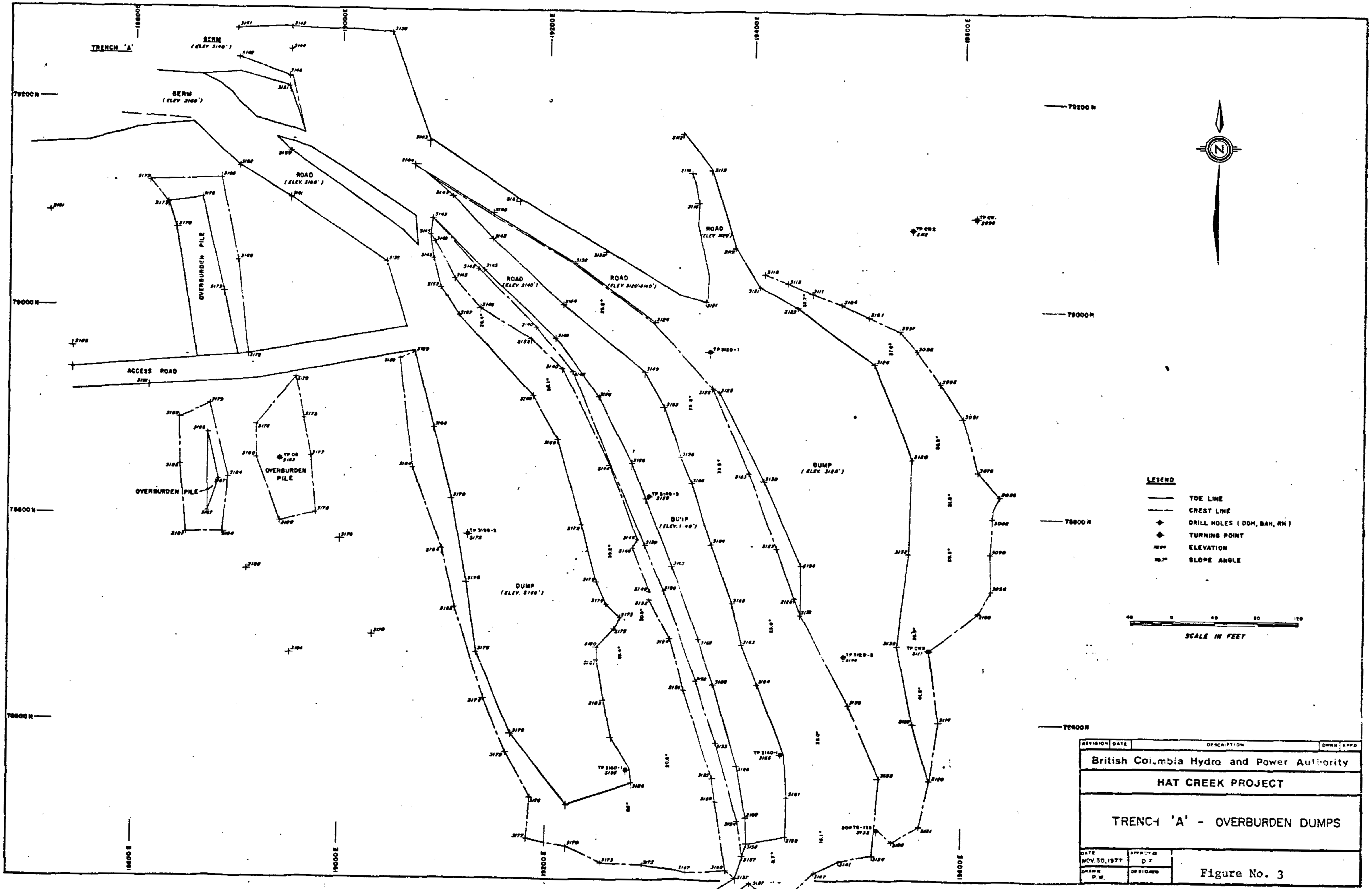
British Columbia Hydro and Power Authority

HAT CREEK PROJECT

TRENCH 'A'

DATE	APPROVED
NOV 29, 1977	D.F.
DRAWN	DESIGNED
P.W.	

Figure No. 2


TRENCH 'A'
BERM (ELEV 3140')
BERM (ELEV 3160')
ROAD (ELEV 3160')
ROAD (ELEV 3140')
ROAD (ELEV 3120'-3140')
ROAD
ACCESS ROAD
OVERBURDEN PILE
OVERBURDEN PILE
OVERBURDEN PILE
DUMP (ELEV. 3160')
DUMP (ELEV. 3140')
DUMP (ELEV. 3120')
79200 N
79000 N
78800 N
78600 N
18800 E
19000 E
19200 E
19400 E
19600 E
LEGEND
TOE LINE
CREST LINE
DRILL HOLES (DDH, BAH, RH)
TURNING POINT
ELEVATION
SLOPE ANGLE
SCALE IN FEET
British Columbia Hydro and Power Authority
HAT CREEK PROJECT
TRENCH 'A' - OVERBURDEN DUMPS
NOV. 30, 1977
P.W.
Figure No. 3

3.4 RESULTS - (Cont'd)

overburden and burnt zone material and one for the coaly waste. The overburden dumps were terraced on the slope of the hillside east of the trench to approximately coincide with the bench levels in the pit such that minimum grades were maintained on the haul roads.

Overburden removal was done in most part using Caterpillar D-8's for ripping and pushing. The coal, coaly waste, clinker and some overburden were loaded and hauled using a Poclain 300 hydraulic excavator and two 25-ton Dave and John Brown scrapers (DJB's, approximately 18 cubic yard capacity). Twelve cubic yard highway trucks were used to fill in when either of the scrapers was down. A Caterpillar D-6 was used for pit clean up and levelling dumps; an Air-trac drill used to drill the hard clinker; a grader used on the pit roads and dumps; and a water truck was used for dust suppression. All the equipment operated well during the program and had a minimum amount of down-time for repairs.

Two methods were used to determine the volumes of materials moved, one a load count and the other a survey. The load count was used to keep account of the day to day progress. The final surveyed yardage for the Trench A bulk sample excavation was 177 636 BCM of which 63 percent was overburden, 29 percent coaly waste and 8 percent coal (low and shipping grades).

Excavation of Trench A was relatively straight forward with the only area requiring unforeseen work being the large block of hard clinker-like material which was encountered in the burnt zone; it was drilled

3.4 RESULTS - (Cont'd)

with an Air-trac drill and blasted with 4.5 cm by 40.6 cm cartridges of IRECO H high velocity explosives. Ripping of the burnt zone material was required to facilitate scraper removal; good fragmentation resulted due to the brittle nature of the material and the scrapers had no difficulty in loading with the aid of a push-dozer.

The hydraulic excavator was able to dig and load the coal with no difficulty. One area of blocky coal on the south side of the trench did cause some minor loss in productivity due to the tougher digging. Note that the Poclain was always crosscutting the bedding which allowed it to separate the coal more easily along bedding planes and jointing.

Pit wall stability was not a problem. Several minor bench failures in the face occurred but did not delay production. The digging face was parallel to strike and hence the bedding (at 30^{o}) was undercut causing the face to fail along the weaker bedding planes. The pit walls (at 60^{o}) that crosscut the bedding stood very well during the excavation and continue to do so.

On several occasions heavy rain showers caused traction problems and slick conditions in the pit, on the dumps and on access roads. One of the important contributing factors was the amount of fines generated by traffic and pit activity which when wetted created slick conditions. This factor was also influenced by the amount of bentonitic clay materials.

3.4 RESULTS - (Cont'd)

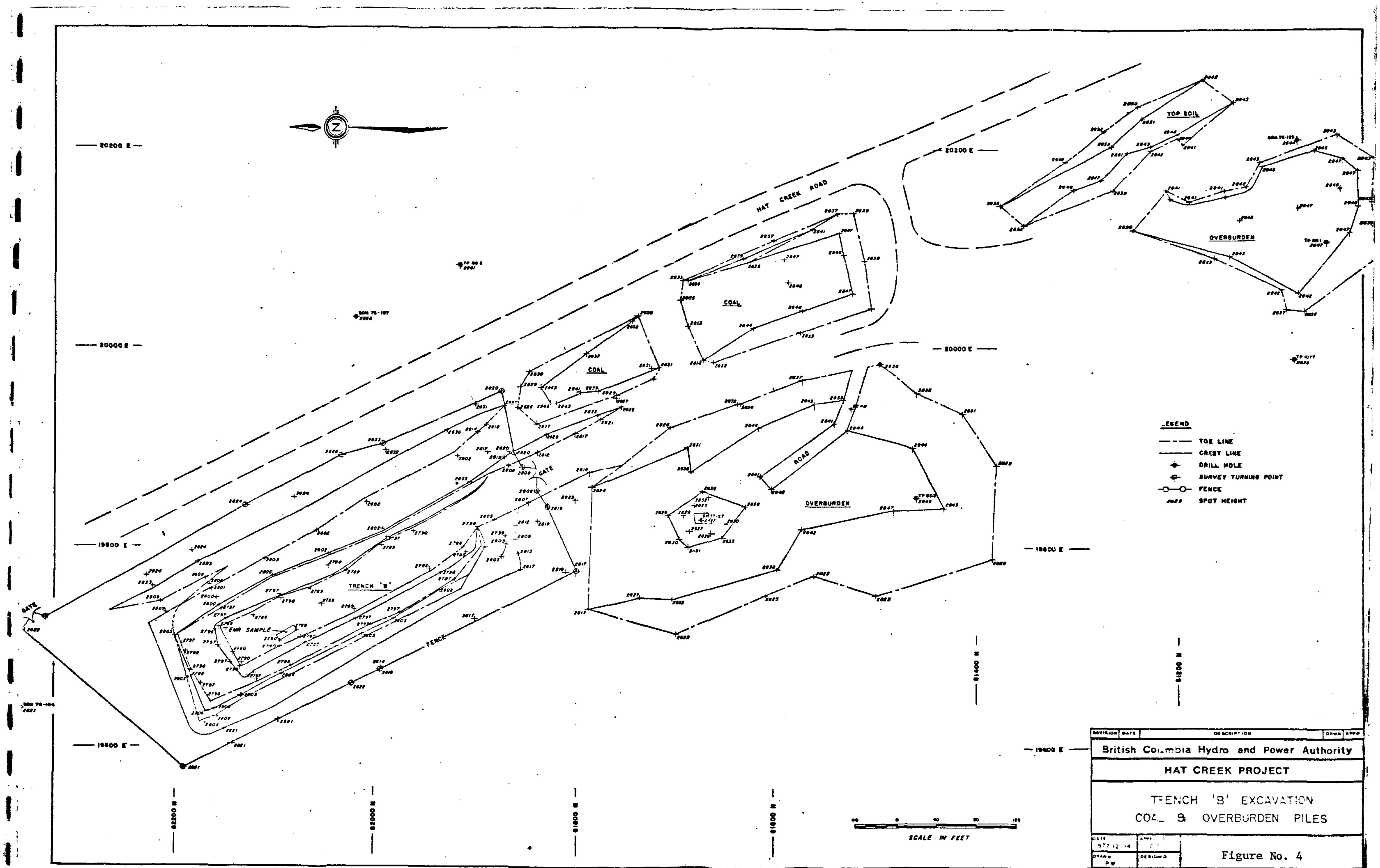
A significant quantity of petrified wood was encountered throughout the coal sequence and especially in the footwall coal; several large logs were excavated with diameters from 5 to 1.2 m along with some large petrified stumps.

Selective separation of the clay interbeds was very limited due to their thinness; the thickest band encountered was approximately 1.2 m while the remainder were generally less than one half metre. When the larger bands were encountered the excavator would attempt to load the trucks with the clay only, but a mixture of coal and clay always occurred; this material was sent to the coaly waste dump. The excavator did have moderate success on the 1.2 m bed, but some coal was loaded with the clay. It was noted that the fresh clay exposures were very dark in appearance and were difficult to distinguish from the adjacent coal, especially so for the excavator operator working at the face.

(ii) Trench B

The Trench B excavation was undertaken to provide higher quality coal from the D-zone in the event that the Trench A coal did not meet test burn requirements. The trench also provided valuable information from the materials handling point of view.

A plan of the final pit and dump locations is shown on Fig. 4; it varied from the original in that the lower bench was moved approximately 3 to 4.5 m off center to take advantage of the additional coal on the west side of the pit. The excavation consisted of an


HAT CREEK ROAD
COAL
TOP SOIL
OVERBURDEN
TRENCH 'B'
EMR SAMPLE
ROAD
GATE
FENCE
LEGEND
TOE LINE
CREST LINE
DRILL HOLE
SURVEY TURNING POINT
FENCE
SPOT HEIGHT
20200 E
20000 E
19800 E
19600 E
82200 N
82000 N
81800 N
81600 N
81400 N
81200 N
SCALE IN FEET
British Columbia Hydro and Power Authority
HAT CREEK PROJECT
TRENCH 'B' EXCAVATION
COAL & OVERBURDEN PILES
Figure No. 4

3.4 RESULTS - (Cont'd)

overburden and coal cut to establish a bench at a 2800 level; then a 3 m deep by 15 m wide bench in coal was removed. The maximum dimensions were approximately 90 m long by 48 m wide by 9 m deep. The pit slopes in the gravels were excavated at 45^0 and in coal at approximately 60^0. The slopes in the gravels were steepened by the action of water washing at the base of the slope when the pit was allowed to partially fill with water after the scrapers had completed removal of as much of the overburden as possible and before the Poclain had completed Trench A.

Three overburden dumps plus a coaly waste pile and a coal stockpile were established in the trench area. The overburden dumps were topsoil, subsoil and gravels; the coaly waste pile consisted mainly of coal mixed with gravel from cleaning off the top of the coal.

Most of the overburden was stripped using the scrapers and a Caterpillar D-8 for pushing. The remainder of the overburden and coal were removed using the Poclain and DJB's; these were used for the overburden directly over the coal as more control on the water could be maintained and hence a more selective job could be done in separating the overburden and coal. A Caterpillar D-6 was used for pit clean-up and levelling the dumps while stripping with the Poclain and truck. A 75 L/s diesel-electric pump was installed to pump water from the sump to Dry Lake.

The final surveyed yardage was 36 199 BCM of which 82 percent was overburden, 4 percent coaly waste, and 14 percent according to the load counts.

3.4 RESULTS - (Cont'd)

The most serious problem encountered in excavating this trench was the amount of water inflow. The average rate of inflow was calculated at 14.4 L/s over a 16 day period from July 18 to August 3; the maximum flow experienced during the recorded period was approximately 18 L/s over a 40 hour period on July 18, 19 and 20. The water seeped into the pit from the south end through an old drainage channel that flowed south to north parallel to Hat Creek at that point; very little water seeped in from the creek side of the pit even though the pit was well below the level of Hat Creek. In addition to having to pump continuously problems were encountered in keeping the water draining towards the sump and in operating the equipment in water. As there was always some water on the pit floor the overburden and coal were often soaked and hence heaped loads could not be put on the trucks or picked up by scrapers.

The Poclain had much more difficulty in digging the coal in Trench B than in Trench A. The coal appeared more massive and did not separate as well along bedding planes and jointing as did Trench A coal; the coal came out in platy slabs rather than in blocks. This indicates that blasting may be required in future operations in order to maintain productivity.

As in Trench A a significant quantity of petrified wood was encountered with the greatest concentration being in the south end of the trench; here a portion of a petrified log was uncovered over the height of the 3 m bench.

A number of large boulders were encountered in the overburden; several were 1 m square and a half metre thick. It has been suggested that these may be concentrated along the old Hat Creek channel the side of which was encountered in the trench.

(iii) Trench A Slope Stability Excavation

This excavation was made to produce a pit slope of sufficient height and length to allow examination of materials and observation of slope stability in the rocks common to the A_2 and C_1 rock zones and the detrital rocks underlying the D- zone. The excavation was made between August 22 and September 13. A total of 15 185 BCM was excavated from the west end of Trench A for this purpose. A plan of the excavation is shown in Fig. 2.

The Poclain was used for digging and loading the rock; three highway trucks (approximately 12 cubic yards) were employed for hauling the material to the dumps.

In general the Poclain was able to dig these materials adequately although it was somewhat slower than in digging the coal in the trench. Some hard zones were encountered in which the Poclain had difficult digging; in particular, there is a hard 1.2 to 1.5 m band of calcareous sandstone immediately below the coal. Also the sandy shales and siltstones in the south half of the excavation was massive and quite cohesive making for tough digging.

3.4 RESULTS - (Cont'd)

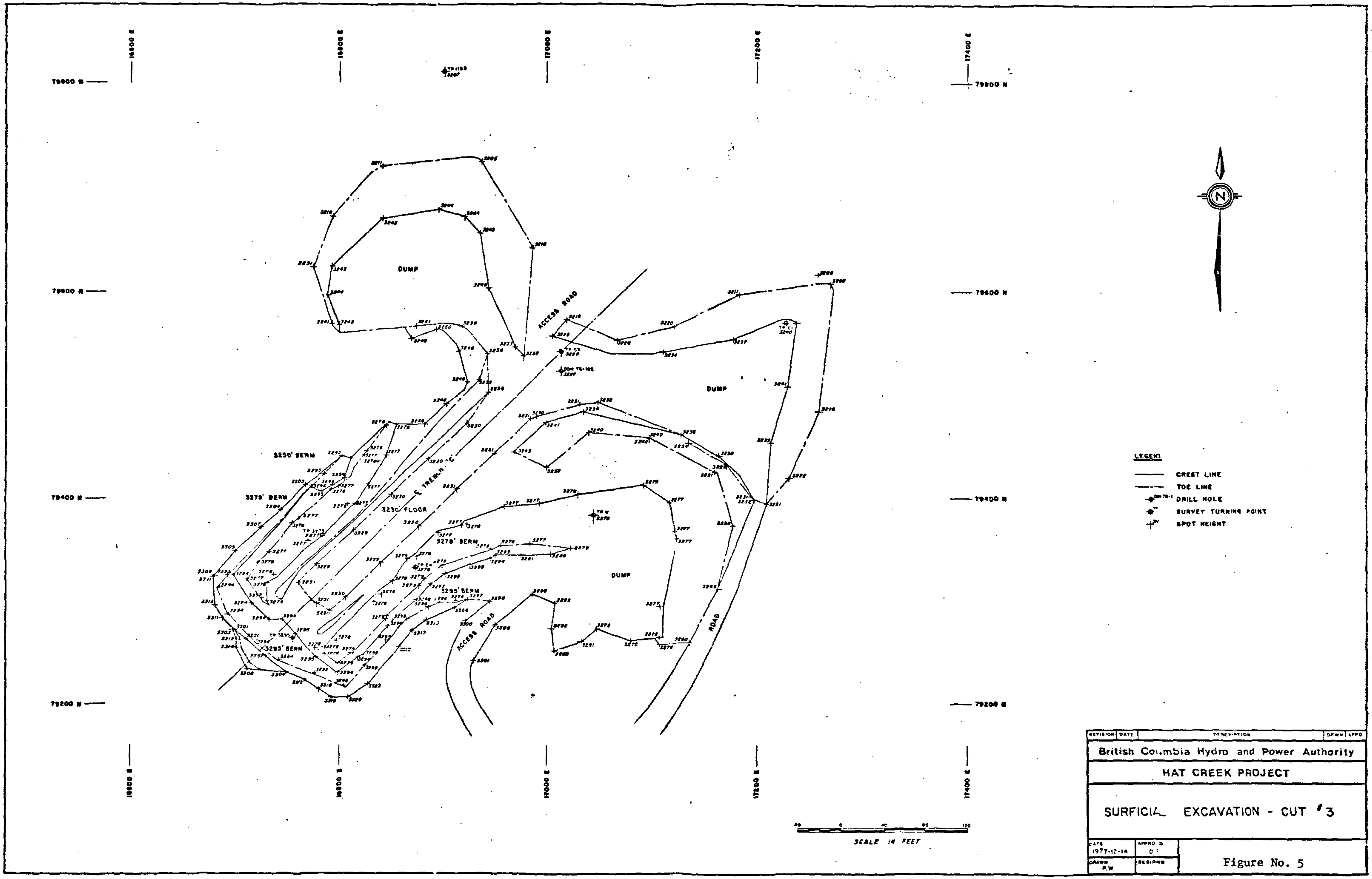
The amount of petrified wood in the base of the coal was noted again, several logs were dug out, one of which has been left for observation on the 3140 bench.

(iv) Excavation in Surficial Materials of the Inactive Slide

Three excavations have been made in the surficial materials of the inactive slide zone west of Trench A, to obtain information on slope stability, material characteristics, and handling qualities.

The first cut was made on June 23 approximately 60 m southeast of drill hole 76-182. Excavation was by scrapers aided by a Caterpillar D8K for pushing and ripping. No difficulties were encountered as the materials were dry; three short benches were cut, the first being 3 to 5 m high, the second and third 2.5 to 3 m high (slopes at approximately 45^{o}) with 4.5 to 8 m berms in between giving an overall slope of approximately 35^{o}. No failures have occurred in this cut.

The second cut was made July 8 in the bottom of an old slough along the access road to Trench A from the Savona logging road to test performance in wet clay. Excavation was by a 621 scraper aided by a Caterpillar D8K. Several passes through the clay were made once a good base was established at each end of the pass. With each pass the machines sank deeper into the clay until on the final pass they almost became immobilized. The clay had a high water content and was highly bentonitic. The scraper was able to cut the clay and it rolled into



British Columbia Hydro and Power Authority

HAT CREEK PROJECT

SURFICIAL EXCAVATION - CUT #3

DATE	APPROVED	
1977-12-14		
DRAWN P.W.	DESIGNED	Figure No. 5

3.4 RESULTS - (Cont'd)

the bowl. The material was pushed out with the hydraulic ram and the scraper pushed off the pile with the bulldozer.

The third cut was made from September 21 to October 27 to establish high slopes in bentonitic materials. It was located immediately southwest of hole 76-182. The cut consisted of four benches; surface to 3295, 3295 to 3275, 3275 to 3252.5 and 3252.5 to 3230. There was a 9 m berm left between the upper two and lower two benches except on the south face which was made one slope over the entire height. A total of 23 726 BCM was excavated.

Investigation of the pit revealed that the greater part of the material belonged to the Coldwater Formation a large mass of which appears to have slid over the top of more recent deposits of glacial till as evidenced by the exposure in the bottom bench of the pit. A report of the geotechnical aspects of this cut will be made by Golder Associates.

Several excavation problems were encountered. A few delays were caused by rain; sufficient rain to wet the ground would cause slick surfaces and force the operation to shut down. The work areas were surfaced with the baked clay from Trench A and afforded better traction at all times, but a heavy shower would still halt operations. In some areas the digging was difficult due to the cohesiveness of the material, especially in the 3230 cut where a glacial till was encountered that consisted of boulders in a mixture of clay and sand

3.4 RESULTS - (Cont'd)

which was quite hard and tough. There was some build-up of the clayey materials in the excavator bucket which had to be cleaned out from time to time.

No significant failures occurred during excavation although a few small 15 to 40 m^3 blocks had to be removed before or after falling on the bench.

Three dumps were constructed from the excavated materials - the 3275 end-dump, compacted dump and the 3240 end-dump. The 3275 end-dump has a maximum height of 15 m above original ground level; the 3240 end-dump a height of 11 to 12 m and the compacted dump a height of 7.5 m. The end dumps were constructed by dumping over and along the edge of the top of the dump such that minimum compaction occurred. The compacted dump was built up in 3 to 4 foot layers. The slopes on the dumps were from 34 to 70^{o} when completed. These will be observed from time to time for evidence of failures.

(b) Coal Crushing and Stockpiling

In order to provide the desired product for shipment to Battle River it was necessary to install a crushing system to reduce the run of mine coal to passing 38 mm.

The major pieces of stationary equipment used were:

Hopper:	14.5 m^3
Conveyor:	76 m x 15.24 m
Bradford Breaker:	2.13 m x 2.13 m
Diesel Generator	

TABLE NO. 1

EXCAVATION RECORD

SUMMARY

TRENCH A

Equipment	Total BCM	Total Operating Hours	BCM/Hour
Scrapers	122 593	992	123.58
Caterpillar DJBs	63 264	811.5	77.96
Highway Trucks	4709.66	96.5	48.80

TRENCH B

Equipment	Total BCM	Total Operating Hours	BCM/Hour
Scrapers	31 366	230.5	136.08
Caterpillar DJBs	10 234	130	78.73
Highway Trucks	489.31	16	30.58

3.4 RESULTS - (Cont'd)

A number of on site modifications and additions were made to the equipment for more efficient and safe operation. A grizzly with .3 m openings was constructed and placed over the hopper to prevent large blocks of coal and petrified wood from blocking the conveyor feed opening. A ramp was also constructed to facilitate efficient hopper loading by the front-end loaders. Metal slides were constructed to move the product and reject away from the breaker. After initial trials the conveyor beltspeed was adjusted to 48 m/min and the conveyor feed opening was modified to allow more feed and larger coal lumps. After some breaker tests the 90^0 lifter shelves were set for maximum retention due to the rejection of the hard coal lumps by the breaker; the breaker ran most efficiently at 16 rpm and it was operated at this speed for most of the crushing. Various guards, safety switches, and work platforms were added around the equipment to provide safe working conditions.

The run of mine coal was separated into three stockpiles - coaly waste, low grade and shipping grade. The separating was made by visual observation in the pit by a geologist who directed the trucks to the appropriate pile.

The reject opening was closed for the first few days of crushing on the 6350 tonne sample to retain the hard lumps of coal until they broke, but production dropped due to build up in the breaker and to having to shut down to clean out the rock and petrified wood from the drum. Hence the cover was removed and to obtain good coal recovery and maintain maximum calorific content the rejects were recycled several times.

There was very little reject from the breaker that could be described as waste material: the waste reject would not have amounted to more than 0.5 percent of the feed. There was essentially no separation of clay with the breaker. By the time the hard lumps of coal broke up much of the petrified wood had also fragmented and come out in the product.

It was noted that the coal often built up on the product slide which was sloped at 30^{0}. Build up in the breaker drum was minimal except when the wet coal from Trench B was crushed, then the breaker had to be shut down and the drum cleaned out on a number of occasions.

A test was carried out to determine if addition of water to the coal as it entered the breaker would cause the clays to ball. The coal for the test came from the Trench A low grade pile and was well blended before being put in the hopper. There was some evidence in the reject that balling had occurred and there was some reduction in ash content as shown by the following analyses done on the products:

Sample No.	Description	% Ash (Dry Basis)	Average
15	Dry coal: breaker at 16 rpm	43.90	42.29
16	Dry coal: breaker at 16 rpm	40.67	
17	Dry coal: breaker at 12 rpm	36.30	39.11
18	Dry coal: breaker at 12 rpm	41.92	
19	Wetted coal: breaker at 12 rpm	36.25	34.65
20	Wetted coal: breaker at 12 rpm	33.04	
21	Wetted coal: breaker at 16 rpm	29.73	
22	Wetted coal: breaker at 16 rpm	34.99	34.04
23	Wetted coal: breaker at 16 rpm	37.40	

(c) Drop Tests

Drop tests simulate the breaking action of the Bradford Breaker. The test involves raising a measured quantity of coal to a specific height and dropping it with no initial velocity to a steel plate.

The requirements regarding drop heights, sample consist, and screen sizes are determined from a procedure outlined by Pennsylvania Crusher. The following parameters were used:

Drop heights:	2.7, 3.0, 3.4, 3.7 and 4.9 m
Weights:	45 to 90 kg averaging 57 kg
Screen sizes:	152, 76 and 48 mm
Test sample:	from one to twenty hard lumps of coal, all 152 mm

The test equipment included a structure with a platform that could be placed at the desired heights (the platform had a trap door for dropping the lumps with no initial velocity), and a drop plate made of 1/2-inch steel set on a concrete pad with an enclosure built to catch and retain the broken material. Platform weigh scales were used for weighing.

The drop test record sheets for the tests are given in Bibliography Reference 4. They include comments on the coal before and after drop testing and include the sample analysis.

One of the important characteristics of the products observed was the large number of wedge shaped pieces produced, especially in the smaller sizes.

3.4 RESULTS - (Cont'd)

From the sample analyses the -48 mm products had higher ash contents than the +48 mm lumps.

(d) Spontaneous Combustion

Spontaneous combustion is a problem with most low rank coals when exposed to such conditions as wind, heat and moisture in storage stockpiles. Test piles of crushed coal were established and temperature monitoring and observation carried out on these and the raw coal stockpiles to accumulate information on heat build up and occurrence of fires.

Four piles of crushed coal were specifically built for temperature monitoring; they were:

1. Trench B loose coal pile (approximately 450 tonnes).

2. Trench B compacted coal pile (approximately 800 tonnes).

3. Trench A loose coal pile (approximately 680 tonnes).

4. Trench A compacted coal pile (approximately 635 tonnes).

These were of sufficient volume and dimensions to allow adequate exposure to the elements as wind and ambient temperatures are important factors influencing rate of oxidation and heat dissipation. When the heat of oxidation exceeds the rate of heat dissipation danger of spontaneous combustion exists.

In addition to these piles a larger compacted (3600 tonne reserve crushed coal pile) was monitored for additional data.

3.4 RESULTS - (Cont'd)

Heating within the piles was first observed in the stockpiles of crushed coal prepared for the 6350 tonne sample; steam was noticed coming from a bucket load of coal being dumped into a truck. Temperatures were taken the following day and were found to range from 60 to 70°C in the warmest area. As there was not any prior experience with spontaneous ignition of the Hat Creek coals, the hot coal was dug out and compacted to prevent any further heating. This pile had been exposed for approximately 2 weeks.

Fire began occurring in the uncrushed low grade pile after 50 to 70 days of exposure. These generally occurred around the base of the pile in areas that appeared loose and made up of a high percentage of lumps. This pile was observed to gradually heat over fairly large areas with fires occurring frequently within these zones. The fires and hot coal were dug out when discovered and the hot coal compacted. These fires continued to occur until the pile was sloped and the surface thoroughly compacted by padding a Caterpillar D-6 bulldozer over it.

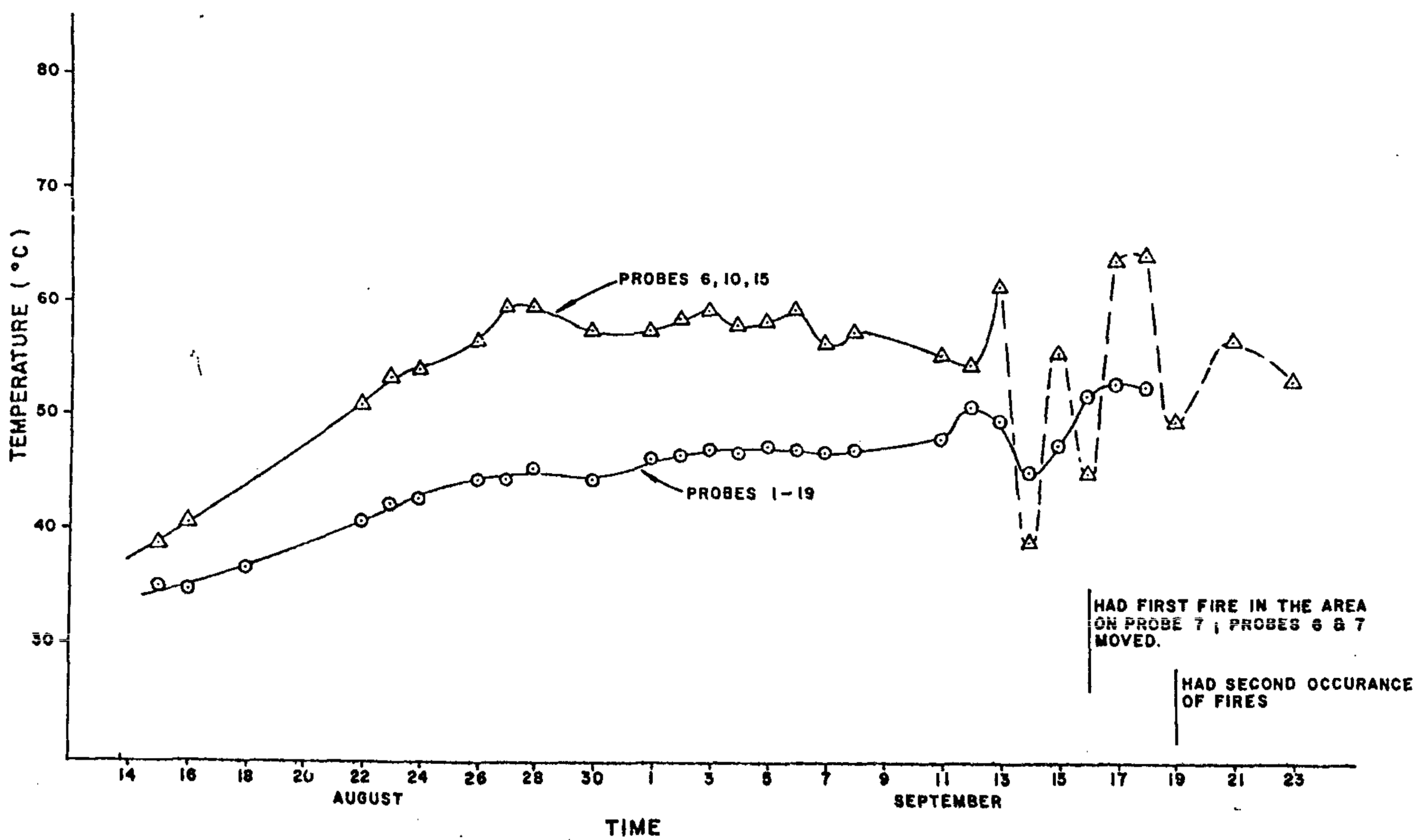
Fires started occurring in the loose crushed piles after 4 weeks of exposure and continued to break out until the piles were compacted. Generally these occurred around the base of the pile in zones where the average temperature had risen to 65 to 70°C. These fires may have started sooner but a period of rain and cold weather appeared to cause the daily rise in temperature to level off.

The following five graphs showing the relationship of temperature rise with time were compiled from the temperature monitoring records. These were done with either individual probes, averages of certain probes, or averages for the pile on

Figure 6

TEMPERATURE RISE Vs TIME

TRENCH A CRUSHED LOOSE PILE

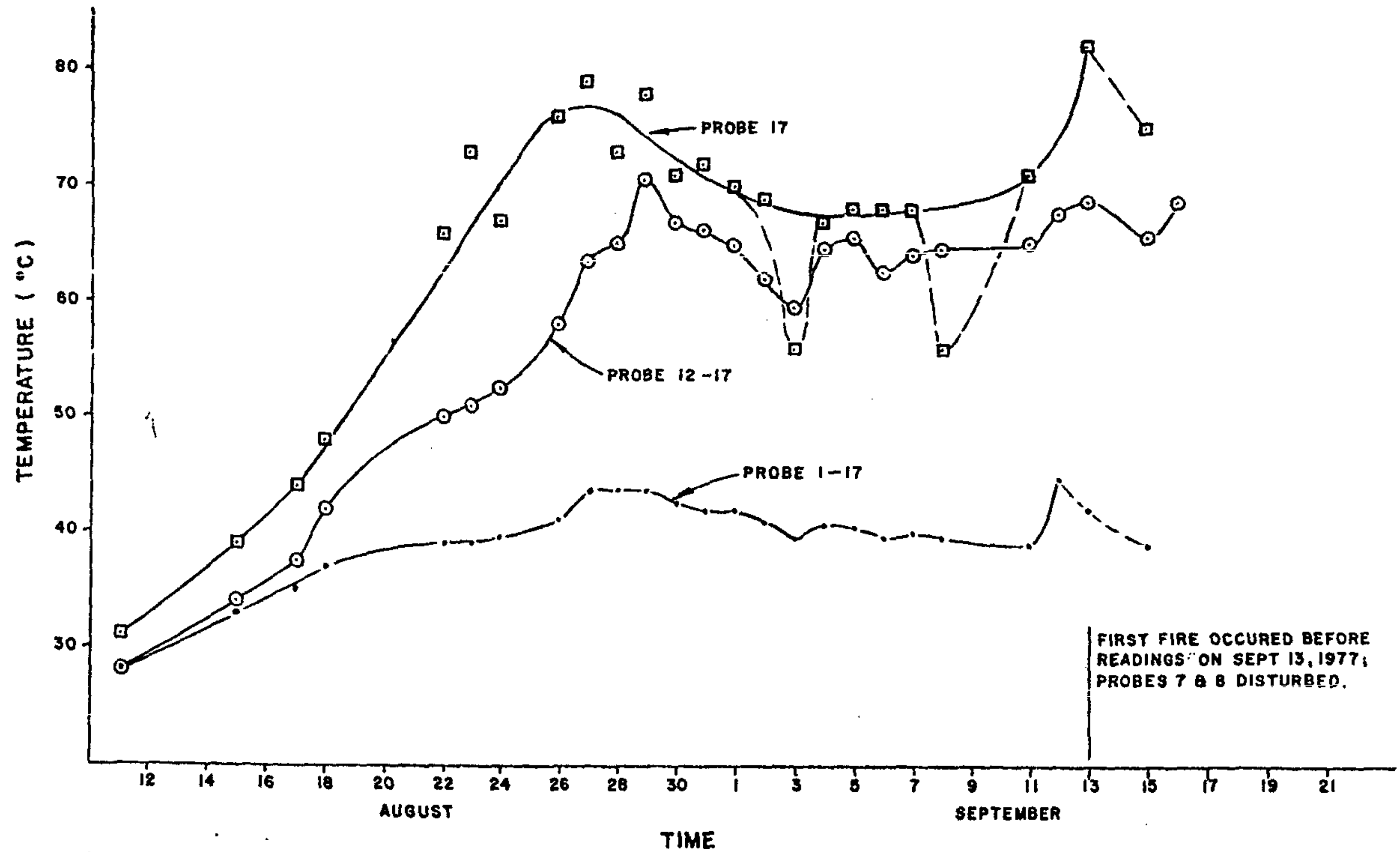


NOTE THAT THE TIME AT EACH DATE INTERCEPT IS 7:00 A.M.

Figure 7

TEMPERATURE RISE Vs TIME

TRENCH B CRUSHED LOOSE PILE



NOTE THAT THE TIME AT EACH DATE INTERCEPT IS 7:00 A.M.

Figure 8

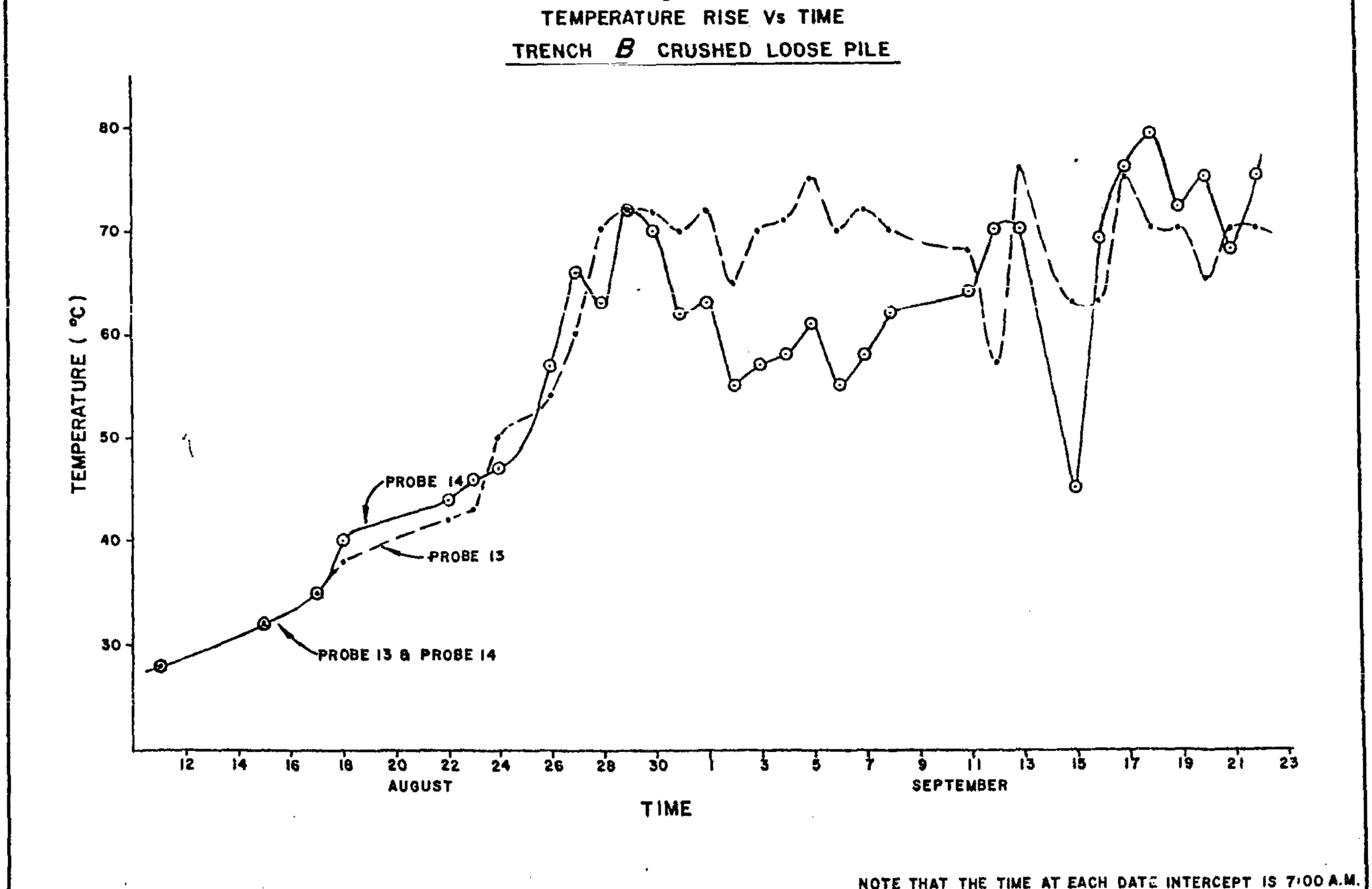
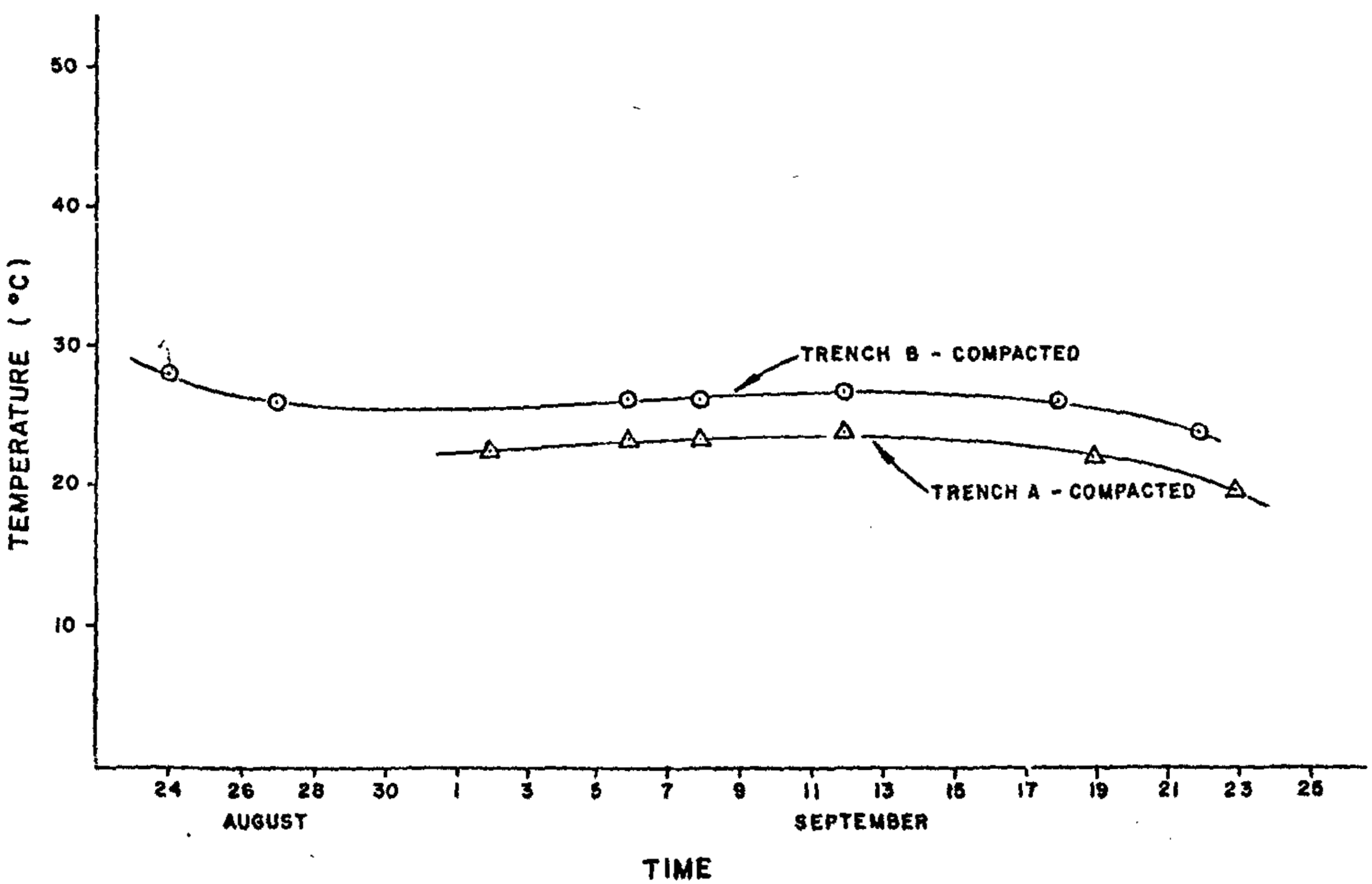

TEMPERATURE RISE Vs TIME
TRENCH B CRUSHED LOOSE PILE
TEMPERATURE (°C)
80
70
60
50
40
30
PROBE 14
PROBE 13
PROBE 13 & PROBE 14
12 14 16 18 20 22 24 26 28 30 1 3 5 7 9 11 13 15 17 19 21 23
AUGUST
SEPTEMBER
TIME
NOTE THAT THE TIME AT EACH DATE INTERCEPT IS 7:00 A.M.

Figure 9

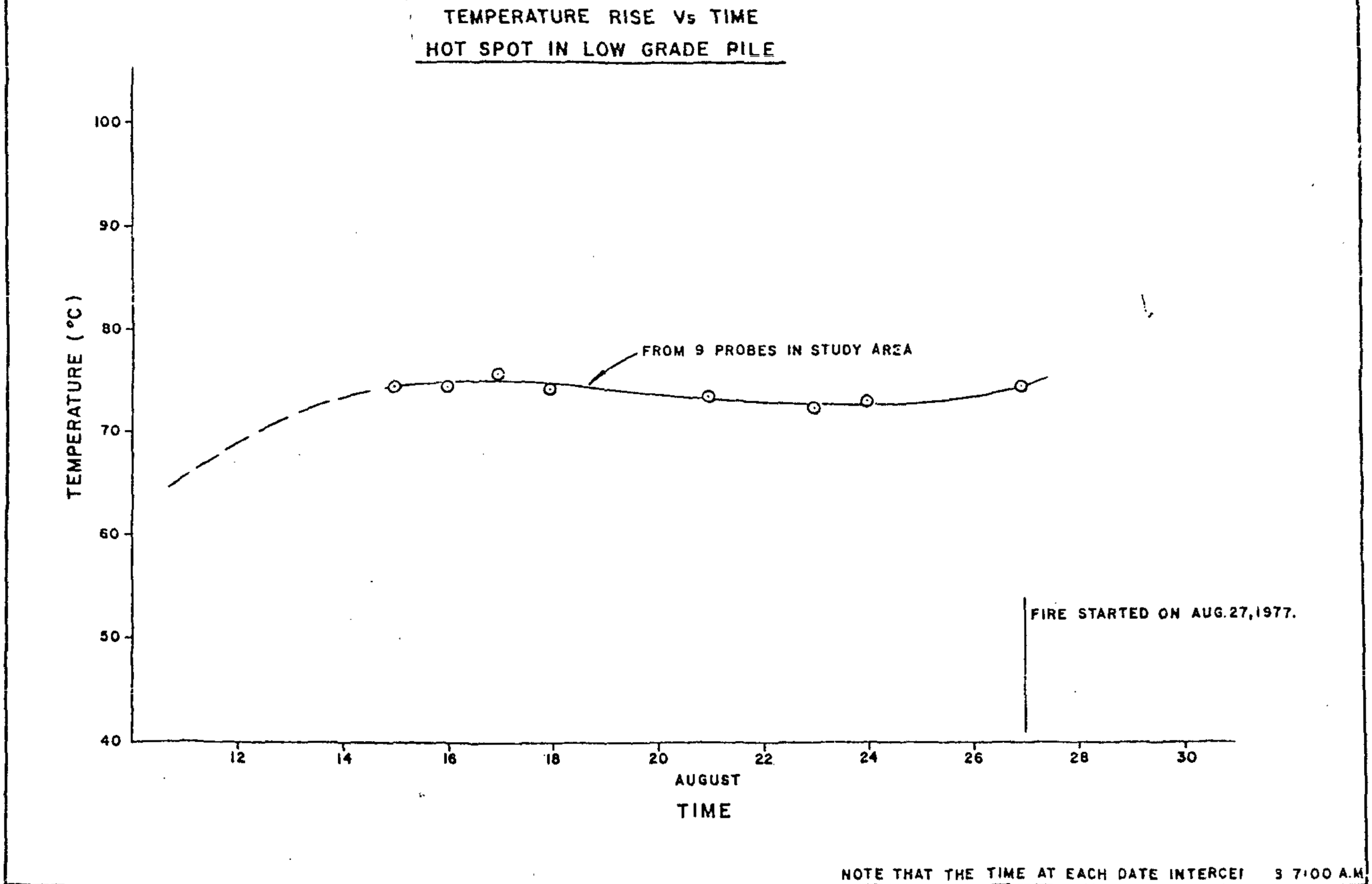
TEMPERATURE RISE Vs TIME

COMPACTED COAL PILES



NOTE THAT THE TIME AT EACH DATE INTERCEPT IS 7:00 A.M.

Figure 10


TEMPERATURE RISE Vs TIME
HOT SPOT IN LOW GRADE PILE
TEMPERATURE (°C)
100
90
80
70
60
50
40
FROM 9 PROBES IN STUDY AREA
FIRE STARTED ON AUG.27,1977.
12
14
16
18
20
22
24
26
28
30
AUGUST
TIME
NOTE THAT THE TIME AT EACH DATE INTERCEI 3 7:00 A.M

3.4 RESULTS - (Cont'd)

the crushed coal test piles, the compacted test piles and the low grade pile (in a local area where the heat build-up was observed and monitored). The graphs for the crushed loose piles show a rapid temperature rise during the first 2 weeks with a levelling off for approximately 2 weeks before fires started occurring. The reason for this levelling off is not known at the present time although the weather may have had some influence as there was a rainy, cooler period coinciding with the levelling off in temperature rise. This same phenomenon also occurred in the low grade pile but here was only a brief period of rain when the area monitored in the stockpile had reached the 70 to 75°C range. The heating was not detected in this zone until after the period of rapid temperature rise.

There was only minor heating in the coaly waste pile and this occurred in areas where the pile was not compacted sufficiently. Also this pile contained a large amount of clays which probably helped to seal the pile.

Most of the fires started in the early morning possibly due to heat build up within the pile overnight (no air movement preventing heat dissipation) and then being fanned by early morning breezes.

Compaction of the hot and/or burning coal always extinguished the fire and caused the coal to cool off.

SECTION 4.0 - TRANSPORTATION

A purchase order was issued to the Canadian Pacific Railway on May 9, 1977, to cover the transport of approximately 6000 tonnes of coal from Hat Creek to Cordel, Alberta. By agreement Alberta Power Ltd. was responsible for unloading the coal from railcars and transporting by highway to their Battle River plant.

Delivery was scheduled as follows:

400 tonnes	-	commence shipment June 14th
	-	complete delivery June 21st
5400 tonnes	-	commence shipment July 15th
	-	complete delivery August 17th

The initial 400-tonne shipment was handled in accordance with our "agreements" with CPR and APL. The only problem encountered was unloading the cars; the coal hung up in the cars and most of it had to be shovelled out. The reasons for this are still being studied but it is believed that the main causes were the fine nature of the coal, compaction caused by transportation vibration, and the high clay content of the coal.

CPR notified us on July 15th that the Cordel siding could not be used for the main 5400-tonne shipment, due to poor track conditions caused by heavy rains since the initial shipment was delivered. Ensuing negotiations resulted in:

1. Use of the Halkirk siding approximately 24 km south of Cordel and 29 km south of Battle River.

2. CPR accepting responsibility for unloading and delivering the coal to the Battle River plant at no additional cost to the Authority.

Although a car supply problem was encountered and the total quantity of coal shipped was increased by 550 tonnes, delivery was completed on August 17th as scheduled.

SECTION 5.0 - BURN TEST

5.1 OBJECTIVES

The main objective was to monitor the behaviour of Hat Creek coal in a commercial scale powerplant and, accordingly, to obtain data needed for steam generator and other powerplant design. This was accomplished by observing key parameters including:

1. Coal handling.
2. Pulverizer performance.
3. Combustion characteristics (flame stability and ignitability).
4. Slagging and fouling characteristics.
5. Ash handling.
6. Precipitator performance.

5.2 METHOD

The burn tests were conducted in Unit No. 2, a 32 MW (nominal capacity) unit at the Alberta Power Ltd. (APL) Battle River station near Forestburg, a town located 160 km southeast of Edmonton. This unit was selected for the following reasons:

1. The unit is a commercial scale powerplant which utilizes equipment similar in nature to the type that would be used in the proposed Hat Creek Project (although much smaller in size).

2. The unit was available for test purposes owing to a scheduled shutdown on account of reduced load demand in the summer months.

3. This unit was chosen over a larger unit since:

5.2 METHOD - (Cont'd)

a. Less coal would be required for prolonged steady operation.

b. There was a reasonable distance for transportation.

c. It could be made available for tests and loss of the unit, in summer, was acceptable.

d. It had a new electrostatic precipitator.

e. Performance could be compared with the Alberta Power Ltd.'s normal low-rank coal on the same boiler.

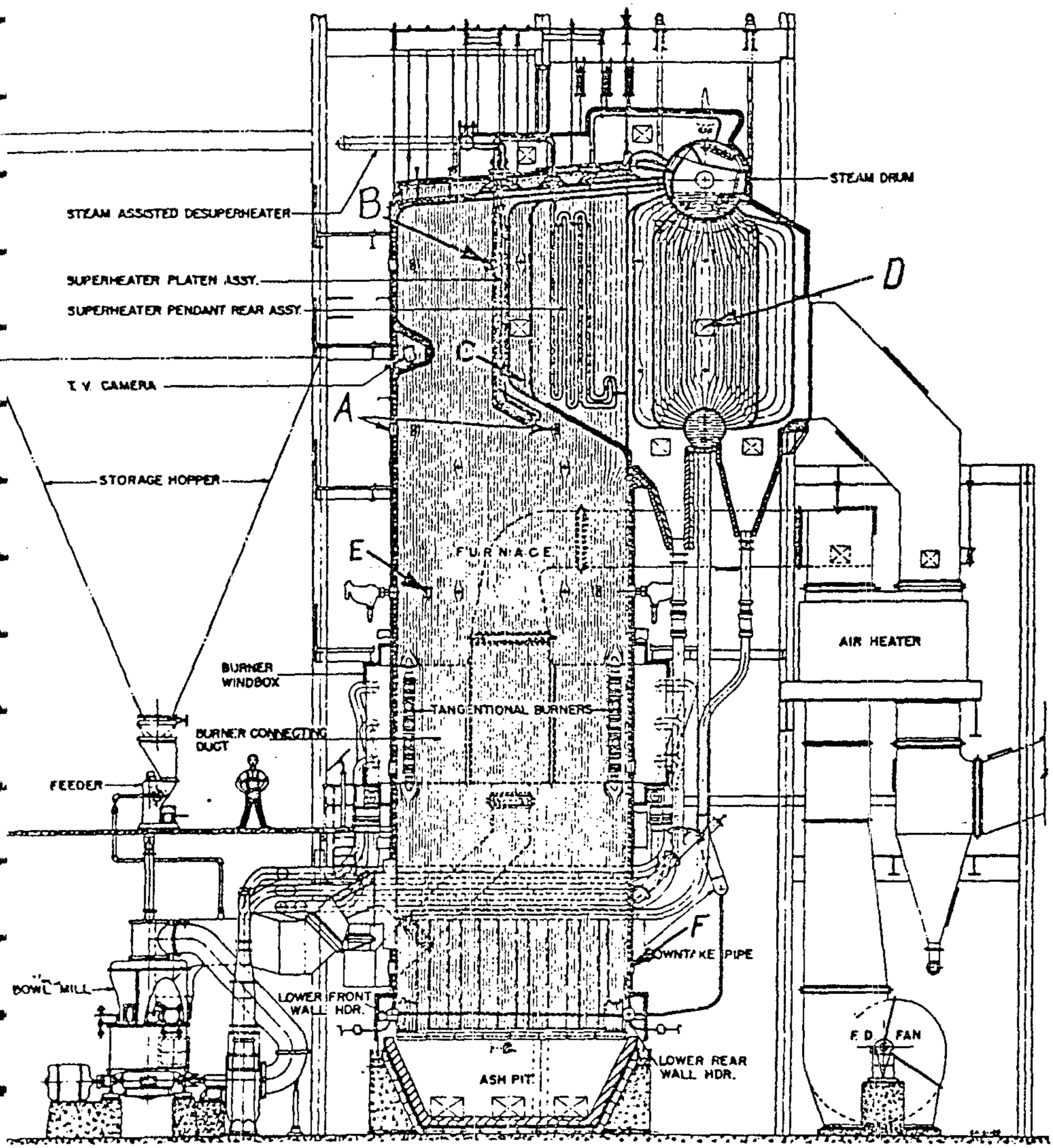
Fig. 11 is a side section of this unit.

5.3 UNIT DESCRIPTION

(a) Key Design Characteristics of Unit No. 2 Battle River

Nominal rating	32 MW (Brown Boveri non-reheat)
Maximum continuous rated steam flow	172 350 kg/hr (Combustion-Engineering blr)
Furnace Width	6.5 m
Furnace Depth	5.6 m
Furnace Plan Area	36.2 m^2
Furnace Volume	577.3 m^3
Furnace Project Area	470.3 m^2
Superheater outlet pressure	4300 kPa (625 psi)
Superheater outlet temperature	400^{o}C (825^{0} F)
Number and type of pulverizers	3 Raymond Bowl
Number of burners	3 levels of 4
Firing type	corner-tangential

FIG. 11 - BATTLE RIVER BOILER - GENERAL ARRANGEMENT



A, B, C, D, E and F = ASH DEPOSIT PROBE LOCATIONS.

5.3 UNIT DESCRIPTION - (Cont'd)

Design fuel	19 300 kJ/kg; 6.8% ash (8300 Btu/lb)
Fans	1 F.D.; 1 I.D.
Preheaters	2 vertical rotary
Precipitator (S.F. - Retrofit in 1974)	106 m^3/s @ 190°C
Auxiliary fuel	light oil/steam atomized

(b) Coal Handling System

Coal deposited by trucks onto an open dump is bulldozed into a grizzly and run through a secondary crusher. From this point a conveyor belt and movable tripper fills the hopper above each of the three feeders as determined visually by the plant attendant. Discharge from the rotary vane type coal feeders is monitored by a vibration pick-up in the coal stream into each pulverizer inlet pipe. Each of the three pulverizers supplies one level of four burners.

(c) Ash Handling System

Both bottom ash and fly ash are removed from the powerhouse by a semi-automatic dry vacuum system.

Dry bottom ash is removed manually from the three furnace ash-pit doors, and while large sinters are usually disposed of separately, the majority are broken up and forced into the vacuum extraction header by the operators.

Fly ash is withdrawn from the precipitator hoppers through automatically controlled valving and is deposited into a storage hopper external to the building. Bottom ash is also deposited within the compartmentalized hopper and both are stored until transferred by gravity dump into transport vehicles for disposal.

5.3 UNIT DESCRIPTION - (Cont'd)

(d) Burn Test Parameters

In conducting the test, the three main operating variables were: load, excess air and pulverizer fineness. During each test run, usually of 4 hours duration, each of these variables was kept constant with values, as shown in Fig. 12, which indicates the schedule for the burn test program. The "Classifier" is the mechanism that controls the degree of fineness to which the pulverizer grinds the coal, and "Fluegas O_2" indicates the excess air level, while "Mills I/S" designates the number of pulverizers in service. By conducting the test runs at these different settings it was possible to monitor boiler performance over a wide range of operating conditions.

The following table indicates items that were measured or calculated for each test run:

Test, No./duration	Proximate
Period Evaluated	Ultimate Fuel Analysis
Boiler-turbine load, MW	Feedwater flow
Pulverizers I/S	Feedwater temp./press.
Classifier setting	SH temp./press.
CO Lvg precipitator	Windbox press.
NO_x Lvg precipitator	Air Lvg Ljungstrom
SO_2 Lvg precipitator	Gas to Ljungstrom
SO_3 Lvg precipitator	Coal/air temp. Lvg mills
Furnace Lvg gas temperature	Mill inlet temperature, ^oF
Carbon in fly ash	HHV as fired, Btu/lb
Carbon in bottom ash	Boiler efficiency
Rejects of mills, lb/hr	Coal-fired, lb/hr
P.F. fineness	Fluegas opacity

FIG. 12 - HAT CREEK PROJECT - BURN TEST - TEST SCHEDULE

DATE	TEST #	TIMES	COAL	LOAD (MW)	MILLS I/S	CLASSI-FIER* (Mill Fineness Indication)	FLUE-GAS O_2 (Excess Air Level Indication)	COMMENTS
4 Aug.		0800-1200	APL	29	All	3	3	
4 Aug.		1700						#6 Mill on Hat Creek coal
5 Aug.		0800		23				#6 Mill on Hat Creek coal
5 Aug.		1025	H.C.	20.5	All			
8 Aug.								Fireside inspection of Boiler & Equipment
11 Aug.	1	0800-1200	H.C.	17	All	3	5	
11 Aug.	2	1400-1800	H.C.	17	All	3	5	
12 Aug.	3	0800-1200	H.C.	18	All	3	4	
12 Aug.	4	1530-1930	H.C.	18	All	3	5	
13 Aug.	5	0800-1200	H.C.	10	4&5	3	6	
13 Aug.	6	1500-1900	H.C.	10	5&6	3	6	
14 Aug.	7	0800-1200	H.C.	10	5&6	4	5	
14 Aug.	8	1400-1700	H.C.	10	4&5	4	5	
15 Aug.	9	0800-1200	H.C.	16.5	All	4	3	Large quantities of bottom ash clinkers
15 Aug.	10	1530-1830	H.C.	16.5	All	4	3	
16 Aug.	11	0800-1200	H.C.	16	All	4	5	
16 Aug.	12	1500-1800	H.C.	16	All	4	5	
17 Aug.	13	0800-1200	H.C.	21	All	2	3	Heavy clinker formation
17 Aug.	14	1530-1800	H.C.	21	All	2	3	Heavy clinker formation
18 Aug.	15	0800-1000	H.C.	21	All	2	5	High ash level in precipitator hopper
19 Aug.								No damage found at Precipitator
19 Aug.	W.R.&D.	2000-2400	H.C.	11	5&6	2	6	(W.R.&D. - Western Research & Development)
20 Aug.	16	0800-1200	H.C.	21	All	2	5-4	Heavy clinker during last hour
20 Aug.	17	1800-2130	H.C.	21	All	2	5	
21 Aug.	18	1000-1215	H.C.	11	4&5	3	5	
21 Aug.	19	1615-1830	H.C.	19	All	3	5	
22 Aug.	20	0000-0800	H.C.					Shift coverage overnight
22 Aug.	21	0800-1200	H.C.	20	All	3	+5	MgO added to furnace
22 Aug.	22	2030-2230	H.C.	19	All	3	4	

DATE	TEST #	TIMES	COAL	LOAD (MW)	MILLS I/S	CLASSI-FIER*	FLUE-GAS O_2	COMMENTS
23 Aug.	23	0800-1200	H.C.	25	All	2/3	3	
23 Aug.	24A&B	1830-2100	H.C.	18/26	4&6/All	2/3	5	Walls in high heat release area heavily fouled
26 Aug.								Fireside inspection of boiler & Equipment
27 Aug.								Unit start-up on H.C. coal & changed to APL coal
29 Aug.	25	0800-1200	APL	24	All	3	3	Heavy fouling of entire unit
29 Aug.	26	1400-1800	APL	25.5	All	3	5	Heavy fouling of entire unit
30 Aug.	27	0800-1145	APL	11	4&5	3	4	
30 Aug.	28A	1300-1500	APL	11	5&6	3	4	
30 Aug.	28B	1545-1730	APL	11	4&6	3	4	
30 Aug.	29	1845-2030	APL	16.5	4&6	3	4	
31 Aug.	30	0800-1000	APL	16.5	4&5	3	4	
31 Aug.	31	1015-1215	APL	21	All	5	5	
31 Aug.	32	1315-1515	APL	21	All	5	3	
31 Aug.	33	1530-1730	APL	25	All	5	3	
31 Aug.	34	1830-2030	APL	25	All	5	5	

LEGEND:

H.C. = Hat Creek coal

APL = Alberta Power Coal, the normal fuel burned in the test unit.

Mills I/S = Mills in service; the test unit has a total of 3 pulverizers, numbered 4,5 and 6.

* The range of classifier settings is from 0 - 5, with 0 being the coarsest grind and 5 being the finest grind.

5.3 UNIT DESCRIPTION - (Cont'd)

+ 50 mesh
- 200 mesh
Inlet air temperature, ^oF
Exit gas temperature, ^oF
CO_2 Lvg Ljungstrom
O_2 Lvg Ljungstrom

Furnace outlet temperature, ^oF
Ash deposition at various locations in the boiler

Lvg = leaving

5.4 RESULTS

(a) General

Several firms and individuals participated in the power-plant aspects of the Bulk Sample Program. The bibliography at the end of this report lists the relevant reports which are summarized in this Section.

(b) Fuel Analyses

1. Typical Hat Creek Coal Analyses from Test Burn:

	Air Dried	Dry Basis	As Received
Proximate Analysis			
Moisture ______%	5.8	-	21.9
Ash ______%	38.2	40.5	31.7
Volatile Matter ______%	31.5	33.4	26.1
Fixed Carbon ______%	24.5	26.1	20.3
Heating Value			
kJ/kg ______	14 759	15 668	12 237

5.4 RESULTS - (Cont'd)

Fly Ash Analyses

	Percent		Percent
Silicon Dioxide	55.09	Chromium Oxide	0.01
Aluminum Oxide	26.48	Nickel Oxide	-
Iron Oxide	6.60	Vanadium Pentoxide	-
Calcium Oxide	1.85	Sodium Oxide	0.36
Magnesium Oxide	1.40	Potassium Oxide	1.12
Titanium Dioxide	1.21	Phosphorous Pentoxide	0.18
Manganese Oxide	0.40	Sulphur Trioxide	0.02
Molybdenum Trioxide	-		

Bottom Ash Analyses

	Percent		Percent
Silicon Dioxide	56.54	Chromium Oxide	0.02
Aluminum Oxide	23.02	Nickel Oxide	-
Iron Oxide	10.21	Vanadium Pentoxide	-
Calcium Oxide	2.14	Sodium Oxide	0.47
Magnesium Oxide	1.59	Potassium Oxide	0.91
Titanium Dioxide	1.18	Phosphorous Pentoxide	0.17
Manganese Oxide	0.13	Sulphur Trioxide	1.06
Molybdenum Trioxide	-		

2. Typical Alberta Coal Analyses from Test Burn:

		As Analysed	Dry Basis	As Received
Proximate Analysis				
Moisture	%	7.3	-	27.4
Ash	%	13.6	14.7	10.7
Volatile Matter	%	40.5	43.7	31.7
Fixed Carbon	%	38.6	41.6	30.2
Heating Value				
kJ/kg		22 546	24 321	17 657

5.4 RESULTS - (Cont'd)

Fly Ash Analyses

	Percent		Percent
Silicon Dioxide	46.97	Chromium Oxide	0.01
Aluminum Oxide	24.39	Nickel Oxide	-
Iron Oxide	6.10	Vanadium Pentoxide	-
Calcium Oxide	9.59	Sodium Oxide	3.28
Magnesium Oxide	1.88	Potassium Oxide	0.94
Titanium Dioxide	0.79	Phosphorous Pentoxide	0.49
Manganese Oxide	0.06	Sulphur Trioxide	0.17
Molybdenum Trioxide	-		

Bottom Ash Analyses

	Percent		Percent
Silicon Dioxide	56.01	Chromium Oxide	0.01
Aluminum Oxide	18.93	Nickel Oxide	-
Iron Oxide	7.26	Vanadium Pentoxide	-
Calcium Oxide	8.18	Sodium Oxide	1.76
Magnesium Oxide	1.45	Potassium Oxide	0.90
Titanium Dioxide	0.70	Phosphorous Pentoxide	0.46
Manganese Oxide	0.12	Sulphur Trioxide	0.24
Molybdenum Trioxide	-		

Stock facilities simulated coal flow from hoppers of 71^o and 78^o (from the horizontal) through 61 cm down-spout and 61 cm gravimetric feeder, and also from identically constructed hoppers to a 91 cm downspout and feeder.

Flowability of the coal was excellent as received, total moisture was 22.5 percent with equilibrium moisture at 21.94 percent. The surface moisture was 0.6 percent. Moisture was gradually added to the coal and no flow problems were encountered with the 24 inch set up until a moisture total of 26 percent was reached, giving a 5.2 percent surface moisture. As the moisture was increased from 26 to 29 percent, the flowability of the coal continued to decrease. At 29 percent the flow stabilized at relatively poor with frequent hang-ups at the tank outlet and at the feeder inlet. The system was changed over to a 91 cm outlet, and the flow was good, even at this high moisture content of 29 percent total with an 8.9 percent surface moisture.

The important thing to note for this series of tests was that the flow became unreliable somewhere between 5 and 8 percent surface moisture and was poor at 8.4 percent and above. It is concluded that this is a typical characteristic of Hat Creek coal because of the very high percentage of clay. It was concluded that 91 cm feeders should be used for Hat Creek coals.

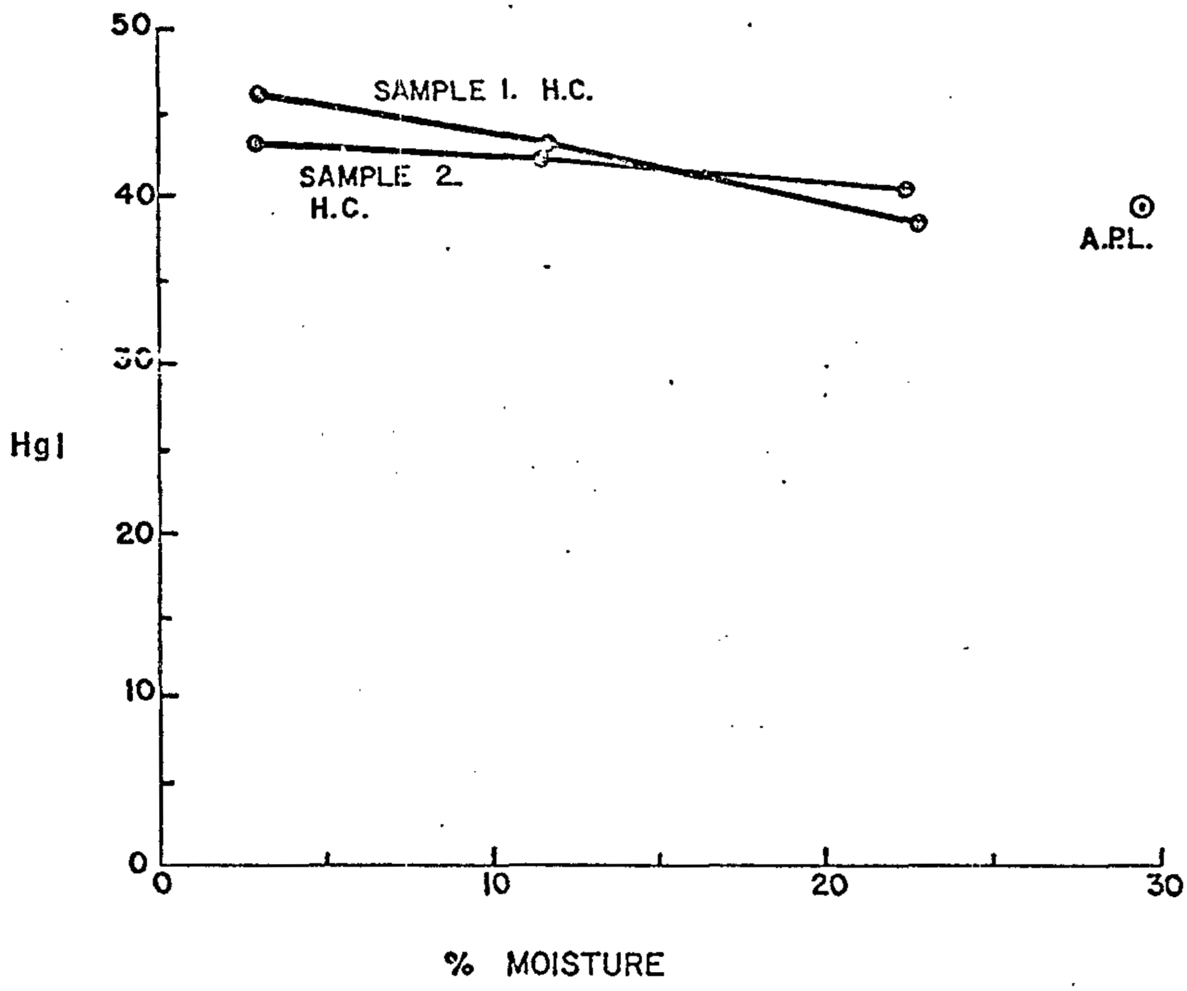
(d) Pulverizer Performance

Information on pulverizer performance and grindability was obtained by determining the grindability index for several samples during the test, by determining the degree of fineness to which the Battle River pulverizers ground the coal at various classifier settings, and comparing this result with the fineness to which the same pulverizers ground APL coal, and by determining the primary air temperature required for satisfactory mill, exhauster and burner operation.

The Hardgrove grindability index varied substantially from sample to sample due to differences in moisture percent, ash percent and degree of degradation of the samples. In order to determine the effect of moisture on grindability, the HGI was measured for the same samples with different moisture contents. The results are shown on Fig. 13 which also shows typical Battle River coal.

Figure 13

GRINDABILITY AND MOISTURE



5.4 RESULTS - (Cont'd)

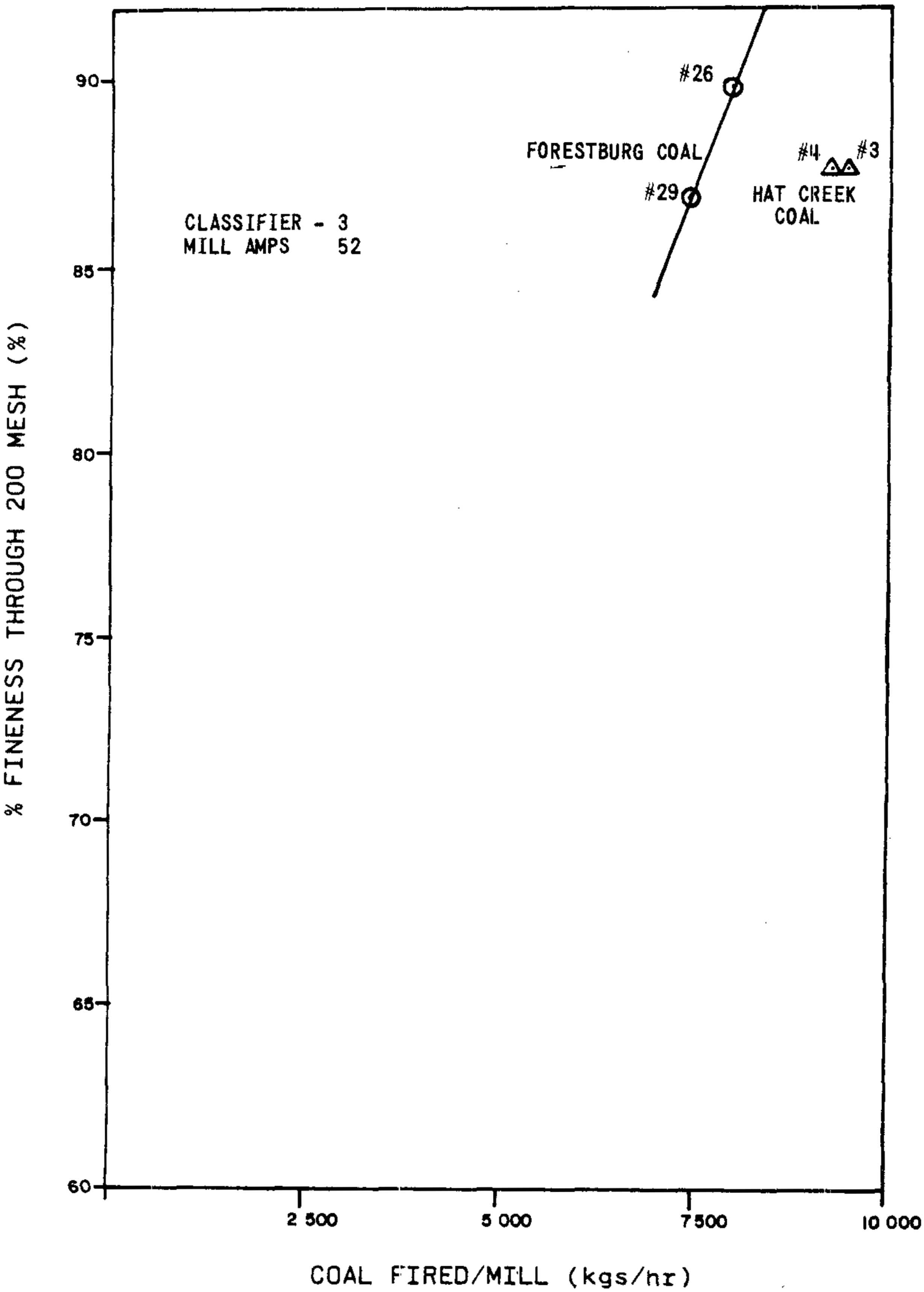
It was observed that at the same throughput the Battle River pulverizers produced a higher degree of fineness when utilizing Hat Creek coal as compared to APL coal. Fig. 14 compares tests 3 and 4 on Hat Creek coal, and tests 26 and 29 on Forestburg coal. At the same fineness to -200 mesh, the Hat Creek coal has a higher throughput indicating it is easier to grind. The increased capacity is approximately 25 percent at 87.5 percent through 200 mesh.

Besides fineness, the ability of the pulverizers to reject heavy tramp material from the coal was monitored. With Hat Creek coal the pulverizers performed very satisfactorily with the rejects being small quantities of non-combustible fine gravel-like material. This gravel-like material could have been part of the in-situ coal or it could have been picked up from the stockpile base. When burning APL coal, the pulverizers produced a larger amount of rejects with a higher percentage of combustibles. Some of the APL coal normally includes heavy waste material which is rejected by the pulverizer and which includes some combustibles.

As expected, with the lower moisture content of the Hat Creek coal no difficulties were encountered with regard to adequate primary air temperature. The maximum temperature of the primary air was unusually high at 450°C; the Battle River unit adds furnace gas to the hot air to the mill due to the high moisture content of the Battle River coal. The coal/air maximum temperature with Hat Creek coal was correspondingly high at 82°C. The design value for a Hat Creek boiler would be in the crater 370°C for primary air temperature.

FIGURE 14

AVERAGE % FINENESS THROUGH 200 MESH
VS
AVERAGE COAL FIRED PER MILL



5.4 RESULTS - (Cont'd)

(e) Combustion Characteristics and Furnace Design

As a basis for comparison purposes, the plan area heat release, furnace heat release and furnace liberations for both Hat Creek and APL fuels at different loads are tabulated in Table 2.

(i) Furnace Temperature Profile Burnout

Furnace temperatures were measured by suction pyrometers at locations shown on Fig. 15. The temperature measurements at locations A and B are plotted against steam generated in Figs. 16 and 17. Under the superheater nose at location A, the furnace temperature was 93^{o}C higher when firing Forestburg coal than when firing Hat Creek coal at loads above 100 000 kg/hr steam flow. The temperature entering the super-heater at location B was approximately the same for both coals at loads greater than 90 000 kg/hr steam flow. Both measurements were made 2.7 m in from the left side wall.

Fig. 18 compares temperature readings versus elevation in furnace for Hat Creek coal and Forestburg coals under similar load conditions. This shows that, based upon optical hydrometer readings, furnace temperatures were about 38^{o}C higher in each case with the Battle River coal.

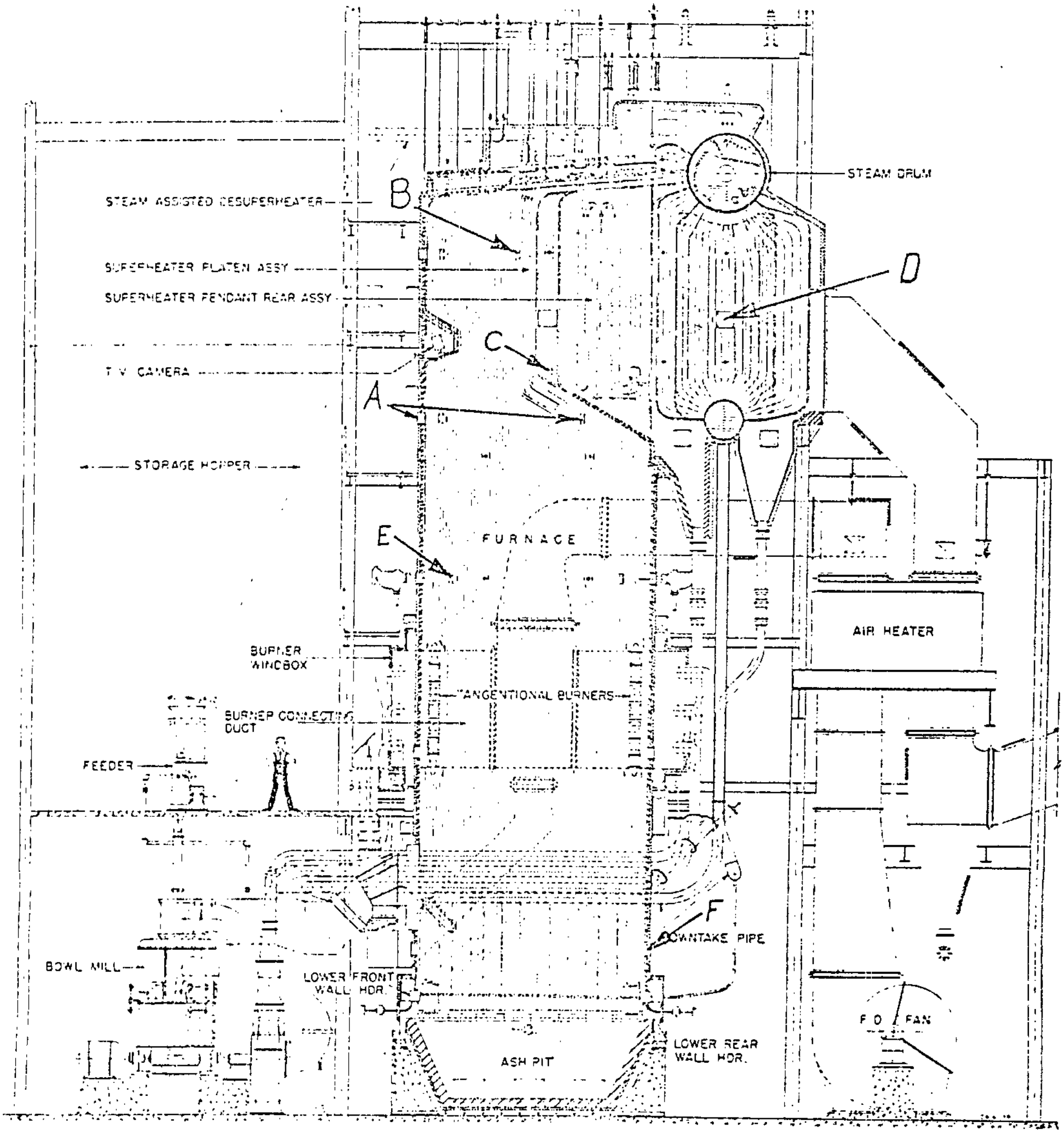
These furnace gas temperature profiles indicate that the release of thermal energy burning Hat Creek coal was somewhat delayed compared to APL coal which released its thermal energy quicker. Heat flux meters were also installed on the furnace walls which confirmed that higher gas temperatures burning Hat Creek coal occurred higher up in the furnace than with APL coal.

TABLE 2

HEAT INPUT, FLUE GAS FLOW, COAL FLOW, HEAT RELEASES

Test No.	Load MW	Boiler Load %	Pulv. In Oper.	Pulv. Set.	Burner Tilt	Heat Input GJ/Hr	Flue Gas Flow Mg/Hr	Coal HHV KJ/kg	Coal Flow Mg/Hr	GJ/m²Hr Plan Area Release	MJ/m²Hr Heat Release	MJ/m³Hr Furnace Liberation
HAT CREEK COAL												
1	16.7	48.6	3	3	+13	280.3	152.6	10 837	28.9	7.73	595.9	484.1
2	17.	48.8	3	3	+11	278.5	144.3	11 514	24.2	7.68	591.3	480.4
3	18.3	52.3	3	3	+12/0	299.9	162.1	11 574	25.9	8.27	637.9	517.6
4	18.	52.6	3	3	- 2	299.7	159.9	11 665	25.7	8.26	637.7	517.6
5	10.5	32.6	2	3	+10	192.4	103.2	11 425	16.8	5.31	408.6	331.4
6	10.3	31.3	2	3	- 5	188.5	104.2	11 062	17.1	5.20	400.7	327.7
7	9.9	29.8	2	2	0	175.1	94.6	11 135	15.7	4.84	258.8	301.6
8	10.	30.3	2	2	+ 9	180.4	95.4	10 888	16.6	4 97	383.6	312.8
9	16.3	44.7	3	4	+11	255.5	112.2	11 325	22.5	7.05	542.5	443.2
10	16.1	44.7	3	4	+18	251.0	115.2	11 211	22.4	6.92	533.5	435.7
11	15.3	42.7	3	4	+21	243.0	111.4	11 539	21.0	6.71	516.4	420.8
12	15.9	44.7	3	4	+15	255.8	118.0	11 207	22.8	7.06	543.7	443.2
13	21.3	58.1	3	2	+15	334.2	149.6	10 379	32.2	9.22	712.8	577.2
14	21.	57.8	3	2	+12	318.0	140.4	11 972	26.6	8.77	676.5	551.2
15	21.	57.1	3	2	+18	323.6	158.0	11 686	27.7	8.92	687.8	562.3
16	20.7	57.9	3	2	+ 2	327.9	158.0	12 086	27.1	9.05	696.9	566.0
17	21.2	59.4	3	2	0	329.8	162.9	11 544	28.6	9.10	701.4	569.8
18	10.9	34.2	2	3	0	196.4	94.0	12 237	16.1	5.41	417.7	338.9
19	18.5	52.6	3	3	0	296.3	142.0	12 865	23.0	8.17	628.8	513.9
21	4/20											
22	18.9	52.6	3	3	0	300.3	149.6	12 207	24.6	8.29	637.9	521.4
23	25.1	70.4	3	2/3	+0/5	391.3	193.5	11 665	33.6	10.79	832.0	678.9
24A	17.6	48.4	2	2/3	+12	276.3	132.8	11 365	24.3	7.62	586.8	476.7
24B	26.	71.7	3	2/3	+12	397.7	178.2	11 363	35.0	10.96	845.6	688.9
ALBERTA POWER COAL												
25	25.1	69.6	3	3	-10	370.4	163.2	16 770	22.1	10.22	787.7	640.5
26	25.6	70.4	3	3	-10	375.0	176.3	16 770	22.4	10.34	796.8	648.0
27	11.	32.9	2	3	0	184.6	86.0	17 017	10.8	5.10	392.7	320.3
28A	11.	32.7	2	3	+10	188.3	91.2	17 808	10.6	5.19	399.5	324.0
28B	11.1	32.5	2	3	+10	185.0	88.0	17 743	10.4	5.22	392.7	320.3
29	16.5	45.9	2	3	- 1	252.5	123.4	17 657	14.3	6.97	536.9	435.7
30	16.5	45.5	2	3	- 1	258.2	123.9	17 657	14.6	7.12	548.2	446.9
31	21.5	59.4	3	5	- 1	321.2	156.2	17 657	18.2	8.86	688.3	554.9
32	21.4	50.2	3	5	- 1	317.6	146.8	17 657	18.0	8.76	675.3	551.2
33	26.1	71.9	3	5	-1/0	383.5	181.4	17 657	21.7	10.58	814.9	662.9
34	26.	71.5	3	4	0	382.0	180.9	17 657	21.7	10.56	811.5	662.9

Figure 15

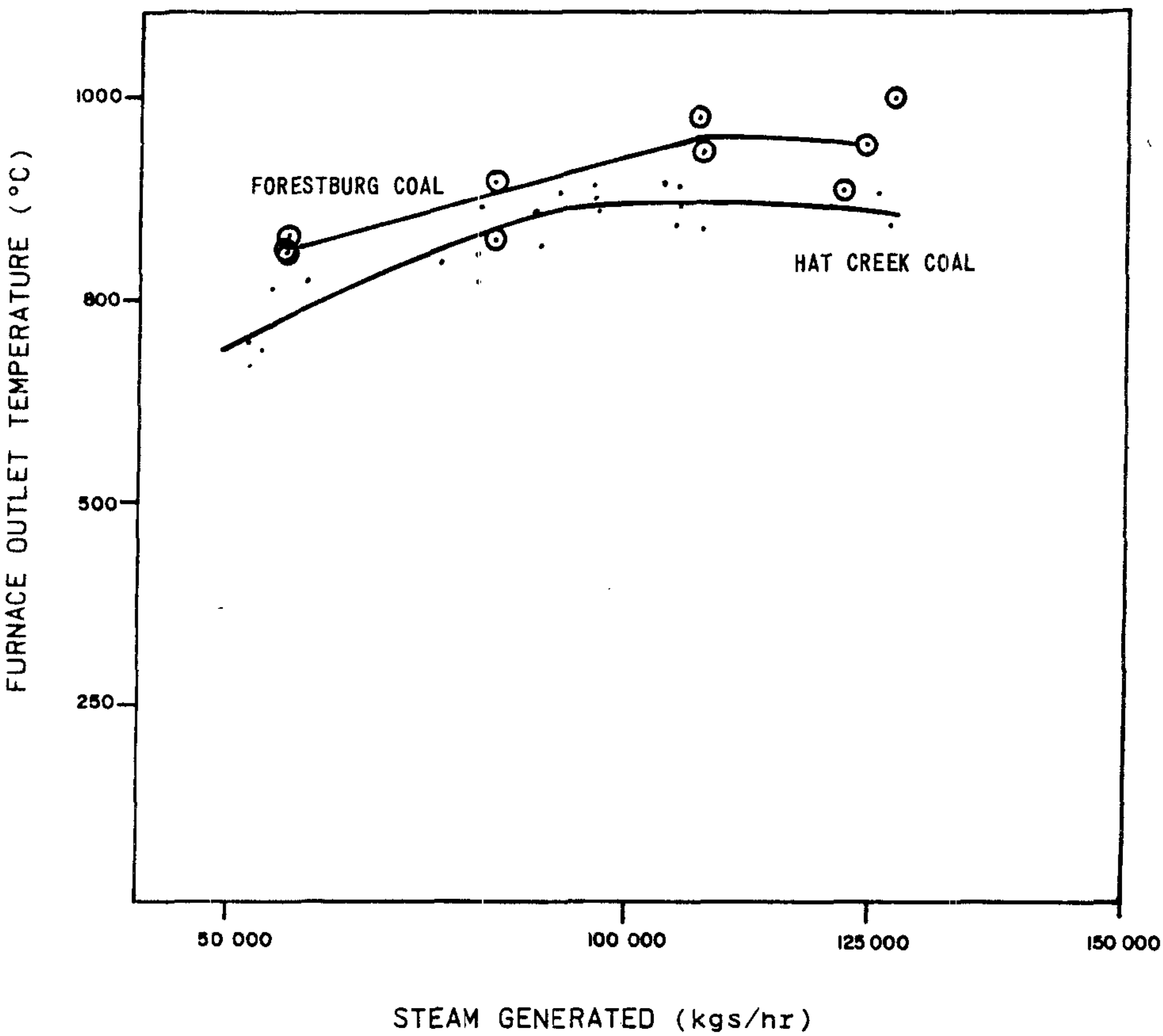


GENERAL ARRANGEMENT

LOCATION OF WATER-COOLED TEMPERATURE PROBES AND ASH DEPOSITION PROBES

FIGURE 16

FURNACE OUTLET TEMPERATURE BELOW SUPERHEATER NOSE VS STEAM GENERATED



FURNACE OUTLET TEMPERATURE
ENTERING SUPERHEATER (LOCATION B)
VS
STEAM GENERATED

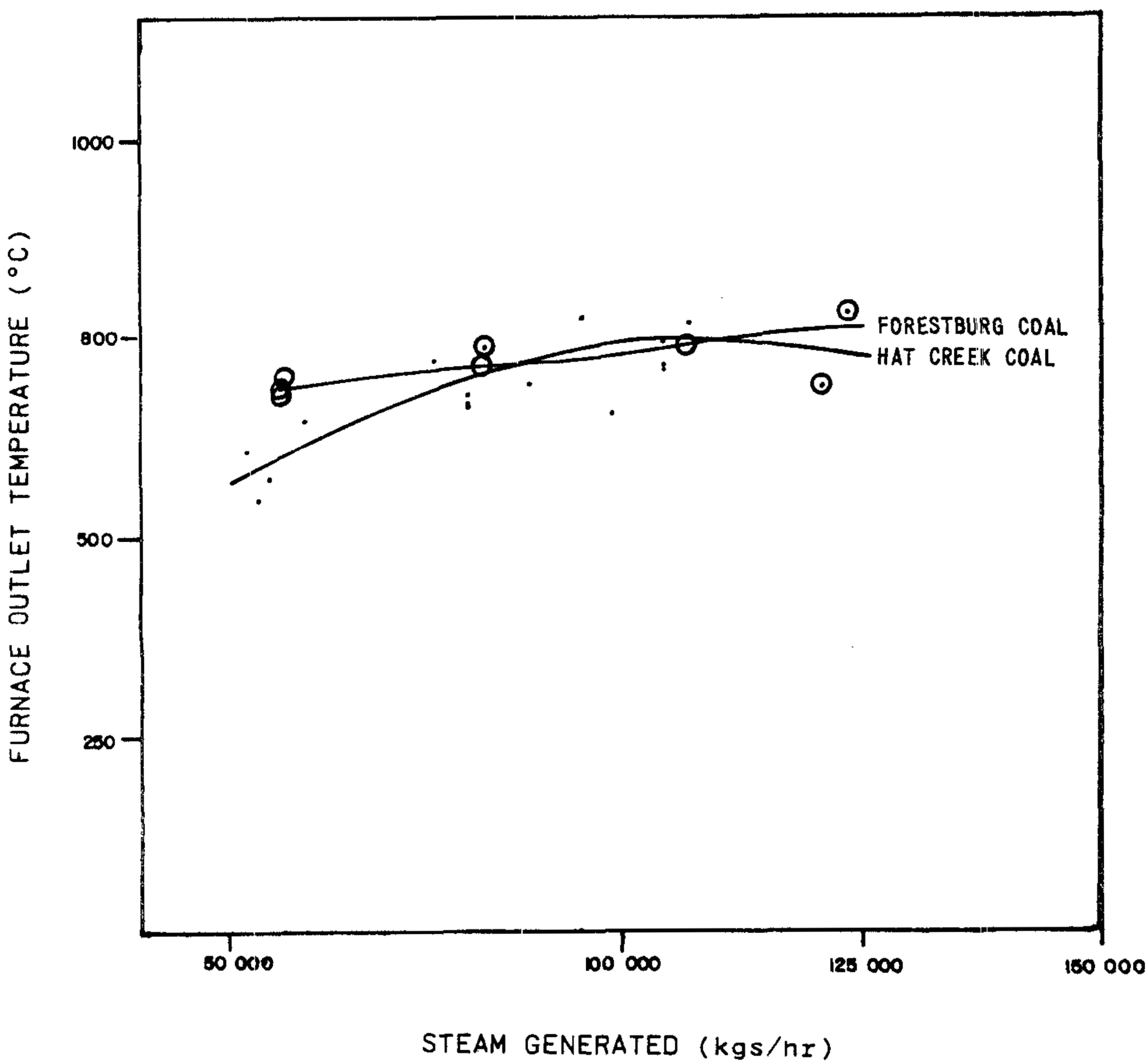


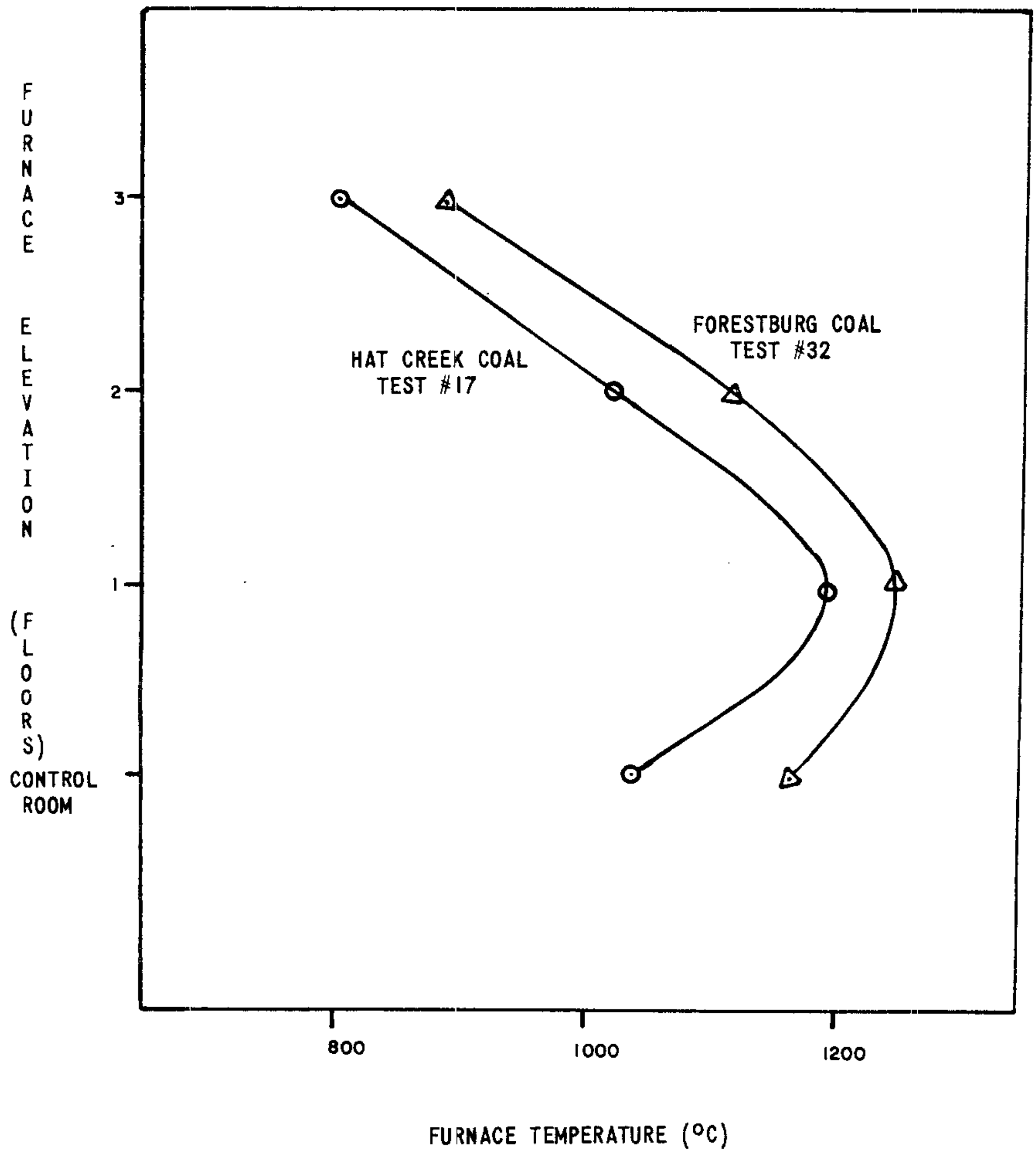
FIGURE 18

HAT CREEK PROJECT BURN TEST

FURNACE TEMPERATURE

HAT CREEK COAL VS FORESTBURG COAL
AT 102,000 kgs/hr STEAM FLOW

(TEMPERATURES MEASURED WITH L&N OPTICAL PYROMETER)



5.4 RESULTS - (Cont'd)

(ii) Flame Stability and Ignitability

There were no problems during initial start up on coal or maintaining a stable fireball condition in the furnace. On tests 5, 6, 7, 8 and 18, the unit was run at 31.8 percent, 31.3 percent, 30.3 percent, 30.3 percent and 34.2 percent load respectively, with two mills in service and no instability was noticed. Test No. 24A was run at 48.9 percent load with two mills in service with the top and bottom elevations of coal nozzles in service and the middle elevation out of service to try to create unstable furnace conditions, but no instability occurred.

(f) Fouling and Slagging Characteristics

(i) Slagging

Slagging in these full-scale burn tests compared closely with the results obtained in the pilot-scale trials at CCRL. The dominant form of deposits falling to the ash pit were porous sinters ranging from 2.5 cm to 30 cm or more in diameter. Colour varied from charcoal grey to reddish brown. Although their porous structure made them very light, they were typically strong enough to bear a man's weight.

The sinter deposits did not bond firmly to any of the boiler surfaces and thus, as they increased in thickness or due to load changes, fell off of their own weight. The appearance of some of the sinters indicated that the outer layers, in some cases, had become plastic and started to bend downwards before they broke free and fell.

5.4 RESULTS - (Cont'd)

Slag formed in the area of highest heat flux, 3 to 5 m above the burners and at the junction of the furnace nose and rear wall where it formed and fell or slid down the rear wall to the furnace hopper.

Of the various air-cooled deposition probes inserted in the furnace, and operated at temperatures up to 650°C, none showed any sintered deposit. Fairly heavy deposits of dust formed, but these adhered to the probes so weakly that they frequently fell off as the probes were being removed from the furnace. Similar behaviour was observed during the CCRL trials, although sinters formed on uncooled refractory probes. At Battle River, an uncooled stainless steel tube thrust several feet into the furnace 1.5 m above the top burner level, glowed orange-yellow when removed, but like the cooled probes, it bore only a weakly-adhering deposit of dust after 15 minutes of exposure in the flame.

It should be noted that the furnace heat flux (as measured by the previously noted meters) did not increase during the test which indicates that the furnace remained clean and hence confirms that Hat Creek coal is a low slagging fuel. In comparison, heat flux readings increased when burning APL coal which indicates that APL coal is a higher slagging fuel. This is what would be expected since the Hat Creek test coal ash fusion I.D. temperature is 1480°C compared to 1140°C for Forestburg ash.

5.4 RESULTS - (Cont'd)

(ii) Fouling

Hat Creek coal firing caused light fouling of the superheater and boiler bank tubes. For comparison, the superheater and boiler bank acquired heavy, hard and highly sintered deposit build-up when APL coal was fired. It is concluded that the high sodium content in the APL coal is responsible for its high fouling tendencies.

(g) Erosion

The high volume of ash as well as causing disposal problems, may also cause erosion problems. However, due to the shortness of the test any erosion was of such small amount that the individuals inspecting the unit disagreed as to its extent.

(h) Precipitator Study and Design Recommendations

Southern Research Institute with the assistance of Western Research and Development conducted a series of tests at the Battle River power station during the burn tests program, to develop information necessary to provide a design for an electrostatic precipitator to be installed at the Hat Creek thermal plant.

Determinations were made of fly ash emission concentrations and rates, and flue-gas analyses at the inlet and outlet of the Forestburg precipitator.

Sulphur dioxide and trioxide concentrations at the precipitator outlet were measured and also nitrogen oxides concentrations at the outlet.

5.4 RESULTS - (Cont'd)

Measurements were also made of fly ash resistivity and particle size analysis at the inlet and outlet. Pulverized coal and fly ash mineral analyses were obtained and precipitator curves and operating data constructed.

The following minimum recommended design parameters for the power station utilizing Hat Creek coal were developed. The test data were used to estimate the performance of an installation at an altitude of 1400 m above sea level, with the electrostatic precipitator operating at a temperature of 150°C. The collection electrode area estimates include a recommended safety factor of 20 percent to allow for operation with sets out of service.

(i) Future Test Work

The Bulk Sample program was part of an on-going test program. Data from it was compared with other test work results available and the design lessons learned have been incorporated in the Preliminary Engineering study for the Hat Creek Project and further studies will be decided upon at the completion of this phase of the Project.

5.4 RESULTS - (Cont'd)

MINIMUM DESIGN RECOMMENDATIONS

Item	Design 0.11 g/m^3	Design 0.05 g/m^3
Area to volume flow rate $m^2/m^3/min$	2.36	3.15
Electrical Sections - in direction of gas flow	6	8
Rapping interval each set	Inlet 1 5 min	4 min
	Inlet 2 15 min	10 min
	Inlet 3 30 min	20 min
	Inlet 4 60 min	40 min
	Inlet 5 100 min	60 min
	Inlet 6 150 min	100 min
	Inlet 7 -	150 min
	Inlet 8 -	200 min
Gas velocity range m/s	.6-1.2	.6-1.2
Gas flow geometric standard deviation	0.25	0.25
Design efficiency (20 percent out of service)	99.75	99.9
Design precipitation rate parameter cm/s (20 percent out of service)	5.0	4.4

SECTION 6.0 - ENVIRONMENTAL

6.1 MINING AND RECLAMATION

Areas of environmental concern were identified prior to commencement of the Bulk Sample Program and included air quality, water quality, noise and reclamation. Modifications to the proposed program were developed, in consultation with B.C. Hydro's engineering staff, in order to avoid and minimize potential adverse impacts.

Environmentally sound practices were incorporated into the trench excavation plans and were carried out as work on the project progressed. Measures included maintaining an undisturbed buffer strip between Hat Creek and all activities, including waste pile construction, near Trench B. Drainage water from Trench B was pumped to an area constructed for disposal purposes. The coal storage and processing area was sealed off by earth filled dams and natural ridges to ensure that any run-off did not flow into the surrounding area. Prior to excavation of the trenches, topsoil was removed and stockpiled for future use. Waste piles were re-seeded after the trench excavations had been completed.

Groundwater wells were installed for water quality monitoring purposes and samples were taken periodically before, during and after excavation activities, together with samples from sites along Hat Creek. Analyses to date have indicated that the activities of the Bulk Sample Program did not appear to affect the water quality of the creek or the groundwater. The monitoring program is being continued.

Fugitive dust emissions were reduced through the utilization of a water spray truck. However, dusting was not completely eliminated and localized emissions were evident particularly in the area of the

6.1 MINING AND RECLAMATION - (Cont'd)

Trench A operations during dry, windy periods when excavating topsoil and carbonaceous shale. Data from sampling stations in the Hat Creek valley indicate that the suspended particulate loading of the ambient air, outside the immediate areas of activity, varies widely but no direct relationship with the excavation activities specifically has been established. It is noted that dust loadings at the station located at the junction of the Hat Creek valley road and Highway 12 were higher than those at other stations in the valley due to road dust from traffic. The Cache Creek station had the highest overall readings, as might be expected from the high volume of traffic through this location and the activities at this centre. Noise levels were briefly investigated and, while noise increased in the immediate areas of activity, no appreciable change was noted outside these areas.

The surficial and sub-surface soils of both Trench A and Trench B were sampled and characterized prior to excavation of the trenches. Trench B soils were relatively uniform, whereas Trench A materials were typically diverse, varying widely in texture and reaction. The soils are generally deficient in available nitrogen and phosphorus, with variable amounts of potassium, and have adequate, if not excessive, amounts of calcium and magnesium for plant growth.

Bulk samples of the various trench waste materials have been collected and characterized and now comprise part of the field revegetation plots at the Hat Creek site. These plots have been established to obtain further data for future planning purposes.

Two distinctly different types of test plots have been established. Those located at Aleece Lake consist of seven separate waste materials in level plots 4.6 m square and 1 m deep, together with an eighth plot of smaller size. The plots at Houth Meadows and Medicine Creek (proposed as major waste disposal areas for future use) are

6.1 MINING AND RECLAMATION - (Cont'd)

inclined at three different slope angles, 22, 26 and 30 degrees to test the effects of slope on plant growth. Field revegetation tests have been initiated on all plots, under a number of different treatments using topsoil, fertilizer and mulch, with various seed mixes.

The transportation of coal proceeded as planned. Coal was transported on two occasions. An advance shipment of 400 tonnes was transported to Ashcroft in mid-June with the major shipment of approximately 5950 tonnes being completed in mid-August. The boxes of the trucks used to transport the coal were well sealed with tarpaulins or metal covers. There were no dust emissions from these trucks. High volume samplers along the route ran every 3 days; results indicate that there was no increase in dust levels attributable to this program.

6.2 TRACE ELEMENT STUDY

The test program provided the opportunity to determine more fully the rate of trace constituents in Hat Creek coal when fired in a large-scale utility boiler. (Previous work was undertaken in the pilot combustion tests at the Canadian Combustion Research Laboratories in Ottawa during September and October 1976.) During the six, half-day tests, representative samples of coal, fly ash and bottom ash were collected for trace elements analysis. In addition, a major effort was expended to determine stack emissions of trace elements. This included sampling of both post-precipitator particulate and vapour phase materials.

Based on previous analyses and studies, the following elements were selected as being important:

6.2 TRACE ELEMENT STUDY - (Cont'd)

Mercury	Fluorine	Arsenic
Selenium	Beryllium	Boron
Cadmium	Chromium	Copper
Lead	Manganese	Molybdenum
Nickel	Strontium	Uranium
Vanadium		

Of these, mercury, fluorine, arsenic and selenium were sampled and analysed for as vapour phase emissions.

From the results it appears that a large proportion of the mercury content of the coal is emitted in gaseous form, whereas the gaseous fluorine emissions are low relative to the input coal content. Several elements, such as vanadium, zinc and lead, appear to concentrate in fly ash. Detailed results of emissions of trace elements, mean trace element concentrations in solids and a typical material balance are given in Tables 3, 4 and 5 respectively.

It is important to note the large standard deviations associated with this work, e.g. Table 4. This is indicative of the difficulty in determining precisely the very low and possibly variable concentrations of trace elements of these materials.

The results of this work have been used by consultants carrying out the Detailed Environmental Studies for the Hat Creek Project to predict emissions of trace elements from the full-scale powerplant.

TABLE 3

B.C. HYDRO TRACE ELEMENT STUDY

SUMMARY OF STACK EMISSIONS

	Morning Tests			Afternoon Tests		
	Solids Kg/hr	Gaseous Kg/hr	Total Kg/hr	Solids Kg/hr	Gaseous Kg/hr	Total Kg/hr
August 14, 1977						
Arsenic	<0.00225	<0.00375	<0.00600	<0.00064	<0.00107	<0.00171
Beryllium	<0.00039		<0.00039	<0.00005		<0.00005
Lead	0.00552		0.00552	<0.00058		<0.00058
August 20, 1977						
Fluoride	<0.01735	0.14690	0.16425	<0.2187	0.25150	<0.27337
August 21, 1977						
Mercury	<0.00010	0.00023	<0.00033	<0.00089	0.00134	<0.00223
Selenium	<0.00045	<0.00135	<0.00180	<0.00052	<0.00263	<0.00315
Boron	0.00108		0.00108	0.00250		0.00250
Cadmium	<0.00011		<0.00011	0.00050		0.00050
Chromium	0.00013		0.00013	0.00110		0.00110
Copper	0.00031		0.00031	0.00190		0.00190
Manganese	0.00325		0.00325	0.01840		0.01840
Molybdenum	<0.00015		<0.00015	0.00080		0.00080
Nickel	0.00042		0.00042	0.00340		0.00340
Strontium	0.00014		0.00014	0.00290		0.00290
Vanadium	<0.00011		<0.00011	0.00020		0.00020
Zinc	0.00699		0.00699	0.00610		0.00610

TABLE 4

B.C. HYDRO TRACE ELEMENT STUDY
MEAN COMPOSITION OF TRACE ELEMENTS
mg/Kg

	Element	Hg	F	As	Se	Be	B	Cd	Cr	Cu	Pb	Mn	Mo	Ni	Sr	U	V	Zn
Coal	n	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	mean	0.08	123	10.3	10.0	0.43	12.2	1.03	46	> 557	13.2	> 483	3.8	34.8	176	5.8	172	56
	Std Dev	0.02	39	7.3	10.6	0.27	8.3	0.50	17	369	3.7	432	0.41	33.4	100	2.6	116	23
Bottom Ash	n	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	mean	0.14	73	5.4	13.2	0.96	29	0.74	164	> 678	12.6	> 854	8.2	55	380	9.6	>564	58
	Std Dev	0.16	32	2.7	9.5	0.63	27	0.23	158	443	5.0	213	7.4	22	213	6.0	416	36
A Field Hopper Catch	n	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	mean	0.04	50	27.0	18.3	1.7	41	0.68	179	> 958	31.0	> 560	10.8	68	415	13.8	>697	136
	Std Dev	0.01	38	7.7	11.7	1.2	18	0.16	92	102	7.3	385	3.5	23	180	3.7	228	82
B Field Hopper Catch	n	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	mean	0.09	75	87	24	2.0	117	1.0	266	> 893	60	> 767	14.8	105	>557	18.3	>660	393
	Std Dev	0.10	52	56	12	0.6	76	0.5	158	261	19	379	9.7	129	260	6.2	292	208
C Field Hopper Catch	n	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	mean	0.04	201	201	14.2	2.0	109	1.9	319	>1000	86	> 760	16.2	156	>544	17.4	>762	>604
	Std Dev	0.01	122	296	12.2	1.2	62	1.3	144	0.0	67	329	6.2	198	345	15.3	264	366
Composite A, B & C Hopper Catch	n	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
	mean	0.06	104	99	19.1	1.9	88	1.1	251	> 948	57	> 692	13.8	107	>503	16.5	>703	>364
	Std Dev	0.06	97	168	11.9	1.0	65	0.9	138	163	42	358	7.0	129	256	8.9	249	295
Flyash Emitted*	n	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1	2
	mean	<67.8	500.1	<220.4	<76.2	<3.1	189.8	<28.1	85.4	>160.5	<38.1	>2992.4	<67.9	92.9	78.5		< 30.4	231.3
	Std Dev	16.6	32.3	288.8	6.8	2.5	98.0	1.3	22.7	105.4	9.6	3540.6	34.5	19.5	61.4		37.0	52.2

* Total front half of EPA Train (probe wash plus filter).

TABLE 5

B.C. HYDRO TRACE ELEMENT STUDY
TYPICAL MATERIAL BALANCE

	ELEMENT INPUT		ELEMENT OUTPUT								TOTAL OUTPUT
	Element Input Kg/hr		Bottom Ash Kg/hr		Flyash Kg/hr		Flyash Emitted Kg/hr		Vapour Phase Mat'l Kg/hr		
Trace Element	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Kg/hr*
Hg	0.004	± 0.001	0.0003	± 0.0004	0.0008	± 0.0008	<0.002	± 0.00002	<0.0037	± 0.0027	<0.007 ± 0.004
F	6.17	± 1.93	<0.180	± 0.080	1.430	± 1.340	0.030	± 0.004	0.4000	± 0.1393	<2.040 ± 1.563
As	0.52	± 0.37	0.010	± 0.007	1.370	± 2.320	<0.001	± 0.0008	<0.0353	± 0.0207	<1.390 ± 2.349
Se	0.50	± 0.53	0.030	± 0.020	0.260	± 0.160	<0.005	± 0.005	<0.0129	± 0.0146	<0.308 ± 0.200
Be	0.02	± 0.01	0.002	± 0.0015	0.030	± 0.010	<0.0001	± 0.00003			<0.032 ± 0.01
B	0.61	± 0.42	0.070	± 0.0065	1.210	± 0.890	0.014	± 0.011			1.294 ± 0.908
Cd	0.05	± 0.03	0.002	± 0.0006	0.020	± 0.010	<0.002	± 0.0009			<0.024 ± 0.012
Cr	2.31	± 0.83	0.400	± 0.390	3.460	± 1.900	0.003	± 0.00002			3.860 ± 2.290
Cu	<27.84	± 18.44	<1.650	± 1.080	<13.080	± 2.250	0.005	± 0.0014			<14.735 ± 3.331
Pb	0.66	± 0.19	0.030	± 0.010	0.790	± 0.580	<0.0014	± 0.0002			<0.821 ± 0.590
Mn	<24.14	± 21.60	2.080	± 0.520	<9.550	± 4.940	0.054	± 0.017			<11.684 ± 5.477
Mo	0.19	± 0.02	0.020	± 0.018	0.190	± 0.100	<0.0024	± 0.0008			<0.212 ± 0.119
Ni	1.74	± 1.67	0.130	± 0.050	1.470	± 1.770	0.008	± 0.0006			1.608 ± 1.821
Sr	8.79	± 5.02	0.930	± 0.520	<6.940	± 3.530	0.005	± 0.0026			<7.875 ± 4.053
U	0.29	± 0.03	0.020	± 0.010	0.230	± 0.120	0.0007	± 0.0004**			0.2507 ± 0.1304
V	8.62	± 5.78	<1.380	± 1.010	<9.700	± 3.440	<0.0013	± 0.0013			<11.081 ± 4.451
Zn	2.78	± 1.16	0.140	± 0.090	<5.030	± 4.070	0.014	± 0.0002			<5.184 ± 4.160

* Values are sum of stream output means or standard deviations.

** Value for uranium based on mean value of uranium in composite A, B and C hopper catch (Table 3-5 Appendix 3).

Parameters:
- Coal Flow = 50 000 Kg/hr (Wet Basis)
- Bottom Ash = 2437.5 Kg/hr
- Flyash = 13812.5 Kg/hr
- Flyash Emitted = 41.4 Kg/hr

SECTION 7.0 - PUBLIC AND COMMUNITY RELATIONS

7.1 OBJECTIVE

The objective of the community relations activities during the Bulk Sample Program was to establish a two-way flow of information between B.C. Hydro and the interest groups and local governments. In this way Hydro was able to inform those groups about the Bulk Sample Program and in return local people were able to make their concerns known to Hydro planners.

7.2 OUTLINE OF PROGRAM

In March 1977 the Bulk Sample Information Bulletin was compiled. It was distributed first by hand to the residents of the Hat Creek Valley and the Indian Communications Committee, and then to the regular community groups, local and other government officials. An accompanying letter announced the upcoming open house meetings in the various towns and suggested that concerns regarding the Bulk Sample Program could be discussed at those meetings.

During April 1977 open house meetings were held in Ashcroft, Cache Creek, Clinton, Lytton, Lillooet and Kamloops. Copies of the Information Bulletin were available and questions concerning the program were answered.

It was anticipated that the most significant impact from the public viewpoint would be the transportation of the coal. To minimize adverse effects, trucks with covers were utilized. In addition there appeared to be a need for a Hydro focus in the area where public complaints or comments could be made. Personnel in the site office were equipped with information to deal with these situations.

7.2 OUTLINE OF PROGRAM - (Cont'd)

To familiarize local government officials with the valley and the Bulk Sample operation, tours of the trenches were held with the Thompson-Nicola Regional District subcommittee for the Hat Creek Project and the mayors and councils from Ashcroft, Cache Creek and Clinton.

7.3 CONCLUSIONS

The information provided by Hydro to the community groups appeared adequate to satisfy local interest levels. The concerns expressed by groups throughout the program were few in number and generally comments were limited to inquiries of a factual nature. In conclusion, the information flow that was established was sufficient to meet the needs of both B.C. Hydro and the communities.

7.4 PUBLIC RELATIONS

The objective of the public relations program was to inform the general public through the news media of the Bulk Sample operation. In March 1977 a news release was distributed describing the program. An announcement was later issued regarding the appointment of the contractors for the program.

In July 1977 a presentation by Hydro officials and a tour of the trenching operation were organized for members of the Vancouver and Hat Creek area press.

The results of the Bulk Sample Program in general terms were released and distributed to the public in July 1978 as the Bulk Sample Information Bulletin No. 2.

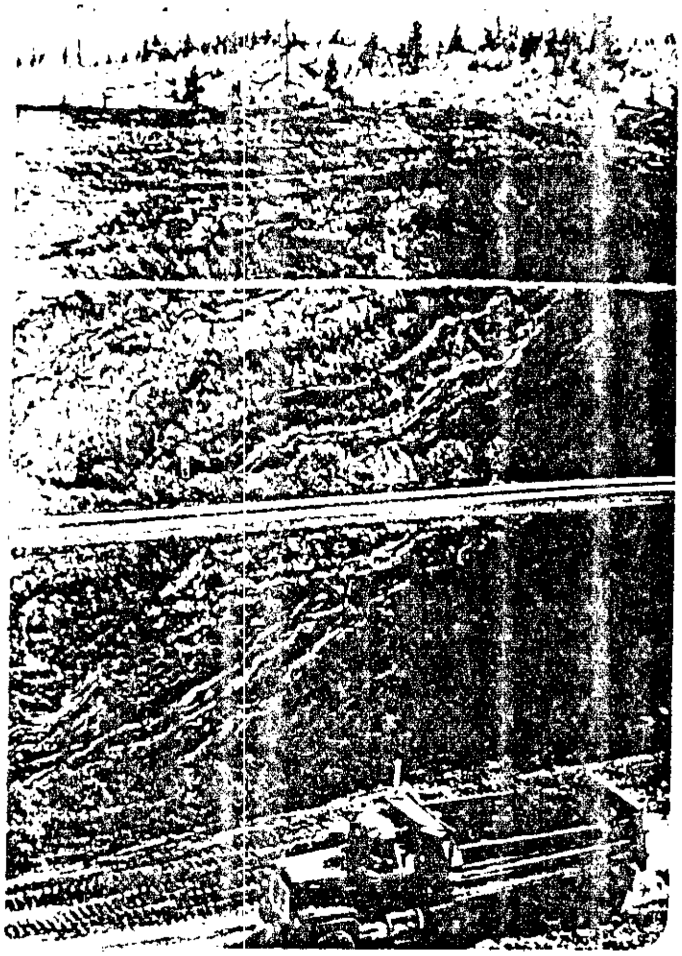
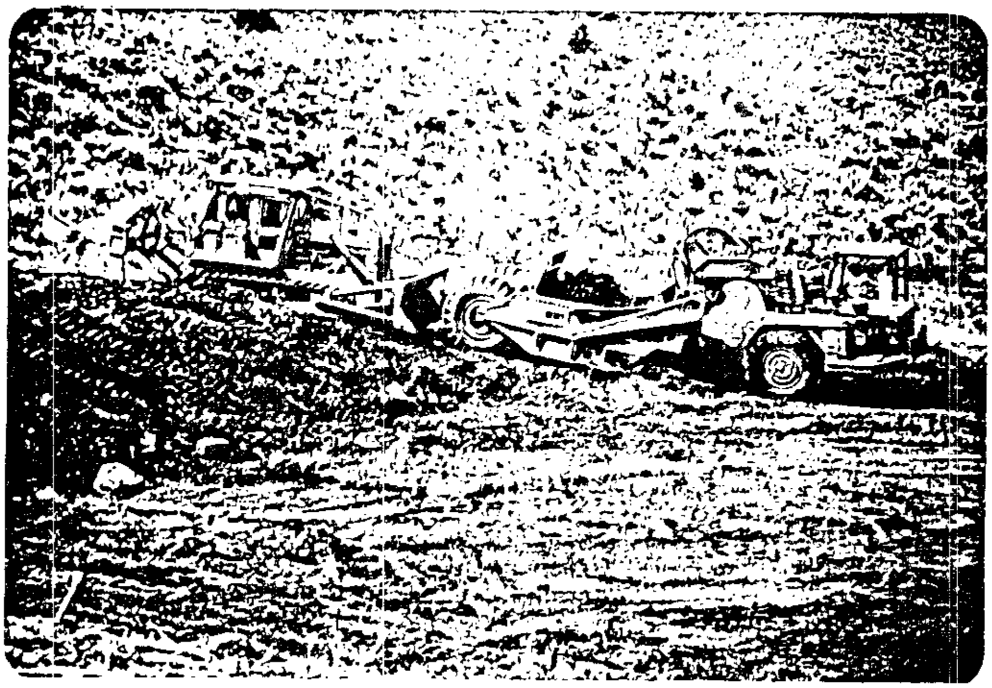


Plate 1

Plate 2



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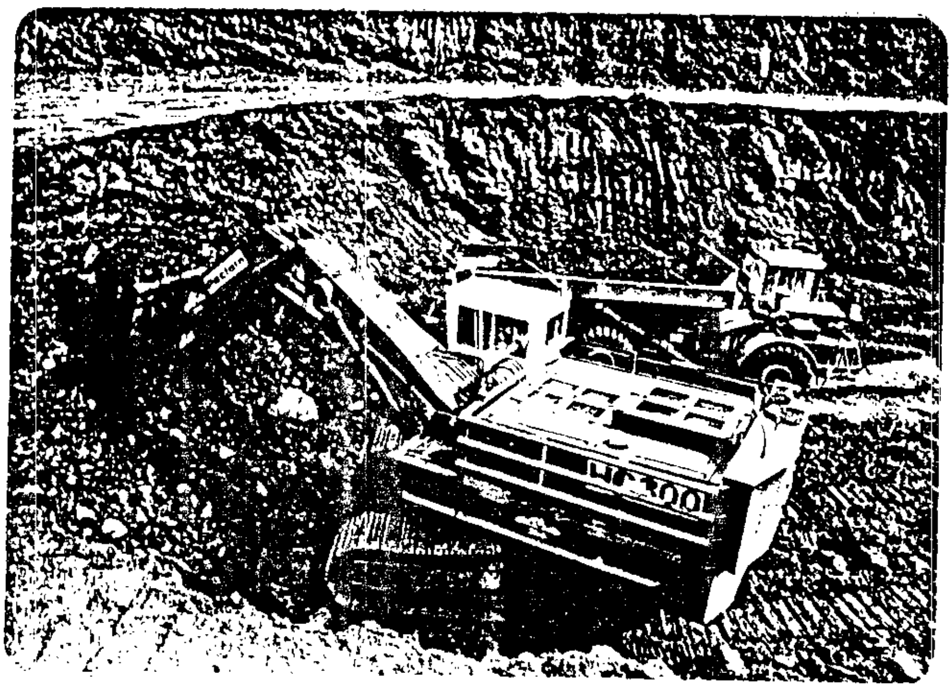
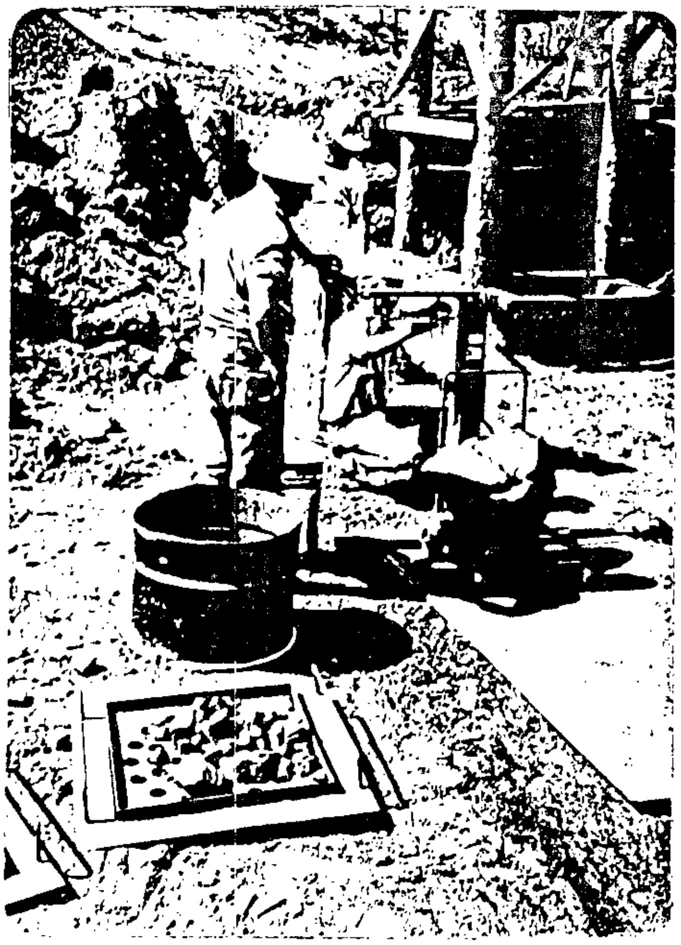


Plate 4

Plate 5

Plate 6



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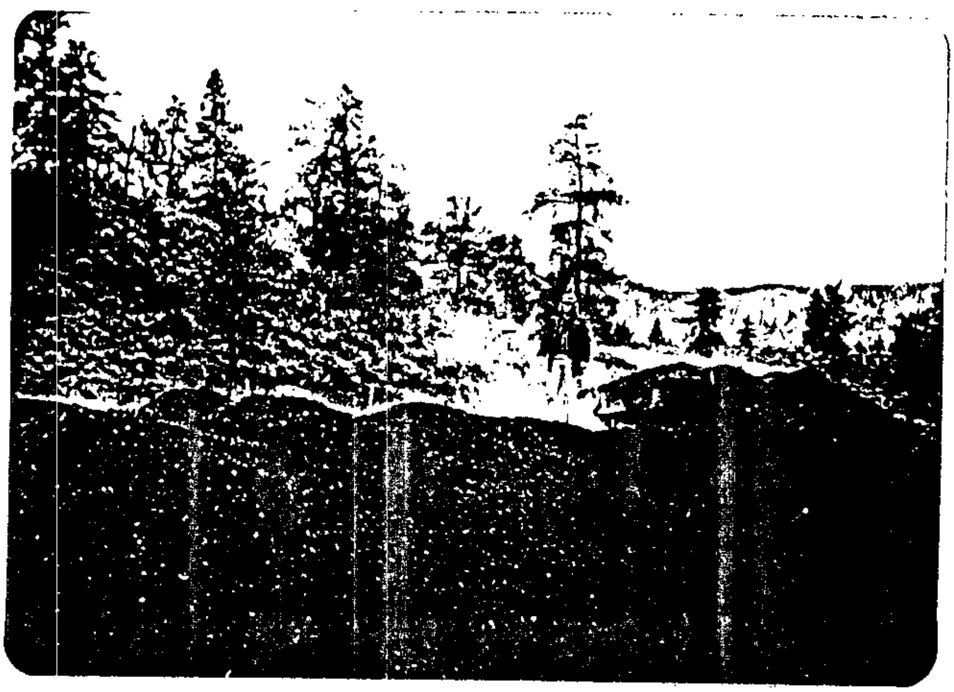
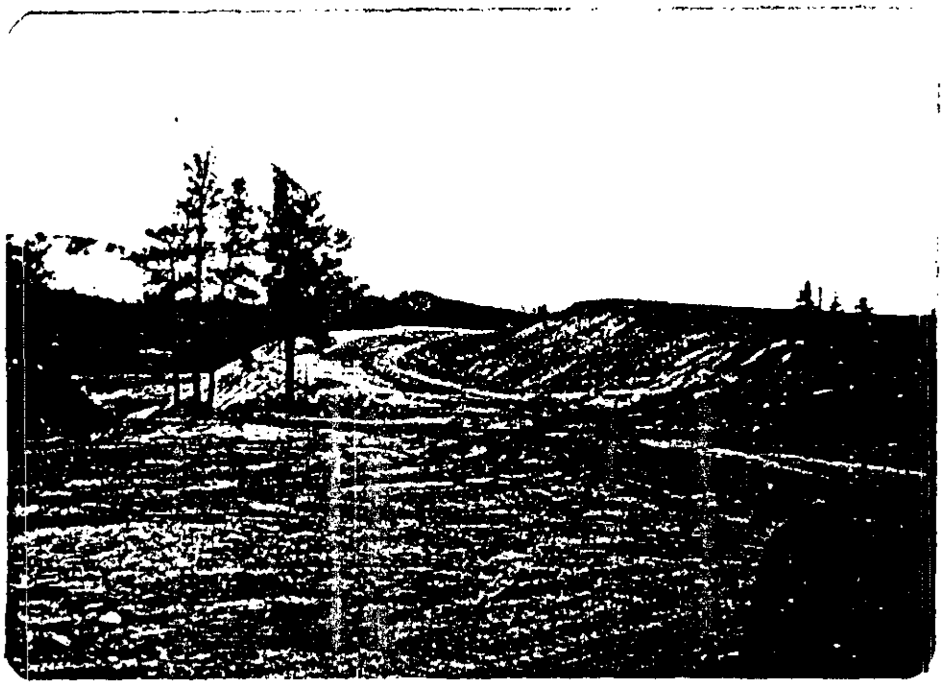


Plate 8

Plate 9



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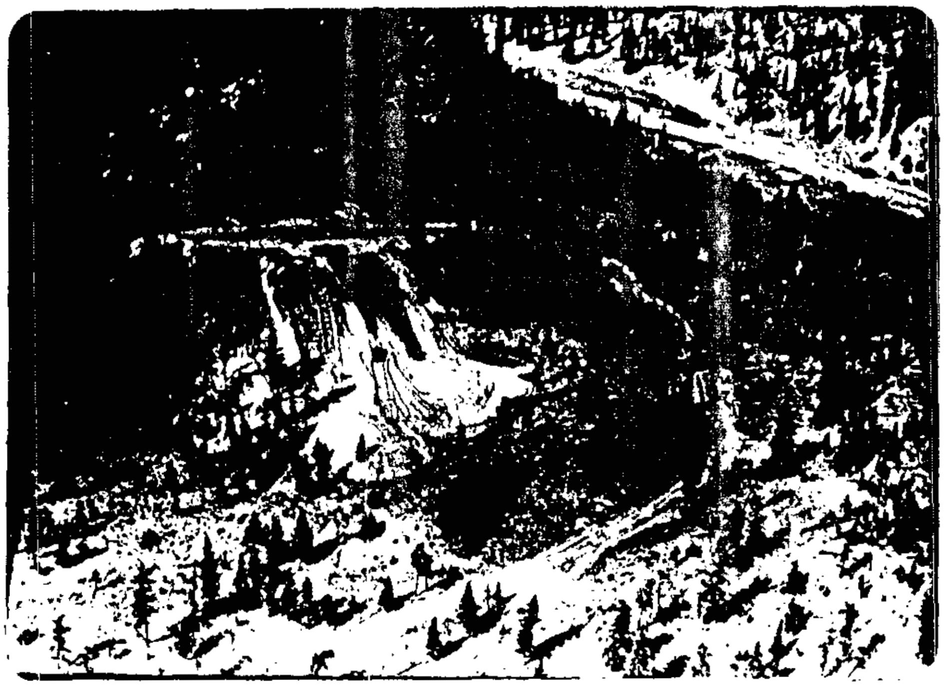

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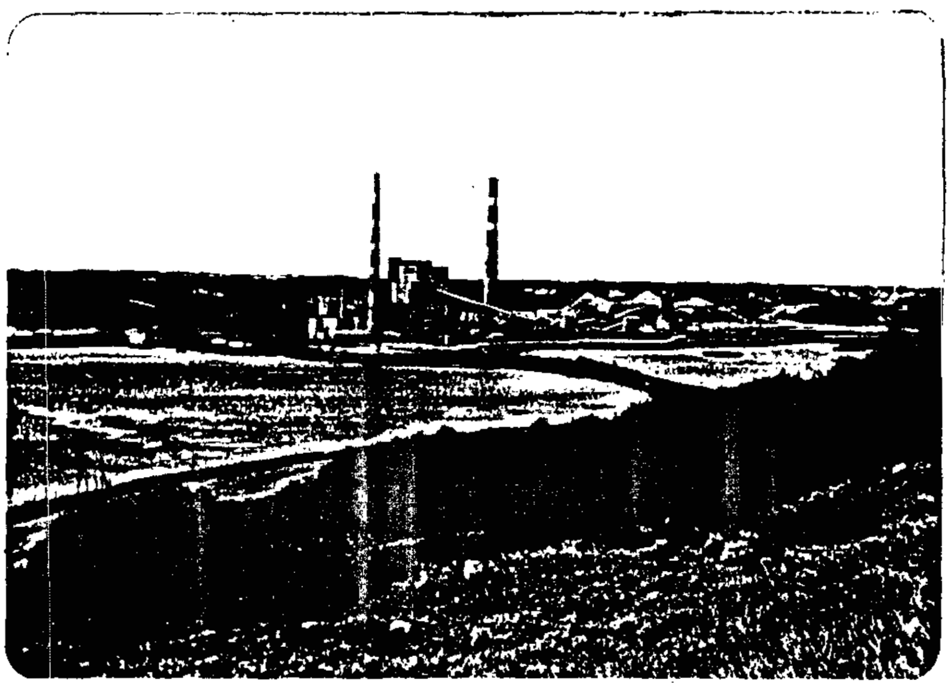

Plate 12

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