

**AURUN MINES LTD.**  
**HAIL HARPER CREEK PROJECT**  
**PRE-FEASIBILITY STUDY**

**PHILLIPS BARRATT KAISER - PROPOSAL A**

**1.0 INTRODUCTION**

Aurun Mines Ltd., (Aurun), wishes to have a pre-feasibility study conducted on its Hail Harper Creek copper property. In discussions with Mr. J. A. Chapman, President, it has been agreed that the level of estimate desired for this study is, in Phillips Barratt Kaiser's (PBK) terminology, a **Type II Estimate**. The property is located north of Kamloops, B. C., and is held under option by Aurun from Quebec Cartier Mining Co., a subsidiary of U.S. Steel.

**2.0 SCOPE**

**2.1 Geology**

Ore reserve and grade estimates will be derived to provide an arm's length audit on those presently being quoted. This will involve the production of a base plan, cross sections, and longitudinal sections.

**2.2 Mine Plan**

Using the above data as a base, and upon meeting with Aurun, an initial cut-off grade will be derived and mutually agreed to. This will allow the mine planning effort to proceed on a preliminary basis. Results will be subject to revision once the study is completed, at which time the economics will dictate cost estimates as used in the calculation of the cut-off grade be revised. This reiteration will not take long and will only be done once. During the course of this step, mutually agreed equipment selection, manpower levels, and maintenance procedures will be determined. Waste dump and stockpiles will be included in this section.

**2.3 Metallurgical**

From the expected mill feed grades, derived on an annual basis from the mine plan, a flowsheet will be calculated, forming the basis for process, equipment selection, and manpower levels. Philosophy of used, as compared to new equipment, will be discussed. In addition, proven technology will be defined for the purpose of this study.

## 2.0 SCOPE - Continued

### 2.4 Infrastructure

This will include the following:

- . Site Selection and Development
- . Buildings
- . Power Supply
- . Water Supply
- . Waste Water Management
- . Fuel and Lube Management
- . Fire Protection
- . Explosives
- . Communications
- . Tailings Pond

### 2.5 Cost Estimates

Capital costs will be calculated to +/- 20%, and operating costs to +/- 15%. Discounted cash flows and internal rates of return on investment will be derived.

### 2.6 Future Scope

A recommended scope of future work will be provided, both for possible field work, and for further studies.

## 3.0 WORK PLAN

### 3.1 Geology

All geological reports made available will be carefully reviewed, and together with the examination of all available physical specimens, will form the basis of the study. It is felt that field investigations at this time would, at best, tend to yield confusing and limited results. Discussions with key individuals who have been involved in this project from a geological point of view will, wherever possible, be held. This will require the direct assistance of Aurun personnel for both the setting up of some meetings, and their own experience on this property.

A base plan, cross and longitudinal sections, at scales mutually agreed to be appropriate for mine planning at this time, will be produced. Wherever deemed to be cost and time effective, a computer aided drafting approach will be used. However, the resulting ore reserve and grade calculations will be based on manual methods, as computer modeling is felt by PBK to be too expensive at this time.

### **3.0 WORK PLAN - Continued**

#### **3.2 Mine Planning**

Using the data from 3.1, a preliminary mine plan will be produced. It will rely on cut-off grades selected mutually and subject to revision, over all pit wall slopes at one angle, and a one pass approach as to optimum pit design. The annual mine production schedule will be based on certain assumptions which will be clearly set out in the study.

The choice of mine equipment, staffing and maintenance procedures, will be made with Aurun personnel.

#### **3.3 Infrastructure**

The level of detail for each of the items to be considered will be sufficient to serve as the basis for cost estimates at the required level of accuracy. They will not serve as the basis for regulatory data. Key points within this section, such as the power distribution scheme and tailings pond, will receive more attention than others.

#### **3.4 Cost Estimates**

Capital cost estimates will be produced in accordance with the definition of **Type II Estimates** which are defined on the Table attached. Input from the best and the most expeditious sources available will be made in concert with Aurun personnel. The final results will be compared, on a gross basis, with past but similar projects.

Operating cost estimates will follow the same analysis as for the capital cost estimates

#### **3.5 Future Scope of Work**

This section of the study will outline the scope of work necessary to achieve results anticipated from a final, definitive feasibility study. Field efforts and those in the office will be defined.

### **4.0 PBK PERSONNEL**

By necessity, this type of study requires the use of the most senior people available. This ensures both that the study be completed on time, within the level of accuracy required, and within the budget. The key personnel proposed by PBK for this study, and for whom resumes are attached, are as follows:

#### 4.0 PBK PERSONNEL - Continued

##### **Geology - Jean Jacques Lefebvre**

Mr. Lefebvre is a **Senior Geologist** with PBK and returned to its Vancouver office in mid 1987 from a four year period in Zaire working for PBK as the Chief Geologist for a copper mine complex. His duties entailed supervision of both the mining geologists and those involved in the exploration and development of a large mining concession.

##### **Mining - Robert Rodger**

Mr. Rodger is a **Senior Mining Engineer** with PBK and has a career in the studying, operating and evaluating of a large variety of mines, including copper mines. This evaluation experience is at both a domestic and international level, and is of the type where fast decisions need to be made without much technical data. There will be more data available on this study than others, and his familiarity with his field will be most useful for this one.

##### **Metallurgy - Gregory Wortman**

Mr. Wortman is a **Senior Metallurgical Engineer** with PBK and has had a great deal of experience in a wide variety of minerals, including copper. Recently he was responsible for a major part of the circuit for an expansion of a copper producer. He also provided startup services for this client, who was very pleased with the minimal time required to get his facilities into full production.

##### **Infrastructure - William Hayes**

Mr. Hayes has many years of experience in the site facilities aspect of several types of operations. His background covers all aspects of this study, and will ensure that the work is completed in an expeditious manner. Like all the above staff, he is currently involved on mining projects, so comes prepared with current data.

##### **Cost Estimates - Hector Hebert**

Mr. Hebert has many years of experience in estimating and budgeting for mining projects. His background in the construction industry as it pertains to mineral projects will assist him to provide the necessary results for this study.

##### **Support Staff and Project Management**

All other staff to be used on this study will do so only if they have an in-depth background in the mineral industry. They will range from the designer/draftsman level to the highest corporate level of PBK. This will include the involvement of Mr. J. E. Dagenais, Vice President, Mines. His experience is wide ranging, and as such he will be involved in all aspects of this study.

**5.0 STUDY SCHEDULE**

The study will commence immediately upon award. Assuming approval to proceed by the **15th of January, 1988**, it is anticipated that the final report will be completed by the end of **March, 1988**.

**6.0 COMPENSATION**

PBK will complete this study for a lump sum of **\$50,000**. Two invoices will be sent, one half-way during the study, and the final one upon completion. The rate for the key individuals and support staff are shown below, together with their time of involvement in the study:

	Rate	Man-hours
J. J. Lefebvre	\$46.88	80
R. Rodger	65.63	80
G. Wortman	65.28	80
W. Hayes	63.33	60
H. Hebert	64.32	80
J. E. Dagenais	82.82	120
Designer/Draftsman	41.69	200
Word Processing	24.70	40

The compensation above is submitted to you in accordance with the attached '**Schedule of Services, Rates and Conditions of Agreement,**' Section 2 c).

**JEAN-JACQUES MAURICE LEFEBVRE**

Jean-Jacques Lefebvre is Senior Geologist with PHILLIPS BARRATT KAISER. He has participated in numerous projects acquiring valuable experience, mostly in the field of economic geology. He has spent five years in the Zairian copper belt as a Research Geologist. He has been deeply involved in exploration geology, acting as a Consultant Geologist in deep ocean nodule prospecting in the United States.

**EDUCATION** University of Brussels, Degree "Licencie en Sciences Geologiques, Mineralogiques et Geophysique", 1964 -1968

Ecole Superieure de Geologie de Nancy, France,  
Degree: Engineering (Rock mechanics major), 1968 - 1970

**MEMBERSHIPS** Canadian Institute of Mining and Metallurgy  
Mineralogical Association of Canada  
Geological Association of Canada  
Societe Geologique de Belgique  
Societe belge de Geologie  
Society of Mining Engineers of AIME  
Society for Geology Applied to Mineral Deposit  
Society of Economic Geologists

**CAREER HISTORY**

Prior to joining **PHILLIPS BARRATT KAISER**, Mr. Lefebvre was Chief Research and Exploration Geologist with **UMEX INC.** and Consultant Geologist for **UNION SEAS, INC.**

From 1975 - 1980 he was Research Geologist with **UNION MINIERE EXPLORATION AND MINING CORPORATION LTD. (UMEX)**, Canadian subsidiary of Union Miniere, S.A.

During the period 1971 - 1975, he worked in various capacities on behalf of **UNION MINIERE, S.A.** in Gecamines (Zaire), and in 1970 on a Phosphate Project at Aveta (Togo), and was involved in limestone exploration and cement industry surveys in Biskra and Zahana (Algeria) for a Swiss firm "Prospecting Engineering Gestion".

**JEAN-JACQUES MAURICE LEFEBVRE****PROJECT EXPERIENCE****Umex Inc., Chief Research and Exploration Geologist, 1980 - 1983****Union Seas, Inc. Consultant Geologist**

- . Massive sulphide exploration in northern Ontario and Quebec.
- . Mn Nodule exploration: on behalf of the Union Seas Inc., Toronto-New York) served as a consulting geologist, involved in modern deep sea technology, geostatistic reserve estimations, and strategical decisions.

**Union Miniere Exploration and Mining Corporation Ltd. (UMEX), 1975****Canadian Subsidiary of Union Miniere, S.A.****Research Geologist**

- . Laboratory and field assistance with exploration, mapping and geophysical surveys of massive sulfide (Canadian Shield through Apalachians) and Mississippi Valley type deposits (Yukon).
- . Development of an original computerized lithochemical method for hydrothermal ore deposits. Application of this method to a known volcanogenic Cu-Zn deposit (research contract with Patino).
- . Geostatistic analyses of ore reserve of Cu-Ni deposits.
- . Detailed study of the UMEX Thierry Cu-Ni deposit, Pickle Lake, Ontario, involving independent studies and coordination of M.Sc. and Ph.D. theses respectively for Carleton University at Ottawa (Professor D. Watkinson) and Pennsylvania State University (Professor D. Gold).
- . Thierry deposit: study of the distribution pattern of precious metals (Au, Ag, Pt, Pd) as a guide to minerals dressing and enhanced recovery of the precious metals. This assignment is an ongoing project in close cooperation with the Thierry mill superintendent.
- . Tin placer deposits (Brazil): contract with Patino led to discovery of new tin deposit (alluvial) which is going to be mined.
- . Participation on behalf of Union Miniere, S.A. in the detailed re-evaluation of the Oracle Ridge deposit (copper-skarn) in Arizona.

**Union Miniere, S.A. (Brussels, Belgium), 1971**

On behalf of Union Miniere sent to Gecamines (Zaire)

- . Responsibilities: Special projects, exploration for unusual Cu-Co occurrences in the Central part of the Shaba Copperbelt. Also mapping of large areas and geochemical surveys of stratiform copper deposits.
- . From 1974 to 1975 metallogeny and sedimentology research in the Katangan sequence. Computerization of reserve estimations.
- . Microscopic studies of mill concentrates.
- . Study of problems relating to slope stability in open pit mining operations.

**JEAN-JACQUES MAURICE LEFEBVRE**

Mr. Lefebvre's early experience includes:

- 1963        Geological mapping and sedimentology studies of tertiary sands and gravel deposits (Belgium).
- 1964        Field work in the sedimentary rocks of Massif Central (France).
- 1965        Graduate research in the skarn deposits of Tuscany (Italy).
- 1966        Field work and economic studies in the volcanic Eifel area (Germany).
- 1967        Sedimentology and paleomagnetic studies in the Paleozoic zone of Brabant (Belgium).
- 1969        Research in concentration processes with Professor Blazy, Nancy, France.  
Hydrological and geological survey of the Gravelotte aquifer (for the French Government).



**ROBERT JAMES RODGER, P.ENG.**

Bob Rodger is currently Senior Mining Engineer with PBK and has more than 26 years experience in the mining industry.

**EDUCATION:** Bachelor of Science, Mining Engineering  
Queen's University

Diploma, Business Administration from the Alexander  
Hamilton Institute

**MEMBERSHIPS:** Member, Order of Engineers of Quebec  
Member, Canadian Institute of Mining and Metallurgy  
Member, AIME Society of Mining Engineers  
Member, Prospectors and Developers Association

**CAREER HISTORY**

Since 1982, Mr. Rodger has been a Consultant through RJR Resource Inc. His assignments have included monitoring of mining projects, property evaluations, mineral sector reviews, and personnel searches.

For five years prior to his current position, he was with Societe de developpement de la Baie James, responsible for business development in mining, including development of a 500 tpd gold mine in Northwestern Quebec.

During 1973 to 1976, Mr. Rodger was a Mining Engineer with the World Bank where he was involved with the evaluation of mining projects for Bank financing and technical assistance to borrowers.

Prior to that position, he held supervisory positions in mine operations and engineering including Superintendent of the Cupra and Destrie Mines of the Sullivan Mining Group.

**PROJECT EXPERIENCE****500 tpd Gold Mine, Quebec**

Responsible for all aspects of development including preparation and analysis of projects, presentation to the Board, and negotiation of agreements.

**Renabie Gold Mines Ltd., Renabie, Ontario****Mine Superintendent**

Responsible for underground mining engineering, and geology.

**ROBERT JAMES RODGER, P.ENG.****Mattagami Lake Mines Ltd., Mattagami, Quebec  
Chief Mine Engineer**

Responsible for mine planning, layout, research, ventilation and surveying for projects such as: feasibility studies on the Norita Mine; studies on conversion of the mine to trackless equipment; and study and technical control of overburden removal over the ore zone.

**Cupra and Destrie Mines, Stratford, Quebec**

Superintendent responsible for underground mining engineering, geology, and mechanical maintenance for Sullivan Mining Group Ltd. while the Cupra Mine was being phased out and the Destrie Mine was prepared for production.

**Icon Mine, Chibougamau, Quebec**

Assistant to the Manager, responsible for underground mining, milling, and maintenance for Merrill Island Mining Corp., including preparing the Icon Mine for production.

**Feasibility Study, Burkina Faso**

Mining aspects of an integrated feasibility study on manganese and limestone deposits in Burkina Faso.

**Nimkish Iron Mines Ltd., Beaver Cove, B.C.**

Pit engineering and surveying, pit foreman, and shiploading supervisor.

**Lead-Zinc Mining Project, Morocco**

Monitoring of the technical aspects of a small scale lead-zinc mining project in Morocco.

**Zinc Deposit Evaluation, Burkina Faso**

Monitoring of the technical aspects of a project to evaluate a zinc deposit in Burkina Faso.

**Gecamines Loan Activities, Zaire**

Monitoring of the technical aspects of World Bank loan activities with Gecamines, a state owned mining company in Zaire.

**Mineral Sector Reviews, various countries**

Mineral sector reviews in Burkina Faso, Ethiopia, Morocco, Tunisia, Yemen and Zaire for the World Bank.

**Mining Evaluation, various properties**

Preliminary evaluation of mining properties and other assets for Nokomis Resources Inc.

**ROBERT JAMES RODGER, P.ENG.****Mining Projects Appraisal, various locations**

Appraisal of mining projects for World Bank financing for projects covering all minerals, from exploration through to production.

**Mineral Surveys, third world countries**

Surveys of the mineral industry in third world countries. Surveys reviewed mineral potential, producing companies, relevant legislation, and institutions.

**Technical mineral assistance, various countries**

Technical assistance to governments concerning mineral policy, project formulation, and project promotion.

**GREGORY G. WORTMAN, P.Eng.**

Greg. Wortman is Senior Metallurgical Engineer with Phillips Barratt Kaiser. He has over 20 years of experience in engineering, operations and design in mineral processing.

**EDUCATION**

(Bachelor of Metallurgical Engineering) Technical University of Nova Scotia, Halifax, Nova Scotia, Canada, 1967.

Professional Development Courses in:  
Project and Human Resources Management, Continuous Ion Exchange Technology, Solvent Extraction Processes and Equipment, the Metallurgy of Gold and Silver and Oil Spill Response Management

**MEMBERSHIPS**

Association of Professional Engineers of Ontario  
Association of Professional Engineers of British Columbia  
Canadian Institute of Mining and Metallurgy

**PROJECT EXPERIENCE****Copper****INCO Metals Company, Copper Refinery, Coppercliff, Ontario**

Process design, equipment selection, circuit design, and commissioning activities related to various modifications and modernization revisions to gold, silver, and platinum group metals concentration and refining operations.

**Copper/Zinc****Phillips Barratt Kaiser Engineering Ltd., Vancouver, B.C.**

Process Consultant for process optimization review, equipment revision and upgrading, and performance assessment for a 5000 t/d sulfide/oxide copper concentrator operation at Sodimiza in Zaire, Africa. This included a detailed computer based analysis of daily production and operating data for a one year period in order to assess long term effects of overall operating parameters and mineralogical variations in feed on product grade and recovery.

Commissioning assistance engineer for Les Mines Selbaie 5000 t/d copper/zinc concentrator facility in northern Quebec as described below.

**Copper/Zinc****LAVALIN - Fenco Engineers Inc., Vancouver, B.C.**

Senior process design and equipment engineer for a 5000 tpd expansion to B.P. Selco's Les Mines Selbaie copper/zinc mine and concentrator facility in northern Quebec. Project includes all facilities and infrastructure from run of

**GREGORY G. WORTMAN, P.Eng.**

mine ore receiving and crushing, stockpiling and reclaim through semiautogenous/ball mill and selective copper/zinc flotation concentration to final product loadout facilities.

Project management, metallurgical test program design supervision, and process design for a preliminary feasibility evaluation for a 10,000 tpd copper mill for E&B Explorations Ltd.

**INCO Metals Company: Copper Refinery, Copper Cliff, Ontario**

Technical Assistant to the Superintendent of Process Technology

Provided process and engineering evaluation of modifications to anode furnacing and casting, electro-refining, refined shapes casting, high pressure leaching, solution purification, electrowinning, and precious metals refining.

**INCO Metals Company: Copper Refinery, Coppercliff, Ontario**

General Foreman, Operations.

Full operational responsibility for the Electrowinning Department, an installation treating a mixed sulphide, high precious metals feed including pressure leaching, precipitation of sulphides/hydroxides/carbonates, solvent extraction of nickel/cobalt, copper electrowinning, and P.M. concentrate purification.

Technical Assistant to the Superintendent

Provided project engineering services during the start-up of the Electrowinning Department including preparation of flow sheets and P & I.D.'s, engineering and commissioning modifications.

**INCO Metals Company: Research Stations, Port Colborne, Ontario, Canada**

These include a pyrometallurgical and hydrometallurgical pilot plant to develop design data for the commercial application of new processes for copper, nickel, and precious metal ores. Experience involved integrated pilot plant testing, and development of design data for the Copper Refinery Electrowinning Department, described above.

**Gold****Phillips Barratt Kaiser Engineering Ltd., Vancouver, B.C.**

Process design and equipment selection for a 50 - 500 t/d gold mill based on modular concepts around a standard shipping container size. Incorporated separate modules for crushing, grinding (including gravity circuit), flotation, leaching, CIP or Merrill-Crowe Recovery, and smelting.

**GREGORY G. WORTMAN, P.Eng.****Phillips Barratt Kaiser Engineering Ltd., Vancouver, B.C.**

Project management, process design, and equipment selection for an exploration decline, ore reserves evaluation and mill modification and upgrading project for a 125 tpd. underground gold mine/mill complex for a confidential Saskatchewan client.

**Phillips Barratt Kaiser Engineering Ltd., Vancouver, B.C.**

Project Manager and process design engineer for a feasibility assessment and metallurgical testing program for a mill relocation and upgrading project for a potential 200 tpd gold/silver project in South Central B.C. for Ark Energy Ltd.

**LAVALIN - Fenco Engineers Inc., Vancouver, B.C.**

Metallurgical test program design and supervision, process design and project management for a feasibility study of a 500 to 1000 tpd gold mill for E&B Explorations Ltd. from R.O.M. receiving through finished product, for both conventional and heap leaching processes. This led to a commercial heap leaching operation at the property.

Process design for a preliminary feasibility study for a proposed 500 tpd gold/silver ore operation, from R.O.M. receiving through finished product.

Project management and process co-ordination, feasibility evaluation and test program design and supervision for a roaster/acid plant system for a 10,000 tpd gold mill for the Cinola Operating Company.

**Uranium****Rio Algom Ltd., Toronto, Ontario, Canada**

Metallurgist, Central Engineering

Process design engineer and mill area project engineer for the Stanleigh project, redesigning and re-equipping the uranium mine-mill complex to increase capacity from 3,300 tpd to 5,000 tpd. Involvement included design review in all areas from underground crushing and conveying through product drying and packaging and tailings disposal.

Specific design innovations included large mill semi-autogenous grinding, horizontal belt filtration dewatering, continuous up-flow ion exchange and centralized process control and monitoring.

Also during this period, metallurgical evaluation of new projects for Rio Algom Ltd., and participation in various projects for optimizing existing operations.

**GREGORY G. WORTMAN, P.Eng.****Other Minerals****LAVALIN - Fenco Engineers Inc., Vancouver, B.C.**

Project Management for a magnetite stockpile and processing system evaluation for Joy Industries Ltd., at Craigmont Mines Ltd., Merritt, B.C.

**Simon-Carves of Canada Ltd., British Columbia****Senior Process Engineer**

Process and mechanical equipment design for a new electro-cobalt refinery for INCO Metals Company.

**INCO Metals Company: EXMIBAL Smelter, Guatemala, G.A.**

EXMIBAL is a new smelter, located in Guatemala, designed to process laterite nickel ores to produce a sulphide matte. It was commissioned in 1977.

**Superintendent of Process Technology**

Responsible for process control and development and for environmental control programs for the nickel smelter which included wet ore receiving, crushing, stockpiling, blending, kiln drying, kiln selective reduction and sulphiding, electric furnace smelting, and converting.

**Supervisor of Process Development**

Responsible for the evaluation of process P & I.D.'s, implementation of plant-wide maintenance and operator training programs, extensively involved in pre-operational testing and inspection of process systems.

**INCO Metals Company: Research Stations****Senior Project Engineer**

As part of a three man team, during the start-up for the Copper Refinery Electrowinning Department (one from the constructor, two from INCO) responsible for the supervision of acceptance procedures, and for commissioning and pre-operational testing of all plant systems.

Responsible for the planning and operation of hydrometallurgical pilot plant tests, including specification, bid evaluation, and performance evaluation of equipment. Processes included grinding and flotation, high pressure continuous leaching and solvent extraction systems, integrated into complete process circuits for treating both oxide and sulphide base metal, and precious metal ores.

**Project Engineer**

Participated extensively in the design, procurement, installation and optimization of pressure leaching, solvent extraction, and precipitation integrated pilot plant systems.

**GREGORY G. WORTMAN, P.Eng.****Senior Test Engineer**

Carried out a variety of assignments related to the operation of hydro-metallurgical pilot plant test programs.

**Junior Test Engineer**

Carried out various assignments in a multi-purpose pyrometallurgical pilot plant, including kiln refractory specification, dust collection systems, heat and mass balances for kilns, electric furnaces, and converters.

**Sulphur****Phillips Barratt Kaiser Engineering Ltd., Vancouver, B.C.**

Senior Process and Equipment Engineer for detailed design of a 30 t/h washing plant for recovery of elemental sulphur from sour natural gas treatment plant sulphur stockpiles. Operations included trommel and screen washing, cyclone desliming, flotation, centrifuge and filter dewatering, tailings thickening, and atmospheric and elevated pressure melting circuits, molten sulphur filtration, storage, and loadout.

**LAVALIN - Fenco Engineers Inc., Vancouver, B.C.****Senior Metallurgical Engineer**

Senior Metallurgical Engineer in charge of the review of all available data (assays, laboratory work etc.) of the sulphur deposits on North Island, New Zealand prior to undertaking a Project Feasibility Study.

Senior Metallurgical Engineer in charge of the metallurgical test work, process evaluations and environmental concerns for the preliminary study of the sulphur deposits at Sulphurdale, Utah.

**Materials Handling****LAVALIN - Fenco Engineers Inc., Vancouver, B.C.****Senior Metallurgical Engineer**

Project Engineer for an ongoing prefeasibility study for development of a bulk liquids and solids marine terminal for a confidential B.C. client.

Project Engineer for a proposed marine receiving, bulk storage, and rail shipping terminal for lead/zinc concentrates for a confidential B.C. client.

Project evaluation consultant to the Toronto Dominion Bank on the \$220 million Ridley Island Coal Terminal Project.



**GREGORY G. WORTMAN, P.Eng.**

**Simon-Carves of Canada Ltd., Vancouver, B.C.**  
Senior Process Engineer

Project management for design, B.C. fabrication and procurement, and erection of a railcar unloading system for Strachan and Henshaw Inc. at Ridley Terminals Inc., Prince Rupert, B.C.

**INCO Metals Company: EXMIBAL Smelter, Guatemala, C.A.**

Responsible for the development of an oil spill response plan for ship unloading and barge transportation of Bunker "C" oil and Diesel for the plant and mine.

**WILLIAM H. HAYES, B.Sc., P.Eng.**

Bill Hayes is Director of the Civil and Transportation Engineering Group. He has over twenty years of civil engineering experience in a variety of areas including municipal, transportation, land development, and waterworks projects.

**EDUCATION:** University of Strathclyde, Glasgow, Scotland  
Civil Engineering, 1969

Graduate course in Engineering Project Management  
Memorial University, St. John's Newfoundland

Graduate course In Hydraulics  
Memorial University, St. John's Newfoundland

**MEMBERSHIPS:** Member, The Association of Professional Engineers  
of the Province of British Columbia  
Member, The Association of Professional Engineers  
of Yukon Territory  
Member, Canadian Water Resources Association

**CAREER HISTORY**

Prior to joining the firm, Mr. Hayes was Vice-President of Fenco Lavalin Corp., Vancouver, B.C. and Whitehorse, Yukon. In his role as Vice-President he was responsible for administration of operations, direction and management of multi-disciplinary projects and marketing of company's services in British Columbia and Yukon. Earlier as Manager of Municipal and Transportation Engineering he was responsible for the management and engineering of municipal services, roads and highways, land development, tourism resort development and park engineering projects.

Mr. Hayes was a partner in Hayes Laird Engineering Ltd. of New Westminster, and Hayes Sharpe Consultants Ltd. of North Vancouver for two years prior to joining Lavalin-Fenco. As a partner, he was responsible for the daily operations of the company which included management and engineering of site servicing for a subdivision, townhouse and apartment projects, and road and waterworks projects.

While with Genstar Development Company between 1977 and 1980, as Development Manager he was responsible for planning, design, approval, servicing and marketing some 2000 acres of the company's properties in the Lower Mainland including the 400 acre, 800 unit development of Eagle Ridge in Coquitlam. Previously as Manager of Engineering, he was responsible for survey, design and construction supervision of the company's land development projects in the Lower Mainland and on Vancouver Island.

**WILLIAM H. HAYES, B.Sc., P.Eng.**

Prior to that he was a Project Engineer with Dayton and Knight Ltd. in West Vancouver, where he was responsible for the study, design and construction supervision of waterworks projects in Campbell River, Langley, Kimberley, Port Moody and Coquitlam, sewerage collection in New Westminster and drainage works in Langley.

While with Foundation of Canada Engineering Corporation (FENCO) between 1972 and 1975 in Vancouver as Head of the Environmental Section and in St. John's, Newfoundland as a Project Engineer, Mr. Hayes was involved in drainage, water, sewerage and arterial road project works.

Prior to 1972 he was engaged on a variety of municipal services projects in Newfoundland and Ontario, and the construction of the 57 storey Commerce Court Tower in Toronto and highway and bridge works in Northern Ireland.

**PROJECT EXPERIENCE****Municipal Services****Watermain, Port Moody, B.C.**

Principle in charge of design and construction supervision of 300 mm diameter watermain on Murray Street for the City of Port Moody, B.C.

**Waterworks and Street Improvements, Port Moody, B.C.**

Direction of design of City of Port Moody 1986 waterworks and street improvement design program including relocation of a pressure reducing station.

**Sanitary Sewers, Delta, B.C.**

Directed and supervised design and construction administration of sewage collection system on River Road for Corporation of Delta.

**Rapid Transit System, Vancouver, B.C.**

Utility conflict identification and relocation planning, grading, storm drainage and railroad track relocation, street restoration design and specifications for 5 km section of Skytrain Rapid Transit System, Vancouver and Burnaby, B.C.

**Large Diameter Water Supply Main, Campbell River, B.C.**

Detail design and contract documents for 750 mm dia. steel watermain and appurtenances, Greater Campbell River Water District, B.C.

**Sewage Collection, New Westminster, B.C.**

Sewage collection study for Queensborough District of New Westminster, B.C.

**Water Supply System, Kimberley, B.C.**

Review and report on upgrading of existing water system, City of Kimberley, B.C.

**WILLIAM H. HAYES, B.Sc., P.Eng.**

**Water Distribution, Langley, B.C.**

Water distribution system study for Aldergrove area of Township of Langley, B.C.

**Storm Sewers, Langley, B.C.**

Design of confluence manhole for 900 mm diameter and two 450 mm diameter storm sewers, Township of Langley, B.C.

**Watermain Replacement, Port Moody, B.C.**

Construction, supervision of watermain replacement St. John's Street, City of Port Moody, B.C.

**Water Intake, Kitimat, B.C.**

Inspection and report on water supply intake for Ocelot Industries Methanol Plant at Kitimat, B.C.

**Pressure Reducing Valve Stations, Burnaby, B.C.**

Consultation on design of four water system pressure reducing stations for District of Burnaby, B.C.

**Watermain Construction, Coquitlam, B.C.**

Construction supervision of new watermain on Barnet Highway, District of Coquitlam, B.C.

**Storm Drainage, Port Mann Railyards, B.C.**

Storm sewer study, field investigations, flow measurements and report, CN Yard, Port Mann, B.C.

**Regional Water Supply Study, St. John's Newfoundland**

Assistant project coordinator for Comprehensive Regional Water Supply Study, St. John's Newfoundland involving development of new supply service, 60 km of trunk lines, treatment and other ancillary facilities of 40 mgd capacity to serve a population of over 200,000 spread over 1,000 km<sup>2</sup>.

**Large Diameter Water Supply Main, St. John's, Newfoundland**

Survey and design of first phase conveyance system of St. John's Regional Water Supply system consisting of approximately 22 km of 1066 mm diameter 760 mm diameter and 600 mm diameter prestressed concrete piping.

**Regional Sewage Collection Study, St. John's, Newfoundland**

Regional Sewage collection study for Conception Bay Area, St. John's Newfoundland. Project initiation and final report writing.

**Water Supply Improvements, Happy Valley, Labrador**

On site investigations of existing supply and treatment systems and participation in design and office administration of construction of water supply system improvements for Town of Happy Valley, Labrador.

**WILLIAM H. HAYES, B.Sc., P.Eng.**

**Water and Sewerage System Construction, St. John's, Newfoundland**

Construction supervision of water and sewage system in Kilbride Development Area for St. John's Metropolitan Area Board, Newfoundland.

**Water Supply Systems, Newfoundland**

Field surveys and design of improvements to the existing water supply systems in the towns of Burin and Port Aux Basques, Newfoundland.

**Salt Water Supply to Fish Plant, Ramea, Newfoundland**

Field investigations and study report for improvements to John Penny Fish Plant for Government of Canada.

**Water Distribution and Sewage Collection, Sudbury, Ontario**

Detail design and preparation of contract documents for a water distribution and sewage collection system for the Ontario Ministry of the Environment in the Village of Val Caron, Sudbury, Ontario.

**Federal Penitentiary, Lower Mainland, B.C.**

Grading and drainage improvements associated with perimeter security fences at one of the Government of Canada's penitentiary service security prisons in the Lower Mainland of British Columbia.

**Hydro Supply to Mine Development, Banks Island, B.C.**

Co-ordination of a report on the feasibility of Hydro supply for a proposed mine on Banks Island for Trader Resource Corp.

**Construction Camp, Layout and Design, Rogers Pass, B.C.**

Camp layout and services design of 320 and 640 man camps for National Caterers/Canadian Pacific for Rogers Pass Tunnel Project in Glacier National Park including bear protection fencing.

**Transportation**

**Coquihalla Highway, Hope, B.C.**

Project Manager for survey, design and contract documents for 5.5 km section of Coquihalla Highway, B.C. for B.C. Ministry of Transportation and Highways.

**Highway Corridor, Study Anchorage, Alaska**

Supervision of highway corridor study through Elmendorf Air Force Base to connect with a structure crossing of the Knik Arm of Cooke Inlet including an impact analysis on military installations, regional recreation facilities and Air Force flight operations for the U.S. Department of the Air Force, Anchorage, Alaska.

**WILLIAM H. HAYES, B.Sc., P.Eng.****Highway 1 Connection Study, Vancouver, B.C.**

Participation in a report on a highway upgrading connection between Second Narrows Bridge and Trans Canada Highway (Cassiar Street) in Vancouver for British Columbia Ministry of Transportation and Highways and the City of Vancouver, B.C.

**Parking Lot Expansion, Burnaby, B.C.**

Design and contract administration to expand the existing parking lot to accommodate 70 additional vehicles at B.C.I.T. Discovery Park for Discovery Parks Inc. in Burnaby, B.C.

**Truck Storage Yard, Langley, B.C.**

Contract administration for construction of truck storage yard in Langley for Trimac Trucking Co. Ltd.

**Automobile Reception Terminal, Richmond, B.C.**

Drainage and paving improvements and parking storage at Fraser Wharves Automobile Reception Terminals, Richmond, B.C.

**Transit Operating Centre Study, North Vancouver, B.C.**

Participation in a study to examine and report on the relative merits of three alternative arrangements for the location of a new transit operating centre in North and West Vancouver for B.C. Transit.

**Road Reconstruction, North Vancouver, B.C.**

Project Engineer for survey and preliminary design for reconstruction of sections of chesterfield and 24th Avenue for the City of North Vancouver, B.C.

**Arterial Roadworks, Coquitlam, B.C.**

Arterial road design of Matthewson Avenue, Coquitlam for the B.C. Ministry of Lands, Parks & Housing.

**Truck Storage Yard, Richmond, B.C.**

Design of 5 Ha truck storage in Richmond, B.C. for Trimac Trucking Co. Ltd.

**WILLIAM H. HAYES, B.Sc., P.Eng.**

**Airports**

**Abbotsford International Airport Taxiways, Abbotsford, B.C.**

Project Manager for survey, preliminary design and cost estimates for resurfacing of taxiways D and E and apron 1 at Abbotsford International Airport for Transport Canada, Abbotsford, B.C.

**Fixed and Rotary Wing Airport Improvements, Prince Rupert, B.C.**

Project Manager for preliminary engineering and cost estimates for improvements to Seal Cove Fixed and Rotary Wing Airport, for Transport Canada, at Seal Cove in Prince Rupert, B.C.

**Miller Road, Vancouver International Airport, B.C.**

Principle in charge of relocation of Miller Road, an internal service road, at Vancouver International Airport for Transport Canada.

**Runway and Apron Overlay Design, Prince George, B.C.**

Principle in charge of survey and preliminary design of overlay to Runway 15-33 and Apron II, Prince George Airport, B.C.

**Runway and Taxiway Overlay Design, Williams Lake, B.C.**

Principle in charge of design for overlay of Runway 11-29 and Taxiway 'A', Williams Lake Airport, B.C.

**Access Road Rehabilitation, Williams Lake, B.C.**

Principle in charge of supervision of reconstruction of main access road rehabilitation at Williams Lake Airport, B.C.

**Access Road and Car Park, Smithers, B.C.**

Principle in charge of design and construction supervision of new main access road and 150 lot car park at Smithers Airport, B.C.

**Land Development**

**Deer Lake Area Subdivision, Burnaby, B.C.**

Project Manager for survey and design of engineering services (road, water, storm drainage, sanitary sewers and streetlighting) for a 65 lot single family subdivision in the Deer Lake area for Corporation of Burnaby, B.C.

**Waterfront Development Proposals, North Vancouver, B.C.**

Servicing report and development proposals for Fullerton Property, a 26 Ha of undeveloped fill fronting on Burrard Inlet for Thompson Berwick Pratt & Partners in the City of North Vancouver, B.C.

**WILLIAM H. HAYES, B.Sc., P.Eng.**

**Destination Resort Planning & Engineering, Saanich, B.C.**

Conceptual and preliminary planning and engineering for 500 ha resort hotel, condominium and 18 hole championship golf course development for Windmill Enterprises Ltd. at Tod Inlet, Saanich, B.C.

**Industrial Park Servicing, University of British Columbia**

Roads, water distribution, sewage, drainage and utilities planning and engineering for a high technology industrial park at the University of British Columbia, for Discovery Parks Inc., Vancouver, B.C.

**Townhousing and Apartment Projects, Surrey, B.C.**

Engineering of subdivisions, and servicing of townhousing and apartment projects for The Imperial Group, Springer Development Corporation, and Block Bros. Ltd. in the District of Surrey.

**Subdivision and Townhousing Projects, Port Coquitlam, B.C.**

Design of site services for subdivision and townhousing projects for Marquis Properties Corporation, Cressey Development Corporation and Oceanic Enterprises in Port Coquitlam, B.C..

**Townhousing and Apartment Projects, Pitt Meadows, B.C.**

Design and construction supervision of services for subdivision townhouse and apartments for Cressey Development Corporation, Howard Yano Architects and John Currie Architect, Pitt Meadows, B.C.

**Subdivisions and Apartments, Coquitlam, B.C.**

Services design and construction supervision for a number of subdivisions and apartments for Community Builders Ltd., Marquis Properties Corporation and Tretex Development Ltd.

**Apartment and Townhousing Projects, Richmond, B.C.**

Servicing design for Tom Morton, Architect/Block Bros. Ltd. for proposed apartment development, Garden City Way, Richmond, B.C.

**Subdivision Servicing, Delta, B.C.**

Construction supervision of services installation of 30 lot subdivision for Friend Enterprises Ltd.

**Site Servicing, New Westminster, B.C.**

Site Servicing for apartment and townhouse development for Braeside Developments Ltd.

**Subdivision Feasibility Report, New Westminster, B.C.**

Preparation of planning and servicing report for 60 lot waterfront subdivision in Queensborough for Kirk Realty Ltd.



**WILLIAM H. HAYES, B.Sc., P.Eng.**

**Construction Supervision, Port Moody, B.C.**

Construction supervision completion for 20 lot subdivision for Webb and Knapp Ltd. in the City of Port Moody, B.C.

**Site Servicing, Vancouver, B.C.**

Participation in site servicing for an apartment project in False Creek for Narod Construction Ltd.

**Site Servicing, Burnaby, B.C.**

Designed site servicing for highrise apartments at Lougheed Gardens, and Strathmore Towers for Marquis Properties/Jones Haave Architects; and participation in the design of site services and offsite road construction for Metro Town Centre, a commercial highrise development for Polygon Properties Ltd.

**Topographic Site Survey, Burnaby, B.C.**

Supervised topographic site survey of a 20-acre townhouse site for Polygon Properties Ltd. and Bain Burroughs Hanson Architects in Harold Winch Park.

**Townhouse Development, Vernon, B.C.**

Detail design drawings for a 120-unit townhouse development for Barjack Enterprises Ltd. in Vernon, B.C.

**Services Design, Port Alberni, B.C.**

Responsible for detail design of services for a 60-lot recreational subdivision for Haggard Development Corporation at Port Alberni, B.C.

**Development Management of 2000 Acres of Property in Lower Mainland, B.C.**

Responsible for feasibility, planning, design, approval, servicing and marketing of some 2000 acres of Genstar Development Company's properties in the Lower Mainland.

These large acreage developments were located in the Municipalities of Coquitlam, Port Coquitlam, Maple Ridge, and Mission. Included here were daily project management of the development of Eagle Ridge, a 400 acre, 1800 dwelling unit, mixed land use, seven stage development in the District of Coquitlam. Review, construction inspection and approval of single family, townhouse and multi-family housing for conformance with design guidelines for developments at Eagle Ridge and Harbour Village, Coquitlam.

**WILLIAM H. HAYES, B.Sc., P.Eng.****Eagle Ridge Development, Coquitlam, B.C.**

Responsible for topographic survey, preliminary and detailed engineering, negotiation of construction contracts, construction supervision, and layout of servicing for two 100-lot stages of the Eagle Ridge development.

**Southmere Village, South Surrey, B.C.**

Conceptual and preliminary engineering of site services, including servicing reports for water supply, sanitary sewerage, storm water management and traffic impact. Negotiation of development of engineering requirements for the 165 acre Southmere Village development. Also detail design of the first stage development.

**Development of Mary Hill, Port Coquitlam, B.C.**

Preliminary engineering of services and engineering requirements for land use planning for the proposed development of the 130 acre Mary Hill area in Port Coquitlam, and three proposed development areas in the municipalities of Maple Ridge (150 acres), Mission (over 1000 acres), and Langley (160 acres).

**Mixed Land Use Development, Tod Inlet, B.C.**

Conceptual and preliminary engineering of site services for proposed large scale mixed land use development including marina facilities at Tod Inlet near Victoria.

**House Building Inspection, Coquitlam, B.C.**

Inspection of construction and monitoring of progress for mortgage certification payments for 27 single-family dwellings in Coquitlam for Western Capital Trust.

**Land Use Plan, Victoria, B.C.**

Conceptual engineering and input to land use plan formulation for proposed 100-lot residential development at Metchosin, in the Capital Regional District, Victoria.

**Marine****Ridley Island Development Plan, Prince Rupert, B.C.**

Participated in comprehensive port development plan for Ridley Island in the Port of Prince Rupert, B.C.

**Port of Kitimat Planning, Kitimat, B.C.**

Preparation of a report on future use of a 15 Ha portion of inner harbour, waterfront and backup lands for District of Kitimat, B.C.

**WILLIAM H. HAYES, B.Sc., P.Eng.****Solid Waste****Incinerator Proposal, Burnaby, B.C.**

Civil engineering aspects of design-built proposal for an incinerator for Dominion Bridge - Shultzer for Greater Vancouver Regional District.

**Landfill Operating Plan, Richmond, B.C.**

Involved in preparation of a development and operating plan for future extension of a landfill in Richmond, B.C.

**Incinerator, Tumbler Ridge, B.C.**

Report on fire damage and savagability of District of Tumbler Ridge Incinerator for Underwriters Adjustment Bureau, Prince George, B.C.

**Parks****Stanley Park Master Plan, Vancouver, B.C.**

Responsible for engineering components of Stanley Park Master Plan for Vancouver Parks and Recreation Board, City of Vancouver, B.C.

**Mountain View Park, Port Moody, B.C.**

Principle in charge of site grading drainage, access parking and playing fields design for Mountain View Park in Port Moody.

**Patient Park, University of British Columbia**

Water supply and drainage, design and construction supervision of Patient Park at University of British Columbia, Vancouver, British Columbia.

**National Gallery Landscaping, Ottawa**

Drainage concepts for landscaping design for National Gallery in Ottawa for Cornelia Oberlander Landscape Architects.

**Tourism****Regional Tourism Strategy, Pacific Rim, B.C.**

Engineering components of Alberni-Clayoquot (Pacific Rim) Regional Tourism Development Strategy, Regional District of Alberni-Clayoquot and the Ministry of Industry and Small Business, Vancouver Island, B.C.

**Tin-Wis Native Cultural Resort, Tofino, B.C.**

Engineering aspects of Tin-Wis Native Cultural Destination Resort Master Plan and Feasibility Study for Tin-Wis Development Board and Department of Indian Affairs, Tofino, B.C.

**WILLIAM H. HAYES, B.Sc., P.Eng.**

**Recreational Complex Study, Tofino, B.C.**

Engineering components of Fisherman's Village Tourism - Recreation Complex Feasibility Study, West Close Holdings, Tofino, B.C.

**Construction Engineering**

**Field Engineer, Building Construction, Toronto, Ontario**

Field engineering for the construction management contractor on the 57-storey Commerce Court Head Office Building for the Canadian Imperial Bank of Commerce, Toronto, Ontario.

**Construction Superintendent, Road & Bridge Construction, Northern Ireland**

In charge of construction of 4 km of divided highway, and railway overpass, Belfast, Northern Ireland.

**Field Engineer, Highway Construction, Northern Ireland**

Section Engineer engaged on the layout of earthworks, retaining walls, storm drainage, catchbasins, curbs and asphalt works for M2 Motorway Belfast, Northern Ireland. Calculation and agreement with client of all earthwork and drainage quantities.

**HECTOR J. HEBERT, P. Eng.**

Hector Hebert is an Engineer with a wide range of experience developed over 26 years of active and direct involvement in Consulting Engineering and Construction. Five of these years were spent on International Projects as Construction and Engineering Manager. Recent experience relates to project development, preparation and negotiation of proposals, senior marketing in the construction industry and responsibility for all construction in a specific region of Canada. He has designed and implemented procedures for construction management in the Pulp & Paper and Mining disciplines, along with systems checkout and run-in procedures. He is completely fluent, both written and spoken, in English, French and Spanish.

**EDUCATION**

Diploma in Business Administration, University of Sherbrooke, Quebec, 1966

D.I.C. in Concrete and Steel Structures, Imperial College of London, England, 1963 (Athlone Fellowship)

B.A.Sc. in Civil Engineering, University of Sherbrooke, Quebec, 1961

B.Sc. in Pure Science, Bishop's University, Lennoxville, Quebec, 1955

**MEMBERSHIPS**

Association of Professional Engineers, British Columbia

Ordre des Ingenieurs, Quebec

Project Management Institute, B.C. Chapter

**CAREER HISTORY**

For the past fifteen years, Mr. Hebert has been a senior engineer and manager for Commonwealth Construction Company of Burnaby, B.C. Initially, as construction engineer, he was assigned to various projects such as the Arthur Laing Bridge in Vancouver, Real de Angeles Silver Mine in Mexico, Maranducque Copper Mine in the Phillipine Islands, and several pulp and paper, and mining projects. In each of the projects, he performed estimating duties, contract and sub-contract control, construction engineering design and acted as assistant project manager in some cases. He was assigned senior construction management responsibility in the following projects:

**HECTOR J. HEBERT, P. Eng.****Key Lake Mining Corporation, Saskatchewan (1981-84)**

Provided coordination for design, procurement, construction management of a \$300 million plant to produce 12 million pounds of uranium oxide per year. Direct responsibilities as **Deputy Director, Administration** included management of EPCM activities, procurement, expediting, cost forecasting and control, business administration, project estimating and scheduling, marshalling and warehousing, preparation of tender documents, tender evaluation and issuance of 67 construction packages, contracts management and owner-client relations. Managed a staff of 53 persons. Plant delivered on time at \$23 million below budget.

**Instituto Nacional de Obras Sanitarias, Caracas, Venezuela (1978-80)**

On a Turnkey Project, designed and constructed the Turimiquire Water Treatment Plant, a 15 cubic metre per second plant for \$52 million U.S. in 2 years, using local and foreign tradesmen in a mountainous and remote region. As **Construction manager**, his responsibilities included direction and coordination of the design of the plant by Dr. Sanchez-Mora of Caracas, Venezuela, coordination of equipment purchases valued at \$12 million U.S., estimating, scheduling, organization and management of the construction team. This function especially required close liaison with the client, INOS. Using a 330 man mixed nationality work force, the plant was completed on time and at a profit.

**Industrias Del Peru (INDUPERU), Lima, Peru (1975-78)**

For the design and construction of a bagasse newsprint mill in Santiago de Cao, organized and directed the owner's technical department and directed the owner's architectural and structural design group to guarantee timely production of drawings and specifications for the project. Managed the tendering process, contract comparison and issuance process, and as Project Engineer, performed the construction engineering function as part of the Management Group. The project was successfully completed for \$110 million U.S. and in the originally scheduled 30 months.

For the past three years as **Corporate Engineer - Special Projects**, he was Team Leader and participant in the preparation of major proposals for Commonwealth and Joint Ventures with Consulting Engineers. His main activities were:

- . **Constructibility reviews** with Design Consultants
- . **Estimating and Budget preparation**
- . Develop and adapt **suitable cost control** mechanisms
- . Organize **Construction Teams**
- . **Assign responsibilities** of construction and support personnel
- . **Coordination** of proposal preparation
- . Organisation of **Contract modes** and **Business proposals**

**HECTOR J. HEBERT, P. Eng.**

The above listed activities were performed by Mr. Hebert on the following projects and proposals:

- . Byron Creek Coal Project (Esso)
- . Red Dog Zinc Mine (Cominco) - Alaska
- . Maclaren Paper Machine Installation, Masson
- . Rio Algom Copper - Chile
- . GKN Birwelco Incinerator, Burnaby, B.C.
- . Centennial Gold Mine, Montana
- . Domtar Pulp & Paper, Windsor Mills, Que.
- . Donohue Paper, Clermont, Que.
- . Lac Minerals Gold, Hemlo, Ont.
- . Montono Gold, Montana
- . Cordeica - Peru, Electrification

From 1964 to 1972, he was Senior Partner with Hebert & Associates Consulting Engineers in Sherbrooke, Quebec. They were involved in Project Management and Structural Design in structural and foundations engineering and field inspection for diverse clients. Also prepared a technical study of the telephone system of Port-au-Prince, Haiti and a feasibility study for a filtration plant and water supply system for the city of Santiago de Los Caballeros, Dominican Republic.

From 1963 to 1964, he worked for Bertrand-Charron Consulting Engineers in Sherbrooke, Quebec as a Design and Supervision Engineer where he was involved in projects in low and highrise buildings, bridges, foundations and miscellaneous structures. He designed and coordinated construction of a fifteen storey student residence, seven highway bridges, two arenas and other miscellaneous structures.

Between 1958 and 1961, he was with Cartier-Cote-Piette, Consulting Engineers in Montreal, Quebec as a Design Engineer and Inspector where he designed and supervised structures in heavy construction including railroads, wharf work and building construction.

**JED E. DAGENAIS, B.Sc.**

Jed Dagenais has over 23 years of mining experience including exploration and development of ore deposits, mining and milling operations, engineering, feasibility studies, capital and operating estimating of potential and existing projects. Most of the experience has been in open pit and strip mining operations for iron ore, coal, copper, oil sands and perlite. Underground experience has been in gold and copper mines. Duties ranged from those associated at the direct, hourly employee level, through supervisory and administrative positions including Mine Manager and President. A period of consulting is also included.

**EDUCATION**

University of British Columbia, B.Sc. Degree (Geology-Geophysics Majors), 1965

50 hr. Certificate: American Management Association (AMA)

2 yr. course: Canadian Business, Law, Finance - ICS Diploma

Canadian Securities Course: Investment Dealers Association of Canada, Diploma

**MEMBERSHIPS**

Fellow, Geological Association of Canada

Member, American Institute of Mining Engineers

Member, Canadian Institute of Mining and Metallurgy (National)

Member, Canadian Institute of Mining and Metallurgy (Vancouver Branch)

Past Chairman, Calgary and Knob Lake Branches of Canadian Institute of Mining and Metallurgy

Past Vice President, District 5 - CIM

Past Advisor, University of Alberta, Department of Mineral Engineering Advisory Board

**PROFESSIONAL AWARD**

CIM District Distinguished Service Award

**CAREER HISTORY**

Jed Dagenais is Vice President, Mines with the firm. Prior to joining Phillips Barratt Kaiser, Mr. Dagenais was President of Aurun Mines Ltd., Calgary, Alberta.



**JED E. DAGENAIS, B.Sc.**

From 1979 to 1982 he was Manager of Mining with Alsands Energy Company, Calgary, Alberta where he was directly responsible for the planning of the mining operations part of the Alsands Project, from exploration and development to delivering of oil sands to the extraction plant wall.

During the period 1975 - 1979 Mr. Dagenais was Manager of Mines at Transalta Utilities Ltd., and from 1974 - 1975 he was employed by Fluor Canada, Calgary, Alberta as Mining Manager (Principal Project Engineer). Consulting engineering duties involved the direction and coordination of mining aspects of all studies related to mining on behalf of clients in developing mining fields (Oil Sands, coal feasibility studies, gold mines).

Mr. Dagenais was with Iron Ore Company of Canada, Seven Islands, Quebec from 1970 - 1974 where he was responsible for capital and operating feasibility studies and cost estimates on a corporate basis for projects exceeding \$50,000. The scope of work ranged from mining to concentrator and pellet plant projects.

Jed Dagenais held various positions with Iron Ore Company of Canada, Schefferville, Quebec. As Chief Geologist from 1968 - 1970 he was responsible for the exploration and development of iron ore at the Schefferville Project. From 1967 - 1968 he was Supervising Engineer (Exploration) responsible for exploration of iron ore deposits in the Schefferville area. From May 1967 to September 1967 he held the position of Ore Grading Engineer responsible for ore grading for five iron ore open pit mines. He joined the company as a Geologist in 1965. At varying periods until 1967 field responsibility included geological mapping, drilling, trenching, test pitting, and office evaluations (plans and cross sections of this geological data).

Mr. Dagenais held various summer jobs from 1955 through 1965, some for up to ten months. They included Assistant Geologist (exploration for copper in Southern British Columbia, oil exploration in Alaska, base metal exploration in Northern British Columbia), stope mining, (cut and fill stopes at a B.C. copper mine), tram operator (underground gold mine in Yellowknife, N.W.T.), Assistant Processing Engineer (Gold mill at Yellowknife, N.W.T.), mill attendant (ball mill, flotation circuit, tailings and hydraulic back fill circuits). Included in the above diverse types of work was an extensive practical knowledge of production blasting and drilling procedures for open pit and underground operations.

**JED E. DAGENAIS, B.Sc.**

## **PROJECT EXPERIENCE**

### **Minerals**

#### **Aurun Mines Ltd., Calgary, Alberta**

##### **President**

Started up a junior mining company, initially with private status, converted to public status in 1983 and listed on a Canadian stock exchange. Opened up Canada's first perlite mine, built a test plant and developed markets for the product. Expanded to a full size commercial plant, acquired the only adhesive extender plant on Canada's west coast, relocated it and brought it back to production in late 1985. Acquired precious metal properties from Nevada to the N.W.T. for future development.

#### **Alsands Energy Company, Calgary, Alberta**

##### **Manager of Mining**

Duties included the design of the mine plan (400,000 tonnes of ore and waste per day) equipment selection using the largest existing draglines (110 cubic yard capacity) and bucket wheel excavators and reclaimers, tailings pond design, ore reserve and grade evaluation and mining infrastructure.

#### **Transalta Utilities Ltd., Calgary, Alberta**

##### **Manager of Mines**

Directly responsible for operations of existing company's mines (Whitewood and Highvale Mines). Annual coal production was 8 million tons, expanding to 12 million by 1983. Overburden removal was done by large draglines (12 - 60 cubic yard bucket capacity). Coal loading and hauling was done by 15 yard electric shovels and front end loaders and 60 to 100 ton bottom dump trucks.

Indirectly responsible for future mining developments, acting in an advisory capacity to the company's planning group. Duties included coordination of the operation and maintenance functions of mines through the mine operators, insuring through the on-site mining personnel that the mines were being developed in a professional manner. Surveillance of the mining operations was done to ensure mining was carried out in a manner consistent with environmental legislation, safety procedures, and with the intent of maximizing coal recovery, all within costs.

#### **Fluor Canada, Calgary, Alberta**

##### **Mining Manager (Principal Project Engineer)**

- The scope of this position was all inclusive, from ore reserve and grade determination to pit engineering, equipment selection, drilling and blasting procedures, operating and maintenance procedures, operating and capital cost estimating and financial evaluations.
- Developed and directed geological and geotechnical field programs for Oil Sands operators and developers and coal operators.

**JED E. DAGENAIS, B.Sc.**

**Iron Ore Company of Canada, Seven Islands, Quebec  
Supervisor of Corporate Cost Estimating**

Scope of work ranged from mining to concentrator and pellet plant projects. Located in head office, the coordination of these studies was made in and between three project locations separated by 220 miles and 360 miles from head office. Some studies were made for other companies in the area and in these cases were all inclusive from geological and pit engineering, equipment selection for mines, plants and terminal shipping facilities. Most of these studies were related to iron ore mines. The iron ore was grouped into three categories namely, direct shipping, specular hematite, amenable to beneficiation, and magnetic taconite. Other mining studies were related to limestone, magnetic beach sands, ilmenite deposits, nepheline syenite, and coal.

**Iron Ore Company of Canada, Schefferville, Quebec  
Chief Geologist**

Duties included drilling evaluations, geological field mapping (plane tabling and aerial photos) surveying, sample analysis, trenching and test pitting, extensive field operations (tents and/or mobile bunkhouses) geophysical and hydrological studies, environmental studies and all the related auxiliary and supporting operations.

**Ore Grading Engineer**

Duties included daily, weekly, monthly, yearly and long term ore grading. In the short term, responsibility was for quality of all ore mined in Schefferville. Ore categories included 13 ore types. In the long term, responsibility was for ore grading schedules for 42 iron ore deposits owned by the company, so as to ensure the orderly development of them.

**PAPERS PUBLISHED:**

Co-author "Ore Reserve and Grade Estimation" - Iron Ore Co. of Canada - presented orally at Ore Reserve and Grade Estimate Symposium held at L'Estereil, Quebec (Sept. 1967) - included in a special volume published by Canadian Institute of Mining and Metallurgy (classed as reference book).

**UNPUBLISHED PAPERS:**

"Alsands Mine Plan" - oral presentation at CIM Annual General Meeting, Calgary, 1983.

"Starting Up A Mining Company in the Early Eighties" - oral presentation at CIM District 5 Meeting - Hinton, 1985.

**PHILLIPS BARRATT KAISER ENGINEERING LTD.****VANCOUVER, B. C.****SCHEDULE OF SERVICES, RATES  
AND CONDITIONS OF AGREEMENT****August, 1987****1. General Services**

Phillips Barratt Kaiser Engineering Ltd., hereinafter called "PBK" provides professional engineering services. Based on a mutually agreed scope of assignment, PBK undertakes to render its services to the Client with that degree of care, skill and diligence normally provided in the performance of services in respect of projects of a similar nature at the time that such services are rendered.

**2. Professional Fees**

Charges to the Client for consulting engineering services shall be on a **Time Rate** basis, on a **Percentage of Cost of Construction** basis or a **Fixed Fee**, as specified in the proposal and as described hereunder.

**a) Time Rate Basis**

Charges to the Client are based on the actual number of hours worked on the project by professional, technical and clerical staff as taken from time sheets.

The fees for time worked are computed on the basis of salary costs for each staff member plus a percentage of the salary costs to cover employee benefits, overheads and profit. The percentage to be added to the salary costs is stipulated in the proposal.

The salary cost for each staff member is determined by dividing his annual salary by 1950.

**b) Percentage of Cost of Construction Basis**

Where fees are based on a percentage of construction costs, the cost of construction is the total cost to the Client of all material and labour (including taxes and the contractor's overhead and profit) necessary to complete the work for which the consultant is responsible.

Whenever the Client furnishes material or equipment, labour or other services that are incorporated in the work, the fair market value of the material or equipment as though they were purchased new, and current prices of labour or other services when the work was executed, shall be included in the total cost of construction.

The cost of construction shall not include professional fees and reimbursements due to the consultant.

The percentage fee to be applied to the cost of the work shall be as stipulated in the proposal.

c) **Fixed Fee**

PBK may agree upon a fixed fee for the services involved where the scope and schedule of the work are sufficiently defined to allow PBK to calculate expected costs with reasonable accuracy.

**3. Disbursements**

The following disbursements are chargeable at cost: reproduction of drawings and documents, travelling and subsistence away from office, long distance telecommunications, specialist consultants approved by the Client, tender advertisements, permits, licenses, customs and shipping charges, computer services, word processing, highly specialized equipment and other special out-of-pocket expenses required for the proper execution of the Work.

When approved by the Client, overtime will be worked and will be chargeable at the above Time Rates, plus the cost of the extra overtime salary paid to the employee.

**4. Construction Insurance And Performance Bonds**

It is expressly understood and agreed that the Client will obtain the necessary insurance counselling services and make decisions on all insurance and performance bond requirements for construction contracts.

**5. Field Services**

When field services are included in the scope of work, it shall mean applying such selective sampling at the project site as PBK, in its sole professional discretion, considers necessary to ascertain that the work of the contractors is in general conformity with the construction contract documents.

When field services as described above are not included in the scope of work, PBK may attend at the site at the Client's request, but in that case PBK will not be liable to the Client for its subsequent inability to observe defects or deviations in the contractor's work from the contract documents.

**6. Cost And Time Estimates**

Cost and time estimates prepared for the Client are based on PBK's past and current experience, and represent its best judgements as engineers familiar with the construction industry. It is understood and agreed by the Client that such estimates are subject to change and are contingent upon factors over which PBK has no control such as labour efficiency, market conditions, contractors' methods of determining prices, changing costs of labour, materials and equipment, etc.

**7. Building Codes And By-Laws**

PBK, to the best of its ability, interprets building codes and by-laws as they apply to a project. It is expressly acknowledged and agreed by the Client that these codes and by-laws are subject to differing interpretations by public regulatory bodies, and that the cost of changes to the work to conform to such differing interpretations will be paid by the Client.

**8. Termination Of Services**

The Client may terminate PBK's services by giving 15 days prior written notice. Any termination or wind-down expenses reasonably and necessarily incurred by PBK which result from such termination by the Client shall be payable to PBK in the event of a termination of services for reasons beyond the control of PBK.

**9. Invoices**

Invoices for services performed will be submitted to the Client monthly and shall be payable within 30 days thereafter. Invoices which are unpaid after 30 days shall bear interest at an annual rate of 1% over the prime rate charged by the Bank of Montreal at the time that any arrears occur.

**10. Limit Of Liability**

PBK carries Public Liability Insurance for bodily injury and property damage in the amount of \$5,000,000.00, and Professional Liability Insurance in the amount of \$5,000,000.00. The Client agrees that any claim which he has or may have against PBK, its servants, employees and representatives in respect of its services shall be absolutely limited to the amount of the foregoing insurance coverages, and shall only be in respect of loss or damage which is directly attributable to negligent acts by PBK or omissions to provide the standards of care, skill and diligence normally provided in the performance of such services. In no event shall PBK be liable for loss or damage occasioned by delays to the project or for loss of earnings or other consequential damages incurred by the Client, howsoever caused.

In the event that the Client wishes additional insurance coverages to those set forth above, PBK will co-operate with the Client to obtain such insurance at the Client's expense provided such additional insurance is available.

**11. Additional Services**

The following additional services may be provided at the request of the Client and for which PBK shall receive additional payments on the time rate basis as set out above or as negotiated separately. PBK shall perform such additional services on the receipt of the Client's written authorization to that effect.

- a) Making revisions to the drawings and specifications when such revisions are requested by the Client after approvals or instructions have previously been given by the Client.
- b) Preparing drawings and specifications in connection with Change Orders to construction contracts when the adjustment to the fee resulting from the adjustment to the Cost of Construction resulting from the Change Order does not fairly compensate PBK for their services in making the changes, or when the Change Order results in a reduction of the Cost of Construction, provided such changes are required for reasons not within the control of PBK.
- c) Services related to future facilities which are not intended to be constructed during the time of these services.
- d) Preparation of designs for alternative building systems.
- e) Services made necessary by the default of contractors or by major defects or deficiencies in the work of contractors.

## 12. Certification

PBK's certifications of the Contractor's substantial or total performance of the work as well as the Contractor's applications for payment are subject to the standard of field services provided, and unqualified certificates will only be issued when the level of field services are left to PBK's professional discretion.

### FEASIBILITY ESTIMATES CHARACTERISTICS

ITEM	TYPE I	TYPE II	TYPE III	TYPE IV
<b>Site</b>				
Plant capacity	Assumed	Preliminary	Optimized	Finalized
Geographical Location	Assumed	General	Approximate	Specific
Maps and Surveys	None	If available	Available	Detailed
Soil and foundation tests	None	None	Preliminary	Final
Site visits by project team	Possibly	Recommended	Essential	Essential
<b>Process</b>				
Process flowsheets	Assumed	Preliminary	Optimized	Finalized
Bench-scale tests	If available	Recommended	Essential	Essential
Pilot plant tests	Not needed	Recommended	Recommended	Essential
Energy and material balances	Not essential	Preliminary	Optimized	Finalized
<b>Facilities Design</b>				
Nature of facilities	Conceptual	Possible	Probable	Actual
Equipment selection	Hypothetical	Preliminary	Optimized	Finalized
General arrangements, mechanical	None	Minimum	Preliminary	Complete
General arrangements, structural	None	Outline	Outline	Preliminary
General arrangements, other	None	Minimum	Outline	Preliminary
Piping drawings	None	None	One-line	Some detail
Electrical drawings	None	None	One-line	Some detail
Specifications	None	Performance	General	Detailed
<b>Basis for Capital Cost Estimating</b>				
Estimates prepared by	Project Engineer	Senior Estimators	Senior Estimators	Estimate Department
Vendor quotations	Previous	Single source	Multiple	Competitive
Civil work	Rough sketch	Drawing estimate	Drawing estimate	Take-offs
Mechanical work	% of machinery	% of machinery	Man-hours/ton	Man-hours/ton <sup>1</sup>
Structural work	Rough sketch	Prelim. drawings	Take-off/ton	Take-off/ton <sup>1</sup>
Piping and instrumentation	% of machinery	% of machinery	Take-off	Take-off <sup>1</sup>
Electrical work	\$ per hp	\$ per hp	Take-off	Take-off <sup>1</sup>
Indirect costs	% of total	% of total	Calculated	Calculated
Contingency <sup>2</sup>	20-25% <sup>2</sup>	15-20% <sup>2</sup>	15% <sup>2</sup>	10% <sup>2</sup>
<b>Operating Cost Determination</b>				
Labour rates	Assumed	Investigate	Get contracts	Get contracts <sup>3</sup>
Labour burden	Assumed	Calculated	Calculated	Calculated <sup>3</sup>
Power costs	Assumed	Actual	Actual	Contract <sup>3</sup>
Fuel costs	Assumed	Verbal quote	Letter quote	Contract <sup>3</sup>
Expendable supplies	Assumed	Verbal quote	Letter quote	Contract <sup>3</sup>
Reagents	Assumed	Verbal quote	Letter quote	Contract <sup>3</sup>
Parts	Assumed	Verbal quote	Letter quote	Letter quote
<b>Economic Analysis D.C.F.</b>	Not meaningful	If requested	If requested	If requested
<b>Use of Estimates</b>	Comparison rejection Feasibility		Budget	Funding

**Notes:** 1 Often subject to subcontract bids

2 In this definition the percentage assigned to contingencies is a judgment factor and is not to be interpreted as meaning that estimates are necessarily accurate within this percentage range, nor is there an implied reference to any order of accuracy.

3 Contracts can be solicited if project is near-term.