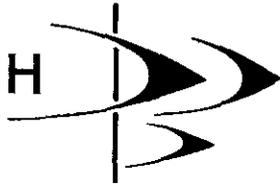


B.C. RESEARCH



3650 Wesbrook Crescent, Vancouver 167, Canada.

Phone (604) 224-4331 • Cable 'RESEARCHBC' • Telex 04-507748

August 20, 1974

PROGRESS REPORT NO. 1

To: B.C. Hydro and Power Authority,
970 Burrard Street,
Vancouver, B.C. V6Z 1Y3

Attention: Dr. H.M. Ellis,
Manager, System Engineering Division

Subject: ENVIRONMENTAL IMPACT - HAT CREEK THERMAL
GENERATING STATION

Project 2410

SUMMARY

An environmental impact study is being carried out with respect to a proposed thermal generating station to be fired with lignite from a deposit located in the Hat Creek Valley. The environmental study is to include ecological, social and economic factors relevant to the Valley and its environs. Progress during the first month of the study (July 26 - August 22) is outlined below.

22 August 1974

HAT CREEK THERMAL GENERATING STATION

TERMS OF REFERENCE FOR ENVIRONMENTAL
IMPACT STUDIES - PHASE I

Abstract

To investigate, analyse, and evaluate in a single integrated study the combined environmental (ecological, social and economic) effects of the construction and operation of a 2000 Mw conventional thermal generating plant and its associated coal mining operations located at, or in the vicinity of, B. C. Hydro's Hat Creek coal deposit. The earliest in-service date for a plant at this site would be October 1981.

Terms of Reference

1. The environmental study shall include identification and analysis of the construction and operational impacts of the proposed mining and power developments on existing and potential ecological, social and economic conditions.
2. Identified impacts - beneficial and adverse - are to be evaluated both qualitatively and quantitatively wherever possible, including an assessment of the risk or probability of their occurrence, their extent (local, regional and provincial), and their duration.
3. The study shall identify and evaluate possible measures to enhance the potential benefits (apart from power production) of the developments and to avoid, reduce, or compensate for the associated losses.
4. The study shall identify the impacts of the construction phase separately from the longer term operating effects.
5. The study shall identify possible expansions and diversification of the mining and power development complex and indicate the nature of their probable impacts. This would include assessment of the impacts of expansion of the generating plant to 4000-5000 Mw.
6. The Regional District, municipalities, and residents of the area are to be informed of this study. Participation by local and regional governments, provincial government departments, and other public organizations, as well as from B. C. Hydro operating and construction staff, shall be sought by the consultant. Initial contact with the government agencies and liaison with the public will be coordinated by B. C. Hydro.

7. At the onset of the study, consultation will be held with the appropriate departments of B. C. Hydro responsible for planning, design and construction of the project, land acquisition, and community relations.
8. The site location for the plant will be determined upon completion of concurrent studies by B. C. Hydro (engineering), Dolmage Campbell and Associates (geological) and B.C. Research (environmental).
9. The consultant shall submit progress reports as appropriate; a draft report by 31 October 1974; and a final report by 31 December 1974.
10. The study is to be controlled and coordinated on behalf of B. C. Hydro by Dr. H.M. Ellis, Manager of the System Engineering Division.

JCD:SS:gj

ANALYSIS OF FOREST VALUES

FOR PROPOSED HYDRO AND THERMAL PROJECTS

OBJECTIVE

To compare the net returns which can be expected from forest products and services derived from designated forest areas under sustained yield management and under estimated "normal" conditions of industrial and regional development; with the net returns which can be expected when land is to be withdrawn from forest use in a specified time, necessitating changes in timber harvesting, the abandonment of sustained yield activities in that area, and additions of external economies and diseconomies of disrupted forest activities.

METHOD

Costs and returns must be carefully evaluated for each alternative - a) normal development under sustained yield forestry, and b) transition and withdrawal from forest use, so that an accurate comparison of the two paths can be made.

Provincial timber inventories emphasize growing stock and classify stands by age and maturity in order to estimate the m.a.i. so that A.A.C. can be calculated in sustained yield management. Terminal forests require an accurate inventory of commercial timber only, irrespective of age.

Forest Management plans include cutting schedules (using A.A.C.), sequential road development, reforestation and other silvicultural activities, all within the objectives of the sustained yield policy.

During the transitional period, terminal forests are placed under entirely different objectives. Within the time frame commercial timber will be harvested in so far as constraints on manufacturing facilities and markets will allow, and if it is advisable, the residual timber will be felled in situ to reduce hazards in the future use of the area. It follows that road development will be at a different rate and cost than originally planned, and silvicultural activities will cease altogether. Other forest uses will be disrupted accordingly.

Forest industrial capacity and market supply are often intimately tied with the A.A.C. of an area. Even normal cutting schedules may release timber supplies which do not always match fluctuating markets, but any significant surge of supply may not only lack manufacturing capacity within an economic distance, but may also seriously disrupt markets in the region.

External economies may result from improved access and transportation to adjacent forest areas. The reverse may happen just as easily. Withdrawals of growing stock decrease the A.A.C. for an area, and operators may have to resign to a smaller annual timber supply, or to a decreased potential for future expansion. Small additions to timber supply may be welcome in times of high product demand, but a glut when markets are poor. If the time frame is sufficient and the additional supply large, it can be argued that production capacity should be increased to accommodate the timber, and only at a rate the market can absorb.

TYPES OF SURVEYS

A. Extensive areas of forest:

1. High forest values
2. Low forest values

B. Limited areas of forest:

3. High forest values
4. Low forest values

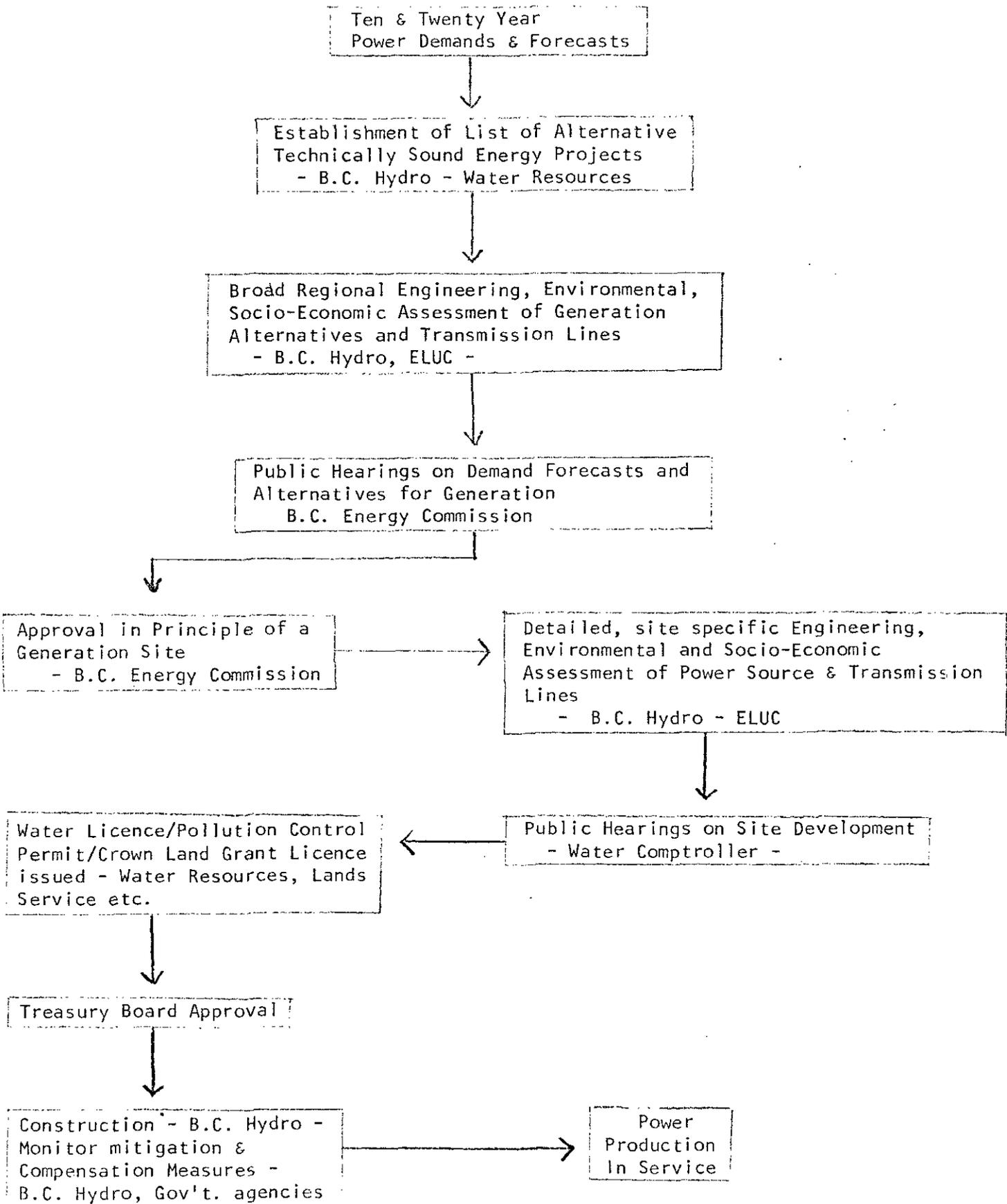
Revelstoke-Downie would fit into Class 1, and Hat Creek probably be in Class 4. Good inventory data is available for Revelstoke-Downie area because of forest interest. Class 2. would probably be accommodated by a broad inventory based on a statistical approach. Class 3. would require an operational cruise because broad data applied to a small area would not be valid.

When an additional intensive survey is contemplated, the forest values involved must justify the expense.


E.A.F. Wetton
Senior Economist
Special Studies Division


EAFW:bc

POWER GENERATION PLANNING
PROCEDURES



Planning of Hydro and Thermal Projects

The following is a statement of the kind of information deemed necessary by the B.C. Department of Agriculture to facilitate effective appraisal and planning for all hydro or thermal power development sites.

Category 1 - Physical Inventory

- 1) Soil and Landform maps
- 2) Capability for agriculture ratings
- 3) Agriculture Land Reserve maps
- 4) Climate Capability for Agriculture maps
- 5) Land Capability for Grazing maps
- 6) Present Land Use map and related inventory of livestock, crops, farm structures, etc. Agriculture to work with Geographic Division, E.L.U.C. Secretariat, in developing an appropriate classification
- 7) Acreage of each Agriculture Capability class on each soil map unit
- 8) Crop suitability listing for each soil
- 9) An appraisal of any unique aspects of the Agriculture resource by virtue of soil-climate relationships, proximity to market, scarcity of resource, etc.
- 10) An appraisal of negative or positive effects of pondage with regard to climate, drainage (e.g. watertable levels), irrigation, downstream flood control.

Preliminary to or coincident with it would be necessary to have the following information:-

- 1) Slide susceptibility of proposed reservoir shoreline, and probable acreage of land affected above the shoreline - data should outline the extent of any set-backs required and general limitations to agricultural use thereon.
- 2) Quality and quantity of water in pondage, and fluctuation in water level.

Category 2 - Socio-Economic Aspects

-Consider before and after pondage as some losses of land may be adequately compensated for through new development opportunities.

- 1) Potential crop productivity listing for each soil.
- 2) Potential animal unit month carrying capacity where applicable.
- 3) Socio-economic studies with econometric appraisal to establish value of potential production of crops, meat, milk, etc. (i.e. secondary benefits of primary production).

The foregoing would basically apply to thermal plants although preliminary data requirements here would include source and volume of coolant water and particulate fallout.

B.C. Department of Agriculture,
Victoria, B.C.
September 6, 1974.

FILE: 604-

21 August 1974

Dr. A. D. McIntyre
 B. C. Research
 3650 Westbrook Crescent
 Vancouver, B. C.

Dear Dr. McIntyre:

Hat Creek Environmental Studies

Please consider these notes as supplementing the Terms of Reference for the Hat Creek environmental studies.

1. Environmental effects should include significant beneficial and adverse primary, secondary and induced effects of power development.
2. Where pertinent, the quantitative predictions of environmental conditions should cover the situation both with and without the proposed action.
3. When it is not possible to specify the probability of an impact occurring, the reason for the uncertainty of the impact should be noted.
4. When considering costs and methods of compensating and mitigating environmental losses, consider (identify and evaluate) also the foregone efficiency benefits in any proposed mitigation action.
5. The social and economic component of the report should:
 - (a) Identify the major social and economic impacts of the project and these should include both the adverse and beneficial consequences of the action;

5. (b) The incidence of impacts should be identified and evaluated both spatially and on certain groups of people. A spatial impact would include identification and distribution of the socio-economic project effects (primary and secondary) at the local, regional, provincial and possibly national levels. Socio-economic benefits and costs should also be considered in relation to ethnic and special interest groups at the local and regional levels;
- (c) Effects on the economic base and the short-term and long-term economic stability of the region should be considered, paying attention to the effects on basic (export industries) and non-basic (local serving industries), including:
- net income generation at local, regional and provincial levels;
 - impact on the income distribution by groups, both inter-regionally and intra-regionally;
 - impact on population and its distribution at local and regional levels;
 - employment and its distribution within the region and among the different socio-economic groups affected by the project (direct, indirect and induced effects);
 - impact on labour force, net migration and unemployment within the region;
 - physical resources of the communities in the region including land and property values, housing, roads, water, sewer, and electric services;
 - effects on revenue and expenditure of local and regional governments;
 - families whose homes may be displaced by the project;
 - local and regional health, welfare and education services;

21 August 1974

5. (c) - consideration is to be given to whether permanent housing should be provided by the Authority, and, if so, whether it should be part of the existing communities in the area or should be part of a new community established close to the project;
- examine the effect of the project on the life-style and social structure of the community and region. Consideration should be given to the impact on such factors as public health, public order, and community integration;
 - consider the recreational and aesthetic use of land which people of the community, region, and province make of land which will be affected by the project, and the present and future value which is placed on that use;
 - the visual natures of the communities in the region;
 - noise and odors;
 - likely net economic benefits in the region without the project;
 - recommend means of regulating the socio-economic impacts of construction on the surrounding communities;
 - study and report on any facilities which B. C. Hydro may reasonably provide in order to enhance public interest in the development both during and after construction;
 - include a summary of impacts in a tabular form. One convenient form is the attached sample.

This list of aspects of the environment which are to be considered is not meant to be inclusive of all impacts that may be identified, but rather is intended as a reminder of some items which, at the beginning of the study, appear to B. C. Hydro to be indexes of the economic and social quality of the local and regional communities.

Yours very truly,

C. B. Guelke
C. B. Guelke
Assistant Manager
Generation Planning Department

cc: J. C. Dawson
R. M. Dundas J. B. Hedley
H. M. Ellis S. Stairs
H. J. Goldie R. M. Woodley

PROGRESS REPORT

Introduction

B.C. Hydro and Power Authority, a Crown Corporation charged with responsibility for providing electrical energy in British Columbia, will require additional generating capacity to meet expected growth in the Province. Among the alternatives for such capacity is to utilize a lignite deposit located in the Hat Creek Valley to fire a conventional thermal generating station. The size of the installation envisaged, initially 2000 MW and rising to 4000 - 5000 MW at a later date, is such that the potential environmental impact is likely to be significant. A study of this impact (ecological, social and economic) has been commissioned; the study is to include recommendations for enhancement or mitigation of the various impacts uncovered.

An impact study must, of course, address itself to a large number of potential variables; however, in this Progress Report we outline work done during the first month of the study (July 26 - August 22) on a limited number of these variables.

Vegetation

A combined aerial and ground survey of vegetation in the Hat Creek Valley has been completed and plant communities have been mapped. In conjunction with the vegetation survey soil samples were obtained for laboratory analysis now in progress.

Before additional surveys can be undertaken it will be necessary to identify generation station location(s), transmission line location(s) and access routes for water supply, traffic and a possible railroad.

Water Quality

Data on all sampling and analyses carried out by the Pollution Control Branch on the Thompson River, Bonaparte River and Hat Creek have been obtained and are being compiled.

Water Use

An aerial and ground survey of the Thompson River near Ashcroft, the Bonaparte River and Hat Creek has been carried out and a report is in preparation.

Canada Land Inventory

Information has been obtained for waterfowl, ungulates, agriculture, forestry and recreation and is currently being "translated" into map form.

Air Pollution

Three air contaminants of probable significance with respect to the proposed generating station are water vapor, NO_x and particulates. We have estimated the emission rate of the latter on the basis of a 35% overall efficiency of conversion of lignite to electricity and of an allowable emission rate of 0.1 gr/sdcf (Level A of PCB Objectives):

<u>Capacity, MW</u>	<u>Emission Rate lb/min</u>
2000	70
4000	140

Clean air, i.e., atmospheric perspective of 50 miles or more, generally contains 200 - 300 lb/cu mi of particulates. On the other hand dirty air, i.e., typical of the New York City area on occasion, generally contains some 10 to 20 times this concentration of particulates. It should be noted that the emission rate per minute for the 2000 to 4000 MW capacities equates to about 1/3 to 1/2 the particulate loading in a cubic mile of clean air. The significance of this estimate cannot, of course, be assessed until climatic conditions are obtained and dispersion calculations carried out. It would appear, however, that particulate emissions may be a factor in deterioration of air quality.

Topography

Topography, along with climatic conditions, governs the dispersal of contaminants emitted to the atmosphere. While some experts can visualize a contour map in three dimensions, most people cannot. For this reason a topographic model of Hat Creek Valley and the surrounding area, including Lillooet, Ashcroft and Hat Creek, has been prepared (Figure 1). In addition to being useful for technical aspects of an environmental study, we have found such models to be very helpful for describing the situation at public hearings.

When detailed mapping of the Hat Creek Valley, now in progress, is complete we propose to have a second model prepared of the Valley alone. In addition a three-dimensional model of the coal deposit is being prepared. This latter model will probably require revision as the current drilling program proceeds.

Land Alienation

Should a decision be made to proceed with the Hat Creek project land alienation resulting from the mining operation will be unavoidable, and it obviously will be restricted to the valley. The extent of this alienation will be governed ultimately by the extent of the coal deposit. The rate of this alienation, e.g., acres/year, will include the quantity of overburden and waste that is associated with the coal required for power generation and that must be placed elsewhere. An estimate of this rate is being prepared.

Land alienation will also result from the installation of the generating station, transmission lines and access routes to the station. Unlike the mine, however, the generating station need not be located in the Hat Creek Valley and, until the location is fixed, only the land alienation associated with the generating station can be estimated:

<u>For 2000 MW Capacity</u>	<u>Acres</u>
Generating Station	40
Ash Disposal	240
Coal Storage (3 days "surge")	4
Coal Storage (10 days "dead")	<u>20</u>
	304



Figure 1

TOPOGRAPHICAL FEATURES OF HAT CREEK VALLEY AND ENVIRONS

For 4000 MW capacity the acreage involved would essentially double to 600. For a cooling system and water reservoir an additional 400 acres is needed, giving a total of 1000 acres. It should be noted that about 50% of the acreage alienated is required for ash disposal during the first 10 years of operation of the facility, suggesting that utilization of the ash, rather than disposal, may be attractive. After the 10 year period it should be possible to place the ash in the coal pit, if an alternative use cannot be developed.

Utilization of Ash

Six of the seven companies producing aluminum metal in B.C. or the Northwestern U.S. were contacted and, of these, five expressed strong interest in following up the possible use of Hat Creek ash for alumina production. (The sixth did not respond immediately, but referred the situation to its parent company in France.) The quantity and timing of availability of the ash coincides with future planning of the aluminum industry.

Technology for production of alumina is still under development and one candidate process, which utilizes limestone available near Hat Creek and on Texada Island, yields a by-product suitable for cement manufacture. One cement manufacturer expressed interest in further examination of this by-product.

An outline of a proposed course of action will be formulated and will be provided in the next progress report.

Social and Economic Factors

The initial field trip to the area, following letters of introduction to the Regional Districts sent out by B.C. Hydro was during the week of August 5. Discussions were held with:

- administrative officials at the Regional Districts of Squamish-Lillooet and Thompson-Nicola
- administrative and elected officials at the villages of Ashcroft, Cache Creek, Clinton, Lillooet, Squamish
- hospital administrators in Lillooet and Ashcroft
- school district administrators in Lillooet (SD 29), Ashcroft (SD 30)
- Manager, Bethlehem Copper, Highland Valley
- municipal engineering consultants for Clinton, Cache Creek, Ashcroft
- superintendent of economic development, Department of Indian and Northern Affairs, Kamloops.

The nature of the proposed project was outlined in general terms. It was emphasized that present inquiries are of a feasibility nature and that ample time and opportunity will be provided for all opinions to be heard before any firm decisions on the project are taken. They were invited to state any concerns or opinions they now held, and particularly to give ongoing consideration to any further information or questions that they or their colleagues might have. In brief, highlights of initial comments offered were as follows:

a) Regional Districts

Principal concerns relate to community planning, traffic, and tax revenue. Thompson-Nicola is passing a new zoning bylaw covering their two western areas.

b) Hospitals

Fortunately both Lillooet and Ashcroft have new hospitals with spare capacity apparently adequate to handle a permanent resident addition of 1000 people (e.g., as related roundly to 300 jobs).

c) Schools

SD 30 (Ashcroft) is already bussing students from as far as Clinton and Ashcroft (including Hat Creek Valley). No insurmountable problems are foreseen, though expansion plans may require recalculation when expected impacts on enrolment are better defined.

d) Villages

All are interested in prospects for supporting new growth and diversity. Lillooet pointed out a possible problem if they only received some residents and their associated costs, but no tax revenue because of being in a different Regional District. Clinton, Cache Creek, and Ashcroft have all had detailed engineering studies done in recent years. Therefore much data are available on capacity to carry new subdivisions, sewer and water, etc. Consultants' reports will be obtained and abstracted. There appears to be more existing capacity for growth than might be at first supposed. Improvement of area roads such as Highway 12 is hoped for.

e) Indian Affairs

Concern was expressed about disturbance of fish and water supply from Hat Creek below the project. There would be considerable interest in the possibility of job opportunities for Indian workmen, and the nature of any manpower training that might be appropriate.

f) Bethlehem Copper

This firm now has about 300 of its workers housed in Ashcroft, largely in company owned, financed, or subsidized housing. Much detail on housing development experience is available from the company. This seems like a good opportunity to examine a somewhat similar impact to that which might be created by the Hat Creek project.

g) Other

The Canada Department of Public Works, Pacific Region, has compiled a great deal of information about the general area as part of its Program Planning function. Their Forward Planning Officer, Mr. G.W. Webster, assures us of close cooperation in providing access to this, and has already done so to a useful extent.

Other reports and background data have been gathered, and several leads unearthed to follow up. The possibility of some improvement in the Hat Creek Valley water supply is a matter of some interest. The Provincial Government is understood to be looking into this already, quite apart from any relationship to the proposed coal project.

At the time of writing no interviews have yet been carried out with Indian bands, individual local residents, merchants, Provincial Government Departments, B.C. Rail, police, etc., but these will progress with time. Some potential additional consulting assistance is being considered.

h) Contacts, G.S. Crawford, week of August 5

Kamloops

J.F. Cornwall, Superintendent of Economic
Development, Indian Affairs

Kamloops (Cont'd)

Herb Viridi and Larry Wolfe, Planning,
Thompson-Nicola Regional District
R.T. McQuillan, Strong, Lamb and Nelson
Consulting Engineers

Highland Valley

T.P. Liss, Manager, Bethlehem Copper

Ashcroft

Bob Nishiguchi, Assistant Sec-Treas., SD 30
Richardson, Administrator, Hospital
Thompson, Clerk, Village of Ashcroft

Cache Creek

A.F. McLean, Mayor
C. Cameron, Clerk-Treasurer
M. Gordon, Works Superintendent

Clinton

Fred Boyd, Mayor
John Botterial, Alderman, Village of Clinton

Lillooet

Art Nichol, Administrator, Hospital
J. Rickard, Mayor
Logan, Clerk, Village of Lillooet
Ches Hunter, Alderman, Village of Lillooet,
and Representative to Regional District
John Thompson, B.C. Hydro
Mrs. V. Rickard, Secretary-Treasurer, SD 29
Joan Young, Clerk, SD 29

Pemberton

G.D. Smith, Administrator, Squamish-Lillooet
Regional District

Squamish

Harper, Accountant
(Craven, Clerk, on vacation)

Project Outline

In Figure 2 we show the major tasks that are involved in the project and how they are interrelated. As noted above work has been initiated on the current situation with respect to ecological, social and economic assessments. It is proposed that a list of potential options be generated and that during the first two to three months of the study these options be examined and discarded as found to be appropriate. Keeping in mind that the results of the study will be presented at a public inquiry, it is essential that B.C. Hydro's legal department assess the "long" list for completeness, the validity of the reasons for discarding certain options (decision point 1) and the validity of selection of the preferred option(s) (decision point 2).

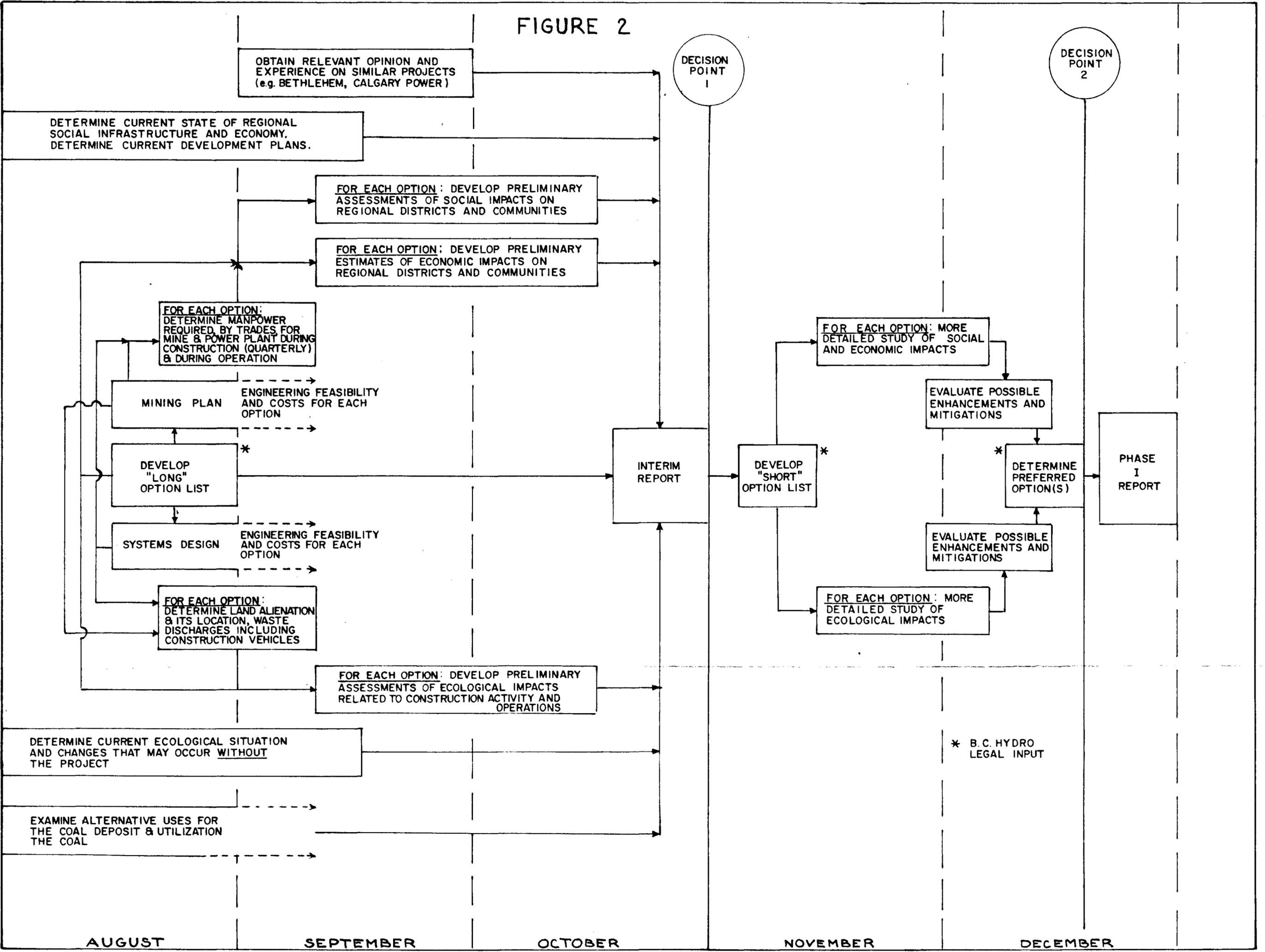
For the mining plan the options are somewhat limited, e.g., where to start mining the coal and where to place the overburden and waste. The location of the generating station is not, however, as rigidly constrained, and there are several options potentially available with respect to provision of housing and services for construction and operating personnel. It is proposed that an early meeting be held to establish the options.

Although not explicitly shown in Figure 2 it is intended that inputs from the mining plan and systems design to the other functions will be on a continuous basis and, for this reason, weekly meetings have been scheduled during the project.



for A.D. McIntyre
Head, Division of Applied Chemistry

FIGURE 2



* B.C. HYDRO LEGAL INPUT