SAM GOOSLY PROJECT

INFORMATION SUMMARY

EQUITY MINING CAPITAL LIMITED

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PROPERTY FILE

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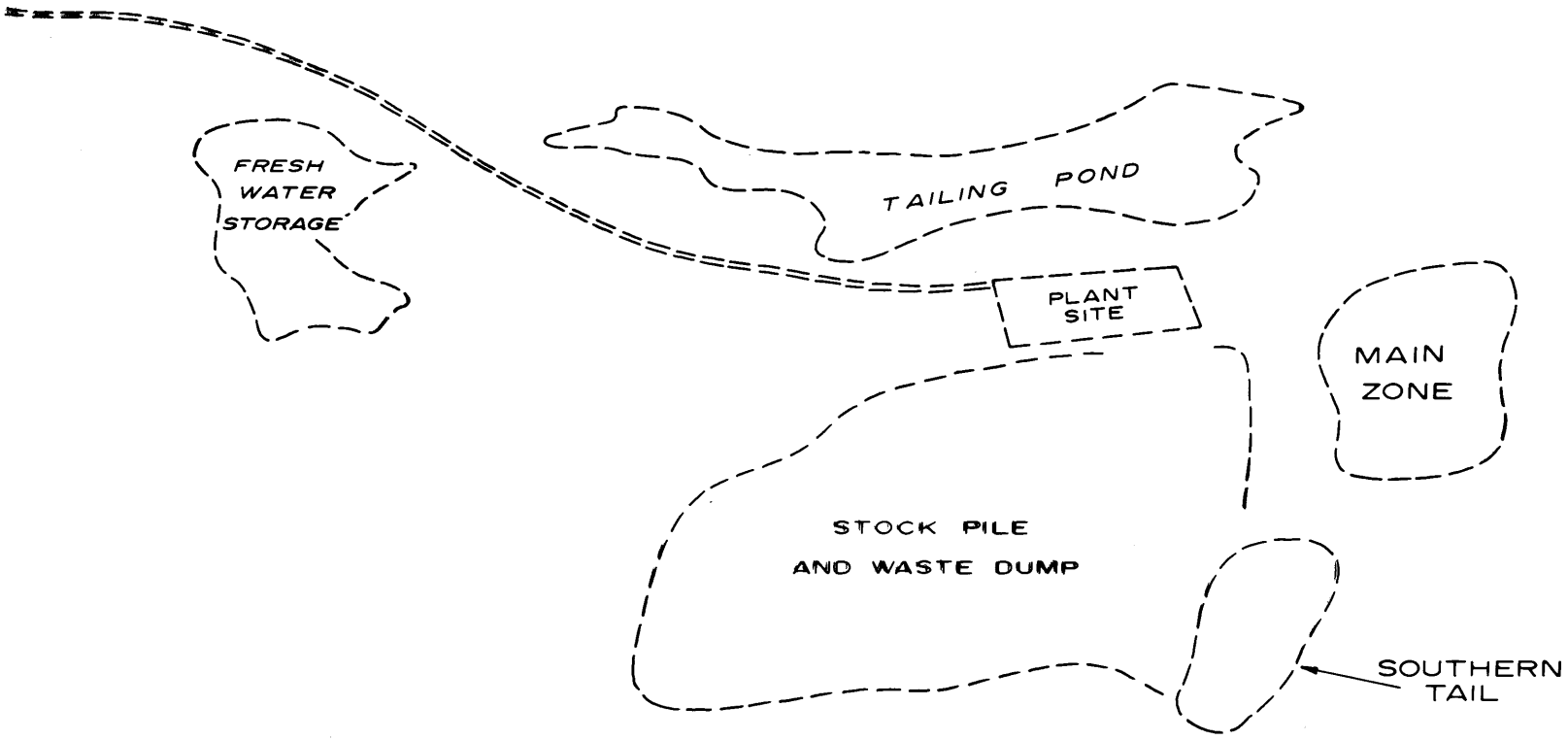
OCTOBER 1975



GOOSLY PROPERTY

LOOKING SOUTH TO NORTH

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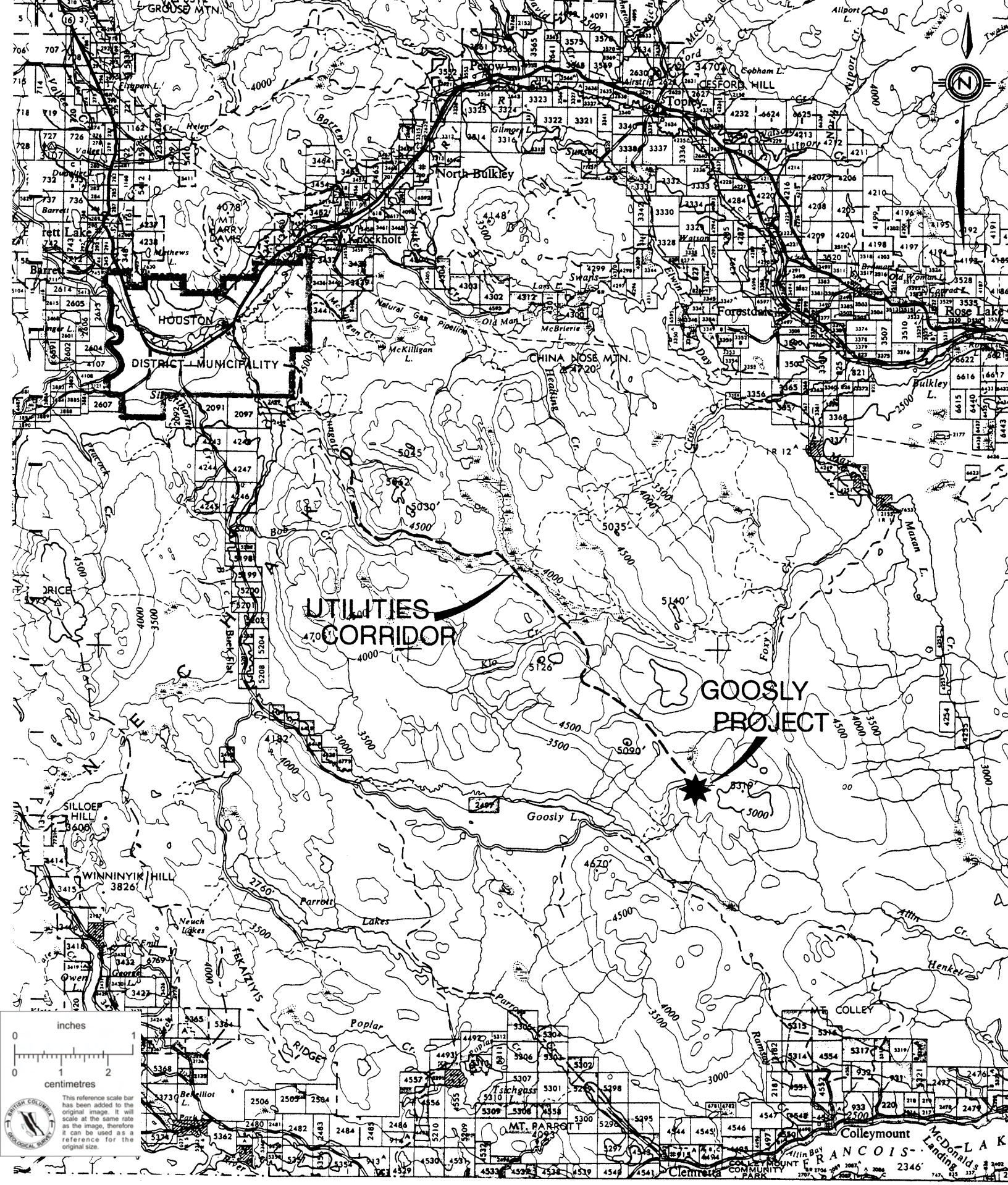
INTRODUCTION

This report has been prepared as a means of informing government authorities regarding the current status of a potential mining operation on the Sam Goosly property in the Houston area of British Columbia.

The project is currently at an advanced stage of development: following definition drilling, underground bulk sampling, pilot plant scale concentrate production and pilot plant operation of the antimony leaching and recovery circuit, but preceding the development of a final flow sheet and preliminary plant designs. In this regard the data provided must be regarded as preliminary and is subject to refinement as feasibility data is finalized.

The objective of this report is to formalize the continuing dialogue between the company and concerned government departments with a view toward identifying and resolving at an early stage any potential conflicts of land use, land management and environmental impact.



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Scale of Kilometres

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GENERAL DESCRIPTION OF PROJECT

The Sam Goosly mineral deposits are located in north-central British Columbia, approximately 20 miles south-east of Houston. Current access to the mine is via a 34-mile logging road.

The property was discovered by Kennco Explorations (Western) Limited in 1968 and was extensively explored by them during the period 1968 to 1971. In 1973 the property was optioned by the present operators, and has subsequently been developed to the point where a substantial portion of the feasibility data has been assembled.

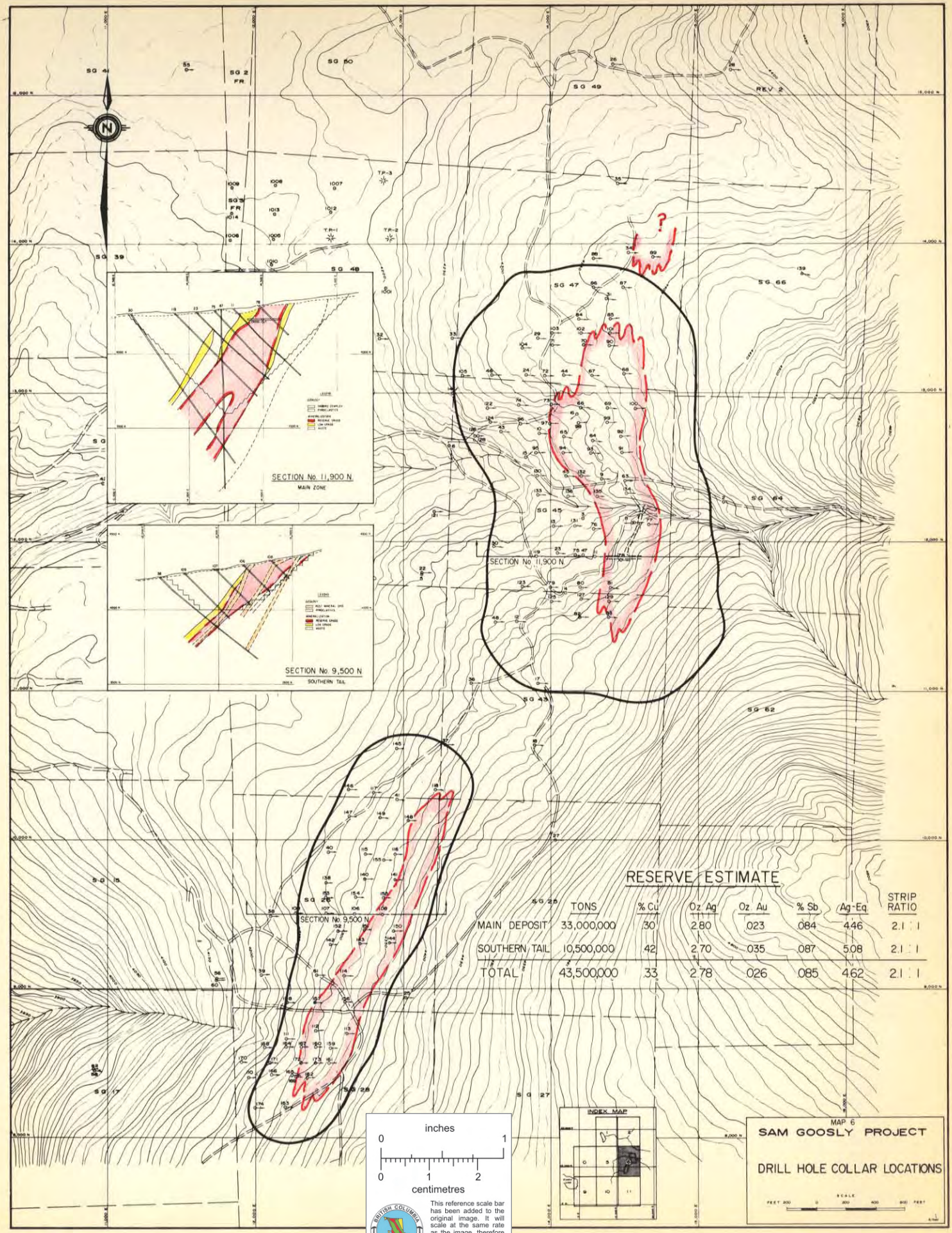
The principal metals of economic importance are silver and copper, with lesser amounts of gold and antimony. Tetrahedrite and chalcopyrite are the main ore-bearing minerals.

The reserves, as presently outlined on the Sam Goosly property, and defined by 2.0 oz. silver equivalent cut-off, are estimated at:

	Tons	% Cu	Oz Ag	Oz Au	% Sb	Stripping Ratio
Main Zone	32,997,000	.30	2.80	.023	.084	2.1:1
Southern Tail	10,514,000	.42	2.70	.035	.087	2.3:1
Total Reserve	43,511,000	.33	2.78	.026	.085	2.1:1

The reserves are contained within two separate pits and are mineable by open pit methods at an overall stripping ratio of 2.1:1. Both deposits are amenable to concentration in the same plant; however, Main Zone ore requires much finer grinding and thus has reduced throughput and increased milling costs.

Ore reserves have been estimated from 93,666 feet of diamond drilling and 581 feet of underground bulk sampling. Diamond drilling has



RESERVE ESTIMATE

	TONS	% Cu	Oz Ag	Oz Au	% Sb	Ag-Eq	STRIP RATIO
MAIN DEPOSIT	33,000,000	30	2.80	023	084	446	2.1 : 1
SOUTHERN TAIL	10,500,000	42	2.70	035	087	5.08	2.1 : 1
TOTAL	43,500,000	33	2.78	026	085	462	2.1 : 1

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MAP 6

SAM GOOSLY PROJECT

DRILL HOLE COLLAR LOCATIONS

been carried out on sections spaced at 200 ft. intervals with 100 ft. spacing in areas where uniformity was lacking. Approximately 45% of the above-mentioned drilling was carried out by Kennco, providing independent sampling and assaying data.

All of the reserves are MINEABLE RESERVES; that is, they are located within the limits of trial pits which adhere to normal open pit mining constraints. The cutoff grade used was 2 oz. silver equivalent.

Although the two deposits are quite similar in most respects, some significant differences exist. The pattern of metal distribution in the Southern Tail is erratic, with dramatic grade variations over relatively short distances, while in the Main deposit the mineralization is much more pervasive with fairly consistent grade trends. The population of finely disseminated mineralization which is present in most of the Main Zone ore is entirely lacking in the Southern Tail deposit. In the latter deposit the mineralization is contained in fracture fillings or as massive stringers or blebs and consequently is much easier to liberate.

Both deposits are approximately 2,000 feet in strike length and dip about 45° to the west. The mineralization in the Southern Tail averages approximately 100 feet in thickness, while the Main deposit ranges from 200 to 400 feet.

The potential for adding tonnage to the presently known deposits or of locating other zones of mineralization must be considered good. This is true both along strike within the Hazelton host rocks and in

the down dip direction. The underground potential is, as yet, unexplored.

OPERATING PLAN

The proposed mining and concentrating plans are generally comparable to existing operations, with the exception of the unusually fine grind required to liberate Main Zone minerals. In order to meet smelter specifications and to produce a saleable antimony byproduct, the development of new concentrate leaching and roasting processes was necessary. The leaching process is similar to that which has been employed by other tetrahedrite producers over several decades. The recovery of antimony and arsenic from the leach solutions will be accomplished using a proprietary process developed for the Goosly project.

The proposed operating plan is to commence production from the Southern Tail deposit at a rate of 3,000 tons of ore per day. A subsequent expansion is planned which would increase production to 4,500 tons per day commencing in operating year 6. Production from the Main Zone deposit would commence during operating year 9 and would continue beyond year 20. Subsequent production would come from low grade stockpiles or new reserves.

The technical side of the project is in its final stages. Wright Engineers have been commissioned to complete the feasibility study and discussions are underway with smelters and a customer for the antimony byproduct. Assuming that unforeseen delays are not experienced, the sequence of events as currently envisioned would be as follows:

1976-1977 Construction

1978-1982 Production from Southern Tail @ 3,000 T.P.D.

1983-1985 Expansion to 4,500 T.P.D. Southern Tail ore

1986-2002 Main Zone production @ 4,500 T.P.D.

2003 onward Production from low grade stockpiles, underground ore or new open pit reserves

A second plant expansion is necessary during operating year 8 (1985 above) in order to maintain the 4,500 ton per day throughput while processing Main Zone ore. This would involve major expansion to the grinding and flotation sections of the concentrator.

Expansions are necessary in order to stabilize concentrate production. This results in maximum utilization of the leach plant and minimizes fluctuations in metal production.

The primary reasons for commencing production from the Southern Tail deposit are to take advantage of its relatively simple metallurgy, the excellent metal recoveries and the lower concentrate production costs. The initial production rate is limited in part by the physical characteristics of the Southern Tail deposit.

Mining during the foreseeable future will be by open pit methods although ultimately substantial production may come from underground. Thirty-three foot bench heights are planned with overall pit slope not exceeding 1 to 1.

Concentrate production will be by conventional methods. Crushing,

screening and grinding will be followed by flotation, filtration and drying. The reagents required are, in lbs/ton ore milled:

	Main Zone	Southern Tail
Dow Chemical Z-200	0.0260	0.010
Dowfroth 250	0.0120	0.050
Aeropromoter 3477	0.0475	0.030
Pine oil	0.0640	-
Sodium silicate	1.5000	-
Burnt lime	7.5500	2.000
Sulphur dioxide	3.0000	-
Return water recycled	75%	75%

The silver/copper concentrates produced from Sam Goosly ore contain a number of impurities at levels much higher than are commonly found in typical B.C. copper concentrates. In order for the concentrates to be acceptable in tonnage quantities at copper smelters, it will be necessary to subject them to an extraction process to reduce the levels of arsenic, antimony and mercury.

The first step in the extraction process is a neutral roast in an atmosphere consisting of nitrogen, carbon dioxide and some elemental sulphur. The neutral roast was selected to avoid generating sulphur dioxide and the oxides of antimony and arsenic. The purpose of the neutral roast is to convert arsenopyrite, which is refractory to the leach chemicals, into a material that is more readily leachable. The roaster off-gases will be scrubbed with dilute leach liquor to recover any volatilized arsenic,

antimony and mercury compounds. The scrubber exhaust gases are discharged to the atmosphere. The liquid effluent from the roaster scrubber will be sent to the leach plant along with the roaster calcine.

The leach plant follows essentially the flow sheet used by the Sunshine Mining Company in Kellogg, Idaho. The leaching is done in mild steel vessels at elevated temperatures using sodium sulphide, which converts the arsenic, antimony and mercury into soluble thio-salts. The leach residue is separated by filtration and will be sent to a copper smelter for the recovery of copper and the precious metals. The pregnant leach liquor is processed to recover the dissolved arsenic, antimony and mercury.

At Sunshine, antimony is recovered from the pregnant leach solutions electrolytically, as metallic antimony. The product is contaminated with arsenic and a portion of the spent electrolyte must be bled from the circuit to prevent the buildup of impurities in the circuit. The bleed solutions represent a serious pollution problem for Sunshine. Goosly concentrates contain relatively higher As/Sb ratios than Sunshine, so that the electrolytic recovery method was not suitable from either a product quality or environmental standpoint.

A proprietary hydrometallurgical process has been developed for the treatment of Goosly concentrates. A number of patent applications are being made concerning the process, particularly as it relates to the separation of the dissolved impurities, first from the pregnant leach liquor, and subsequently from each other.

The antimony, arsenic and mercury are to be recovered from the hydrometallurgical plant in solid form. The antimony product is of high quality

and a potential customer is interested in purchasing the product. At present it appears unlikely a market will be found for either the arsenic or the mercury compounds, and alternative disposal methods are being considered.

Wright Engineers are presently designing the flow sheet for the antimony plant. A number of equipment manufacturers have been asked to make design recommendations and provide performance characteristics for the specialized process equipment. Concurrently Wright Engineers are working on the mass and heat balances and assessing air and water emissions. It is hoped to have some definitive results in three or four weeks' time in order that detailed discussions on the process with the appropriate government agencies can be expedited.

INFRASTRUCTURE

The support facilities required for a mining project at Sam Goosly include: water supply, a tailings disposal and water reclamation system, power supply, access road, natural gas pipeline and housing.

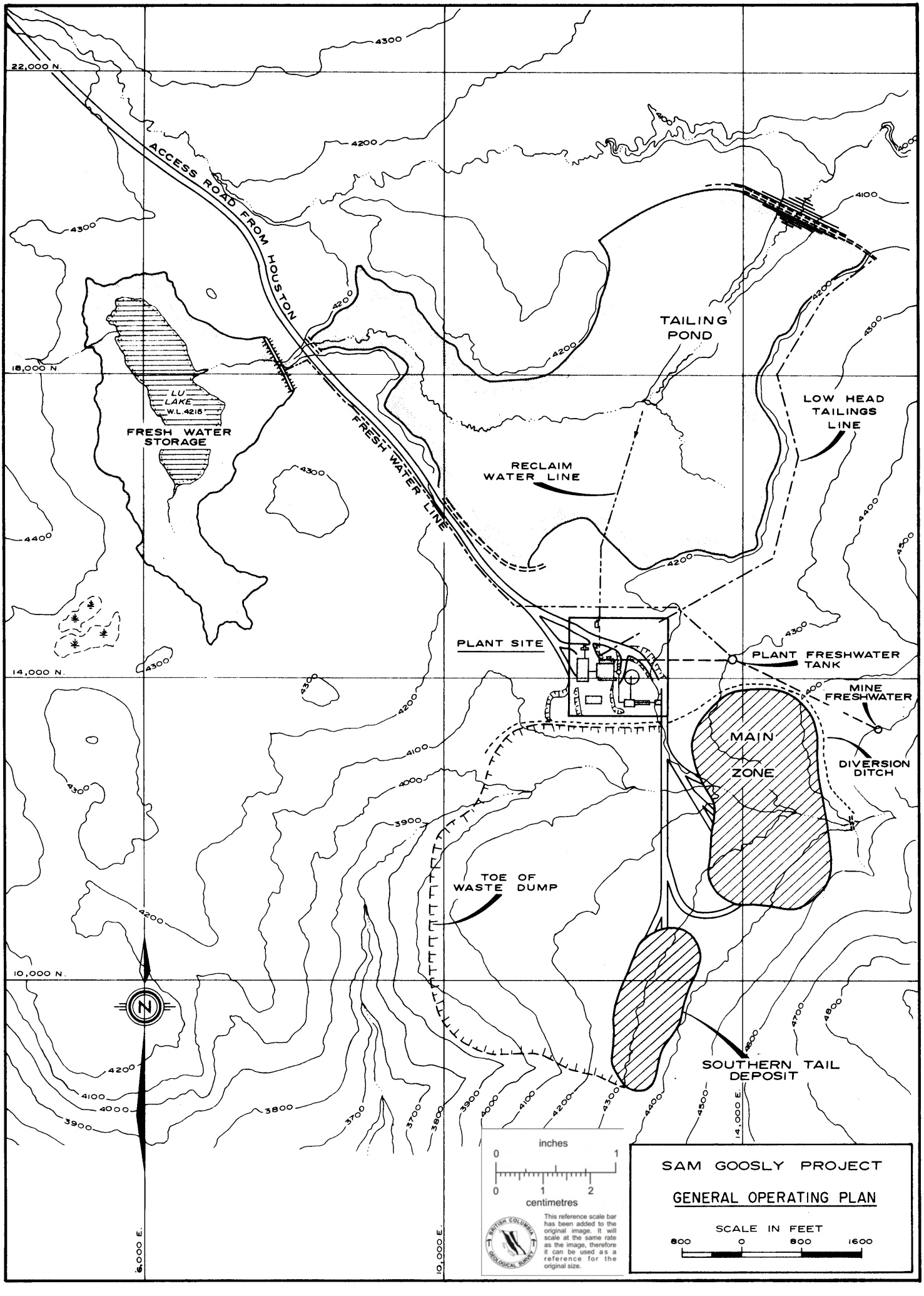
Water flow readings have been taken in Lu Creek which indicate that under normal conditions sufficient water would be available from Lu Lake to meet initial production requirements which approximate 350 gallons per minute of makeup water. Total process water will approximate 4,400 gallons per minute. A small dam would be constructed near the mouth of Lu Creek raising Lu Lake water level a maximum of 34 feet during spring runoff. Supplemental water, if required, could be provided by pumping water over the divide from Foxy Creek during periods of high water flow.

Lu Lake is part of the Foxy Creek-Maxan Lake drainage system; thus depletion of the Goosly Lake - Buck Creek system is avoided.

Tailings disposal would be within a broad open valley immediately north of the plantsite. A dam which would reach an ultimate height of 80 feet would be constructed at the lower end of the basin. This location will accommodate 33 million tons of tailings (23 years' production as currently planned). Other suitable locations are available for tailings storage both on and off the property.

Test data demonstrates that the tailings dam will form a closed circuit, with all available reclaim water being recycled to the concentrator.

Current road access is via a 34-mile logging road which follows the Buck Creek valley south from Houston. The road is a low class dirt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ACCESS ROAD FROM HOUSTON
FRESH WATER LINE
LU LAKE W.L. 4215
FRESH WATER STORAGE
TAILING POND
LOW HEAD TAILINGS LINE
RECLAIM WATER LINE
PLANT SITE
PLANT FRESHWATER TANK
MINE FRESHWATER
DIVERSION DITCH
MAIN ZONE
TOE OF WASTE DUMP
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GENERAL OPERATING PLAN
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standard, with a bare minimum of gravelling. Up to mile 18.5 it is a marginal two-lane road which includes two single lane bridges. Beyond mile 18.5 it is generally single lane, although vehicles can pass with care.

In order to provide a road acceptable for commuting between Houston and the property, the company favours a new route via the Dungate Creek valley. This would be a 23-mile road which would form a utilities corridor providing access, power and gas to the property. Detailed road and power line surveys were carried out over this route during the summer of 1974.

A report entitled "Alternate Access Routes - Sam Goosly Project" dated August 29, 1975 discusses some of the merits regarding the Buck Creek vs. Dungate Creek alternatives. A copy of this report is appended.

Initial power requirements have been estimated at 4,000 KVA. Subsequent expansions would increase the power consumption threefold. Power would be provided by the B.C. Hydro and Power Authority with a transmission line commencing at their Houston substation and following the proposed Dungate Creek access road to the minesite.

The mine would employ approximately 186 people during the initial operating years with modest increases following each expansion. All operating personnel would be encouraged to live in the town of Houston, an established town of 2,232 people (1971 census). At the present time Houston has an excess of housing units due to over-expansion in anticipation of a local production increase of forest products which did not fully materialize. Most of the required services such as schooling,

recreation, shopping etc. are currently underutilized.

ENVIRONMENTAL IMPACT

The Sam Goosly property is located within an area of dissected plateau with broad open valleys. The deposits are situated in an area of gentle relief at an elevation of 4,300 feet.

The climate can be described as northern temperate with an annual precipitation of 20 inches and temperature extremes of -50 to +49°F. Soils of the area are essentially dense glacial till with occasional rock outcropping present. Vegetation is second growth coniferous forest with white spruce and lodgepole pine being the major species present, with black spruce in the wetter areas. Wildlife indigenous to the area include moose, mule deer, black bear, and ruffed and spruce grouse. The common furbears in the area are beaver, lynx and fox.

The Goosly property straddles the high point between two watersheds and encompasses a variety of small streams. Several of these flow north into the Foxy Creek basin and others flow south toward Goosly Lake. With the exception of spring runoff, stream flows are low or intermittent and appear not to support fish populations in the immediate area of the mine. An environmental survey was conducted by Beak Consultants Limited to determine biological and chemical parameters at eight stream locations in the general area in the summer and fall of 1973. The results of this survey are contained in a report entitled "An Environmental Baseline Survey - 1973, Sam Goosly Project, for Equity Mining Capital Limited." A copy of their report is appended.

In 1973, Environment Canada initiated a pre-operational survey of the watersheds adjacent to the mine by the Habitat Protection Unit of Fisheries Operations and the Environmental Protection Service. Their report is entitled "A Biological Survey of the Watershed Adjacent to a Proposed Mine Site near Houston, B.C." by R. Hallam and R. Kussat, dated February 1974.

During 1974, Environment Canada undertook an additional study of the watershed adjacent to the proposed mine development. This work was done to supplement water quality baselines established in 1973. They also reported on chemical analysis and 96 hour LC_{50} bioassays which were performed on samples of the tailings. This second report is entitled "Environmental Impact Information of the Proposed Equity Mining Capital Limited Development near Houston, British Columbia," by R.L. Hallam, R.H. Kussat and M. Jones, dated June 1975.

During the period when Environment Canada was carrying out the above-mentioned surveys, Goosly Lake was proposed as the most likely source of process water. Subsequent to their survey, and in part because of it, a new water source has been selected. Reduced makeup water requirements, successful recycling of process water during pilot plant operation and the collection of water flow data over the past two years have demonstrated that the water supply can be obtained from the Foxy Creek rather than the Buck Creek drainage system. Goosly Lake provides a minimal flow into Buck Creek during winter months and concern had been expressed regarding any depletion of this flow.

Land use of the area has been primarily mining exploration in

the recent past. In addition, recreational use by both resident and non-resident hunters has occurred. Extensive logging is evident in the adjoining region, primarily in the lower Buck Creek valley levels, but active logging near the area of proposed development has not occurred. Agricultural activities are non existent in the immediate area as the soils and topography do not lend the area to such utilization.

The extent of the area to be occupied during the probable duration of the operation is estimated to be:

Facility	Acres
Pits and Bench Access Roads	150
Waste Dump and Low Grade Ore Stockpile	278
Plant Site	46
Tailings and Process Water Supply	939
Fresh Water	4
Access Road and Power Line	360
Total	1,777

The extent of the area to be occupied during the first three years of production is estimated to be:

Facility	Acres
Pits and Bench Access Roads	85
Waste Dump and Low Grade Ore Stockpile	109
Plant Site and Construction Camp	46
Tailings	145
Initial Process Water Supply	66
Fresh Water	4
Access Road and Power Line	360
Total	815

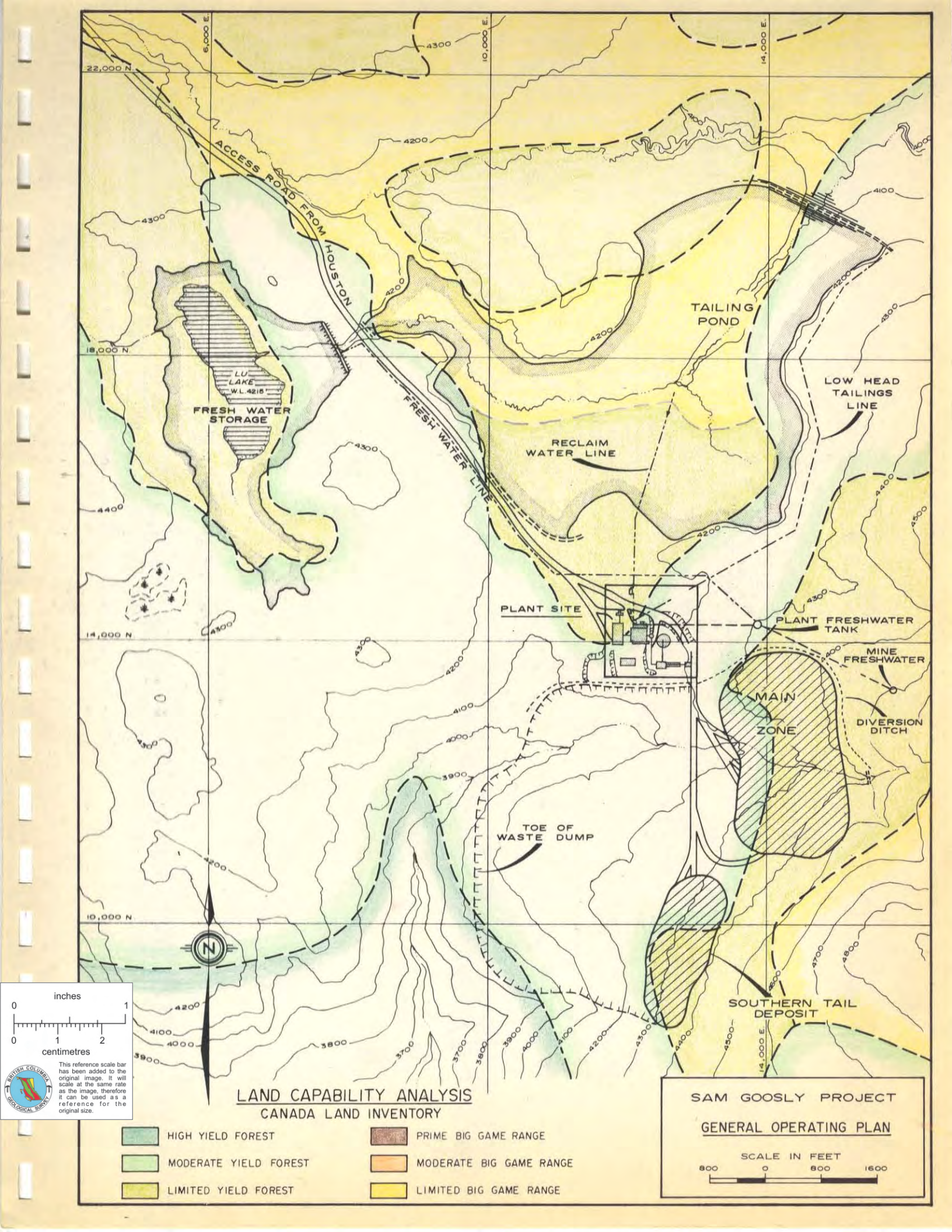
The specific portions of land which would be disturbed lie astride a divide separating the Buck Creek and Foxy Creek water sheds. The plant site is located on moderately sloping, timbered land at the crest of the divide. The open pits and waste dumps are on a gentle sloping mountain side about one and one quarter mile to the west of the summit (5,330 feet). The area of the open pits is timbered, while the area of the waste dumps was partly denuded of timber by a forest fire some years ago. The tailings and water impoundment areas lie in the Lu Creek drainage basin, a small headwater tributary of Foxy Creek. The bottom of the proposed tailings and water impoundment areas are presently open swampy meadows which are nearly enclosed by more steeply sloping, timbered hills at their outer margins. Mining and processing operations will be carried on at varying elevations within the general range of 3800 to 4500 feet.

The Sam Goosly property has been surveyed and assessed as to its potential land capability by the Canada Land Inventory (ARDA). This land capability analysis examined the area for its potential use for agriculture, big game, forestry, recreation, and waterfowl. The information was then compiled and the "best use" of the land selected.

Based on the above categories the land to be developed was classified as follows:

Approx. 50% - Moderate Yield Forest, productivity ranging from 51 to 70 cubic feet per acre annually for main commercial species.

Approx. 30% - Limited Yield Forest, productivity ranging from 31 to 50 cubic feet per acre annually for main commercial species.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BRITISH COLUMBIA GEOLOGICAL SURVEY
LAND CAPABILITY ANALYSIS
CANADA LAND INVENTORY
HIGH YIELD FOREST
MODERATE YIELD FOREST
LIMITED YIELD FOREST
PRIME BIG GAME RANGE
MODERATE BIG GAME RANGE
LIMITED BIG GAME RANGE
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Approx. 20% - Limited Big Game Range, severe limitations for production of wild ungulates and a low to moderate capability for summer use only.

These lower ratings for the mine area are evident from the lack of logging activities in the immediate area while extensive logging has been carried out at lower elevations where the capability has been classed as high yield.

Although not abundant, both black bear and moose are periodically noted in the vicinity of the planned development.

As indicated by the Land Capability Analysis the Sam Goosly property is located in an area of limited or moderate land use potential for those resources included in the ARDA study. In addition a second industry in the Houston area would provide a means of stabilizing the economy and utilizing existing facilities.

Beak Consultants Limited have been asked to prepare an environmental impact matrix. Their comments and matrix are given on the following pages.

As an aid to understanding the overall potential ramifications of the proposed Sam Goosly project, Beak Consultants Limited have reviewed the environmental and engineering information contained in this report and prepared the following preliminary environmental impact matrix. The matrix will enable Equity to outline for the various government departments those specific portions of the overall development which at this moment in time may have a major impact on specific portions of the environment and to discuss the proposed methods of elimination, reduction or mitigation.

The proposed development activities have been presented in two major groupings: Construction and Operations, with the latter further subdivided into Mining, Processing and General. Each of these divisions lists certain specific activities.

Environmental characteristics have four major divisions: Physico-chemical; Biological; Land Use; and Cultural with the specific activity detailed.

With the development and environmental factors itemized the matrix is then reviewed and the specific interaction between the two components noted, and the degree (major, moderate, minor) and type of interaction (positive, neutral, negative) is then recorded.

PRELIMINARY ENVIRONMENTAL IMPACT MATRIX - SAM GOOSLY PROJECT

EXISTING ENVIRONMENTAL CHARACTERISTICS \ PROPOSED DEVELOPMENT ACTIVITIES		CONSTRUCTION						OPERATIONS													
								Mining				Processing								General	
		Alteration of Ground Cover	Service Corridor	Tailings Pond	Reservoir	Noise	Labour Force	Open Pit Excavation	Pit Drainage	Stockpiling	Reclamation	Process Water Supply	Tailings Pond Discharge	Concentrate Drying	Concentrate Roasting	Leach Plant Drying	Leach Plant Solid Waste	Domestic Effluent	Garbage Disposal	Noise	Labour Force
PHYSICO-CHEMICAL	Construction Materials		○−	○−	○−																
	Water Quality	○−	○−	◒−	◒−				○−	○−	○+		●−		○−	○−	◒−	○−	○−		
	Water Quantity											◒−									
	Air Quality	○−	○−					○−						○−	●−	◒−					
	Floods	○−			○−					○−	○+										
BIOLOGICAL	Terrestrial Flora	○−	○−	○−	○−			○−		○−	○+				◒−	○−	◒−				
	Terrestrial Fauna		○−		○−	○−		○−			○+						○−		○−	○−	
	Fish		○−		○−							◒−	◒−		○−	○−	○−				
	Benthos		○−		○−								○−		○−	○−	○−				
LAND USE	Forestry	○−	◒−					○−			○+										
	Mining		◒+					●+		●+											
	Hunting		◒+				○−														○−
CULTURAL	Camping & Hiking		◒+			○−								○−	○−	○−				○−	
	Open Space		◒−			○−	○−							○−	○−	○−				○−	○−
	Cultural Patterns						◒o														●o
	Employment		○+				◒+														●+
	Housing						◒+														●+

LEGEND

● Major + positive

◒ Moderate o ambivalent

○ Minor - negative

On the basis of the environmental matrix the following conclusions can be drawn:

1. Mining Operations

Overall impact of the mining operations appears to be minor as standard mining procedures are to be used.

2. Processing Operations

It is important to recognize that potential impacts rather than actual impacts are the basis of this assessment. The potential for major negative impacts exists within the processing activities but measures to mitigate these potential impacts will be incorporated into the plant design.

The fishery resources of Foxy Creek are not well documented at the present time, but a potential impact does exist should the flow regime of Foxy Creek be altered by water withdrawals to augment the proposed reservoir at Lu Lake. In addition the water quality of Foxy Creek could be negatively impacted through the tailings pond section of the process flow. Presently, any potential impacts have been mitigated by the design of a 75% recycle process within the concentrating cycle itself and, considering the tailings pond as the source of recycle water, no surface discharges would occur. Hence the entire process system, including the tailings pond, can be considered as a 100% recycle process.

Both aquatic and terrestrial biota could potentially be affected by the possible emission into the air of detrimental substances from the concentrate roasting and leach plant drying process activities. This potential negative interaction will be mitigated with the design of

appropriate air emission treatment facilities.

Disposal of solid waste from the leach plant circuit presents a potentially moderate negative impact. The substances to be handled can under certain instances be detrimental to the biotic system. To mitigate the potential negative impact, special handling and disposal procedures will be proposed.

3. Land Use

All land use and land alteration activities occurring with the development generally have a minor impact on the existing environment. This low level of impact is due to the limited present value of the land and the planned instigation of reclamation procedures.

4. Cultural Activities

Impacts on the cultural sphere from the development will be moderate to major. Changes in cultural patterns in the region will be expected due to the influx of both transient construction workers in the initial phases followed by permanent staff in the operation phase. Whether these changes are of a positive or negative aspect is very subjective and hence have been considered as ambivalent. Preliminary data suggests that a major positive impact will be a result of this development on employment and housing in the region.

ECONOMIC IMPACT

The Sam Goosly project is expected to create employment for approximately 300 people during the construction phase and 186 during the initial operating years. Subsequent expansions would increase the operating crew by approximately 30 people.

In a study by Price Waterhouse for the Mining Association of British Columbia, it was determined that for each direct employee of a mining company, there were approximately 2.5 other workers in the province in jobs based on the mining industry. It was also determined that the mining industry in B.C. supported seven other workers in Canada for each worker directly employed.

On the basis of 186 employees, a further 465 persons might be expected to be employed in British Columbia. The current reserve estimates would sustain the above-mentioned employment for some 25 years. As mentioned previously the potential for locating additional open pit ore or developing underground reserves must be considered good. Underground production, if feasible, would expand the work force while additional open pit ore would sustain it.

The increase in assessment base, and the tax revenue will benefit all levels of government, both directly and indirectly--through the operation itself and through the employment created.

From the current open pit reserve of 43,000,000 tons grading .33% copper, 2.78 oz. silver, .026 oz. gold and .085% antimony the total value of metal produced from this area could exceed $750,000,000 and provide over 11,000,000 man hours of employment directly.

The potential use of the land for mineral production surpasses its potential for any other use. This is particularly true when it is realized that with proper reclamation most of the area disturbed can be revegitated and returned to its present use.

The capital cost of the project is estimated to be in the order of $40 to $50 million. Over $3,000,000 has already been invested in exploration and research.

Once in production, the economic multiplying effect of the primary industrial jobs provided at Goosly will show up in such areas as transportation, repair services, personal services, retail trade, etc., and in total should more than double the direct payroll value ($2,500,000) to the Houston area.

The development and operation of a mine at Sam Goosly combine to yield an environmental impact of relatively low magnitude, yet offer the possibility of supporting a high yield mineral extraction industry.

RECLAMATION AND CONSERVATION

The reclamation program as envisaged would be staged over the life of the mine and would include:

A. Research and Definition of Objectives

B. Experimental Revegetation

C. Long Term Reclamation

The research and definition of objectives would be conducted with the assistance of consultants and with the aid and consultation of provincial and federal Resource Departments. The first phase of research would be to expand the data base presently available with respect to natural vegetation, water quality, fish and wildlife and soil analysis for those areas where disturbance is likely. A second phase of research would be conducted during the preproduction period and during initial operation and would include research into the characteristics of mine and mill waste products in order to determine their potential as a growth medium for plant life.

Experimental revegetation would be conducted with the ultimate objective of determining optimum revegetation procedures which would return as much of the disturbed areas to as productive, or conceivably to a more productive state than currently exists. Experimental work would include both aerial and surface seeding, studies of fertilizer application and the study of plant growth under various conditions.

Since, with the exception of tailing dam faces, not much can be accomplished on reclamation of tailing area surfaces during active operation, experimental revegetation will be conducted on test plots of tailings to determine appropriate mixtures of fertilizers, grasses and legumes for

ultimate reclamation.

As portions of the disturbed area become "inactive", they will be reclaimed. The reclamation procedure would be based on the results of the research and experimental revegetation previously described.

The mine waste dump area will be terraced and ultimately smoothed along the down dip side in order to prevent slumping subsequent to reclamation. Rock volumes and road access routes are being studied in order to ensure that the necessary lower terraces can be laid at the appropriate time.

Conservation efforts will be directed towards minimizing the area disturbed and conserving materials excavated which may have future use or value. Topsoil will be conserved, whenever feasible, for possible use in reclamation of disturbed areas. Low grade stock piles will include rock which is well below current cutoff grades. The low grade rock will be segregated according to grade and stored in areas convenient for retrieval should technical improvements or economic conditions change to the point where such rock becomes ore.

Regardless of which access route is developed, the mine will be located at the end of the road and presumably would not be visited by people who find such operations aesthetically displeasing. Those facilities which could be observed from the access road, the fresh water dam and the tailings impoundment area, will be screened wherever possible by preserving the present trees, planting new trees or if necessary building a dyke-like embankment.

The nearest inhabitants reside on a farm in the Buck Creek valley

6.5 miles to the west. Beyond that several families live in the Buck Flats area 10 miles further downstream.

To the north, in the Foxy Creek drainage system, the nearest inhabitants live in the Maxan Creek valley a distance of more than 10 miles from the mine.

The Francois Lake area to the south of the mine is in a separate drainage basin and is not connected by road and thus should be unaffected by any development at Sam Goosly.

E.S. Holt

J.C. Mitchell

October 21, 1975
ESH:dc

ALTERNATE ACCESS ROUTES

SAM GOOSLY PROJECT

ALTERNATE ACCESS ROUTES - SAM GOOSLY PROJECT

Introduction

This report provides a preliminary evaluation of the existing road access to the S.G. Mining property, and indicates anticipated costs to upgrade this road or alternately to provide access via the Dungate Creek valley.

The findings are based in part on data provided by Mr. Norman Read of Caledonia Engineering Services. This is particularly true with regard to the Dungate Creek data where a detailed survey was carried out under his supervision during 1974. A synopsis of Mr. Read's engineering experience is appended.

The author has had intimate experience with the Buck Flats road during the past three years and has traversed the Dungate Creek route both on foot and by helicopter.

August 29, 1975

BUCK FLATS ROAD

History

The first part of this road was constructed early this century as a mining trail from Houston via Parrott Lakes to the Francois Lake area. In the 1950's and 1960's logging activity in the Goosly Lake area prompted Buck River Lumber Company to branch from the original road at mile 18.5 and construct new road for about 12 miles to Goosly Lake. This road was extended a further 5 miles to the S.G. Mining property in the late 1960's.

For many years, the Buck River Lumber Company (and later Bulkley Valley Forest Industries) held a special permit from the Department of Highways to use over-size logging trucks on this road, in return for which the company undertook all maintenance. However, with an increase of settlement along the road, this permit was revoked in 1969, and the Department of Highways took over maintenance to the mile 18.5 junction. Ahead of mile 18.5 the road is a forest road under the jurisdiction of the B.C. Forest Service. The only maintenance performed on this section is that undertaken by the logging contractors during periods of logging activity.

General Description

The road is a low class dirt standard, with a bare minimum of graveling. Up to mile 18.5 it is a marginal 2-lane road which includes two single lane log bridges. Beyond mile 18.5 it is generally single lane, although vehicles can pass with care.

The current travelling time from Houston to the Goosly property is one hour and 15 minutes; however during periods when the entire road

was being maintained, a one-hour travelling time was achieved by light traffic. It is conceivable that with good maintenance and the calibre of rerouting and upgrading that is currently being carried out by the Department of Highways between miles 2 and 7, a 50-minute commuting time would be possible. Any additional reduction in travelling time would require major realignment and a substantial expenditure.

As shown on the appended plan, the present Buck Flats road is 34.5 miles long and does not include any straightaway sections of more than 1/4 mile except within the Houston town limits where a 30-mile-per-hour speed limit is in force.

Grades in general are not excessive with the exception of a 1000-foot climb and subsequent descent of a hill in the first seven miles of road and the 1200-foot climb from Goosly Lake to the plant site over the last few miles.

Known gravel sources are both scarce and limited in extent. A 14-mile section of road between miles 14 and 28 is void of any developed pits.

Bedrock exposures are rare with only five short sections of rock encountered to date.

Detail Description

Mile 0 - 7.2 - The road climbs steadily to mile 5, then drops steeply to the first Buck Creek bridge at mile 7.2. This two-mile long steep adverse grade (10%) is the most severe stretch on the entire road for log haul, especially in winter conditions. A much better route is possible following close to Buck Creek, which entirely eliminates the

adverse grade. Such relocation has been considered by the logging companies, but to date has not been implemented.

The current upgrading by the Department of Highways is within this section. They have widened the road in some areas and have improved the alignment by reducing the sharpness of the most hazardous curves, but unfortunately have not improved the grade.

The bridge at mile 7.2 is a single-lane log structure over 10 years in age. It is in fair condition, and regularly carries heavy logging traffic.

Mile 7.2 - 10.6 - This section of road climbs several hundred feet above Buck Creek and then drops back to the second bridge at mile 10.6. Alignment is generally good, and grades are not severe.

The single lane log bridge at mile 10.6 was constructed in 1969 to replace an older structure. The new bridge is in good condition.

Mile 10.6 - 18.5 - The road passes through low-lying river flats known as 'Buck Flats'. Some sections are poorly graveled and break up in wet weather.

Mile 18.5 - 29.5 - This section of road was constructed for logging at Goosly Lake, and is almost exclusively used by logging traffic. There is only one farm beyond mile 18.5; their access road branches off the Buck Flats road at mile 24.

This road is mostly single-lane, well compacted, but not heavily graveled. There are no severe grades. Gravel is available near Buck Creek just upstream from mile 29.5.

Mile 29.5 - 34.5 - The road commences to climb at mile 30, with switchbacks at mile 30.7 and 31.8, reaching the S.G. mine at mile 34.5.

The first switchback is well located and causes no difficulties for vehicle travel. The second (mile 31.8) is sharp and steep, and could cause difficulty to long vehicles. The steepest section on the road is mile 33.0 to 33.5, with grades of over 12%.

If slow speeds and a long continuous 8% grade is acceptable, then the above-mentioned problem areas could be rectified without major expenditure. However, if speeds of say 45 m.p.h. and grades suitable for heavy traffic were desired, then major realignment and substantial expenditure would be required.

Using the latter mentioned guidelines, a road branching off the present road at approximately mile 22 and proceeding toward the mine site via the north side of Goosly Lake may provide the only acceptable solution.

Costs

Detailed estimates of the expenditures required in order to bring the Buck Flats road up to a standard acceptable for commuter traffic to the Sam Goosly project have not been developed. However, for comparative purposes some general guidelines are provided.

Cost estimates vary substantially depending on the calibre of road required; therefore two different standards have been considered:

(A) A road suitable for 50-to 60-minute commuting time for light vehicle traffic but subject to severe load restrictions during road ban periods;

Cost estimate $ 915,000

(B) A 50 m.p.h. road suitable for 40- to 50-minute commuting time with reduced road restrictions. This road would be of the same general

standards as the one proposed for Dungate Creek (30-foot subgrade, 80-foot clearings, 2-foot ditches, one to one and one-half feet of gravel with good crushed surface and grades acceptable for heavy vehicle traffic).

Cost estimate $1,673,000

Detail Road A

The standard of road provided for in estimate "A" is essentially a 45 m.p.h. gravel road with the exception of some short sections where slower speeds would be required.

The road would be subject to a ban on concentrate and mill supplies' movement during the following periods:

March 20 - May 20 - Spring breakup

October 20 - November 20 - Fall wet season to freeze-up

The above periods may vary slightly depending on the particular year, but are generally realistic and necessary to avoid extensive damage to the road.

The work required would be limited to upgrading of the existing road with minor alignment changes, and would not include major new construction. This standard would be in line with the current upgrading being done between miles 2 and 7.

Cost Estimate Detail

Mile 0 to 18.5		
Upgrade 13 miles @ $15,000/mi	$200,000	
Graveling 1,200 cu.yds./mi @ $1.80/yd	40,000	
Bridges: two-lane untreated log span, 40' span, 2 @ $38,000	76,000	$316,000
Mile 18.5 to 30.0		
Upgrading, alignment changes & ditching, 11.5 miles @$20,000/mi	230,000	
Graveling 2,000 cu.yds./mi @ $2/yd.	46,000	
Culverts, 15 @ $200	3,000	
Bridge, one 30' log bridge	25,000	304,000
Mile 30.0 to 34.5		
Rerouting, 3 miles @ $60,000/mi.	180,000	
Upgrading, 1.5 miles @ 15,000/mi.	23,000	
Graveling, 1,200 cu. yds./mi @ $0.75/yd.	9,000	212,000
Sub Total		832,000
Supervision and Contingency		83,000
Total Cost Estimate		$915,000

Detail Road B

In order to maintain 50 m.p.h. alignment and acceptable grades, this road would have to deviate significantly from the existing road and in some cases would require complete rerouting. Such a road has not, to my knowledge, been scouted or designed.

Although detail cost estimates are not available, the general conditions are similar to those existing on the Dungate Creek route, and on a per mile basis the consturction costs would probably be quite similar. The terrain is generally comparable, both routes are through glacial till and glacial fluvial deposits with sparse rock outcrop. Clearing and grubbing costs would be higher on the Buck Flats route as would the

graveling costs; however this would be more than offset by the presence of the existing road. Both routes require three small bridges and numerous culverts.

Cost Estimate Detail

Realignment, widening, upgrading and graveling existing road to 50 m.p.h. standards: 26.5 miles @ $45,000/mi.	$1,193,000
Rerouting*: 8 miles @ $60,000/mi.	480,000
Total Cost Estimate	$1,673,000

* Rerouting would be necessary where excessive grades currently exist (miles 2-7 and 31-34).

DUNGATE CREEK ROAD

General

A survey of the Dungate Creek access route was carried out by Mr. Norman Read of Caledonia Engineering Services during the summer of 1974 for S.G. Mining Inc. This survey included cutting a centre line, plotting profiles and generating detail cost estimates.

The current Dungate Creek road is in poor condition and is traveled only by 4-wheel drive vehicles, trail bikes and skidoos. No road access currently exists between Klo Creek and the Sam Goosly property (the last 7 miles).

The proposed road is 23 miles long and would provide approximately 30-minute commuting time between Houston and the mine. Grades are not excessive and tangents of a mile or more are common.

The proposed road is designed for 50 m.p.h. traffic with a 30-foot subgrade, 2-foot ditches and a gravel surface. Clearing would be a minimum of 80 feet with additional clearing over most of the route as required for the B.C. Hydro right-of-way. One to one and one-half feet of gravel with good crushed surface would be provided.

Detail Description

Mile 0 to 9 - The road follows the northern side of Dungate Creek climbing 1,500 feet at grades varying from 3 to 8%. The planned road is generally in close proximity to the existing road. A few rock exposures were noted and minor rock work is anticipated. The valley supports a moderate timber stand. Good sources of gravel are known to exist near the road at miles 2, 5 and 6. A 30-foot span bridge will be

required to cross one of the Dungate Creek tributaries.

Mile 9 to 16 - This section of road is essentially flat as it traverses the broad open valley of upper Dungate and Klo Creeks. Mile 13 to 16 passes through a recent burn area. Klo Creek will require a 40-foot span bridge. Eskers provide gravel sources. This section of road is essentially straight.

Mile 16 to 20 - This section climbs steeply at grades of between 6 and 8% to mile 19, where it reaches an elevation of 4,600 feet, and then descends back down into the Foxy Creek valley. A substantial portion of the climb and subsequent descent are to circumvent a deep canyon which would require a several hundred foot bridge. Gravel is available at mile 19. Miles 19 to 21 are in poorly drained ground supporting sub-marginal timber, while the previous three miles pass through dryer ground and some commercial timber.

Mile 20 to 23 - This section drops slowly to the property at 4,200 elevation. The road is essentially straight with modest grades. A 30-foot span bridge will be required at the Foxy Creek crossing.

Cost Estimate

The cost estimate of $1,304,500 is as provided by Mr. Norman Read based on his detailed survey of the access route. Detail of Mr. Read's estimate is appended.

August 29, 1975

COMPARISON OF ALTERNATE ACCESS ROUTES

HOUSTON TO SAM GOOSLY PROJECT

The merits of the various alternative access routes between Houston and the Sam Goosly property include numerous intangibles, which in most cases are difficult to weigh. Fortunately some direct comparisons can be made and are summarized below.

	Buck Flats Minimum Improvement	Buck Flats Substantial Improvements	Dungate Creek New Road
Commuting distance	34.5 miles	34.5 miles	23 miles
Estimated commuting time	50 to 60 min.	40 to 50 min.	30 minutes
Cost estimate	$915,000	$1,673,000	$1,304,000

In attempting to assess some of the more important intangible items, the following generalizations can be made:

Suitability for commuting	unacceptable	marginal	acceptable
Other road usage	good potential	good potential	limited
Utilities corridor	excessively expensive	excessively expensive	logical

The comments outlined above regarding the suitability of the various routes for personnel residing in Houston and working at the mine are based on comments by our consultants, on discussions with mine operators, and on the results of other comparable situations. The commuting time is a significant factor in maintaining a stable contented work force. If the commuting time exceeds 1/2 hour there is always strong pressure to maintain a camp at the mine site and trailer parks invariably spring up along the access route.

The Dungate Creek route would be used as a utilities corridor for a power transmission line and possibly a natural gas pipeline. To route these via Buck Flats would involve excessive expenditures.

E.S. Holt
S.G. Mining Inc.

August 29, 1975
ESH:dc

Commuting Time Comparisons
Light Vehicle Traffic

	Buck Flats 45 M.P.H. Road	Buck Flats 50 M.P.H. Road	Dungate Creek 50 M.P.H. Road
Basic Time	47 min.	42 min.	28 min.
Effect of Grade	4	2	2
Effect of Alignment	5	2	1
Sub-Total	56	46	31
Effect of Other Traffic (10%)	6	5	3
Total Commuting Time	62 min.	51 min.	34 min.

ESH:dc
September 10, 1975

Houston - Goosly Access Road

Cost Estimate Summary

Mile 0 - 23.0

ITEM	UNIT	QTY.	$/Unit	$
1. Right-of-Way				
Clearing & Grubbing				
R/W	acres	335.0)	850.00	306,000
Gravel Pit Clearing	"	25.0)		
2. Excavation				
Solid Rock	cu. yds	5800	3.00	17,400
Other Material				
Movt. under 200'	"	322,420	0.70	225,690
200'- 500'	"	159,970	0.80	127,980
500'- 1000'	"	52,880	1.05	55,520
over 1000'	"	16,150	1.30	16,150
		547,690	0.78	425,340
3. Gravel Surfacing				
Haul 1st. ½ mile	"	64,500	0.90	58,050
2nd. "	"	44,300	1.05	46,520
3rd. "	"	29,300	1.25	36,630
4th. "	"	14,300	1.40	20,020
5th. "	"	7.500	1.55	11,630
6th. "	"	7,500	1.70	12,750
		167,400	1.11	185,600
Contingency for problems in locating gravel 30%				55,680
4. Drainage Structures				
Corrugated steel pipe culverts				

	Matl.	Install.				
12" dia.	$ 5.00	$ 3.10	lin.ft.	5,520	8.10	44,710
18" "	7.40	5.20	"	3,100	12.60	39,060
24" "	10.30	7.30	"	1,800	17.60	31,680
60" "	49.60	36.00	"	190	85.60	16,260
72" "	59.40	42.00	"	590	101.40	59,830
						191,540

Bridges*: two-lane untreated log spans
H20-S16 (Highway) loading

Sta. 350	30' span		25,000
890 Klo Ck.	40' "		38,000
1156 Foxy "	30' "		25,000
			88,000
5. Mobilization Allowance			35,000
		TOTAL	$ 1,304,560
Average cost per Mile			$ 56,720

* Alternative pressure-treated glulaminated two-lane timber bridges

Sta. 350	30' span	$ 60,000
890 Klo Creek	40' "	85,000
1156 Foxy Creek	30' "	60,000
		$205,000

N.A. Read P.Eng. MEIC, MCSCE.

Synopsis of Engineering Experience

Age : 43 years

1952 B.Sc.(Eng.), London, England. First Class Honours in civil engineering.

1952-57 England.
3 years highway design and construction.
2 years Royal Engineers. Served as officer in Northern Ireland.

1958 Emigrated to Canada. Joined BC Forest Service as engineer on Forest access road construction.
1958- Location survey work in Prince George area.
1959- " in Peace River area.
1960- " in Smithers area.
1961- Project engineer i/c construction of 40 miles road in Morice River system south of Houston. Also 20 miles in Fort St. James area.
1962-3 Development planning. Evaluation of road access requirements in Peace River and other areas.
1964- Joined BC Highways Dept., bridge design office.
1965- Re-joined BC Forest Service as District Engineer, Prince Rupert Forest District. Responsibilities included:
a) Supervision of BCFS road construction, including
25 miles Kispiox F.R. (north of Hazelton).
20 miles Suskwa F.R. (east of Hazelton).
10 miles Owikeno F.R. (near Bella Coola).
Above included several glulam bridges, including a 150' span 90 ton bridge over the Bulkley River at Hazelton.

b) As approving officer, evaluation of all logging company road proposals. (Including Columbia Cellulose, Eurocan, BVFI, Skeena Forest Products etc..)

1968- Joined Bulkley Valley Forest Industries, Houston, as road development engineer. However, almost immediately appointed as General Logging Supt., in charge of all BVFI woods operations and log haul. Involved intermittently in BVFI road programme.

1971- Started Caledonia Engineering Services, consulting civil engineers. Work undertaken to date includes:

- Structural design (buildings and small bridges).
- Preparation of road construction estimates on behalf of contractors (for bidding purposes).
- Inspection work for W.C.B. (concrete formwork, scaffolding, pile drivers etc..)
- Various engineering survey work.
- Road and logging consultant to World Bank. (Project in Nigeria, Burma, New Guinea.)
- Small water systems.
- etc..

(The above is a general outline, and further details of any specific aspect can be furnished if necessary.)

Suggested references:

Mr. P.J. Hemphill, P.Eng., Assistant Chief Forester, B.C. Forest Service, Victoria.

Mr. M. Pogue, BCRF, District Forester, B.C. Forest Service, Vancouver. (formerly District Forester, Prince Rupert.)

Mr. E.S. Reid, BCRF, Reid-Collins & Assoc., Vancouver.

HOUSTON

BULKLEY

CNR

RIVER

McKilligan Creek

AITKEN CREEK

Swans Lake

Elwin Lake

Day Lake

BULKLEY RIVER

BULKLEY LAKE

CROW CREEK

MAXAN CREEK

MAXAN LAKE

B.C. HYDRO SUB-STATION

339 333 622A 619 341 2088 3443

342A 342 332 2089

2090 2094 2095 2499

2097 2499A

4248

DUNGATE CREEK

BOB CREEK

KLO CREEK

(CANYON)

CREEK

FOXY

Lu Creek

BUCK CREEK

SOL CREEK

PARROTT CREEK

PARROTT LAKE

GOOSLY LAKE

MINE SITE

N

LEGEND

○ Potential Gravel Source

22 Mileage From Houston

S.G. MINING INC.

ALTERNATE ACCESS ROUTES

HOUSTON - GOOSLY

SCALE: 1 : 50,000

MILES 0 1 2 3 MILES

inches 0 1 2

centimetres 0 1 2 3 4 5

BRITISH COLUMBIA GEOLOGICAL SURVEY

This reference scale bar has been added to the image. It was not to scale at the same rate as the image, therefore it can be used as a reference for the original size.

SAM GOOSLY PROJECT

GENERAL OPERATING PLAN

INITIAL TAILING POND

TAILING LAUNDER

LOW HEAD TAILINGS LINE

ACCESS ROAD FROM FRESH WATER LINE HOUSTON

RECLAIM WATER LINE

FRESH WATER LINE

SURFACE LEASE APPLIED FOR

PLANT SITE

Water Treatment Plant (If req'd)

PLANT FRESHWATER TANK

MINE FRESHWATER DIVERSION DITCH

DIVERSION DAM

TOE OF WASTE DUMP

WASTE DUMP

TOPSOIL STOCKPILE

LU LAKE W.L. 4215'

FRESH WATER STORAGE

SG No. 1 Fr.

SG No. 2 Fr.

SG No. 3 Fr.

SG 5 FR.

SG 6 FR.

REV. No. 4

LOT 5090 REV No. 2

LOT 5088 SG No. 64

LOT 5087 SG No. 62

LOT 5066 SG No. 27

LOT 5067 SG No. 28

LOT 5057 SG No. 26

LOT 5056 SG No. 25

LOT 5058 SG No. 43

LOT 5059 SG No. 44

LOT 5060 SG No. 45

LOT 5061 SG No. 46

LOT 5062 SG No. 47

LOT 5063 SG No. 48

LOT 5064 SG No. 49

LOT 5065 SG No. 50

SG No. 66 LOT 5089

SG No. 52

SG No. 41 SG No. 42 SG No. 40 SG No. 39 SG No. 38 SG No. 37 SG No. 36 SG No. 35 SG No. 16 SG No. 15 SG No. 18 SG No. 7

T 84 T 85 T 86 T 87 T 89 T 90 T 91 T 92 T 93 T 94 T 95 T 96 T 97 T 98 T 99 T 100 T 101 T 102 T No. 103 T 104 T 105 T 106 T 107 T 108 T 109 T 110 T 111 T 112 T 114 T 116 T118

W1 W2 W3 W4

SG 1 SG 2 SG 3 SG 4 SG 5 SG 6 SG 7 SG 8 SG 9 SG 10 SG 11 SG 12 SG 13 SG 14

6,000 E. 8,000 E. 10,000 E. 12,000 E. 14,000 E. 16,000 E.

22,000 N. 20,000 N. 18,000 N. 16,000 N. 14,000 N. 12,000 N. 10,000 N. 8,000 N.

LEGEND

- INITIAL PIT
- FINAL PIT OUTLINE
- SURVEYED CLAIMS

inches 0 1 2 / 0 1 2 3 4 5 centimetres

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BRITISH COLUMBIA GEOLOGICAL SURVEY

SCALE

FEET 400 0 400 800 1200 FEET

Altair