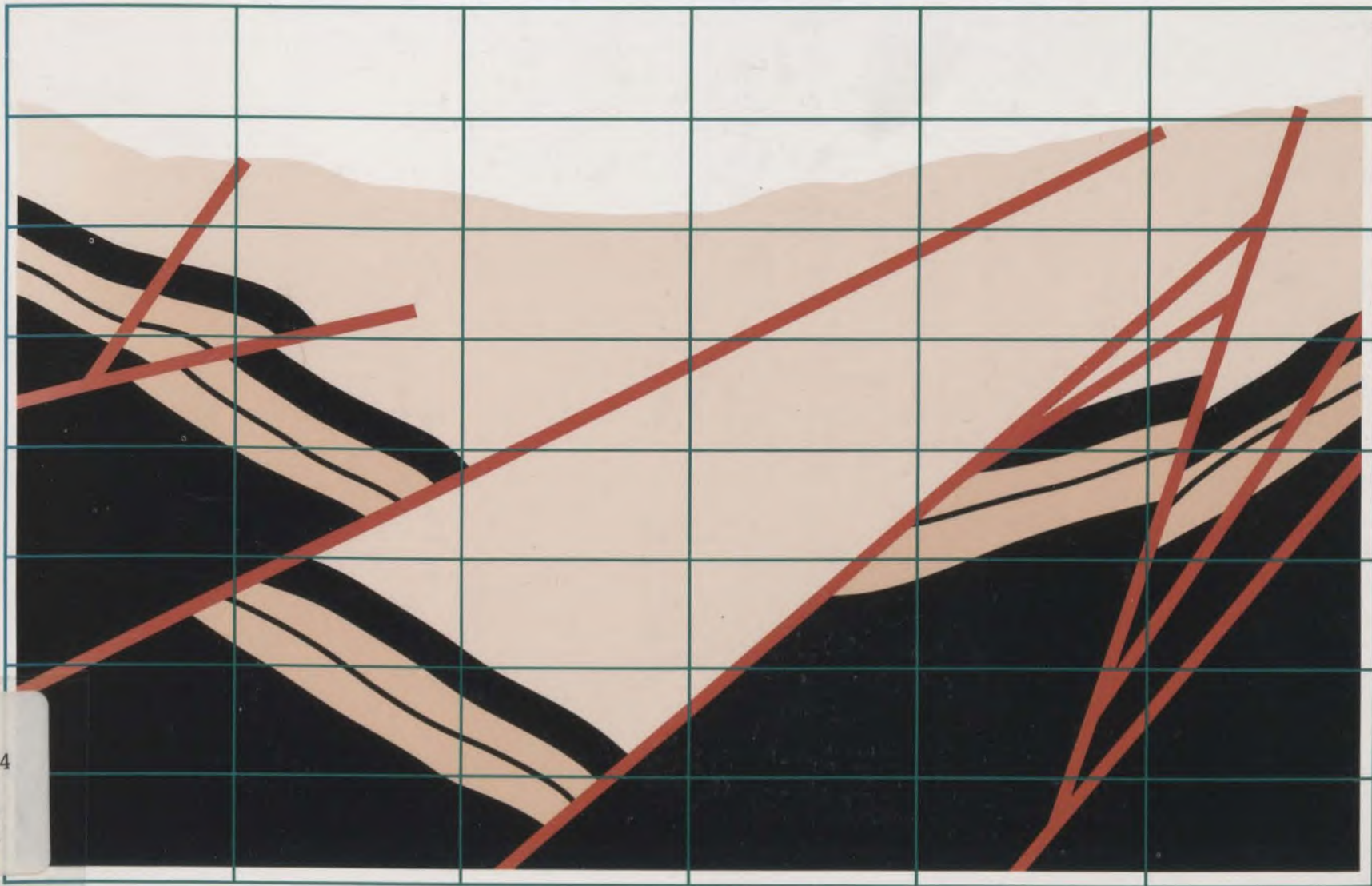
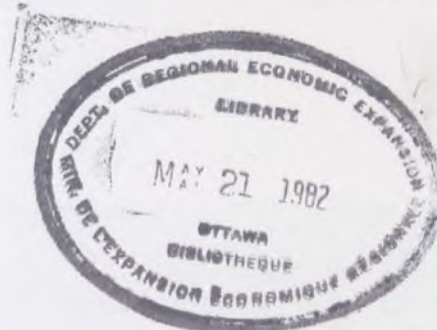


# PLANNING FOR BRITISH COLUMBIA'S NORTHEAST COAL DEVELOPMENT



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**Province of  
British Columbia**

**Ministry of Industry  
and Small Business  
Development**



**Government  
of Canada**

**Gouvernement  
du Canada**

**Regional  
Economic  
Expansion**

**Expansion  
Économique  
Régionale**

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## INTRODUCTION

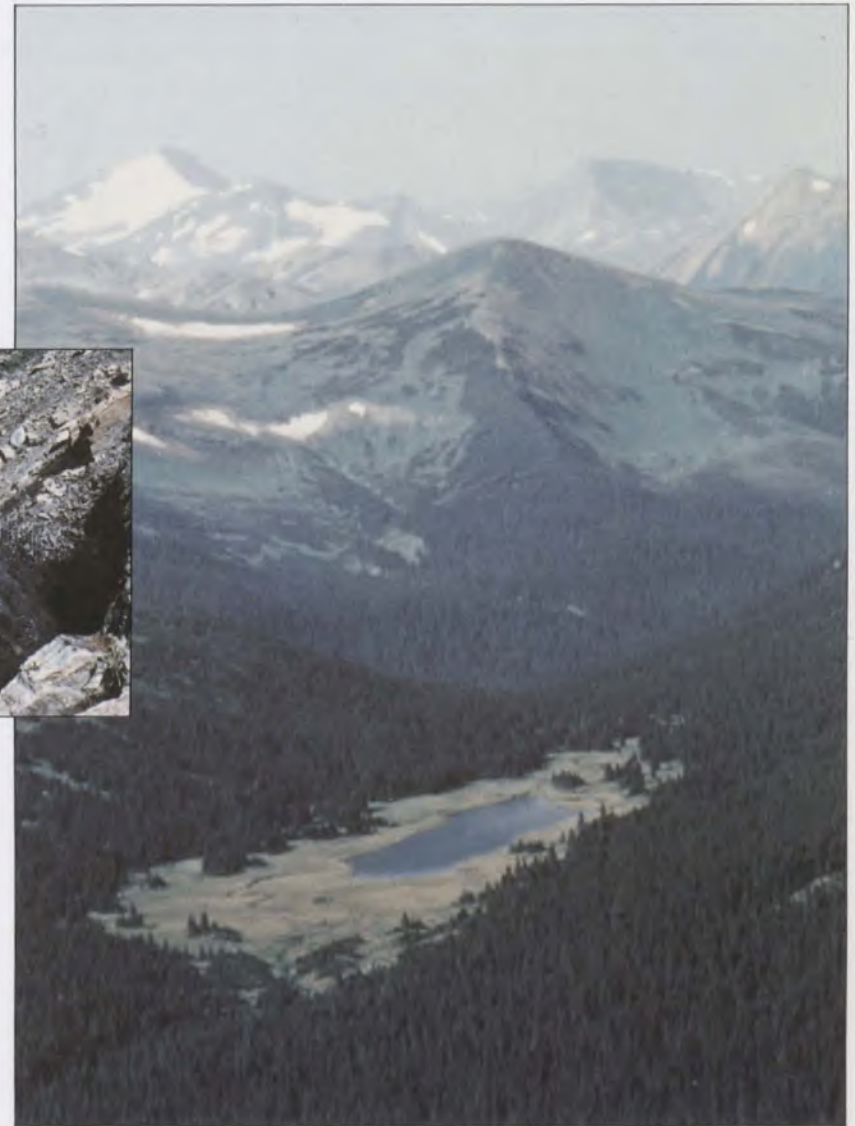
This information booklet outlines the joint planning efforts by the federal and provincial governments to investigate proposed coal development in northeast British Columbia. This five-year, \$13-million resource development study program is one of the most ambitious ever undertaken in Canada. Its purpose has been to ensure that as the development proceeds, the people of B.C. and Canada will receive the greatest possible benefits and minimal adverse impacts.

The study process was equally funded and coordinated through the Canada-British Columbia Subsidiary Agreements on Northeast Coal and Related Developments. Under these agreements the British Columbia Ministry of Industry and Small Business Development and the federal Department of Regional Economic Expansion (DREE) established a joint management committee to oversee the study process.

The six major areas of investigation were the coal resource, transportation needs and costs, community development requirements, manpower needs, the environment, and overall economic, financial, and marketing considerations.



Other important study work on northeast coal development was done by the government of British Columbia and by various mining companies with an interest in the northeast area.



## BACKGROUND

4 British Columbia's northeast region comprises nearly one-quarter of the province's land area. About 60,000 persons reside in the northeast with 60 per cent of these living in the cities of Dawson Creek and Fort St. John, the villages of Chetwynd, Fort Nelson, Pouce Coupe and Taylor, and the district of Hudson's Hope. The economy of the northeast relies mainly on the region's natural resources. These include agriculture, forestry and, more recently, oil and natural gas. Processing of natural resources in the region is minimal. Significant coal deposits were identified by Alexander Mackenzie when he explored the northeast in 1793. Little serious investigation took place, however, until the late 1960s when the increasing world demand for coking coal (used in steel making) spurred intense commercial exploration in British Columbia. Northeast findings have revealed estimated coking and thermal coal resources of more than eight billion tonnes. These high-quality deposits are a significant part of the province's

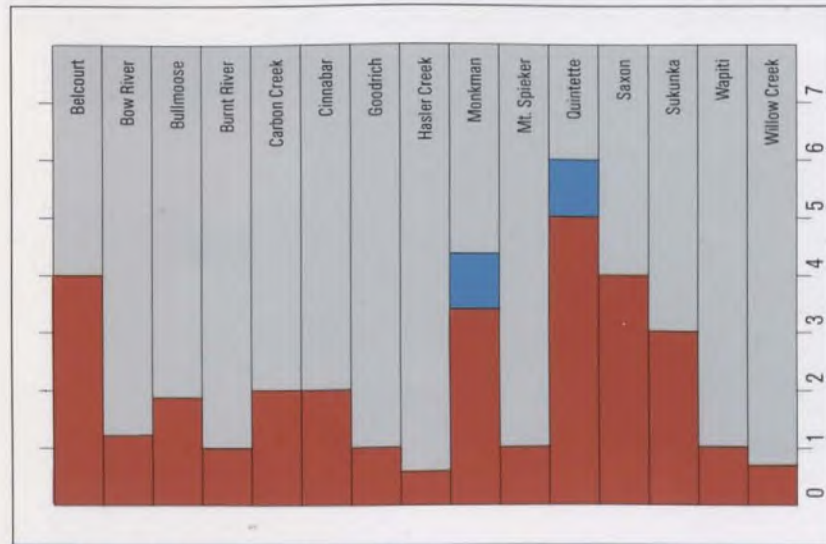
35-billion-tonne total. More than a dozen companies investigated coal resources in the northeast. Their work established much about the coal resources and also highlighted the development constraints of the region. Coal mining operations require roads, railways and utilities. In the northeast, however, existing railways and roads are far from the proposed mine sites. The population is too small and scattered to form the needed workforce, and towns are too distant to serve the proposed mines. As well, the northeast coalfields are about 1000 kilometres, by rail, from the nearest ocean port.

Although the coal developers invested heavily in feasibility and engineering studies and assessments of the environmental and social effects of their operations, the overall infrastructure problems and the regional and provincial impacts of the proposed developments required a much broader program of study. Responding to coal company proposals, the federal and provincial governments recognized this need in a



preliminary planning report, entitled *The Northeast Report '75* which was released in early 1976. This report led to the start of a more ambitious planning process in 1976. Planning was carried out under cost-sharing agreements between the provincial Ministry of Industry and Small Business Development and the federal Department of Regional Economic Expansion

(DREE). The first agreement, for \$3 million, funded a preliminary examination of critical factors for development and indicated where further detailed analysis would be needed. The second agreement provided an additional \$10 million for comprehensive analyses and design studies. It was intended that these studies would advance the planning process to a level



Annual Clean Coal Production (proposed) (in million tonnes)

■ Metallurgical ■ Thermal

■ Railways ■ Roads



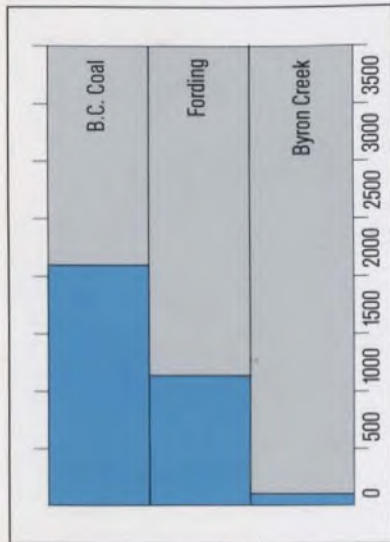
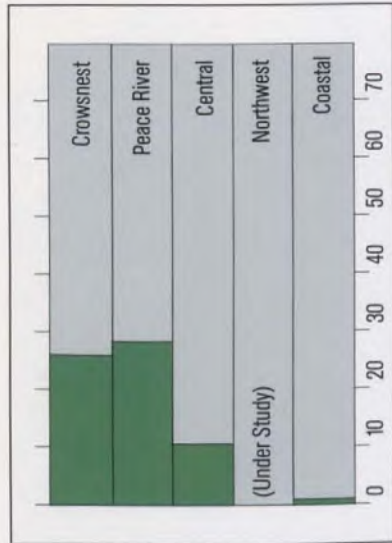
where governments would be in a position to respond quickly to private sector initiatives.

The size and complexity of the proposed developments and the limited amount of physical information available on the northeast dictated the large scale of the planning process. Representatives of appropriate federal and provincial agencies were responsible for carrying out the investigations under the agreements. These covered such topics as the size and quality of the coal resource base, methods of mining, transportation requirements, townsite and community development, environmental concerns and standards, manpower requirements, the economic, financial and market benefits, and the costs of the proposed developments.

This study of the northeast coal resource identified the possible benefits and costs of the alternative development proposals. The viability of such options depends on the actual size and timing of development by the coal companies, which in turn depends on the level of assured coal sales.



# BRITISH COLUMBIA'S COAL RESOURCE



British Columbia possesses extensive coal deposits, estimated at 35 billion tonnes, in 12 major coalfields.

Coal mining has always been a major industry in the province, with large operations in the past on Vancouver Island and at present in southeast British Columbia. Here, three operating mines produce about 10 million tonnes a year and provide about 3100 jobs.

Planned expansion of these southeast operations will increase annual production to 13 million tonnes within the next few years.

**Potential British Columbia Coalfield Production**  
 ■ (in millions of tonnes per year)

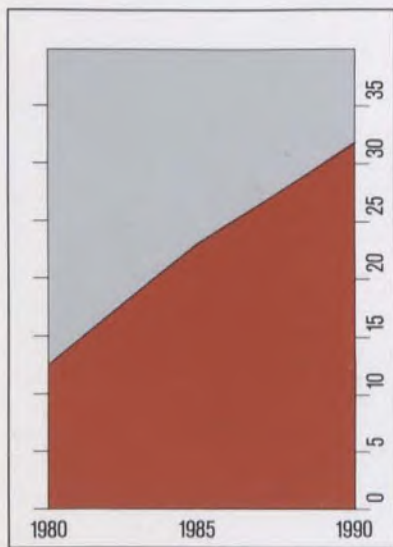
**Manpower Requirements**  
 ■ Employment at Operating Mines





# THE WORLD COAL MARKET

8 Current world coal trade is mostly in coking (or metallurgical) coal, which is used for steelmaking. In 1979, about 229 million tonnes of coal were traded on the world market. About two thirds of this was coking coal and one third was thermal coal, which is used as a fuel. The U.S.A. leads in exports, with substantial shipments also made by Canada, Australia, Poland and the Soviet Union. It is estimated that by 1990, annual world coal shipments will rise to about 400 million tonnes. In 1979, B.C. provided about



four per cent of the the world trade in coal.

British Columbia provided about 11 per cent of Japan's imports of coking coal in 1979. Through northeast coal development and other new production the province may eventually supply as much as one third of Japan's requirements.

While metallurgical coal trade will nearly double, thermal coal exports will more than quadruple. This tremendous growth in demand offers British Columbia an opportunity to profit by increasing its share of the supply. The northeast metallurgical and thermal coal resources are expected to form a major part of Canada's new exports to world markets.

**World Market for Western Canadian Metallurgical Coal**  
(in million metric tonnes)



# COKING COAL

Coke is a critical component in steel production. It is made by burning metallurgical types of coal in airtight ovens. Tarry substances are either burned off or captured for use in the chemical industries. The remaining carbonous material is coke. Coke is combined in blast furnaces with iron and other ingredients to produce steel.



Blast furnace

Discharging of hot metal from a blast furnace.



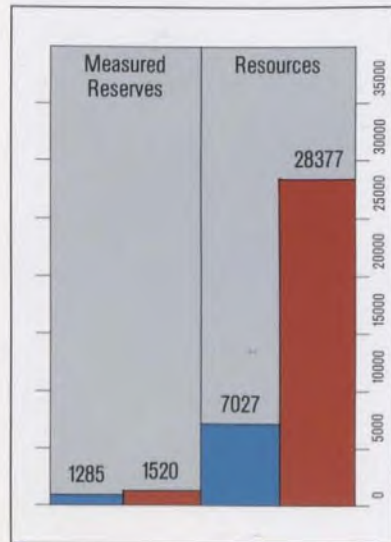
Ultramodern coke oven





# HOW MUCH COAL IS THERE IN THE NORTHEAST?

Coal deposits in the northeast occur in a sedimentary formation along the eastern side of the Rocky Mountains. The resource is currently estimated at just over eight billion tonnes, of which 300 million tonnes could be mined by existing methods. In geological terms, the coal of the northeast is generally classified as medium volatile bituminous. This classification provides some of the best coking and thermal coal. Studies estimate that 85 per cent of northeast coal deposits consist of high-grade coking



coal. The remaining 15 per cent is considered to be high-grade thermal coal.

The coal resources of the northeast are so extensive that they will be able to sustain large-scale production for many decades. Preliminary investigation indicates that about one-third of the resource can be recovered by surface methods, and the remainder by underground mining techniques.

In sub-alpine sites anticipated for most mines, reclamation is particularly sensitive. When these sites are reclaimed, careful attention will be paid to restoration of this delicate environment.

Coal is one of the world's most important energy resources. The quantity of coal in the earth's crust is estimated to be 10 trillion tonnes.

**British Columbia Coal Resources**  
(in million metric tonnes)  
■ Metallurgical ■ Thermal

Coal is a combustible carbonous material which has resulted from the partial decomposition of vegetable matter away from air and under varying degrees of

increased temperature and pressure during millions of years. The coal classes are: anthracite, semi-anthracite, bituminous, sub-bituminous, and lignite.

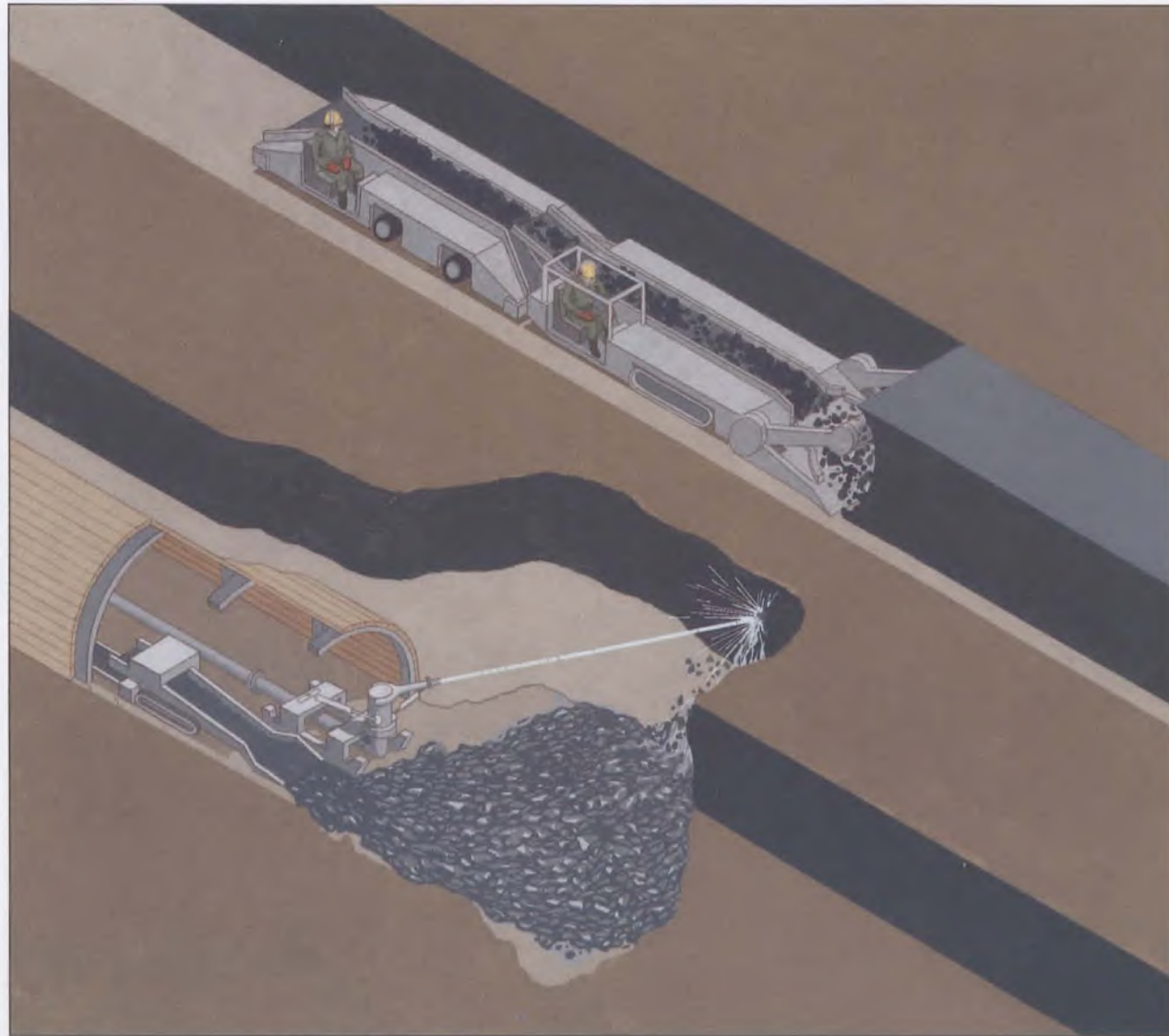
REPRESENTATIVE B.C. COAL TYPES	
<b>1 Thermal Coal</b> Taylor Mines, Princeton	<b>3 Thermal Coal</b> Old Granby Pit, Princeton
<b>2 Metallurgical Coal</b> B.P.'s Sukunka Property	<b>4 Metallurgical Coal</b> Crownsnest's Line Creek Mine

## UNDERGROUND MINING FOR DEEP DEPOSITS

- 12 In underground mining, specially designed "continuous miners," one of many mining methods, cut and load the coal onto armored conveyor belts for carriage to the surface.

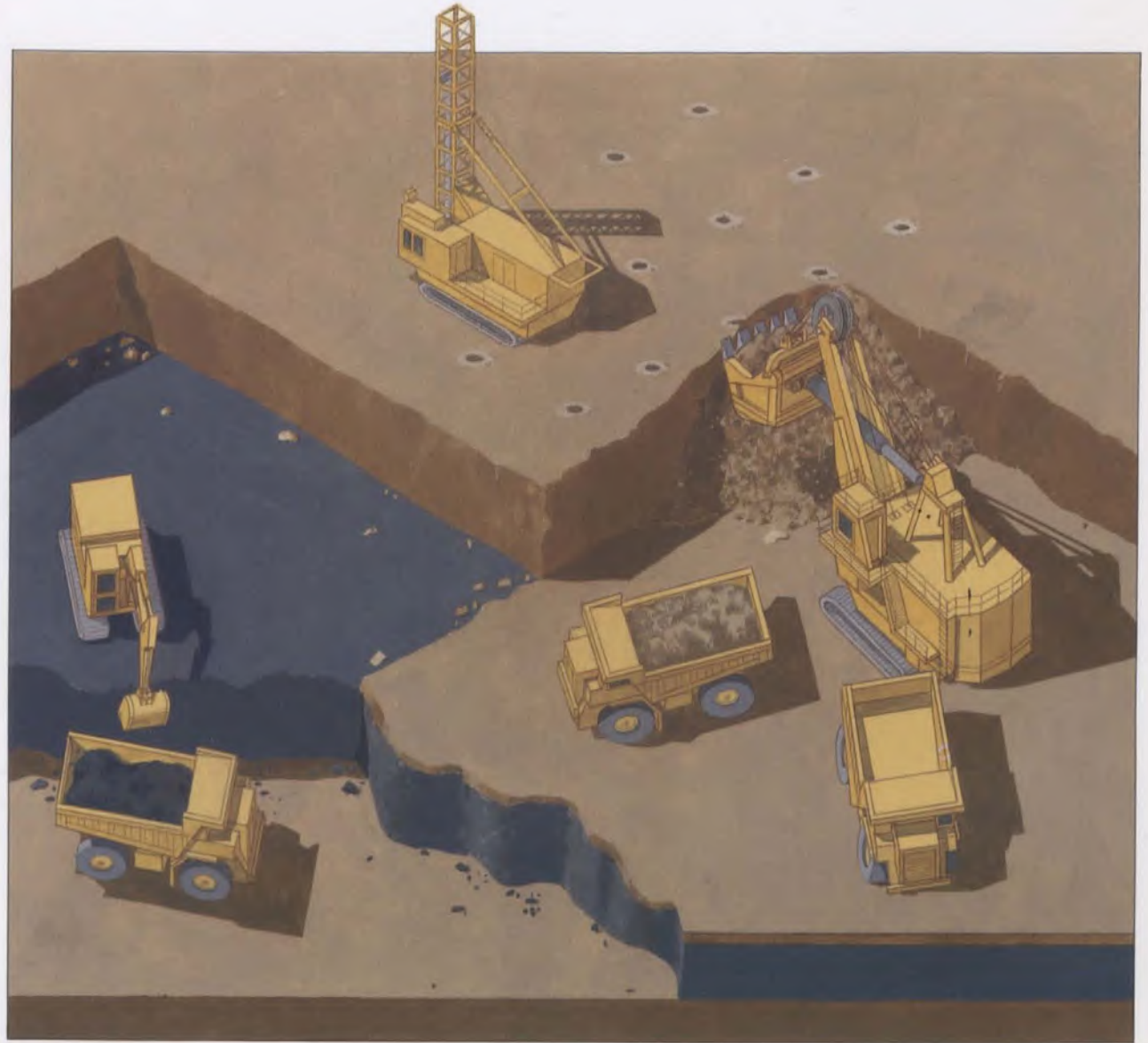
Hydraulic mining is a variation used in British Columbia to extract coal from thick, steeply pitching seams. Under extremely high pressure, water cuts out the coal lying between two parallel roadways previously driven into the coal seam. The water carries the extracted coal away in steel flumes. Hydraulic mining is much more efficient than the conventional room and pillar method and extracts up to 70 per cent or more of the available coal, while conventional room and pillar methods extract up to 50 per cent.

Longwall mining is another method. A rotating steel-toothed cutter, called a shearer, moves back and forth across the working face which is usually over 100 metres long.



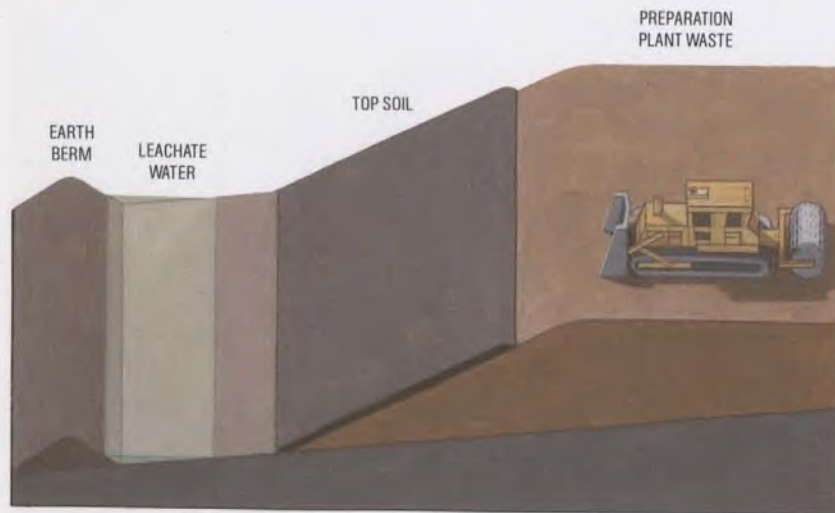
## **SURFACE MINING FOR SHALLOW DEPOSITS**

Surface mining involves the removal of "overburden" to reach coal deposits. Giant dragline machines and power shovels load the coal into trucks of up to 200 tonnes capacity which transport it to central processing facilities for cleaning and sizing.



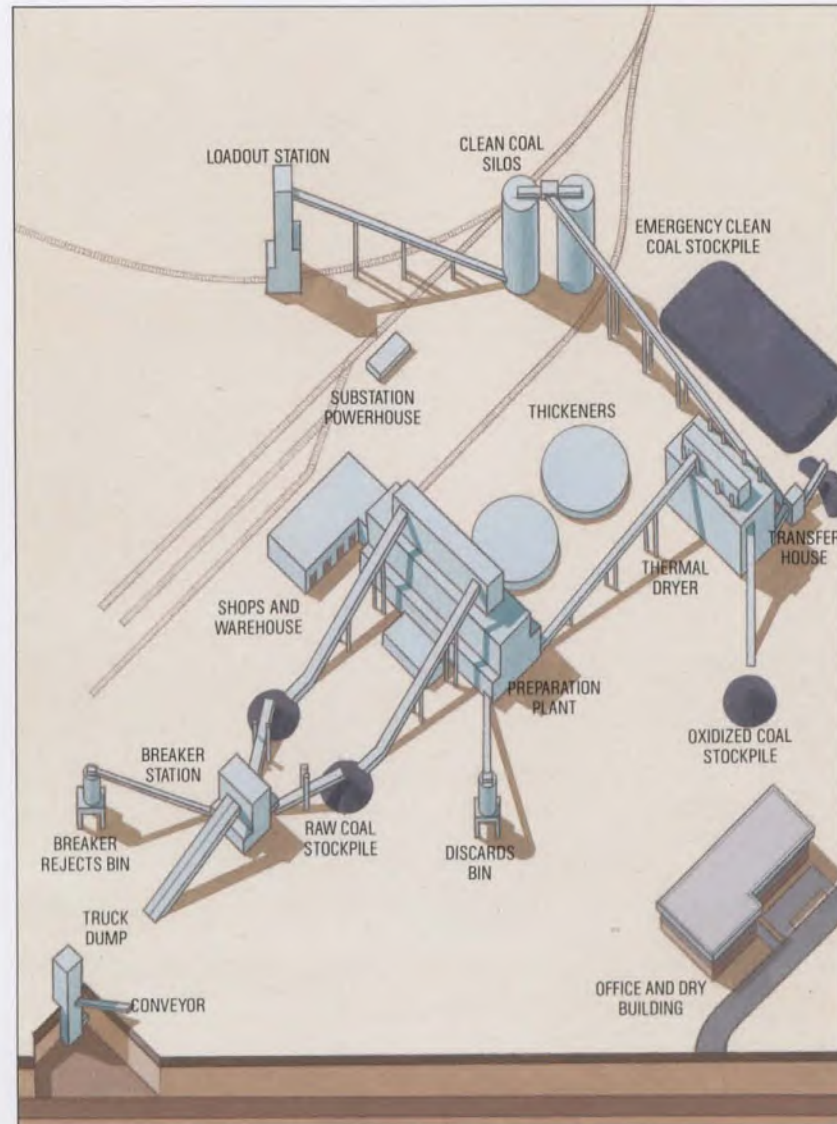
# THE PREPARATION PROCESS

- 14 Before coal is shipped from the mine, it is crushed, sorted by size, cleaned and dried. In this process most of the unusable elements in the coal such as ash, which could impair its later use, are removed.



Disposal and reclamation of waste material from coal preparation.

Coal preparation plant.



# THE RECLAMATION PROCESS

- 1 Sub-surface soils and topsoils are redistributed over mine spoils.
- 2 Cleared land and mine spoils are seeded with a variety of ground covers to prevent erosion.
- 3 Reclaimed land is seeded with new forest cover.
- 4 Land returns to its natural state.



1



2



3



4





# HOW WOULD THE COAL BE SHIPPED TO MARKET?

The cost of transportation is a major factor in marketing northeast coal. In this rugged, undeveloped area to the south of Chetwynd and Dawson Creek there are no railway branch lines. With the 1000 kilometre distance to the coast, an efficient transportation system is essential. The study of possible transportation components included road, rail and port facilities development.

For the northeast coal resource a three-part transportation system is proposed. Industrial roads or railway spur lines will connect the mines to a railway branch line which in turn will connect with the existing British Columbia Railway and subsequently with the Canadian National Railway mainline enroute to port facilities at Prince Rupert. The scale of mining operations proposed also requires the construction of new highways to join the mines and townsites to existing communities.

For the railway branch line, three possible routes were studied in complete engineering and environmental detail. The option selected by the B.C. government for transport from the central part of the coalfields was the Anzac-Wolverine-Tumbler Ridge route, called the "Tumbler Ridge Branch Line."



**Existing Routes**  
■ Railways    ■ Roads  
**Proposed Routes**  
■ Railways    ■ Roads

18 Rail traffic and port facility studies indicated that Vancouver would become heavily congested if large amounts of northeast coal were shipped through it, particularly with increased coal shipments from southeast B.C. and Alberta using this route. Ridley Island in northwest British Columbia was chosen as the site for a new bulk commodity port. Northeast coal and other bulk products, such as grain and possibly potash, would be shipped to world markets from Ridley Island. These other cargoes would help support the costs of port developments and upgrading the CN rail line between Prince George and Prince Rupert.

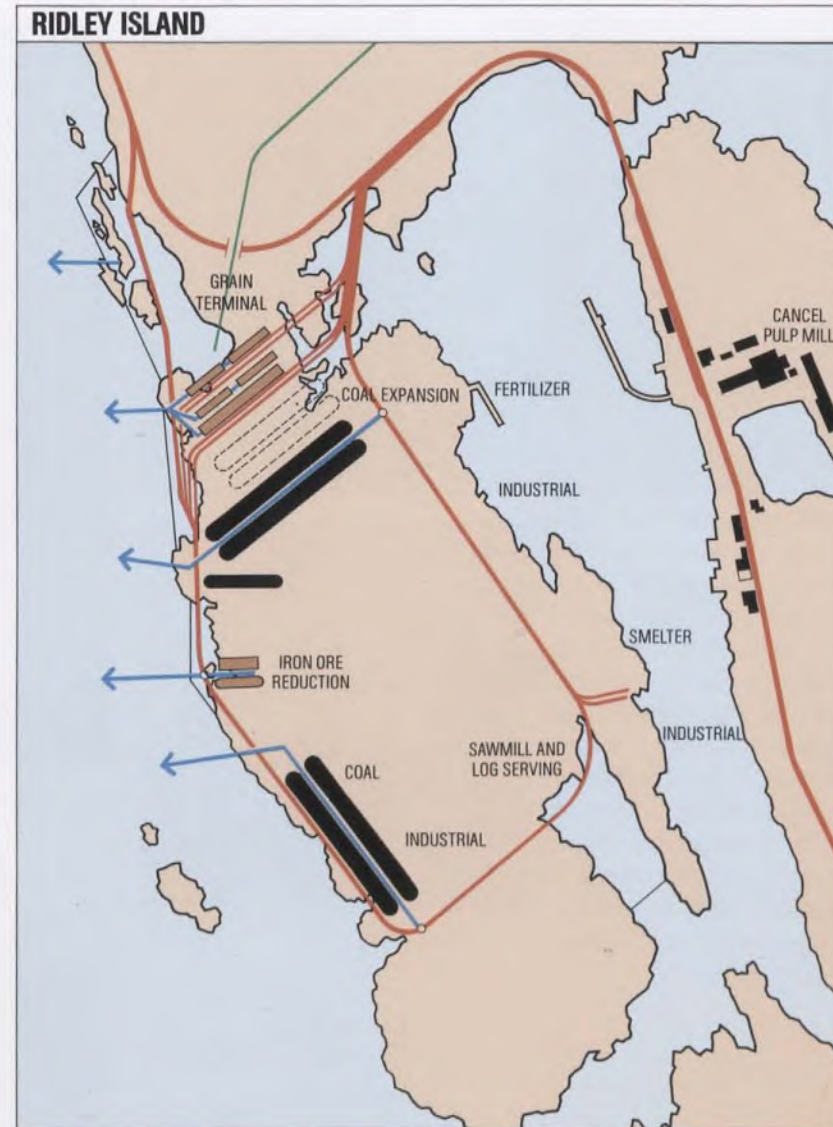
Regional highway planning centred on options to provide access to the proposed mines and to the planned Tumbler Ridge townsite. The new road route, selected by the British Columbia government, is from Chetwynd to Tumbler Ridge, with industrial roads radiating to the mining developments. The B.C. government also recognized that major upgrading

of the Heritage Highway, which connects the new townsite to highways east and west of Dawson Creek, was also required.

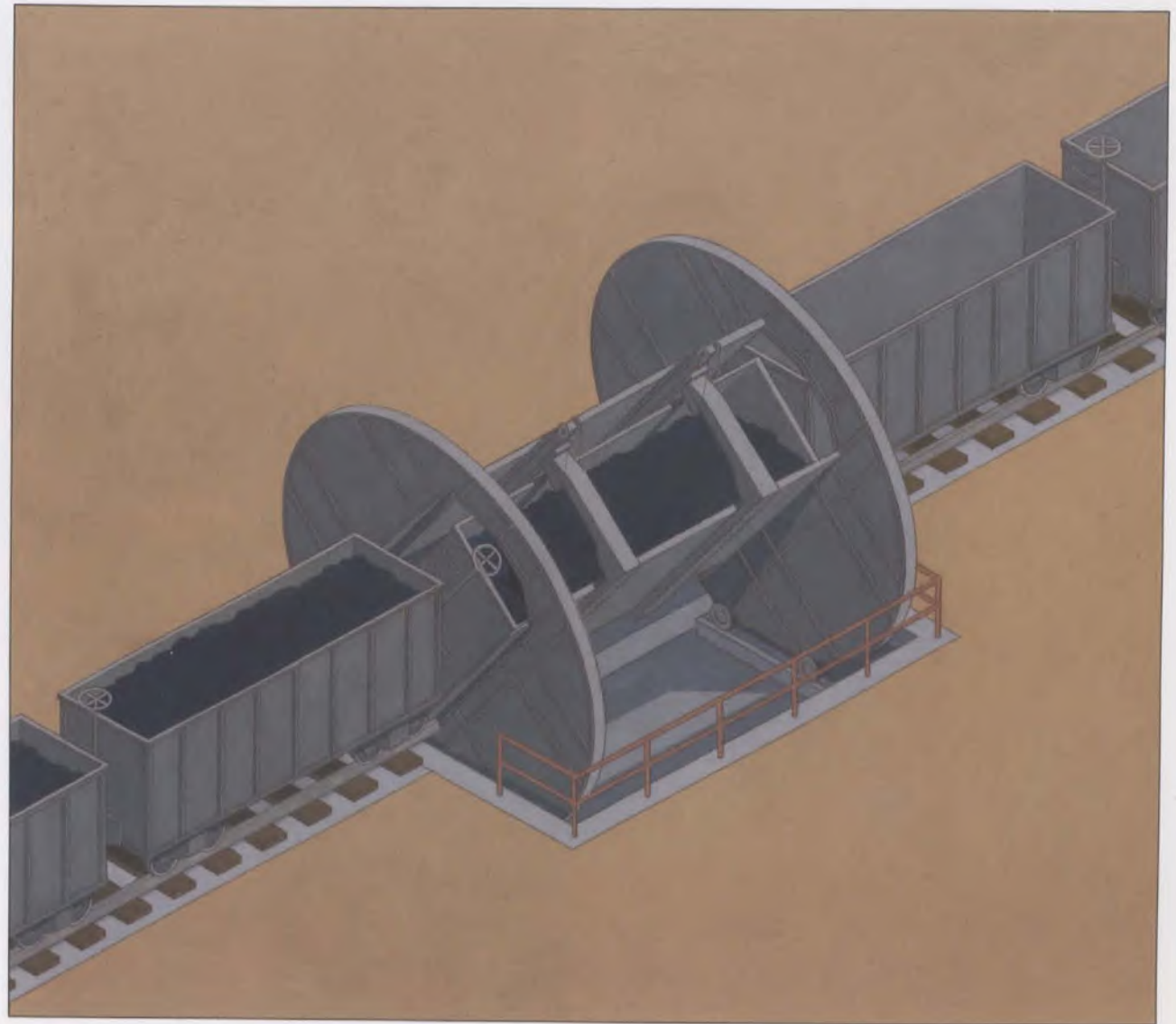
The environmental impact of roads and railways had to be carefully examined. Climatic conditions, coal dust problems, and the interruption of animal migration routes, were among the many concerns which were taken into consideration in planning and engineering the new transportation routes.

This map of the Ridley Island area shows one way that the shipping terminals and other facilities could be arranged.

■ Railways ■ Roads



The massive scale of coal shipments requires special loading and transport facilities. A rail branch line is needed to connect the mine to the mainline of the railway. The coal would be carried by "coal unit train sets," of about 100 cars capable of carrying 90 tonnes per car. Each car would be equipped with rotary couplings so that the train could be emptied by an automatic dumper at the coal port without uncoupling the cars. The coal port itself would be a highly-specialized facility with automatic dumpers, and loading facilities for bulk carriers.





# WHAT ARE THE COMMUNITY DEVELOPMENT REQUIREMENTS?

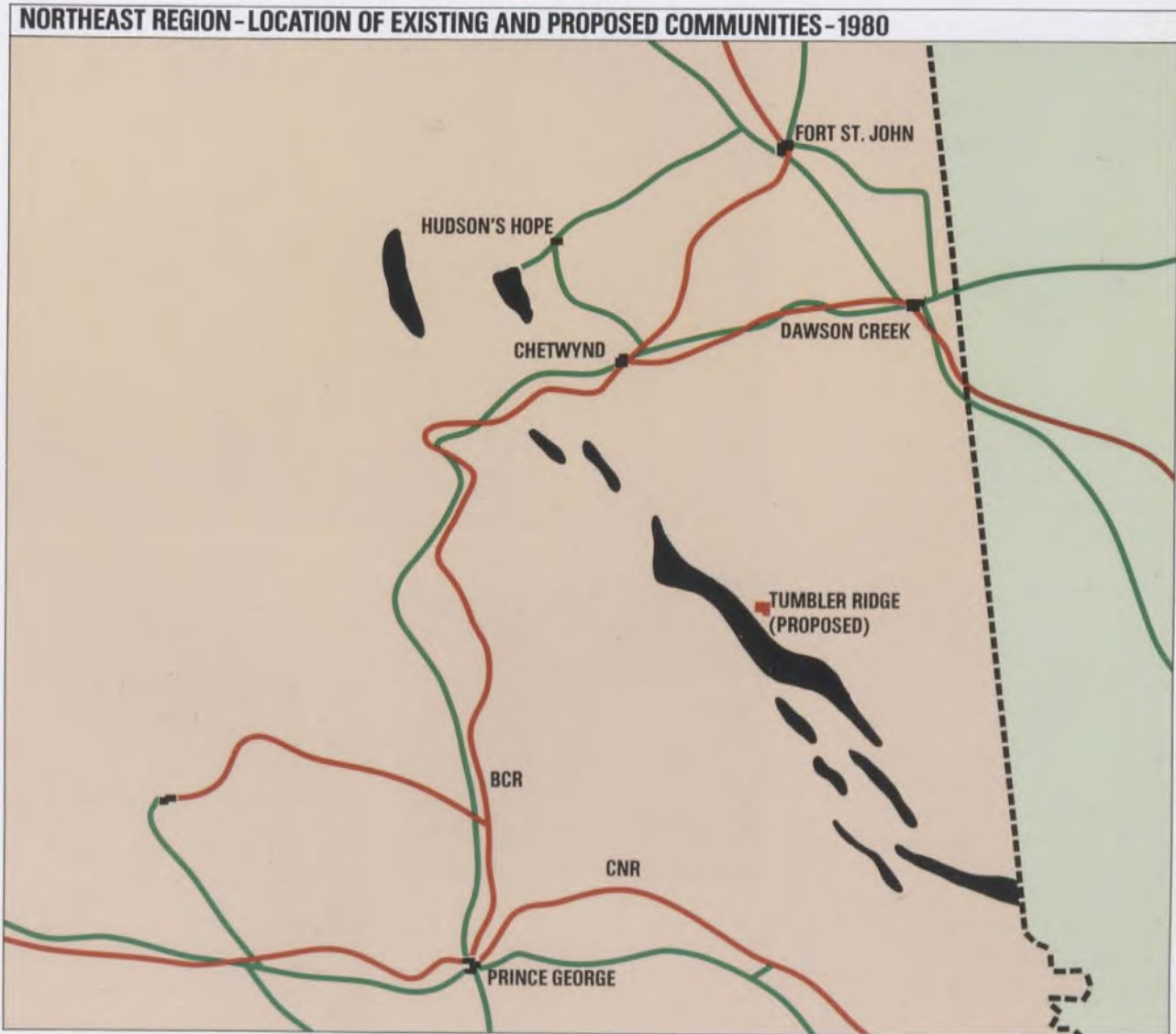
Most of the major proposed mine sites in the northeast are situated too far away from existing communities for convenient commuting.

Chetwynd has potential to serve as a home to a work force for mines in the northern part of the coalfield. Proposed operations in the central and southern portions of the coalfield are too remote and for these mines, a new town has been planned.

Studies were undertaken to examine the need for new townsites, possible locations, and costs. The effect of population increases on existing communities was also investigated.

For the central area of the coalfields, a number of possible townsite locations were compared. Each had to be conveniently close to the mine sites, with minimum disturbance to the environment. After detailed analysis, Tumbler Ridge emerged as the most suitable location.

- Existing Communities
- Proposed Communities
- Railways
- Roads



22 In the design of the new town of Tumbler Ridge the planners tried to avoid the negative aspects of a "company town" atmosphere. The community needed to have an economic base potentially broader than that provided by a single employer. One of the reasons Tumbler Ridge was chosen was because it is well located to serve as the home of workers from several different mining operations. In addition, it is likely that employees in industries other than coal, such as natural gas and forestry, would make their homes in Tumbler Ridge.

Planners departed from conventional community planning by conceptualizing life in Tumbler Ridge on the basis of the character of life in the northeast. The town had to be a place where people would want to settle. Rather than merely providing public works and commercial facilities, the planners considered those physical and social features which would contribute to a high quality of life in the new community.



They had to forecast the population levels and age and sex ratios and other characteristics of the people who would live at Tumbler Ridge. Using population models and other techniques, planners developed several alternative design concepts. All these designs consider the extent of mining operations in the area, yet each design can potentially provide the features considered necessary to provide a positive character for the town. The influence which an increased population would have on existing communities and on the settlement pattern of the region in general was also assessed in detail. This involved an investigation of the capacity of the existing communities to assimilate growth, and the cost of upgrading their community services.

**PLANNING MAP SHOWING POSSIBLE LAYOUT OF TUMBLER RIDGE TOWNSITE**

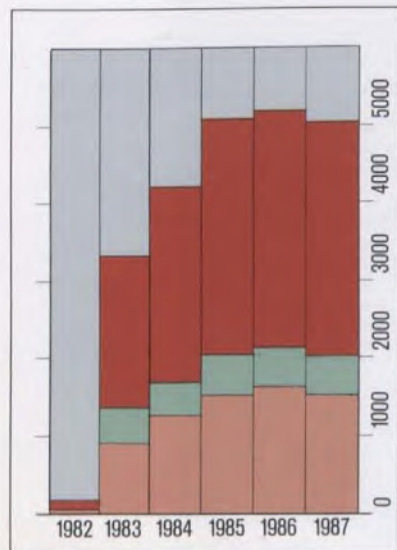
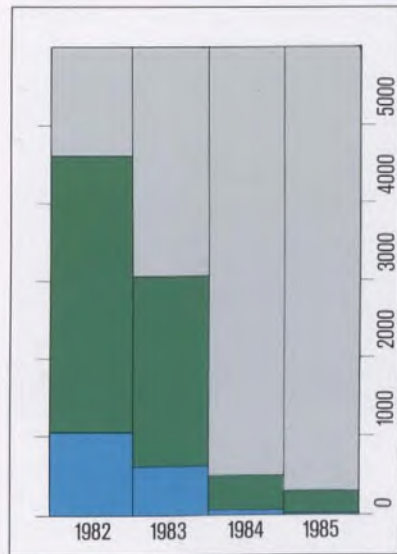
- 1 Secondary School
- 2 Recreation Centre, Community College
- 3 Family Centre, Human Resources, Library
- 4 Commercial/Food
- 5 Commercial/Retail
- 6 Hotel
- 7 Apartments
- 8 Possible Hospital
- 9 Possible Commercial
- 10 Municipal Hall, Post Office, Fire Hall, Ambulance
- 11 Community Park







# WHAT ARE THE MANPOWER REQUIREMENTS?



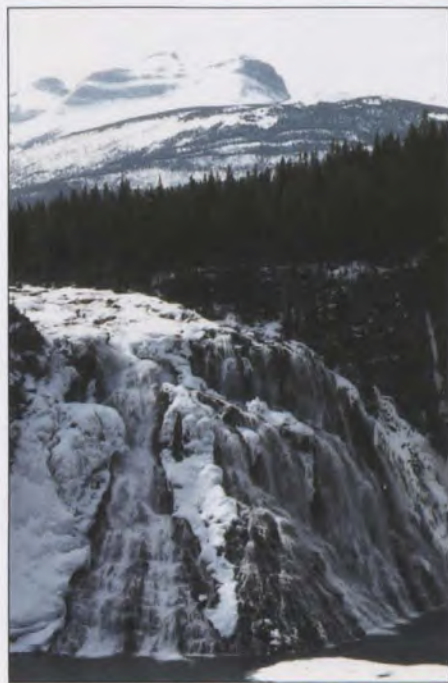
Development of coal mining in the northeast will require a large work force. Estimates of full employment potential range up to 9,000 in mining, 21,000 in related industries throughout Canada, and 25,000 man-years of construction employment. Major labour supply questions are: how to ensure the participation of the regional population, including native people, in new employment opportunities, and how to train the necessary mining work force.

In underground mining, a trained work force is essential. Studies indicated that careful attention would have to be paid to training for underground operations. The need for specially-trained workers is considered to be less critical in open pit mining since a majority of the workers would be heavy equipment operators and maintenance crewmen.

High labour turnover causes costly social and economic problems for mining operations in isolated locations. However, labour turnover could be reduced by the application of measures which increase job and community satisfaction. Another factor that could reduce turnover is the presence of women in the mining work force. In the case of northeast coal, there appear to be good prospects for female employment, especially in the surface mining operations. To make such non-traditional employment possible, planners included day-care facilities and other social services in community designs.

**Construction Employment in Peace River-Liard Region**  
 Direct Indirect and Induced

**Operating Employment in Peace River-Liard Region**  
 Quintette (Basic) Bullmoose (Basic) Non-Basic



# ENVIRONMENTAL CONSIDERATIONS

Prior to the start of coal development activities, little detailed information on the environment of the northeast coal block was available. Consequently, a major program of collecting, assembling, coordinating and analyzing environmental information was required. The environmental programs had two specific objectives: firstly, to gather environmental baseline information on the entire northeast coalfield area and secondly, to assess the environmental impacts of potential road and rail corridors and townsite developments. The effects of the proposed coal mine developments themselves would be the responsibility of individual developers in accordance with provincial guidelines.

Studies were designed to take inventory of, and analyze, the climate, terrain, soils, vegetation, hydrology, and water and air quality of the northeast coalfield area, together with the associated visual, fishery, aquatic migratory bird, wildlife and heritage values.



Environmental information is important to almost every aspect of planning. Engineers need climatic information to select and plan rail and road routes. Snowfall, for example, can strongly influence the choice of a route since it can affect both operating and maintenance costs. In evaluating townsite locations, planners were influenced by such environmental information as climate, the strength and stability of soils, and the location of major underground water sources.

The results of each study must be interpreted in the context of the environmental relationships of the whole area. This can be accomplished through the preparation of a Resource Planning Framework.

# GUIDELINES FOR COAL DEVELOPMENT

28 Under the Province of British Columbia's guidelines for coal development, coal companies are required to assess the environmental and social effects of their developments, and provide plans for managing these effects. Administered by the Provincial Ministry of Energy, Mines, and Petroleum Resources, the guidelines are comprehensive in their requirements for information. They are also specific about the planning process which will develop the management plan.

This planning process is divided into four stages, moving from a general view of the proposed development, to the final detailed monitoring required in the plan. The four-stage sequence enables all government agencies concerned with environmental matters to examine the company's proposal and make amendments. The coordination of this process is handled by the Provincial Ministry of Energy, Mines, and Petroleum Resources and then the Environment and Land Use Committee of the B.C. Cabinet finally approves the plan.



### COAL DEVELOPMENT ASSESSMENT PROCEDURE

**Prospectus**  
 Initial outline of coal reserves and exploration, mine site and off-site development proposals including:

- the mining properties
- the reserves (location, type, amount, recoverable, developed, etc.
- forecast production by phase
- estimated labor force by phase
- exploration and mining programs and areas influenced



**Stage I: Preliminary Assessment**

**1** Preliminary outline of development program impacts related to:

- exploration
- mine development
- mine reclamation
- coal processing
- power development
- transportation
- community development
- regional economy

**2** Analysis of existing data to identify data gaps related to existing environment and the community.

**3** Design and implementation of environmental monitoring programs to fill data gaps. This to be done by contact with appropriate agencies.

**4** Preliminary identification of problems warranting assessment and alternative solutions to be explored.



**Review Process**



**Stage II: Detailed Assessment**

**1** Detailed outline of development program related to:

- exploration
- mine development
- mine reclamation
- coal processing
- power development
- transportation
- community development
- regional economy

**2** Site specific impact assessments for all elements of the development program on natural environment terrestrial resources, including:

- land capability
- water and aquatic resources
- air resources, including noise levels.

**3** Alternative proposals for managing identified environmental impacts and meeting identified community and social development requirements.

**4** A statement of alternatives preferred by developer with supporting reasons.

**Approval by B.C. Cabinet**



**Stage III: Operational Plans and Approval Applications**

**1** Preparation of detailed plans of action for:

- managing identified environmental impacts
- meeting community and social development requirements of selected alternatives.

**2** Application for necessary permits:

- Energy, Mines and Petroleum Resources
- Pollution Control Branch
- Water Rights
- Lands Service
- Municipal Affairs
- Transportation and Highways
- Forest Service

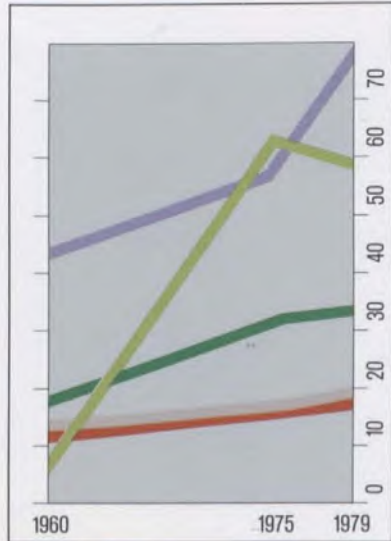
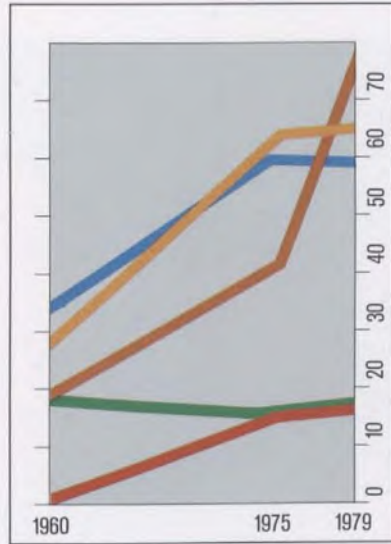
**3** Design of monitoring programs for construction and operation.



**Stage IV**  
 Implementation of continuing monitoring programs.



# WHAT ARE THE ECONOMIC, FINANCIAL AND MARKETING CONSIDERATIONS?



The development of northeast coal is dependent upon mining methods and costs, transportation costs, taxes, royalties and government regulations as well as demand and competition in the world marketplace.

Several studies examined the world market for coking coal and the potential impact of changing technologies within the steel industry on the use of coking coal. The studies indicated that the high quality of northeast coal should assure large markets both now and over the long-term. The main markets for northeast coal would likely be in Pacific rim countries, and in particular, Japan. In addition, coal could find growing markets in Canada, Mexico, South America and Europe.

### World Coal Trade - Export

(in million tonnes)

- United States
- USSR & Poland
- Canada
- Other
- West Germany

### World Coal Trade - Import

(in million tonnes)

- Canada
- E.E.C.
- Japan
- Rest of Western Europe
- Eastern Europe

Other studies were conducted to assess the overall economic viability of the proposed developments as well as the benefits and costs of the project to the British Columbia and Canadian economies. The production and sale of northeast coal can produce employment and revenue benefits for British Columbia and Canada.

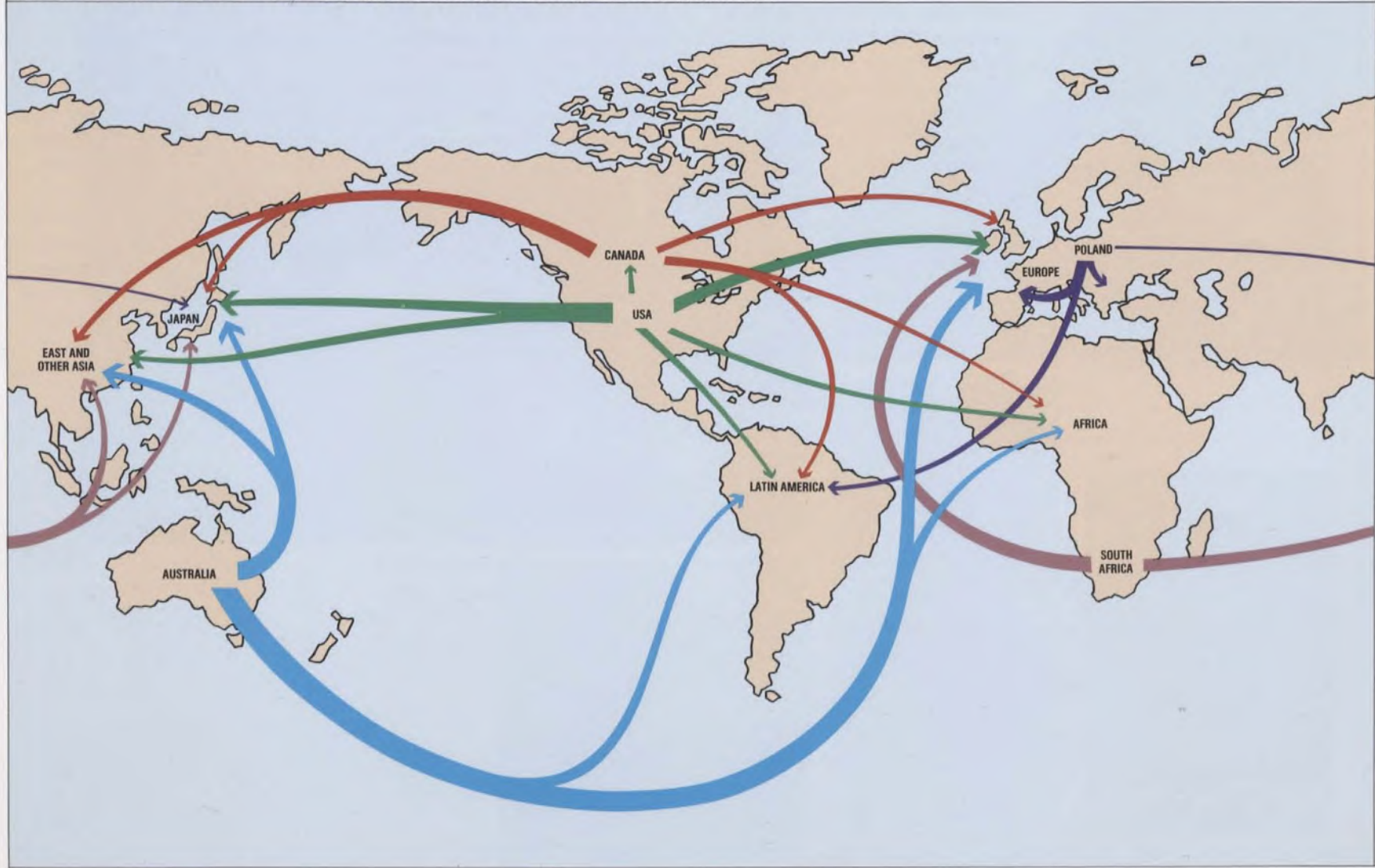
The most significant benefit of the coal development in the northeast would be the long-term growth it would bring to the economy of the region. On an individual basis, direct and indirect employment would mean increased personal incomes.

Improvements in the existing transport system and the construction of new roads and railways would provide new access to the area which, in turn, would enhance and diversify regional social and economic opportunities.

Joint federal-provincial planning has resulted in a high degree of cooperation among all levels of government and industry. The "Canada-British Columbia Subsidiary Agreements to Evaluate North East Coal and Related Developments" have provided a comprehensive analysis of the proposed northeast coal developments and have taken these planning activities successfully to the stage where major decisions are now being made by both senior levels of government and private companies.



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