Cominco Red Dog Project--Overview

H. M. GIEGERICH

PRESIDENT AND GENERAL MANAGER

COMINCO ALASKA, INC.

HOUSE SPECIAL COMMITTEE ON LOANS & HOUSE RESOURCE COMMITTEE

FRIDAY, FEBRUARY 8, 1985

MADAM CHAIRMAN OF THE RESOURCE COMMITTEE, MADAM CHAIRMAN AND MR. CHAIRMAN OF THE FINANCE COMMITTEE, MEMBERS OF THE COMMITTEES, LADIES AND GENTLEMEN, GOOD AFTERNOON.

THANK YOU FOR THE OPPORTUNITY TO TESTIFY BEFORE YOU ABOUT OUR PENDING DEVELOPMENT, THE RED DOG MINE. MY NAME IS HANK GIEGERICH, AND I AM PRESIDENT AND GENERAL MANAGER OF COMINCO, ALASKA, INC. BASED IN ANCHORAGE. WITH ME IS BILL WILSON, PRESIDENT OF OUR PARENT COMPANY, COMINCO LTD. OF CANADA, AND BOB STONE, CHIEF FINANCIAL OFFICER FOR COMINCO.

OUR PRESENTATION TODAY WILL BE DIVIDED INTO THREE SECTIONS. FIRST, BILL WILSON WILL COMMENT ON COMINCO'S BUSINESS ACTIVITIES, AND SOME OF THE ISSUES WHICH COMINCO WILL CONSIDER BEFORE MAKING A PRODUCTION DECISION. FOLLOWING THIS, I WILL PRESENT A SLIDE SHOW WITH DETAILS ON THE PROJECT. THEN, I WOULD LIKE TO WIND UP WITH SOME OF THE KEY REASONS WHY WE BELIEVE IT IS BENEFICIAL FOR COMINCO ALASKA, AND THE STATE OF ALASKA, TO DEVELOP THE RED DOG MINE.

COMINCO AMERICAN, WHICH IS A WHOLLY OWNED SUBSIDIARY OF COMINCO LTD. OF CANADA, HAS BEEN OPERATING IN THE STATE OF ALASKA SINCE 1973. COMINCO ALASKA, A SUBSIDIARY OF COMINCO AMERICAN, WAS INCORPORATED AS AN ALASKAN COMPANY IN 1982 TO LOOK AFTER ALL OF COMINCO'S BUSINESS ACTIVITIES IN ALASKA.

IN FEBRUARY 1982, NANA AND COMINCO AMERICAN SIGNED AN AGREEMENT FOR THE EVALUATION AND DEVELOPMENT OF THE DEPOSIT. THIS AGREEMENT REQUIRED NANA TO PUT THE MINERAL DEPOSIT IN A PARTNERSHIP IN WHICH COMINCO IS THE MANAGER AND FINANCER. MR. JOHN SCHAFFER, PRESIDENT OF NANA, WILL BE DISCUSSING THIS FURTHER.

NOW I WOULD LIKE TO CALL ON BILL WILSON.

I WOULD LIKE TO ELABORATE ON WHY WE CONSIDER RED DOG SHOULD BE DEVELOPED NOW. ALASKA IS AT A POINT IN ITS HISTORY AND DEVELOPMENT WHERE IT IS DESIRABLE FOR THE STATE TO DIVERSIFY ITS ECONOMY. THIS IS NECESSARY PRIMARILY BECAUSE OF THE STATE'S VULNERABILITY TO DECLINES IN OIL REVENUES. IF ALASKA DOES NOT BEGIN TO DIVERSIFY SOON, THERE WILL BE NO WAY TO CREATE THE NEW JOBS, NEW WEALTH, AND NEW OPPORTUNITIES FOR ALASKANS WHEN THE OIL IS GONE.

BY ASSISTING IN DEVELOPING THE TRANSPORTATION INFRASTRUCTURE, ALASKA WILL SEND OUT A SIGNAL THAT THE STATE IS SERIOUS ABOUT

DIVERSIFYING ITS ECONOMY AND BECOMING COMPETITIVE IN THE WORLD MINERAL MARKETS.

ANOTHER POSITIVE ASPECT TO ASSISTING WITH THIS PROJECT IS THE MESSAGE THAT IT WILL SEND TO OTHER MINING COMPANIES OPERATING IN ALASKA, AND TO COMPANIES INTERESTED IN DOING BUSINESS IN THE STATE IN THE FUTURE. IT IS IMPORTANT FOR A MAJOR MINE TO COME INTO PRODUCTION SOON IN ALASKA, TO ENCOURAGE FURTHER INVESTMENT IN NATURAL RESOURCES. THE RED DOG MINE WILL DEMONSTRATE THAT ALASKA KNOWS HOW TO USE ITS OIL REVENUES WISELY IN DEVELOPING ITS OTHER RESOURCES. MINING HAS PLAYED AN IMPORTANT ROLE IN ALASKA'S PAST, AND CAN PLAY AN EVEN MORE IMPORTANT ROLE IN ITS FUTURE.

AS I MENTIONED, TWO CRITICAL AND RELATED FACTORS IN THE DEVELOPMENT OF THE RED DOG MINE HAVE TO DO WITH TIMING AND MARKETS. FROM THE STANDPOINT OF TIMING, RED DOG MUST BE IN PRODUCTION BY THE END OF THIS DECADE SO THAT WE CAN TAKE ADVANTAGE OF THE MARKET OPPORTUNITY WE HAVE IDENTIFIED. IF ALASKA FALTERS, THE MARKET COULD BE LOST UNTIL SOMETIME IN THE FUTURE. THIS WOULD NOT ONLY BE A MISSED OPPORTUNITY FOR COMINCO, BUT, MORE IMPORTANTLY, IT WOULD BE A GREATLY MISSED OPPORTUNITY FOR THE STATE AND PEOPLE OF ALASKA.

I WOULD LIKE TO MAKE ONE FINAL POINT. OVER THE PAST FEW MONTHS THIS PROJECT HAS BEEN CRITICIZED BECAUSE OF THE PERCEPTION THAT

IT HELPS ONE INDUSTRY, ONE REGION AND ONE REGIONAL CORPORATION. LADIES AND GENTLEMEN, WE CONSIDER THIS TO BE FAR FROM THE TRUTH. AS HAS BEEN SHOWN BY RECENT STUDIES COMPILED BY THE ALASKA OIL AND GAS ASSOCIATION, INDUSTRIAL DEVELOPMENT RESULTS IN SIGNIFICANT SPIN-OFFS TO BUSINESSES IN THE REST OF THE STATE, DUE TO THE NEW MONEY THAT IS INJECTED INTO THE ECONOMY, AND MINING IS NO DIFFERENT. IN THE CASE OF RED DOG, A MAJORITY OF THE NEW MONEY WILL PROBABLY GO TO SERVICE INDUSTRIES IN THE ANCHORAGE/ FAIRBANKS AREA.

AS WELL, THE 7(i) PROVISION IN THE NATIVE CLAIMS SETTLEMENT ACT ENSURES THAT THE INCOME AND EXPENDITURES FOR THE RED DOG MINE WILL BE DISTRIBUTED, AND FELT, ALL AROUND ALASKA. THIS PROJECT CAN DEFINITELY BE DESCRIBED AS AN ALASKAN PROJECT!

WITH YOUR APPROVAL, BEFORE TAKING ANY QUESTIONS, WE WOULD FIRST LIKE TO SHOW A SLIDE PRESENTATION WHICH PROVIDES FURTHER DETAILS ON THE PROJECT. MR. WILSON WILL THEN CLOSE OUR FORMAL PRESENTATION.

W. G. WILSON

PRESIDENT

COMINCO LTD.

HOUSE SPECIAL COMMITTEE ON LOANS & HOUSE RESOURCE COMMITTEE

FRIDAY, FEBRUARY 8, 1985

Mr. Chairman of the Special Committee on Loans, Madam Chairman and Mr. Chairman of the Resource Committee, Members of the Committees, Ladies and Gentlemen, good afternoon.

My name is Bill Wilson. I am President of Cominco Ltd. and I live in Vancouver, B.C. Accompanying me from Vancouver is Bob Stone, Vice President, Finance, of Cominco Ltd. Hank Giegerich has already described some aspects of Cominco and I would like to add a few comments.

Worldwide, Cominco employs approximately 10,500 people. In 1984 our total assets were more than $2 billion, and annual sales were about $2.1 billion. We have active operations in 9 countries and carry on exploration activities in a further 12 countries.

Our major business is mining and metals. Cominco Ltd. owns zinc and lead mines at Kimberley, at Pine Point and at Polaris, N.W.T., in Canada; Black Angel in Greenland; Rubiales in Spain;

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Que River in Australia; and the Magmont mine in Missouri. Other mines owned by Cominco include a gold mine in the Northwest Territories of Canada and a gold mine in Nevada; a copper mine in British Columbia; a coal mine in British Columbia; a potash mine in Saskatchewan; and a phosphate rock mine in Montana. At Trail, British Columbia, Cominco operates the world's largest integrated smelter and refining complex, producing zinc, lead and silver plus chemical fertilizers, and high purity electronic materials. Cominco's sales of zinc and of lead amount to approximately 10% of each of the world's production.

Now I would like to talk a little about world metal markets, so that you can see where we think Red Dog will fit in. In the late 70's and early 80's, zinc concentrate markets were bouyant due to the general "boom" conditions that existed worldwide. This shifted dramatically in 1982 when the world moved into recession. Concentrate markets softened, inventories increased significantly, and prices dropped to the lowest "real" level in 50 years. For the metals industry this was the most severe recession since the 1930's.

During 1983/84 production and consumption remained in balance, and there was slow improvement in price, but not enough to put the industry back into complete health. The situation today is essentially unchanged. Zinc consumption in the Western World has increased but so has production, so there is still some surplus capacity over-hanging the market. This was the major reason behind Cominco's recent temporary shutdowns -- to try to eliminate some of these surpluses. All of our mines are now operating again, and we will hope to see an improved inventory situation by next summer. And, if the economic recession that the experts are predicting for 1986 materializes, we may again see lower prices for a period and this may result in a shake-out in the market that will finally eliminate some of the high-cost, marginal producers.

However, by the end of this decade, we anticipate some significant changes in the world zinc market. To start with, there are going to be a number of good-sized mines going out of business due to exhaustion of ore reserves. These include our own Black Angel mine in Greenland, Nanisivik in Canada's arctic, the Meggan mine in West Germany (which has been in production for 300 years), plus other major operations in Canada and Australia. These shutdowns are going to take more than half a million tons off the market annually by the end of this decade. Exansions and new mines that have been announced will compensate for some of this, but will not take care of the new zinc production that will be required by 1990, due to the normal expansion of the world economy. So this is where Red Dog comes in, as this market gap that has been identified fits in with our proposed timing for bringing Red Dog on by the end of the decade.

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Cominco is therefore taking metal prices and markets, and the future outlook, into consideration in our planning on when to bring the Red Dog mine into production. Our production decision will be based on these market considerations, plus the return on investment, and the risk. And probably the most critical factor is whether the State of Alaska can assist in the initial financing of the road and port facility. This is the single largest item in the project, and accounts for almost 40% of the total project cost. Our present studies indicate that if Cominco is required to directly finance this portion of the project, the return on the investment will not likely be adequate to justify developing this mine, with its problems of isolation, climate and short shipping season.

In return for State assistance in developing the transportation infrastructure, we have stated that Cominco will make certain guarantees to the State of Alaska covering repayment of the State financing and start-up of the mine. We have been asked what these guarantees mean, and whether the State of Alaska can count on Cominco. These guarantees are backed by the assets of Cominco Ltd., which are more than $2 billion, with two-thirds in fixed assets such as land, building, equipment and developed mineral properties. Cominco is owned by 20,000 shareholders in Canada and the U.S.A., including 54% by Canadian Pacific Ltd., the company instrumental in forming Cominco Ltd. over 80 years ago. Canadian Pacific Ltd. is the largest company in Canada, with assets of $17.6 billion, and sales of $13.1 billion.

Another way to measure our guarantee is to look at our past performance. The proposal we are making to you is not new in the world, or to Cominco. In 1961 we reached an agreement with the Canadian Federal Government which called for the construction of a railroad and hydro-plant to assist in bringing the Pine Point mine in Northern Canada into production. We made commitments and guarantees similar to what we are proposing with the State of Alaska. One of these called for the repayment of capital costs for the railroad. As a result of increased production and higher revenues at the mine over that which we expected, we paid for the capital cost in a shorter time period than was required in the agreement. This mine is still in production and is expected to continue for another 5 to 10 years.

Thank you for the opportunity to address this hearing. I am sure that you have a lot of questions about our project and the company. We will be happy to answer any questions you might have, and look forward to meeting with you again.

Thank you.

Cominco Alaska

H M Giegerich
President & General Manager

Editor
The Anchorage Times
P.O. Box 40
Anchorage, Alaska 99510

December 17, 1984

Dear Editor:

On Monday, December 10, 1984 your paper carried a rather lengthy editorial on the proposed road and port facilities for the Red Dog mine. Unfortunately, the editorial contains numerous inaccuracies about the mine, the road and port facilities, and about Cominco Alaska.

To those who are unfamilar with the Red Dog project, it is one of the premier zinc-lead-silver deposits in the western world. The mine could start producing as early as 1988/1989 and, when at full production, will be the largest zinc mine in the western world. The project will directly provide over 600 Alaskans with year-round jobs, and indirectly will employ approximately 3,000 other Alaskans, also in year-round jobs, for at least 50 years. The mine will be in the NANA region, where almost 90% of the income today is dependent, in one form or another, on government, and where unemployment in the winter time is well over 50% in most of the villages. So these jobs are very significant.

To start with, I am going to summarize the main points, and then discuss them in some detail, so that you will get the complete background.

Your editorial briefly mentioned the positive aspects of this project. However, you failed to note that:

- Red Dog will diversify the State's economy

- Red Dog will provide Alaska with new opportunities

- Red Dog will benefit all of Alaska through jobs and cash injection into the economy

- Red Dog will open up new markets and trade to Pacific Rim countries.

The transportation system will be a multi-purpose facility, as undoubtedly there will be further development in this region of Alaska. There will also be substantial benefits to the people in the region through reduction in freight costs.

There are other key factors in regard to the transportation system.

- The State of Alaska will own the road and port facility

- Cominco Alaska will guarantee to pay the cost of operation and maintenance of the facilities

- Cominco Alaska will guarantee the toll fees which will repay the State for the industrial aspects of the system

- Cominco Alaska agrees to start production at the mine within a definite time period.

- Cominco Alaska guarantees that if it is necessary to postpone development of the mine, it will still repay to the State the money invested in the system.

As an indication of our confidence in the future viability of the Red Dog mine, Cominco Alaska will have spent, by the end of next year, over $40 million. The entire project is presently estimated to cost $400 million, of which Cominco Alaska will be responsible for financing $250 million, or 2/3 of the project, and is proposing to repay to the State most of the $150 million cost of the transportation system.

You made reference to Cominco's shut downs of zinc-lead mines, but failed to note that this is strictly temporary. You also indicated that this should have had an immediate effect. However, considering that these short shut downs are just taking place, this seems to be a rather optimistic expectation.

In any event, the production decision for Red Dog will be based on long-term supply and demand factors, and not short-term fluctuations like we are seeing now. Our present detailed marketing studies indicate that there is a definite market opportunity for Red Dog by the end of this decade.

Now I would like to give you a few details.

Your editorial briefly mentioned the positive aspects of this project. However, you failed to note that:

- Red Dog will diversify the State's economy, providing over $100 million a year in payroll, taxes, royalty payments and the purchase of goods and supplies.

- Red Dog will provide Alaska with new opportunities. As the first major mine to begin operating in Alaska in modern times, this project will enhance Alaska's reputation in the United States and the world, and encourage further investment.

- Red Dog will benefit all of Alaska. The jobs and money provided by this project will be felt from Barrow all the way to Ketchikan.

- Red Dog will open up new markets and trade to Pacific Rim countries. The products produced at Red Dog will be sold to Pacific Rim countries which will open doors for other Alaskan resources.

Your discussion of the negative aspects of the Red Dog project contains some erroneous statements. The road and port will not be a single-purpose facility, as it is likely that there will be further development in this region of Alaska.

Recent articles, which have appeared in your paper, indicate that GCO Minerals Company is planning to use both the road and port facilities to develop the Lik deposit just north of Red Dog. This region of Alaska has been described as the "Noatak Zinc Belt", and it is anticipated that other major deposits will be discovered. While the road will initially link Red Dog with the coast it will undoubtedly be used for these other projects.

As well, the port facility will be of major benefit to the people in the NANA region, by reducing the cost of bringing in fuel and supplies, due to the backhaul capabilities which will be available with the Red Dog project.

Your editorial also missed some other key factors about the road and port. While you pointed out that these facilities will cost $150 million, there was no reference to the fact that Cominco Alaska will repay the cost of the industrial-use portion of the system, which will be most of the $150 million, to the State. Some other important points that could also have been mentioned are:

- The State of Alaska will own the road and port facility, and it will be available to other commercial users.

- Cominco Alaska will guarantee to pay the cost of operation and maintenance of the facilities, with no cost to the State.

- Cominco Alaska will guarantee to pay the toll fees for the use of the port and road, which will repay the capital invested by the State in the industrial aspects of the transportation system.

- Cominco Alaska agrees to start production at the mine within a definite time period.

- Cominco Alaska guarantees that if it is necessary to postpone development of the mine, it will still repay to the State the money invested in the system.

Some of these points have been made in previous articles which have appeared in The Anchorage Times, but were not included in your editorial.

As an indication of our confidence in the future viability of the Red Dog mine, Cominco Alaska has invested over $25 million in the project to date, and the planned expenditure next year will bring our total investment to over $40 million by the end of 1985. The cost of the entire project is presently estimated to be $400 million. Cominco Alaska will be responsible for financing $250 million, or 2/3 of the project, and as noted above, is proposing to repay to the State most of the cost of the transportation system.

Your reference to the required zinc price of $.70 per pound was unfortunately rather misleading. You missed completely the factors of timing and financing. First, the statement to which you referred was in regard to the price required when Red Dog is planned to start operations in 1988/1989, and not today's price. Second, the $.70 price was if the total project, including the road and port, was financed by Cominco Alaska. Based on our market studies and world demand for zinc, we are convinced that Red Dog will be economical when it begins producing in 1988/1989. Zinc is the fourth most widely used industrial metal, and compared with other base metals, has the greatest potential for growth in terms of world demand.

The editorial also mentioned that we have already shut down two of our Canadian operations, "....to reduce the amount of zinc in the marketplace". It is fairly understandable that the price of zinc has not yet been affected, as the shut-downs are just now taking place. Your expectation that this should have an immediate effect appears to be somewhat optimistic, as one cannot cannot anticipate that the market will react immediately to changes made in supply. It also was not noted in your editorial that the shut-downs are only temporary. I trust that you will give us as much press when we resume operations in early January, as you have for the temporary closures.

In any event, short-term market fluctuations (which is what is behind the shut-downs) are not the basis on which we would make a decision on a long-term development such as Red Dog. This production decision will be based on long-term supply and demand factors, and our present detailed marketing studies indicate that there is a definite market opportunity for Red Dog by the end of this decade.

The last point in your editorial was that this was going to be used as a weapon by rural legislators against urban projects requiring large capital outlays. We don't consider that this is correct. However, if enough suggestion in this direction is made, it could become a self-fulfilling prophecy, and I do not believe any of us wish to create such a situation.

Urban Alaska stands to benefit as much from this project as rural Alaska. This is not a project for one region of Alaska, nor for just the mining community, as Red Dog will benefit all regions and segments of Alaska.

Cominco Alaska considers that projects requiring state financial assistance should be judged on their economic and social merits. The key factors are employment, fiscal responsibility and economic benefits to the State. We believe that Red Dog meets all of these requirements.

I would be pleased to be able to discuss this with you at your convenience.

Very truly yours,

H. M. Giegerich
President and General Manager

HMG:jaz

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For further Information: Lisa M. Parker
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Cominco Alaska

Release: Thursday, January 10, 1985

COMINCO NORTHERN GROUP MINES RESUME PRODUCTION FOLLOWING CHRISTMAS SHUTDOWNS

Yellowknife, N.W.T. - Full production of zinc and lead operations at the Polaris Mine will resume tomorrow, January 11, 1985 following a shutdown over the Christmas period. Pine Point Mines Limited resumed production on January 2, 1985.

The interruptions coincided with market oversupply and low prices for zinc and lead.

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Cominco closing may rescue zinc

by Olav Svela

When Cominco Ltd. announced a month-long closure starting mid-December of the Polaris zinc-lead mine and the Black Angel mine in Greenland, it was thought its European customers' appetite for concentrates had been sated.

That is true. The European smelters and refiners of Cominco zinc concentrates are sitting with seasonally high inventories.

But the real reason for the closing of two profitable mines could be quite different than what is generally accepted, says Raymond Goldie, mining analyst with Richardson Greenshields.

At the time of the announcement, Cominco and its overseas customers, who rely on the company for nearly one-quarter of zinc metal production, were in the midst of negotiations. In the absence of new agreements, the Europeans could be sitting with near-empty warehouses by the spring of 1985.

Mr. Goldie believes Cominco is prepared to extend the shutdowns to prove a point — if the Europeans still demand discounts from the posted $US900-per-tonne price, then Cominco will not be shipping concentrates.

"Cominco's actions appear to carry an implicit threat that, if zinc prices don't improve, Cominco will extend the shutdowns," Mr. Goldie said.

There is also the possibility the company, fed up with the braying for discounts by its traditional buyers, could strike a deal with Japanese smelters.

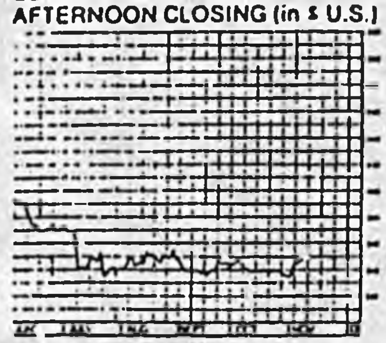
Nor does Cominco seem overly concerned about losing market share, Mr. Goldie noted. Marginal suppliers only reopened mines about a year ago when prices improved. With tags again at lower levels, these producers might be loathe to boost production until solid price gains have been made.

Besides, Mr. Goldie observed, any expansions would require six months to complete.

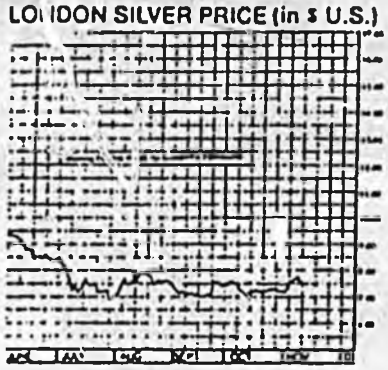
So Cominco is taking the lead in showing discipline.

"It demonstrates that at least one producer is willing to make a stand when it believes that it is not getting a fair price for its product," the analyst said.

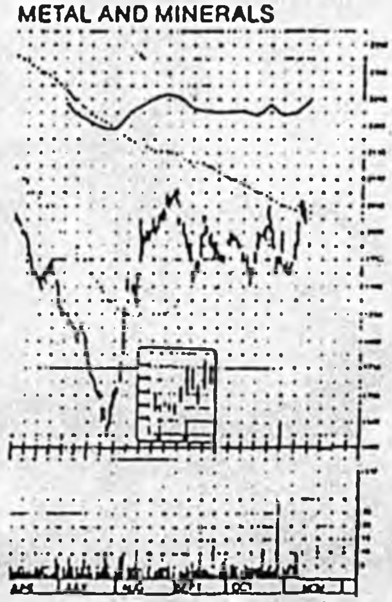
LONDON GOLD PRICE — AFTERNOON CLOSING (in $ U.S.)



LONDON SILVER PRICE (in $ U.S.)



METAL AND MINERALS



Courtesy: GIM Publishing, Toronto

The implication for the price of zinc? Obviously, less concentrates should translate into a tighter market. It hasn't happened so far with free market prices (London Metal Exchange) having slipped nearly a cent to 39.1¢ (US) since the Cominco move.

But Mr. Goldie is confident that with supply and demand in fairly close balance even before Cominco's actions, prices will respond.

Cominco itself projects world shortages.

"Cominco and the smelters both have their eyes on the long term. Cominco wants to take full advantage of a major world shortage of zinc concentrates which, it expects, will develop by the late 1980s," Mr. Goldie said.

The strength of the yellow metal, meanwhile, continues. At presstime the second London fix (Nov. 13) was $US350.45 while the key December contract on Comex was trading at $350.90.

Richardson Greenshields analyst David R. James, noting "the much more positive tone to the gold market," said he expects a "ragged, slow erosion" of the American dollar if newly-reelected President Ronald Reagan keeps his promise to try to lower interest rates.

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ALASKA OIL AND GAS NEWS
DECEMBER 1984

Closure of Polaris mine proof of Cominco's Red Dog commitment

By BERT TARRANT

There's more than meets the eye in Cominco Ltd. of Canada's recent announcement of a month-long closure (which began Dec. 1) of its Polaris lead-zinc mine in northern Canada.

When word of the closure was announced, the fact was jumped on by the Anchorage media as if it were proof positive that any efforts by the state to help Cominco Alaska and partner, NANA Regional Corp., develop the Red Dog lead-zinc project would be throwing so much money down a rat hole.

Cominco and NANA, the Kotzebue-based Native regional corporation, are seeking help from the state to take the edge off the steep front-end infrastructure costs (road and port) the joint venture faces if it is to develop what is considered the richest lead-zinc deposit in the world.

NANA and Cominco had made notable progress in pleading their case and demonstrating the benefits of the project (especially in local hire in unemployment-plagued northwest Alaska) for state help when the Polaris closure (and one in Greenland) was announced.

Tactically, the announcement came at an inopportune time. The knee-jerk reaction from the media and some state-help opponents was that the closures indicated Red Dog wasn't all it was cracked up to be.

But mining industry analysts of international repute are taking an entirely different view of the closures.

When Cominco announced closure of the Polaris mine and the Black Angel mine in Greenland, it was thought its European customers' appetites for concentrates had been sated.

That is true, according to industry observers in Canada. The European smelters and refiners of Cominco zinc concentrates are sitting on seasonally high inventories.

But the real reason for the closure of the two profitable mines could be quite different than what is generally accepted, says Raymond Goldie, mining analyst with Richardson Greenshields.

At the time of the announcement, Cominco and its overseas customers, who rely on the company for nearly one-fourth of zinc metal production, were in the midst of negotiations. In the absence of new agreements, the Europeans could be sitting with near-empty warehouses by the spring of next year.

Goldie believes Cominco is prepared to extend the shutdowns to prove a point – if the Europeans still demand discounts from the posted $900 per ton price, then Cominco will not be shipping concentrates.

"Cominco's actions appear to carry an implicit threat that, if zinc prices don't improve, Cominco will extend the shutdowns," Goldie said.

There is also the possibility the company, fed up with the braying for discounts by its traditional buyers, could strike a deal with Japanese smelters.

Nor does Cominco seem overly concerned about losing market share, Goldie noted. Marginal suppliers only reopened mines about a year ago when

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• Cominco's mine move shows spine

Continued from Page 1

prices improved. With lower prices once again, these producers might be loathe to boost production until solid price gains have been made.

Besides, Goldie said, any expansions would take six months to complete. So Cominco is taking the lead in showing discipline.

"It demonstrates that at least one producer is willing to make a stand when it beleives it is not getting a fair price for its product," the analyst said.

Although it hasn't happened so far, that should translate into a tighter market and higher prices and Goldie is confident, with supply and demand in fairly close balance even before Cominco's actions, prices will respond.

Cominco itself projects world shortages. "Cominco and the smelters both have their eyes on the long term. Cominco wants to take full advantage of a world shortage of zinc concentrates which it expects will develop by the late 1980s," Goldie said.

And the late 1980s, incidentally, is when Cominco and NANA would like to bring the Red Dog project on line.

Resources Comm.

T H E

R E D   D O G

P R O J E C T

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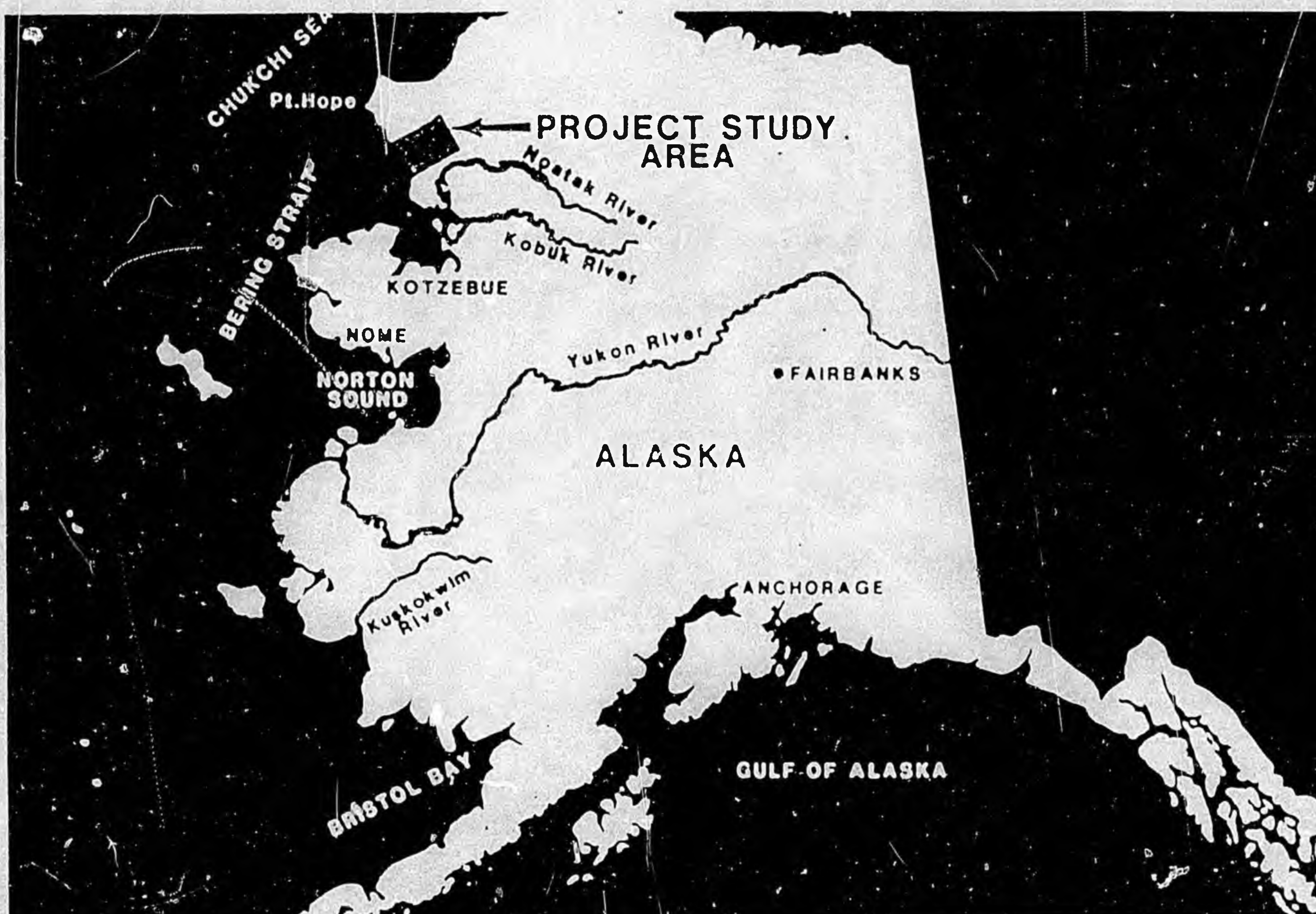
CHUKCHI SEA
Pt.Hope
PROJECT STUDY AREA
Noatak River
Kobuk River
BERING STRAIT
KOTZEBUE
NOME
NORTON SOUND
Yukon River
FAIRBANKS
ALASKA
ANCHORAGE
Kuskokwim River
BRISTOL BAY
GULF OF ALASKA

THE RED DOG PROJECT

1. MINERAL DEPOSIT

RED DOG IS A LARGE BASE-METAL MINERAL DEPOSIT IN NORTHWEST ALASKA CONTAINING ZINC, LEAD AND SILVER. IT IS LOCATED 90 MILES NORTHEAST OF THE VILLAGE OF KOTZEBUE, AND IS BEING DEVELOPED BY THE NANA CORPORATION AND COMINCO ALASKA, BOTH OF WHICH ARE ALASKAN CORPORATIONS.

RED DOG PROJECT

ORE RESERVES

85,000,000 TONS

ZINC	17.1 % (14,500,000 TONS)
LEAD	5.0 % (4,300,000 TONS)
SILVER	2.4 OUNCES/TON (204,000,000 OUNCES)

THE RED DOG PROJECT

1. MINERAL DEPOSIT CONTD.

THE DEPOSIT CONTAINS ALMOST 15 MILLION TONS OF ZINC, OR ENOUGH TO SUPPLY THE ENTIRE WESTERN WORLD FOR MORE THAN THREE YEARS.

IN TERMS OF SIZE, RED DOG IS THE SECOND LARGEST ZINC DEPOSIT EVER DISCOVERED IN THE WESTERN WORLD AND, AT FULL PRODUCTION, WILL BE THE LARGEST ZINC MINE IN THE WORLD.

RED DOG PROJECT
EMPLOYMENT

	Construction	Production
Construction	250	---
Mine	50	400
Service Industries	100	230
Total Employment	400	630

2. EMPLOYMENT

IN TERMS OF JOBS, DURING THE 24 TO 36 MONTHS OF CONSTRUCTION THERE WILL BE APPROXIMATELY 300 PEOPLE WORKING AT THE MINE SITE, AND MORE IN THE SERVICE INDUSTRIES. ONCE IN PRODUCTION ABOUT 400 PEOPLE WILL BE EMPLOYED AT THE MINE, AND AN ADDITIONAL 230 PEOPLE WILL BE WORKING IN THE INDUSTRIES SERVICING THE MINE.

RED DOG PROJECT

ANNUAL EXPENDITURE IN STATE

(Operating Period)

1985 DOLLARS

	$ Million
Mine Payroll and Benefits	20
Purchases	15
Transportation	20
Taxes	15
Royalties	30
Total per Year	$ 100 Million

Over 30 Years	$3,000,000,000
Over 50 Years	$5,000,000,000

Cominco Alaska

3. ANNUAL EXPENDITURES

WHEN THE MINE IS IN FULL OPERATION, IT IS ESTIMATED THE EXPENDITURES BY RED DOG IN ALASKA WILL AMOUNT TO $100 MILLION PER YEAR. THIS INCLUDES:

- MINE PAYROLL AND BENEFITS	$20 MILLION
- PURCHASES	$15 MILLION
- TRANSPORTATION	$20 MILLION
- TAXES IN ALASKA	$15 MILLION
- ROYALTIES TO THE REGIONAL CORPORATIONS	$30 MILLION
TOTAL	$100 MILLION

RED DOG WILL BE OPERATING FOR AT LEAST 50 YEARS, SO THE MINE WILL INJECT $5 BILLION INTO THE ALASKAN ECONOMY DURING THIS PERIOD. THESE FIGURES ARE IN 1985 DOLLARS AND DO NOT INCLUDE THE EFFECTS OF INFLATION.

THE PAYROLL IS WHAT WILL BE PAID THE PEOPLE WORKING AT THE MINE. THE PURCHASES IN ALASKA INCLUDE SERVICES (SUCH AS AIR CHARTERS AND AIR FARES, MAINTENANCE SERVICES, MEDICAL FEES) PLUS MATERIALS (SPARE PARTS, FUEL, FOOD AND CONSTRUCTION SUPPLIES).

RED DOG PROJECT

ANNUAL TRANSPORTATION EXPENDITURES IN ALASKA

1985 DOLLARS

	$ Million
Toll Fees to State	10
Operating and Maintenance	5
Trucking Contractor	5
Spent in Alaska per Year	$20 Million

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3. ANNUAL EXPENDITURES CONTD.

TRANSPORTATION PAYMENTS IN ALASKA, WHICH WILL BE $20 MILLION PER YEAR, INCLUDE THE TOLL FEES TO PAY BACK THE STATE INVESTMENT, USER FEES TO COVER THE OPERATING AND MAINTENANCE COST OF THE ROAD AND PORT, PLUS TRUCKING AND HANDLING THE INCOMING FREIGHT AND OUTGOING CONCENTRATES FROM RED DOG.

RED DOG PROJECT

ROYALTIES

1985 DOLLARS

	$ Million per Year
NANA Corporation	10
Alaskan Native Corporations	20
Total	$30 Million

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3. ANNUAL EXPENDITURES CONTD.

THE ROYALTY PAYMENTS WILL AVERAGE ABOUT $30 MILLION PER YEAR OVER THE LIFE OF THE PROJECT. THE NANA CORPORATION, THE OWNER OF THE MINERAL DEPOSIT AND COMINCO ALASKA'S PARTNER IN THE PROJECT, WILL KEEP ABOUT ONE-THIRD OF THIS AMOUNT, AND TWO-THIRDS WILL BE DISTRIBUTED TO THE OTHER ALASKAN NATIVE CORPORATIONS UNDER THE PROVISIONS OF SECTION 7 (i) OF ANCSA. THIS MONEY, WHICH WILL BE SPENT IN ALASKA, WILL PROVIDE ADDITIONAL JOBS AND SERVICES AROUND THE STATE, AND SHOULD SIGNIFICANTLY REDUCE THE TRANSFER PAYMENTS FROM THE STATE GOVERNMENT TO VARIOUS REGIONS OF ALASKA.

RED DOG PROJECT

STATE TAXES

1985 DOLLARS

	$ Millions		
	Per Year	Over 30 Years	Over 50 Years
Income and Mining Taxes			
RED DOG	$ 8	$ 240	$ 400
REGIONAL CORPORATION	4	120	200
TOTAL to State Government	$ 12	$ 360	$ 600
Borough Taxes			
RED DOG	3	90	150
TOTAL in State	$15	$ 450	$ 750

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3. ANNUAL EXPEDITURES CONTD.

THE TAXES THAT WILL BE PAID IN ALASKA INCLUDE THE STATE MINING LICENSE TAX AND CORPORATE INCOME TAX, WHICH WILL BE PAID BY BOTH COMINCO ALASKA AND THE REGIONAL CORPORATIONS. ALSO INCLUDED ARE BOROUGH TAXES, WHICH IT IS ESTIMATED WILL BE PAID BY COMINCO ALASKA. ALL THESE TAXES COULD AMOUNT TO ALMOST HALF A BILLION DOLLARS IN 30 YEARS.

RED DOG PROJECT
POSITIVE FACTORS

- Diversify Alaska's Economy
- New Opportunities for Alaska
- Benefit All Alaskans
- New Markets for Alaska

Cominco Alaska

4. KEY FACTORS

IN SUMMARY, THIS IS WHAT RED DOG MEANS TO THE STATE OF ALASKA:

- RED DOG WILL DIVERSIFY THE STATE'S ECONOMY BY PROVIDING $100 MILLION A YEAR IN PAYROLL, TAXES, ROYALTY PAYMENTS, AND THE PURCHASE OF GOODS AND SUPPLIES.

- RED DOG WILL PROVIDE ALASKA WITH NEW OPPORTUNITIES. AS THE FIRST MAJOR MINE IN ALASKA IN MODERN TIMES, THIS PROJECT WILL ENHANCE ALASKA'S REPUTATION IN THE THE WORLD AND ENCOURAGE FURTHER INVESTMENT.

- RED DOG WILL BENEFIT ALL OF ALASKA. THE JOBS AND MONEY PROVIDED BY THIS PROJECT WILL BE FELT ALL THE WAY FROM BARROW TO KETCHIKAN.

- RED DOG WILL PROMOTE NEW MARKETS AND TRADE. THE PRODUCTS FROM RED DOG WILL BE SOLD TO PACIFIC RIM COUNTRIES, AND THIS WILL OPEN DOORS FOR OTHER ALASKAN RESOURCES.

5. PRODUCTS

THE METALS PRODUCED BY RED DOG WILL BE ZINC, LEAD AND SILVER. THE MOST IMPORTANT PRODUCT IS ZINC, AS 80% OF RED DOG'S REVENUES WILL COME FROM THIS METAL, AND AT FULL PRODUCTION, RED DOG WILL BE THE LARGEST ZINC MINE IN THE WORLD.

ZINC IS A SHINEY BLUISH-WHITE METAL THAT PROVIDES CORROSION PROTECTIVE COATINGS FOR AUTOMOBILES, CHAIN LINK FENCES, STEEL SIDING, GARBAGE CANS AND MANY OTHER STEEL ITEMS. ZINC IS THE MAIN REASON THAT CARS NOW LAST UP TO 5 YEARS OR LONGER WITHOUT RUSTING. OTHER USES FOR ZINC ARE IN DIE-CAST PARTS SUCH AS CARBURETORS ON CARS OR SNOW MACHINES, AND SMALL CASTINGS AND PULLEYS ON WASHING MACHINES AND DISHWASHERS.

LEAD, LIKE ZINC, ALSO HAS MANY INDUSTRIAL USES. SOME OF THE PRODUCTS PRODUCED FROM LEAD ARE LEAD WEIGHTS FOR FISHING, BALLAST FOR BOATS, AND UNDERWATER CABLE SHEATHING. HOWEVER, THE MAJOR USES ARE IN BATTERIES FOR CARS, TRUCKS AND BOAT ENGINES, OR ANYTHING THAT NEEDS STORED ELECTRICAL POWER. OVER HALF OF THE WORLD'S LEAD GOES INTO LEAD ACID STORAGE BATTERIES.

SILVER IS A PRODUCT THAT NEEDS LITTLE INTRODUCTION. IT IS A PRECIOUS METAL THAT IS USED FOR JEWELERY, SILVER-WARE AND TABLE-WARE. SILVER IS ALSO ONE OF THE MAJOR CONSTITUENTS IN FILM AND IS USED IN THE ELECTRICAL AND HIGH-TECH INDUSTRIES BECAUSE OF SUPERIOR ELECTRICAL PROPERTIES.

RED OG PROJECT
PRODUCTION FORECAST
TONS PER YEAR

	Initial Stage	Full Production
Mined Ore	1,500,000	2,000,000
Zinc Concentrate	450,000	580,000
Lead Concentrate	90,000	120,000
Total Concentrate	530,000	700,000

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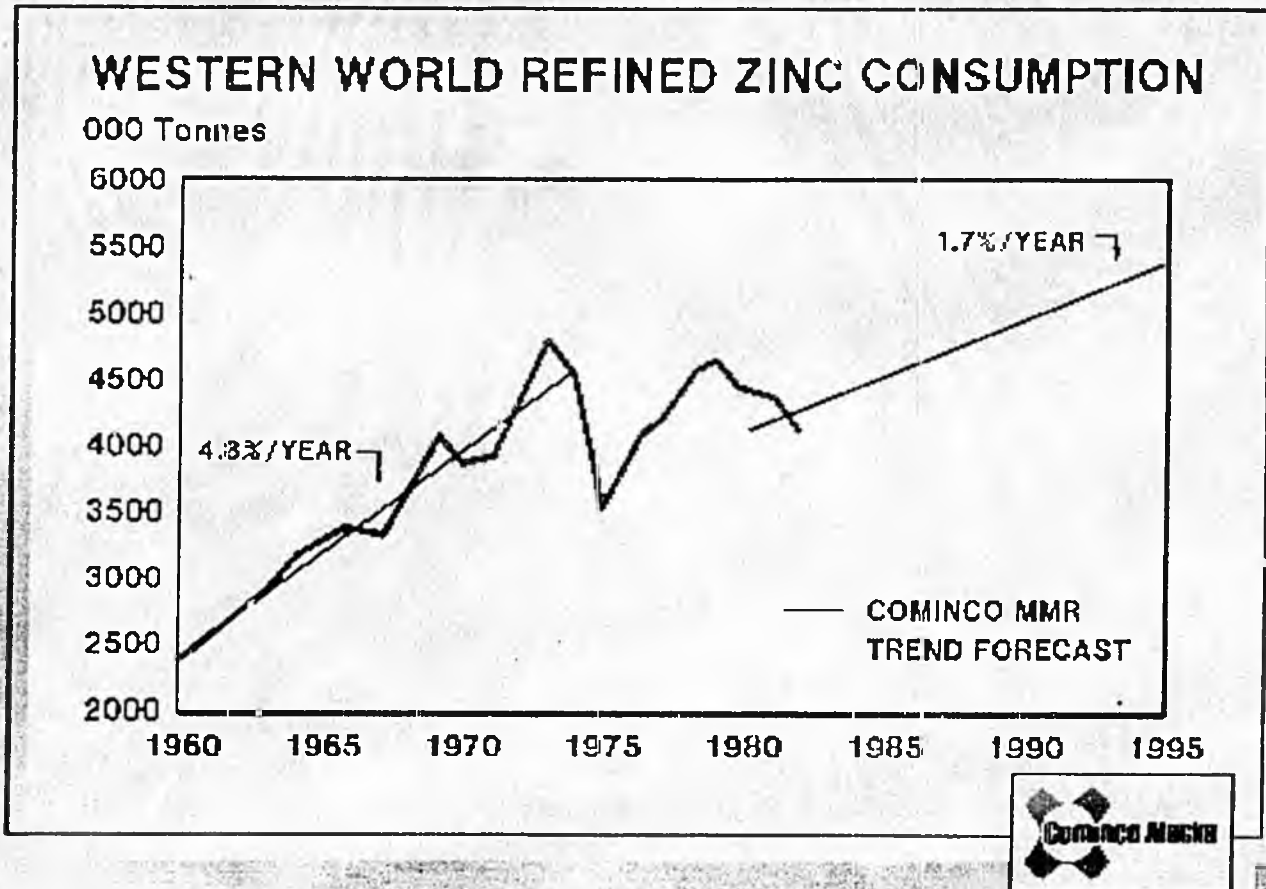
6. PRODUCTION AND MARKETS

THE RED DOG MINE WILL PRODUCE ZINC AND LEAD CONCENTRATES WHICH WILL BE SOLD TO SMELTERS IN EUROPE, CANADA, AND THE FAR EAST. THUS RED DOG WILL BE A MAJOR CONTRIBUTOR TO EXPANSION OF ALASKAN TRADE IN THE PACIFIC RIM COUNTRIES.

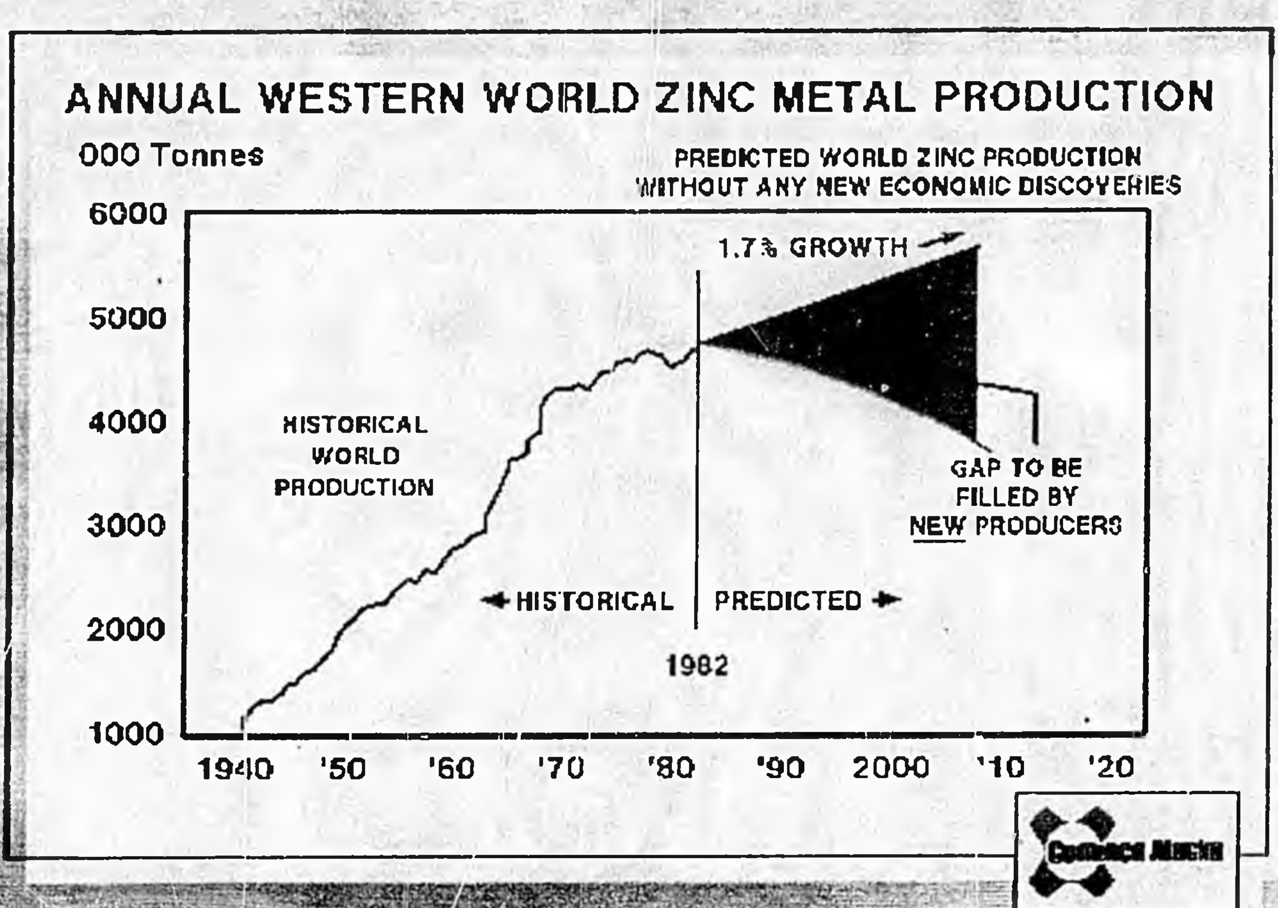
INITIALLY THE MINE WILL PRODUCE ABOUT HALF A MILLION TONS PER YEAR OF ZINC AND LEAD CONCENTRATES. WHEN AT FULL CAPACITY, RED DOG PRODUCTION WILL INCREASE TO 700,000 TONS OF CONCENTRATE ANNUALLY. ZINC IS THE KEY METAL, AND RED DOG WILL SUPPLY MORE THAN 5% OF THE WESTERN WORLD'S ZINC REQUIREMENTS.


WESTERN WORLD REFINED ZINC CONSUMPTION
000 Tonnes
6000
5500
5000
4500
4000
3500
3000
2500
2000
1960
1965
1970
1975
1980
1985
1990
1995
4.3%/YEAR
1.7%/YEAR
COMINCO MMR
TREND FORECAST

6. PRODUCTION AND MARKETS CONTD.

RECENT STUDIES ON THE FUTURE MARKETS FOR RED DOG ZINC ARE ENCOURAGING. A DEFINITE MARKET OPPORTUNITY HAS BEEN IDENTIFIED AT THE END OF THIS DECADE, BASED ON AN ANTICIPATED INCREASE IN ZINC DEMAND OF BETWEEN 1% AND 2% PER YEAR.

THIS GRAPH SHOWS, ON THE LEFT, THE HISTORICAL GROWTH RATE OF ALMOST 5% PER YEAR DURING THE 60'S AND 70'S. THE CURRENT PROJECTION OF 1.7% PER YEAR IS SHOWN ON THE RIGHT. EVEN THOUGH THIS RATE IS LOWER, THE ANNUAL INCREASE IS CLOSE TO WHAT IT HAS BEEN IN THE PAST, AS THE CONSUMPTION IS HIGHER.



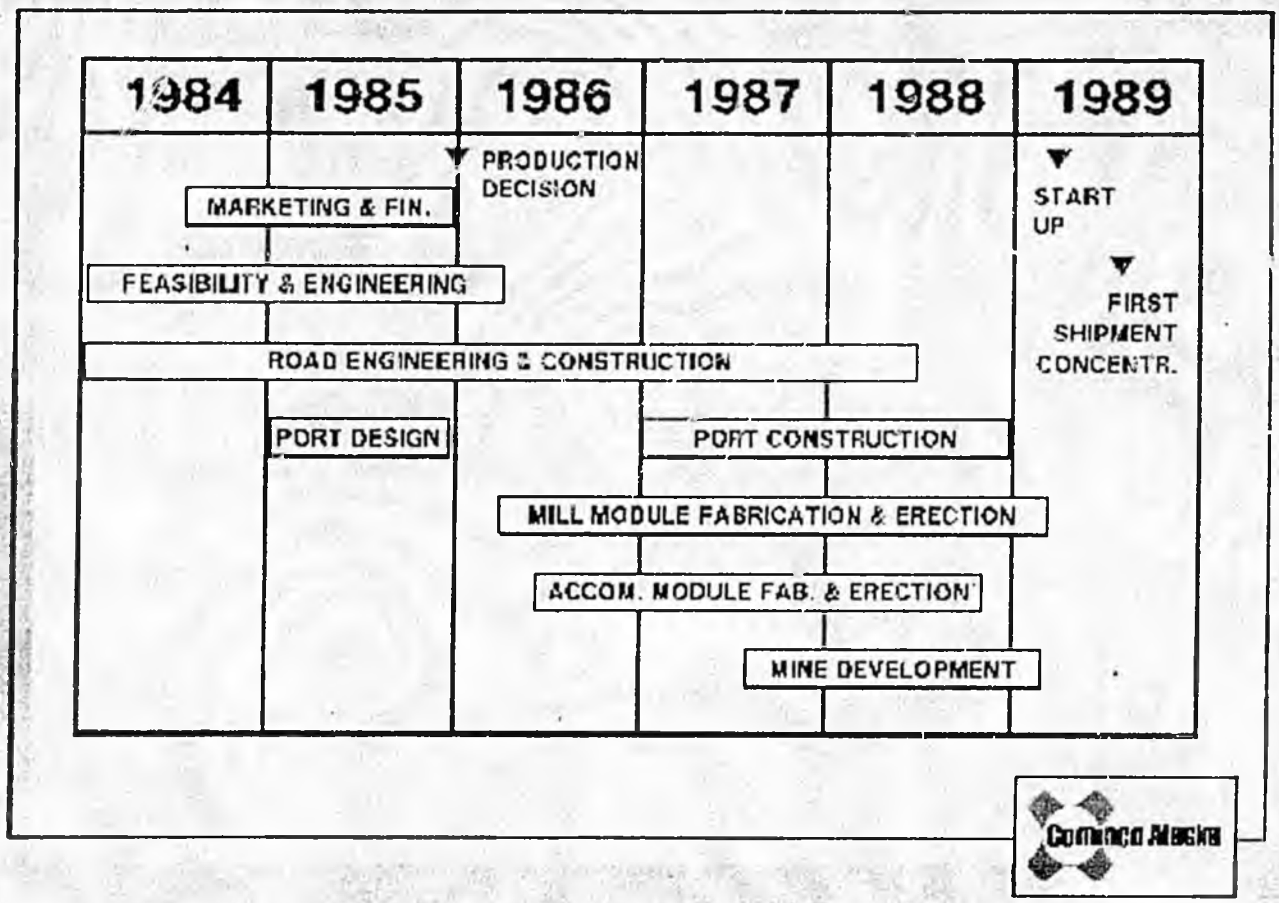
ANNUAL WESTERN WORLD ZINC METAL PRODUCTION
000 Tonnes
PREDICTED WORLD ZINC PRODUCTION
WITHOUT ANY NEW ECONOMIC DISCOVERIES
6000
5000
4000
3000
2000
1000
1.7% GROWTH
HISTORICAL
WORLD
PRODUCTION
GAP TO BE
FILLED BY
NEW PRODUCERS
HISTORICAL
PREDICTED
1982
1940
'50
'60
'70
'80
'90
2000
'10
'20

6. PRODUCTION AND MARKETS CONTD.

THE OTHER MAJOR FACTOR THAT HAS BEEN IDENTIFIED IS A DECLINE IN PRODUCTION IS DUE TO CLOSURES OF MAJOR MINES IN CANADA, GREENLAND, W. GERMANY AND AUSTRALIA. THE TRIANGLE ON THE RIGHT OF THIS GRAPH SHOWS THE GAP, BETWEEN THE INCREASE IN CONSUMPTION AND DECREASE IN PRODUCTION, THAT MUST BE FILLED. IF RED DOG IS ON-STREAM BY THE END OF THIS DECADE, IT WILL FILL ABOUT HALF OF THE GAP. THE REMAINDER WILL BE FILLED BY SOME OF THE OTHER POTENTIAL MINES THAT ARE BEING LOOKED AT NOW.

RED DOG IS THE MOST LOGICAL SOURCE TO SUPPLY THE WORLD WITH THIS ADDITIONAL ZINC, FROM THE STANDPOINT OF TIMING, LOCATION, AND PRODUCTION COSTS. WITH STATE ASSISTANCE IN FINANCING THE ROAD AND PORT FACILITIES, COMINCO ALASKA CAN BRING THE RED DOG PROJECT INTO PRODUCTION BY THE END OF THE 1980'S.

THIS TIMING IS CRITICAL. THE WORLD'S ZINC INDUSTRY IS VERY COMPETITIVE, PARTICULARLY FOR MARKETS, AND THERE ARE OTHER POTENTIAL MINES, IN AUSTRALIA, AND EVEN CLOSER TO HOME, IN WISCONSIN, LOOKING AT THE SAME SALES OPPORTUNITIES AS RED DOG, AND THERE PROBABLY ISN'T ROOM IN THE PRODUCTION GAP FOR ALL THESE POTENTIAL MINES. AT THE PRESENT TIME, RED DOG IS AHEAD OF THE COMPETITION. BUT A DELAY COULD RESULT IN LOSS OF THAT MARKET OPPORTUNITY, AND IT MIGHT BE NECESSARY TO WAIT SEVERAL YEARS BEFORE ANOTHER MARKET FOR RED DOG CONCENTRATES BECOMES AVAILABLE. THE STATE OF ALASKA CAN BE THE CATALYST THAT WILL KEEP THE PROJECT MOVING.


1984
1985
1986
1987
1988
1989
PRODUCTION DECISION
START UP
FIRST SHIPMENT CONCENTR.
MARKETING & FIN.
FEASIBILITY & ENGINEERING
ROAD ENGINEERING & CONSTRUCTION
PORT DESIGN
PORT CONSTRUCTION
MILL MODULE FABRICATION & ERECTION
ACCOM. MODULE FAB. & ERECTION
MINE DEVELOPMENT
Cominco Alaska

7. SCHEDULE

THE PRESENT PROJECT SCHEDULE REQUIRES A COMMITMENT FROM THE STATE LEGISLATURE DURING THE 1985 SESSION, FOR THE METHODS TO FINANCE THE ROAD AND PORT, SO THAT COMINCO WILL BE IN A POSITION TO MAKE THE PRODUCTION DECISION. TO ENSURE THAT THERE WILL BE NO DELAY IN THE SCHEDULE, COMINCO ALASKA IS PROCEEDING WITH THE DETAILED DESIGN AND ENGINEERING WORK IN 1985, EVEN THOUGH THE PROJECT HAS NOT BEEN APPROVED. THIS WILL PUT THE PROJECT IN A POSITION TO MOVE AHEAD WITH CONSTRUCTION IN 1986 IF THE LEGISLATURE APPROVES THE FINANCING. THE REMAINDER OF THE SCHEDULE IS AS FOLLOWS:

- 1986
  - AIDA ISSUES ROAD AND PORT CONTRACTS
  - COMINCO COMMENCES MODULAR CONSTRUCTION OF MILL
- 1987
  - AIDA CONTRACTOR CONSTRUCTS ROAD AND PORT FACILITIES
  - CONTINUE MODULAR CONSTRUCTION OF MILL
  - COMINCO STARTS TO DEVELOP MINE SITE
- 1988
  - COMPLETE ROAD AND PORT FACILITIES
  - MODULES MOVED TO MINE SITE
- 1989
  - RED DOG PRODUCTION BEGINS
  - FIRST CONCENTRATES SHIPPED TO WORLD MARKETS

RED DOG PROJECT

ESTIMATED CAPITAL INVESTMENT

1985 DOLLARS

	$ Million
Mine Preparation	60
Mill and Services	125
Power	35
Exploration and Feasibility	30
Road and Port	150
	$400 M

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8. INVESTMENT

THE CAPITAL COST OF THE RED DOG PROJECT IS ESTIMATED TO BE $400 MILLION, IN 1985 DOLLARS, OF WHICH $250 MILLION IS REQUIRED FOR MINE FACILITIES AND DEVELOPMENT, AND APPROXIMATELY $150 MILLION TO DEVELOP THE TRANSPORTATION SYSTEM. THIS IS THE PRESENT PRELIMINARY ESTIMATE, AND CONCEPTS ARE STILL BEING STUDIED TO DETERMINE IF THE COSTS CAN BE FURTHER REDUCED. COMINCO WILL FINANCE THE $250 MILLION FOR THE MINE THROUGH CONVENTIONAL MEANS, INCLUDING EQUITY AND BANK LOANS.

THE MAJOR ECONOMIC HURDLE FOR RED DOG IS THE HIGH COST OF THE TRANSPORTATION SYSTEM, WHICH AMOUNTS TO ALMOST 40% OF THE TOTAL PROJECT COST. THIS COMPARES WITH COMINCO'S RECENT ARCTIC DEVELOPMENTS IN CANADA AND GREENLAND, WHERE TRANSPORTATION WAS LESS THAN 10% OF THE TOTAL PROJECT. AND IN MORE DEVELOPED AREAS OF THE WORLD, IN MANY CASES THE COST OF TRANSPORTATION IS ALMOST NIL, AS THE INFRASTRUCTURE ALREADY EXISTS. IF RED DOG WAS IN THE SAME POSITION, STATE ASSISTANCE WOULD NOT BE REQUIRED. SO THIS IS WHERE THE STATE CAN PLAY THE KEY ROLE.

AS HAS BEEN NOTED EARLIER IN THIS REPORT, THE RED DOG PROJECT IS DEPENDENT UPON THE STATE LEGISLATURE TO ASSIST IN FINANCING THE ROAD AND PORT IN ORDER TO BRING THE MINE INTO PRODUCTION BY 1989. THE TYPE OF FINANCING BEING SUGGESTED IS UNIQUE TO ALASKA, BUT NOT TO OTHER

8. INVESTMENT CONTD.

PARTS OF THE WORLD SUCH AS CANADA OR AUSTRALIA, WHERE SUPPLY OF INFRASTRUCTURE BY THE GOVERNMENT, TO ENCOURAGE RESOURCE DEVELOPMENT, IS A COMMON OCCURRENCE. IT IS BEING PROPOSED THAT THE LEGISLATURE RATIFY AN AGREEMENT WHICH WILL PROVIDE FUNDS TO BUILD THE ROAD AND PORT ON A LONG-TERM BASIS, TO CONVERT PART OF THE COST FROM A CAPITAL TO AN OPERATING BASIS, AND THUS ALLOW COMINCO ALASKA TO FINANCE THE MINE PORTION OF THE PROJECT. THIS WILL ALSO PUT RED DOG ON AN EQUAL FOOTING WITH THE REST OF THE WORLD, BY REDUCING THE ECONOMIC PENALTY FOR RESOURCE DEVELOPMENT IN ALASKA, CAUSED BY LACK OF TRANSPORTATION.

RED DOG PROJECT

COMINCO ALASKA COMMITMENTS

- Pay Toll Costs
- Pay Operating and Maintenance Costs
- Start Mine Production
- Repay State Investment, if Significant Delay

9. COMINCO ALASKA COMMITMENTS

THIS IS NOT A ONE WAY COMMITMENT. IN RETURN FOR THIS FINANCING, COMINCO ALASKA WILL PAY BACK TO THE STATE THEIR INVESTMENT IN THE TRANSPORTATION SYSTEM. WE ARE ALSO PREPARED TO GIVE THE FOLLOWING DEFINITE GUARANTEES:

- COMINCO ALASKA WILL GUARANTEE TO PAY THE TOLL FEES WHICH WILL REPAY THE STATE INVESTMENT.
- COMINCO ALASKA WILL GUARANTEE TO PAY THE COST OF OPERATION AND MAINTENANCE OF THE FACILITIES
- COMINCO ALASKA GUARANTEES TO START PRODUCTION AT THE MINE WITHIN A DEFINITE TIME PERIOD
- COMINCO ALASKA GUARANTEES THAT IF IT IS NECESSARY TO POSTPONE DEVELOPMENT OF THE MINE, IT WILL STILL REPAY THE STATE THE MONEY IT HAS INVESTED IN THE SYSTEM

IN EFFECT, THESE GUARANTEES ELIMINATE THE ELEMENT OF RISK FOR THE STATE IN THE TRANSPORTATION INVESTMENT.

RED DOG PROJECT
TRANSPORTATION SYSTEM
MAJOR ADVANTAGES

- Owned by State of Alaska
- Multipurpose Facility
- Benefit the Region

Cominco Alaska

10. MAJOR ADVANTAGES

MORE IMPORTANTLY, THE ROAD AND PORT WILL BE A MULTI-PURPOSE FACILITY OWNED BY THE STATE OF ALASKA. IT IS VERY LIKELY THERE WILL BE FURTHER DEVELOPMENT IN THIS REGION OF ALASKA. FOR EXAMPLE, GCO MINERALS COMPANY IS STUDYING THE FEASIBILITY OF THE LIK DEPOSIT JUST NORTH OF RED DOG, AND WOULD THEREFORE USE BOTH THE ROAD AND PORT FACILITIES. THIS REGION OF ALASKA HAS BEEN DESCRIBED AS THE "NOATAK ZINC BELT" AND IT IS ANTICIPATED THAT OTHER DEPOSITS WILL BE DISCOVERED. WHILE THE ROAD WILL INITIALLY LINK RED DOG WITH THE COAST, IT WILL UNDOUBTEDLY BE USED FOR THESE OTHER PROJECTS.

AS WELL, THE PORT FACILITIY WILL BE OF MAJOR BENEFIT TO THE PEOPLE IN THE WESTERN REGION. IT SHOULD REDUCE THE COST OF BRINGING IN FUEL AND SUPPLIES, DUE TO THE BACKHAUL CAPABILITIES WHICH WILL BE AVAILABLE BECAUSE OF THE RED DOG PROJECT.

RED DOG PROJECT

STATE INCOME

(Over 30 Years)

1985 DOLLARS

	\$ Million Over 30 Years
Direct Taxes to State	360
Toll Fees to AIDA	260
	\$620

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11. STATE GOVERNMENT INCOME

THE PROPOSAL PROVIDES FOR REPAYMENT OF THE CAPITAL COSTS OVER A 30 YEAR PERIOD. BASED ON THE PRESENT COST ESTIMATES, THE PROJECTIONS SHOW THAT DURING THIS PERIOD COMINCO ALASKA WILL PAY AIDA TOLL FEES OF ABOUT $260 MILLION, WHICH WILL RECOVER THE $150 MILLION INVESTMENT, PLUS $110 MORE. IN ADDITION, COMINCO ALASKA AND THE REGIONAL CORPORATIONS WILL PAY TAXES TO THE STATE GOVERNMENT OF $360 MILLION.

ALL OF THIS AMOUNTS TO OVER $600 MILLION, SO THE STATE WILL RECOVER THEIR INITIAL INVESTMENT MORE THAN FOUR TIMES OVER. AND THIS DOES NOT INCLUDE ALL THE SPIN-OFFS FROM THE $3 BILLION THAT RED DOG WILL INJECT INTO THE ALASKAN ECONOMY DURING THE PAYBACK PERIOD.

RED DOG PROJECT

REGIONAL BENEFITS

- Increase Income
- Reduce Transfer Payments
- Less Dependence on Government
- Reduce Unemployment
- Provide Economic Base

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12. REGIONAL BENEFITS

THE PROJECT WILL PROVIDE JOBS, OPEN UP MARKETS AND TRADE TO THE PACIFIC RIM, AND GENERATE NEW BUSINESS IN ALASKA.

AND, THERE WILL BE, PARTICULARLY IN NORTHWEST ALASKA:

- INCREASED INCOME DUE TO THE NEW JOBS BEING CREATED
- A REDUCTION IN TRANSFER PAYMENTS FROM THE STATE
- LESS DEPENDENCE ON WELFARE AND GOVERNMENT EMPLOYMENT
- A DRAMATIC DECLINE IN THE UNEMPLOYMENT RATE
- A NEW ECONOMIC BASE PROVIDED FOR THE PEOPLE OF THE REGION AND FOR THE STATE OF ALASKA

THIS MAY APPEAR TO BE LESS IMPORTANT, BUT WHEN PERSONAL INCOME IN THIS REGION IS 88% DEPENDENT ON THE STATE AND FEDERAL GOVERNMENTS, IT IS INDEED SIGNIFICANT.

RED DOG PROJECT
COMINCO ALASKA EXPENDITURES

To End 1984	$25 Million
1985 Plan	15+ Million
To End 1985	$40+ Million

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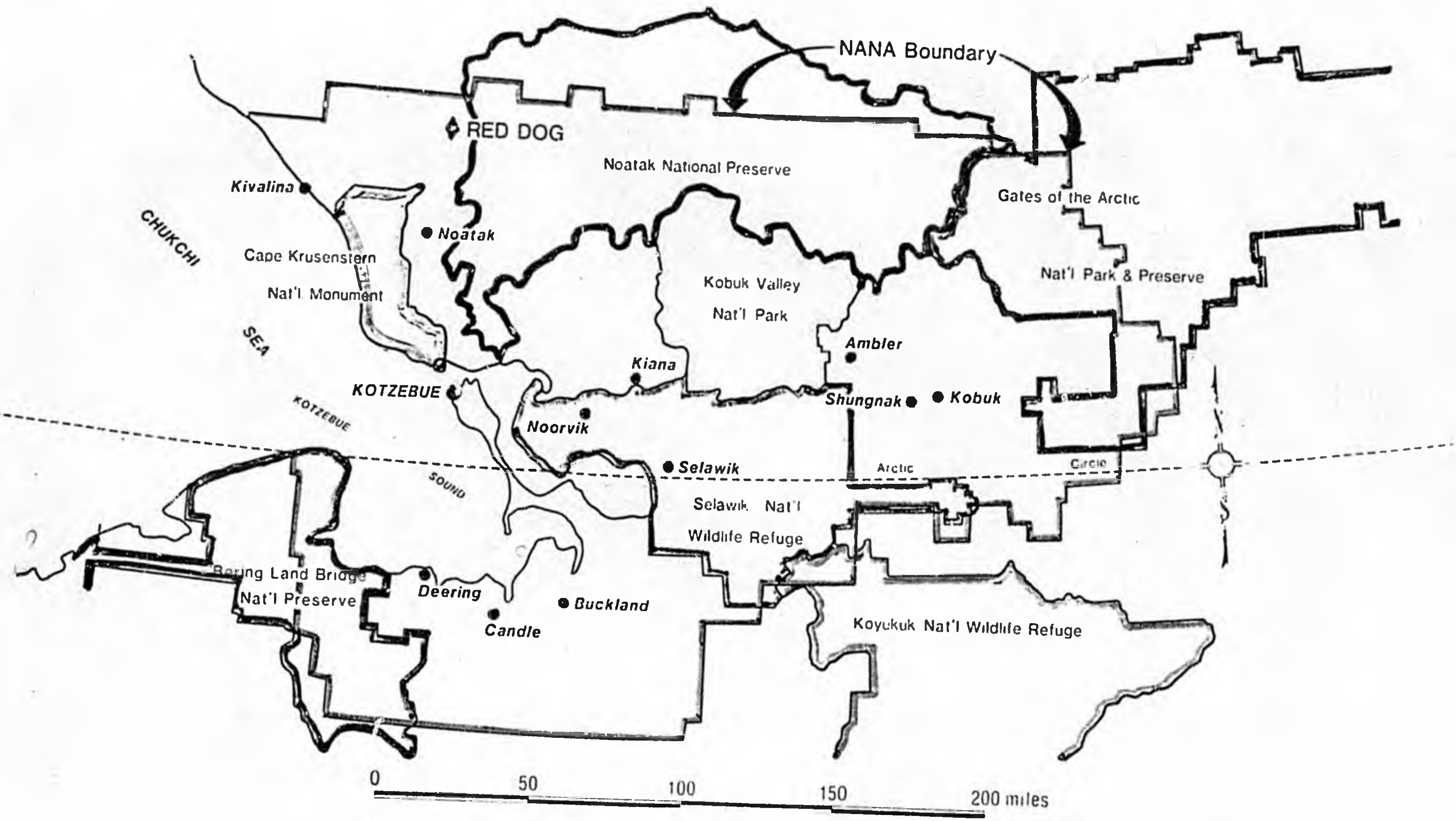
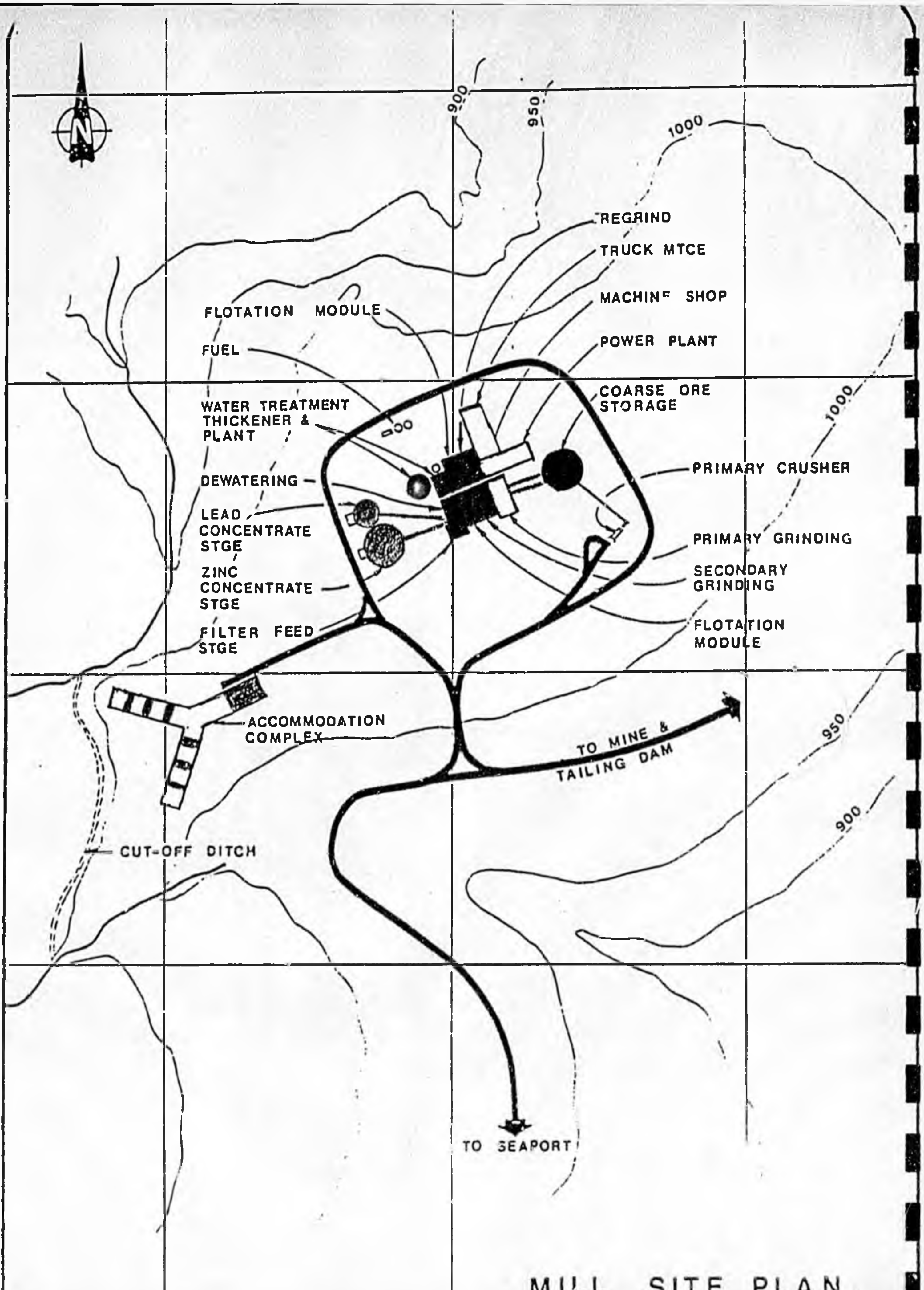
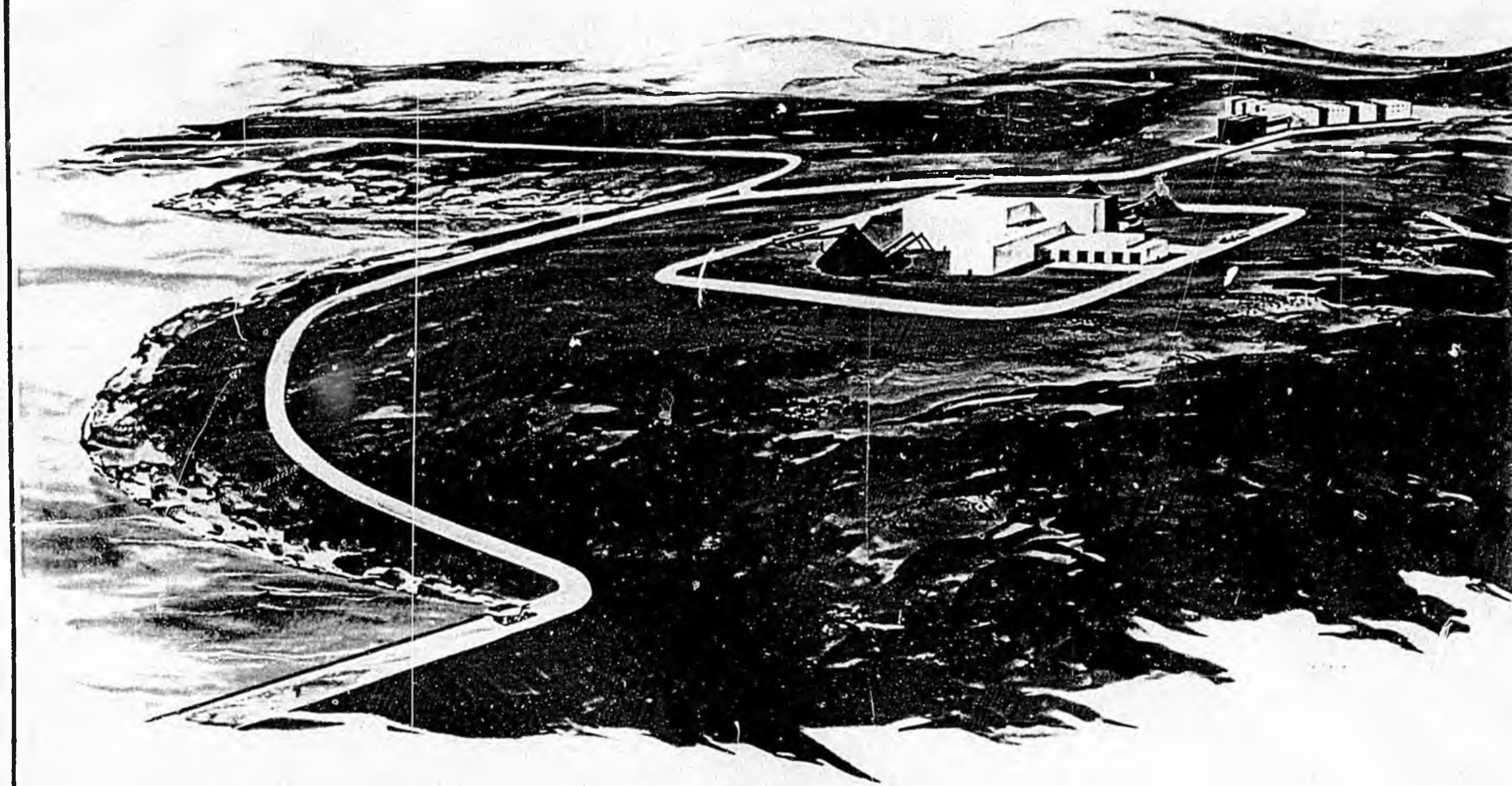
13. COMINCO ALASKA INVESTMENT

COMINCO ALASKA IS ENTHUSIASTIC ABOUT THE RED DOG PROJECT. IF THE STATE OF ALASKA CAN ASSIST THE PROJECT IN THE FINANCING OF THE ROAD AND PORT, COMINCO ALASKA IS PREPARED TO MOVE AHEAD AND BRING THE MINE INTO OPERATION BY THE END OF THIS DECADE. AS AN INDICATION OF COMINCO'S DEDICATION TO RED DOG, AND CONFIDENCE IN THE FUTURE VIABILITY OF THIS MINE, COMINCO ALASKA HAS INVESTED OVER $25 MILLION IN THE PROJECT, OVER THE LAST THREE YEARS, AND PLANNED EXPENDITURES IN 1985 WILL BRING THE TOTAL INVESTMENT TO OVER $40 MILLION BY THE END OF THE YEAR.

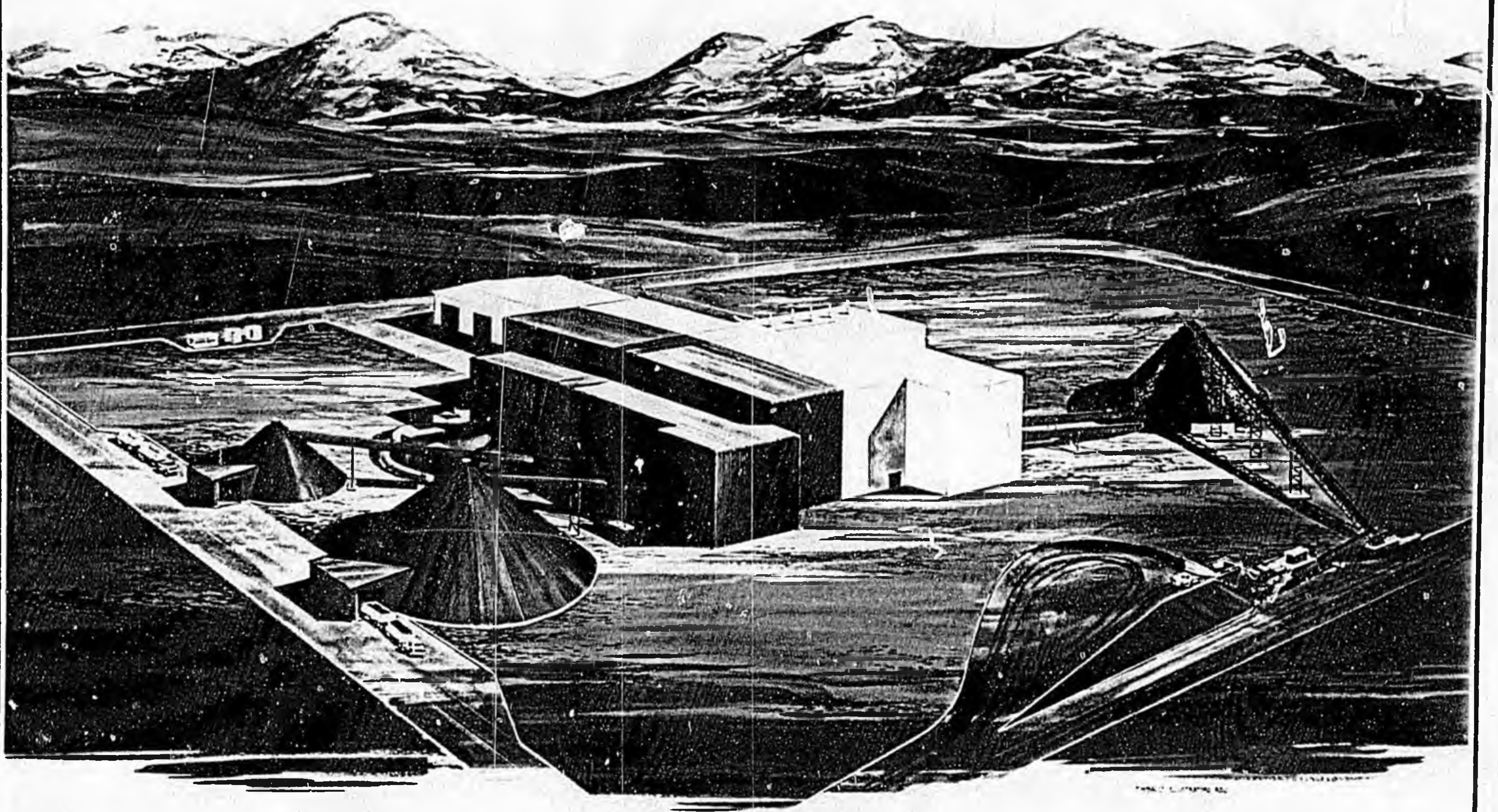

NANA Boundary
RED DOG
Noatak National Preserve
Kivalina
Noatak
CHUKCHI
SEA
Cape Krusenstern
Nat'l Monument
Kobuk Valley
Nat'l Park
Gates of the Arctic
Nat'l Park & Preserve
Ambler
Kiana
KOTZEBUE
Shungnak
Kobuk
KOTZEBUE
Noorvik
Selawik
SOUND
Arctic
Circle
Selawik Nat'l
Wildlife Refuge
Bering Land Bridge
Nat'l Preserve
Deering
Buckland
Candle
Koyukuk Nat'l Wildlife Refuge
0
50
100
150
200 miles



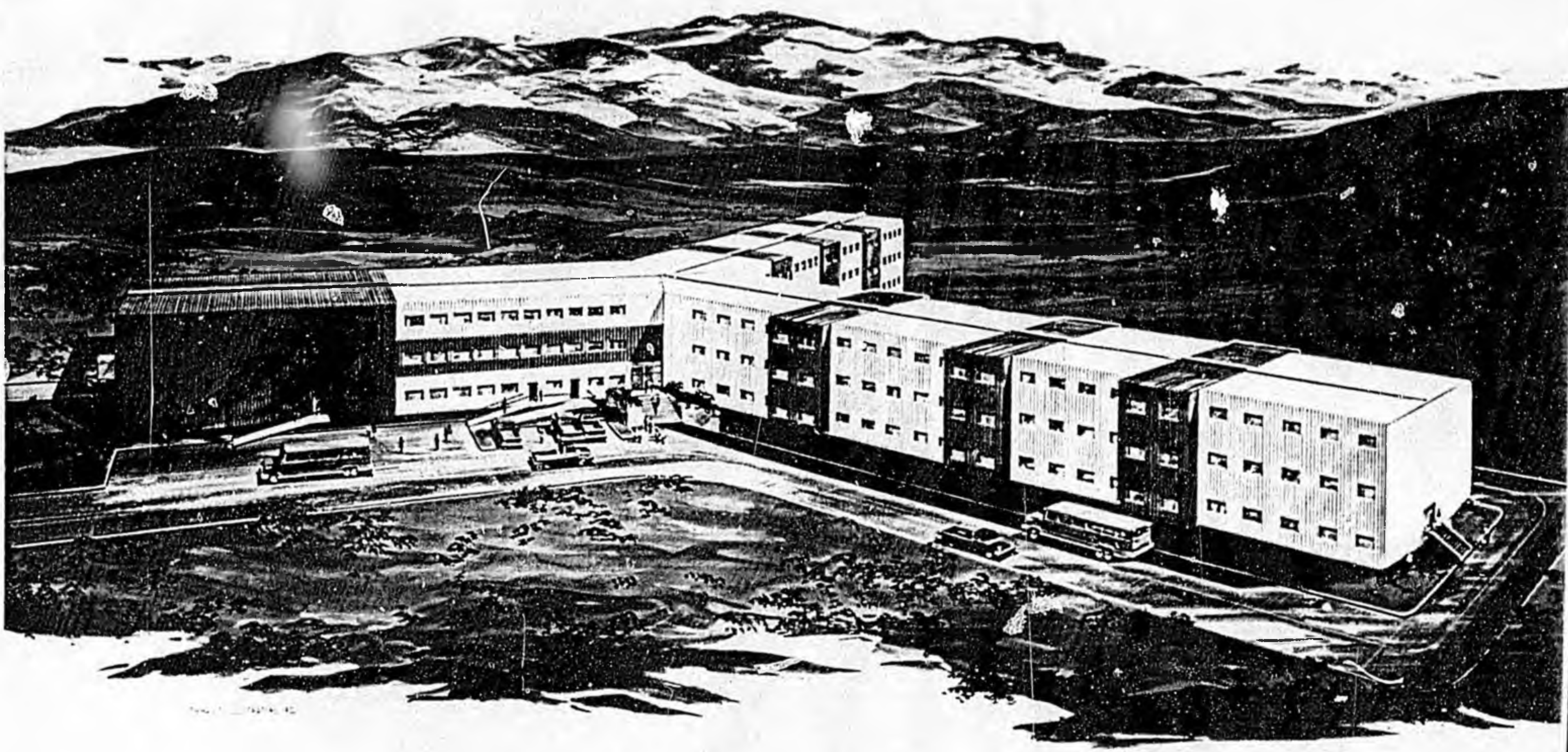
MILL SITE PLAN



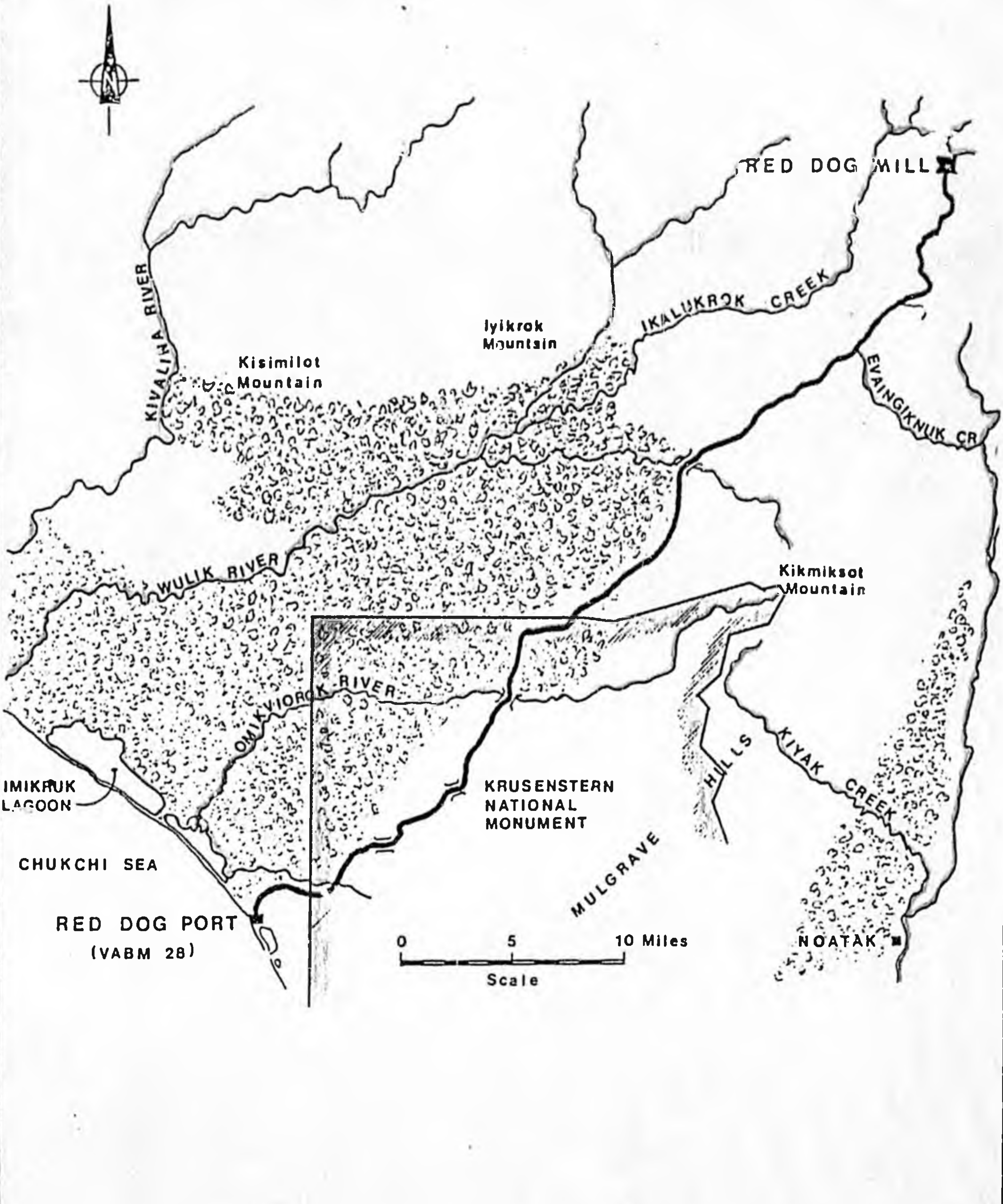
RED DOG PROJECT MIL. AND ACCOMMODATION COMPLEX



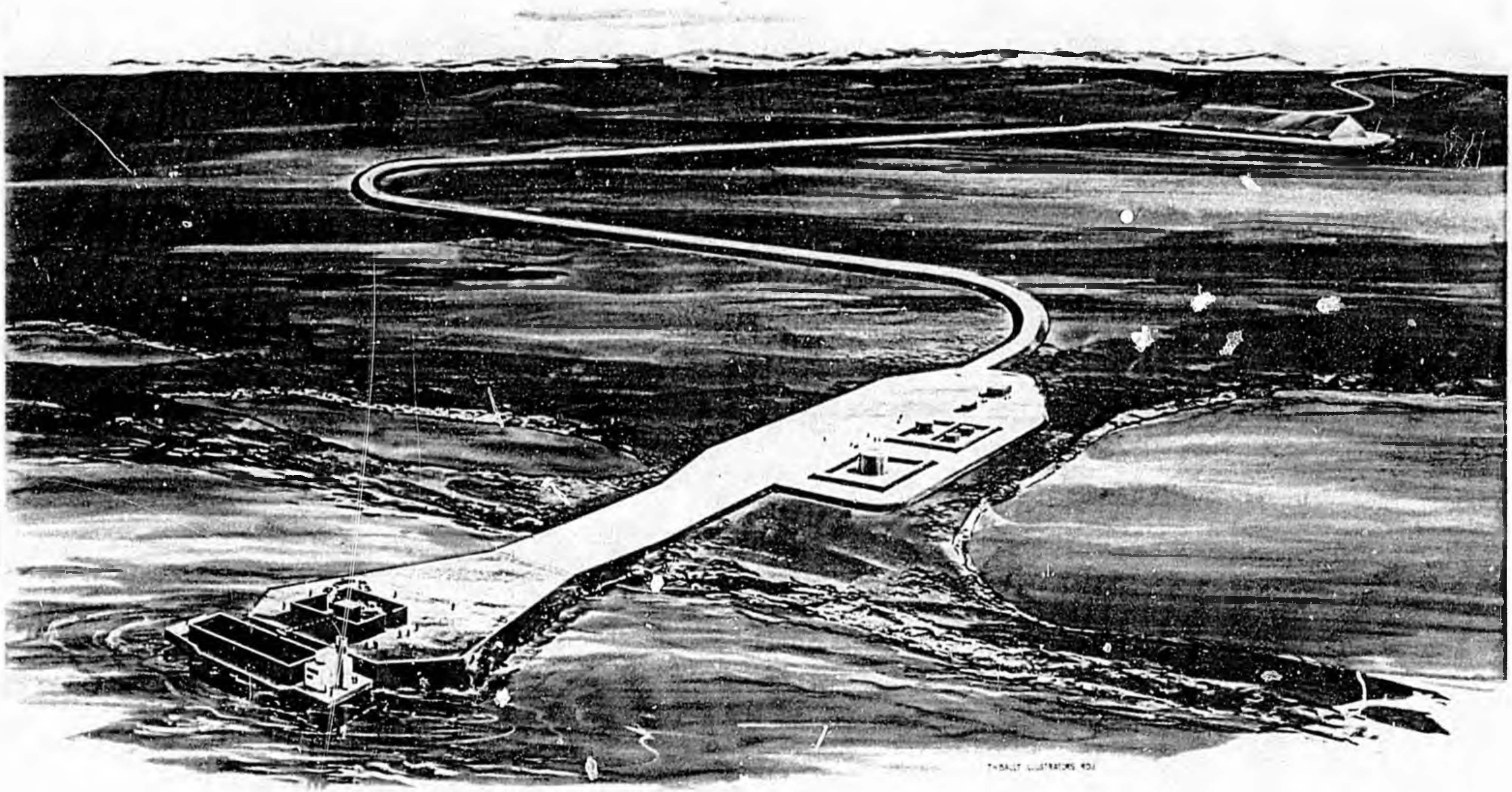
RED DOG PROJECT MILL COMPLEX



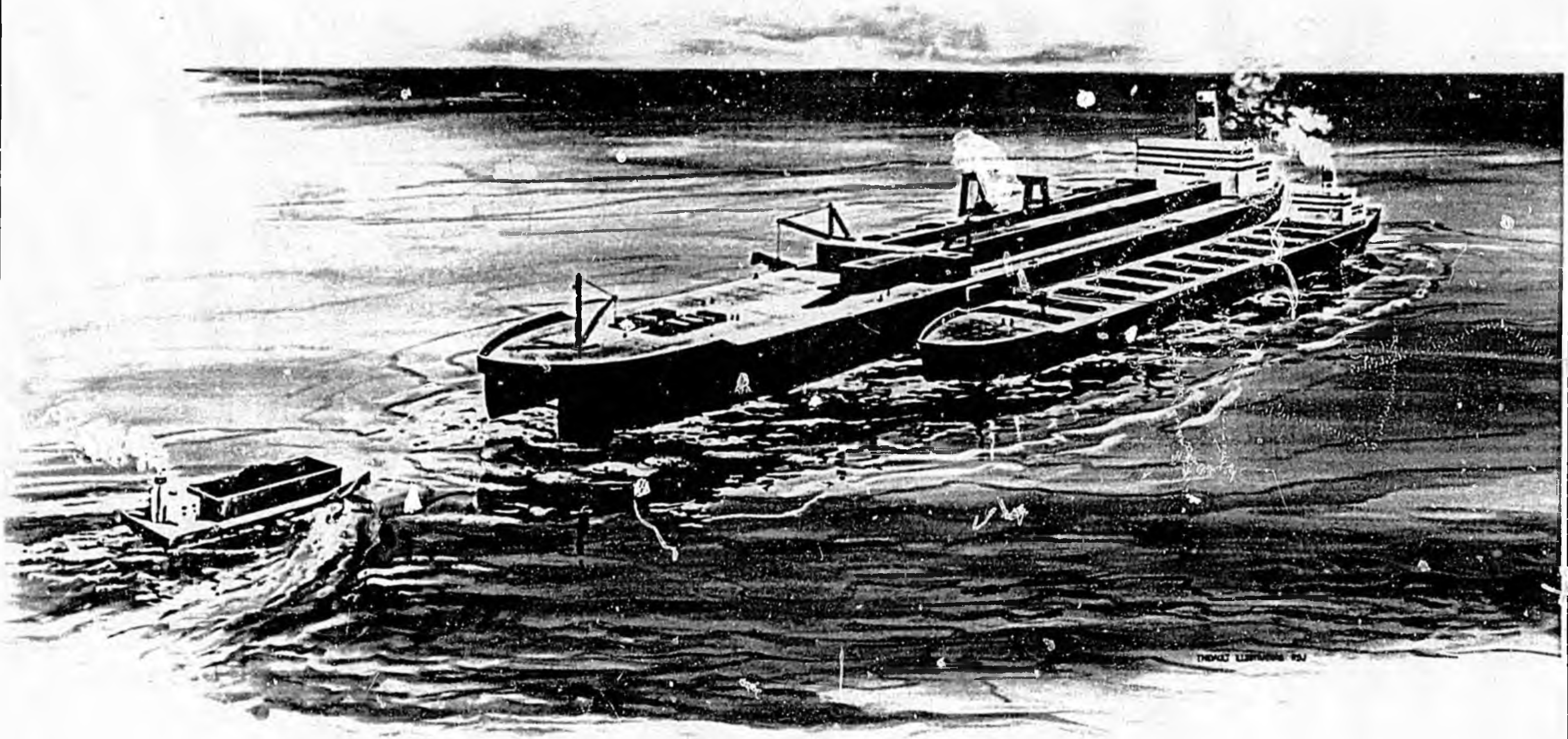
RED DOG PROJECT ACCOMMODATIONS AFTER YEAR 5


RED DOG MILL
IKALUKROK CREEK
Iyikrok Mountain
Kisimilot Mountain
KIVALINA RIVER
EVAINGIKNUK CR
WULIK RIVER
Kikmiksot Mountain
OMIKVIOROK RIVER
HILLS
KIYAK CREEK
KRUSENSTERN NATIONAL MONUMENT
IMIKRUK LAGOON
MULGRAVE
CHUKCHI SEA
RED DOG PORT
(VABM 28)
0
5
10 Miles
Scale
NOATAK

ROAD



RED DOG PROJECT PORT SITE



RED DOG PROJECT DEEP WATER DOCK

RED DOG PROJECT MINE AREA YEAR 20

1. KEY DATA

NOTE: The following key data is based on installed plant capacities.

1.0 LOCATION

A. OREBODY/MILL COMPLEX

The orebody is located 57 miles from the Chukchi Sea, east-north-east of Kivalina at the base of Deadlock Mountain; and 90 miles north of Kotzebue.

B. SEAPORT

The proposed location of the seaport is in the vicinity of VABM 28 about 17 miles southeast of Kivalina.

2.0 CLIMATIC DATA

Date	Max. Temp (°F)	Min. Temp (°F)	Snowfall (Inches)	Max. Wind (MPH)	Hours of Sunlight
1982 Oct	+ 30	- 12	12	N @ 40	9.3
Nov	+ 30	- 20	21	SE @ 50	5.0
Dec	+ 28	- 28	7	E @ 30	0.0
1983 Jan	+ 30	- 34	1	NW @ 30-40	2.5
Feb	+ 29	- 20	1	NE @ 30	7.3
Mar	+ 33	- 10	9	NE @ 35	11.5
Apr	+ 31	- 1	3	N @ 20	15.5
May	+ 60	+ 12	--	S @ 30	20.2
Jun	+ 82	+ 22	7	S @ 30	24.0
Jul	+ 92	+ 38	--	NE @ 30	24.0
Aug	+ 59	+ 19	--	N @ 20	17.5
Sep	+ 46	+ 8	--	SW @ 30	13.5
Oct (not recorded)	--	--	--	--	9.3
Nov	+ 52	- 25	14	NE @ 50	5.0
Dec	+ 51	- 30	--	SE @ 45	0.0
1984 Jan	+ 36	- 45	10	NW @ 30	2.5
Feb	+ 5	- 48	--	NW @ 30	7.3
Mar	+ 36	- 12	1	N @ 15	11.5

3.0 ORE RESERVES

	Tons	% Pb	% Zn	oz/ton Ag
Published Data	85×10^6	5.0	17.1	2.4

4.0 PRODUCTION SCHEDULE

	Feed Tons		Feed Grade		Concentrate Tons/Yr			Design
Years	Day	Year	% Pb	% Zn	Pb	Zn	Total	Tons/Day
1	--	1,000,000	6	21	70,000	315,000	385,000	6,400
2 and 3	5,150	1,800,000	6	21	125,000	580,000	705,000	6,400
4 to 20	5,700	2,000,000	5	19	115,000	580,000	695,000	6,400
21 to 30	5,700	2,[illegible],000	5	16	115,000	490,000	605,000	6,400

5.0 WORK SCHEDULES -- OPERATIONS

a) All employees:

-- 7 days per week

b) Mine:

-- 10 hours per shift, 2 shifts per day, 700 shifts/year

c) Concentrator, Power Plant:

-- 12 hours per shift, 2 shifts per day, 700 shifts/year

d) Seaport:

-- 12 hours per shift, 2 shifts per day, 240 shifts/year Summer operation.

-- 12 hours per shift, 2 shifts per day, over the Winter period.

6.0 MINE -- FACILITIES

Primary Crusher - skid mounted, 300 HP Minpro Mineral Sizer.

7.0 CONCENTRATOR

	Length feet	Width feet	Height feet	Wt. tons	Plan Area Sq. Ft.
Modular Construction					
Primary Grinding Module #1	74	63	84	900	4,662
Primary Grinding Module #2	74	63	84	620	4,662
Secondary Grinding	130	63	84	1,390	8,190
Regrind	120	63	84	1,200	7,560
Flotation Module #1	74	64	70	890	4,736
Flotation Module #2	56	64	70	720	3,584
Flotation Module #3	120	64	59	1,090	7,680
Dewatering	96	60	59	1,400	5,760
Power Plant	132	66	46	1,450	8,712
Water Treatment	120	60	59	800	7,200
Subtotal				10,460	62,746
Conventional Construction					
Mill Shop	66	63	84	--	4,158
Warehouse (utilizes space under modules)	--	--	--	--	50,600
Vehicle Repair Shop	200	80	varies	--	16,000
Subtotal					70,758

8.0 CONCENTRATE STORAGE -- MILL SITE

Dome Structure 180 ft. dia. x 70 ft. high for Zn
(adequate for 3 weeks storage)
Dome Structure 100 ft. dia. x 42 ft. high for Pb
(adequate for 3 weeks storage)

9.0 MISCELLANEOUS MILL SITE

Fuel Storage	2 x 200,000 USG
Fresh Water Storage	350,000 USG
Coarse Ore Storage	6,000 ton

10.0 THICKENER

Water Treatment	90 ft. dia.

11.0 POWER SYSTEM

Demand: Nominal 13,900 kW ±10%
Peak 15,300 kW

Generators:	Main	Emergency
Number of units	5	3
Cylinders/unit	6	12
BHP -- full load	5,310	
Kw -- full load/unit	3,800	500
-- total installed	19,000	1,500
RPM	600	1,800
Voltage	4,160	480

12.0 ACCOMMODATIONS

Modules	Length feet	Width feet	Height feet	Weight tons
Living (4 modules)*	144	52	50	1150 x 4
Communal	164	78	50	1400
Services	130	78	50	1100
TOTAL				7100

* Living modules will not be installed until year 5. Initial sleeping quarters will utilize the camp facilities left over from construction.

Facilities (after installation of final living modules)

- 111 single rooms
- 112 single (or 56-2 room suites), 8 two-roomed suites
- Dining capacity -- 235 people
- Gymnasium -- 90' x 78' x 24' high

12.0 ACCOMMODATIONS (continued)

AREA	SQ. FT.
Building Services	7,500
Storage	10,900
Laundry	1,100
Accommodations	59,150
Commons	39,370
Dining & Serving	3,520
Kitchen	1,600
Kitchen Storage	1,280
Administration	2,300
Infirmary	960
Gymnasium	7,000
Changerooms & Sauna	2,850
Hobby Rooms	3,800
Commissary	800
Lounges	1,970
Library	400
Radio/Communications	400
Post Office	140
Janitors' Rooms	420
TOTAL AREA	145,460

13.0 LAND TRANSPORTATION

a) Route from mine to VABM 28 through Krusenstern

Distance 57 miles
Elevation @ Mine + 1030 ft.
Elevation @ Port + 10 ft.
Maximum grade 4%
Road Width 30 ft.
No. of bridges -- 5
Passing lanes @ 2 mile intervals

b) Concentrate Haulage Trucks

6 - 700 HP tractors each with 2 side-dump or rear-dump trailers each with a 36 cu.yd. capacity.

14.0 PORT

a) Shallow Water Dock:

Sheetpile dock face in 10' water depth
Earthfill causeway 400' long

b) Deepwater Dock:

(i) Ship ballasted to seabed in 35' water depth with storage capacity for:
- 71,000 tons of Zn concentrate
- 38,000 tons of Pb concentrate
- 10,000,000 USG of Fuel
- Deck storage for 400 - 8'x8'x20' containers

(ii) 2 - 1,000 ton self-propelled lighter barges

c) Shore Facilities:

(i) Truck dump pad and barge loading facility.

(ii) Fuel transfer tank (50,000 USG) and truck loading facility.

(iii) Accommodations for 20 - left over camp from construction.

(iv) Small 250 kW power plant.

(v) Small storage building 40' x 40'.

(vi) Powder magazine.

d) Facilities at Mile 2.5:

(i) A-frame structure 180' x 1280' x 90' high to store 480,000 tons of concentrates.

(ii) Small 250 kW plant.

15.0 WATER SYSTEM

Fresh Water Consumption	° Process	-- Avg. =	449,280 USGPD
		-- Max. =	511,200 USGPD
	° Domestic	-- Avg. =	17,280 USGPD
		-- Max. =	64,800 USGPD

15.0 WATER SYSTEM (continued)

Recycled Water Consumption (from pond + dewatering) 8,534,880 USGPD

Fresh Water Supply

- Bons Creek Reservoir
- Drainage area -- 3.7 sq.mi.
- Daily usage -- 501,120 USGPD
- Dam height -- 37 ft. (30' for minimum storage)
- Dam crest length -- 280 ft.
- Total storage -- 630 ac.-ft.
- Live storage -- 246 ac.-ft.
- Dam crest elev. -- 852 ft.
- Normal water surface elev. -- 845 ft.

Fresh Water Facility Specs.

- Floating raft -- 16 ft. x 9 ft.
- Pumps: Type -- Vertical turbine
  No. -- 2 operating and 1 standby
  HP -- 75 each pump
- Pipeline: Material -- high density polyethelene (SCLAIR)
  Length -- 18,000 ft.
  Diameter -- 10 in. to main storage tank
  Heat Tracing -- 110 volt
  Insulation -- 2 inch styrofoam

Fresh Water Tank

- Elevation -- 1,030 ft.
- Dimension: Diameter -- 45 ft.
  Height -- 30 ft.
- Volume -- 350,000 USG

16.0 TAILING SYSTEM

	% Solids	Volume
Tailing -- from process to pond	18	4,208,000 USGPD

Tailing Embankment:

° Height -- 150 ft.

° Length -- 2,200 ft.

° Fill Volume -- 255,000 cu.yd. starter dam (2 million cu.yd. to Elev. 950)

Tailing Impoundments @ 950 Elev.

° Area -- 25,472,000 ft^2

° Volume -- 29,860 ac.-ft.

Tailing Facility Specs.

° Tailing line: Material -- H.D.P.E.

Length -- 3,500 ft.

Diameter -- 14 inches

Insulation -- 2 inches styrofoam

I. BACKGROUND

To help understand the Alaska Industrial Development Authority's (AIDA) potential role in the DeLong Mountains transportation project, some history is useful. Prior to 1984, AIDA could not have participated in projects such as that contemplated for the DeLong Mountains, in that State law did not permit AIDA to own projects, except in cases of default. Rather, what AIDA could do then, and still does now, is to issue tax exempt industrial development bonds to assist private investors in the financing of a variety of projects. AIDA has been very successful in this role, having issued over $700 million worth of tax exempt revenue bonds during the past few years. However, despite this success AIDA still could only play a passive role, in that AIDA could neither initiate or own projects.

During the 1984 legislative session, both the Governor and the Legislature decided that a more active State participant was needed for certain economic development projects. Many proposed developments are likely to be of a joint public-private nature, because of resource ownership, access, and so forth, hence an active state representative is needed. This is especially true if it appears that the State will become involved financially. For instance, in many situations, new infrastructure facilities have to be constructed before development can proceed. Although these facilities are, by and large, the responsibility of developers as a group, they are not necessarily the responsibility of any single developer. And, if the cost of providing the required infrastructure facilities has to be borne by one developer, it may be that these costs, in addition to the developer's other costs, are simply too much for the proposed project to bear, so the development does not proceed. In such cases, it may be appropriate for a governmental entity to construct the necessary infrastructure facilities, and then charge fees to all users to pay for the facilities. Furthermore, if the State decides to participate financially in providing these infrastructure facilities, it is much easier to do so via a governmental entity as opposed to directly with a private developer.

Of course, State government should not get involved in a development project simply because it is difficult for the developer to pay for some costs. Rather, State involvement should be based upon the benefits of the project to all Alaskans. In light of the State's almost singular dependence upon the petroleum industry, development of new, non-petroleum based or dependent industries is of critical importance. Further, when evaluating a proposed new development, it is important to keep in mind the total impact of that project or development. Generally the project is being evaluated during its start-up phase, where costs are significant and revenues are, at best, just starting. Since the State is concerned with the future economic situation, as well as the present, the benefits to the State over the long term must be given adequate weight, rather than focusing strictly on short term return.

II. WHY IS AIDA INVOLVED

The question remains, why did the Governor and the Legislature decide AIDA should have the ability to actively become involved in infrastructure projects such as discussed above. Although there may be other reasons, at least some of the major factors were:

(1) AIDA is a known, existing entity that has an independent legal existence from the State, but is still controlled by the State.

(2) AIDA can (and does) issue debt that is separate and distinct from the State.

(3) AIDA has experience with complex projects.

(4) AIDA has extensive experience with financing and bonding, particularly tax exempt bonding.

As a result, in 1984 the Legislature passed Chapter 162, which broadened AIDA's ability to participate in economic development projects. As well as expanding AIDA's powers, Chapter 162 also established a new fund in AIDA, the Economic Development fund, that is legally and financially separate from the Authority's existing fund. It is through this new fund that AIDA can exercise its new powers to:

(1) own and operate certain types of projects;

(2) charge user fees for these projects;

(3) issue debt for these projects; and

(4) accept state loans or grants for these projects

III. AIDA AND THE DELONG MOUNTAINS TRANSPORTATION PROJECT

Because of AIDA's newly acquired abilities, the decision was made to involve the Authority in the DeLong Mountains transportation project. The transportation project itself consists of a port and a 55 mile road in the western DeLong Mountains area, near Kivalina. The cost of the port is estimated at $65 million, and the cost of the road is estimated at $85 million, for a total estimated cost of $150 million for the project, with all figures in 1985 dollars. Although this region is a heavily mineralized area, only one mine site is presently close to going into production. This is the Red Dog deposit, a zinc, lead and silver deposit being jointly developed by Cominco Alaska and the NANA Regional Corporation. Other major deposits are known, such as GCO Mineral's Lik deposit, but development of these are thought to be five years or more behind Red Dog.

What is being considered at this time is to have AIDA construct the transportation project, and then charge fees (or tolls) to all users. At first, it is expected that Cominco Alaska would be the only significant user, but eventually other users are expected.

At this time, AIDA's continued involvement and eventual completion of the project looks favorable, however, no final "go-no go" decision has yet been made. Prior to making a final decision, the Authority has to prepare a Finance Plan, as prescribed by AS 44.88.173.

The Finance Plan has to identify the operational and capital costs of the project, and identify where all revenues will come from to pay these costs. The Finance Plan will offer a variety of financing options, with at least one of the options being that approach which minimizes any cost to the State. In preparing a Finance Plan, AIDA has identified the following guidelines:

(1) attempt to minimize the total costs of the project;

(2) minimize any State General Funds required;

(3) make maximum use of tax-exempt financing;

(4) design a plan that has the optimum chance of completing the project as expeditiously as possible; and

(5) never allow the State or AIDA to be in the position of having a completed project without a user, unless the State and AIDA are reimbursed for their investments.

IV. WHAT HAS OCCURRED TO DATE

Since AIDA became involved with the transportation project in the summer of 1984, a number of activities have occurred.

(1) A Resolution of Intent has been executed between the Department of Commerce and Economic Development and Cominco Alaska (Appendix A).

(2) An RFP for the Finance Plan (required by 44.88.173) has been prepared and distributed (Appendix B). A draft report is due this session of the Legislature. The statute requires that a Finance Plan be prepared and presented to the Legislature, the Governor and the State Bond Committee before issuing bonds or otherwise incurring debt for the project. It also mandates, among other things, that if a project requires financial assistance from the State, the state financial assistance must be available before bonds are issued for the project.

(3) An RFP for civil engineering services to verify cost figures for the road and port has been prepared and distributed.

(4) The Authority has assembled a team of legal and financial experts to assist with the project.

(5) Much attention has been focused on how to finance the project. For AIDA to build the project, it will need to have $150 million to pay for construction. These funds can come from a variety of sources, with the most likely ones being tax exempt revenue bonds, state loans to AIDA, and possibly state grants. A number of differing financial scenarios have been considered, all of which have indicated the need for some initial state financial involvement, for instance loans to AIDA.

(6) Last year the Legislature appropriated $3.4 million to AIDA for the project. To date, it has been used for the following items:

(1) Finance Plan costs of between $250,000 - $300,000
(2) Engineering services of $50,000 - $100,000
(3) Miscellaneous AIDA expenses of approximately $10,000

The remainder is available for various aspects of the DeLong Mountains transportation project consistent with the appropriation and finance plan.

(7) An additional $18 million request for a state loan to AIDA has been included in the Governor's FY86 Budget Request. As noted above, all analysis to date indicates the need for state loans, and this would constitute the initial capitalization.

V. WHAT IS PLANNED FOR THE FUTURE

The goal of this project is to allow development and production of the mineral resources of the western DeLong Mountains, along with the new employment and new economic activity that would result. Since this is a new (non-petroleum dependent) industry that will provide economic benefits to Alaskan citizens and State government over a long period, AIDA is eager to proceed with the project, assuming a suitable financial arrangement can be achieved. Although, of course, no results from the Finance Plan RFP are available yet, both the Department of Commerce and Economic Development and AIDA have made some initial calculations with respect to financing and costs and revenues associated with the transportation project. At this stage, under a range of different assumptions and alternatives, it is inevitably the case that State financial assistance is required, at least initially, if the transportation project and mineral development are to occur in the near future. The details of how much assistance would be required, and under what terms, will be provided in the Finance Plan. AIDA is continuing to meet with Cominco Alaska and NANA to devise an approach that minimizes any required financial assistance from the State, but still allows the project to proceed in an expeditious manner.

In closing, one seeming inconsistency needs to be discussed. The transportation project is being acclaimed as being part of a new self-supporting economic development project that will bring jobs, tax revenues, and increased economic activity to Alaska, yet a major part of this, and other discussions on the project center on the need for State financial assistance. While it is true that the project definitely appears to need State assistance, at least initially, to fairly appraise the true impact and value of the project, one must consider both the broad geographic and duration of the project. This infrastructure project will facilitate development of not just Red Dog, but also other mineral resources in the area. Further its benefits are by no means short term, but rather should go o for decades. So although there appears to be an initial financial need, when viewed in this broader perspective, available information suggests that the State may receive its initial investment back many times over. Indeed, the State's ultimate decision regarding financial involvement should consider all of these broadly based factors, and then proceed only if, in this broad perspective, it is a "good deal" for the people of Alaska.

APPENDIX A

STATE OF ALASKA

BILL SHEFFIELD, GOVERNOR

DEPARTMENT OF COMMERCE & ECONOMIC DEVELOPMENT

OFFICE OF THE COMMISSIONER

7TH FLOOR FRONTIER BLDG.
3601 C STREET, SUITE 722
ANCHORAGE, ALASKA 99503
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RESOLUTION OF INTENT

WHEREAS, the State of Alaska encourages the diversification of the Alaska economic base through the development of mineral resources; and

WHEREAS, the State of Alaska supports economic development in Alaska and the expansion of regional job opportunities; and

WHEREAS, the State of Alaska recognizes that the lack of transportation facilities in Northwest Alaska poses an economic barrier to the attainment of economic development; and

WHEREAS, the Alaska Department of Commerce and Economic Development is the principal state department responsible for facilitating economic development in all regions of the state; and

WHEREAS, Cominco, Alaska, a division of Cominco, American is considering the development of the Red Dog mineral deposit in the DeLong Mountains area; and

WHEREAS, other mineral resources have been identified in the area near the Red Dog mineral deposits; and

WHEREAS, the Alaska Department of Commerce and Economic Development, in a report entitled Red Dog Project Analysis, identified substantial regional benefits in the event that the DeLong Mountains transportation project is developed; and

WHEREAS, the projected cost of the development of the Red Dog mineral site, excluding the cost of developing transportation facilities, is estimated to be $290 million (in 1985 dollars); and

WHEREAS, the projected cost of the transportation facilities is estimated to be $152 million (in 1985 dollars); and

WHEREAS, the lack of available transportation facilities near the mineral deposit may substantially delay private development of the Red Dog mineral deposit; and

WHEREAS, it is contrary to the best interests of the state for there to be a substantial delay in the development of the DeLong Mountains mineral resources and, in particular, in the development of the Red Dog mineral deposit; and

WHEREAS, the transportation facilities which, among other public purposes, would be used in conjunction with the development of the Red Dog mineral deposit are collectively referred to as the Delong Mountains transportation project; and

WHEREAS, the Alaska Industrial Development Authority (AIDA), a public corporation of the State of Alaska has authority under Alaska Statutes Title 44, Chapter 88, to participate, either independently or in conjunction with a private developer, in the financing and development of public transportation facilities such as the DeLong Mountains transportation project;

NOW THEREFORE BE IT RESOLVED that Cominco, Alaska and the Alaska Department of Commerce and Economic Development, on behalf of the State of Alaska, agree to the following STATEMENTS OF INTENT:

1. The State of Alaska supports ongoing efforts by the Alaska Industrial Development Authority to examine the feasibility of AIDA financing of the DeLong Mountains regional transportation project.

2. The parties recognize and support AIDA's intent to promptly execute all necessary professional services contracts, including a contract with a firm nationally recognized in the field of financial planning, to assist in the preparation of the financial plan required pursuant to AS 44.88.173.

3. If AIDA participates in the financing of the DeLong Mountain transportation project, the parties agree that AIDA and Cominco, Alaska will enter into an agreement which will provide, inter alia, for the establishment of equitable user fees payable to AIDA in an amount sufficient to enable AIDA to repay amounts loaned by the state to AIDA; and for the refunding of certain state expenditures in the event that Cominco, Alaska decides not to proceed with the development of the Red Dog mineral deposit.

4. The State of Alaska states its intent to submit appropriate funding requests to the Alaska legislature in support of the DeLong Mountain transportation project.

5. The State of Alaska and Cominco, Alaska recognize that this Resolution of Intent does not limit or otherwise affect AIDA's Board of Directors' independent judgment with respect to AIDA's participation in the DeLong Mountain transportation project, nor does this Resolution of Intent limit or otherwise affect the independent judgment of the Alaska legislature upon its consideration of funding requests.

Date: Dec 18/1984

H. M. Giegerich

H. M. Giegerich, President
Cominco, Alaska

Date: Dec 17, 1984

Richard A. Lyon, Commissioner
Department of Commerce and
Economic Development

REQUEST FOR PROPOSAL FOR FINANCE PLAN

The Alaska Industrial Development Authority is inviting proposals to assist in preparation of a finance plan for a proposed transportation project in the DeLong Mountains area.

This RFP does not in any way obligate the Authority to reimburse recipients of this RFP for any costs incurred in the preparation of a proposal. The Authority reserves the right to reject all proposals. The Authority may request some or all respondents to clarify or supplement their proposals through additional written submission. All respondents will be notified in writing of the acceptance or rejection of their proposal.

I. Introduction and Explanation of Project

A. Alaska Industrial Development Authority:

The Authority was created by the Alaska Legislature in 1967. The purpose of the Authority, as stated in the Act, is to promote, develop and advance the general prosperity and economic welfare of the people of the State of Alaska, and to relieve problems of unemployment. In 1982, the Authority's enabling legislation was amended to add to its purpose the promotion, development and maintenance of an adequate supply of multi-family housing projects. Under legislation enacted in 1984, the Authority may acquire, manage and operate certain types of projects which the Authority considers necessary or appropriate to serve a public purpose. Under the newly enacted statutory authority, the Authority is presently reviewing the possibility of financing and constructing a transportation project in the DeLong Mountains area.

B. <u>The Proposed Transportation Project</u>

The proposed transportation project (sometimes also referred to herein as "the project") consists of two components; (1) a 55 mile segment of road, commencing near the Red Dog mine site and going to tidewater, and (2) a port, including shore facilities. The intent of the transportation project is to provide the necessary infrastructure to encourage mining development and regional port in the western DeLong Mountains area, in northwest Alaska.

The entire western DeLong Mountains is believed to be heavily mineralized. One mine site in particular has been extensively explored, and it is understood that this particular mine would be the initial user of the proposed transportation project. This mine would be based upon the Red Dog zinc, lead, and silver deposit. The Red Dog deposit is one of the richest in the world, having indicated reserves of 85 million tons of ore with an average grade of 17.1% zinc, 5.0% lead, and 2.4 ounces per ton silver. The mine would be developed as a joint project involving Cominco Alaska and the NANA Regional Corporation. The mine site itself would be developed by Cominco Alaska without any state involvement.

The transportation project would be owned and operated by AIDA. Users, such as Cominco Alaska would be charged a fee for use of this transportation system.

C. <u>The Finance Plan</u>

Before AIDA can proceed with a project which it intends to own and operate, it must first prepare a finance plan. The requirements of the finance plan are listed in AS 44.88.173, which is reproduced below. The purpose of this RFP is to fulfill the requirements of AS 44.88.173.

Sec. 44.88.173. Finance plan.

(a) Before approving a project financed under AS 44.88.172, the authority shall prepare a finance plan. The finance plan must include an estimate of the total cost of the project, and a description of the sources of money that will be used to finance the total cost of the project. The finance plan must also include an estimate of the operational costs of the completed project, as well as a description of the source of the money that is to be used to pay the operational costs.

(b) The authority shall give preference to a project that does not require financial assistance from the state. If the authority determines that a project requires state financial assistance, and if the authority further determines that it is desirable to finance the project, the authority shall recommend a method of financing that minimizes cost to the state. A finance plan required under (a) of this section must identify the method of financing that minimizes the cost to the state.

(c) The authority shall submit a finance plan prepared under this section to the state bond committee, the governor, and the legislature before issuing bonds or otherwise incurring debt for the project. If a project requires financial assistance from the state, the state financial assistance must be available before bonds are issued for the project. (§ 8 ch 162 SLA 1984)

II. Terms & Conditions of Performance

A. Your proposal should be submitted with the understanding that it may form a material part of any subsequent contract. Your proposal should be complete as to all terms and conditions. After the contractor is selected the Authority may negotiate a contract with conditions considered in the best interest of the Authority. All terms and conditions must remain a firm offer for a period of not less than 60 days.

The proposal is due by February 15, 1985 (see Submission of Proposal section for details). The Authority expects to select a successful contractor by February 22, 1985. A complete first draft that is available and suitable for public distribution and comment must be completed by April 15, 1985.

Please note that the contract will not take effect until approved by the Commissioner of the Department of Administration pursuant to Alaska Statutes 36.98.040 (c).

B. Preparation of the finance plan requires the use of certain cost figures. In general estimates of these cost figures should be available from Cominco Alaska via the Authority. Some of these estimates will have been verified by the State Department of Transportation and Public Facilities, and/or by an independent contractor. It is not the intention of the Authority that a contractor employed as a result of this RFP prepare totally independent estimates of germane cost figures. Rather, a contractor should verify that cost estimates provided are reasonable, or make any modifications which the contractor believes are appropriate.

III. Scope of Services

A. Costs of the Project

1. Capital Costs: The contractor should provide an estimate of the capital costs of the project, broken down by major component.

2. Operational & Maintenance Costs: The contractor should provide an estimate of the Operational & Maintenance costs of the project, including an estimate of cost sensitivity to different use factors.

3. All estimates should be provided in 1985 dollars, and relevant cost escalators should be provided so that cost figures can also be estimated in future years dollars.

B. Revenues of the Project

1. The revenues of the project will be provided by fees charged to users of the project. All user fees should be in dollars per ton of ore shipped through the project, unless otherwise stated. Since no final user fee structure has been adopted by the Authority, alternative possibilities need to be examined. These alternatives must consider, at a minimum, the cases listed below.

   Some of the alternatives will require information specific to the proposed Red Dog mine. The contractor should assume that Cominco Alaska will, through the Authority, provide estimates of the capital costs and operational costs, including transportation costs, of the proposed mine, as well as estimates of ore production and the resultant concentrate tonnage that would be transported through the proposed road and port. A contractor may use these figures, or provide alternative figures.

2. The first set of alternatives assumes that the State will provide no financial assistance for the project. Since Cominco Alaska will be the initial user, baseline revenue projections should be based on Red Dog mine ore shipments. The contractor should provide estimates of different user fees, based upon: a range of price assumptions for zinc; a range of rates of return on investment to Cominco Alaska; a range of cost of capital to AIDA; other options deemed pertinent by the contractor.

3. The second set of assumptions assumes that the State is willing to make an unspecified amount of subsidy to the project, both to encourage its early completion and to account for its regional benefits. In this case, the contractor should select what it believes to be the "minimum rate of return on investment" required to induce a mining firm such as Cominco Alaska to make a major mining investment such as the Red Dog mine. More than one value may be selected for the "minimum rate of return", if the contractor believes a range of estimates would present a more accurate picture. Given this "minimum rate of return", the contractor is to estimate the amount of subsidy (if any) on the transportation project needed to cause the investment to be made. This should be estimated under a range of alternatives based upon differing assumptions for the: price of zinc; cost of capital for AIDA; other options deemed pertinent by the contractor. For all of the various alternatives estimated above, the contractor should indicate the cash flow to the project and the implied user fee structure of this cash flow. For any given level of subsidy, the contractor should indicate how the rate of return to the mine investor is affected depending upon whether this subsidy is used to offset the construction cost of the transportation project, or is reflected in deferred imposition of user fees on the project, or some combination thereof.

4. A proposal has been made to charge a certain user fee schedule to Cominco Alaska for its use of the proposed transportation project. This proposal will be made available to the successful contractor.

   Using the proposal and using the assumptions of the earlier alternatives with respect to costs and production, the contractor is to estimate: the implied rate of return to Cominco Alaska on its mine investment, and the amount of subsidy, if any, implied in the proposal. The contractor should state specifically what assumptions are being used for key variables (e.g. price of zinc) in this analysis, and further should discuss how sensitive the results are to changes in these key variables.

5. There are potential users of the transportation project other tnan Cominco Alaska for the Red Dog mine. The contractor should demonstrate how the above results would change if other users were to utilize the transportation system. Estimates of the production volume attributable to other users will be available from AIDA, however an independent estimate should also be made by the contractor.

C. <u>Financing Options</u>

1. The intent of the Finance Plan is to develop a financial plan that will provide adequate resources to enable a project to be undertaken and completed, while at the same time minimizing the costs both to the State and to the proposed project. As such, any proposed plan that will not realistically provide for enough resources to complete the proposed project is, by definition, not a Finance Plan.

2. The contractor should examine the question of debt financing for the project. At a minimum, the following questions should be answered:

- What forms of debt financing are available, and under what conditions?

- From a financial perspective, how much of the proposed project can be debt financed, and under what conditions?

- What types of security will be required for debt financing, and what are the possible interest rates for various types of financing?

3. If State financial assistance is required, it could come in a variety of forms. The contractor should consider different types of State assistance, such as a cash grant, low or deferred interest loans, appropriation of capital reserve funds, and so forth. The attributes of different types of assistance should be discussed, included specific advantages and disadvantages to the State, or to the financial feasibility of the project.

4. The contractor should consider these various financing options for both the construction phase, and the term financing. That is, one type of financing may be more appropriate during construction, whereas a different option may be better for term financing.

D. Presentation of Alternative Finance Plans

1. The contractor is to provide a series of alternative total Finance Plans. The term total Finance Plan refers to including financing during construction as well as term financing. At a minimum, the contractor must include as alternatives: (1) The Finance Plan involving the minimum cost to the State; (2) the option proposed by Cominco Alaska; and (3) an option that utilizes the maximum possible tax exempt bonding. Other options having particularly favorable attributes should also be included, up to a maximum of eight alternative Finance Plans.

2. The advantages and disadvantages of each plan should be discussed. At a minimum, each plan should include the total costs of the project; the costs, if any, to the State; the estimated rate of return to Cominco Alaska; the proposed cash flow and user fee structure; and explicit listing of key assumptions.

3. The models used to develop these alternatives must be available at no additional costs to the Authority. If requested by the Authority, the contractor will make these available in a computer ready manner that can be loaded on the Authority's equipment (see Appendix A).

E. Presentation of Results

An integral part of this study is satisfactory presentation of findings. These presentations would include at a minimum interim reports as requested by the Authority, an initial completed draft report, and a final report. In addition, the contractor must be available to make presentations to the Governor, other members of the administration and to various legislative committees during, and after, the course of the study.

F. Fees

A contractor should provide a fixed price bid for the entire contract. Also, an hourly charge should be provided for any work done at the request of the Authority after the completion of the project described in this R.F.P. The Authority has budgeted approximately $250,000 to $300,000 for this study.

IV. Method of Evaluation

An evaluation system will be utilized to review the proposals. The factors to be considered will consist of:

(i) a work plan which addresses the scope of services set forth in Section III of this RFP

(ii) proposed staff;

(iii) experience of respondent in performing an analysis of the feasibility of comparable capital facilities; and

(iv) availability of respondent to confer with staff of the Authority and to complete the feasibility study within the contemplated time frame.

In addition, the Authority may elect to conduct oral interviews with some or all of the respondents, and if oral interviews are conducted, the interviews will be considered in the award of the contract.

V. Submission of Proposals

Proposals may be submitted by providing 6 copies of your proposal to:

Bertram L. Wagnon, Executive Director
Alaska Industrial Development Authority
1577 "C" Street, Suite 304
Anchorage, Alaska 99501

Proposals must be received at the offices of the Alaska Industrial Development Authority, 1577 "C" Street, Suite 304, Anchorage, Alaska, 99501, no later than 3:00 p.m. on February 15, 1985. The proposer is solely responsible for the delivery of their proposal and proposals received after the above date and time will be rejected.

Each proposal should be clearly marked "Proposal to the Alaska Industrial Development Authority" on its outside cover. All proposals will remain sealed and unopened until after 3:00 p.m. on February 15, 1985.

APPENDIX A

TECHNICAL SPECIFICATIONS

COMPUTERS:	WANG VS 80	with a 308K-Byte Diskette Drive (S.S.,S.D.) and a Phoenix Disk Drive (75M Fixed Disk & 15M removable pack).
	WANG PC	5 1/4 inch, 360KB Diskett Drive, 256 KB or RAM and Asynchronous Serial Communications Port.
MODEMS:	RACAL VACIC	Full Duplex, 0 to 300 BPS, Asynchronous Full Duplex, 1200 BPS, Asynchronous or Synchronous Half Duplex, 2400 BPS, Synchronous
TELECOPIER:	XEROX 295	Group three digital facsimile, 9600 BPS with automatic fall-back to 7200/4800/2400 BPS based on line quality; transmission speed of 25 seconds average.

Geoffrey G. Snow, President

Noranda Exploration, Inc.

Joint Resources and Special Committee on Loans

Briefing

Friday, February 8, 1985

Mr. Chairmen, members of the committee - Thank you for the opportunity to brief you today. Noranda Exploration, Inc. is the wholly-owned subsidary of Noranda Inc. Noranda Inc. is a major Canadian mining company and a major zinc producer. Noranda mines produce (in 1982) about 625,000 tons of zinc per year, or close to 15% of world consumption. Zinc is important to Noranda's earnings. A 10% change in the price of zinc (4¢ today) affects Noranda's earnings 30%.

I am employed because Noranda's mines are being depleted. In order to survive, a mining company must replace material mined-out. Noranda can look any were in the world, but our organization has focused on the western Brooks Range. We have just concluded an agreement with GCO Minerals that permits us to examine a large claim block in the DeLong Mountains.

Why did we select the DeLong Mountains? Figure 1 shows where zinc has been mined. Most was from the Mississippi Valley. We are not looking there because, at today's prices and costs, the 6% average grade is not attractive.

Further we think the environment labled volcanic-exhalitive has greater potential. Figure 2 shows where reserves are.

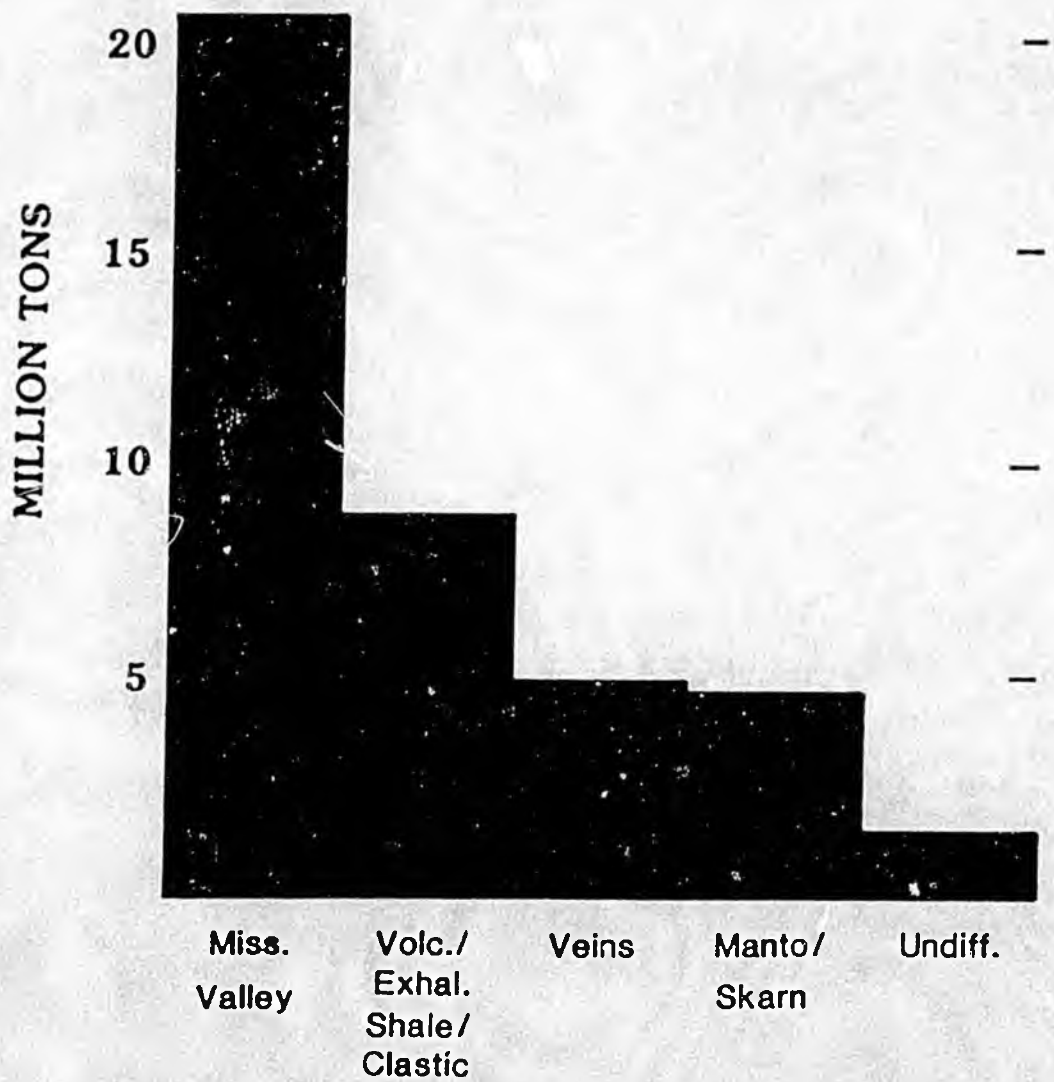
The Red Dog geologic environment is analogous to others in the world, for example the Selwyn Basin of the Yukon. There 10 deposits, ranging in size from 20 to 100 million tons, are in similar rocks over a length of 200 miles.

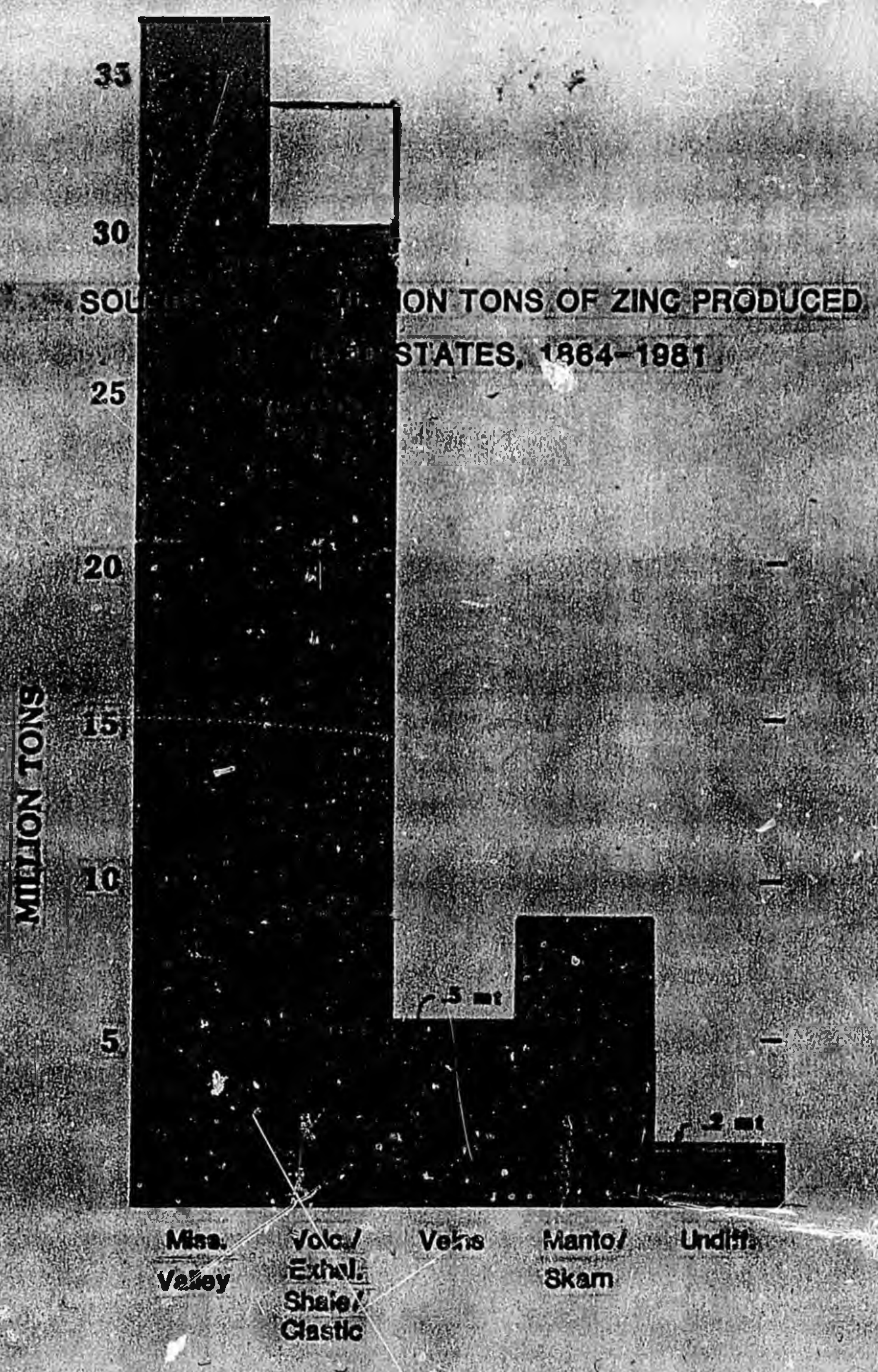
The point for me as an exploration geologist and for you as legislators is that deposits of this type occur in clusters. Noranda hopes to discover others in the Red Dog-Lik cluster.

We are not looking in the Yukon because that is too far from tide water. We are attracted to the DeLong Mountains because tide water is close. We are attracted because there is the possibility of a road to that water. We are attracted because Alaska's tax structure does not penalize those who produce.

The viability of mining operations is directly related to the capital required. A road into the DeLong Mountains will encourage exploration. Because of the clustering nature of deposits of this type, discoveries will hopefully result. Once started the DeLong Mountain zinc belt can provide long term employment, social benefit and new wealth to Alaska.

SOURCE OF 42 MILLION TONS OF ZINC PRODUCED IN THE UNITED STATES, 1864-1981





ON TONS OF ZINC PRODUCED
STATES, 1864-1981
MILLION TONS
35
30
25
20
15
10
5
5 mt
2 mt
Miss. Valley
Volc./ Exhal./ Shale/ Clastic
Veins
Manto/ Skarn
Undiff.

David S. Kennedy

Senior Geologist

GCO Mineral Company

Joint House Resources Committee and

House Special Committee on State Loans

Committee Hearing

Friday, February 8, 1985

Mister chairman, members of the committee:

On behalf of GCO Minerals Company, I appreciate this opportunity to testify before you in support of an important mine development in Alaska. My name is David Kennedy, and I am a Senior Geologist for GCO. First of all, let me provide a brief background of GCO Minerals Company. GCO is a wholly-owned subsidiary of International Paper Company. International Paper Company, one of the largest wood products companies in the country, provides the wood products component of the Dow Jones Index. Annual sales in 1984 were in excess of four billion dollars. Until the Native Claims Settlement Act in Alaska, IP was the largest private land owner in the country. IP is still one of the largest private owners of real estate in the world, owning approximately seven million acres of timberland in the U.S.

To help illustrate the magnitude of probable mine development in northwestern Alaska, in addition to Red Dog, I would like to give a very brief review of GCO's DLM project and then provide some order-of-magnitude operational and financial data for the Lik deposit.

GCO has carried out exploration in Alaska since 1969 and has conducted a continuous exploration program in the DeLong Mountains region since announcement of significant lead-zinc mineralization at Red Dog on D-2 lands in 1976. To date, GCO has expended approximately twenty million dollars on this project, delineated significant zinc-lead ore reserves in the Lik deposit which is located approximately twelve miles northwest of Red Dog and maintains over 6,000 federal and state mining claims. These mining claims contain other good mineral showings which occur within ten to fifteen miles of the proposed right-of-way. An agreement between GCO and Noranda Exploration for further aggressive exploration on these mineral claims has been recently consumated.

Prior to 1984, over 100 holes totalling more than 60,000 feet were drilled on the Lik deposit. Ore reserves indicated by this drilling were approximately 25,000,000 tons containing 12% combined zinc and lead with approximately 2 oz/ton silver. Exploration drilling this past summer resulted in the discovery of an extension to the known deposit which we feel confident will double the present reserves.

Conceptual engineering design and order-of-magnitude feasibility studies have been carried out for the Lik deposit.

These studies indicate a mine operation with the following parameters:

1) A mine operating at approximately 5,000 tons per day. Initial production will come from a small open pit with an underground mining system being introduced in later years.

2) Capital costs exclusive of a road and port would be in the order of 300 million dollars.

3) Concentrate production would be in the range of 275,000 to 350,000 tons per year with higher production occurring in early years due to selective mining of higher grade reserves near the surface.

4) The Lik operation would be connected to the DeLong Mountains Transportation system by a spur road 14 to 25 miles in length.

5) Direct full-time employment generated by the Lik operation will be in the order of 300 jobs at start-up with an additional 20% added at the point of phasing-in the underground operations.

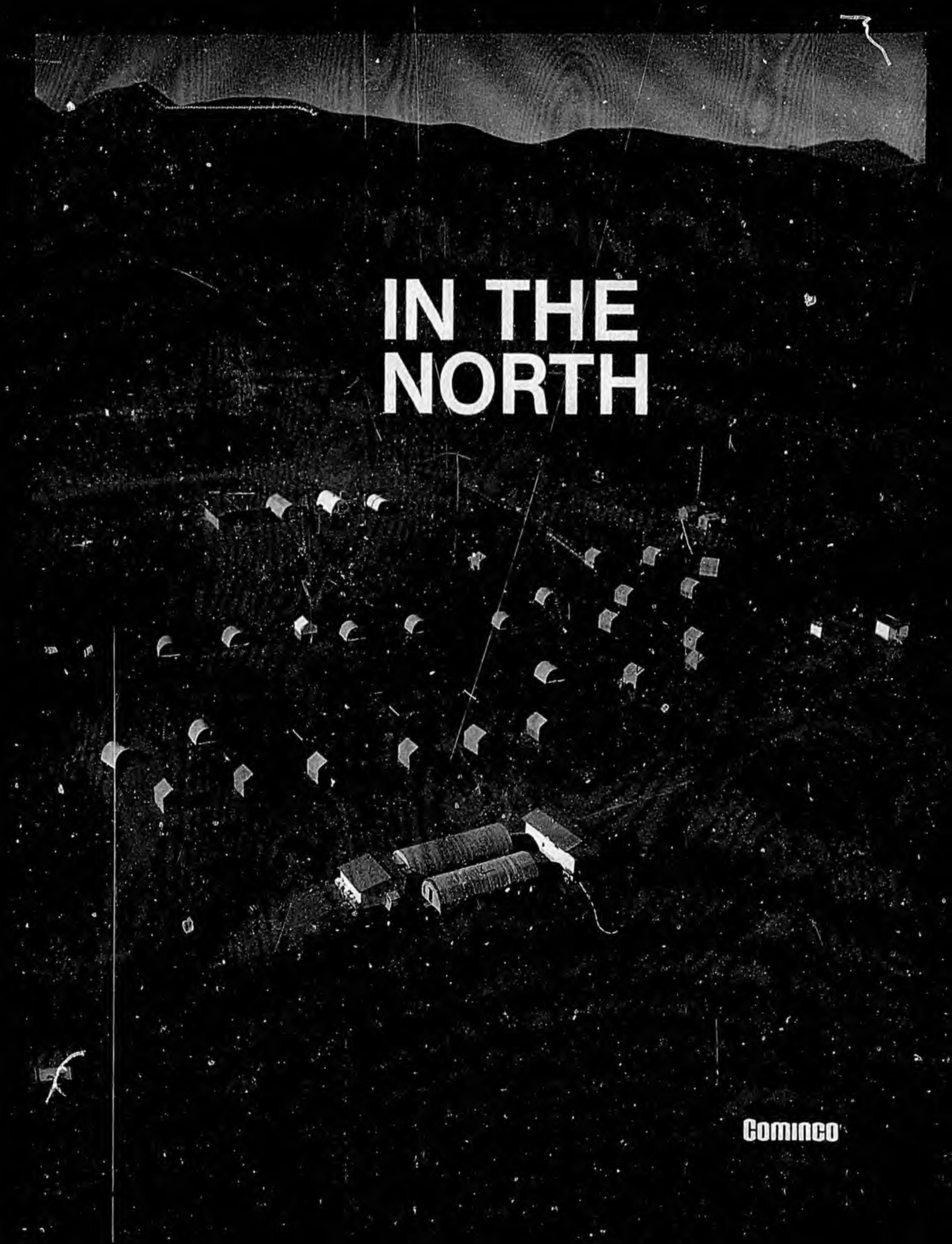
6) The importance of the 1984 exploration results is a potential increase in mine life to at least 30 years.

We have not at this point calculated a dollar value for the benefits that will accrue to the state from this additional mine development. However, implications from the Lik conceptual mine plan in addition to those previously stated for the Red Dog mine clearly show long term economic benefits for Alaska.

There is no question that state aid in financing of the road and port will speed the development of Red Dog and make possible additional mine developments such as Lik in the region. We are confident that the road and port will make the Lik deposit economically viable. The importance of the road and port project and the Red Dog mine to mine development in Alaska can be illustrated by an analogy with north slope oil development. Red Dog would be analogous to Prudhoe Bay development in the mid 1970s, and subsequent development of the Lik deposit and others would be analogous to development of the Kuparik, Milne Point and Endicott reservoirs.

In conclusion, GCO strongly endorses the Red Dog Project, as it will be the first major mine development in Alaska in over 50 years. In view of Cominco's unparalleled experience in mine development in arctic environments, the Red Dog project should set a very positive precedent for mine development in Alaska and is thus deserving of broad support from the state and the public. GCO believes that the state involvement in the development of the DeLong Mountains Transportation system will not only enhance the opportunity for development of mineral deposits in addition to Red Dog, but will be the first step in the creation of a viable mining industry in the state of Alaska.

IN THE NORTH



Cominco

Cominco's commitment to the North spans 50 years. Our Arctic operations range from Alaska in the west to Greenland in the east.

We are proud of our northern ventures and our achievements. As Northerners, we look forward to expanding our horizons with exciting new developments here in Alaska.

This zinc-lead deposit in northwestern Alaska could be our largest and richest mine ever. It's an exciting challenge for us-and for NANA, our Inupiat partners. How Cominco has become involved with Red Dog is a continuing story of company-wide teamwork, perseverance — and the willingness to take a chance.

It was a routine flight in 1968 for Bob Baker. The veteran Alaska bush pilot was flying south to Kotzebue, Alaska, home base for his small but busy charter service. Suddenly he spotted something he had never noticed before: a distinctive rusty coloring in a creek and the surrounding hills. Bob Baker had done some prospecting in his spare time and was curious about what these colors might indicate. He mentioned his sighting to Dr. Irving Tailleur of the United States Geological Survey. Dr. Tailleur followed up, and ultimately made the first report of the mineralization that is now called Red Dog.

From this chance beginning may develop the largest and richest open-pit zinc and lead mine ever. The prospective mine, now in the early planning stage, has a potential life of 50 years with the probability of extension if new ore is discovered. Diamond drilling now indicates 77 million tonnes of ore, with grades of 17% zinc, 5% lead and 2.6 ounces per tonne of silver.

"The magnitude of Red Dog and our nearby properties will influence the world zinc and lead mining industry for decades," says Norman Anderson, Cominco's Chairman and Chief Executive Officer. "Red Dog is likely to be as important to Cominco in the next century as the Sullivan mine has been in this century."

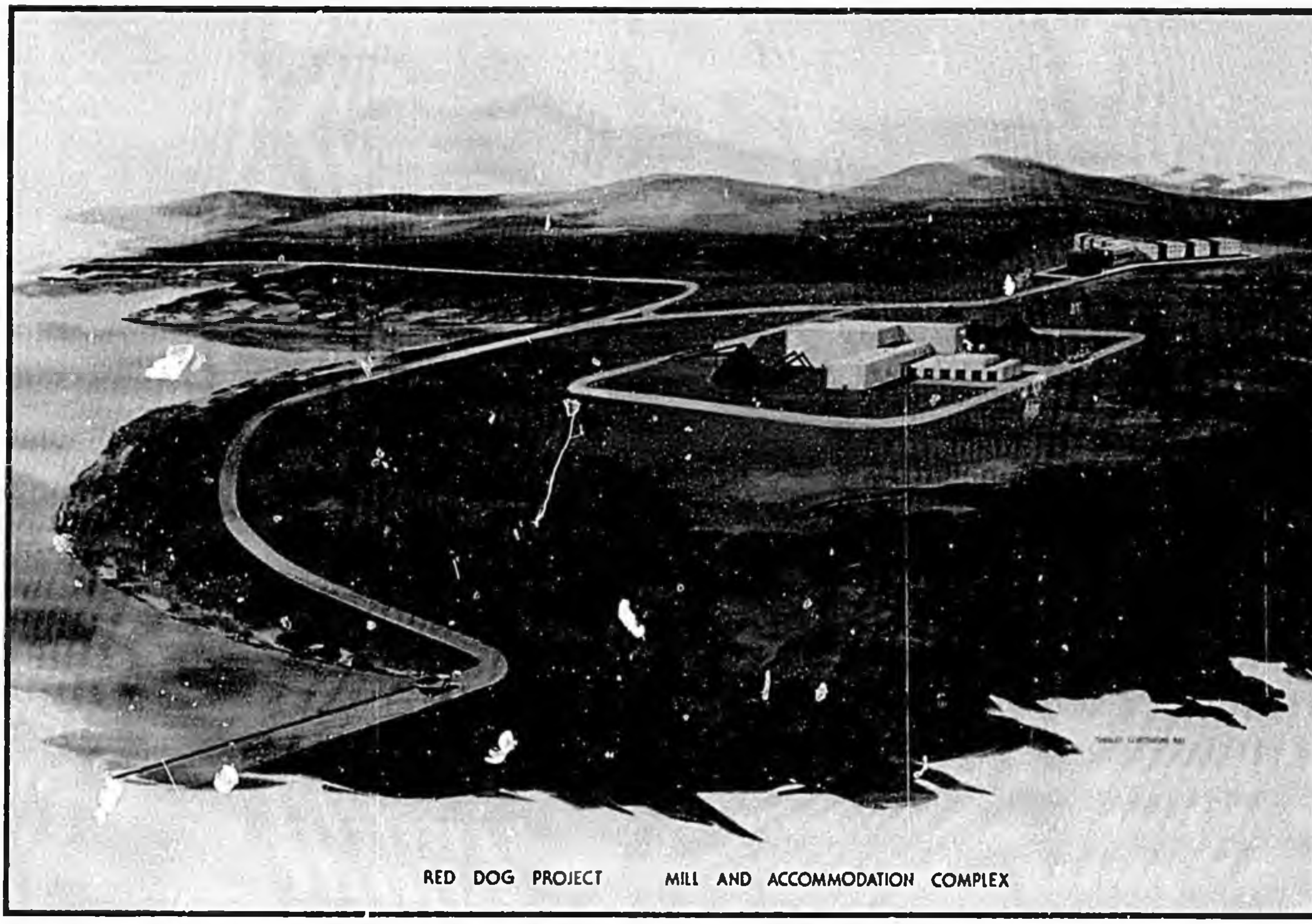
Magnificent discovery

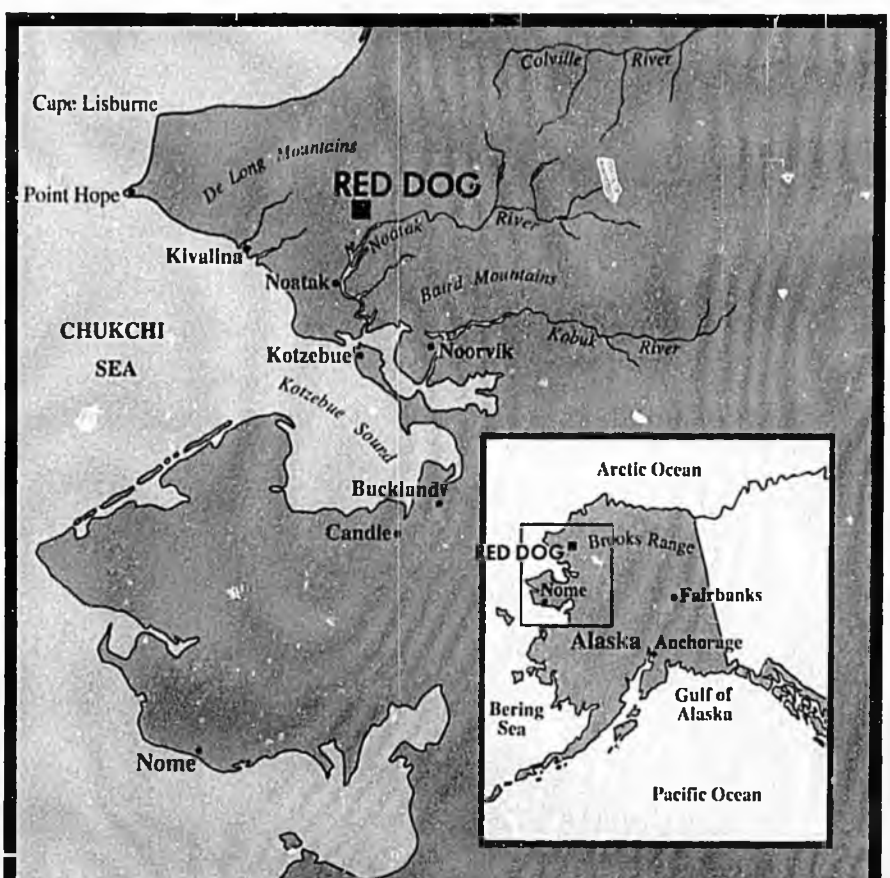
The deposit is 145 km north of Kotzebue and 115 km east of Kivalina on the Chukchi Sea (see map). Its isolation, environmental aspects, the

CLARK MISHLER

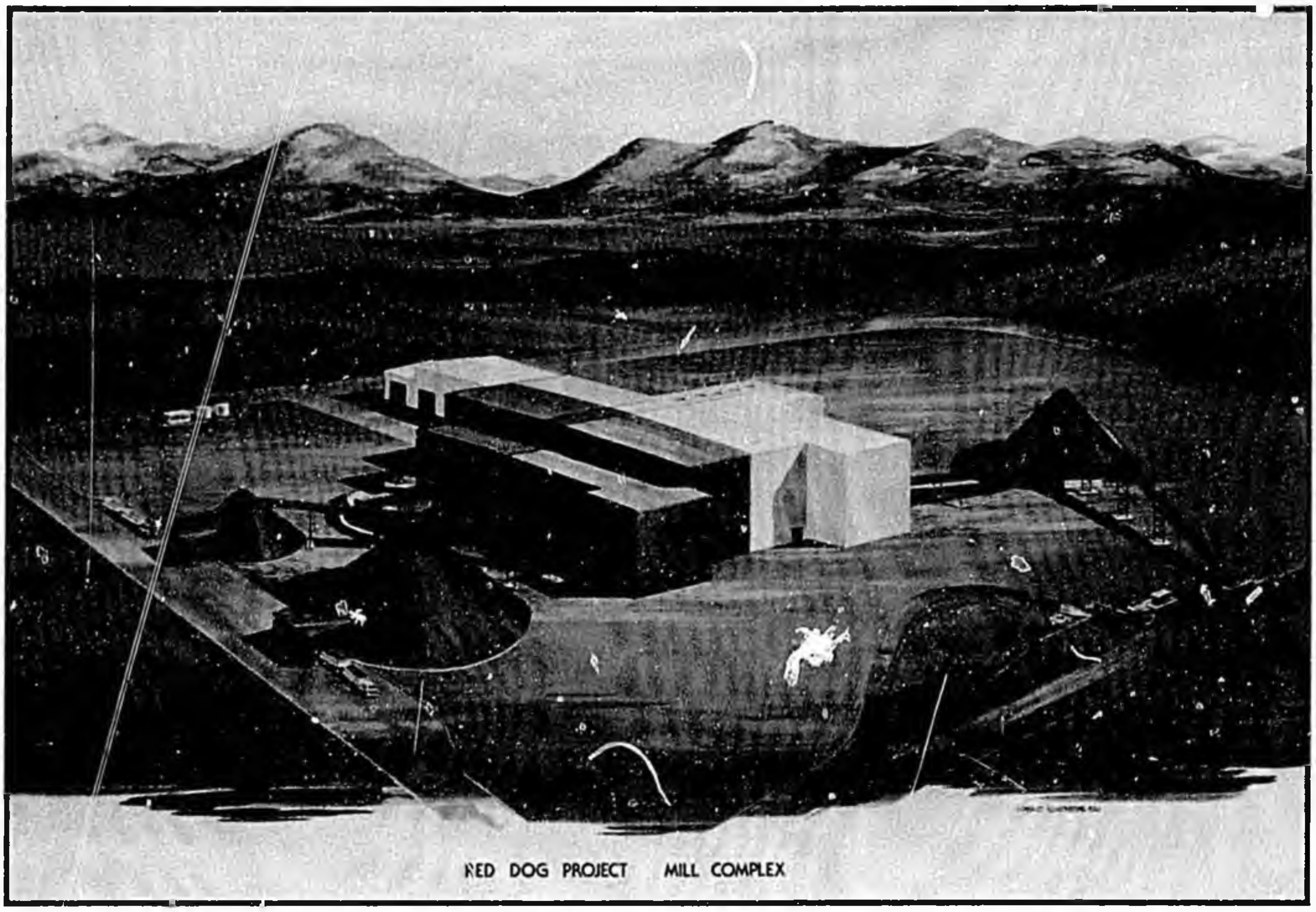
Top right: Diamond-drilling at Red Dog is a summer-long activity. Right: Core samples indicate very high grades of zinc and lead. Above: Rock samples arrived at Trail, B.C. for metallurgical assessment. The ore belongs to the same class of deposit as the Sullivan Mine at Kimberley, B.C.
◀ Drill crews work 24 hours a day during the long daylight hours of the Arctic summer.

CLARK MISHLER





Top: Artist's impression of the mine site. The mill is in the foreground, concentrate storage building to the right and accommodation complex in the background. Tailings from the mill will form the pond at left. Engineering studies have identified the optimum locations for surface facilities.
Above: Surveying for drill locations and engineering studies is carried out with laser equipment.



Top: Design of the mill complex is nearly complete. The larger dome structure is for zinc concentrate, the smaller is for lead.
Above: A 1,500-metre air-strip at top right, providing the only current access to the site, was constructed at Red Dog in the summer of 1982.

large capital expenditure required to build the mine and the concentrator and the current depressed prices for zinc and lead are all factors that must be considered before Red Dog gets the go-ahead. Still, this "magnificent discovery", as the *Northern Miner* recently described it, could be a producing mine as early as 1987.

The official beginning of the Red Dog story for Cominco was February 5, 1982, when Cominco American Incorporated and the NANA Regional Corporation reached agreement to proceed with the exploration and potential development of the deposit.

But there was a lot of spadework before that event. In 1970, Dr. Tailleur of the U.S. Geological Survey filed an "open report" on the occurrence of zinc, lead and barite in the area. (An open report is a preliminary report to which the public has access.)

About this time it became unclear whether the area would ever be opened for mining. The passage of the Alaska Native Claims Settlement Act of 1971 resulted in a program of evaluation of the resource potential of lands being considered for inclusion in parks and wilderness areas. In 1973, the land containing the Red Dog deposit was withdrawn from staking.

Like the Sullivan

In September 1975, the U.S. Bureau of Mines issued a press release on its exploration program in the Red Dog area. Cominco American had exploration crews on the Seward Peninsula, 300 km to the south, and the government announcement prompted Cominco American to take a close look at Red Dog. Cominco recognized it as an occurrence with great potential. It was a sedimentary deposit just like the Sullivan, a producer for Cominco for nearly 80 years.

Although the Red Dog prospect could not be staked because it was located on withdrawn land, land close by could be staked and explored. Intensive exploration of the area began in 1976, and has continued every year since.

In 1976, the NANA Regional Corporation filed a Regional Corporation Selection Application with the Bureau of Land Management, covering the Red Dog deposit. However, it was the opinion of Cominco's lawyers that NANA's selections might be invalid.

In 1978, the 1973 withdrawal expired, and on December 18, Cominco American staked the Red Dog deposit. It was deep in the Arctic winter, with its limited daylight, severe cold and high winds.

In 1980, Cominco American moved a drill onto the claims. Eight holes were drilled, of which five showed spectacular results. However, action by the Bureau of Land Management caused Cominco to cease drilling. Cominco's claim to the deposit conflicted with that of the NANA Regional Corporation.

It was not until the passage of the Alaska National Interest Land Conservation Act, in December, 1980 during the last days of the Carter administration, that NANA's right to select was reaffirmed.

Mining beneficial

The people of the NANA region had, by 1979, come to the viewpoint that mining could be beneficial. It could provide jobs while traditional values were still protected. Cominco knew that the sensible long-term solution was to show NANA that an agreement with the company would be mutually advantageous.

To convince NANA, Cominco invited six of its leaders to observe the company's operations in the north. They went to Pine Point; to the Con gold mine in Yellowknife; to Polaris on Little Cornwallis Island, Northwest Territories; and to the Black Angel Mine in Greenland. They were able to meet privately with local Indian, Inuit and Greenlandic Inuuk leaders at these locations, to hear whatever these local people wanted to tell them about Cominco.

Cominco also shared with NANA the results of the drilling, preliminary metallurgical testing and early-stage feasibility studies. After the trip, Cominco did further drilling at Red Dog, and with these results in hand, settled down to serious negotiation, culminating with the agreement signed in Kotzebue, on February 5, 1982.

Although any go-ahead decision on Red Dog is still at least a year away, the project demonstrates once again the value of some old virtues, particularly perseverence and making the fullest use of one's resources. The project has benefited by contributions from the diverse talents of scores of Cominco people in different countries. It was and remains a great team effort.

— George Tikkanen

This distinctive red and orange coloring led to the Red Dog discovery

What does it mean? Red Dog

Red Dog is Cominco Alaska's rich prospect in northwestern Alaska, and we will be hearing a lot about Red Dog in the future. But isn't that a strange name for a mine?

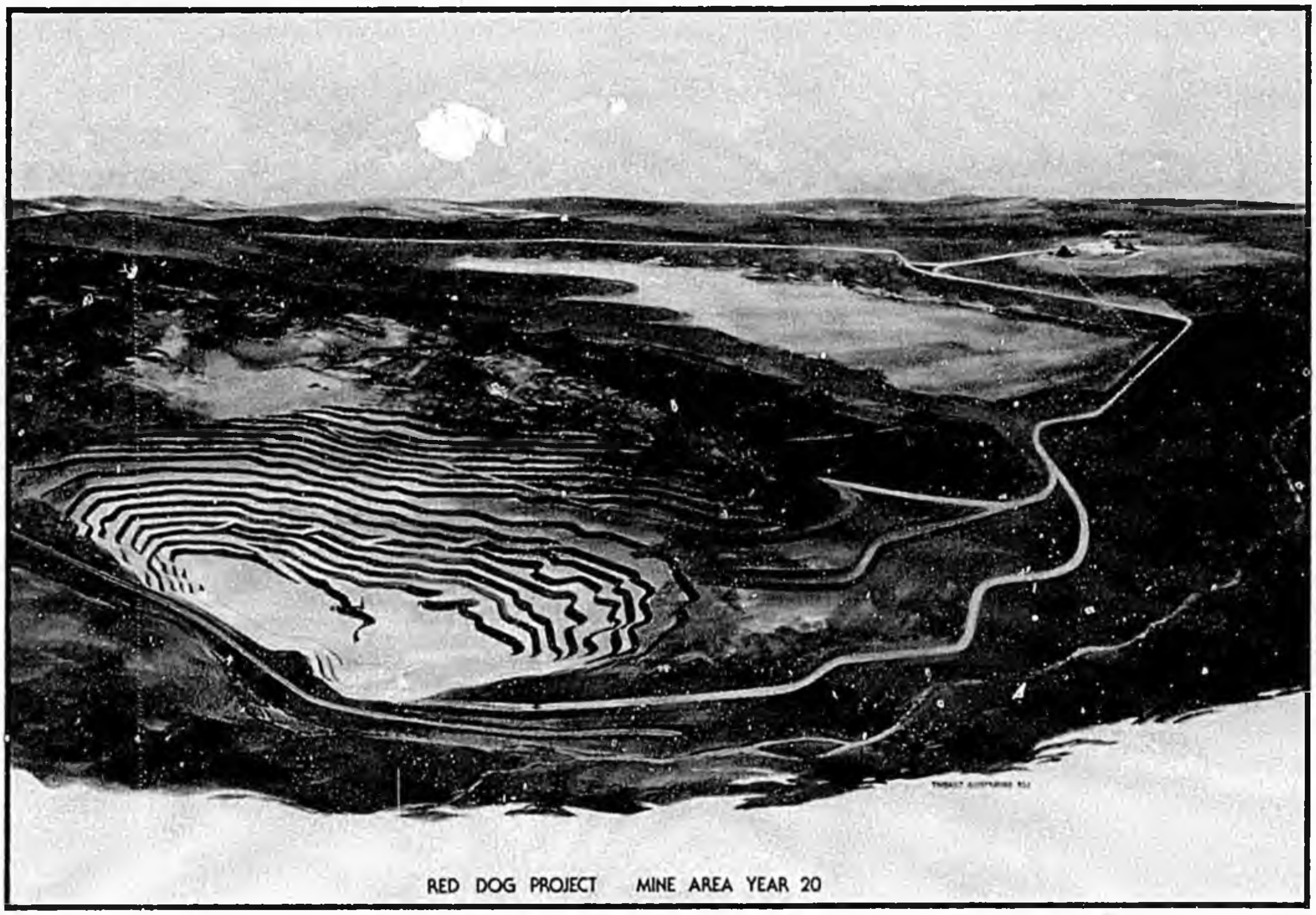
In the late 1950s, bush pilot Bob Baker operated a charter service out of Kotzebue and in his spare time did some prospecting in the region. Baker's small prospecting company, The Red Dog Mining Co., was named in honor of Baker's pet dog O'Malley, a reddish-colored dog with a Heinz pedigree.

While flying over northwest Alaska, Mr. Baker noted conspicuously red and orange stained hillsides in the DeLong mountains and surmised that they indicated mineralization. Irving Tailleur of the U.S. Geological Survey, who often flew with Baker, was advised by Baker to take a closer look at the hillsides. When he did, Dr. Tailleur named the place Red Dog on his maps.

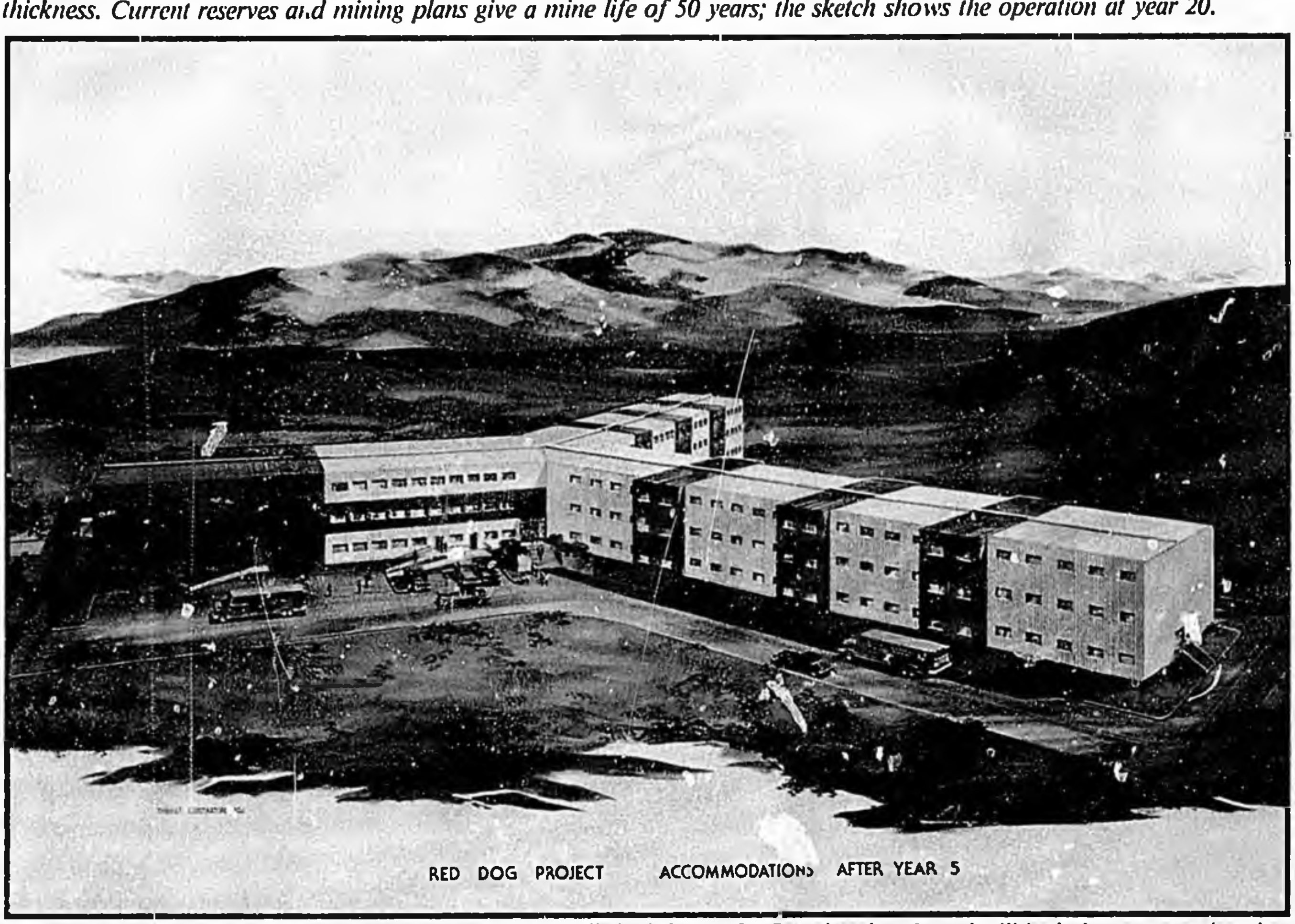
Tragically, Baker was killed flying a 1968 mercy mission and never heard the initial results of his eagle-eyed observation: he had spotted one of the biggest and richest zinc-lead deposits on earth.

Cominco American's involvement came about through quick response to a bulletin issued by the U.S. Bureau of Mines about Red Dog in 1975.

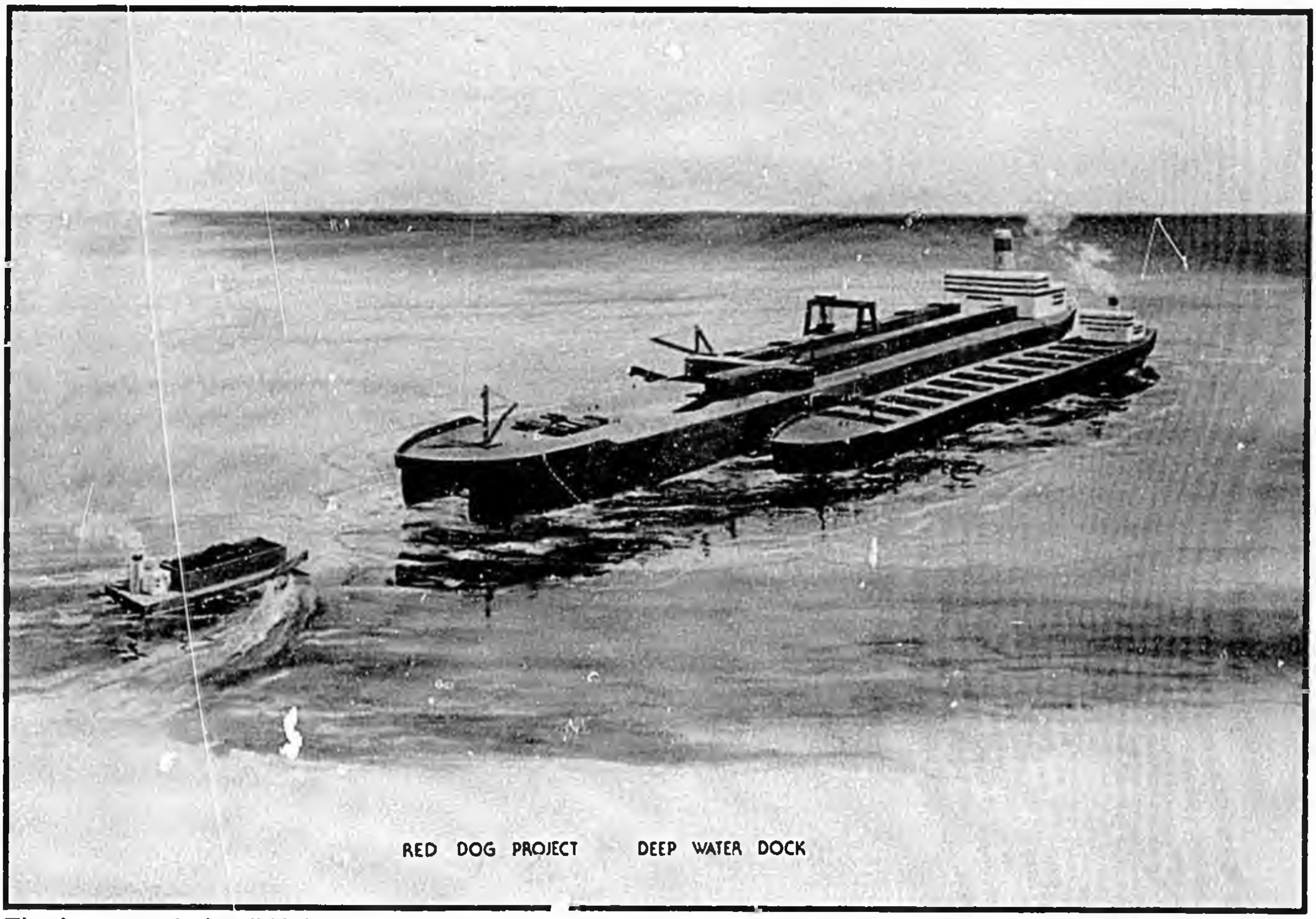
The Red Dog camp's population in the summer of 1984 ranged between 35 and 40 and many of the workers were NANA shareholders. All communication is by radio and is maintained on a round-the-clock basis.



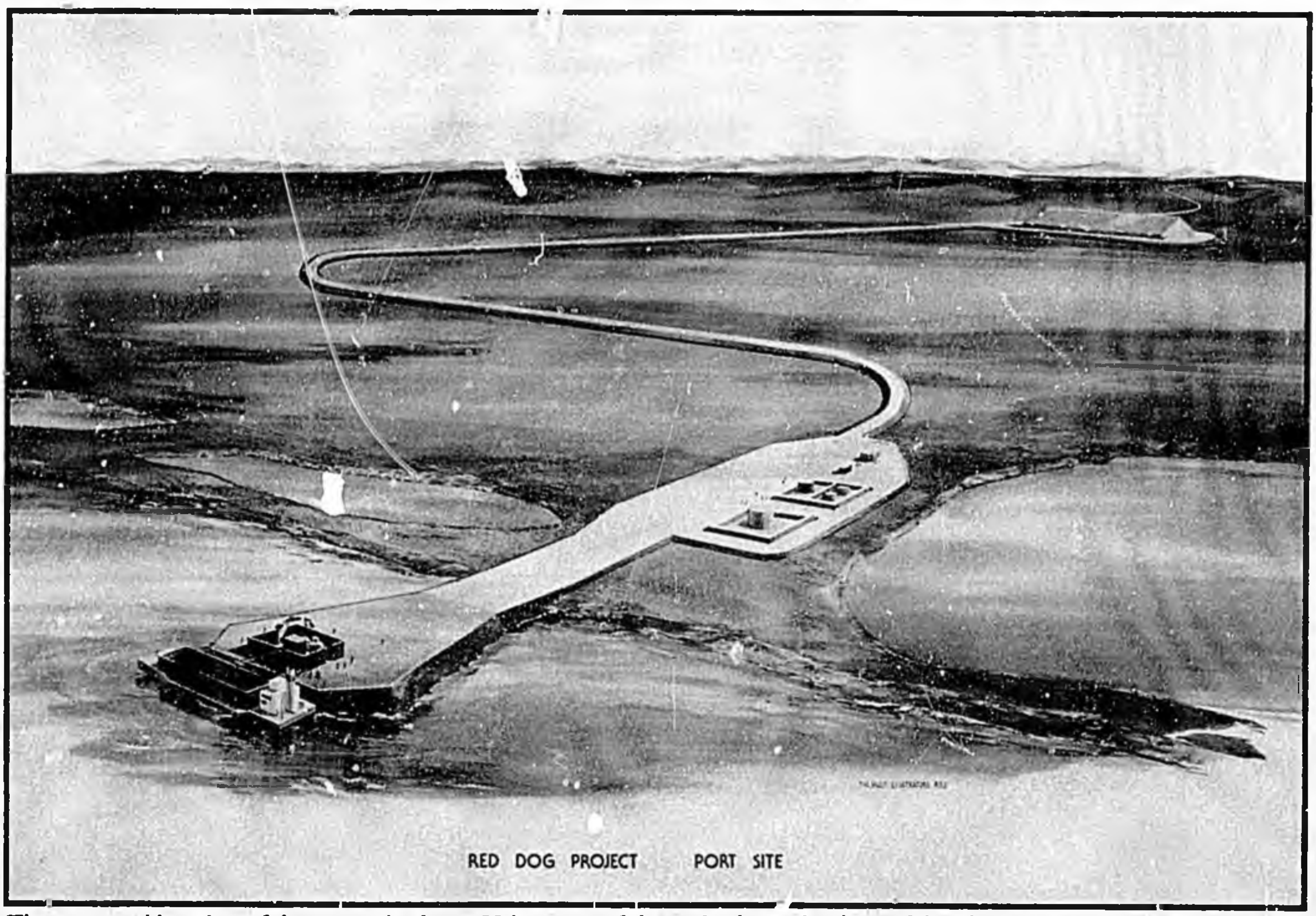
The actual open-pit mine area is quite small; the main deposit is 1,360 metres long and varying from 60 metres to 430 metres in thickness. Current reserves and mining plans give a mine life of 50 years; the sketch shows the operation at year 20.



The accommodations for the workers at the mine site will rival those of a first-class hotel, and will include a gym, swimming pool and a library as well as the mine's administration facilities.



The deepwater dock will likely be a former oil tanker ballasted 11 metres down to the seabed. Serviced by lighters, the ship could hold 65,000 tonnes of zinc concentrate, 35,000 tonnes of lead concentrate and 38 million litres of fuel oil.



The proposed location of the seaport is about 88 km west of the orebody on the shore of the Chukchi Sea, about 27 km north-east of Kivalina.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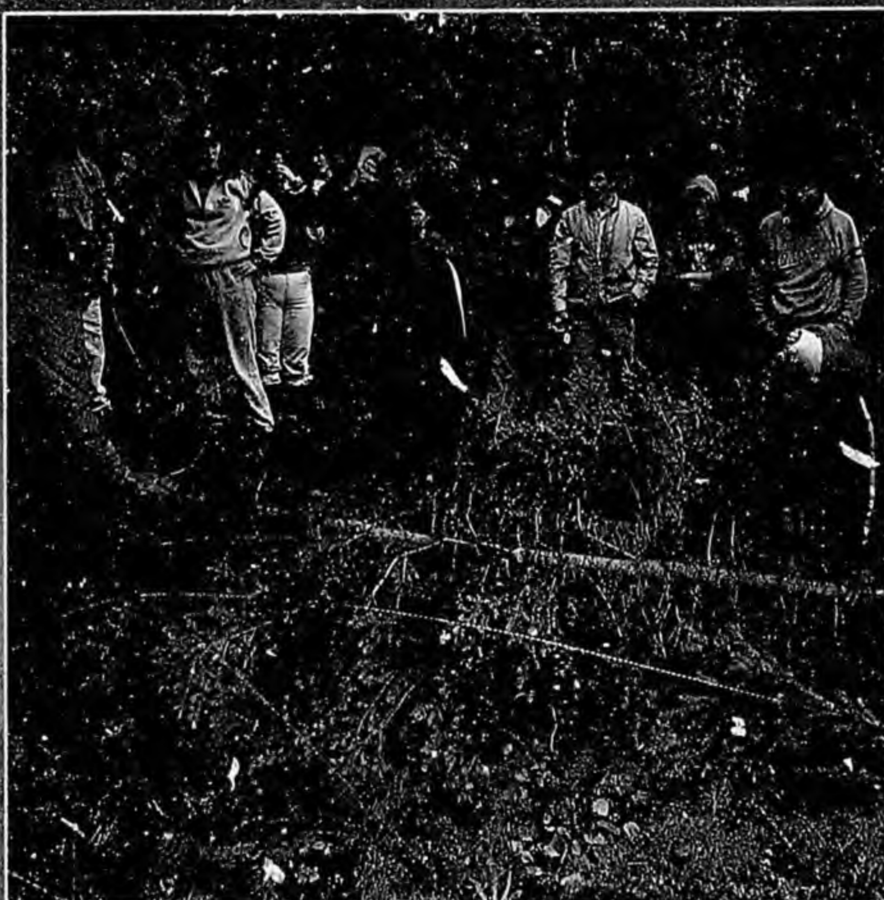
NANA

Our Alaskan partner



ROB STAPLETON/NANA

In Alaska, Cominco enjoys a unique partnership with 4,700 Inupiat Americans in the potential development of the Red Dog zinc-lead-silver deposit. NANA is the corporate name for one of 12 Alaskan regional corporations formed as a result of the Alaska Native Claims Settlement Act of 1971. Red Dog, and the prospective overland routes to the sea, lie within the NANA region.

The formal agreement between Cominco American Inc. and NANA Regional Corporation, Inc., whose shareholders are all Natives, calls for minimum payments by Cominco to NANA of $1 million a year.

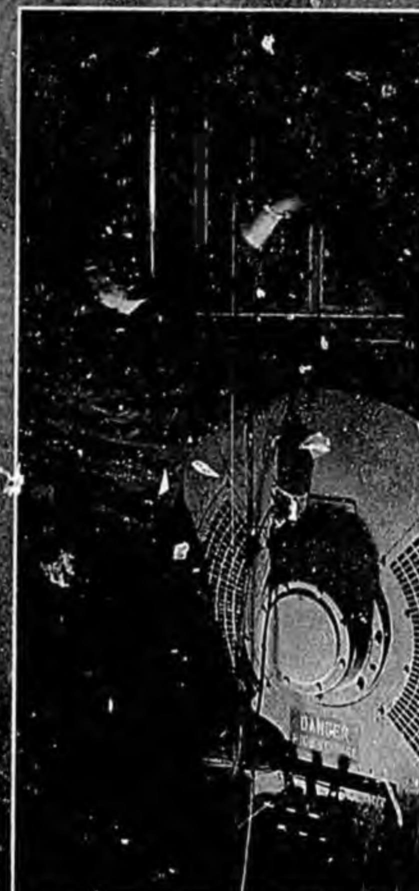
But it's much more than a business arrangement. For the people of NANA it's another step in strengthening their economic base while continuing to preserve their important traditions.

And for Cominco, it's also an engineering challenge and the opportunity to make further progress in our remarkable and pioneering record in working harmoniously with Native northerners, including Inuit in Canada, and Inuuk in Greenland.

NANA Regional Corporation, Inc. was created to improve and expand the assets acquired by the Inupiat in northwestern arctic Alaska under the U.S. Alaska Native Claims Settlement Act. This Act provides for the Corporation's share of US$962 million given to them from the Alaska Native Fund and a 16-million-hectare land settlement made with them and the other similarly organized Native corporations in Alaska.

NANA's symbol is an Eskimo

Opposite page: The traditional and the contemporary are important in NANA's programs. Here, children learn how to weave a wind shelter under the direction of elder Billy Sheldon. This page, right: In addition to electrical power generation (seen here), NANA is involved in oil activities in the Beaufort Sea. NANA's symbol is a stylized Eskimo hunter.



FRANK P. FLAVIN

FRANK P. FLAVIN

hunter moving aggressively toward a successful future in a vast, beautiful and sometimes harsh world," says its 1982 Annual Report. "NANA is all of us together as the hunter, successful if we are of one mind and purpose, hungry if we are split by doubts and mistrust of each other. As one hunter is small and insignificant when compared to our environment so is NANA when compared to the corporate and governmental environment in which it must hunt successfully to survive."

NANA Class A shares are held by Natives enrolled as residents of villages in the region, and Class B shares are held by Natives enrolled in the region but not registered as residents. Each shareholder is issued 100 shares of stock, and these cannot be sold or transferred until 1991.

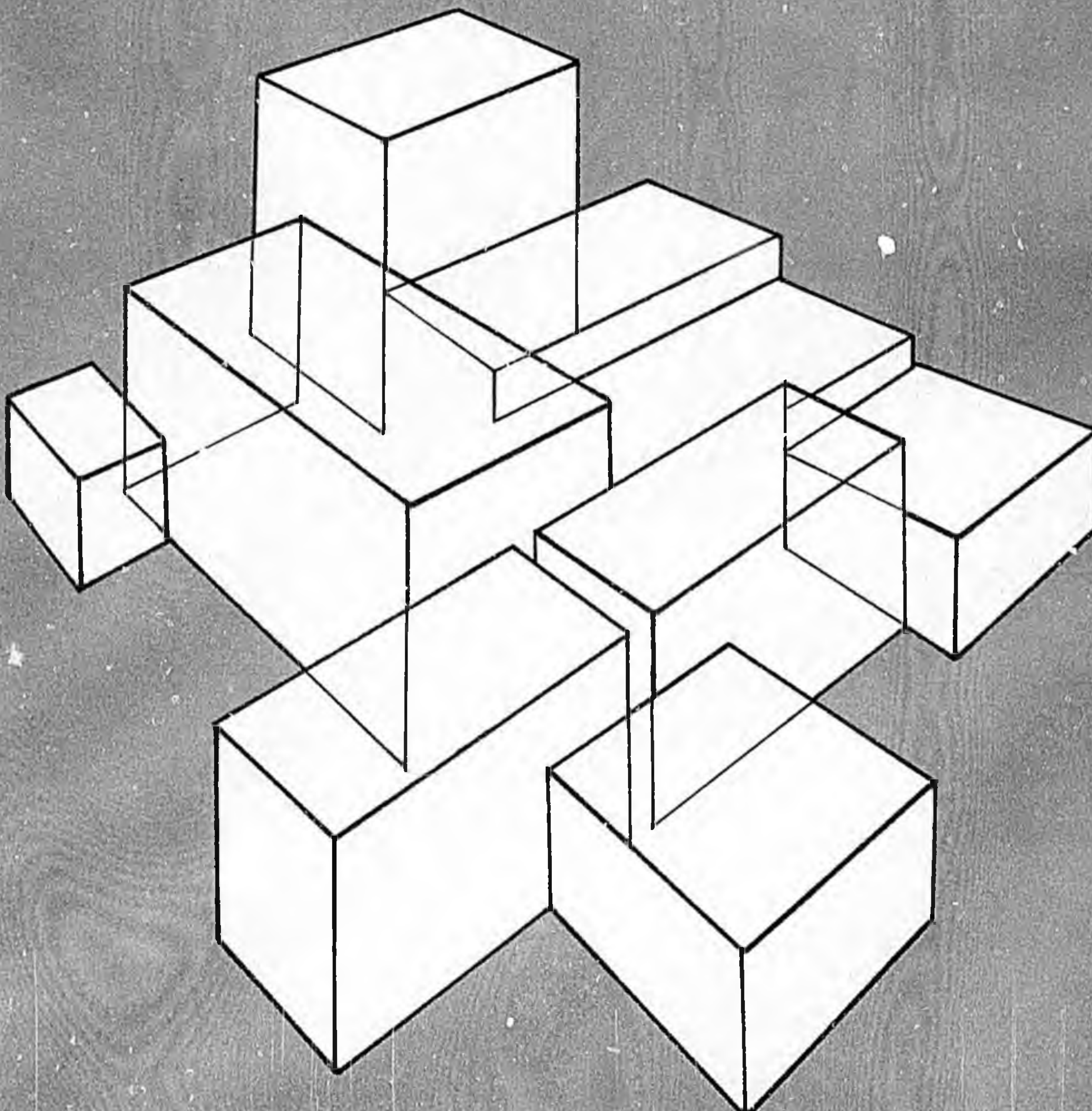
NANA's business activities include construction, oilfield services, an electrical utility, rearing of reindeer, jade production and hotel operations. NANA believes the development of the Red Dog property will have a long-term positive impact on the economy of the area, improving the Corporation's business position in a manner consistent with NANA's social and cultural goals.

A NANA program, Inupiat Ilitqusiat, teaches traditional ways to children and adults to reawaken awareness of the Inupiat spirit. The program teaches cultural values such as honor, hard work, family ties and an understanding of ancestors. These are all important factors in preserving Inupiat identity, spirit, language and tradition. At the same time the modern present and future are not rejected.

Under Cominco American's agreement with NANA, Cominco is to be the operator and provide the funding at Red Dog. At the outset, Cominco will make minimum payments to NANA of $1 million a year. Until Cominco has recovered its investment, interest, it will pay to NANA 4.5% [illegible] royalties. After that, NANA will receive 25% of net proceeds, increasing to 30% five years after Cominco recovers its investment and further increasing by 5% every five years until Cominco and NANA share the proceeds on a 50-50 basis.

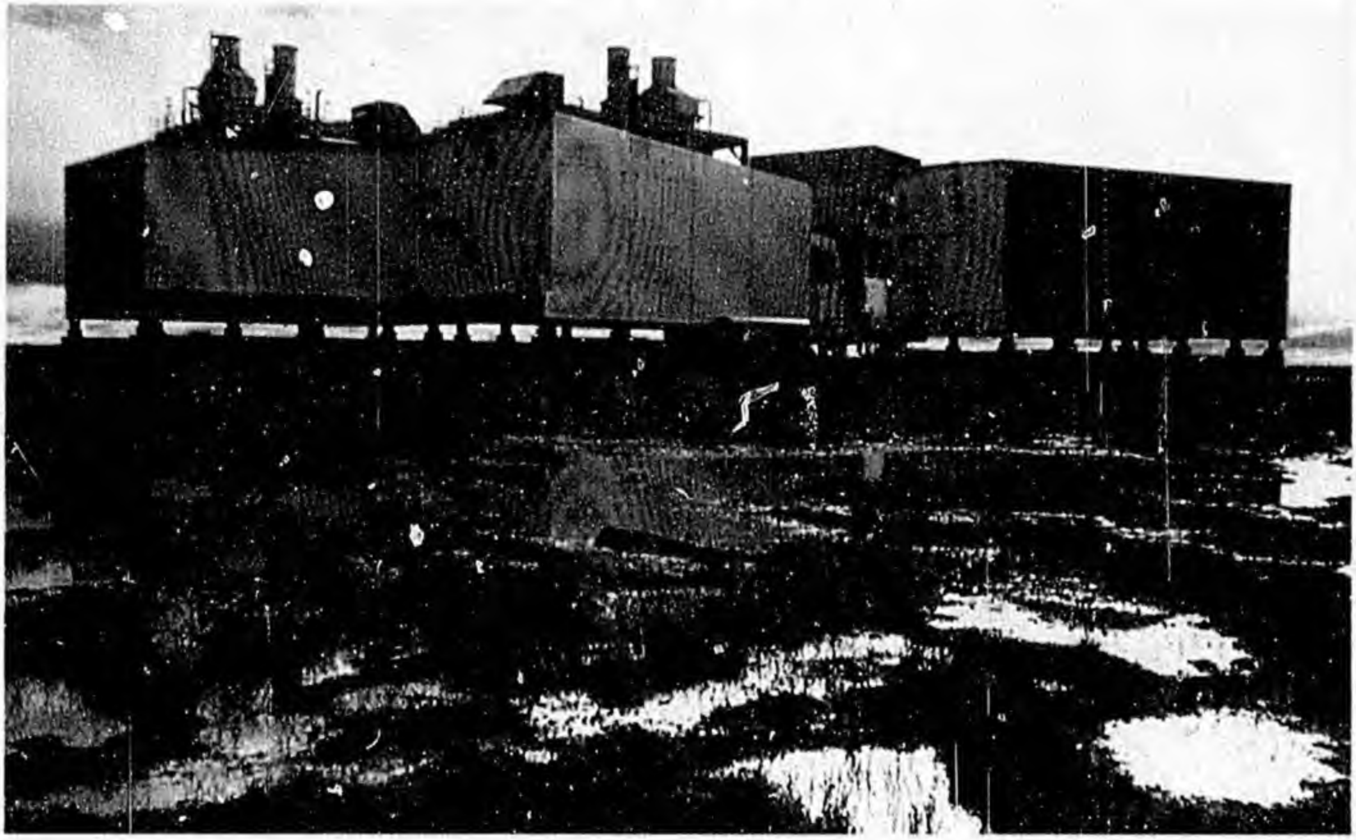
In addition, Cominco has undertaken to assist in the vocational training of NANA shareholders, so that eventually they will comprise the permanent workforce at Red Dog.

Opposite page: [illegible] business [illegible] and the promotion [illegible] including [illegible] construction [illegible] employment [illegible] a major [illegible] Below [illegible] values [illegible]



The Red Dog Concept

The following article is reproduced from the September, 1983 issue of ORBIT, the Cominco quarterly magazine.



Modules for processing crude oil are seen at a module staging area at Prudhoe Bay on the North Slope of Alaska. They were built in Seattle.

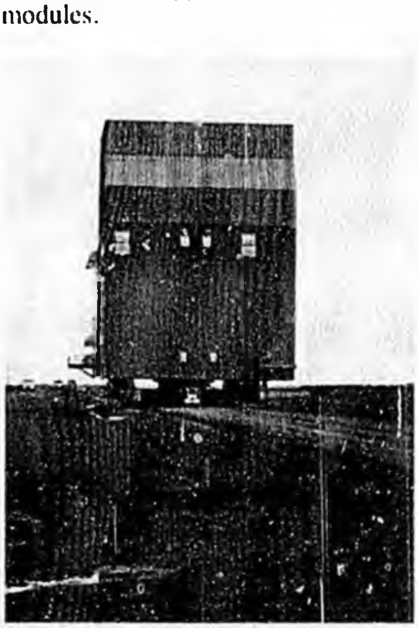
Modules: building blocks for an Arctic mine

Anchorage, Alaska — A complete mine processing plant, divided into seven separate units for transportation thousands of kilometres by sea and over land to a remote location in Alaska: That's the modular concept Cominco engineers in Trail, B.C. envision for the potential Red Dog Mine. Plants to process North Slope oil in Alaska have been transported in sections aboard barges from Seattle, but the Red Dog concept would be the first application of this modular building system for a mine concentrator.

Modular construction saves time and money. It saves project time because different stages can be developed simultaneously, and it saves money because construction manpower and supplies are found in an established industrial location.

For these same reasons, Cominco specified the world's first wholly prefabricated mine plant for the Polaris Mine on Little Cornwallis Island in the Canadian High Arctic. The entire mill complex was built on a barge the size of a city block, towed north and beached to become a shorebound facility.

Red Dog's plant will be much bigger in size, and will be located far from the ocean, so the mill built on a barge method isn't practical. However, the Polaris project did demonstrate the advantages of prefabrication in the south and points toward bigger and better applications — like modules.



Module transportation at Prudhoe Bay

Cominco Engineering Services engineers in Trail are planning seven modules for the process concentrator: one each for the grinding mill, the regrind mill, flotation cells, dewatering, dryers, power plant and a primary crusher. Each would be built in the south, lashed to the deck of a barge and towed to a staging area on the northwest coast of Alaska.

Giant crawlers would transport the modules 91 km to the mine site where they would be placed on prepared foundations and connected to each other inside and out to form a ready-made industrial plant. Most of the on-site work would be indoors and it would take about four months.

The largest and heaviest unit would be the flotation equipment, weighing in at 1,500 tonnes and measuring 45 m by 20 m and eight stories high. The lightest module would be the concentrate dryers at a hefty 450 tonnes, and the smallest the primary crusher at 19 m by 15 m and five stories high. Arvik, the Polaris plant, weighs 12,000 tonnes and measures 126 m by 30 m and is six stories high.

Six more modules for the accommodation complex would be built off-site and transported to the site. These

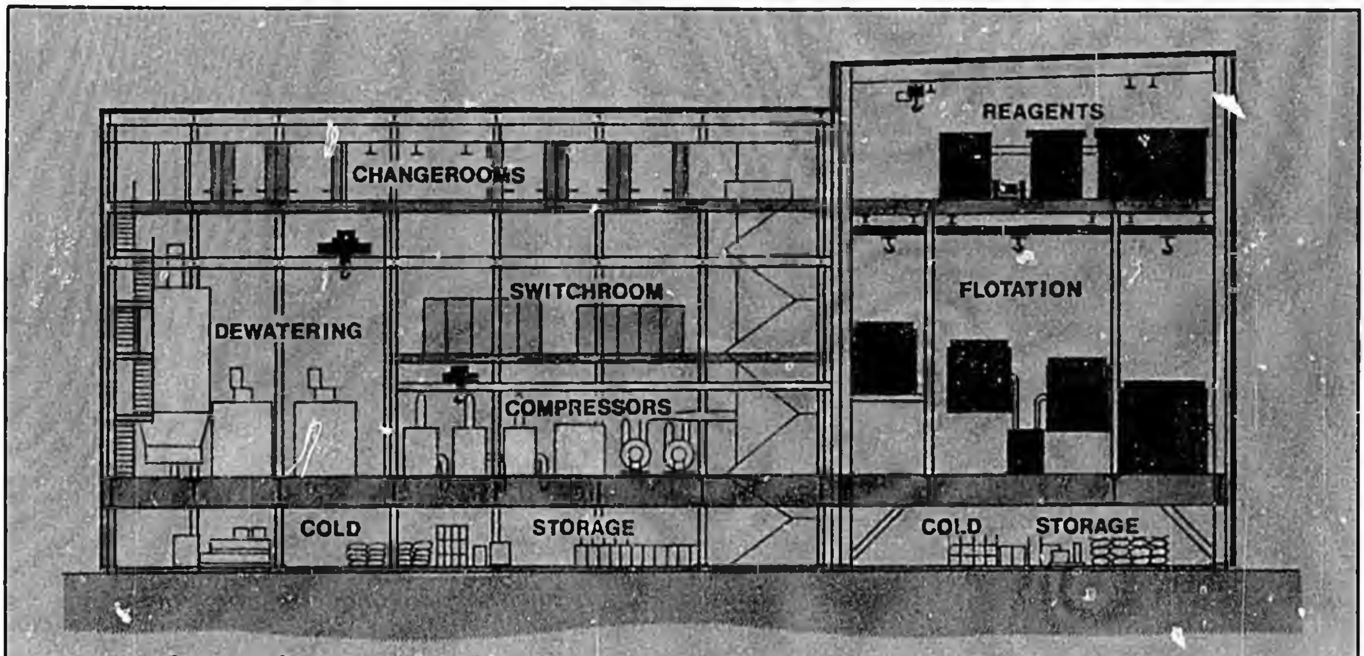


Diagram showing a section through the dewatering and flotation modules proposed for Red Dog

would arrive first and be put in place to provide living quarters for the construction crews working on the plant modules.

Because of winter sea ice and the short shipping season, scheduling is critical for success of the Red Dog project. Modules would be advantageous, because conventional on-site construction methods would require that a road be built from the ocean before any work could start. Using the modular method, plant construction in the south can go on apace while the road is being built in readiness for the arrival of the modules.

To house the workforce employed in preparing the road and port for arrival of the modules, another barge concept is being considered. A barge could be outfitted in the south as a construction camp, towed into a lagoon at the port site near Kivalina and ballasted in. Once the accommodation modules were on-site, workers would move there and the barge would be removed.

The workforce doing preparatory work for the modules at the mine site would be housed in the existing exploration camp, expanded for the purpose, until the accommodation modules are in place.

The use of a barge recalls Polaris, and the construction camp aboard the ship *C.D. Howe* at the Black Angel Mine in Greenland. There are a number of lessons learned at Polaris and Black Angel that are benefiting the Red Dog planners. For example, Polaris showed that mounting foundations on frozen rock is feasible at Red Dog, contrary to the popular wisdom in Alaska that permafrost requires piled foundations to appreciable depths.

Heavy structural demands

The Polaris barge taught lessons about the structural demands of a mine plant that puts to sea. To make the modules seaworthy and to allow them to be picked up and moved, they must be built more rigidly than a plant built on land, heavier steel must be used and designers must take into account load factors and distribution for land and sea transportation.

But not all construction at Red Dog is expected to be modular. Engineers talk of a "guts to fresh air ratio": the less there is inside a module the less cost-effective it is to modularize it. Modules that are like a box of fresh air are not economic. Structures such as those used for vehicle maintenance, concentrate storage and water treatment will be built on-site. However, once again, they will be built from units prefabricated elsewhere, just like a do-it-yourself kit.

— Terry Manning, Ian Hanks, Tony Cowell with Hugh Leggatt

These modules, bound for Alaska, were constructed by National Shipbuilding Co[illegible] in San Francisco.

Cominco

from the air

A company portrait by aerial photography, revealing the great individuality of our operations around the world

Mataiva: Like the spokes of a wheel, dykes radiate out in this lagoon in French Polynesia, South Pacific. Papeete is the closest town to this joint-venture project, still in the feasibility-study stage. The dredge, left, pumps phosphate mineral samples into the basins formed by the dykes, part of stringent environmental measures.

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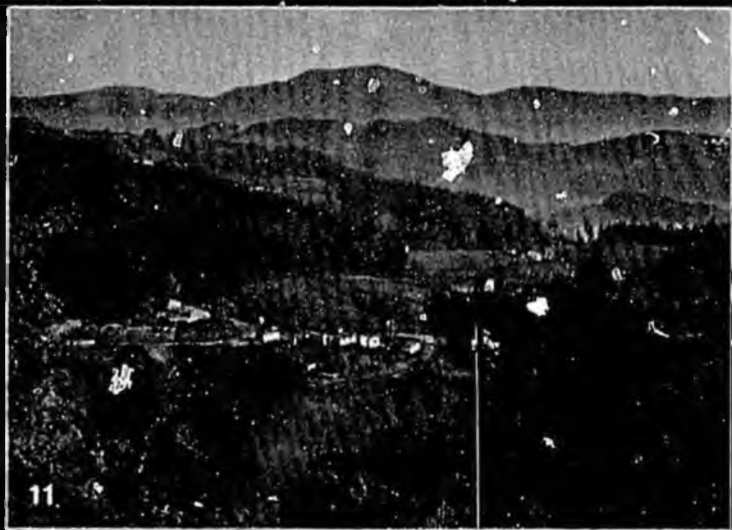
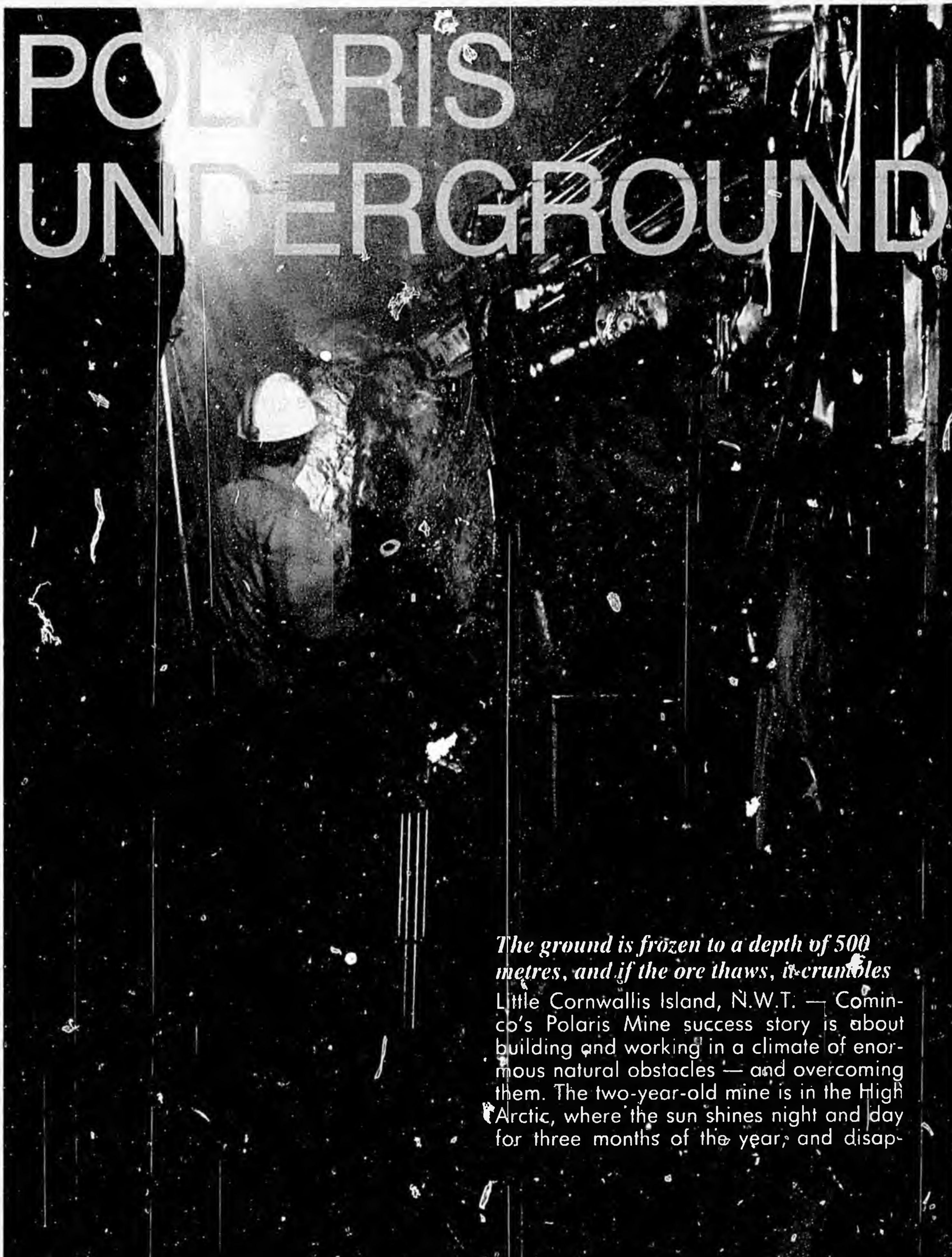
1. Con: If the Eiffel Tower is the symbol of Paris; then the 76-metre-high Con headframe is the symbol of Yellowknife. Built in 1977, it is the tallest structure in the N.W.T. Con has been producing gold since 1938. 2. Polaris: The largest Maple Leaf in Canada, 40 metres high by 76 metres wide, proudly identifies the most northerly zinc-lead mine in the world, 1,440 km from the North Pole. 3. Black Angel: At Maarmorilik on Greenland's west coast, Greenex A/S operates a zinc-lead mine inside Black Angel mountain. The mine is connected to the mill by aerial tramway. 4. Pine Point: On the southern shore of Great Slave Lake, N.W.T., the zinc-lead mining and milling operations produce concentrates for Canadian and Japanese smelters. 5. Red Dog: Diamond drilling will continue this summer at Cominco Alaska's zinc-lead mine property, 145 km north of Kotzebue.

6. The Product Research Centre: At an R & D park in Mississauga, just west of Toronto, P.R.C.'s program is devoted to developing commercial uses of zinc and lead. 7. Rubiales: The Exminesa lead-zinc mine is located 450 km northwest of Madrid in the Province of Lugo, Spain. 8. Vade: Southwest of Saskatoon, Saskatchewan, potash for fertilizer is mined 1,000 metres below the surrounding wheatfields. 9. Sullivan: In southeastern British Columbia the Sullivan Mine at Kimberley has been a major zinc-lead-silver producer for Cominco for more than 75 years.



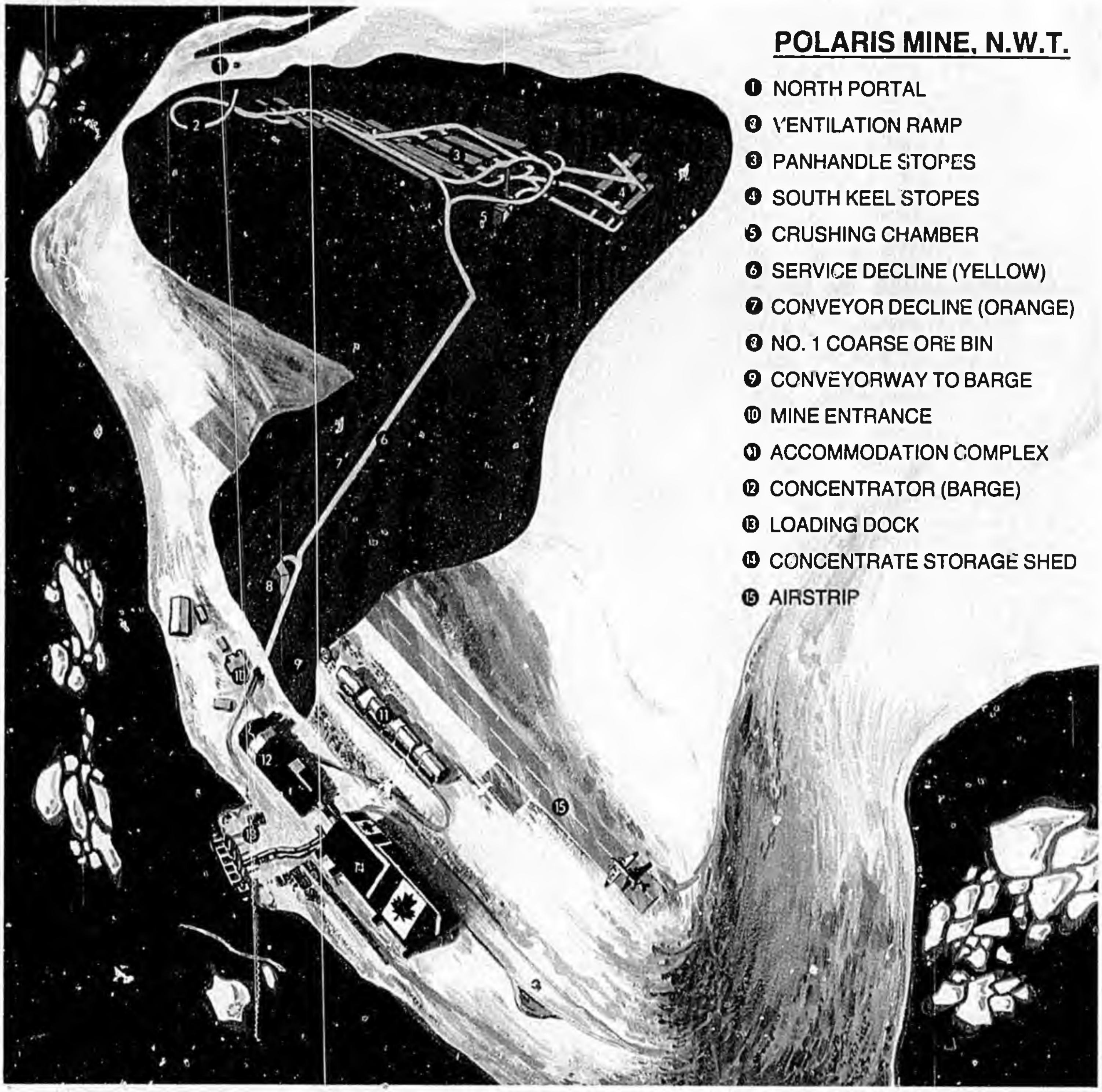
10. Owens Lake, California: A unique dyking system in the desert 360 km north of Los Angeles recovers trona, which is refined to soda ash and used in glass manufacturing.
11. Troya: Exploration work is in progress at Troya, a potential zinc-lead mine, in the beautiful Basque countryside of northern Spain. **12. Trail:** In the foreground, the new zinc electrolytic and melting plant, the world's largest, looking southeast. A wide range of non-ferrous and precious metals, chemicals, fertilizers, electricity and electronic materials are also produced at Trail.

POLARIS UNDERGROUND



The ground is frozen to a depth of 500 metres, and if the ore thaws, it crumbles

Little Cornwallis Island, N.W.T. — Cominco's Polaris Mine success story is about building and working in a climate of enormous natural obstacles — and overcoming them. The two-year-old mine is in the High Arctic, where the sun shines night and day for three months of the year, and disap-



***PREVIOUS PAGE:** Underground in the Polaris Mine. **Above:** A three-dimensional schematic view of the underground and surface facilities at Polaris. The orebody is not shown, but is located primarily in the Panhandle and South Keel areas.*

BILL MAYRS ILLUSTRATIONS AND DIAGRAMS

pears entirely for another three in winter. It is only 100 km from the magnetic North Pole, and only 1,600 km from the geographic North Pole. It is nearly as dry as the Sahara Desert, and the ground is frozen to a depth of 500 metres. When mineralization was first discovered there in 1960, the obstacles to recovering it seemed almost insurmountable.

All the same, Cominco began detailed investigations in 1964 and a drill program in 1971 outlined a substantial body of lead and zinc sulphides. Underground development began in 1972, and the decision to bring the Polaris Mine into production was made in October 1979.

The remote and harsh environment created a number of problems that had to be overcome in constructing facilities at Polaris. The shipping season at Polaris is only six weeks — the ice-free period. Careful planning was required because all supplies for a full construction year had to arrive at that time. Anything forgotten would have to be flown in as there are no roads or railways within 1,500 kilometres. Wages were necessarily high to attract workers to the north, and there was the additional cost of maintaining room and board on-site.

Unique concept saves money

Cominco adopted a scheme where as many as possible of the permanent facilities would be built in southern Canada on a barge that would be towed to the mine site during the ice-free period. The barge was built in Lauzon, Quebec and outfitted in Trois-Rivières. It contains the concentrator, powerhouse, warehouse, dry, shop and offices. The galvanized steel structure, 31 m wide, 18 m high, and 122 m long, was towed 4,800 km through the St. Lawrence River, along the coast of Greenland and through Lancaster Sound to the mine site, arriving safely in August of 1981.

This unique concept of building a large portion of the project on a barge in southern Canada and simultaneously doing the necessary site work, saved about a year of time and millions of dollars.

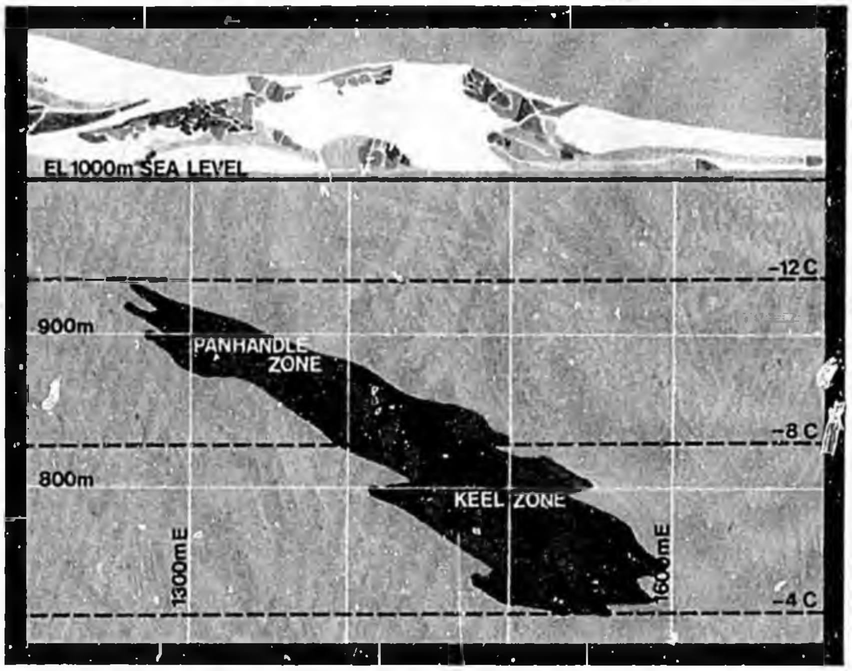
Construction on the island included a galvanized steel concentrate storage shed (with the familiar Polaris maple leaf), accommodations, an airport, fresh water and tailings disposal systems and a dock. Rather than using concrete to reinforce the dock structure, waste rock fill was frozen in place resulting in significant savings.

High grade orebody

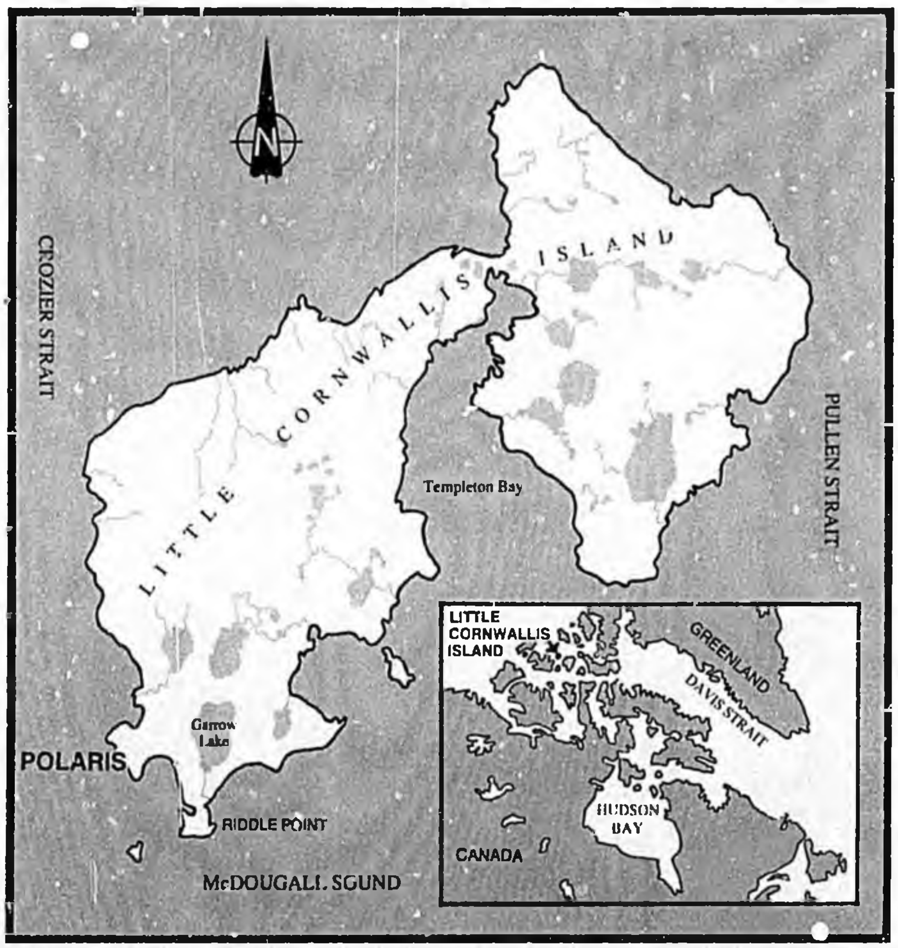
The Polaris orebody lies near the top of the Thumb Mountain Formation. Ore minerals are sphalerite and galena with the waste being predominantly dolomite with calcite and marcasite. Reserves in 1982 consisted of 11 million tonnes of indicated ore grading 4.4% lead and 15.2% zinc with a further twelve million tonnes of inferred ore at slightly lower grades.

The orebody is divided into two sections: the Panhandle Zone and the Keel Zone. The Panhandle Zone, about 25% of the reserves, is the upper portion of the orebody some 120 metres below surface. The ore thickness in this area ranges from 10 to 40 metres. The rest of the orebody, the Keel Zone, is attached to the east side of the Panhandle This is the deeper zone with ore thickness of up to 110 metres.

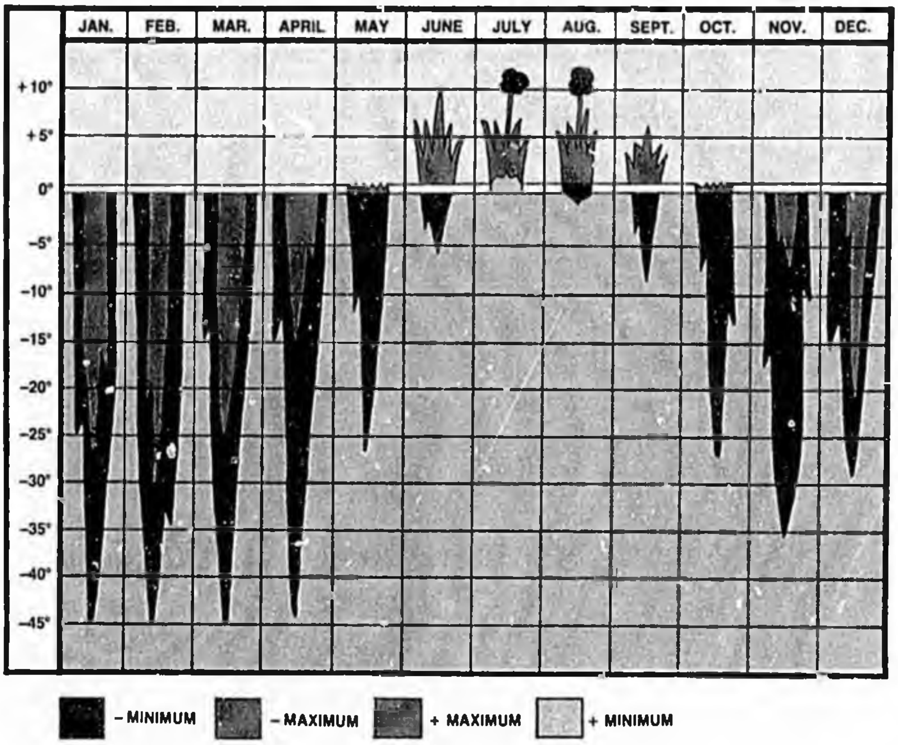
The ore is porous and the voids are generally filled with ice, as the mineralized zone lies entirely within permafrost. The cross-section of the orebody shows typical rock temperatures as a function of depth. The influence of permafrost on the physical characteristics of the ore cannot be overemphasized. If allowed to thaw, much of the ore deteriorates to the extent that it crumbles. The stability of openings in the ore zone is entirely dependent on the permafrost.



Above: The deeper you go, the warmer it gets: a cross-section of the orebody. ***Below:*** *Little Cornwallis Island is just off the northeast coast of Cornwallis Island in the High Arctic.*



Above: *Aerial view of Polaris showing Garrow Lake in the background.* ***Below:*** *Only four months have above-freezing temperatures.*



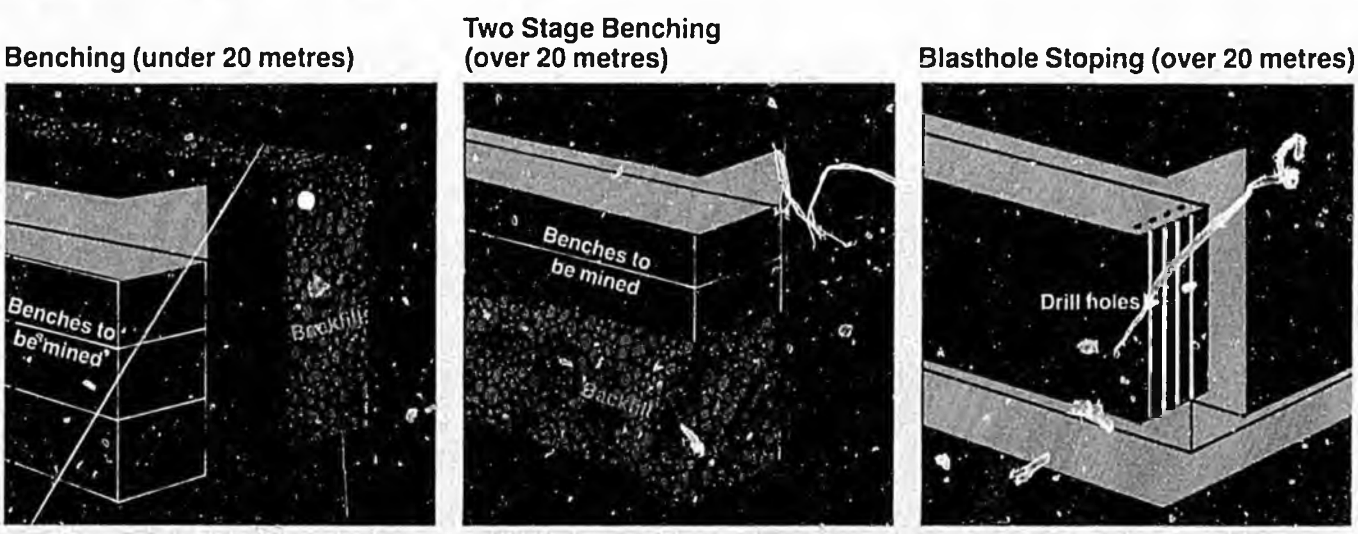
Underground mining methods were chosen at Polaris because the large amount of waste overburden made an open-pit method impractical. Primary stopes are mined in a series of parallel panels 10 metres wide. The cavity is then backfilled to allow recovery of the intervening pillars. Where ore thicknesses are less than 20 metres, panels are benched in five-metre vertical lifts from the top to the bottom of the ore zone. Higher ore thicknesses are extracted by blasthole mining.

A backfill material was required that would not introduce heat to the mine and melt the permafrost. Shale rock, which is also in permafrost, is quarried on surface and delivered to the stope voids via boreholes between the surface and the mine workings. The shale is packed into the mined-out areas and a limited amount of water or snow is mixed in to form a consolidated frozen mass.

A lake in layers

The Polaris tailings disposal concept incorporates a water recycle feature to conserve water and to recover heat in the process water. The mill tailings are pumped to a thickener overlooking Garrow Lake, 2½ km from the process barge. The thickened tailings are pumped to a depth below 20 metres in Garrow Lake and the overflow water from the thickener is returned to the concentrator.

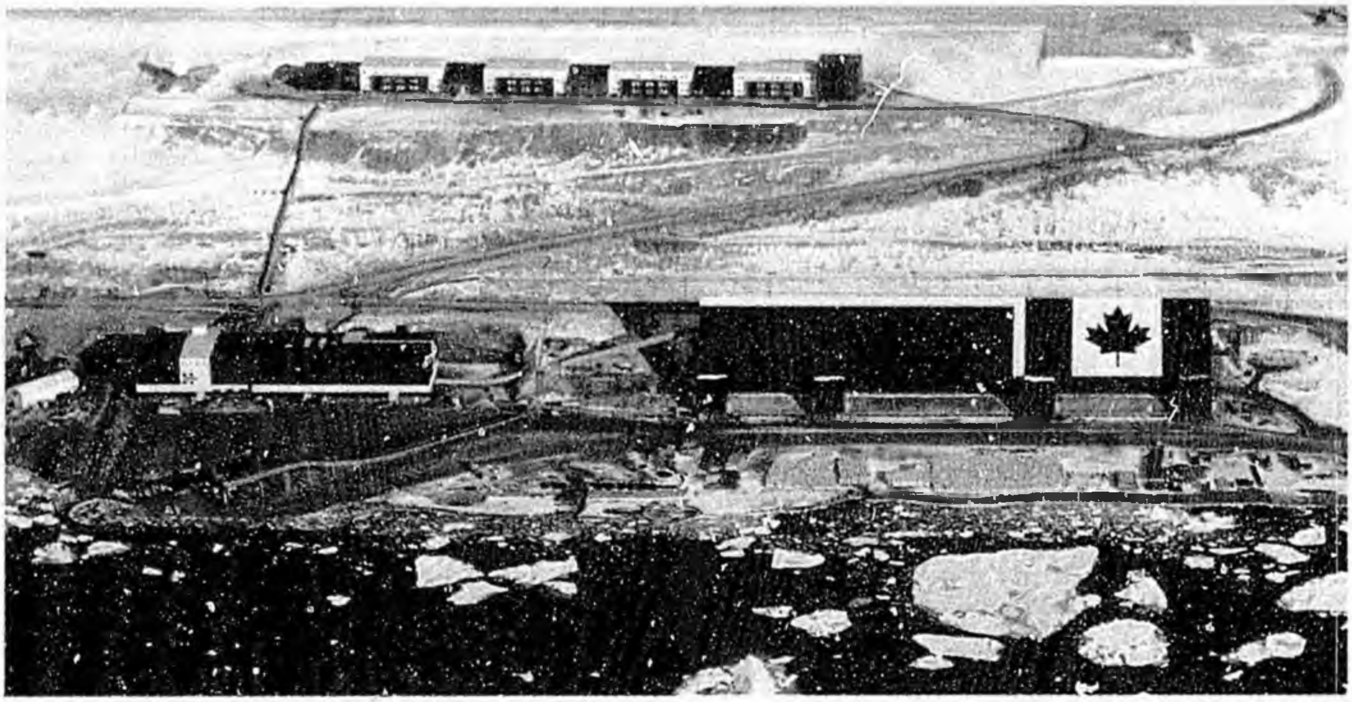
Garrow Lake is a meromictic lake — a lake that has no vertical circulation of its water. The upper 13 metres of the lake is essentially fresh to brackish water supporting limited aquatic life forms. The transition zone (halocline) that extends from 13 to 20 metres is characterized by decreasing



Mining methods used at Polaris include benching, two-stage benching and blasthole stoping. Blastholes of 82 mm are drilled from the top; the ore is blasted out and is then removed through an access tunnel at the bottom.

CP PHOTO

Above left: ***The swimming pool at Polaris is the most northerly in the world.*** *Above right:* ***The accommodation complex is raised off the ground so that heat transfer from the buildings does not melt the permafrost.*** *Below:* ***Aerial view showing the accommodation complex at the top, the concentrator (barge) at lower left and the storage shed (with maple leaf) at lower right.***



CP PHOTO

oxygen content and increased salinity. It supports no aquatic life.

The bottom zone, below 20 metres, has abundant soluble hydrogen sulphide (H_2S) to 120 mg/L, and salinity three times that of sea water, resulting in a hostile environment to conventional aquatic life. It is a habitat for anaerobic, decay-causing bacteria that generate hydrogen sulphide.

Deposition of the mill tailings in this bottom zone, where there are no sensitive life forms, is uniquely environmentally acceptable. The presence of hydrogen sulphide prevents the release of soluble heavy metals. The thickening of the tailings prior to discharge in the lake precludes the vertical transportation of solids in the lake and reduces the volume of material deposited.

Living in the cold

The facilities and personnel policies at Polaris must take into consideration the extreme climate and isolation of the operation. The air temperature in the mine remains about 0°C in summer, and from -15° to -20°C in winter. In winter, miners wear thermal underwear, work clothes, company-provided quilted coveralls, parkas and gloves. There is an underground lunch room where miners can take a coffee break and get a hot lunch.

Air conditioning for the Arctic: ventilation fan at the mine entrance.

The accommodation complex is a carefully designed, well-built construction. It contains 208 single rooms and 16 suites within four residential modules. Recreational facilities include a billiard room, library, indoor swimming pool with sauna, gymnasium, games area and weight-lifting room. There is a common dining-room and lounge area. Some eight channels of television are available via satellite in both English and French.

The opportunity to work long hours at high rates of pay and the quality of the room and board are the main advantages attracting workers to Polaris. The standard work week is 11 or 12 hours a day, six days a week. Work schedules are on a rotation basis, and employees are flown to their homes following each work rotation. Southern employees work 10 weeks at the mine and then have two weeks off.

Northern native employees have the option of working for six weeks followed by four weeks off. This rotation is designed to allow the Inuit to continue with traditional pursuits such as hunting and fishing.

The High Arctic is a very difficult location in which to construct and operate a mine and concentrator. Cominco has had to adapt its construction approach and operating practices to suit the harsh environment and isolated site. The experience to date at Polaris demonstrates the success of our innovative approach to northern development. This northern Canadian frontier is largely unexplored and prospects for new mineral finds in the immediate area around Polaris are high. Cominco's success with the Polaris Mine project and operation may well be a model for future northern development. **— Jim Drake**

Jim Drake

Jim Drake, who is General Superintendent Polaris Operations, started with Cominco as an engineer-in-training at Kimberley in 1973. After nine months there, he worked for 2½ years at the Con Mine in Yellowknife on the Robertson Shaft project. In 1976 he went to Spain to work at Rubiales for three months — and ended up staying for five years. He has been at Polaris since 1981.

*The **Federal Elbe** loading concentrates during Polaris' first production season in September, 1982. The 1983 sealift had a new twist.*

Roundabout resupply saves dollars

Little Cornwallis Island, N.W.T. — For the Polaris Mine, resupply, like Christmas, comes but once a year — in the brief Arctic summer when sea lanes open through the ice for ships to reach Little Cornwallis Island.

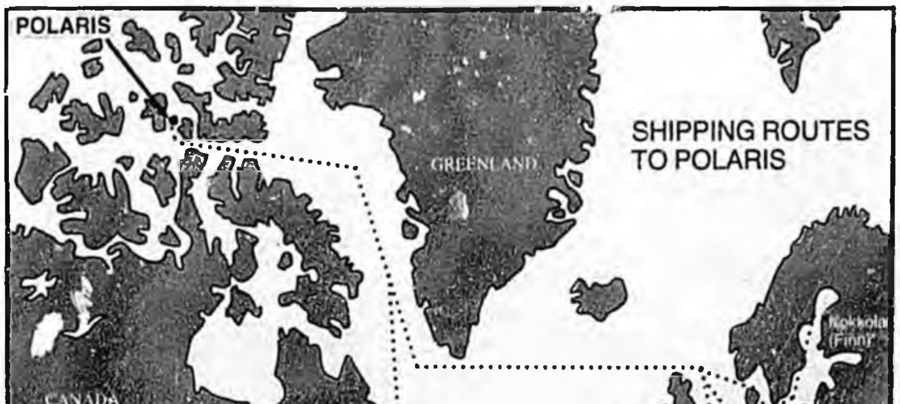
In 1983 the second annual sealift of materials to the mine was different from the first summer. Most of the goods for Polaris were shipped to Europe first. They went from Montreal across the North Atlantic to Antwerp in Belgium for transshipment into another vessel bound for the Canadian Arctic. The dogleg route is about double the 4,800 km of the conventional route from Montreal to Polaris, but resulted in savings of about $1 million.

The circuitous route (see map) was taken because Polaris has a contract for shipment of concentrates in the MV *Arctic*, a Canadian icebreaking carrier which also ships zinc-lead concentrates from the Nanisivik Mine on Baffin Island.

With the *Arctic* delivering her first shipment from Nanisivik to Antwerp in July, the Polaris purchasing group in Toronto determined that it would be cheaper to send supplies for Polaris to Europe for transfer to the MV *Arctic* than to ship direct from Montreal to Little Cornwallis Island. The *Arctic*'s northbound trip is part of the Cominco contract; why not fill her holds with cargo instead of ballast?

A total of 1,250 tonnes of supplies for Polaris were purchased in Canada and shipped in the MV *Lady Franklin* from Montreal to Antwerp. Among the supplies were containers of canned food, hardware, parts, chemicals, tires, lubricants, lumber and 11 mine vehicles.

Another 3,000 tonnes of goods were purchased in Europe and delivered to the Port of Antwerp. Both cargoes were loaded aboard the *Arctic* in July, 1983. The *Arctic* arrived at Polaris on



August 10, 1983. The supplies were unloaded and the *Arctic* departed for Antwerp on August 15 loaded with 2,271 tonnes of lead concentrate and 24,230 tonnes of zinc concentrate. The *Arctic* made two more calls at Polaris to load concentrates before the end of October.

Total concentrate shipments from Polaris in 1983 were 43,531 tonnes of lead and 196,910 tonnes of zinc. Besides the *Arctic*, five other ships called to take off the year's production of concentrates: the *Federal Hudson* on August 31 and September 21 to Nordenham, West Germany, and Antwerp; the *Finntimber* on September 1 to Kokkola, Finland; the *Federal St. Laurent* on September 11 to Antwerp; the *Federal Huron* on September 13 to Nordenham and Kokkola; and the *Columbialand* on October 10 to Antwerp.

Polaris was also supplied with 15,600,000 litres of fuel oil to satisfy the mine's energy needs for a year. The tankers *Gulf Gatineau* and *Gulf MacKenzie* called at the end of August and the end of September respectively.

Over 300 tonnes of Polaris-bound supplies, which did not go to Antwerp to connect with the MV *Arctic* in July, were shipped in the *Federal Pioneer* out of Montreal. The *Pioneer* supplied other northern settlements on its way to Polaris. Included in her cargo for Polaris were a year's supply of frozen meat and ice-cream — a case of exporting ice to the Arctic.

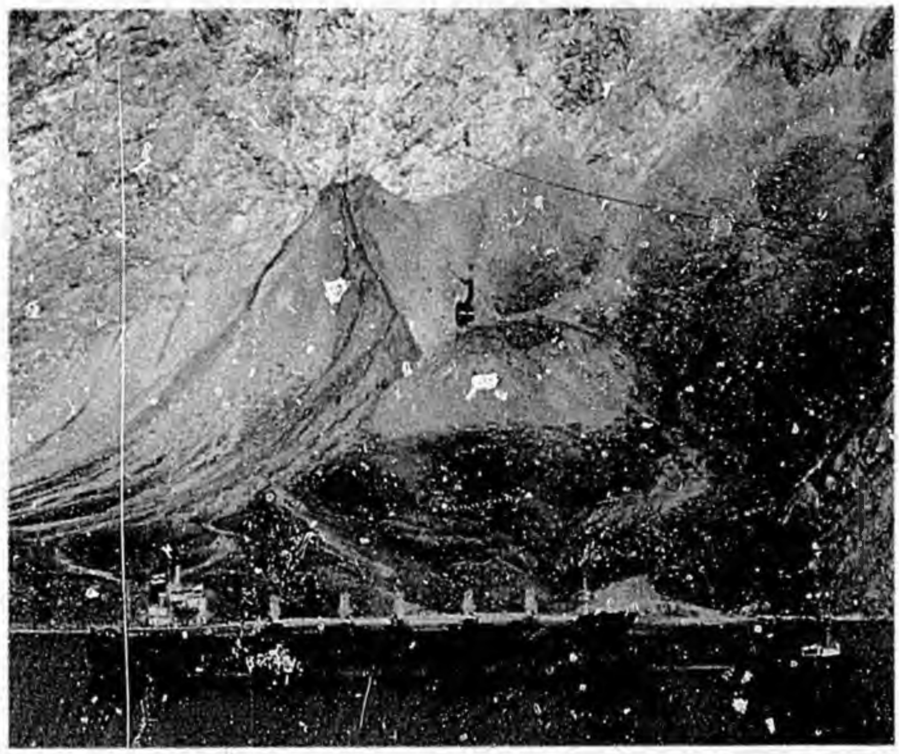
What does it mean?

Polaris

Little Cornwallis Island, N.W.T. — The northernmost metal mine in the world was named for its location beneath the pole star, Polaris, and near the magnetic north pole in Canada's High Arctic.

The pole star, or North Star, is the nearest star to the North Pole visible to the naked eye. Medieval Norse navigators learned to steer by the pole star that remained constant in the northern sky.

Over the eons, a succession of stars have passed near enough to the North Pole to serve as markers. But Polaris has been the pole star for at least 2,000 years, and will come even closer to the pole over the next hundred years. Three thousand years ago, the pole star would have been Beta Ursa Minoris; 12,000 years ago, it was Vega.



With a cablecar suspended above, a bulk carrier docks at Maarmorilik to load zinc and lead concentrates for smelters in Europe.

Black Angel: A Mine in a Mountain

Can a mine high on a mountainside in a remote part of Greenland be both a financial and a social success?

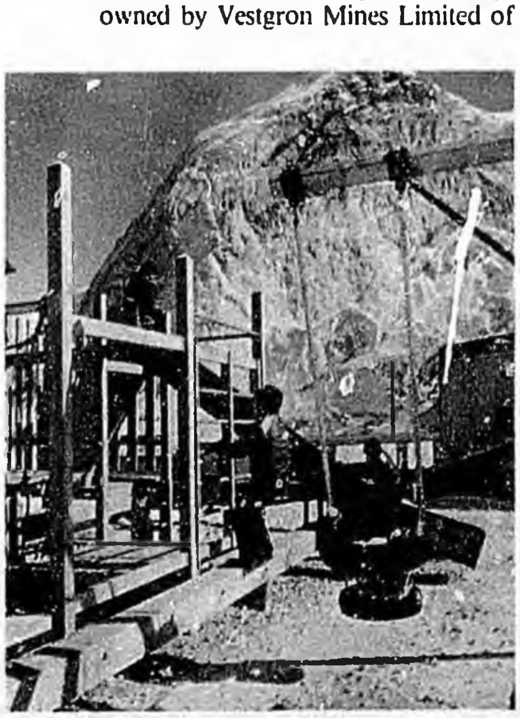
Now ten years after start-up, the Black Angel zinc-lead-silver mine has demonstrated that native Greenlanders, who comprise nearly half of the workforce of 348, have been a key factor in this remarkable operation.

The mine, located 500 km north of the Arctic Circle on the northwest coast of Maarmorilik, is Greenland's first large-scale industrial installation. The operation forms a complete community of its own, unlike the fly-in, fly-out camp system proposed for Red Dog in Alaska.

Evidence of lead and zinc minerals was found many years ago in rock debris along the shoreline of Maarmorilik fjord. In 1963 the region was examined by a prospecting party supported in part by Cominco Ltd. The first large-scale exploration work was carried out from June to September in 1966. Many difficulties were encountered, not the least of which was that the lead and zinc bearing minerals were located on nearly vertical cliffs. Mountaineers were used and exploration crews encountered storms, permanently frozen rock and other difficulties.

The mine and mill began producing in October 1973.

The operation is owned by Greenex A/S, a Danish company wholly-owned by Vestgron Mines Limited of



These children are part of the mine community at Maarmorilik.

Canada. Cominco Ltd. controls Greenex A/S through a 62 per cent interest in Vestgron. Hank Giegerich, President and General Manager of Cominco Alaska, was project engineer at Black Angel for two years from 1972.

Another engineer who would become Vice-President of Cominco's northern operation, John Willson, served at Black Angel as Project Superintendent and later Manager, Black Angel Operation, until 1974. Erik Sprunk-Jansen, Managing Director of Greenex A/S participates in the Red Dog management committee to which he brings experience of both Arctic mining and the concerns of local hunters and fishermen.

The mine's facilities include a concentration plant, townsite, concentrate storage facilities, docks and shiploading equipment, electric power and seawater desalination plants. The mill equipment was transferred to the Greenland site from a Cominco American Incorporated mine in Montana and reassembled on site. The grinding equipment uses seawater as process water.

Although the mine is on tidewater navigation is closed from December to June due to ice conditions. Greenex has an agreement with the community board of Uummannaq concerning ice breaking in order to protect the traditional hunting and fishing life.

The mine is inside the Black Angel mountain which takes its name from the clear outline of an angel with outstretched wings darkening the side of the mountain. The mountain has an altitude of 1100m and the mine portal is located at the 600m level. The entire mountain is permanently frozen. The mine portal is reached by two cableways with a span of 1500m stretching across the fjord to the concentrator and town site on the opposite edge of the fjord.

The ore is treated in a standard concentration plant and the concentrates stored for shipping.

Since 1979 Greenland has had home rule under the kingdom on Denmark. The Danish Ministry for Greenland is still responsible for several areas but more and more are being transferred to the Greenlandic home rule government in Nuuk.

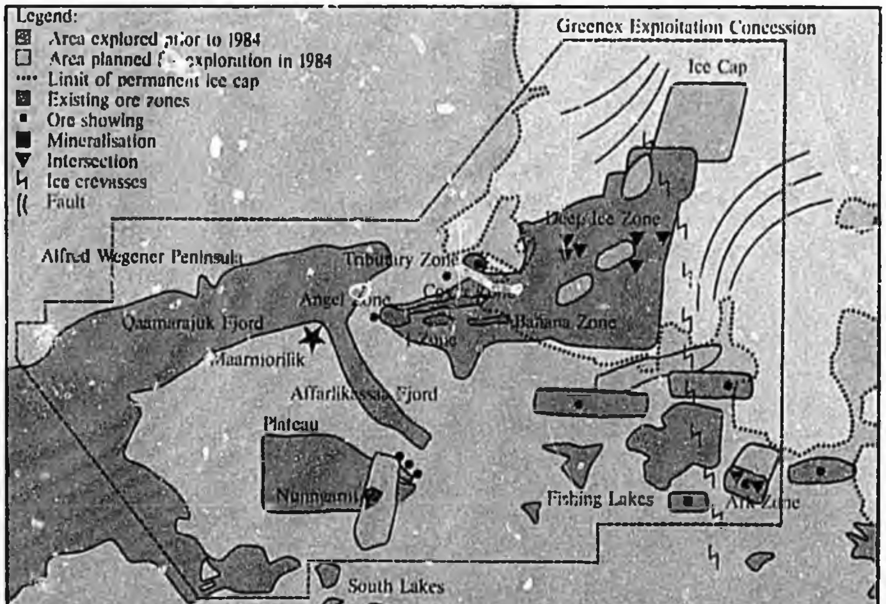
A joint committee for mineral and oil resources in Greenland was established on July 1, 1979. Five if its 10 members are appointed by the Danish government, the remaining five by Greenland Home Rule. The committee follows developments in the mineral and oil resources sector; in addition, it submits its recommendations in matters of resources on which a decision must be made jointly by the Danish government and Greenland Home Rule. Chairman of the committee is Premier Jonathan Motzfeldt. The Ministry for Greenland has an agency responsible for the central administration of mineral and oil resources. The agency also acts as secretariat for the joint committee.

In 1971, Greenex got an exclusive concession from the Minstry for Greenland after extensive negotiations. As a consequence of the introduction of Home Rule and of the complexity of the operation, Greenex's head office moved to Maarmorilik from Copenhagen on June 1, 1984. The administrative office in Copenhagen will be transferred during 1984, leaving four or five persons in Copenhagen.

Environmental control is an important element of the agreement with the Danish Government. It requires the company to follow strict pollution control measures to safeguard the environment. Prior to the start of operations, the waters, flora and fauna near the mine were studied to assess their natural state. Tests are made periodically to ensure that metal elements and chemicals resulting from mine activity are within acceptable limits.

The townsite includes bunkhouses, apartments, townhouses, kitchen, dining and laundry units, a recreation centre and medical centre with resident doctor. Electric power is provided by three diesel units.

The mine relied on Canadian mining specialists until 1975 when Greenex replaced them with Danish and Greenlandic personnel. Greenex also draws on graduates from Scandinavian mining schools and technical universities. Employees are encouraged to take internal and external educational courses offered through the company.



Location of the Black Angel Mine, operated by Greenex A/S, on the west coast of Greenland 500 km inside the Arctic Circle. The plan of the property (above) shows ore zones and explored areas.

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Cominco Ltd. Annual Report 1983

Cominco

Cominco Ltd.

Summary of Business Activities and Corporate Objectives

Cominco Ltd. is an integrated natural resource company with principal activities in mineral exploration, mining, smelting and refining. It is one of the world's largest mine producers of zinc and lead.

Cominco is Western Canada's second largest chemical fertilizer producer. Principal chemical and fertilizer products are ammonia, urea, potash, ammonium nitrate, ammonium phosphate, ammonium sulphate, sulphuric acid and sulphur dioxide.

Cominco also produces silver, gold, copper, tin, cadmium, bismuth, indium, diamonds, coal, steel products, fabricated metals, high purity metals and compound semiconductors and components for the electronics and other high-technology industries.

Cominco's primary objective remains steady, long-term growth. To accomplish this it seeks to strengthen its position in zinc and lead, and to expand its activities in selected other non-ferrous metals, particularly gold, and in chemicals and fertilizers. Cominco is endeavouring also to broaden its markets and geographic base.

In managing the growth of its business, Cominco continues to seek high standards of production efficiency, to provide customer satisfaction and to reward employee energy and initiative. Emphasis is placed on the health and safety of its employees and the protection of the environment.

Cover:

Cominco became a copper producer with the opening of the Valley Mine in British Columbia in 1983. The cover photograph, taken from the northwest corner of the open pit mining area, shows the former Bethlehem Copper Corporation concentrator, where ore from the mine is processed. Photo at left shows ore being hauled 4.1 miles (6.6 km) from the mine to the concentrator.

Highlights of 1983

(All dollar amounts in millions except per share figures)

		1983	1982
Financial	Loss (1982 before extraordinary item)	$ 39.3	$ 49.3
	— per common share	$ 2.60	$ 3.16
	Dividends on common shares	$ 8.2	$ 24.4
	— per common share	$ 0.40	$ 1.30
	Capital expenditures	$ 106.3	$ 230.4
Production and sales	Production of concentrates in tons *(tonnes)*		
	zinc	666,000 *(604,200)*	722,700 *(655,700)*
	lead	313,600 *(284,500)*	386,800 *(351,000)*
	copper	84,000 *(76,200)*	28,800 *(26,200)*
	Sales of metals in tons *(tonnes)* (includes metal content of concentrates sold)		
	zinc	434,600 *(394,300)*	379,000 *(343,800)*
	lead	300,000 *(272,200)*	257,100 *(233,200)*
	copper	33,600 *(30,500)*	17,900 *(16,200)*
	Production of chemicals and fertilizers in tons *(tonnes)*	2,804,000 *(2,544,000)*	2,497,000 *(2,265,000)*
	Sales of chemicals and fertilizers in tons *(tonnes)*	2,895,000 *(2,626,000)*	2,536,000 *(2,300,000)*

Contents

Terms used

In this report, all dollar amounts are Canadian unless otherwise noted. All tons are short tons, with metric tonnes appended in italics and in parentheses. A tonne is 1,000 kilograms, or 2,204.6 pounds.

Annual Meeting

The Annual and a Special General Meeting of shareholders of Cominco Ltd. will be held on Thursday, April 19, 1984, at 11:00 a.m., in the Park Ballroom, Four Seasons Hotel, Vancouver, B.C.

Report of the Directors to the Shareholders

M. N. Anderson
Chairman and
Chief Executive Officer

The economic recovery experienced by some industries in 1983 has been slow to influence demand and prices for most of Cominco's principal products.

The loss for the year was $39.3 million or $2.60 a common share on sales of $1,374.7 million. The loss in 1982, before including an extraordinary gain of $18.1 million, was $49.3 million or $3.16 a common share on sales of $1,234.7 million.

Cominco is recovering from the deep recession that proved to be especially difficult for the mining and fertilizer businesses. The rise in demand and in prices has been mainly in consumer-linked commodities and products, and as a result zinc has performed well. The other base metals Cominco produces, such as lead and copper, are in oversupply and demand and prices have not improved. As well, fertilizer markets had a poor year as a result of government programs to regulate production of crops, high interest rates, low prices and surplus supplies.

We have adapted to this harsh economic environment to ensure long-term competitiveness in our traditional base metal and fertilizer markets, and we are developing in new, fast-growth areas. We are renewing our strengths as a low-cost producer.

Our program emphasizes the efficient use of capital and technology, of our strong mineral resources and plants, and of the skills of our talented workforce.

During the year, $100 million was raised through the issuance and sale of additional common shares at a price of $45.625 a share.

Interest costs were lowered by prudent deferments of capital expenditures, and through lower inventory levels. However, energy costs continued to escalate, largely as the result of governments using energy pricing as a means of raising revenues. High natural gas costs, high water license fees for the generation of our own hydroelectric power and high property taxes have become major concerns.

Costs were rigorously controlled through the year and significant gains made in productivity. Production tonnages in general were the same as or greater than in the previous year, while the total number of employees decreased by 3 per cent. Reductions in personnel since 1982 have resulted in ongoing savings of over $50 million each year.

The six-month shutdown at Pine Point, caused by a combination of low metal prices and high operating costs, ended following temporary cost-reducing agreements reached with governments, employees and others.

The Polaris zinc-lead mine in the Canadian High Arctic concluded its first full year of operation by producing more concentrates than its rated capacity. The Valley copper mine in British Columbia was officially opened during the year, and an increase in production from the present 23,000 tons *(21,000 tonnes)* of ore a day will be considered when market conditions permit.

At the Trail metallurgical complex, the start of production in the zinc electrolytic and melting plant in 1983 marked the completion of the first major phase of the modernization and expansion program started in 1977. The result has been an increase in productivity and greatly improved working conditions.

Planning continued on the proposed Red Dog zinc-lead-silver mine in Alaska which may ultimately become a primary source of concentrates for the Company. An environmental impact statement and engineering plans for the mine site facilities were prepared. The project is a joint venture of Cominco and NANA Regional Corporation, Inc., an Alaskan native organization. During the year alternative road routes from the mine site to the coast were studied, as were plans for a deep water port at a point on the coast north of Kotzebue.

Plans to put the Buckhorn gold mine in Nevada into production were announced in September. This low-grade heap-leach project is expected to reach full production in the second quarter of 1984.

The already strong zinc market is expected to continue throughout 1984. The improved lead market at year-end may lead to higher prices. The outlook for copper is that weak prices will continue until inventories in the Western World are reduced through higher consumption. Demand for our chemical and fertilizer products is expected to improve, and at increased prices.

In the longer term, we will be challenged by a slower rate of growth in demand for our primary products, and we intend to win new markets for them. The mining industry has entered a new era, characterized by the emergence of strong competition from producers in less developed countries, particularly in copper. New opportunities exist for sales of our technical services, and for joint ventures.

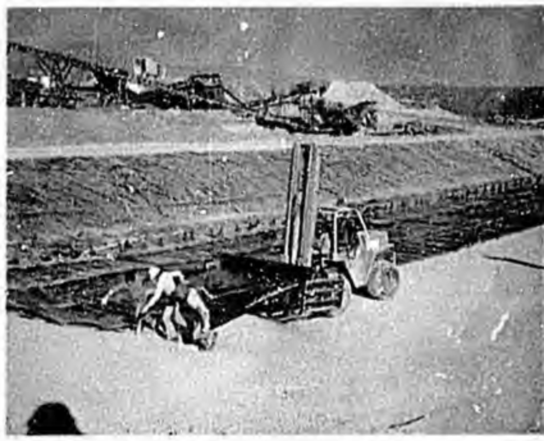
Mr. John Stenason left the Board after 12 years of service as a Director, and Mr. Stuart Eagles, President, Canadian Pacific Enterprises Limited, was appointed to the Board.

On behalf of the Directors and Officers, I wish to thank our employees who worked with enthusiasm and dedication in a most difficult year toward our goal of excellence. The best measures of their success are the reduced costs, increased productivity and improved safety performance achieved in 1983.

M N Anderson

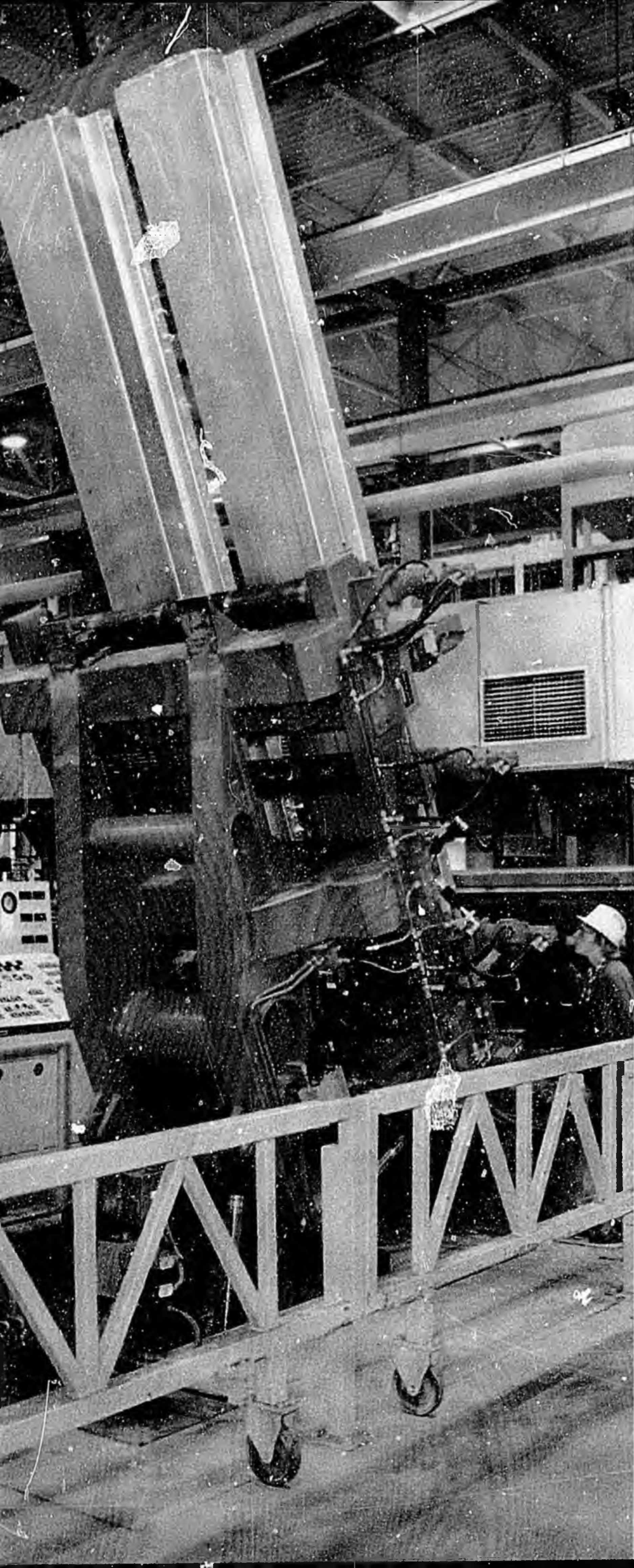
March 14, 1984

Cominco's strong mineral resources: a key △ part of the Company's future.



Carlin, Nevada: heap-leaching ponds under △ construction at the new Buckhorn operation.

Red Dog, Alaska: in summer, the exploration △ camp on the property in the NANA region of northwestern Alaska.



◁ Trail, B.C.: continuous-cast zinc "logs" at the new electrolytic and melting plant are sawn into one-tonne "jumbos" for shipment to customers.

Revenue and Earnings

Cominco incurred a loss of $39.3 million in 1983, an improvement of $10 million over the $49.3 million loss in 1982. Losses occurred in the first three quarters of the year, with a small profit achieved in the fourth quarter. Operating results improved, highlighted by a marked reduction in the loss from the mining and integrated metals business segment. In spite of a very difficult year in U.S. fertilizer markets, the operating profits from chemicals and fertilizers were only slightly below 1982 levels.

Revenue from sales of products and services increased to $1,374.7 million in 1983, compared with $1,234.7 million in 1982. In 1983 sales volumes increased revenues by $119.2 million, and sales prices accounted for an additional $20.8 million.

The cost of products and services in 1983 was $1,015.2 million, an increase of $82.9 million over 1982, due principally to costs attributable to increased sales volumes. Operating costs during the year were marginally lower than 1982 as a result of continuing programs to increase productivity and reduce costs.

Distribution costs of $161.8 million increased $22.2 million over 1982 levels, due mainly to the increased volume of products sold. General and administrative expenses decreased $3.9 million, principally due to the continuing programs to reduce costs. Reduced borrowings and a decline in interest rates during the year resulted in a decrease of $9.0 million in interest expense charged to earnings. Depreciation and depletion expense increased $13.8 million as a result of including charges for a full year of operation at the Polaris Mine, for the Valley Mine which started up in the year and for projects associated with the Trail modernization program, particularly the new zinc plant.

The loss for 1983 has been reduced by a credit for income taxes. Current income taxes of $5.9 million have been reduced by investment and research and development tax credits of $1.7 million. A tax credit of $32.6 million, arising from deferment of claims for capital cost and other allowances for tax purposes, will be realized in future years when the Company returns to profitability.

Equity in net earnings of associated companies decreased to $2.3 million from $5.2 million in 1982. This reduction is attributed mainly to a $3.1 million decrease in the Company's share in earnings of Fording Coal Limited. Lower earnings by that company were a result of a negotiated coal price reduction of 15 per cent and an 82-day shutdown due to a strike.

Liquidity and Capital Resources

The Consolidated Statement of Changes in Financial Position on page 25 shows 1983 sources of funds totalling $149.7 million. Funds from operations were $31.6 million, an increase of $39.6 million over 1982. Proceeds from the disposal of assets contributed $8.9 million. Additional long-term debts in the year amounted to $8.8 million. In April 1983, Cominco received $100.0 million from the issue of 2,191,780 Common Shares. The proceeds were used to reduce short-term borrowings.

Funds used during 1983 were $183.7 million compared with $304.0 million in 1982. Combined capital expenditures on facilities and mineral properties at $106.3 million represent significant savings compared with $230.4 million in 1982. Capital projects in the year were severely curtailed, with expenditures being directed mainly towards sustaining production capacity and completing projects under construction in 1982. Major projects funded during the year included $25.7 million on modernization projects at Trail, B.C., $5.5 million on the new continuous rolling mill at Western Canada Steel Limited's Vancouver plant, $9.2 million on the Buckhorn gold property in Nevada and $7.7 million on the Red Dog zinc-lead-silver deposit in Alaska.

Payments of $46.7 million were made on long-term debt during the year, an increase from 1982. Total dividend payments were $24.6 million, including $13.9 million to preferred shareholders and $2.5 million to minority shareholders of subsidiary companies. Common share dividends of $8.2 million, or $0.40 a share, were distributed in 1983, sharply down from the 1982 level of $24.4 million, or $1.30 a share. Dividends of $2.00 a share on Series A Preferred Shares, $1.98 a share on Series C Preferred Shares and $3.25 a share on Series D Preferred Shares were paid in 1983.

Working capital declined during the year to $187.0 million from $221.0 million at the end of 1982. Lines of credit available to Cominco and its consolidated subsidiaries totalled $489.8 million, of which $347.7 million remained unutilized at year-end.

W. G. Wilson,
President

Cominco sold its entire 17.2 per cent interest in Tara Exploration and Development Company Limited in January 1984. Proceeds from the sale amount to approximately $22.5 million. The loss resulting from the sale had been fully provided for in Cominco's accounts as amortization of the original purchase price had reduced the carrying value to the amount received.

Early in 1984 federal legislation providing incentives for the financing of research and development was enacted. As a result, the rights to tax benefits on research and development expenditures of $5 million incurred in 1983 were sold to another company in February, 1984 as Cominco was unlikely to utilize the tax benefits in the foreseeable future. A gain of $450,000 on this sale was recorded in the 1983 accounts.

Operations

The operations of Cominco Ltd. and its subsidiaries are divided into three industry segments as follows:

1 ***Mining and integrated metals****, comprising principally the mining, processing, smelting and refining of zinc, lead, copper, silver and gold;*

2 ***Chemicals and fertilizers****, comprising principally the production of sulphuric acid, sulphur dioxide, potash, ammonia, urea, phosphates and nitrates;*

3 ***Other operations****, comprising principally electronic materials, fabricated metal products and the generation and distribution of electric power.*

The revenues and operating profits (losses) of each segment are shown in Note 14 of the Notes to Consolidated Financial Statements. Operating profits (losses) are before providing for unallocated costs and expenses, including interest expense, general mineral exploration and income and resource taxes.

Mining and Integrated Metals

Revenues and Operating Profit (Loss)

	Revenues		Operating Profit (Loss)	
	1983	1982	1983	1982
	(millions)			
Sullivan Mine	$103	$ 79	$ 19	$ 13
Pine Point Mines	52	88	(15)	(10)
Polaris Mine	61	29	6	2
Black Angel Mine	66	65	16	14
Magmont Mine	24	24	2	3
Con Mine	36	37	8	7
Valley Mine[1]	54	25	7	(5)
Trail Metallurgical Operations	402	328	(35)	(44)
Nonproducing mines and properties	—	—	(14)	(18)
	$798	$675	$ (6)	$(38)
First Quarter			$(11)	$(18)
Second Quarter			(1)	(7)
Third Quarter			1	(14)
Fourth Quarter			5	1
			$ (6)	$(38)

[1] 1982 figures are for the Jersey Mine which was closed in June, 1982

At Trail, B.C. Cominco operates an integrated smelter and refining complex producing various refined metal products, principally zinc, lead and silver. In addition to processing concentrates from Company mines, it also purchases and refines concentrates from mines in southern British Columbia, the northwest United States and offshore.

The Sullivan Mine at Kimberley, B.C. and Pine Point Mines in the Northwest Territories are the chief sources of zinc and lead concentrates for the metallurgical operations at Trail. Other mines operated by Cominco and its subsidiaries are the Polaris Mine, N.W.T. (zinc, lead); the Black Angel Mine, Greenland (zinc, lead, silver); the Magmont Mine, Missouri (lead, zinc, copper); the Con Mine, N.W.T. (gold); the Buckhorn Mine, Nevada (gold); and the Valley Mine, B.C. (copper).

The Industry

Demand was weak for most metals at the beginning of the year due to the continuing effects of the world recession. The recovery which began slowly in the fourth quarter of 1982 was uneven and first affected North American zinc markets with improved consumer demand for automobiles, housing and durable goods. Demand for lead and copper was not affected to the same extent and Western World inventories of these commodities increased during the year. Demand for lead improved in the fourth quarter as battery manufacturers increased their lead consumption because of severe winter conditions in North America.

At year-end, total Western World zinc stocks were near the normal level of six weeks' consumption, and lead stocks amounted to seven weeks' consumption compared with the normal level of five weeks'. Copper stocks at eleven weeks' consumption at the end of the year were almost twice the normal level.

The Western World's consumption of refined zinc increased in 1983 by 7 per cent over 1982, while lead and copper consumption stayed at about 1982 levels. Exports of refined zinc and lead to China and to the U.S.S.R. were considerably higher in the year.

Mine production of zinc and lead in the Western World declined in 1983 by 0.5 per cent and 3.3 per cent respectively from the 1982 levels, but supplies of both concentrates were ample throughout the year. Mine production of copper decreased by 3 per cent in the year, and as the year progressed a shortage of concentrate began to develop. Despite the decline in Western World mine output during the year, refined production of zinc increased by 6.8 per cent to 5.09 million tons *(4.62)*, refined copper production increased 1.5 per cent to 7.97 million tons *(7.23)* and refined lead production at 4.35 million tons *(3.95)* was up one per cent from the previous year.

Quoted refined zinc prices were weak during the first half of the year but strengthened in the second half.

reflecting improved demand. North American lead prices remained weak until demand increased late in the year; however, lead prices on the London Metal Exchange were sluggish throughout the year reflecting world oversupply conditions. After strengthening during the first half of the year, copper prices weakened steadily during the second half of the year (see price charts on page 11).

Summary of Results

The revenues and operating results of Cominco's mining and integrated metals business segment improved over 1982 mainly because of higher prices for zinc, silver and gold, and increased sales volumes of copper and zinc concentrates and zinc metal. Realized silver and gold prices were substantially higher in 1983 than in 1982 but declined in the fourth quarter to prices that were below their respective 1982 year-end levels. Operating results also benefited from continuing programs to increase productivity and to reduce operating costs.

Higher prices for gold and silver and earnings from the new Valley Mine were the main contributors to improved operating results in the first and second quarters. In the third and fourth quarters, increased sales volumes of zinc and lead metals and higher prices for zinc contributed to the improved results.

The Company sold 261,600 tons *(237,300)* of zinc concentrate compared with 215,700 tons *(195,700)* 1982; and 169,600 tons *(153,900)* of lead concentrate compared with 142,200 tons *(129,000)* sold in 1982.

The sales volume of copper concentrate in 1983 was 76,300 tons *(69,200)*, containing 33,600 tons *(30,500)* of copper.

Sales of refined zinc rose 9 per cent to 279,100 tons *(253,200)* in 1983, compared with 255,900 tons *(232,100)* in 1982. Refined lead sales rose 22 per cent and totalled 179,000 tons *(162,400)*, compared with 147,200 tons *(133,500)* in 1982. At year-end, Cominco's inventories of refined zinc were normal and lead inventories were below normal.

Sales of gold were 89,700 ounces *(2,790 kilograms)*, down from 104,100 ounces *(3,238 kilograms)* sold in 1982. Sales and production were affected by an eight-week strike at the Con Mine. Cominco sold 11,316,000 ounces *(351,970 kilograms)* of silver, compared with 10,004,000 ounces *(311,159 kilograms)* in 1982. The increase in sales was a result of the higher silver content in custom concentrates and lower consumption of silver for anodes by the new zinc electrolytic and melting plant. Year-end inventories of gold and silver were minimal.

In January, 1984, Cominco (UK) Limited relinquished its ring dealing privileges on the London Metal Exchange because the financial risks involved were not warranted in view of that company's earnings level.

Sullivan Mine

The Sullivan zinc-lead-silver mine at Kimberley, B.C. celebrated its 75th year of production in 1983. This mine is a principal supplier of zinc and lead concentrates to the metallurgical plants at Trail.

Sullivan ore production in 1983 was 2,224,000 tons *(2,017,000)*, 9 per cent below the 1982 level. There was an eight-day strike which affected this total. About 38 per cent of production came from mechanized mining in 1983, resulting in an improvement in productivity.

Zinc concentrate production at 136,000 tons *(123,400)* increased above the 1982 level due to improved zinc grades, while lead concentrate production at 139,300 tons *(126,400)* fell below the 1982 level because of lower lead feed grades and reduced ore production.

		1983	1982
Ore milled	tons	2,224,000	2,446,000
	(tonnes)	*(2,017,000)*	*(2,219,000)*
Zinc			
Average grade		3.6%	3.2%
Concentrate	tons	136,000	131,000
	(tonnes)	*(123,400)*	*(118,800)*
Concentrate grade		49.3%	49.4%
Lead			
Average grade		4.6%	5.0%
Concentrate	tons	139,300	170,600
	(tonnes)	*(126,500)*	*(154,800)*
Concentrate grade		62.2%	61.4%
Silver			
Average grade	oz/ton	1.6	1.9
	(g/tonne)	*(55)*	*(65)*
No. of employees at year-end		941	959

Pine Point Mines

Cominco owns 69.1 per cent of the shares of Pine Point Mines Limited, which has zinc-lead mines and a concentrator at Pine Point, N.W.T., on the south shore of Great Slave Lake. All of the zinc concentrate produced at Pine Point is treated at Cominco's metallurgical plants at Trail. Most of the lead.concentrate is sold to an associated company, Mitsubishi Cominco Smelting Company Limited (45 per cent owned), which operates a lead smelter in Japan.

Pine Point operations were shut down from January 2 to June 15 because of the severe decline in metal prices and the higher operating costs associated with the increasing strip ratio. Resumption of operations was made possible by the improved outlook for metal prices at mid-year, and by obtaining temporary cost-saving concessions from major service sectors.

Pine Point's salaried staff were the first to contribute by accepting a continued salary freeze in force since July, 1981. The unionized employees, who had continued to receive pay increases established by the two-year collective agreement negotiated in 1981, accepted a 10 per cent pay cut on May 1, 1983. This agreement provided that the reduced wages would remain in effect until metal prices increased sufficiently to allow Pine Point to break even on a cash basis. The contractual base rate was restored to its previous level in two stages in November 1983 and January 1984 as zinc prices increased; staff salaries were increased about the same time.

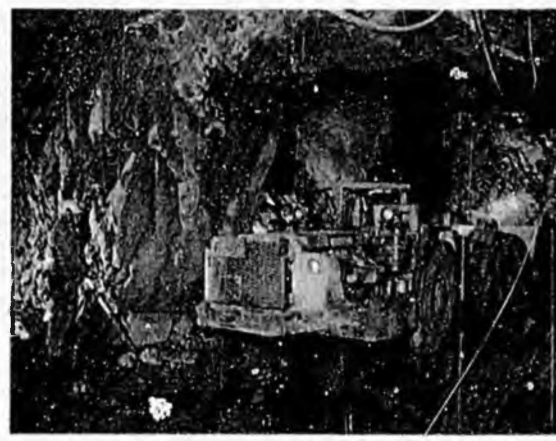
Financial assistance was obtained from the Federal and Territorial Governments for mine development and temporary concessions were negotiated for freight rates, smelter treatment charges and power tariffs. By early 1984 most of this assistance had been discontinued.

Concentrate sales were $51.7 million compared with $87.9 million in 1982. Concentrate production was 129,700 tons *(117,700)* of zinc and 32,100 tons *(29,100)* of lead.

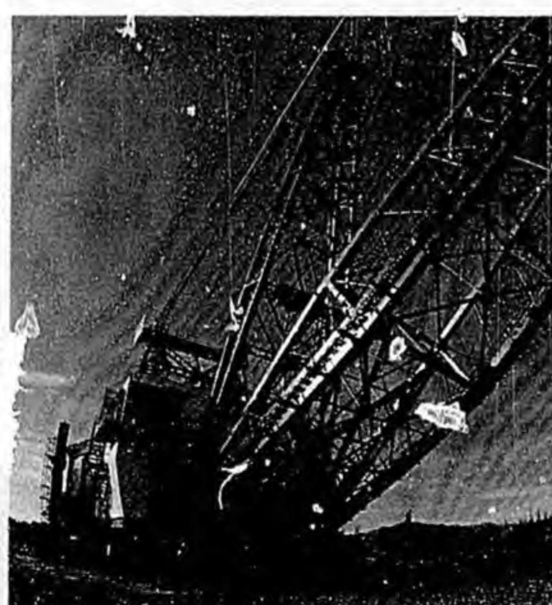
Rising mining costs and lower metal prices necessitated the removal of uneconomic ore from reserves, including ore accessible only by underground mining methods. The 1983 exploration program located 780,000 *(708,000)* tons of ore grading 4.2 per cent zinc and 1.1 per cent lead in two current production areas. This amount was less than the tonnage milled during the year.

		1983	1982
Ore milled	tons	985,000	2,445,000
	(tonnes)	*(894,000)*	*(2,218,000)*
Zinc			
Average grade		8.1%	7.3%
Concentrate	tons	129,700	287,400
	(tonnes)	*(117,700)*	*(260,700)*
Concentrate grade		56.9%	57.3%
Lead			
Average grade		2.7%	3.0%
Concentrate	tons	32,100	84,500
	(tonnes)	*(29,100)*	*(76,700)*
Concentrate grade		73.8%	76.5%
No. of employees at year-end (490 at mid-year start-up)		544	583

Tadanac silver bar: production and sales of △ Cominco's silver increased in 1983.



Kimberley, B.C.: mechanized mining △ methods at the Sullivan Mine resulted in important productivity gains. The mine has been in production since 1909.



Pine Point, N.W.T.: the 30-cubic-yard dragline △ removes overburden at the largest mine in the Territories.

◁ Polaris, N.W.T.: ice floes in Crozier Strait in the High Arctic provide a majestic foreground to Canada's most northerly metal mine. The operation completed its first full year in 1983.

The Year in Review

Polaris Mine

The Polaris zinc-lead mine, the world's most northerly metal mine, on Little Cornwallis Island, N.W.T., completed its first full year of production in 1983. The entire concentrate production is shipped during the brief Arctic summer when the sea lanes are navigable.

Most of the zinc concentrate is sold to European smelters. The remainder is tolled at a custom smelter in Europe, and the resulting metal is sold by Cominco. The lead concentrate is sold to smelters in Europe.

In 1983, revenues from the sale of concentrates and metal were $61 million, yielding an operating profit of $6 million. At year-end, 63,200 tons *(57,300)* of zinc concentrate and 21,300 tons *(19,300)* of lead concentrate were held in inventory at the mine.

The mine was designed to produce 195,000 tons *(177,000)* of zinc concentrate and 45,000 tons *(41,000)* of lead concentrate annually. The actual production in 1983 was considerably greater, with both mill throughput and feed grades being higher than forecast. Production was 239,300 tons *(217,100)* of zinc concentrate, and 56,300 tons *(51,100)* of lead concentrate. The average milling rate was 2,500 tons *(2,300)* a day, well above the designed capacity of 2,300 tons *(2,100)* a day.

The shipping season from Polaris to Europe in 1983 extended from August to late October, about two weeks longer than in 1982. Nine shipments were made, aggregating 202,300 tons *(183,500)* of zinc concentrate and 45,600 tons *(41,400)* of lead concentrate. In 1983, sales equivalent to 165,100 tons *(149,800)* of zinc concentrate, including tolled metal, were taken into revenue, of which 43,900 tons *(39,800)* were from the 1982 shipping season and the remainder from 1983 shipments. Lead concentrate tonnage taken into revenue was 38,700 tons *(35,100)*, of which 9,200 tons *(8,300)* was from 1982 shipments and 29,500 tons *(26,800)* was from 1983 shipments.

As a result of the continuing diamond drilling program at the mine, 8.4 million tons *(7.6 million)* of ore were upgraded from the inferred to the measured and indicated class of reserves during the year, increasing the total of this latter class by more than one-third.

There were 43 northerners employed in a total work force of 237 at year-end. The number of Inuit employed during the year reached a high of 29 at mid-year and was 18 at year-end.

		1983	1982
Ore milled	tons	914,000	518,000
	(tonnes)	*(829,000)*	*(470,0...)*
Zinc			
Average grade		16.8%	17.0%
Concentrate	tons	239,300	142,400
	(tonnes)	*(217,100)*	*(129,200)*
Concentrate grade		60.9%	57.3%
Lead			
Average grade		5.2%	7.0%
Concentrate	tons	56,300	45,900
	(tonnes)	*(51,100)*	*(41,600)*
Concentrate grade		76.2%	72.6%
No. of employees at year-end		237	244

Black Angel Mine

Cominco owns 62.5 per cent of the shares of Vestgron Mines Limited, which, through its wholly owned subsidiary Greenex A/S, owns and operates the Black Angel zinc-lead-silver mine and concentrator at Maarmorilik, Greenland. Zinc and lead concentrates are transported from the mine during the June-November shipping season. Most of the zinc concentrate produced is sold to European refineries. The remainder is tolled at a custom smelter in Europe, and the resulting metal is sold by Cominco. The lead concentrate is sold to smelters in Europe.

Revenues in 1983 were $66 million, up $1 million from 1982. Operating profit increased by $2 million to $16 million. Increased revenues from higher zinc prices were offset by reduced quantities of zinc concentrate and zinc metal sold. Sales volumes of lead concentrate were higher than in 1982, but these gains were offset by lower prices.

The implementation of a stringent efficiency program, with effective cooperation between the workforce and management, held operating costs to about the same level as in the previous year despite the thinning orebody and lower grades.

Underground exploration continued to locate ore but overall reserves declined by 200,000 tons *(181,000)*. In the primary area of interest east of the mine, 24 holes totalling 65,499 feet *(19,964 metres)* were drilled without significant mineralization being located. Surface exploration expenditures were $3.3 million compared with $2.5 million in 1982.

Greenex employed 357 workers at the beginning of 1983 and 347 at year-end. Of the employees at Maarmorilik, 153 were Greenlanders, an increase of 21 over 1982.

		1983	1982
Ore milled	tons	744,000	744,000
	(tonnes)	*(675,000)*	*(675,000)*
Zinc			
Average grade		12.3%	12.6%
Concentrate	tons	150,300	154,900
	(tonnes)	*(136,300)*	*(140,500)*
Concentrate grade		58.1%	56.9%
Lead			
Average grade		3.6%	4.5%
Concentrate	tons	33,800	41,300
	(tonnes)	*(30,700)*	*(37,500)*
Concentrate grade		70.5%	70.7%
Silver	oz/ton	0.8	1.[illegible]
	(g/tonne)	*(28)*	*(35)*
No. of employees at year-end		347	357

Con Mine

The Con gold mine is in Yellowknife, N.W.T. Ore produced at the mine is milled and refined there and the gold is sold in Canada.

The amount of ore processed in 1983 was lower than in 1982 because of a two-month strike at mid-year. The adverse cost effects of lower production were more than offset by higher gold prices, resulting in a profit of $8 million in 1983, compared with $7 million in 1982. Revenues fell to $36 million from $37 million in 1982.

A decision to deepen the Robertson Shaft by 810 feet *(247 m)* to 6,235 feet *(1,900 m)* was made late in the year. The deepened shaft will provide four more working levels and the opportunity to explore further at greater depth. The $9 million project is scheduled for completion in 1985.

Final commissioning of the new arsenic recovery plant was delayed because of difficulties in reaching process and product specifications. Engineering revisions have been made and the plant is expected to operate at design capacity in 1984.

		1983	1982
Ore milled	tons	209,200	234,200
	(tonnes)	*(189,800)*	*(212,400)*
Gold			
Average grade	oz/ton	0.36	0.36
	(g/tonne)	*(12)*	*(12)*
Production	ounces	70,500	79,500
	(kg)	*(2,193)*	*(2,471)*
No. of employees at year-end		317	309

Valley Mine

The Valley copper mine in the Highland Valley, B.C., began operations on January 17, 1983, two months ahead of schedule. Its concentrates are sold directly to smelters in Japan. The ore, processed at the former Bethlehem Copper Corporation mill, proved more amenable both to grinding and to copper recovery than preliminary tests had indicated, resulting in production being consistently above expectations. However, copper prices were low in 1983, peaking in May at 81.8 US cents a pound on the London Metal Exchange and falling to 66.1 US cents a pound at year-end. Revenues were $54 million and the operating profit was $7 million.

The Valley Mine, if developed to its full potential, could sustain an operating level of 90,000 to 110,000 tons *(80,000 to 100,000)* of ore a day, five times the present level of operation. The mine is situated on Canada'a largest known porphyry copper deposit. The measured and indicated ore reserve is estimated to be 509 million tons *(460 million)* with an average grade of 0.475 per cent copper. Valley has additional inferred ore reserves of 272 million tons *(248 million)* at the same grade. A phased expansion program, which would include a new concentrator with a daily capacity of 50,000 tons *(45,000)*, is being examined.

		1983
Ore milled	tons	7,906,000
	(tonnes)	*(7,172,000)*
Copper		
Average grade		0.52%
Contained in concentrate	tons	36,700
	(tonnes)	*(33,300)*
Concentrate grade		44.4%
No. of employees at year-end		427

Buckhorn Mine

Located in Eureka County, Nevada, Buckhorn is a low-grade heap-leach gold operation in which Cominco American Incorporated has a 76 per cent interest. Development plans were announced in September with development and construction costs projected at US$12 million. This included the purchase of mining equipment; construction and erection of crushing, agglomerating and stacking equipment; the preparation of heap-leaching pads and ponds; and the construction of roads and processing and office facilities.

Known ore reserves of about 5 million tons *(4.5 million)* of ore will be processed over the scheduled seven-year life of the mine at a rate of 750,000 tons *(680,000)* a year. Plans call for the initial processing of 2.8 million tons *(2.5 million)* of ore grading 0.059 ounces per ton *(2.0 grams per tonne)* of gold. After this higher-than-average-grade tonnage is processed, the remaining lower-grade tonnage will be processed. The mine is expected to reach full production rates in the second quarter of 1984.

Buckhorn will employ 75 persons when in full production.

Magmont Mine

The Magmont lead-zinc-copper mine at Bixby, Missouri, operated by Cominco American Incorporated under a joint-venture arrangement with Dresser Industries Incorporated, continued to be a profitable operation during 1983 notwithstanding the effect of severely depressed lead prices.

Cominco's 50 per cent share of the revenue was $24 million, the same as in 1982. The operating profit in 1983 was $2 million compared with $3 million in 1982, a reduction brought about by lower metal prices. However, increased sales of byproduct zinc concentrate helped to offset the low lead prices. Production of lead concentrate was higher during 1983, primarily due to higher grade ore. A new drift driven 2 miles *(3 km)* from the Magmont shaft to open up the Magmont West area was completed during the year. Production at Magmont West began late in the year, and a significant amount of ore is expected to be mined in this area in 1984.

A new contract for tolling lead concentrate was negotiated with a Missouri custom smelter during the year.

		1983	1982
Ore milled[1]	tons	1,142,000	1,107,000
	(tonnes)	*(1,036,000)*	*(1,004,000)*
Lead			
Average grade		7.2%	6.5%
Concentrate	tons	52,100	44,500
	(tonnes)	*(47,300)*	*(40,400)*
Concentrate grade		77.4%	78.9%
Zinc			
Average grade		1.4%	1.0%
Concentrate	tons	10,700	7,000
	(tonnes)	*(9,800)*	*(6,400)*
Concentrate grade		60.8%	60.0%
Copper			
Average grade		0.2%	0.3%
Concentrate	tons	1,300	2,900
	(tonnes)	*(1,200)*	*(2,600)*
Contained in concentrate	tons	400	900
	(tonnes)	*(300)*	*(800)*
No. of employees at year-end		181	186

[1] This mine is a joint venture of Cominco American Incorporated and Dresser Industries Incorporated. Ore milled is reported at 100 per cent; the concentrate tonnage reported is Cominco's 50 per cent share of production.

Bixby, Missouri: the headframe of the Magmont Mine.

Trail Metallurgical Operations

Production of Refined Metals

		1983	1982
Zinc	tons	239,800	225,800
	(tonnes)	*(217,500)*	*(204,800)*
Lead	tons	132,300	126,600
	(tonnes)	*(120,000)*	*(114,900)*
Silver[1]	oz	10,235,000	9,681,000
	(kg)	*(318,300)*	*(301,100)*
Gold	oz	21,400	24,800
	(kg)	*(666)*	*(771)*

[1] In 1983, 3,717,000 ounces *(115,609 kilograms)* came from Company-owned sources, compared with 3,489,000 ounces *(108,516)* in 1982.

The integrated smelter and refining complex at Trail produces a wide range of metals, principally refined zinc, lead and silver. Annual production capacity is 300,000 tons *(272,000)* of refined zinc and 150,000 tons *(136,000)* of refined lead. In 1983, over 50 per cent of Cominco's Canadian-mined zinc and lead was upgraded to refined metal in Trail. Additional quantities of custom concentrates are purchased and refined at Trail. Other products include phosphate and sulphate fertilizers. Electric power from Cominco's two generating stations is used by Cominco and any surplus is offered to West Kootenay Power and Light Company, Limited and to other utilities.

Revenues from Trail operations, increased to $402 million from $328 million in 1982. The operating loss was reduced by $9 million to $35 million. Silver prices and quantities sold were significantly higher than in 1982. Realized prices for zinc were above 1982 levels but lead prices declined sharply. The simultaneous operation of the new and old electrolytic and melting plants during the new plant's commissioning period slightly increased operating costs for zinc production. These costs are expected to improve in 1984 as the new facility reaches its rated capacity and the old plant is shut down.

Refined zinc production at Trail was 239,800 tons *(217,500)* compared with 225,800 tons *(204,800)* in 1982 despite an eight-day strike, a six-month interruption in the supply of zinc concentrates from Pine Point Mines Limited, and the processing of increased quantities of custom concentrate containing a higher level of metal byproducts. Higher production resulted from the enhanced reliability of the new zinc pressure leaching plant and from the output of the new zinc electrolytic and melting plant.

Refined lead production at Trail was 132,300 tons *(120,000)* compared with 126,600 tons *(114,900)* in 1982. This high rate resulted from the plan to maximize silver production, including the purchase of concentrates with high silver content, to offset uneconomic lead prices and to increase revenues. Silver production in the year totalled 10,235,000 ounces *(318,300 kg)* compared with 9,681,000 ounces *(301,100 kg)* in 1982. Purchases of custom concentrates accounted for 6,518,000 ounces *(202,733 kg)* in 1983 compared with 6,192,000 ounces *(192,593 kg)* in 1982.

Gold production at Trail in 1983 was 21,400 ounces *(666 kg)* compared with 24,800 ounces *(771 kg)* in 1982. This decrease was mainly the result of the lower gold content in purchased custom concentrates.

The modernization and expansion program initiated at Trail in 1977 continued during 1983, but at a substantially reduced rate. Expenditures were $25.7 million compared with $68 million in 1982, and several large projects, including the lead smelting modernization project, have been deferred until market conditions and corporate earnings improve.

The new zinc electrolytic and melting plant (see page 3) officially opened in October. Earlier, a project to improve the recovery of sulphur gas from the metallurgical operations went into service (see Environmental Protection, page 19).

As a result of the plan to reduce crew sizes and to curtail construction projects, 3,659 persons were employed at Trail at year-end compared with 4,036 at the beginning of the year.

Ore Reserves

	1983				1982			
	Ore Tons x1000	%Pb	%Zn	Ag oz/ton	Ore Tons x1000	%Pb	%Zn	Ag oz/ton
OPERATING MINES								
(Measured and Indicated)								
SULLIVAN	47,000	4.4	6.2	1.0	49,000	4.4	6.1	1.0
PINE POINT	26,000	2.7	6.3	—	35,000	2.4	6.1	—
POLARIS	18,600	4.1	14.8	—	11,000	4.4	15.2	—
BLACK ANGEL	2,000	3.3	11.0	0.8	2,200	4.0	13.4	1.0
MAGMONT	6,200	8.0	1.0	0.4	5,200	9.4	1.2	0.3
QUE RIVER	2,200	7.4	12.7	6.0	2,100	7.5	13.1	5.5
RUBIALES	12,300	1.1	6.9	0.4	14,300	1.2	6.9	0.4
CON	1,900	0.44 oz Au/ton		—	2,100	0.47 oz Au/ton		—
BUCKHORN	5,100	0.04 oz Au/ton		—	—	—		
VALLEY	509,000	0.475% Cu		—	500,000	0.475% Cu		
ARDLETHAN	400	0.51% Sn			900	0.44% Sn		
CLEVELAND	900	0.80% Sn			1,300	0.73% Sn		
WARM SPRINGS	7,700	30.0% P_2O_5			7,300	30.0% P_2O_5		
VADE	153,000	25.3% K_2O equiv.			155,000	25.3% K_2O equiv.		
OWENS LAKE	33,000	sodium carbonate equiv.			33,000	sodium carbonate equiv.		
HONDEKLIP	400	0.4 carats diamonds/ton			500	0.4 carats diamonds/ton		
FORDING	237,000	clean met. coal equiv.			239,000	clean met. coal equiv.		
OPERATING MINES								
(Inferred Ore)								
POLARIS	5,900	3.0	13.1	—	13,200	3.6	11.9	—
BLACK ANGEL, PLATEAU	360	3.9	8.8	1.0	360	3.9	8.8	1.0
MAGMONT WEST	3,100	3.5	1.9	0.4	3,900	3.4	1.5	—
QUE RIVER	2,200	2.8	5.3	1.4	2,900	2.9	5.7	1.5
VALLEY	272,000	0.475% Cu		—	300,000	0.475% Cu		
POTENTIAL MINES								
(Measured, Indicated and Inferred)								
RED DOG	85,000	5.0	17.1	2.4	85,000	5.0	17.1	2.4
TROYA	5,500	1.2	10.7	0.5	5,500	1.2	10.7	0.5
PINCHI	1,200	6.4 lbs. Hg/ton			1,200	6.4 lbs. Hg/ton		
DOUGLAS	12,000	31.0% P_2O_5 equiv.			12,000	31.0% P_2O_5 equiv.		
FORDING	2,100,000	thermal coal			2,100,000	thermal coal		

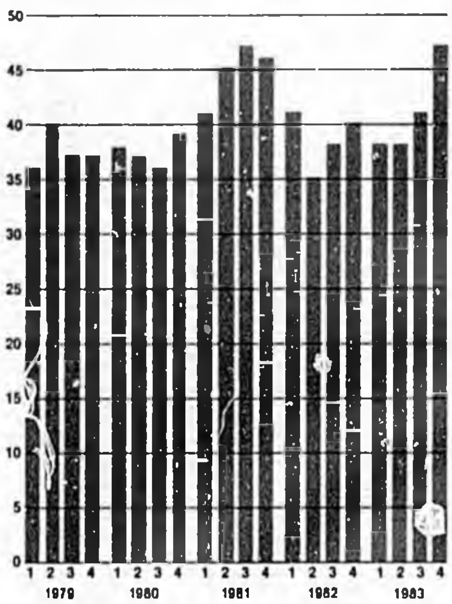
Mineral reserves of Cominco and associated companies are classified as measured, indicated and inferred.

The term *measured* is limited to those reserves at a mine which can be projected from one or more exposed faces on the basis of actual operating results. Reserves are classified as *indicated* where there is sufficient information about the deposit or a portion of it to form the basis of a mine production forecast. Reserves computed on the basis of limited drilling, geological data and through application of geological projections, which are insufficient to support a mine production forecast, are classified as *inferred*.

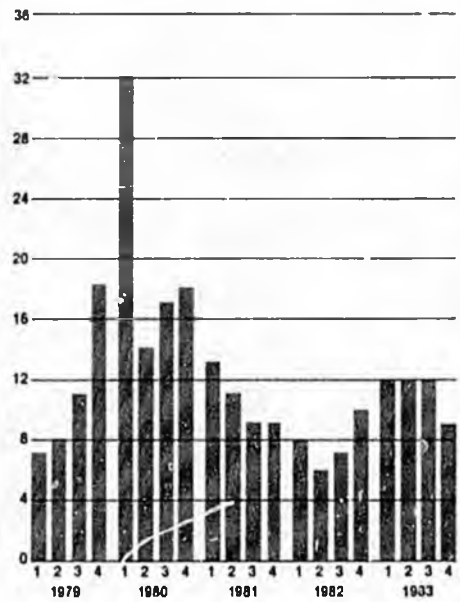
The Year in Review

Quarterly Average Metal Prices

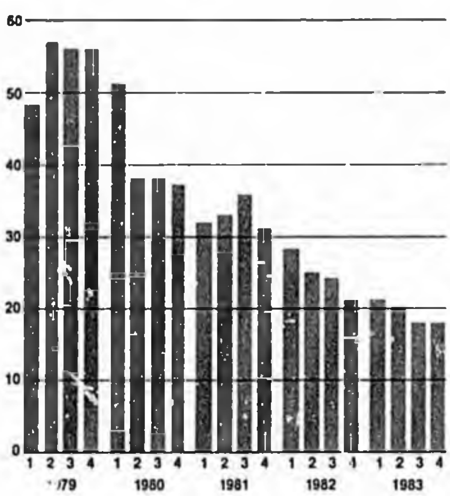
Zinc-U.S. Producer Price (U.S. cents/lb.)
(Source: Metals Week)



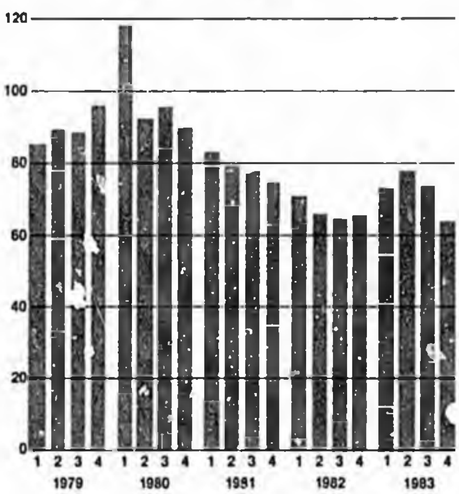
New York Silver Price (U.S. dollars/troy ounce)



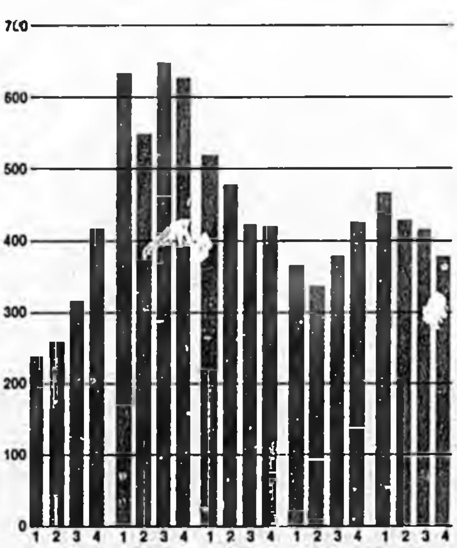
LME Lead Price (U.S. cents/lb.)



LME Copper Price (U.S. cents/lb.)



London Gold Price (U.S. dollars/troy ounce)



Vancouver, B.C.: Cominco zinc from Trail in rail cars awaits export. The Company's head office is located in the Granville Square building in the background. ▷

Chemicals and Fertilizers

Revenues and Operating Profit (Loss)

	Revenues 1983	Revenues 1982	Operating Profit (Loss) 1983	Operating Profit (Loss) 1982
		(millions)		
Kimberley	$ 44	$ 28	$ (3)	$ (4)
Carseland	126	115	25	27
Calgary	25	33	2	4
Borger	56	65*	(5)	(5)
Beatrice	6	18*	(1)	3
Vade	88	74	11	12
Products for resale and others	101	89	5	—
	$446	$422	$ 34	$ 37

*Revenues have been restated to conform with the 1983 presentation.

	1983	1982
First Quarter	$ —	$ 7
Second Quarter	22	32
Third Quarter	(3)	(3)
Fourth Quarter	15	1
	$ 34	$ 37

Cominco is a fully integrated plant food producer operating at eight locations in Canada and the United States — at Trail and Kimberley, B.C.; Carseland and Calgary, Alberta; Vade, Saskatchewan; Warm Springs, Montana; Beatrice, Nebraska; and Borger, Texas. The revenues from the Trail fertilizer operations are included in the mining and integrated metals segment because the operations form a part of the sulphur recovery process of the metallurgical operations.

The principal products are ammonia, ammonium nitrate, ammonium phosphate, ammonium sulphate, potash and urea. About one-half of the Company's 1983 total chemical and fertilizer products were sold in the U.S. market by Cominco American Incorporated. The remainder is marketed in Canada and other countries. Substantial quantities of potash are sold to Canpotex Ltd., a marketing corporation owned by Saskatchewan potash producers, which sells potash outside North America. About 60 per cent of Cominco's potash is sold in the United States. In addition to the chemicals produced and used in the manufacture of fertilizers, Cominco produces sulphuric acid and sulphur dioxide for sale to the forest industry, and trona, which is sold for use in the production of borax.

The Industry

Consumption and prices of fertilizers in the United States continued to fall during the spring of 1983 as a result of poor markets for U.S. farm exports and the U.S. Government's Set Aside and Payment-in-Kind (PIK) programs. These programs reduced major crop acreage by more than 50 million acres *(20 million hectares)*.

As the full impact of the U.S. programs took effect, severe drought conditions were experienced in much of the midwest, and U.S. feed grain inventories fell below normal levels. Prices for feed grains and oilseeds increased significantly. Wheat was an exception, and wheat inventories remained high throughout the year in both Canada and the United States.

Canadian fertilizer consumption increased for all major types of fertilizers, largely due to continuing strong Canadian grain exports. Nitrogen fertilizer consumption in western Canada increased by 5.7 per cent in 1983 while U.S. consumption declined by 16.3 per cent. Sales of nitrogen in western Canada by Canadian manufacturers increased by 10 per cent due to decreased imports from the United States.

Phosphate consumption increased by 5.3 per cent in western Canada in 1983, but declined by 13.5 per cent in the United States.

Canadian phosphate manufacturers increased their participation in the western Canadian phosphate market with corresponding decreases in imports from the U.S. Exports to the U.S. were down substantially.

U.S. consumption of potash in 1983 was 13.8 per cent lower than in 1982.

Prices for all fertilizers continued to soften during the first half of 1983, but stabilized during the third quarter and strengthened significantly in the fourth quarter.

To control inventories, much of the fertilizer industry in North America was shut down during part of the year. Inventories of fertilizer products in Canada were normal or below normal for most products by year-end.

Summary of Results

The increase in revenues from the chemicals and fertilizers segment was due to higher sales volumes of most products, although these were partially offset by lower prices. Operating profits were lower mainly because of lower prices received for most products. The Vade operations received lower prices for potash but benefited from higher levels of production.

During the first half of the year, operating profits continued to be depressed by the weak markets that had developed in the latter part of 1982. The strong fourth-quarter performance resulted from increased sales volumes.

Kimberley Operation

The production of ammonium phosphate fertilizer at Kimberley, B.C. rose by 18 per cent over 1982, and sulphuric acid production increased by 9 per cent, although operations were shut down for eight weeks at mid-year for annual maintenance and inventory control.

Revenues were $44 million compared with $28 million in 1982. The $3 million operating loss in 1983 compared with a $4 million loss in 1982. Sales volumes were well ahead of the previous year but at lower prices. However, losses decreased due to lower production costs.

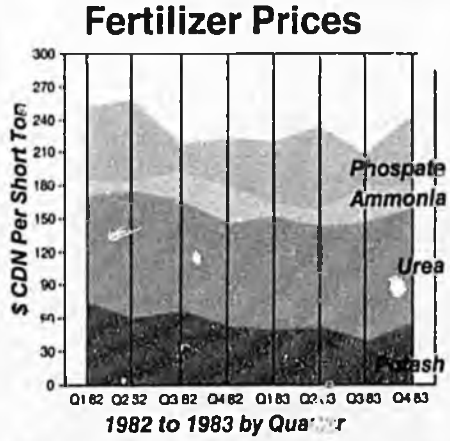
The production of ammonium phosphate fertilizer was 151,000 tons *(137,000)* compared with 123,600 tons *(112,100)* in 1982.

There were 152 persons employed at the Kimberley fertilizer operations at the beginning of the year, and 143 at year-end.

Warm Springs Operation

Phosphate rock is produced at Cominco American Incorporated's Warm Springs, Montana operation from an underground mine and is shipped to Kimberley for use in the manufacture of phosphate fertilizer. Production for 1983 was 188,000 tons *(171,000)* compared with 186,000 tons *(169,000)* in 1982.

Warm Springs was shut down for a total of four weeks during the year for inventory control. The operation employed 114 persons at the beginning and the end of the year.



Calgary, Alberta: the Carseland fertilizer △ operation is one of Cominco's eight plant food facilities in North America.

Vanscoy, Saskatchewan: record production △ at the Vade potash mine in 1983 reflected the completion of major expansion which included the new headframe, right.

◁ Vanscoy, Saskatchewan: wheat farmer Stan Mogenson (right) chats with Cominco employee George McVittie. They are standing 3,530 feet (1,075 metres) above the Vade potash mine. Mr. Mogenson farms 1,500 acres (600 hectares) owned by the Company.

Carseland Operation

The Carseland fertilizer operation produces ammonia and urea. Ammonia production was slightly below the previous year's level because of increased maintenance downtime. Urea production was reduced because of the diversion of ammonia feedstock from urea to meet market demands for ammonia. In 1983, 436,700 tons *(396,200)* of ammonia and 465,900 tons *(422,700)* of urea were produced, compared with 439,800 tons *(399,000)* of ammonia and 494,200 tons *(448,300)* of urea in 1982.

Revenues increased by $11 million to $126 million in 1983 due to higher sales volumes but at lower prices. The operating profit was lower by $2 million. Distribution costs were higher and lower operating costs only partially offset the lower selling prices.

There were 140 employees at the beginning of the year, and 137 at year-end.

Calgary Operation

Lower demand and prices necessitated a 24 per cent reduction of total fertilizer production in 1983 to 158,800 tons *(144,100)* compared with 208,600 tons *(189,200)* in 1982. The urea plant was shut down for 29 weeks because of poor market conditions.

Revenues were $25 million in 1983 compared with $33 million in 1982. The operating profit was $2 million compared with $4 million in the previous year. Sales volumes of ammonia increased but prices were lower. Prices and sales volumes for urea, ammonium nitrate and urea sulphur were also below 1982 levels.

There were 141 employees at the Calgary fertilizer operation at the beginning of the year, and 121 at year-end.

Borger Operation

The production of anhydrous ammonia and urea at Borger, Texas by Cominco American Incorporated declined as the result of production curtailments to control high inventories. The 1983 ammonia production was 240,800 tons *(218,500)* compared with 285,500 tons *(259,000)* in 1982. The 1983 urea production was 51,700 tons *(46,900)* compared with 55,400 tons *(50,300)* in 1982.

The Borger operation was shut down for the month of January, and for three months in the fall for inventory control and maintenance purposes. Revenue was $56 million in 1983, $9 million lower than in 1982. The operating loss remained unchanged at $5 million.

The number of employees was 84 at the beginning of the year and 81 at year-end.

Beatrice Operation

Cominco American Incorporated's Homestead ammonium nitrate plant at Beatrice, Nebraska produced 123,600 tons *(112,100)* in 1983 compared with 113,300 tons *(102,800)* in 1982. The Homestead plant operated through the year, although because of weak demand the production rate was curtailed to control inventories. Sales tonnages were about 60 per cent of the 1982 level and prices were 4 per cent lower. Revenue was $6 million in 1983, down significantly from $18 million in 1982 and a $1 million operating loss was incurred.

The number of employees was 56 at the beginning of the year and 60 at year-end.

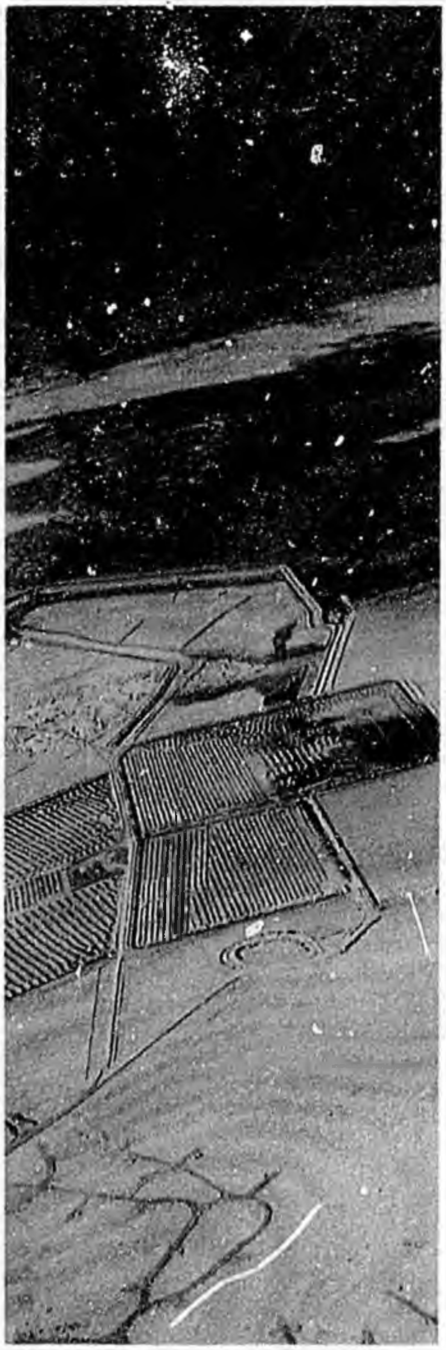
Vade Operation

Potash is produced at the Vade operation near Saskatoon, Saskatchewan. Demand for potash was low in all markets through the first eight months of the year, resulting in lower prices and high inventories. A marked increase in demand in the last four months reduced inventories to normal levels by year-end with some strengthening in prices. The plant was shut down for nine weeks during the year: six weeks for inventory control, and three for maintenance.

Production for the year was 1,123,000 tons *(1,018,000)* compared with 794,000 tons *(720,000)* in 1982. This established a production record, reflecting the completion of a major expansion project in 1982. Production per man-shift rose significantly.

Revenues were $88 million in 1983 compared with $74 million in 1982. The operating profit decreased from $12 million to $11 million. Sales tonnages increased by 34 per cent but selling prices were 8 per cent lower. Unit operating costs were substantially lower due to the increased production, but distribution costs were higher.

There were 442 persons employed at the beginning of the year and one less at year-end.



Owens Lake, California: a unique diking system in the lake bed recovers trona at the Lake Minerals operation.

Lake Minerals

Lake Minerals Corporation generated revenues of US $1.6 million from its Owens Lake, California trona mining operation in 1983. This compares with US $0.7 million in 1982.

The operating profit was US $0.7 million compared with US $0.2 million in 1982. Improved demand resulted in the production of 45,000 tons *(41,000)* of trona, compared with 34,000 tons *(31,000)* mined in the previous year.

Other Operations

Revenues and Operating Profit

	Revenues 1983	Revenues 1982	Operating Profit (Loss) 1983	Operating Profit (Loss) 1982
		(millions)		
Electronic Materials	$ 47	$ 37	$ 2	$ 3
Western Canada Steel	58	76	(4)	2
West Kootenay Power	53	51	18	13
Miscellaneous	11	11	1	3
	$169	$175	$ 17	$ 21
First Quarter			$ 4	$ 7
Second Quarter			4	5
Third Quarter			4	5
Fourth Quarter			5	4
			$ 17	$ 21

This segment of Cominco's business comprises principally the operations of the Electronic Materials Division, Western Canada Steel Limited and West Kootenay Power and Light Company, Limited. Miscellaneous operations include the activities of Cominco Engineering Services Ltd. and European holding and trading companies.

Summary of Results

The fall in revenues and operating profits in this segment was mainly due to lower sales by Western Canada Steel Limited because of the reduced construction activity in its market areas, and the closure of its Vancouver plant for six and one-half months during a labour dispute.

Electronic Materials Division

The Electronic Materials Division produces high-purity materials and compound semiconductors in facilities at Trail. In addition, the production of fabrications, bonding wire and ribbon and sputtering products is conducted through the facilities of a wholly owned subsidiary of Cominco American Incorporated, Cominco Electronic Materials Incorporated, in Spokane, Washington. Seventeen elements, including aluminum, arsenic, gallium, gold, silver, indium and tellurium are refined to high purity to meet the special needs of the electronics industry. Seven compound semiconductors, including cadmium mercury telluride, gallium arsenide and indium antimonide, are in commercial production for use in infrared radiation detection devices, communication equipment and high-speed microcircuits.

Revenues from Electronic Materials were $47 million compared with $37 million in 1982 as a result of higher gold prices and higher sales volumes. The operating profit was $2 million, $1 million less than in 1982 because of increased development and administration costs.

Sales of compound semiconductor wafers increased steadily throughout the year. High-performance cadmium mercury telluride wafers produced in the Trail plant completed in 1982 are being further developed for new applications. The first stage of the gallium arsenide expansion program was completed in 1983. Cominco's gallium arsenide wafers are now recognized as the leading product in the market and, with the resulting rapid growth in demand, a further expansion of production facilities at Trail is in progress.

The marketing group was further strengthened during 1983 with the addition of staff in Canada and the conclusion of a sales agency agreement with two Japanese firms for the Asian Pacific market areas.

The total number of employees in Electronic Materials in Spokane and Trail was 221 at the beginning of the year and 248 at year-end.

Western Canada Steel

Western Canada Steel Limited (100 per cent owned) operates plants producing steel products from scrap metal in Vancouver and Calgary and at Hawaiian Western Steel Limited (51 per cent owned) on the island of Oahu, Hawaii.

Revenues of Western Canada Steel declined from $76 million in 1982 to $58 million in 1983 principally because of lower sales volumes resulting from a lock-out at the Vancouver operations which lasted six and one-half months.

The Vancouver plant production for the year was 37,500 tons *(34,000)* compared with 94,200 tons *(85,400)* in 1982. The labour dispute delayed the start-up of the tandem rolling mill by seven months to March 1984. The new $24 million continuous mill will increase the volume and size range of steel products.

The Calgary plant produced 87,000 tons *(78,900)* of steel during the year compared with the near-capacity total of 96,600 tons *(87,600)* in 1982.

The Hawaiian plant continued to operate at one-half of its capacity, with production and sales of 26,000 tons *(23,600)* of steel, the same as in 1982. This reflected the continuing low level of construction activity in Hawaii.

West Kootenay Power and Light

West Kootenay Power and Light Company, Limited, in Trail, B.C., provides electrical energy for residential and industrial customers in south central British Columbia.

Despite the slow recovery from the recession in its service area, energy sales were only slightly below 1982 levels. In anticipation of higher costs in 1984, the British Columbia Utilities Commission granted West Kootenay a 7.3 per cent interim rate increase effective January 1, 1984.

Construction began in 1983 on the extension of West Kootenay's 230 kV transmission system from Kelowna to Penticton, B.C. Work continued on the conversion of the subtransmission system in the Kelowna area from 60 kV to 138 kV. The period for making the conversion has been extended to match the slow load growth in the area. West Kootenay continued its policy of undertaking new construction of facilities only when needed for load growth or to ensure continuing reliable service.

In the first quarter of 1983, West Kootenay converted $35 million of short-term floating-rate bank debt to fixed-rate longer-term debt.

In 1982 West Kootenay purchased three power plants and concluded a long-term power purchase agreement with Cominco. A detailed analysis is in progress on the various power supply alternatives available to meet anticipated increases in power demand in the West Kootenay service area.

Cominco Engineering Services

Cominco Engineering Services Ltd., formed to sell expertise gained in the development of Cominco operations, completed its second full year of operation in 1983. The subsidiary, with offices in Vancouver and Trail, worked for Cominco, for associated companies and for other customers in Canada, Norway, Spain and the United States.

Associated Companies

Associated companies are those in which Cominco's interest is 50 per cent or less and over which it has significant influence.

Fording Coal

Fording Coal Limited is engaged in the mining and development of metallurgical and thermal coal reserves in southeastern B.C. and Alberta. Revenues were $217 million in 1983, compared with $269 million in 1982, and Cominco's share of net earnings for the year was $1.6 million compared with $4.7 million in 1982.

Despite depressed worldwide coal markets, an 82-day strike, and a 15 per cent price reduction to principal buyers, a modest profit was made due to continued improvements in productivity. The quantity of coal and waste moved per man-shift has almost doubled since 1981.

Fording's production and sales of metallurgical clean coal from its surface operations near Elkford, B.C. were 3,041,000 tons *(2,759,000)* and 3,250,000 tons *(2,949,000)* respectively, compared with production of 4,299,000 tons *(3,900,000)* and sales of 3,786,000 tons *(3,435,000)* in 1982.

Fording's joint venture with Edmonton Power, the city-owned utility, to establish a thermal coal mine at Genesee, Alberta has been delayed by 18 months due to surplus generating capacity in the province. The estimated total cost of the coal mine, which will fuel an electric generating station, is $100 million, with operation now planned for 1987.

Aberfoyle

Aberfoyle Limited of Australia operates a zinc-lead-silver mine in Tasmania and two tin mines, one in Tasmania and the other in New South Wales. Aberfoyle had revenues of $56 million in 1983, compared with $62 million in 1982. Net earnings of Aberfoyle for 1983 were A$2.9 million. After translation into Canadian dollars and amortization of other investment costs, Cominco's share of the earnings was $0.4 million compared with a loss of $1.3 million in 1982.

Aberfoyle's revenues were adversely affected by lower production, by low zinc and lead prices which prevailed during the year and by continuing export restrictions imposed by the International Tin Council, of which the Australian Government is a member. This restriction required the company to reduce production from its Ardlethan and Cleveland mines.

The Que River zinc-lead-silver mine in Tasmania produced 255,000 tons *(231,000)* of ore and delivered 240,200 tons *(217,900)* to a custom concentrator.

Exploration results in 1983 were encouraging. Several diamond drill intersections were made at Hellyer, a new zinc-lead-silver sulphide discovery close to Que River. Grades and thicknesses approach those at Que River and drilling is continuing to define the deposit.

The search for diamonds in the Northern Territory was encouraging during the year, and direct testing of a number of targets is expected to take place in 1984.

Exminesa

Exminesa's (Exploración Minera Internacional España SA) Rubiales Mine in the Spanish province of Lugo had revenues of $37 million in 1983

Associated Companies	Percentage Ownership	Revenues		Share of Net Earnings (Loss)	
		1983	1982 (millions)	1983	1982
Fording Coal Limited	40	$217	$269	$ 1.6	$ 4.7
Aberfoyle Limited	47	56	62	0.4	(1.3)
Exploración Minera Internacional España S.A. (Exminesa)	48	37	54	(0.1)	1.4
Transcom Joint Venture	50	4	7	0.2	0.8
The Canada Metal Company Limited	50	56	63	(0.1)	(0.4)
Other		39	51	0.3	—
		$409	$506	$ 2.3	$ 5.2

Summary of Financial Position of Associated Companies

	1983	1982
	(millions)	
Working Capital	$ 39.2	$ 52.6
Fixed Assets	350.7	347.8
Other Assets	7.6	6.4
	397.5	406.8
Less: Long-term debt	101.4	121.4
Other non-current liabilities	17.0	15.0
Income taxes not currently payable	74.6	67.5
Net assets	$204.5	$202.9
Cominco's share of net assets	$ 91.0	$ 90.2

Summary of Results of Operations of Associated Companies

	1983	1982
	(millions)	
Revenues	$408.9	$506.2
Costs and expenses	398.7	471.8
Earnings before the following	10.2	[illegible].4
Income taxes	7.9	6.1
Exchange gain (losses) on translation of foreign companies	2.4	(1.4)
Total net earnings of associated companies	$ 4.7	$ 16.9
Cominco's share of net earnings	$ 2.3	$ 5.2
Dividends received by Cominco	$ 3.4	$ 4.8

A commitment to quality: these vacuum △ deposition products from the Electronic Materials Division meet the increasingly sophisticated requirements of the electronics industry.

Spokane, Washington: Cominco Electronic △ Materials Incorporated's plants make fabrications, bonding wire, ribbon and sputtering targets.

Vancouver, B.C.: the new continuous rolling △ mill at Western Canada Steel increases the volume and size range of steel production.

◁ Rubiales, Spain: The scenic countryside of Galicia surrounds the headframe of Exminesa's mine in the province of Lugo.

compared with $54 million in 1982. After recording an exchange translation gain of $1.0 million, Cominco's share of the loss was $0.1 million. This compares with earnings of $1.4 million in 1982, after an exchange translation loss of $1.3 million. The 1983 loss resulted from low metal prices and reduced production caused by continuing ground control problems in the mine.

In 1983, the Rubiales concentrator treated 921,000 tons *(836,000)* of ore compared with 1,144,000 tons *(1,038,000)* in 1982. Zinc concentrate production was 103,900 tons *(94,300)* compared with the production of 146,800 tons *(133,200)* in 1982. Lead concentrate production was 16,400 tons *(14,800)*, compared with 19,300 tons *(17,500)* in 1982. Adjustments were made to ore reserves mainly to allow for unrecoverable pillars.

During the year, a basic engineering study was completed for the development of Exminesa's zinc-lead deposit at Troya in the province of Guipúzcoa, Spain. This property has inferred reserves of 5.5 million tons *(5.0 million)* of zinc and lead ore containing small amounts of copper and silver.

Transcom Joint Venture

Production from the small alluvial diamond mine at Hondeklip, South Africa, in which Cominco has a 50 per cent interest, was 53,100 carats in 1983 compared with 97,200 carats in 1982. Revenues were $4 million in 1983 compared with $7 million in 1982, as a result of lower production and higher costs. Cominco's share of the net earnings was $0.2 million compared with $0.8 million in 1982. The terms of employment of the 61 persons on the staff and work force of the Transcom Joint Venture conform with the Canadian Government's guidelines for Canadian companies operating in South Africa.

Canada Metal

The Canada Metal Company Limited is a major Canadian manufacturer of secondary lead and a fabricator of lead and other metal products. Carter Chem Ltée, Montreal, a subsidiary, is the principal manufacturer in Canada of lead chemicals.

Canada Metal had sales of $58 million in 1983 compared with $63 million in 1982. The decline is attributed mainly to the lower value of lead metal. Cominco's share of the net loss was $81,000 compared with a loss of $400,000 in 1982.

Cominco Binani Zinc

During the year, Cominco agreed to sell its 40 per cent interest in Cominco Binani Zinc Limited to the remaining shareholders subject to the approval of the Reserve Bank of India.

Other Investments

Investments in other companies are carried at cost in the accompanying financial statements, less amounts written off due to the uncertainty of the future value of the investments. Income is recorded only to the extent of dividends received. No dividends were received during the year.

Cominco sold its entire 17.2 per cent interest in Tara Exploration and Development Company Limited on January 20, 1984. Proceeds from the sale of 1,125,724 Tara shares, at $20 each, was approximately $22.5 million.

Panarctic Oils Ltd. (6.9 per cent owned) continues to capitalize its exploration costs as none of its properties is in production. Natural gas reserves in the Arctic Islands are 18 trillion cubic feet, insufficient to justify a pipeline under present conditions. Oil discoveries in the region indicate the possibility of substantial oil reserves.

Exploration

The objectives of Cominco's exploration program are to extend known reserves at existing mines, and to discover new deposits that could be developed into profitable mines.

Exploration expenditures in 1983 totalled $35.0 million compared with $42.0 million spent in 1982. Investigation and appraisal of identified mineral properties accounted for $14.3 million. This amount was capitalized as investments in mineral properties and is being amortized against earnings. The remaining $20.7 million was spent on general exploration and charged against 1983 earnings. In addition to these amounts, an expenditure of $7.7 million was made on the continuing evaluation of the Red Dog property in Alaska.

Exploration for new deposits was carried out in North America, Europe and Australia, and on a selected basis in South America and Africa. Projects in Canada accounted for 43 per cent of the total expenditures; 25 per cent was spent on projects in the United States; and the remaining 32 per cent on projects in 12 other countries.

While the major part of Cominco's 1983 exploration program was directed towards the search for zinc, lead and gold deposits, specific programs sought other metals, including silver, copper, phosphate, niobium, diamonds and tin.

Diamond drilling programs were carried out on over 30 properties with results in more than half of them being sufficiently encouraging to justify further exploration.

The search for zinc deposits included programs in Canada, the United States, Europe and Australia. In the central Yukon Territory of Canada, significant zinc-lead-silver values were obtained by drilling. In Australia, drilling is currently in progress on a promising new discovery only 2 miles *(3 km)* north of Que River in Tasmania. Grades in excess of 20 per cent zinc, plus lead and 6 ounces of silver a ton *(206 grams per tonne)* have been found.

In Alaska, work continued by Cominco American Incorporated in the Noatak area, where the large Red Dog high-grade zinc-lead-silver deposit is located. Engineering studies and economic assessments continued in order to select the most suitable development plan for Red Dog. Other showings of interest are held in the immediate area, and drilling on two sites in 1983 gave additional encouraging results.

The search for gold and silver deposits was intensified, with programs carried out in all geographical areas being explored by Cominco. The low-grade Buckhorn leach gold open-pit operation moved from the exploration and feasibility stages of development to plant construction. Exploration continues in Nevada for similar deposits.

In French Polynesia the Mataiva phosphate deposit is being studied for production by a four-party joint venture.

Exploration in 1983 at operating mines was successful in replacing reserves mined during the year at the Polaris, Magmont, Que River and Warm Springs mines.

Environmental Protection

Capital expenditures addressed directly to environmental improvements were $10.7 million in 1983, including $1 million spent on environmental impact and baseline data studies for the Red Dog Project in Alaska.

The mercury removal plant at the Trail operations, a part of the overall sulphur gas handling project, was commissioned in 1983 and approached full operational status at year-end. This plant will allow greater flexibility in the processing of zinc concentrates containing mercury in the integrated zinc-lead processes at Trail. A new smoke eliminator, further reducing the residual emissions from zinc operations, was also installed.

Biological monitoring of employees working in the lead smelter at Trail yielded overall blood lead levels in 1983 that were the lowest on record.

Wide-ranging environmental studies were conducted at the Red Dog project. The project is being planned so that the impact on the quality of air, land, water, wildlife and the local community will be minimal.

Research and Development

The Technical Research Centre at Trail supports Cominco's operations worldwide through its technical expertise, laboratory facilities and pilot programs.

In 1983, a pilot plant began testing new methods of zinc electrolyte purification. A new smelting technique using a top blown rotary furnace has been developed for the recovery of tin, indium and other values from lead smelter dust. A process for the recovery of germanium from the Trail operations was developed and pilot plant work was underway at year-end. Studies are continuing on the recovery of marketable commodities from difficult-to-store waste byproducts, and on the recovery of low but valuable concentrations of metals found in some process streams.

Research for the Lake Minerals operation continued towards the development of a new low-cost process based on the use of solar energy to recover soda ash from a complex salt deposit at Owens Lake, California.

The Technical Research Centre provided assistance in the commissioning and start-up phases of new plants at Trail, and work continued on developing new and improved processes and products from existing operations. The Centre had 48 employees at the beginning of the year and 44 at year-end. Its operating budget was $3.1 million.

The Product Research Centre at Sheridan Park continued to support Cominco's metal customers with technical assistance in applying the latest technologies to their processes and products. Support was concentrated on the galvanizing, die casting and battery manufacturing industries, which represent the largest users of zinc and lead. Work continued on Cominco's battery manufacturing equipment, zinc foundry alloys and electrochemical battery research. The Product Research Centre had 37 employees at the beginning of the year and 35 at year-end. The operating budget was $2.3 million.

Human Resources

Approximately 70 per cent of Cominco's employees are represented by industrial unions. During the year 16 collective agreements were concluded. Before settlements were reached, work stoppages occurred at Trail and Kimberley for eight days, at the Con Mine in Yellowknife for nine weeks and at Western Canada Steel Limited for six and one-half months. During 1984 four collective agreements will expire.

Increased productivity is a vital part of Cominco's business plan. Through improvements in planning and technology, the workforce was reduced in 1983 by 331 or three per cent, bringing the total number of employees at year-end to 10,466. This total includes employees hired for the new Valley and Buckhorn mines. Reductions were achieved through the rationalization of crew sizes and the completion of major portions of the modernization project at Trail. The number of employees on roll at year-end at Trail operations was about the same as in 1977 when the modernization program started. Reductions in staff and increases in production, the reasons for replacement of the old Trail plants, are expected to continue in 1984.

The Government of Canada had determined earlier that commencing in 1984 employer-provided assistance towards travel and housing costs received by employees in northern Canada would be regarded as taxable benefits. After concerted representations to the Government by groups which included Cominco's management and unions, the Government altered its position and continued the remission order exempting northern employees from declaring such assistance to be taxable benefits. The Government's decision averted a significant cost to Cominco employees living in established communities, such as Pine Point and Yellowknife, and helped to maintain the viability of northern mine operations.

Forty years of service was completed by 35 employees in 1983, bringing the total number of those who have reached this milestone to 1,187. There were 65 scholarships of $500 or $750 granted in Cominco's higher education award program for children of employees and pensioners.

To achieve more effective use of benefit dollars received by non-union salaried employees, Cominco has developed one of the first flexible benefit programs in Canada. The new plan, which was implemented on March 1, 1984, covers about 1,850 non-union salaried employees. It combines a base level of benefits with a variety of options available to employees to fit their different personal needs.

Safety

Safety programs throughout Cominco's operations continue to be emphasized and effective. Some of the notable achievements are:

In the United States, Cominco American Incorporated had an outstanding year. The Magmont Mine at Bixby, Missouri won an award from the American Mining Congress and the Mine Safety and Health Administration for the best safety record in the United States in the Underground Metal Mine Division.

Magmont won this award also in 1975 and 1978, and is the first mine to win three times. The Magmont mill achieved another record on its own. At year-end the mill employees had worked over 13 years without a lost-time accident.

The Homestead operation at Beatrice, Nebraska received a National Safety Council award for working since 1979 without a lost-time accident. The award is the fourth major safety award in the Homestead plant's 17-year history.

At year-end, the natural gas ammonia plant at Trail had operated for 28 years, a total of 1.2 million man-hours, with no lost-time accidents.

Production and Sales Statistics

		1983		1982	
		Sales	Production	Sales	Production
Refined Metal					
Zinc					
Trail	tons	242,000	239,800	228,100	225,800
Tolled — Black Angel	tons	13,000	13,400	24,300	21,000
— Polaris	tons	24,100	17,900	3,500	3,500
		279,100	271,100	255,900	250,300
Lead					
Trail	tons	142,800	132,300	113,600	126,600
Tolled — Magmont	tons	36,200	32,300	33,600	33,100
		179,000	164,500	147,200	159,700
Silver[1]	ounces	11,316,100	11,451,300	10,003,800	10,337,800
Gold					
Con	ounces	68,300	70,500	79,300	79,500
Trail	ounces	21,400	21,400	24,800	24,800
		89,700	91,900	104,100	104,300
Concentrates[2]					
Zinc					
Sullivan	tons	—	136,000	—	131,000
Polaris	tons	118,700	239,300	71,400	142,400
Magmont	tons	10,700	10,700	7,200	7,000
Pine Point	tons	—	129,700	9,900	287,400
Black Angel	tons	132,200	150,300	127,200	154,900
		261,600	666,000	215,700	722,7[illegible]
Lead					
Sullivan	tons	32,200	139,300	3,400	170,600
Polaris	tons	38,700	56,300	27,900	45,900
Magmont	tons	1,000	52,100	1,500	44,500
Pine Point	tons	55,300	32,100	76,100	84,500
Black Angel	tons	42,400	33,800	33,300	41,300
		169,600	313,600	142,200	386,800
Copper[3]					
Valley	tons	33,000	36,700	16,800	11,000
Magmont	tons	600	400	1,100	900
		33,600	37,100	17,900	11,900
Chemicals and Fertilizers					
Nitrogen products		1,151,900	1,102,800	1,192,000	1,171,000
Phosphates		356,900	300,600	241,900	250,700
Potash		1,113,800	1,122,400	827,300	793,700
Other		272,200	278,200	274,500	281,900
		2,894,800	2,804,000	2,535,700	2,497,300

1 Includes silver sold in concentrates and intermediate products. 2 Sales exclude concentrates processed at Trail, British Columbia and concentrates processed through other smelters, which are reported as refined metal sales. Operations at Pine Point Mines Limited were suspended for the period January 2, 1983 to June 14, 1983. 3 Tonnages are for copper contained in concentrate.

Statement on Inflation Accounting

Canada and other Western World nations have come through a period of high inflation that has eroded the purchasing power not only of individuals but also of corporations. The cumulative effect of prolonged periods of inflation diminishes the usefulness of the conventional historical cost balance sheet and statement of earnings, which do not measure the ability of a corporation to maintain its productive capacity. To overcome this deficiency, the Canadian Institute of Chartered Accountants (CICA) has recommended that major corporations disclose selected information regarding the effects of changing prices. The CICA views its recommendations as experimental and part of an ongoing process to explain the impact of changing prices.

Cominco's consolidated financial statements are prepared on an historical cost basis. Under this concept, assets are reported at the amounts originally paid and are not adjusted for subsequent changes in the purchasing power of money or for the current cost of replacing the assets.

The CICA recommended disclosure is to report the effects of changes in the replacement cost of productive capacity by adjusting certain historical cost amounts (principally fixed assets and inventory) for changes in current costs and to measure this change against the rate of general inflation.

Cominco has been monitoring this experiment closely and has for several years used some of these principles for management purposes when evaluating the replacement of production facilities and new projects. The process is complex and difficult to understand and involves the use of arbitrary assumptions concerning the replacement of production facilities which will not likely reflect economic conditions when replacement decisions are made.

Therefore, at this stage of the experiment, Cominco does not believe that the recommended disclosures contribute to a better understanding by shareholders of its economic performance. As a mining company, our most valuable assets are our mineral resources and the infrastructure and facilities to process the ore. Resource properties are unique in terms of location, ground condition and mineral potential and, when depleted, they cannot be specifically replaced. The replacement cost of a mineral asset will be influenced to a far greater extent by its location and ground condition than by the direct effect of inflation.

Cominco's management is conscious of the CICA's desire to stimulate improved reporting to account for the effects of inflation and will continue to monitor the development of this experiment.

Management's Statement on Financial Reporting

[illegible]

Consolidated Financial Statements

Auditors' Report

To the Shareholders

[illegible]

We have examined the consolidated balance sheet of [illegible] as at December 31, [illegible] and the consolidated statements of earnings, earnings reinvested in the business and changes in financial position for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as we considered necessary in the circumstances.

In our opinion, these consolidated financial statements present fairly the financial position of the corporation as at December [illegible] and the results of its operations and the changes in its financial position for the year then ended [illegible]

[illegible]

Summary of Significant Accounting Policies

Foreign Currency Translation

Land, Buildings and Equipment

Mineral Properties and Development

Consolidated Statement of Earnings

Year Ended December 31, 1983

	1983	1982
	(thousands)	
Revenue		
Sales of products and services	$1,374,723	$1,234,727
Income from investments	4,600	5,933
	1,379,323	1,240,660
Costs and Expenses		
Costs of products and services	1,015,195	932,301
Distribution	161,817	139,585
Selling	28,491	27,205
General and administrative	44,023	47,910
General mineral exploration	15,642	14,452
Interest (Note 8)	81,375	90,383
Depreciation, depletion and amortization	100,153	86,388
	1,446,696	1,338,224
Loss before the Following	67,373	97,564
Taxes on income including resource taxes (Note 9)		
Current	5,853	6,829
Not currently payable (reduction)	(32,591)	(49,871)
	(26,738)	(43,042)
	40,635	54,522
Minority interests in net losses of subsidiary companies	1,327	686
	39,308	53,836
Equity in net earnings of associated companies	(2,275)	(5,207)
Loss on translation of accounts of foreign subsidiaries	2,292	674
Loss before Extraordinary Item	39,325	49,303
Extraordinary gain (Note 10)	—	18,106
Net Loss	$ 39,325	$ 31,197
Per Common Share		
Loss before extraordinary item	$ 2.60	$ 3.16
Net Loss	$ 2.60	$ 2.20

Consolidated Statement of Earnings Reinvested in the Business

Year Ended December 31, 1983

	1983	1982
	(thousands)	
Amount at Beginning of Year	$554,414	$622,310
Deduct:		
Loss for the year	39,325	31,197
Costs incurred on issue of shares	2,326	1,796
Dividends paid		
Preferred — Series A $2.00 per share	3,498	3,542
— Series C $1.98 per share (1982 - $2.64)	3,968	5,275
— Series D $3.25 per share (1982 - $0.82)	6,500	1,643
Common — $0.40 per share (1982 - $1.30)	8,182	24,443
	63,799	67,896
Amount at end of Year	$490,615	$554,414

Consolidated Balance Sheet

at December 31, 1983

	1983	1982
	(thousands)	
Current Assets		
Cash and short-term investments	$ 13,858	$ 31,279
Accounts receivable	224,273	182,573
Inventories (Note 2)	324,352	352,156
Prepaid expenses	9,481	9,732
	571,964	575,740
Investments (Note 3)		
Associated companies	94,796	95,929
Other companies	30,482	31,941
	125,278	127,870
Fixed Assets		
Land, buildings and equipment	1,633,691	1,562,144
Less accumulated depreciation	581,595	518,682
	1,052,096	1,043,462
Mineral properties and development (Note 4)	416,977	417,975
Less accumulated depletion	108,846	101,645
	308,131	316,330
	1,360,227	1,359,792
Other Assets (Note 5)	25,862	28,142
	$2,083,331	$2,091,544
Current Liabilities		
Bank loans and notes payable	$ 157,672	$ 161,633
Accounts payable and accrued liabilities	166,380	146,411
Income and resource taxes	17,830	16,206
Long-term debt due within one year	43,058	30,457
	384,940	354,707
Long-Term Debt (Note 6)	649,428	687,975
Income Taxes Provided but not Currently Payable	144,498	175,520
Minority Interests	34,561	38,397
Shareholders' Equity		
Capital (Note 7)	379,289	280,531
Earnings reinvested in the business	490,615	554,414
	869,904	834,945
Commitments and Contingent Liabilities (Note 12)		
	$2,083,331	$2,091,544

Approved by the Board:

W. Anderson, Director

W. G. Wilson, Director

Consolidated Statement of Changes in Financial Position

Year Ended December 31, 1983

	1983	1982
	(thousands)	
Source of Funds		
Funds (deficit) from operations	$ 31,551	$(8,090)
Disposal of land, buildings, equipment and investments	8,949	13,983
Sale of oil and gas properties (Note 10)	—	25,728
Additional long-term debt	8,811	151,304
Issue of share capital		
— Preferred	—	50,000
— Common	100,406	95
	149,717	233,020
Application of Funds		
Land, buildings and equipment	83,529	176,900
Mineral properties and development	22,807	53,505
Reduction of long-term debt	46,670	29,612
Preferred shares purchased for cancellation	1,552	1,277
Dividends — to preferred shareholders	13,966	10,460
— to common shareholders	8,182	24,443
— to minority shareholders of subsidiary companies	2,487	6,366
Other	4,533	1,429
	183,726	303,992
Decrease in working capital	34,009	70,972
Working capital at beginning of year	221,033	292,005
Working capital at end of year	$187,024	$221,033

Notes to Consolidated Financial Statements

Year Ended December 31, 1983

1. Accounting Policies

The significant accounting policies followed by the Corporation and its subsidiary companies are summarized under the caption "Summary of Significant Accounting Policies".

2. Inventories

	1983	1982
	(thousands)	
Finished goods	$141,936	$165,992
Raw materials and partially processed materials	96,866	100,173
Stores and operating supplies	85,550	85,991
	$324,352	$352,156

3. Investments

	1983	1982
	(thousands)	
Associated companies:		
Shares at cost	$ 65,608	$ 66,788
Equity in undistributed earnings	29,188	29,141
	$ 94,796	$ 95,929
Other companies:		
Shares at cost		
Panarctic Oils Ltd. (6.9% owned)	$ 18,962	$ 19,228
Tara Exploration and Development Company Limited (17.2% owned 1983 at realized value)	22,515	26,903
Other companies	5,092	5,781
Other	519	334
	47,088	52,243
Less accumulated amortization of mineral investments	16,606	20,305
	$ 30,482	$ 31,941

On January 20, 1984 the Corporation sold its shares in Tara Exploration and Development Company Limited for $22,515,000 in cash.

4. Mineral Properties and Development

	1983	1982
	(thousands)	
Operating mineral properties	$291,367	$301,023
Less accumulated depletion	47,350	44,873
	244,017	256,150
Exploration properties, less amounts amortized	64,114	60,180
	$308,131	$316,330

5. Other Assets

	1983	1982
	(thousands)	
Debt financing costs, less amounts amortized	$ 1,886	$ 1,742
Loan to Bankeno Mines Limited	3,000	3,000
Deferred start-up costs, less amounts amortized	13,830	15,440
Other	7,146	7,960
	$ 25,862	$ 28,142

6. Long-Term Debt (excluding amounts due within one year)

	1983	1982
	(thousands)	
Cominco Ltd.		
10% Serial Notes due 1985 to 1996, U.S. $40,000,000	$ 39,380	$ 42,662
8½% Sinking Fund debentures due 1991	50,571	52,106
10⅞% Sinking Fund debentures due 1995	45,074	48,856
Export-Import Bank of the United States 8% loan due 1985 U.S. $763,000	759	2,278
Bank loans due 1985 to 1994 with interest related to prime bank rates	422,800	456,400
West Kootenay Power and Light Company, Limited		
5¾% First Mortgage bonds due 1985	5,218	5,437
Bank loan due 1985 with interest related to prime bank rates	9,300	41,100
13% secured debentures due 1988	10,000	—
14¼% secured Sinking Fund debentures due 1998	10,000	—
14¾% retractable Sinking Fund debentures due 1998	15,000	—
Cominco American Incorporated		
8½% Note payable due 1985 to 2000 U.S. $2,122,000	2,548	2,627
Other debt U.S. $478,000	568	2,029
Pine Point Mines Limited		
Bank loans due 1987 to 199[illegible] with interest related to prime bank rates	15,000	13,700
Western Canada Steel Limited		
Bank loan due 1985 to 1993 with interest related to prime bank rates	22,500	19,900
Other debt	710	880
	$649,428	$687,975

Payments required on long-term debt, assuming the conversion of revolving bank loans into five-year term loans, are: 1984 — $43,058,000; 1985 — $55,756,000; 1986 — $45,177,000; 1987 — $68,167,000; 1988 — $77,916,000.

If translated into Canadian dollars at year-end rates of exchange, long-term debt would increase by $10,704,000 in 1983 and $11,430,000 in 1982. This is not necessarily indicative of the amounts of the exchange premium, if any, which will be payable when the obligations are retired.

7. Capital

The Corporation is incorporated under the Canada Business Corporations Act and is authorized to issue an unlimited number of Preferred and Common Shares.

	1983	1982
	(thousands)	
a) Issued and fully paid:		
Preferred —		
1,722,484 shares (1982 — 1,788,384) — $2.00 Tax Deferred Exchangeable Preferred Shares Series A — issued 1976 (Note 7(d))	$ 43,061	$ 44,709
2,000,000 shares — Floating Rate Preferred Shares Series C — issued 1978	50,000	50,000
2,000,000 shares — $3.25 Cumulative Redeemable Preferred Shares Series D — issued 1982	50,000	50,000
	143,061	144,709
Common —		
21,008,523 shares (1982 — 18,805,743) (Note 7(c))	236,228	135,822
	$379,289	$280,531

b) Preferred Shares:

The Corporation has constituted the following Preferred Shares:

2,000,000 shares as "$2.00 Tax Deferred Exchangeable Preferred Shares Series A"
2,000,000 shares as "$2.4375 Preferred Shares Series B"
2,000,000 shares as "Floating Rate Preferred Shares Series C"
2,000,000 shares as "$3.25 Cumulative Redeemable Preferred Shares Series D"

Each Series A Preferred Share is entitled to a fixed cumulative cash dividend of $2.00 per annum payable semi-annually. The Series A Preferred Shares are exchangeable into Series B Preferred Shares after June 1, 1988. Each Series C Preferred Share is entitled to a cumulative cash dividend which is related to the prime rate of interest charged by certain Canadian banks, adjusted quarterly and payable semi-annually. The holders of the Series C Preferred Shares may call for retraction on March 31, 1988. Each Series D Preferred Share is entitled to a fixed cumulative cash dividend of $3.25 per annum payable quarterly. The holders of the Series D Preferred Shares may call for retraction on March 31, 1988. The Corporation may elect on or after February 1, 1988 to designate a further series of Preferred Shares into which the Series D Preferred Shares may be converted.

c) Shares issued during the year for cash:

	1983	1982
	(thousands)	
Preferred —		
2,000,000 $3.25 Cumulative Redeemable Preferred shares	$ —	$50,000
Common —		
2,191,780 shares	$100,000	$ —
11,000 shares (1982 — 3,025 shares) (Note 7(e))	406	95
	$100,406	$ 95

d) Shares purchased for cancellation:

During 1983, the Corporation purchased for cancellation 65,900 Series A Preferred Shares with an issued value of $1,647,500 for $1,551,500 cash.

e) The Corporation has 55,800 Common Shares remaining available for issuance under stock option plans in favour of certain executives in the full-time employment of the Corporation or a subsidiary. Options are exercisable within five years of issue at 90% of the market price on the day prior to the day when granted.

Outstanding options at December 31, 1983 are as follows:

Granted	Price	Outstanding	Exercised in 1983
1978	24.41	nil	1,000
1979	32.40	7,000	3,000
1980	52.31	19,500	1,000
1981	60.98	24,250	500
1982	36.68	23,500	5,500
1983	46.01	28,050	nil
		102,300	11,000

8. Interest

Interest charges were as follows:

	1983	1982
	(thousands)	
Long-term debt interest	$ 72,091	$ 88,980
Short-term debt interest	14,028	24,365
	86,119	113,345
Less interest capitalized	4,744	22,962
Charged to earnings	$ 81,375	$ 90,383

9. Taxes on income

Taxes on income have been reduced by investment and research and development tax credits of $1,663,000 (1982: $386,000).

Accumulated investment tax credits amounting to $46,400,000 are available to reduce income taxes otherwise payable during the years 1984 to 1990.

10. Extraordinary Gain

In 1982 a subsidiary company, Cominco American Incorporated, realized a gain of $18,106,000 from the sale of its oil and gas properties. The Corporation received proceeds of $25,728,000 after income taxes of $11,915,000.

11. Pensions

The Corporation and its subsidiaries have pension plans covering substantially all employees. Pension costs for current service are charged to earnings in the year incurred. The liability for past service is being funded and charged to earnings over varying periods up to 15 years. The date of the most recent actuarial evaluation for most pension plans is December 31, 1982. At December 31, 1983, actuarial estimates of the liability for past service to be funded in future years amount to $50,000,000 (1982 — $56,000,000). The vested portion of the liability for past service to be funded in future years is $23,000,000 (1982 — $34,000,000).

Total pension expense including past service costs was $18,600,000 for 1983 and $23,300,000 for 1982.

12. Commitments and Contingent Liabilities

a) At December 31, 1983 guarantees amounted to $15,300,000, of which $6,000,000 was for bank loans of an associated company.

b) At December 31, 1983 unexpended amounts remaining on approved major capital projects were $80,000,000, of which $38,000,000 is expected to be spent in 1984.

c) At December 31, 1983 the aggregate minimum payments under operating leases were estimated at $40,295,000 with annual payments in each of the five years following 1983 of: 1984 — $11,821,000; 1985 — $9,183,000; 1986 — $7,283,000; 1987 — $5,906,000; 1988 — $4,263,000.

13. Related Party Transactions

Related parties consist of the Corporation's associated companies and Canadian Pacific Limited and its subsidiary and associated companies. Sales (all at fair market prices) to related parties amounted to $27,900,000 (1982: $29,400,000).

The Corporation has a revolving line of credit with Canadian Pacific Securities Limited in the amount of $75,000,000 which provides for loans of up to one year at interest rates related to commercial paper rates. The amount outstanding at December 31, 1983 was $75,000,000 (1982: $50,000,000).

The Corporation makes extensive use of both major Canadian railroads, one of which is a division of Canadian Pacific Limited (CP Rail), for the transportation of its raw materials and finished products. Freight charges from CP Rail are at published tariff rates. In addition, in the regular conduct of its business, the Corporation makes use of other services, facilities and products of the Canadian Pacific organization. These transactions are at rates and terms similar to those for unrelated customers.

14. Segmented Information

a) The Corporation operates in three industry segments:

Mining and Integrated Metals — Principally the mining, processing, smelting, and refining of zinc, lead, copper, silver and gold into concentrates and refined metal.

Chemicals and Fertilizers — Principally the production of sulphuric acid, potash, ammonia, urea, phosphates and nitrates.

Other Operations — Principally fabricated metal products, electronic materials and electric power distribution.

b) Sales to other segments are accounted for at prices which approximate market.

c) Investment income and certain corporate expenditures and assets relating to the overall direction and management of the Corporation's activities are not allocated to industry segments.

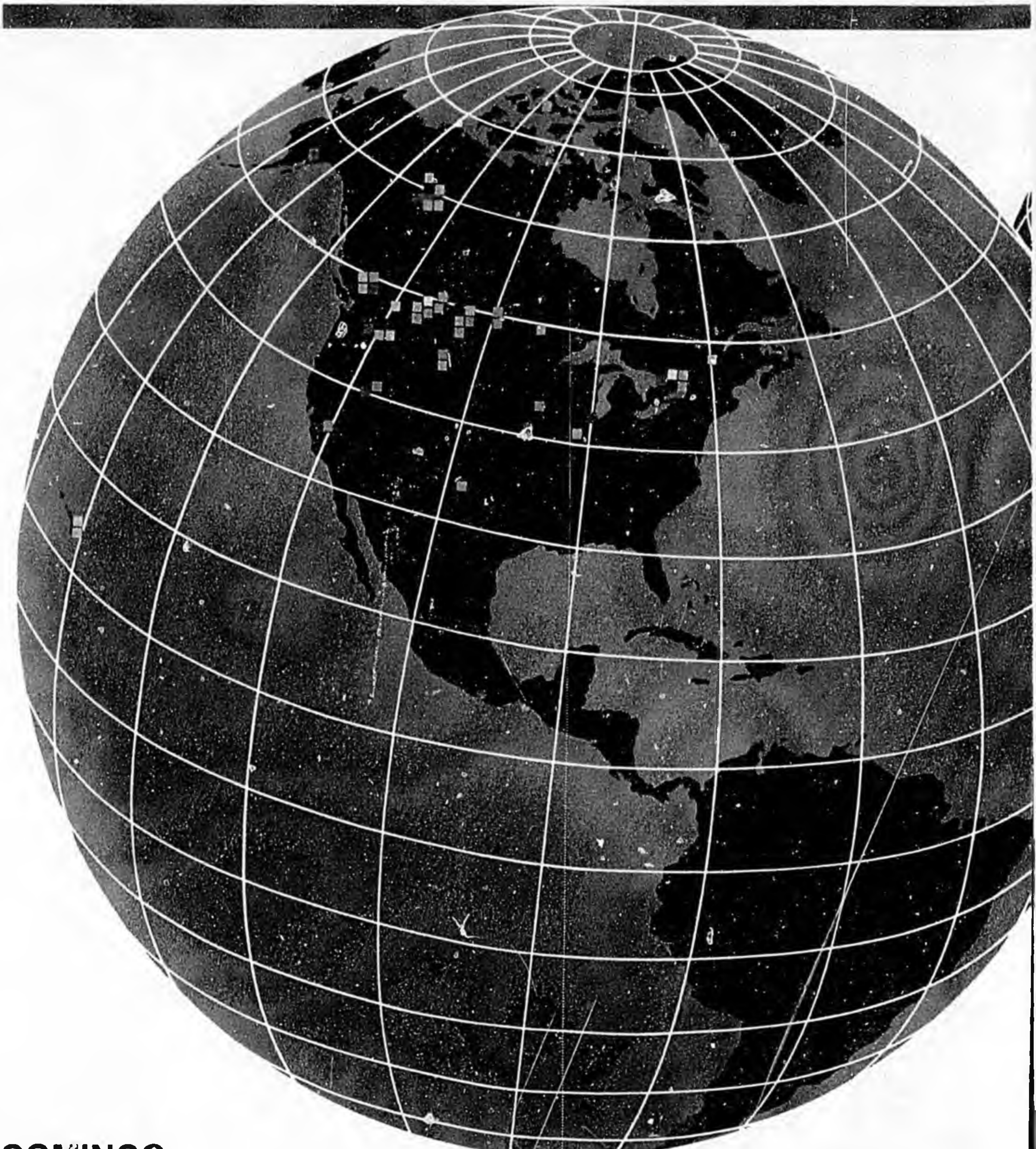
d) Canadian export sales amounted to $605,000,000 (1982: $529,000,000).

Segmented Information

Year Ended December 31, 1983
(Millions)

By Industry Segment	Mining and Integrated Metals 1983	Mining and Integrated Metals 1982	Chemicals and Fertilizers 1983	Chemicals and Fertilizers 1982	Other Operations 1983	Other Operations 1982	Consolidated 1983	Consolidated 1982
Revenue								
Sales to external customers	$ 767	$ 641	$ 443	$ 421	$ 165	$ 173	$1,375	$1,235
Sales to other segments	31	34	3	1	4	2		
	$ 798	$ 675	$ 446	$ 422	$ 169	$ 175		
Earnings								
Operating profit (loss) before unallocated items, below	$ (6)	$ (38)	$ 34	$ 37	$ 17	$ 21	$ 45	$ 20
General mineral exploration							(16)	(15)
Interest expense							(81)	(90)
Corporate (net)							(16)	(13)
Income and resource taxes							27	43
Earnings (loss) before minority interest, gain or loss on translation, equity in earnings of associates and extraordinary item							$ (41)	$ (55)
Identifiable Assets								
Segment assets								
— Operating	$1,183	$ 793	$ 384	$ 339	$ 165	$ 159	$1,732	$1,351
— Undeveloped properties and construction in progress	137	518	1	4	33	27	171	549
	$1,320	$1,311	$ 385	$ 403	$ 198	$ 186	$1,903	$ 1,900
Corporate assets							55	63
Investment in associated and other companies							125	128
Total Assets							$2,083	$2,091
Depreciation, Depletion and Amortization	$ 71	$ 57	$ 22	$ 22	$ 7	$ 7	$ 100	$ 86
Capital Expenditures	$ 81	$ 178	$ 9	$ 21	$ 16	$ 31	$ 106	$ 230

By Geographic Region	Canada 1983	Canada 1982	United States 1983	United States 1982	Other Countries 1983	Other Countries 1982	Consolidated 1983	Consolidated 1982
Revenue								
Sales to external customers	$ 980	$ 840	$ 325	$ 330	$ 70	$ 65	$1,375	$1,235
Sales to other regions	96	99	9	8	—	—		
	$1,076	$ 939	$ 334	$ 338	$ 70	$ 65		
Earnings								
Operating profit (loss) before unallocated items	$ 26	$ 6	$ 4	$ (1)	$ 15	$ 15	$ 45	$ 20
Identifiable Assets								
Regional assets								
— Operating	$1,509	$1,143	$ 150	$ 128	$ 73	$ 80	$1,732	$1,351
— Undeveloped properties and construction in progress	115	503	46	40	10	6	171	549
	$1,624	$1,646	$ 196	$ 168	$ 83	$ 86	$1,903	$1,900
Depreciation, Depletion and Amortization	$ 79	$ 63	$ 12	$ 16	$ 9	$ 7	$ 100	$ 86
Capital Expenditures	$ 75	$ 204	$ 27	$ 21	$ 4	$ 5	$ 106	$ 230



COMINCO

PRINCIPAL OFFICES, OPERATIONS, SUBSIDIARIES AND ASSOCIATED COMPANIES

PRINCIPAL OFFICES

Head Office:
2300 — 200 Granville Street
Vancouver, British Columbia
V6C 2R2

Group Offices:
B.C. Group
J. E. Fletcher,
Vice-President
Trail, British Columbia
V1R 4L8

Prairie Group
W. J. Robertson,
Vice-President
426 —10333 Southport
Road SW
Calgary, Alberta
T2W 3X6

Northern Group
J. M. Wilson, Vice-President
P.O. Box 1979
Yellowknife, N.W.T.
X1A 2P5

Australia
Cominco Australian Pty. Ltd.
N. A. Gilberthorpe,
Chairman & Chief
Executive Officer
367 Collins Street
Melbourne, Victoria 3000
Australia

Europe and Africa
Cominco Europe Limited
P. Hansen, Chairman &
Managing Director
50 Finsbury Square
London EC2A 1DD
United Kingdom

U.S.A.
Cominco American
Incorporated
J. L. Anderson, President &
Chief Executive Officer
818 West Riverside Avenue
Spokane, WA 99220 U.S.A.

Cominco Engineering
Services Ltd.
J. E. Fletcher, Chairman
& Chief Executive Officer
Trail, British Columbia
V1R 4L8

Copper Division
R. P. Taylor, President
2200 — 200 Granville Street
Vancouver, British Columbia
V6C 2R2

Electronic Materials Division
A. V. Marcolin, President
Trail, British Columbia
V1R 4L8

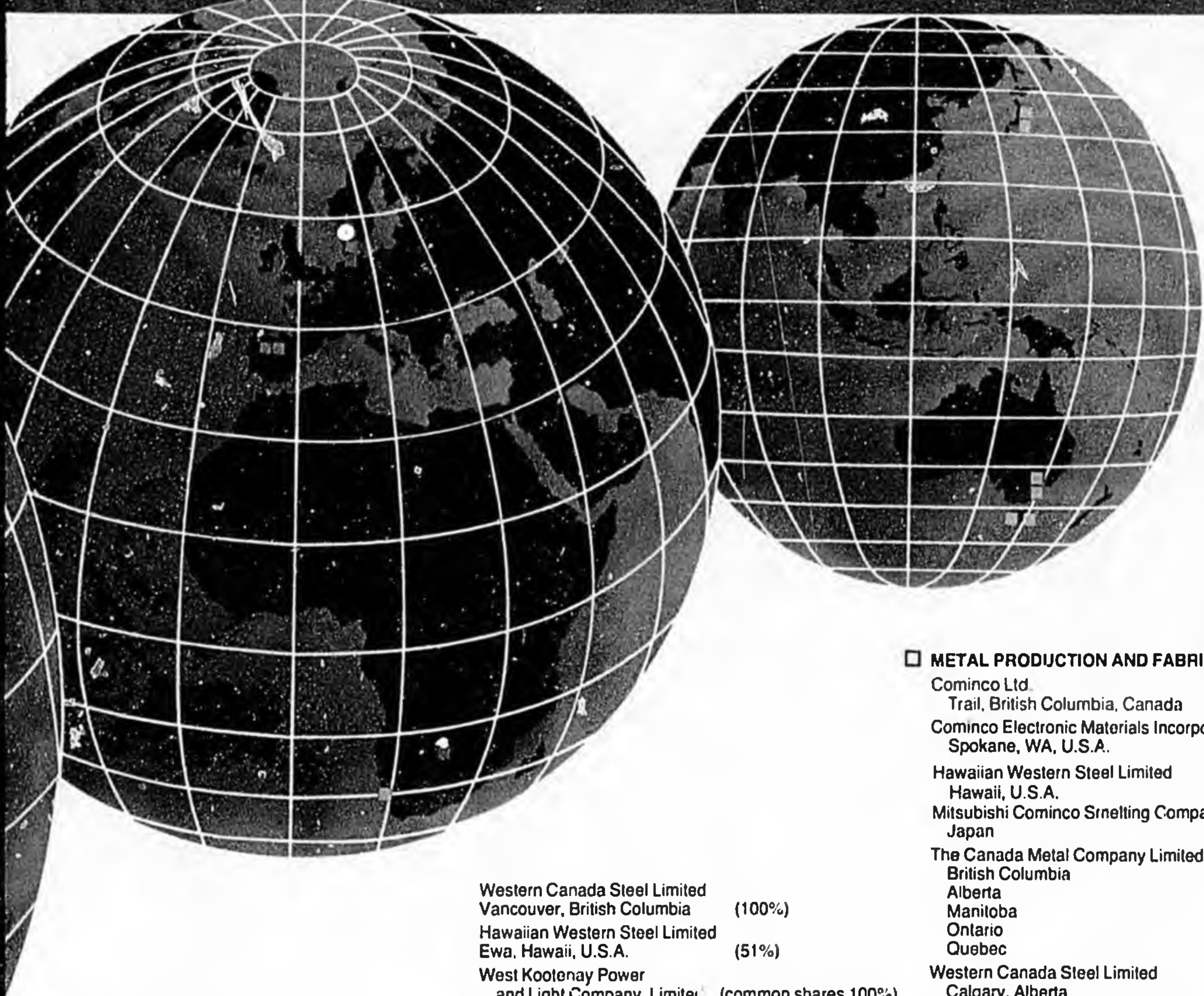
Sales Offices:
Cominco Ltd.
2300 — 200 Granville Street
Vancouver, British Columbia
V6C 2R2

Cominco Ltd.
426 — 10333 Southport
Road SW
Calgary, Alberta
T2W 3X6

Cominco Ltd.
120 Adelaide Street West
Suite 1500
Toronto, Ontario
M5H 1T1

Cominco American
Incorporated
818 West Riverside Avenue
Spokane, WA 99220 U.S.A.
(also Amarillo, Texas;
Chicago, Illinois; Fargo,
North Dakota; Lincoln,
Nebraska; Minneapolis,
Minnesota)

Cominco Electronic
Materials Incorporated
East 15128 Euclid Avenue
Spokane, WA 99216 U.S.A.



Cominco (U.K.) Limited
50 Finsbury Square
London EC2A 1DD
United Kingdom

Cominco (U.K.) Limited
Crown House
550 Mauldeth Rd. W.
Chorlton-cum-Hardy
Manchester M21 2SJ
England

PRINCIPAL SUBSIDIARIES AND ASSOCIATED COMPANIES
(Cominco ownership in parentheses)

Aberfoyle Limited
Melbourne, Australia (47%)

The Canada Metal Company Limited
Toronto, Ontario (50%)

Cominco American Incorporated
Spokane, Washington, U.S.A. (100%)

Cominco Electronic Materials Incorporated
Spokane, Washington, U.S.A. (100%)

Cominco Europe Limited
London, England (100%)

Cominco Holdings (N.V.)
Amsterdam, The Netherlands (100%)

Cominco (U.K.) Limited
London, England (100%)

Exploración Minera Internacional España S.A.
Villafranca del Bierzo, León, Spain (48%)

Fording Coal Limited
Calgary, Alberta (40%)

Mitsubishi Cominco Smelting Company, Limited
Tokyo, Japan (45%)

Pine Point Mines Limited
Pine Point, N.W.T. (69%)

Vestgron Mines Limited
Yellowknife, N.W.T. (63%)

Greenex A/S
Copenhagen, Denmark (63%)

Western Canada Steel Limited
Vancouver, British Columbia (100%)

Hawaiian Western Steel Limited
Ewa, Hawaii, U.S.A. (51%)

West Kootenay Power and Light Company, Limited
Trail, British Columbia (common shares 100%) (preferred shares 30%)

OPERATING MINES

Ardlethan
New South Wales, Australia

Black Angel
Greenland

Buckhorn
Nevada, U.S.A.

Cleveland
Tasmania, Australia

Con
Northwest Territories
Canada

Fording Coal
British Columbia
Canada

Hondeklip
Cape Province
South Africa

Magmont
Missouri, U.S.A.

Pine Point
Northwest Territories
Canada

Polaris
Northwest Territories
Canada

Que River
Tasmania, Australia

Rubiales
León, Spain

Sullivan
British Columbia
Canada

Vade
Saskatchewan,
Canada

Valley
British Columbia
Canada

Warm Springs
Montana, U.S.A.

METAL PRODUCTION AND FABRICATION

Cominco Ltd.
Trail, British Columbia, Canada

Cominco Electronic Materials Incorporated
Spokane, WA, U.S.A.

Hawaiian Western Steel Limited
Hawaii, U.S.A.

Mitsubishi Cominco Smelting Company, Limited
Japan

The Canada Metal Company Limited
British Columbia
Alberta
Manitoba
Ontario
Quebec

Western Canada Steel Limited
Calgary, Alberta
Vancouver, British Columbia

CHEMICAL AND FERTILIZER PRODUCTION

Cominco Ltd.
Trail and Kimberley, British Columbia, Canada
Calgary and Carseland, Alberta, Canada
Vade, Saskatchewan
Canada

Cominco American Incorporated
Beatrice, Nebraska, U.S.A.
Borger, Texas, U.S.A.
Owens Lake, California
U.S.A.
Warm Springs, Montana
U.S.A.

RESEARCH CENTRES

Trail, British Columbia
Sheridan Park, Ontario

EXPLORATION OFFICES

Cominco Ltd.
Vancouver, British Columbia; Toronto, Ontario

Cominco American Incorporated
Spokane, Washington; Anchorage, Alaska; Reno, Nevada

Cominco Europe Limited
Guildford, England

Cominco France S.A.
Paris, France

Cominco S.A.
Brussels, Belgium

Aberfoyle Limited
Melbourne, Australia

Compañia Minera Constelación S.A. de C.V.
Guadalajara, Mexico

Eland Exploration (Pty.) Ltd.
Johannesburg, South Africa

Cominco (Perú) S.R. Ltda.
Lima, Peru

Five Year Financial Summary

(All dollar amounts in millions except per share figures)

	1983	1982	1981	1980	1979
Operations					
Sales of products and services	$1,374.7	$1,234.7	$1,416.9	$1,442.7	$1,273.9
Net earnings (loss)	(39.3)	(31.2)	70.3	171.1	204.6
—per common share	(2.60)	(2.20)	3.35	9.54	11.57
Funds (deficit) from operations	31.6	(8.1)	201.3	307.7	325.7
—per common share	0.88	(0.97)	10.52	17.54	18.69
Dividends on common shares	8.2	24.4	75.2	75.2	80.9
—per common share	0.40	1.30	4.10	4.40	4.75
Capital expenditures	106.3	230.4	333.7	280.3	150.1
Financial Position					
Assets:					
Working Capital	$ 187.0	$ 221.0	$ 292.0	$ 323.7	$ 275.2
Fixed assets (net)	1,360.2	1,359.8	1,242.4	909.9	645.5
Investments and other assets	151.2	156.0	151.4	129.6	166.0
	$1,698.4	$1,736.8	$1,685.8	$1,363.2	$1,086.7
Financed by:					
Long-term debt	$ 649.4	$ 688.0	$ 566.7	$ 329.0	$ 226.0
Income taxes not currently payable	144.5	175.5	219.2	172.9	122.4
Minority interests	34.6	38.4	45.4	90.4	54.8
Shareholders' equity	869.9	834.9	854.5	770.9	683.5
	$1,698.4	$1,736.8	$1,685.8	$1,363.2	$1,086.7
Return on assets	Nil	Nil	7.7%	16.4%	23.7%
Return on common shareholders' equity	Nil	Nil	9.3%	26.2%	37.7%
Number of employees at year-end	10,466	10,797	12,643	12,296	11,254
Total employment costs	$ 400.4	$ 421.3	$ 416.1	$ 341.8	$ 278.5
Market price per common share					
(Toronto Stock Exchange) — High	$64¾	$55¼	$72	$81	$55½
— Low	$44¾	$33¾	$43¾	$47½	$31⅝

Shareholder Information

Transfer Agents and Registrars

The Royal Trust Company
555 Burrard Street
Vancouver, B.C.
V6B 3R7

333 — 7th Avenue S.W.,
Calgary, Alberta
T2P 2Z1

*330 St. Mary Avenue
Winnipeg, Manitoba
R3C 2Z5

23rd Floor, Royal Trust Tower
Toronto Dominion Centre
P.O. Box 7500 — Station A
Toronto, Ontario
M5W 1P9

630 Dorchester Blvd. W.
Montreal, Quebec
H3B 1S6

**One King Street
St. John, N.B.
E2L 1G1

***1660 Hollis Street
Halifax, N.S.
B3J 1V7

Bank of Montreal Trust Company
**2 Wall Street
New York, N.Y.
10005

Stock Exchanges
Vancouver, Montreal,
Toronto (Canada)
**American (U.S.A.)

*Series A and D Preferred Shares Only
**Common Shares Only
***Series D Preferred Shares Only

Share Valuation

For Canadian capital gains tax purposes the Valuation Day value of Cominco Ltd. common shares on December 22, 1971, as established by the Department of National Revenue, was $22.88 per share.

Stock Holdings

The number of registered holdings of voting stock on March 5, 1984 was 20,930. The distribution of the voting rights on that date was as follows:

96.28% Canada
3.32% United States
0.40% Other Countries

Dividends

Cominco's practice is to declare dividends on its common shares quarterly payable towards the end of each calendar quarter.

Dividends are paid in Canadian dollars to all common shareholders who reside in Canada and in U.S. dollars to all other common shareholders. Common shareholders resident in Canada may elect to receive dividends in U.S. dollars and common shareholders not resident in Canada may elect to receive dividends in Canadian dollars upon forwarding a written request to any office of the Company's principal Registrar and Transfer Agent, the Royal Trust Company, listed in this Report.

Sources of Shareholder Information

The Annual Report is one of several sources of information available to Cominco shareholders. A description of other regularly published sources is given below.

Quarterly interim reports are mailed in May, August and November. These reports contain financial results and other news about the Company.

The Information Circular, Proxy and Annual Report are mailed to each registered common shareholder in March. The Information Circular describes the matters to be considered at the Annual General Meeting.

The Company has been qualified under the Prompt Offering Qualification System for securities of senior Canadian issuers. Upon written request to the Corporate Secretary, shareholders may receive a copy of the Company's current Annual Information Form that has been filed under this system.

To permit shareholders who do not hold Cominco stock in their own names to receive published information on a timely basis, the Company has established a special mailing list. Shareholders on the list will have reports mailed directly to them. To be placed on direct mailing lists, shareholders and others should write to the Corporate Secretary, Cominco Ltd., Suite 2300 — 200 Granville Street, Vancouver, B.C., Canada, V6C 2R2.

Directors and Officers

Directors

* M.N. ANDERSON
Chairman and Chief Executive Officer
Cominco Ltd., Vancouver

† H.C. BENTALL
Chairman, the Bentall Group
Vancouver

* F.S. BURBIDGE
Chairman and Chief Executive Officer
Canadian Pacific Limited, Montreal

* F.E. BURNET
Corporate Director
Spokane

* R.W. CAMPBELL
Vice-Chairman and Chief Executive Officer
Canadian Pacific Enterprises Limited
Calgary

R.G. DUTHIE
Corporate Director
Vancouver

S.E. EAGLES
President
Canadian Pacific Enterprises Limited
Calgary

* H.T. FARGEY
Executive Vice-President at Toronto
Cominco Ltd., Toronto

R. HOUGEN
Chairman of the Board,
Canadian Satellite Communications Inc., Whitehorse

D.J. KELSEY
Consultant and
Corporate Director
Vancouver

† R.A. MacKIMMIE, Q.C.
Barrister and Solicitor
MacKimmie Matthews
Calgary

† P.A. NEPVEU
Chairman of the Board
CIP Inc.
Montreal

THE HON. I.D. SINCLAIR, O.C., Q.C.
Senator
Chairman
Canadian Pacific Enterprises Limited
Toronto

* W.G. WILSON
President
Cominco Ltd., Vancouver

Officers

M.N. ANDERSON
Chairman and Chief Executive Officer

W.G. WILSON
President

H.T. FARGEY
Executive Vice-President at Toronto

R.P. DOUGLAS
Executive Vice-President, Operations

R.R. STONE
Vice-President, Finance

O.E. OWENS
Vice-President, Exploration

K.H. SPURR
Vice-President, Metal Sales

J. GIOVANETTO
Vice-President, Human Resources

W.J. ROBERTSON
Vice-President, Prairie Group

J.E. FLETCHER
Vice-President, B.C. Group

J.M. WILLSON
Vice-President, Northern Group

E.A. KOWALENKO
Vice-President, Chemical and Fertilizer Marketing

A.V. MARCOLIN
President, Electronic Materials Division

R.P. TAYLOR
President, Copper Division

K.S. BENSON
Corporate Secretary

L.D. MARGERM
Treasurer

A.D. MILLER
Comptroller

B.J. PARTRIDGE
General Counsel

* Members of Executive Committee
† Members of Audit Committee

Cominco Ltd.
Suite 2300, 200 Granville Street, Vancouver, British Columbia V6C 2R2

ISSN 0711-7167

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Resources Comm.

Red Dog Project Analysis

A report to Governor
Bill Sheffield

February, 1984

Red Dog Project Analysis

February 1984

Lead Agency

Office of Mineral Development
Department of Commerce and Economic Development

Contributing Agencies

Department of Commerce and Economic Development
Department of Community and Regional Affairs
Department of Transportation and Public Facilities
Department of Natural Resources
Office of the Governor

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I. Introduction

The Red Dog zinc, lead and silver deposit was discovered in the mid 1970's. Located in the Noatak River drainage 55 miles from the Chukchi Sea, the deposit was included in a 1976 NANA land selection. In February 1982, the NANA Regional Corporation signed an agreement with Cominco American Ltd. to develop the deposit.

In late 1984, the Board of Directors of Cominco will decide whether or not to proceed with the project according to the present proposed schedule. If the decision is positive, construction would begin in mid 1985, with initial production starting at a rate of one million tons per year. The capacity of the mine would be expanded to 2 million tons of ore per year in 1993.

The development of the mine will require the construction of a port facility on the Chukchi Sea and a 55 mile road inland to the mine. Cominco estimates the cost of port construction to be $57 million and the cost of the road to be $75 million. Total development costs for the mine, including the port and the road are estimated to be $390 million. NANA and Cominco have jointly indicated that they will seek State funding assistance for construction of the road and the port.

This report was commissioned by the Governor to provide his office with the information necessary to formulate the State's role in the development of Red Dog. The lead agency in the preparation of the report is the Office of Mineral Development, Department of Commerce and Economic Development. Other State agencies contributing to the report are the Division of Finance and Economics, Office of Management and Budget, Department of Community and Regional Affairs, Department of Transportation and Public Facilities, the Division of Land and Water Management, and the Department of Revenue. Guidance in the handling of confidential information was provided by the Department of Law.

The following section is an executive summary which includes a summary of findings and recommendations. Following the Executive Summary, the contributions of each agency are included in their entirety. Minor inconsistencies inevitably occur in a report of this type which incorporates contributions from originating agencies.

The information used in the writing of this report represents independent research by the agencies involved as well as confidential and non-confidential information provided by NANA and Cominco.

II. Executive Summary

- This section of the report was prepared by the Office of Mineral Development. The contributing agencies have reviewed the Executive Summary for consistency.

A. Summary of Findings

<u>Project Feasibility</u>

- The enormous tonnage and high combined grade of zinc, lead and silver make Red Dog the worlds largest, undeveloped zinc/lead deposit.

- Development costs will be high. However, the deposit can be mined as an open pit with a very low ratio of waste material to ore. Therefore, actual mining costs will be low compared with the majority of world zinc/lead mines. This will give the Red Dog mine competitive advantage and result in reducing the possibility of temporary mine shutdowns in times of world economic recession.

- For the foreseeable future, 70%-80% of mine revenues will be from the sale of zinc concentrates. Zinc is the fourth most widely used industrial metal, and compared with the other base metals (copper and lead), zinc has the greatest potential for growth in terms of world demand and the least potential for being overproduced.

- Without State investment, an average long term zinc price of 63¢ per pound is estimated to provide Cominco a 15% return on investment. A return on investment of 15% is cited for comparison purposes only and should not be interpreted as a decision threshold for Cominco. A 2.5% change in the return on investment is estimated for each 5¢ change in the long-term average zinc price.

- In the long term, much of Red Dog's concentrate production can be refined at Cominco's smelter and refiner in Trail, British Columbia, and will replace concentrates from other depleting Cominco zinc mines. In the near and long term, concentrates from Red Dog will be attractive to Japanese and European processors because of the reliability of the supplier, the longevity of the mine, and the political stability of the United States. The development of Red Dog and other base metal deposits may eventually make the construction of an in-State smelter and refiner feasible.

Permitting and Access

- Conditions at Red Dog will allow the operators to meet the most stringent environmental regulations and environmental permitting should not pose any problems.

- Obtaining an access right-of-way from a Chukchi Sea port, across the Krusenstern National Monument to the mine site, poses the single greatest hurdle to mine development.

NANA

- The NANA Regional Corporation is solvent and is strongly oriented towards projects which offer long-term employment benefits to its shareholders, principally in the form of joint ventures within the region.

Cominco

- Cominco is a sound corporation, has good overall prospects, is backed by a large, reputable parent corporation, and appears able to provide a solid corporate base for support and development of the Red Dog mine project.

- Cominco is presently the free worlds largest producer of zinc and lead and has been successfully mining, processing and marketing zinc and lead for over 70 years.

- Cominco has developed and successfully operates four major mines in the North American arctic. Three of these are zinc/lead mines and have been developed within the last 20 years. The senior management for the Red Dog project will include many of the same personnel responsible for building and operating these arctic mines.

State Impacts

- The project will create between 350 and 400 direct, permanent jobs within the State with an annual gross payroll of between $11.2 and $12.9 million. Additionally, approximately 225 secondary and indirect jobs will be created. Construction employment will total 143 full time equivalent jobs between 1986 and 1988 with an annual gross payroll of $8.8 million during those years.

- Revenues to the State from the mine will be derived from the mining license tax and the corporate income tax. As both taxes are based on net profits, annual State revenues range from $9 to $20 million in current dollars subject to how repayment of infrastructure costs are treated. The net present value of revenues to the State over 30 years, including estimated reductions in transfer payments, is from $200 million to $300 million based on a zinc price range between 55¢ and 65¢ per pound. Additionally, earnings derived by NANA from the mine will provide revenue to the State. At present, there is no personal income tax so no revenues from employee income can be projected.

- No estimates have been made for the potential demands on State programs from the migration of out-of-state job seekers attracted by the project. Because of the NANA/Cominco agreement requiring preferential local hire, the remoteness of the project, and the lessening of national unemployment, the problem of out-of-state job seekers may not be significant.

- Recent dramatic decreases in the total of state transfer payments to the NANA region have been tentatively linked with permanent fund distributions. This indicates that income derived from mine wages may also have a positive effect on reducing regional transfer payments by the State.

- If State ownership and future control of the transportation corridor and infrastructure facilities are not considered and assuming a 60¢ lb. zinc price an examination of project finances estimates that a direct State subsidy of $40.1 million towards project development costs would assure a 15% rate on investment. This would provide a six-fold net present return on the State's subsidy in the form of tax revenues and transfer payment reductions totaling $270 million. If the State were to completely finance construction of the road and port for an estimated cost of $135 million, the cost/benefit ratio would be reduced to 2:1.

- Industrial development bond financing of the project infrastructure would not adversely affect the State's bonding capacity.

Regional Impacts

- Red Dog will provide approximately 260 full-time jobs for regional residents at mine start-up in 1988, increasing to 400 in 1993. The total regional payroll will total approximately $7.0 million initially and will increase constantly as local employees move into professional and technical positions. Additionally, some 75 secondary jobs will be created after start-up and would mostly be filled by regional residents. At present, 88% of the regional economy is supported by Federal and State revenues, and the existing 1200 full-time equivalent jobs in the region are heavily dependent upon Federal, State and local government employment.

- If the local hire objectives are met, the net effect of the mine on increasing the regional population will not be significant. Some increase in the population of Kotzebue is expected as regional residents relocate to be closer to their jobs. Kotzebue's population increase attributable to the mine represents about 6% of the total increase in Kotzebue's population over the next 20 years. With the possible exception of the water system, existing municipal facilities should not be significantly stressed by population growth attributable to development of the mine.

- Because Red Dog is an enclaved development, no substantial additional demands will be placed upon the region's service delivery. However, an increase in regional affluence is likely to require some increased social service delivery, at least temporarily. Service delivery in Kotzebue will be impacted to some degree if mine workers commute regularly through the city. That impact will depend on the frequency and duration of transient visits.

- The NANA/Cominco agreement requires Cominco, contingent upon the availability of skilled labor, to preferentially hire regional residents, [illegible]te residents and out-of-state residents in that order. While there is no guarantee of the percentage of local hire, NANA has stated it will assume the responsibility to train regional residents for these jobs.

- The region could benefit from the use of the project's port facilities and backhaul capabilities. Savings on freight costs are estimated by Cominco to be between $1 million and $3 million annually assuming port user fees are not assessed to incoming regional freight.

- NANA is presently seeking to detach Red Dog and other mineral deposits in the area from the North Slope Borough. Successful detachment is seen as a factor in the decision to proceed with the Red Dog project (due to uncertain future taxation policies of the North Slope Borough), and in the creation of a Northwest Alaska Borough.

Infrastructure Costs

- Cominco's route selection and road design are based on sound engineering criteria and the cost estimate of $80 to $90 million for the preferred road through the Krusenstern National Monument is realistic for this stage of the evaluation.

- Cominco's estimates for port costs of $50 to $60 million, based on the proposed, ballasted-tanker design, appear reasonable.

B. Recommendations

Red Dog will become one of the premier zinc/lead mines in the world. While the mine would eventually be developed without assistance, there are several reasons why the State may want to consider participating in the funding of all or part of the costs of building a road and regional port.

- There is little risk that the project will not generate sufficient revenues to amortize infrastructure costs at a modest interest rate.

- In addition to being able to repay any State funding, the project will generate over 400 year-round, permanent jobs; provide direct tax revenues to the State and local governments; and may significantly reduce the amount of regional transfer payments.

- The port facility, tidelands, uplands and right-of-way will service the region as well as the mine, and both the road and the port may stimulate future development of additional mineral deposits in the Noatak area. The road could eventually become part of an integrated transportation system that could link other more distant mineral developments such as the Northern Alaska Coal Field.

- The development of Red Dog will signal Alaska's firm intention to become a world supplier of mineral resources. This will have the effect of establishing Alaska's credibility with international consumers and attracting investment capital for other resource development projects.

If the State is to participate in the funding of the road and port facilities, the following recommendations are suggested.

- Any major State investment in the road and port facilities which will initially service the Red Dog mine should be conditional upon firm agreements with NANA and Cominco which will provide for State interests in the facilities and right-of-way, as well as further guarantee the use of the road and the port to other potential users. This requires that State tidelands, privately owned uplands and the right-of-way be available for expanded development and use, in a reciprocal use agreement among affected landowners and users.

- The maintenance and operating costs of the road and the port should be borne by the users.

- If State funding were to take the form of a loan or appropriation, repayment of the funds should be required and should be spread over a period of 20 years or longer to begin with mine production. Whether repayment is to be made in the form of annual installments, tied to a tonnage user fee or some combination of both, the interest rate attached to the repayment should reflect the State's willingness to share in the project risk and should recognize the total benefits the project will provide, including State interests in the road and port.

- Any agreement between the State and NANA/Cominco should include an equitable mechanism to accommodate other future users into a fee schedule which would incorporate a pro rated share of debt amortization as well as operating and maintenance costs.

III. Report of the Office of Minneral Development Department of Commerce and Economic Development

A. Technical Description of the Project and Permitting Requirements

B. Cominco Profile: History; Metal Mining and Processing Operations; and Arctic Mining Experience

C. Commodity Profile of Mine Products, Marketing Considerations and Price Forecasts

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A. Technical Description of the Project and Permitting Requirements

1. Project Description

The Red Dog deposit has indicated reserves of 85 million tons of ore with an average grade of 17.1% zinc, 5.0% lead (22.1% combined) and 2.4 ounces per ton silver. Red Dog's reserves and grades compare extremely favorably on a worldwide basis with other primary zinc/lead mines. These would include the Brunswick Mining Company's (64% Noranda) No. 12 mine in Eastern Canada with reserves of 100 million tons of 13% combined zinc and lead; the Mount Isa Mine in Australia with 93 million tons of 14% combined zinc and lead; and the Tara Mine in Ireland with 59 million tons of 12.7% combined zinc and lead.

On a regional comparison, the open pit Cyprus Anvil zinc/lead mine in the neighboring Yukon Territory has reserves of about 37 million tons with a combined zinc/lead grade of only 7.8%. On a world basis, according the U. S. Bureau of Mines, the average zinc grade of primary zinc mines is between 6% and 9%, spotlighting Red Dog's 17% zinc grade.

While the Red Dog grades and reserve tonnage compare favorably with major world producers, Red Dog will also enjoy the advantage of being an open pit mine, while most major zinc mines operate underground. U. S. Bureau of Mines statistics indicate less than 20% of the world's present primary zinc producers are surface mines. The cost of mining a ton of ore from an open pit is significantly less than the cost from an underground operation. This will enhance Red Dog's ability to operate during periods of market weakness and low prices. Cominco officials believe that Red Dog's actual cost to produce a ton of zinc, excluding development costs, will be lower than production costs of the majority of world zinc mines.

The mine site is located about 55 miles inland from the Chukchi seacoast and about 100 miles north of Kotzebue. A port site is proposed south of the village of Kivalina on the Chukchi Sea. The port will include either offshore or shore-connected docking facilities to accommodate 25,000-35,000 ton ore carriers which will ship mine concentrates to smelters and backhaul mine supplies during the ice-free shipping season from early July to mid October.

A 55 mile road will be constructed between the port and the mine site for the supply of the mine and for the transport of mine concentrates to port. At the proposed initial start-up production rate, 9 to 12 truckloads of concentrate will be hauled over the road daily. The road grade will be engineered for possible modification to a railbed when the production rate doubles and the economics of rail haulage become beneficial.

The mine site facilities will include an accommodation building for housing workers on a rotational basis, a mill complex for concentrating the mine ore, and other buildings for housing a vehicle maintenance shop, a primary ore crusher, an ore storage shed and other facilities. To the greatest extent possible, these buildings will be prefabricated in modules at Pacific port sites, shipped on barges to the port, and transported overland to Red Dog for siting on bedrock foundations.

The mine and mill will require 18 MW of power and the port facilities an additional 1.5 MW. The power will probably be supplied by diesel generators. While the cost of buying and transporting coal to the mine is significantly cheaper on a per Btu basis, Cominco has indicated the capital costs of a coal-fired power plant may not be competitive. A 50 MW power requirement is reported as being the minimum that would allow for the economies of scale necessary for coal fired generation to be considered cost effective.

The mine itself will be an open pit that may eventually reach a depth of 700 feet and cover 65 acres. Associated with the pit is the waste tailing pile area and the mill tailings pond. The tailings pond is located to allow treatment of all discharge water draining from the mine area including the pit, the waste tailings and the mill complex. Water naturally draining into the tailings pond basin will be diverted to an adjacent drainage to minimize the volume of water that must be treated. Once the tailings pond and drainage ditches are in place, the water quality in Red Dog Creek will be improved and the periodic fish kills in Ikalukrok Creek (caused by natural ground water leaching metals out of the orebody) will be eliminated.

The pit will require removal of only 1.3 million tons (less than 1 million yards) of material to prepare the mine site for production. Much of the waste material will be used in the construction of the tailings pond dam and access road. A portion of this preproduction material is mineralized and will be stockpiled in the tailings pond drainage area for possible future processing. The overall ratio of waste stripping to ore production is 0.8:1, which represents an extremely favorable situation compared with most open pit mines and will contribute significantly to the long term viability of the mine. Additionally, the first five years of ore to come from the pit will grade 21% zinc and 6% lead, 5% above the average mine ore grade, enhancing revenues from the initial production.

Initial ore production will be 1.1 million tons per year on a basis of 3000 tons per day. The ore will be crushed and concentrated using selective flotation. The final products shipped to smelters will be a lead sulfide concentrate with an approximate lead content of 62%, and a zinc sulfide concentrate with an approximate zinc content of 59%.

Forecast production at the initial mining rate is 350,000 tons of zinc concentrate and 79,000 tons of lead concentrate. The silver will be equally contained by weight in the lead and zinc concentrates, resulting in a silver grade in the lead concentrate of 4-5 times than that of the silver grade in the zinc concentrate due to the smaller tonnage of the lead concentrate.

The chemicals and technology required to treat and concentrate the raw ore is well developed and the equipment and chemicals needed are readily available. The only departure from an "average" treatment scheme is the need for finer grinding of the ore to effectively liberate the ore minerals from the waste minerals.

Under the expanded scenario beginning in the sixth year of operation, production will nearly double increasing the daily mill throughput from 3000 tons to 5,600 tons. Annual ore tonnage will be 2.0 million tons with annual zinc concentrate shipments of 585,000 tons and lead concentrate shipments of 119,000 tons.

Two Appendices are attached to this report which provide further details on the design, construction and operation of the Red Dog project. Appendix A is from the Preliminary Draft Environmental Impact Statement. Appendix B is a "Red Dog Fact Sheet" generated and distributed by Cominco.

2. Permitting Requirements

Permitting activity to date for the Red Dog project has included the initiation of applications for those permits requiring long lead times. Cominco employs a full time environmental coordinator to manage this aspect of the project. This position is staffed by Mr. Harry Noah who formerly filled a similar position with the Noranda Mining Company during which the Federal EIS for the Greens Creek project was being prepared.

Environmental baseline data collection for the Red Dog project began in the winter of 1981 and continued through the summer of 1983.

The Environmental Impact Statement (EIS) process was begun in January of 1983 and the formal Draft EIS will be distributed to the public in March 1984. The final EIS could be issued by July of 1984. Other major permits applications which have been filed to date include a National Pollution Discharge Elimination System permit, a Section 10(404) Army Corps of Engineers wetlands permit, a State of Alaska right-of-way permit, and a Title 11 right-of-way permit with the U.S. Department of Interior.

The following is an itemization of major permits needed before the construction and operation of Red Dog can begin.

<u>Federal Permits</u>

U. S. Environmental Protection Agency

- National Pollutant Discharge Elimination System Permit
- Review of U. S. Army Corps of Engineers Section 404 Permit for conformance with Section 404(b)(1) guidelines

U. S. Army Corps of Engineers

- Section 404 Permit (wetlands)
- Section 10 Permit (navigable waters dredge and fill)

U. S. National Park Service

- Right-of-way for transportation system

U. S. Fish and Wildlife

- Possible Section 7 Consultation (for endangered species)

National Marine Fisheries Service

- Possible Section 7 Consultation (for endangered marine mammals)

State Permits

Department of Environmental Conservation

- Air Quality Permit to Operate
- Certificate of Reasonable Assurance (Water Quality)
- Wastewater Disposal Permit
- Solid Waste Disposal Permit

Department of Fish and Game

- Title 16 Anadramous Fish Stream Permit

Department of Natural Resources

- Right-of-way Permit
- Water Rights Permit
- Tidelands Use Permit
- Tidelands Lease
- Materials Sale Contract

State Historic Preservation Office

- Archaeological Clearance

Office of Management and Budget

- Coastal Zone Management Consistency Determination

Local Permits

North Slope Borough

- Land Use Permit

Little problem is foreseen by Cominco in obtaining permits for the environmental aspects of the project. However, special interest litigation challenging procedural matters or other aspects of the issuance of federal permits may be possible as the project is large and represents the development of a remote area of Alaska.

In general the project should be able to meet the most stringent environmental standards. A water treatment plant will be installed to process the limited mine and mill discharge water. The naturally contaminated drainage from the mineral zone will also be treated. Ultimately the project will have permanently improved the quality of Red Dog Creek, even after the mine and water treatment facilities have been removed.

It is of interest to note that the present EPA regulations mandating zero-discharge of mill process water (which were developed on the basis of mill tailings ponds in the arid and evaporative climate of Southwest America) will be met at Red Dog by constructing a dam large enough to impound the cumulative volume of mill discharge water over the life of the mine. This regulation is attainable at Red Dog because the topography and the availability of stripped overburden material allow the construction of a mine tailings pond large enough to satisfy this requirement. The Quartz Hill mine, in the rainforest of Southeastern Alaska, will not have to comply with the regulation because a sole variance was granted to the project in the language of the regulations. However, this regulation has the potential to preclude the development of other Alaskan and U. S. mines which have neither a variance nor the favorable conditions found at Red Dog.

A possible major environmental permit that is not listed, but that may be in effect and needed for the permitting of Red Dog is a State Hazardous Waste permit which will be necessary if the proposed hazardous waste regulations are adopted. It is the contention of Cominco's staff that all the applicable provisions of these proposed regulations will have been addressed by the federal permitting process and that the State's permit requirements for Red Dog will be redundant. The State's proposed Hazardous Waste permitting process, however, would present an additional opportunity for project delay through litigation of permitting procedures.

At present, the most critical aspect of permitting for the project is the road access from the Chukchi coast to the mine site. Of two possible routes, a northern route across State lands and southern route through the Cape Krusenstern National Monument, the southern route has been identified in the Draft EIS as the preferred access option as it will have the least environmental impact and is the most cost-effective alternative for the project.

Use of the southern route requires either securing land from the Krusenstern National Monument or gaining a right-of-way across it. Both of these avenues are being pursued. The NANA Corporation is presently seeking a land exchange with the National Park Service for the four, corner townships in the monument through which the road would pass. Cominco has also begun a right-of-way application to the Park Service under the process outlined in Title 11 of ANILCA. The land swap is seen as the preferred method for gaining access as the alternative Title 11 right-of-way process is lengthy, complex, untried and would ultimately require approval of both the U. S. Congress and the President.

At present, government approval for access to the project is seen to be the only major permitting hurdle to the development of the mine. Appendix C contains a permit schedule time-line, and Appendix D is the basic flow chart for the Red Dog permitting process.

B. Cominco Profile: History; Metal Mining and Processing Operations; and Arctic Mining Experience

1. History

The development and operation of Red Dog will be carried out by Cominco Alaska Incorporated, a wholly owned subsidiary of Cominco Ltd. of Canada. Cominco Ltd. was originally formed in 1906 as the Consolidated Mining and Smelting Company of Canada by the Canadian Pacific Railway (CPR), which remains the majority stockholder (53%) of Cominco Ltd.

The CPR entered the smelting business indirectly in 1898 when they purchased a government-granted railroad franchise from Augustus Heinze. Heinze's railroad franchise threatened the viability of the CPR's own rail expansion plans, but as a condition of the sale, Heinze required the CPR to purchase his smelter located at Trail, British Columbia. In 1906, to secure ore concentrates for the smelter, CPR merged its smelting interests with three mining companies and a local power company to form the Consolidated Mining and Smelting Company of Canada.

In 1913, the company purchased the Sullivan Mine in Kimberly, British Columbia (150 miles from Trail) at a sheriff's auction. The ore at the mine was extremely complex for the existing technology, but shortly after acquiring the mine, the company's research division discovered a new recovery technique called selective flotation which allowed the processing of the complex sulphide ore. The actual size of the Sullivan Mine turned out to be larger than anyone had imagined. Still operating in 1983 with an additional mine life of 20 years, the Sullivan Mine is the flagship of the company.

At present, Cominco is one of the largest mining, smelting and refining enterprises in the world. It is the leading producer of zinc and lead, accounting for 10% and 11% of the world's supply, respectively. Additionally, the company operates fertilizer plants in the U.S. and Canada and operates a potash mine in Saskatchewan and a phosphate mine in Montana. Cominco supplies 22% of Canada's fertilizer demand and 12% of the U.S. demand.

2. Metal Mining and Processing Operations

Smelters and Refineries

Trail, British Columbia - The smelting and refining complex at Trail, British Columbia has an annual production capacity of 300,000 tons of refined zinc, 150,000 tons of refined lead and 12 million ounces of silver. Other products include gold, bismuth, cadmium, antimonial lead, sulphuric acid, ammonia, and fertilizers. The operation includes two hydro-electric plants which supply Cominco's power needs and sell the surplus locally. The Trail metallurgical operations represent Cominco's largest single source of revenue. Trail processes concentrates from the Sullivan Mine (100% Cominco) in British Columbia and from the Pine Point Mine (69% Cominco) in the Northwest Territories. Additional Trail capacity is met by purchasing concentrates from other sources including South America.

In 1977 Cominco began a modernization program at Trail which included $210 million for a new zinc refinery. Of the 300,000 ton annual production capacity at the recently completed zinc facility, 70,000 tons is produced in a "state of the art" hydrometallurgical plant which uses a pressure leaching process to produce zinc. Elemental sulfur is a by-product of this process instead of sulfuric acid. An additional $200 million investment is planned to rebuild the lead smelting segment of the complex.

Mitsubishi Cominco Smelting Company - Cominco holds a 45% interest in a lead smelter located on Naoshima Island, Japan. The smelter has a 40,000 ton annual refined lead production annual capacity and purchases lead concentrates from the Pine Point mine.

Cominco Binani Zinc Ltd. - Cominco Ltd. and Metal Distributors Ltd. in joint venture operate an electrolytic zinc plant in India with a capacity of 32,000 tons refined zinc, and by-product cadmium and sulphuric acid.

Metal Mines

Sullivan Mine, Kimberly, B.C. - In its 74th year of production, the Sullivan Mine is wholly owned by Cominco and is the principal supplier of lead and zinc concentrates to the Trail smelter. In 1982 the Sullivan Mine milled 2.4 million tons of ore grading 3.2% zinc, 5.0% lead, and 1.9 ounces per ton silver and shipped 131,000 tons of zinc concentrate and 171,000 tons of lead concentrate to Trail. The Sullivan Mine has published ore reserves of 49 million tons grading 6.1% zinc 4.4% lead, and 1.0 ounces per ton silver, giving it an indicated mine life of an additional 20 years at the present production rate.

Pine Point Mine, Pine Point, Northwest Territory - Cominco is a 69% owner of the Pine Point Mine. In 1982 Pine Point milled 2.4 million tons of ore grading of 7.3% zinc and 3.0% lead. Almost all of the 287,000 tons of zinc concentrates were shipped to the Trail, British Columbia smelter while most of the 85,000 tons of lead concentrate were shipped to the Mitsubishi Cominco lead smelter in Japan. Published reserves are 25 million tons at 6.1% zinc and 2.4% lead. Full mine production capacity is four million tons of ore per year indicating an assured mine life of 7 years.

The Pine Point Mine began production in 1964 after a joint development effort with the Canadian government which provided infrastructure to the remote location consisting of a 400 mile railroad, and a hydroelectric power plant.

Polaris Mine, Little Cornwallis Island, Northwest Territory - The recently developed Polaris Mine commenced operation in 1982 at an annual production rate of 800,000 to 900,000 tons per year. Proven reserves are 11 million tons of 15.2% zinc and 4.4% lead while an additional 13 million tons of ore are inferred, indicating a mine life of 25-30 years. The concentrate production from Polaris is shipped to European smelters.

The Polaris Mine is located on Little Cornwallis Island only 75 miles from the magnetic North Pole. The shipping season from Polaris is restricted to a few months in the summer, as will be the shipping season at Red Dog, and a year's production of concentrate is shipped during the brief ice-free season. The mine's mill complex was constructed as a module at a Quebec port site and barged to Little Cornwallis Island for installation. This is the same method that will be used for construction of facilities at Red Dog.

Black Angel Mine, Maarmorilik, Greenland - Cominco is a 63% owner of the Black Angel Mine which milled 744,000 tons of ore in 1982, grading 12.6% zinc, 4.5% lead and 1.0 ounce per ton silver. Zinc and lead concentrates are shipped from Black Angel to European smelters during the summer shipping season. Black Angel reserves are 2.2 million tons grading 13.4% zinc, 4.0% lead and 1.0 ounces per ton silver. A mine life of 3 years is indicated unless additional reserves are discovered.

Magmont Mine, Bixby, Missouri - Cominco owns 50% of the Magmont Mine which milled 1.1 million tons of ore in 1982 at grades of 1.0% zinc and 6.5% lead. Concentrates from the mine are sold to U.S. smelters. The mine has 9.1 million tons of proven and inferred reserves indicating a mine life of 8-9 years.

Con Mine, Yellowknife, Northwest Territory - The Con Mine is located on the shores of Great Slave Lake and has been in production since 1938. In 1982, 234,000 tons of ore were milled with an average grade of 0.36 ounces per ton gold. The ore is milled and the gold refined locally in Yellowknife. The mine has reserves of 2.1 million tons grading 0.47 ounces of gold per ton for an indicated mine life of 8-10 years.

Jersey Mine and Valley Mine, Logan, B.C. - These two open pit mines have reserves of over 500 million tons of copper ore. The Valley Mine is the largest known copper deposit of its type in Canada. The Valley Mine began production in January 1983 at a rate of 23,000 tons per day.

Warm Springs Mine, Garrison, Montana - Cominco owns and operates the Warm Springs Mine, a major underground producer of phosphate which employs 114 people.

Other Metal Mining and Exploration Interests - Cominco has interests in several other metal mines worldwide including a 47% interest in Aberfoyle Ltd. which operates two tin mines, a zinc/lead mine and other properties in Australia; a 17% interest in Tara Exploration which operates an underground zinc/lead mine in Ireland; and a 47% interest in Exploracion Minera Internacional Espana S.A. which operates a zinc/lead mine in Spain. Cominco also operates wholly owned subsidiaries for exploration in America, Australia, Belgium, France, Italy and the United Kingdom.

Research - Cominco operates a Product Research Center in Ontario which works towards developing uses for lead and zinc, including developing, marketing and licensing new products and processes.

3. Arctic Mining Experience

Cominco has major and minor interests in eight zinc/lead mines in the world of which five are in North America. Of these five, three are located in the arctic and were developed and are being operated by Cominco. The Pine Point Mine in Northern Canada is located at latitude 62°, the Black Angel in Greenland at latitude 71° and the Polaris on Little Cornwallis at latitude 77°N. The Red Dog deposit is located at latitude 68°.

The development and operation of each of these mines has presented special challenges which have been successfully met.

The Pine Point Mine located in Northern Canada required the construction of the Great Slave Lake Railway between the closest existing rail link in Alberta, to the mine site on the south shore of Great Slave Lake, 423 miles to the north. Much of the railroad was built over permafrost. Construction was financed by the Canadian Government under the northern "Roads to Resources" program and construction and operating costs were recovered from the mine through a schedule of user fees based on a guaranteed volume of 215,000 tons of concentrate shipped annually and special fees based upon the value of the concentrate as determined by smelter returns. When the agreement was negotiated, infrastructure costs were to be recovered in 10 years as there were only 10 years of proven ore reserves known at that time. Due to higher than forecast shipping tonnages, the mine ultimately repaid the railroad capital costs in about seven years.

Cominco underwrote the costs of developing a hydro-electric generating plant for use by the Pine Point mine and the developing region. Also a complete townsite was constructed which is today a chartered village with a population of 2200 and presently enjoys the second highest per capita income in the Northwest Territories. 640 residents are employed by the mine. Pine Point is an open pit, as will be Red Dog, with production coming from several pits. The ore is concentrated at the mine site and shipped to smelters at Trail, B.C. and Naoshima, Japan.

The Black Angel Mine was developed in 1972 with production beginning in 1973. The mine's entrance is located in a cliff wall of Maarmorilik Fjord on the west coast of Greenland. The mill and concentrator are located on the opposite side of the fjord and ore is transported from the mine portal, by aerial tramway, across the fjord to the mill site. The mine ships its concentrates by ocean transport to various European smelters, and as will be true at Red Dog, is limited to a shipping season determined by the winter ice pack.

The decision to develop the Polaris Mine was made by Cominco in November of 1979 and the first ore was processed in the mill on November 4, 1981, just two years later and 10 weeks ahead of schedule. Located on Little Cornwallis Island only 1,000 miles from the North Pole, the severe climactic conditions and short ice-free season required innovative development. As at Black Angel, the mine was located virtually at tide water. The mill and administrative offices were constructed as a single barge-mounted module at a port in Quebec and towed to the mine site. This is the same scenario Cominco will use to develop the Red Dog facilities. For Red Dog the modules will be constructed and shipped from Pacific ports and will then be transported overland approximately 55 miles.

Polaris is an underground mine, and mining techniques take into account the underground permafrost conditions which extend to a depth of about 1200 feet. While Red Dog will be and open pit mine and will therefore not have the mining problems as at Polaris, similar arctic conditions will be experienced at Red Dog. During the ice free season at Polaris, eight shiploads of concentrate, representing 12 months of mine and mill production, are shipped to European smelters.

The Polaris Mine maintains a personnel program targeted at maximizing regional employment of the area's Inuit natives. A training program for Northern Canadians is utilized and work schedules have been tailored to accommodate the subsistence lifestyle of the northern residents.

The Con Mine in Yellowknife, Northwest Territories is a gold mine and as such does not handle the same large quantities of ore that a basemetal producer must mine, mill, concentrate and transport. The mine has been in operation since 1938, was one of the first of Canada's northern mines, and has given Cominco 45 years of practical experience operating in the arctic.

Cominco's success has been attributed to its strong management. Locally, the President and General Manager of Cominco Alaska is Hank Giegerich, who is responsible for Cominco's statewide activities and for the development of Red Dog.

Mr. Giegerich is a 30 year Cominco employee and was formerly Vice President of Cominco's northern operations, headquartered in Yellowknife. In that position Mr. Giegerich was responsible for the operation of the Con and Pine Point mines was responsible for the development of the Polaris Mine. Prior to that assignment he was Project Engineer for the development of the Black Angel Mine in Greenland. Mr. Giegerich recently received awards from the Canadian Institute of Mining and Metallurgy and the Alberta Chamber of Commerce for the success of the development of the Polaris Mine and is undoubtedly one of the most qualified individuals in North America (and quite probably in the world) to manage the development of the Red Dog Mine.

The project manager for the Red Dog development is James "Bud" Rae. Mr. Rae is a long time Cominco employee and participated in the construction of the Pine Point Mine and later served as the mine's production superintendent. Mr. Rae managed the rehabilitation and development of Cominco's Pinchi Lake mercury mine in Northern B.C. which operated until the mid 1970's, and has been involved in the development of Cominco's Valley Copper Mine, the operation of the Trail smelter and the construction of hydroelectric dams in British Columbia.

More generally, as the world's largest miner, smelter, refiner and marketer of zinc and lead, Cominco's profitable history is the result of its success in assessing market demand and timing the development of carefully planned and efficiently operated mines. This record is more impressive when it is taken into consideration that four of Cominco's major mines operate in remote regions of the arctic. These mines are successful despite the high development costs of infrastructure creation, and high operating and labor costs.

C. Commodity Profile of Mine Products and Marketing Considerations

1. Introduction

The average grade of the Red Dog Mine is 17.1% zinc, 5.0% lead and 2.4 ounces per ton silver. The importance of zinc to the economics of the mine is understated as the actual zinc grades will be closer to 21% in the first five years and average 19% for the following 15 years. It is in this initial period of the mine' life when capital costs are amortized and therefore the higher ore grade is important to the ultimate return on investment.

Using an average grade of 19.0% zinc, 5.0% lead and 2.4 ounces per ton silver (conservatively representing the first 20 years of operation), an appreciation can be gained for the relative contribution each commodity will make to the total mine revenues by figuring the gross value of a ton of ore and the relative percentage each metal contributes.

Commodity prices published for November 4, 1983 were 49¢ per pound for zinc, 25¢ per pound for lead and $9.00 per ounce for silver. Though the price a smelter pays for contained metals is discounted to reflect smelting charges and other considerations, applying these basic prices will give a relative comparison of the importance of each commodity.

At a grade of 19.0% zinc, one ton of ore will contain 380 pounds of zinc with a gross value of $186.20 at 49¢ per pound. At a 5% grade, one ton of ore will contain 100 pounds of lead with a gross value of $25.00 at 25¢ per pound. And at 2.4 ounces per ton silver, one ton of ore contains 2.4 ounces of silver with a gross value of $21.60 at $9.00 per ounce. The total gross value of a ton of ore at these prices is therefore $232.80. Gross value, as used here, simply states the value of the contained metals and does not account for the costs and losses that occur during mining, milling and refining. Zinc value represents 80% of this total while lead and silver contribute 11% and 9% respectively. It is obvious that zinc is the critical commodity in the economics of the Red Dog mine.

To further highlight the importance of zinc, the same calculations can be done holding the price of zinc at its present level of 49¢ while doubling both the price of lead (to 50¢ per pound) and silver (to $18.00 per ounce.) The recalculated percentage contributions to revenues are 67% zinc, 18% lead and 15% silver. Thus Red Dog is primarily a zinc mine and unless there are extraordinary increases in lead and silver prices, the critical commodity is, and in the foreseeable future will remain, zinc.

2. Zinc

Uses and Substitutes

Zinc is the fourth most widely used industrial metal, surpassed only by iron, aluminum and copper. Its importance, however, often goes unnoticed as the metal loses its identity in most end product forms. There are four primary areas of zinc use.

1) Protective coatings. The greatest use of zinc is for coating (galvanizing) steel and iron products. This use accounted for about 44% of all zinc consumed in 1982. Zinc coating protects steel in two ways; by providing a long-lived barrier between the steel base and the corrosive environment; and by protecting the steel through galvanic action due to zinc's high electrochemical activity. Common applications for zinc coating are steel sheet, fencing, storage tanks, fasteners, wire rope, towers, industrial plants, culverts, bridges, ships and structural shapes. As a second method of protecting steel, sacrificial zinc anodes are used

to inhibit electrolytic corrosion of ship hulls, offshore drilling rigs, submerged or buried steel including tanks, pipes or other works.

2) Brass. Brass is an alloy of copper and zinc containing up to 40% zinc. Brass tubes, valves, radiators, and fittings are extensively used in vehicles, motors, refrigeration equipment, heat exchangers, communication and electronic devices. Brass accounts for about 20% of the world's zinc consumption.

3) Die casting. Zinc's low melting point allows problem-free gravity casting. Zinc used in die casting is often combined with small percentages of aluminum to impart strength and wear resistance, and copper to improve tensile strength, hardness and other properties. Zinc die cast parts, such as handles, grills, brackets, carburetors, gauges, pumps, and housings are extensively used in automobiles, machinery, business machines, appliances, scientific and electronic equipment. Die casting accounts for about 16% of the world's zinc consumption.

4) Rolled Zinc. Products manufactured from rolled zinc include engraving plate, coinage and zinc foil. These uses account for about 8% of consumption.

5) Zinc compounds. Zinc dust, zinc oxide, and other zinc compounds are used in a variety of industrial applications as corrosion inhibitors, activators in vulcanizing rubber, chemical catalysts, fluxing agents, fungicides, pharmaceuticals, TV screen phosphors, and additives in lubricants. Zinc ferrite is used in electrical motors, transformers, coils, amplifiers, timers, and in radios, television and computers.

It also should be noted that zinc is an essential element in the growth of human beings and animals. An animal with a zinc deficient diet will require 50% more food to achieve the same weight-gain as an animal supplied with sufficient zinc. While inhalation of freshly formed zinc oxide can result in the temporary disorder known as "zinc chills" or "oxide shakes," zinc is not considered to be a toxic substance.

The primary substitutes for zinc, (and therefore its economic competition) are aluminum, plastic and magnesium.

In protective coatings there is no substitute for zinc galvanizing in large-tonnage applications and therefore, zinc's largest use has an assured base level demand. In steel sheet coating a recently marketed product, Galvalume, has made significant inroads on traditional zinc-coated steel sheet. Galvalume is comprised of 55% aluminum and 43% zinc. Because the coating is less dense and offers greater corrosive resistance, much less zinc is used than when steel sheet is hot-dipped in zinc to form conventional galvanized sheet. However, Galvalume is not easily molded, nor can it be welded, so there are presently limitations on its ability to substitute for zinc coated sheet. A competitive sheeting product, Galfan (95% zinc, 5% aluminum), has also been developed and may be competitive with Galvalume in some applications. Aluminum sheet also competes with galvanized steel sheet for such applications as roofing and siding.

Aluminum alloys, stainless steels and plastics have replaced many traditional uses of brass and will continue to compete for those applications.

In die casting, aluminum and magnesium are competitive materials where weight limitations, temperature tolerances, and surface finishes are important. Plastics have also made inroads in this field. However the recent development of thinwall zinc die casting and improved zinc alloys and finishing techniques has allowed zinc die casting to retain many of its challenged applications. It is also possible that the recent

MAJOR WORLD ZINC MINES

Mine Name*	Location	Average Grade(1) Zn	Pb	Ag	Annual(2) Capacity	Re-(2) serves	Life(3)	Ownership
#Red Dog (S)	Alaska	17.1	5.0	2.4	2.0	85	40+	NANA (100%)
Sullivan (U)	Canada	6.1	4.4	1.0	2.4	49	20	Cominco (100%)
Pine Point (S)	Canada	6.1	2.4	-	4.0	25	7	Cominco (69%)
Polaris (U)	Canada	15.2	4.4	-	0.8	24	30	Cominco (100%)
Black Angel (U)	Greenland	13.4	4.0	1.0	0.9	2	3	Cominco (63%)
Magmont (U)	Missouri	1.3	6.8	0.1	1.1	9	8	Cominco (50%)
Que River (U)	Australia	8.8	4.8	3.2	0.3	5	17	Cominco (47%)
Rubiales (U)	Spain	6.9	1.2	0.4	1.2	14	12	Cominco (48%)
Tara (U)	Ireland	9.6	2.8	-	3.0	74	25	Noranda (36%)
Nanisivik (U)	Canada	10.4	0.8	-	0.7	4	5	Mineral Res. Int'l. (53%)
Brunswick (U)	Cnanda	9.1	3.7	3.0	3.5	100	29	Noranda (64%)
Cyprus Anvil (S)	Canada	4.5	3.0	1.5	3.5	60	17	Dome Petroleum (100%)
Kidd Creek (U)	Canada	5.0	0.2	2.0	5.0	100	20	Canada Devel. Corp. (100%)
Mount Isa (U)	Australia	6.3	6.5	4.8	3.5	54	15	Mount Isa Mines (100%)
#Hilton (U)	Australia	6.6	9.6	4.8	3.5	46	13	Mount Isa Mines (100%)
Zinc Corp. (U)	Australia	9.5	8.9	2.8	1.0	13	13	Rio Tinto Zinc (61%)
New Broken Hill (U)	Australia	12.2	6.6	1.9	1.5	13	13	Rio Tinto Zinc (61%)
North Broken Hill (U)	Australia	10.0	13.0	6.5	1.1	6	5	North Broken Hill (100%)
Elura (U)	Australia	8.6	5.6	4.4	1.5	30	20	Electrolytic Zinc (100%)
#Scuddles (U)	Australia	9.0	-	2.3	1.5	29	20	Electrolytic Zinc (100%)
Cerro de Pasco (U,S)	Peru	7.9	3.3	2.7	2.5	57	23	Centromin (100%)
Prieska (U)	South Africa	3.0	-	-	3.0	9	3	U. S. Steel (46%)
#Crandon (U)	Wisconsin	5.4	5.0	0.4	3.5	84	24	Exxon (100%)

* - (S) Surface or open pit mine, (U) Underground mine
(1) - Zinc and lead grades in percentages, silver in troy ounces per ton
(2) - Million short tons
(3) - Years
\# - Indicates property is in development stage

developments in thinwall zinc die casting may find new applications, further limiting any erosion of zinc demand.

In chemical uses, aluminum and magnesium replace zinc to some extent in chemical reactions, and titanium oxide can replace zinc oxide in paints.

In general, economic and other considerations favor the continued wide use of zinc and limit inroads of substitutes. Magnesium substitution is limited by the low capacity of magnesium production facilities, and while aluminum and plastics are widely available, the price of zinc is favorable. As aluminum production is energy intensive and as plastics are petrochemical products, both are sensitive to energy price increases.

The energy requirement for producing 1 ton of aluminum from ore is 244 million Btu's while the equivalent process for zinc requires only 65 million Btu's. Additionally, where durability is a factor, plastic will never be an acceptable substitute for metals. Cominco's Product Research Center has developed a super plastic zinc (SPZ) consisting of 78% zinc and 22% aluminum with a low forming temperature which would allow use of the same low cost thermoforming technology utilized by plastics and would possibly result in zinc becoming a substitute for plastic in certain applications.

World Supply and Demand

The U.S. consumes one sixth of the world's zinc supply, but presently produces only a third of its own demand. U.S. zinc smelter capacity has decreased from self-sufficiency in 1968, to 60% dependency on foreign sources at present. In the absence of a repeal of the Jones Act, which penalizes the shipment of commodities between U. S. ports, Red Dog Mine concentrates will be processed by foreign smelters as a matter of economic reality. U.S. consumers will enjoy no inherent domestic supply advantage despite the nationality of the mine. Therefore discussions of supply and demand for zinc and other commodities will be examined from primarily a global perspective.

World mine production in 1982 from non-socialist countries was 4.8 million tons of contained zinc. Production of refined metal was 4.3 million tons while metal consumption was 4.1 million tons. Consumption was 6% below the 1981 level and primarily reflected a 17% decline in U.S. consumption due to the general economic recession, and a lesser decline in Europe for the same reasons. Japan showed no consumption change in 1982.

The decline in world demand reflected general worldwide economic recession. As zinc consumption is tied to automobile production, residential and commercial construction and general industrial output, zinc consumption will parallel general economic trends.

A demand increase in U.S. consumption is forecast as a nationwide program to restore or replace highway structures such as bridges, guardrails and culverts will increase the need for galvanized steel. Additionally the change from a 95% copper penny to a 98% zinc penny will increase the annual U.S. base demand by about 40,000 tons per year, which represents about 1% of the 1982 world demand. Similar changes in coinage elsewhere in the world could add significantly to zinc demand.

In world automotive production, zinc may increasingly be used to coat exterior sheet metal surfaces as well as interior surfaces due to improvements in the ability of zinc coatings to accept high quality paint finishes. A survey of the four major U.S. auto makers found that zinc consumption in sheet metal materials had increased 2% per vehicle for 1983 models. This new demand may begin to offset reductions in zinc die castings used in automobiles which declined in total weight from about 45 pounds per car to 23 pounds per car between 1975 and 1982.

In general, demand for zinc has grown faster in developing industrialized countries such as Brazil, Mexico and South East Asian countries than in the older industrial nations. In 1982 increased export of zinc concentrates and record export levels of refined metal to socialist countries were recorded. Much of this tonnage was shipped to China which may represent a growing zinc consumer.

The U.S. Bureau of Mines estimates a probable annual world growth rate in zinc consumption through the year 2000 of 2.5%. This compares with an annual growth rate of 4.8% between 1960-73. Using the 1981 free world zinc consumption of 4.3 million tons as a base level for demand (this assumes the recessionary 1982 consumption level is not representative of the present base level) a growth rate of 2.5% would indicate an increase in world consumption to 5.1 million tons in 1988. Using the three year mine production high of 4.8 million tons in 1982 as representing present annual capacity, a need for an additional 0.3 million tons of production will be required in 1988. The new production from Red Dog will produce 0.2 million tons of zinc metal in 1988. In 1993 when Red Dog's zinc metal production has increased to 0.3 million tons, the free world demand forecast would be 5.8 million tons or 1.0 million tons greater than 1982 mine production levels. Several sources also suggest the socialist bloc will become a significant importer of zinc, supporting the demand growth forecast.

An important factor in forecasting the need for new mine's is the possibility of new supply coming from recycling or secondary sources. Unlike lead, in which a significant component of supply comes from recycled batteries and other products, the largest uses of zinc are sacrificial. Zinc used for coatings is dissipated and therefore recycle will never become a major supply source.

Marketing Considerations

At the initial production levels, the Red Dog Mine will produce 350,000 tons of zinc concentrate. Assuming a concentrate grade of about 59%, this represents 207,000 tons of contained metal. Cominco has indicated its intention to sell concentrates to Japanese and European smelters and to its own smelter at Trail, B.C. In 1982 Trail produced 226,000 tons of zinc, representing the zinc concentrate output of both the Sullivan and Pine Point Mines. The total zinc capacity at Trail is 300,000 tons so that the smelter has an additional unused capacity of 75,000 tons, representing about a third of Red Dog's initial production.

The reserves at the Sullivan Mine indicate it will continue to produce for about 20 years if no additional reserves are discovered, while reserves at Pine Point indicate the mine may be exhausted in about 10 years. In 1993 Red Dog is scheduled to increase its zinc production to 585,000 tons of concentrate or about 345,000 tons of contained zinc which will exceed the total present capacity of Trail, B.C. However, the new zinc smelter at Trail was designed with space available for installing an additional zinc refining capacity of 150,000 tons. Cominco could exercise the option to expand the zinc smelter prior to Red Dog expansion (or earlier) and thereby have the capability to smelt all Sullivan and Pine Point concentrates (at their present production rate), as well as over 60% of Red Dog's expanded production. When the Pine Point Mine is exhausted the expanded Trail zinc refinery could handle 100% of Red Dog's maximum production, plus all production from the Sullivan Mine.

Japanese zinc refineries at present have a a combined capacity of in excess of 800 thousand tons refined metal. In recent years Japanese refineries have had problems securing adequate supplies of zinc concentrates and may view Red Dog as a desirable long-term, stable source. European smelters, not counting communist countries, have a combined capacity of about 2.0 million tons. At present there is an over capacity of zinc smelters in Europe. Red Dog will be attractive to both Japanese and European refineries as a long term zinc concentrate source (more than 40 years) and, with a competitive climate among smelters to secure adequate concentrate supplies, Red Dog should receive favorable rates and terms from smelters.

A final marketing consideration is the ownership of the zinc mining and processing industry. At present the zinc industry, compared with the copper industry, is being operated more in line with free enterprise concepts. Better balance of zinc metal stocks with demand will result in stronger and more predictable long term prices. This contrasts with metal industries in which gross overproduction for the sake of generating foreign exchange results in depressed or even below cost metal prices - very much a factor in the copper industry for example.

3. Lead

Uses and Substitutes

Lead ranks as the fifth most widely used metal behind iron, aluminum, copper and zinc. At present the two major uses of lead are for lead-acid batteries and as an anti-knock gasoline additive. Other uses include construction materials, ammunition, solders, protective coatings and paints, radiation shielding and electrical cable sheathing.

Over 50% of present lead consumption is used in lead-acid batteries, primarily vehicle starting-lighting-ignition (SLI) batteries. In transportation applications, weight is a primary consideration, and as average car size and "cranking" requirements have diminished, so has the average lead content from about 30 pounds per car in 1977 to 20 pounds per car in 1983. Severe winters shorten battery life and increase demand for replacement batteries.

Research to find alternate combinations of metals and non-metals for batteries has been extensive, and while most substitutes can match or exceed the performance of the lead-acid battery, problems include cost of components, economics of material recycling, toxicity, and operating limitations and difficulties. The U.S. Bureau of Mines indicates no large scale substitution for lead-acid batteries is forthcoming.

Domestically the use of lead additives in gasoline is gradually declining due to environmental restrictions on lead emissions. Consumption of lead in the U.S. for gasoline additives has dropped by 50% since the early 1970's. However, while the use of lead additives has declined in the U.S. and future use may be strictly limited to certain types of engines, consumption in developing countries may continue to increase.

Lead coatings are used on materials exposed to corrosive agents and lead lined containers and tanks are used for the storage of corrosive chemicals and hazardous wastes. Lead coatings are also used as shields against radiation. While demand for these applications may increase, the use of lead in paints and other chemical applications where lead is likely to enter the environmen has declined in recent years.

The large scale use of massive, stationery, lead-acid storage batteries for leveling power loads in electrical generating plants may represent a significant future use.

Supply and Demand

With only a few exceptions, primary lead is produced as a by- or co-product of zinc, copper and silver mining. Recovery of lead from batteries and other sources results in a large component of recycled metal. In 1982 free-world mine production totaled 2.6 million tons.

Refined lead production, including recycled lead, totaled 3.9 million tons while lead consumption totaled 3.8 million tons.

The forecast demand for lead varies. The U.S. Bureau of Mines forecasts a probable average annual world growth rate of 2.8%, which is larger than the agency's forecast of 2.5% growth for zinc. Other sources indicate the lead growth rate will be significantly less, possibly approaching 1.0%.

At present, 75% of lead use is in transportation. If the use of lead in gasoline declines on a world wide basis, the importance of lead-acid batteries as a percentage of total lead consumption will increase. Battery demand for vehicles is a function of the total number of vehicles in use as replacement batteries constitute some 80% of sales. Any increased long term demand for lead-acid batteries will ultimately depend upon increasing automobile use in developing countries.

Marketing Considerations

Markets for lead concentrates from Red Dog would be found either at Cominco's Trail, B.C. smelter, at the Cominco Mitsubishi Lead Smelter in Japan or at other Japanese lead smelters. Lead concentrate production from Red Dog could replace Pine Point concentrates at the Cominco Mitsubishi smelter when the mine is exhausted. Present Trail lead capacity is 150,000 tons refined metal. Actual utilized capacity in 1982 was 126,000 tons. Plans to modernize and expand the lead smelter, as was done with the zinc refinery, could assure an in-house market for lead concentrates.

At present with Pine Point lead concentrates being shipped to Japan, concentrates from Cominco's Sullivan Mine represent about 100,000 tons of the Trail's refined capacity, leaving 50,000 tons available. At Red Dog's initial production rate, mine out put in terms of refined lead would just match this capacity.

4. Silver

Uses and Substitutes

The largest use of silver is in the production of photographic materials. Despite intensive research, no substitutes have been found to replace light sensitive silver-halides used in photographic films. Other industrial uses of silver include electrical switches, silver solders and batteries. Medicinal uses include antiseptics for certain types of infections, and as an amalgam in dental fillings. Silver coinage, jewelry, tableware, and investment bars are also major uses.

No viable substitute has been found for silver in photographic uses. Gold or platinum-group metals may be substituted for silver in electrical applications but only where the more oxidation resistant qualities of these precious metals overcomes the cost disparity. Copper, nickel, zinc and aluminum in various combinations have replaced silver coinage in many countries.

Supply and Demand

About two-thirds of the world's future supply of silver is contained in copper, lead and zinc deposits. Therefore the supply of silver will be determined more by the production of these base metals than by actual silver demand. The long term growth of silver demand, as with zinc and lead, is seen to be tied to the prosperity of developing nations. Increasing industrial and photographic demands, attendant upon an increased standard of living in these countries, will contribute to a strong demand growth.

The U.S. Bureau of Mines forecasts a probable annual world growth rate of 2.5% through 2000. Complicating the supply, demand, and price structure are the large quantities of silver held by investors. Silver holdings of private investors are large compared with annual industrial consumption and these investors can respond to price fluctuations as either a source of supply or a source of demand. Also, despite the large industrial base, the silver price, to a certain extent, is influenced by gold prices. Rarely do the prices of the two metals move in opposite directions, a factor which underlines price linkage.

5. Barite

Uses

Over 90% of the world barite demand, and over 98% of the U.S. barite demand, is for use in oil and gas well drilling fluids. Barite is finely ground and slurried with water and other agents to produce a heavy fluid which is circulated in the drill hole as it is being drilled. In 1982 an average of 47 tons were used per well.

Supply and Demand

Barite has a low per unit cost and high bulk. The reported average value of primary barite in the United States was about $40 per ton in 1982. The delivered price of drilling grade barite to Alaska's North Slope drill rigs is said to be close to $600 per ton, however this cost incorporates a wide range of services carried out at the drill site. If barite must be shipped a significant distance, the transportation costs can easily exceed the cost of the barite itself. Therefore a relatively local market for barite must be available before the commodity is saleable.

Potential markets for Red Dog barite are the North Slope oil fields, and possibly the Norton Sound and Chukchi Sea fields if oil is discovered at either of these locations. Currently restrictive trade practices would inhibit the sale of Red Dog barite to Canadian Arctic oil and gas operations in the Beaufort Sea. At present, Cominco is examining possible processes to recover barite concentrates from the zinc/lead ore. Also, high grade zones of barite are found apart from the metal rich zones of the ore deposit and barite could be selectively mined from these zones. One possible problem with barite from either of these sources is the presence of heavy metal or silica contamination which could result in the barite being unacceptable as a drill mud. The financial analyses of the project have not included any revenues from the possible sale of barite.

6. Zinc, Lead and Silver Price Forecast

The following price projections which were estimated by the Office of Mineral Development are for a 20 year period and represent the average commodity price in 1983 U.S. dollars.

RED DOG METAL PRICES

	Zinc (¢/lb.)	Lead (¢/lb.)	Silver ($ /tr.oz.)
Base Level	55	30	10
Probable	60	35	18
High	65	40	25

The demand for all three of these metals is dependent upon the growth of the world economy. The North American and European economies may be described as maturing and major increases in the consumption of base metals is in these economies unlikely. However, expansion and growth of economies in the developing countries will increase world demand for these metals. The present prices for zinc and lead (49¢/lb. and 25¢/lb. respectively) are below what could be considered base level prices due to the low recessionary demand and present high levels of metal stocks. As the world economy recovers, base level prices will be reached.

Discussion:

Zinc

Zinc is the most important commodity to the Red Dog Mine and will contribute up to 4 times the revenue generated by lead and silver combined.

World demand for zinc will grow commensurate with the growth of the world economy and the increasing industrialization of developing nations. The U. S. Bureau of Mines forecasts a probable growth of world demand at 2.5% annually. The increase in world demand coupled with the following factors indicates a stable market characterized by real price increases is likely for primary zinc producers (mines) over the long term.

1) Zinc is the fourth most widely used industrial metal surpassed only by iron, aluminum and copper.

2) The largest use of zinc (galvanizing) results in its dissipation. Therefore recycling and secondary production will always remain a less important supply factor than is the case for other metals.

3) There are no environmental problems associated with the use of zinc.

4) While known world zinc reserves, including Red Dog, appear adequate to satisfy medium and long term demand, the market is not over-shadowed by enormous undeveloped deposits as is the case with copper.

5) Reserves at several major zinc mines will be exhausted over the medium term, and as most existing zinc mines are underground producers, actual costs will increase as mining depths increase .

6) Unlike the copper industry, the Free World's primary zinc production is largely in private sector hands, eliminating the danger that government operated mines, for the sake of generating foreign exchange, will overproduce and undermine metal prices.

7) It is possible that the socialist countries and China in particular could become significant zinc importers.

8) In addition to increased demand due to an expanding world economy, the potential exists for further increases in zinc consumption as the use of protective zinc coatings becomes more widespread, substitution of zinc for silver or copper in coinage becomes common, and new applications, such as thermoforming zinc alloys, are developed.

A base level zinc price is forecast at 55¢ per pound with probable and high levels forecast at 60¢ and 65¢ respectively.

Lead

Lead is the fifth most widely used industrial metal behind zinc. The two major uses are in automotive batteries and as a gasoline additive.

Consumption as a gasoline additive has declined in North America and Europe due to lead emission restrictions. However demand for lead additives in developing nations has not decreased at present and it is not clear whether or when such restrictions will begin to be imposed.

The trend towards smaller, lighter automobiles, and a concurrent reduction in needed "cranking" power has reduced the amount of lead in the average automobile battery from 30 pounds in the 1970's to about 20 pounds at present. Eighty percent of all automotive batteries sold are for replacement, and therefore lead battery demand is more a function of total number of vehicles in use than annual new car pr uction.

Long term demand for lead, as with zinc, will depend upon the world economy and the economic growth of developing nations. The U.S. Bureau of Mines estimates a probable world growth of 2.8%. However other sources feel it may be as low as 1%.

The present price of 25¢ per pound is unrealistically low, possibly being lower than the cost of even secondary production. This is the result of record inventories of lead stocks. A realistic minimum base level is the price at which secondary production (recycled lead) is viable. That price is felt to be 30¢ per pound. A 35¢ price is felt to be a probable 20 year price average, with a 40¢ per pound high average.

Silver

Silver is an industrial metal used in photographic film and processing and in electronic and electrical components and solders. It is also an investment precious metal and as a "poor man's" gold, its price is influenced by gold prices. As an industrial metal there is little likelihood of significant substitution and with an expanding world economy and rising standard of living, consumption of industrial silver will increase. The U. S. Bureau of Mines estimates an annual growth of 2.5%.

A base price level of $10 is realistic, with a probable average 20 year price of $18, and a high of $25.

Summary

In general these price forecasts are conservative, in that they are predicated on a moderate growth in the world's economy. Stability of world energy prices, resolution of debt crises and general political stability could initiate a period of prosperity for developing nations and create a much higher growth rate for the demand of these metals.

D. Zinc Resources of Alaska and Northwestern Canada

Zinc mineralization is found almost ubiquitously in association with lead and silver. Throughout extensive areas of Alaska and Northwest Canada zinc-lead-silver mineralization occurs in two broad geological associations

i) as disseminated and massive sulfide in shales and other fine grained sediments;

ii) as massive sulfide in volcanic sequences which accumulated in submarine depositional environments.

1. Alaska

Red Dog, though unique in its combined attributes of size and high grade, is but one of a large number of deposits which contain zinc as the main metal or more usually as a significant co-product. Because of the extensive distribution of favorable host rocks, future exploration is certain to discover new major deposits.

Red Dog with its presently defined reserve of 85 million tons grading 22.1% combined zinc-lead and 2.4 oz. silver per ton is the largest and best known deposit of its type in an arcuate trend which could become known as the Noatak Zinc Belt. Within this belt, which extends for several tens of miles, at least 15 significant prospects are known. There is a high probability that this region could become one of the world's major supply sources of zinc, with lead and silver as major co-products.

The Lik and Su prospects appear to be segments of a contiguous deposit located some ten miles from Red Dog. GCO Minerals, owners of Lik, has released a reserve estimate of 25 million tons of 8.8% zinc 3.0% lead and 1.2 oz/ton of silver. This reserve, which is based upon 75 ore sections from 103 diamond drill holes, appears to be well defined.

The orebody itself is open along strike to the north, and southwards it extends into a Cominco owned claim block where it forms the Su deposit for which no tonnage or grade figures have been released. A developed infrastructure for Red Dog should, in time, favorably influence the development schedule for Lik and possibly other reserves in the area. Although GCO Minerals has proposed a northerly access road to the coast as a component of a possible development scenario for Lik, no firm development commitments have been made.

The regional significance of metal associations within a certain rock assemblage is emphasized by the fact that some 90 miles from the heart of the Noatak region, the Drenchwater deposit occurs in similar sedimentary units. This discovery has not been intensively prospected as it was included within the National Petroleum Reserve - Alaska (NPRA) and is off limits for mineral entry. Sampling of surface exposures returned grades of 17.4% zinc 3.0% lead and 3.3 oz/ton silver - very similar tenors to those of Red Dog. However no reserve tonnage has been estimated. Still other impressive surface showings of mineralization have been included within the Noatak National Monument and are off limits to further exploration.

Zinc and lead are significant potential co-products of the Ambler Schist Belt which extends over a trend of more than 100 miles across the south flank of the Brooks Range, north of the broad Kobuk River Valley. Exploration over a period of more than 20 years has identified a large tonnage of polymetallic ore contained in at least four major prospects and the potential for significantly more ore exists in many known but not intensively prospected occurrences. Given the large established reserve base, there is little to encourage further high-cost exploration until some progress is made towards solving access and transportation problems. Although copper appears to be the major metal found in this belt, zinc and lead grades are significant and concentrates containing both metals would be produced from all potential operations in the area with the possible exception of the Bornite deposit which is geologically different.

Substantial production of zinc and lead concentrates from the Ambler District in the future (beyond 1995) would fall far short of the projected production of concentrates from Red Dog.

Another newly discovered base metal trend in Alaska extends across the north flank of the Alaska Range from the Bonnifield area, south of Fairbanks to Tok-Big Delta region in East Central Alaska. Exploration work has been continuous since 1978 to evaluate the potential of the extensive belt within which dozens of individual massive sulfide occurrences have been located. The company most actively involved in evaluating this potentially important belt is Resource Associates of Alaska (RAA), a company within the NERCO Group. Potential tonnage and grade figures supplied by RAA are cited below.

Name		Reserve*	%Cu	%Zn	%Pb	Oz/Ag	Oz/Au	Remarks
Delta System	1) Valley	1.0	.26	3.45	.46	0.7	0.018	Offset segments of one massive sulfide body with overall potential of +40 MT
	2) DW	3.65	.93	1.74	1.15	0.72	0.012	
	3) Middle	5.2	.46	3.34	1.36	1.49	0.038	
	4) LP	1.2	.40	3.69	1.54	1.80	0.061	
DD South		1.60	1.09	5.66	2.27	2.03	0.061	Expectations are to double the reserve base
Dry Creek		1.2 MT	No specific grade figures released					Tenors believed to be significantly better than Delta

* Reserves in millions of tons

In Southeastern Alaska numerous mineral deposits containing zinc are known. However, with the exception of Greens Creek, no development plans for properties capable of producing zinc concentrates have been announced.

Greens Creek is expected to be the first major new metal mine into production in Alaska for many years, and it will produce silver, gold, zinc, lead and copper from an underground mining operation on Admiralty Island. The deposit has not been fully defined by exploration work to date and substantial additions to the reserve base are assured in the future. The latest published ore reserve cites 4 million tons grading 13 oz/ton silver, [illegible] oz/ton gold, 7.5% zinc, 2.5% lead and 0.4% copper. Once in production at a planned milling rate of +800 tons per day, the mine will ship approximately 30,000 tons of lead concentrate and 48,000 tons of zinc concentrate annually. Though significant, these volumes are small compared with the planned production from Red Dog.

2. Northwestern Canada (Yukon, Northern British Columbia and Western NWT)

Excluded from consideration here are the producing properties such as Pine Point and Sullivan in which Cominco has a major interest.

The Yukon has two mining properties which have produced and shipped zinc and lead concentrates. United Keno Hill, which first and foremost is a silver mine, maintains a relatively small proven reserve base and is unlikely, given the geologic characteristics of the deposit, to greatly expand concentrate production. Cyprus Anvil, with its operations centered near the town of Faro, is a major producer of zinc and lead concentrates from a large open pit operation. Future plans may involve underground mining on at least one of the orebodies in Anvil Range.

The Selwyn Basin is rimmed by zinc-lead prospects which occur in rocks equivalent in age to those which host the mineralization in the Anvil Range. Undeveloped reserves in the Anvil District plus other major known deposits in the Selwyn Basin will likely form the next generation of major zinc-lead base metal properties which may be developed in the Yukon Territory between now and the year 2000. The following table lists the announced reserves and grades of major properties in Northwest Canada.

An eastward extension of the Alaska Railroad into the Yukon Territory could "capture" the large volume of mineral traffic which future mines, especially in the Selwyn Basin, are likely to generate. Concentrates would be transported through Alaska to a major bulk materials handling port situated in Cook Inlet. There would be more than enough feed from Interior Alaska and Canadian mines to justify the development of smelter-refinery facilities at tidewater utilizing clean state-of-the-art technology. Two advantages Alaska has which could make this industrial development possible are 1) the abundance of energy in Southcentral Alaska, available in the form of gas, coal, and if the Susitna Dams are built, hydroelectric power; and 2) tidewater access to major Pacific Rim markets. As the value of refined metal products is much greater than the value of the equivalent metal content of ore concentrates, the economic benefits of in-state processing of Canadian and Alaskan minerals far exceeds the benefits to be derived from exporting these resources in raw form.

E. Potential Alaskan Mineral Projects Requiring Public Sector Infrastructure

Given the extraordinary potential within Alaska for the discovery of major new mineral deposits, additional calls for infrastructure support will be made in the future. However some major discoveries will be made as a consequence of the intensification of exploration efforts along arterial transportation corridors constructed to serve the new generation of mining activity between now and 2000. This is an intangible economic benefit of transportation development. However these benefits are not considered in a financial analysis when the initial end user are required to guarantee total capital debt retirement. Without an appreciation of this factor, development of transportation to serve remote areas, such as the Ambler District, will be nearly impossible and public policy will continue to focus on the ability of the initial end-user to totally repay any public sector financing.

Mining projects in Alaska can be divided into two categories in relation to their transportation infrastructure needs.

1) Stand alone projects - Those projects which involve high value, low bulk commodities such as precious metals and those which are located close to a deep water port site which can be developed for exclusive use of the proposed mining operation as are Quartz Hill and Greens Creek.

2) Contingent projects - These are projects which like Red Dog will require significant transportation development.

The following tabulation lists known projects and estimates transportation infrastructure costs and the possible timing of projects.

Lik, Su and Other Deposits. The Lik deposit is located approximately 10 miles from Red Dog and in the same mineralized terrain. The Lik claims are held by GCO Minerals in association with Tenneco. Lik has been intensively prospected and a diamond drill program has identified a reserve of 25 million tons grading approximately 12% combined lead and zinc with 1.3 oz/ton silver. The ore grade is about half of the Red Dog average and mining conditions are such that a much greater ratio of waste stripping to ore would characterize the operation at Lik. These factors notwithstanding, Lik appears to be a very good deposit when compared, in terms of tonnage and grade, with potential lead-zinc properties in northwestern Canada and elsewhere.

The announced reserve for the Lik deposit does not take into account the open-ended character of the orebody or the unannounced reserves which have been proven by diamond drilling on the extension of the Lik orebody on claims held by Cominco. In the Cominco claim block the deposit is known as the Su and a substantial reserve is known to be present.

A number of other zinc occurrences have been staked in the region and it may be reasonable to refer to this area as the "Noatak Zinc Belt." Major additional discoveries will be made as the geology and the ore controls become better understood.

Greens Creek. The Greens Creek project is a "stand alone" mining development on Admiralty Island. No public sector involvement in transportation infrastructure components is foreseen. Impacts on public sector spending which relate to the workforce and their families being housed in Juneau focus upon community service needs - schooling, police protection, emergency services, etc. A power intertie would be a highly desirable component of the project if this satisfied basic beneficial economic parameters. The anticipated workforce to be directly employed at Green Creek is 315.

Quartz Hill. Similarly this is a "stand alone" project which will proceed largely independent of public sector involvement in infrastructure. The 850 employees and their families will be permanently housed in Ketchikan where community service costs will be incurred in the public sector. A power intertie to Quartz Hill is under consideration as part of a Southern S.E. Alaska integrated electric distribution grid. A formula for capital and operational costs of such a system could provide a total user benefit throughout the region.

Bering River Coal. This is a project aimed at developing a large, high quality coal resource for export to Korea. Three years of exploration work have been completed and the feasibility and cost parameters associated with overland transportation and port site alternatives are currently under examination. The project is a joint venture of the Bering Development Company involving Chugach Natives Incorporated, a Native regional corporation, and KADCO, a consortium of Korean companies including the large Hyundai Corporation.

A possible scenario may involve the of an underground mining operation capable of producing 2 million tons per year; an overland transportation system which would link the mine development by service road to Cordova and also provide for a delivery system, probably an overhead tramway, to the coast near Katalla; and the construction of a port-loading terminal possibly on Kanak Island. Transportation infrastructure costs associated with the development of an access-service road, overhead coal transportation tram, and a port loading facility capable of handling 3 million tons per year could approximate $180 million.

The Bering River Project could create a permanent employment base of more than 500 Cordova based jobs, and annual revenues from coal shipments on a 2 million tons per annum basis may approximate $120 million.

An interesting feature of the project is the captive market represented by the involved Korean business participation at all stages of the project.

Alaska Asbestos Project. This is a joint venture project involving the Doyon Native Corporation and GCO Minerals. Progress to bring the project on line will depend largely upon market interest and the extent to which any mining and milling operation will be able to satisfy stringent regulations.

Transportation infrastructure needs center on the construction of a 40 mile haul road from the mine site to join the Taylor Highway near Chicken, Alaska. From Chicken to its junction with the Alaska Highway some 60 miles of major upgrade of the Taylor Highway would be needed. Total cost is estimated to be $100 million. At a production rate of 150,000 tons per year of processed fiber grades, the mining project will generate approximately 500 permanent year round jobs and revenues of $90 million a year.

An eastwards extension of the Alaska Railroad could favorably influence the economics of this project.

Beluga Coal Terminal. Development of coal resources located on State leases and Cook Inlet Regional Corporation (CIRI) land within the Beluga Coalfield will require the construction of a large coal export loading facility near Granite Point on Cook Inlet. Efforts to develop the leases in the near term hinge upon market interest from the Pacific Rim, especially by Japan and Korea. Recent gluts in international markets of oil, natural gas and coal have detracted from the short term development potential for this enormous resource. Diamond Alaska and Placer Amax could supply major Pacific Rim markets with the cheapest delivered energy source in the future. Advantages this resource has over other coal suppliers are the favorable location of coalfield close to tidewater and shorter ocean freight distance.

The major leaseholders at Beluga have not approached the State for infrastructure assistance and in fact, when Beluga coal development potential was brighter, the major leaseholders expressed a willingness to construct and operate a port facility without any assistance. However, as Granite Point may be the only good port site on the west side of Cook Inlet, any port development should require provision for future expansion to handle bulk resources such as coal from Yentna and Nenana and metal concentrates and industrial minerals from the Interior.

A world scale deep water port facility in Cook Inlet would also act as a catalyst for the location of other facilities which may include in-state metals smelting and refining and agricultural product export handling capability.

A major mineral export facility for Beluga Coal having an initial capacity of 15 million tons per year would cost an estimated $250 million, exclusive of any additional rail spurs which could link to the existing railroad or access the Mobil leases in the Yentna area. Full development of the Beluga coal properties could create as many as 1,000 year ro.nd jobs.

Yentna Spur Line. A 50 mile long rail spur would be needed to deliver coal from the Yentna leases of Mobil into the feeder system and on to a Beluga coal terminal. The estimated cost of this spur could amount to $75-100 million.

Matanuska Spur Line. Future production of high quality coal from the Matanuska Coalfield would require rehabilitation of the former rail bed extending beyond Palmer to Sutton. The right-of-way is still owned by the Alaska Railroad. Cost of rehabilitation and engineering improvements to the line may total $25 million based upon $750,000 per mile for ballast, ties and track.

Depending upon the scale of operations a coal mine in the Matanuska field could support as many as 250 year round jobs.

Interior Rail Extension to Canadian Border. Serious justification for this long promoted rail extension may hinge upon potential mineral traffic. The line could capture bulk mineral traffic from a variety of potential mine properties, including Alaska Asbestos (150,000 tpy), Tok-Big Delta massive sulfide base metal district (125,000 tpy), Jarvis Creek coal (up to 500,000 tpy) and perhaps most importantly the next generation of major base metal mines to be developed in Yukon's Selwyn Basin which could have a potential for 1 million tpy. This latter opportunity would make good economic sense if a metal smelting and refining complex was built at Cook Inlet, a logical export gateway to expanding Pacific Rim markets. Agricultural resources from Interior Alaska would also be served by such a route.

The total aggregate of possible annual mineral tonnage could exceed 2 million tons well above the threshold required to justify a rail extension. Capital cost of extending the railroad eastward to the Canadian border would be high. The least tangible cost of railroad construction relates to the primary grading (cuttings, embankments, bridges, etc. across difficult terrains). Such costs could lie in the $1 to $2 million per mile range to which the known cost of ballasting, ties and rail amounting to $750,000 per mile needs to be added. A ballpark figure for total rail construction cost would lie somewhere between $1.75 and $2.75 million per mile. The proposed rail extension to the Canadian border, which is approximately 300 miles, could cost anywhere between $600 and $900 million.

Ambler Mining District. For more than two decades the issue of how best to access the mineral wealth of the Kobuk Valley, represented by the Bornite deposit and those of the Ambler Schist Belt characterized by Arctic, Smucker and Sun-Picnic Creek, has challenged the resolve and ingenuity of Alaskans anxious to see the development of this mineral rich province. The issue was successively examined by the Federal Field Committee in its 1968 report, "Transportation and Economic Development in Alaska," the North Commission in the "Alaska Corridor Study (1970-1972)" and the Corps of Engineers in a study commissioned through the University of Alaska titled, "Northwest Alaska Port Study." More recently the issue has been reexamined by the DOT/PF commissioned "Western Arctic Alaska Transportation Study-1982" (WAATS), and a proprietary 1983 report for Bear Creek Mining Company by Parker Associates, Inc. titled "An Analysis of the Transportation of Ore Concentrates from the Ambler Mining District to Ports in North America and Japan."

The potential aggregate concentrate production from Arctic, Smucker, Sun and Bornite (980,000 tons per year according to an Alaska Miners Association study 1982) exceeds the threshold level of 400,000 tons per year which would favor rail over road haulage. The combined reserve base in known deposits exceeds 100 million tons; a figure which possibly represents a fraction of the gross potential of this mineral province. Future additions to the proven reserve of known deposits and new discoveries will add greatly to the resource value of the District. However until the deadlock over access is resolved and tangible progress made towards opening up the region, there is little or no incentive to add to the proven reserve base.

Besides the question of who would pay for a transportation system serving the Ambler District, there are other concerns which focus on:

1) the most cost effective and long term utilitarian system;
2) the best interests of the regional peoples whose traditions, values and customs differ from those of metropolitan Alaskans.

A recent report prepared by Parker Associates for Bear Creek Mining identifies a railroad from Ambler to a port site near Cape

Krusenstern in Western Alaska as the best choice for a projected 1 million tons per year load. This route seems to satisfy both concerns expressed above. In the WAATS study three transportation modes rail, haulroad and slurry pipeline were compared for four basic routes:

1) Interior Alaska Railbelt link
2) Cape Krusenstern
3) Cape Nome
4) Golovnin Bay

Using cost parameters generated by the WAATS report, a haul road system could cost from a low of $214 million (link to the Dalton Highway at Prospect Creek) to $502 million for a road and related facilities at Golovnin Bay. Projected freight volumes and the preferences of area residents appear to rule out the road in favor of a rail link. Rail costs were estimated by WAATS to be in the range $1037 million for the Krusenstern route up to $1896 million for the Cape Nome scenario; both cases include port construction costs. The Nenana route linking to the existing Railbelt would cost an estimated $1117 million. WAATS revealed that for a traffic volume in excess of 1.5 million tons per year, certainly achievable within a short time of the system going into operation, the Railbelt link through Nenana would have a cost per ton advantage over the other alternatives.

In the Parker Associates 1983 study for Bear Creek, a range of four alternative road and rail routes were. Three western routes for both road and rail provided links to Cape Krusenstern, Cape Darby and Cape Nome. Two other routes were considered; a road to Fairbanks and a railroad to Nenana.

Parker considered two scenarios - one of 400,000 tons per year, the other 1,000,000 tons per year in calculating total delivered costs of concentrates to Vancouver, B.C. Both appear to fall short of the true potential freight tonnage which could move over a regional system.

Major departures between the WAATS and Parker Associates findings focus on capital costs of rail construction. These differences are highlighted in the following tabulation.

		CAPITAL ESTIMATES ($ Millions)	
		WAATS	PARKER
ROAD	Cape Krusenstern	398.7	261.4
	Cape Darby		360.0
	Golovnin Bay	502.3	
	Cape Nome	479.0	365.4
	Interior (Prospect C Fbks)	214.0	227.2
RAIL	Cape Krusenstern	1037.3	368.0
	Cape Darby		518.0
	Golovnin Bay	1589.1	
	Cape Nome	1896.1	653.5
	Interior (Nenana)	1117.0	668.8

Major capital cost disparities are most evident in comparing the capital estimates of rail construction. The lower costs cited by Parker are based on using a single construction heading over a longer time period as opposed to using multiple construction headings of several years (essentially reverting to construction practices used in the heyday of railroad development). Under the Parker approach a rail link to C. Krusenstern or Nenana would take 5 years to complete from mobilization. Other major differences relate to contingency and engineering overheads which total 40% in the WAATS and and 15% in the Parker analysis. On a per mile basis a comparison of the C. Krusenstern and Nenana rail alternatives is as follows:

	WAATS/Mile	Parker/Mile	Parker as a Rate % of WAATS
Ambler-C. Krusenstern	$3,427 M	$1,640 M	48%
Ambler-Nenana	$3,243 M	$1,715 M	53%

Some costs such as major and minor bridging estimates are not significantly different.

Using accelerated construction schedules and considering current cost figures estimated by the ARR, a realistic capital construction cost per mile appears to lie somewhere between the two extremes represented by WAATS and PARKER. The ARR states that once basic grading costs (which are the real intangibles) have been met, the current cost of laying ballast, ties and rail is $750,000 per mile.

The basic findings of the Parker Associates study which focuses specifically on Ambler are as follows:

1) Cape Krusenstern is cheapest route irrespective of mode up to 1 million tons per year.

2) Shipment to Southcentral Alaska through the existing Railbelt is the most expensive irrespective of mode, tonnage or capital amortization schedule (but does not consider a total system volume greater than 1 million tons per year).

3) As tonnages increase so do advantages of a railroad to Cape Nome or Cape Darby.

4) Capital amortization costs for a 1 million tons per year freight volume exceed working costs by more than 100%.

5) Concentrate storage costs, imposed by limited shipping windows for three of the options, do not significantly affect rankings between the four port site alternatives.

Very little consideration is given to the following:

i) the benefits the operation of a year round port site at Cook Inlet or Seward could provide.

ii) the benefits of operating one integrated rail system rather than two unconnected rail lines.

iii) the catalytic effect an integrated transportation system could have in stimulating the creation of a value-added industry along the Railbelt or at Cook Inlet.

The major recommendation contained in the Parker Associates study urges the creation of a Transportation Authority for Northwest Alaska with the prime purposes of:

1) acquiring a right-of-way to the Ambler District and

2) arranging financing for a rail link.

In making this recommendation it is acknowledged that eminent domain has not been tested for public acquisition of reconveyed native lands.

<u>Western NPRA Coal</u>. This is a really long term scenario which if it ever materializes might commence at some time well into the next century. Enormous reserves of good quality coal on the North Slope may eventually be mined on a large scale to help satisfy future domestic and foreign energy needs. Practicalities may require on site processing to liquid phase products which would be moved by pipeline, however bulk transportation of coal by rail may also be viable.

Before development of NPRA coal deposits commences, several major components of a transportation system could already be in place in the form of

1) a western arctic railway to Ambler from C. Krusenstern

or

a completed rail extension from Nenana to the Ambler District;

2) a world scale minerals export facility at Cook Inlet for year round shipments;

3) a seasonal port facility in the Western Arctic for summer shipment.

If these components were already in place, the capital cost of completing an integrated rail system to haul large volumes of coal might not be too intimidating. An estimate in 1983 dollars would be $1.5 billion for completion of the additional 500 to 625 miles of track.

Economic benefits which might flow from a rail link between the existing Railbelt and Northwest Alaska would include:

i) year round servicing of the Ambler Mining District

ii) year round servicing of the Noatak Zinc Belt

iii) year round servicing of coalfields on the NPRA and adjacent lands.

iv) overland servicing for oil and gas related activities

v) intangible benefits stemming from major new mineral discoveries proximal to the arterial transportation route.

Nome Regional Port. Future expansion of the Nome port beyond the planned initial phase may be justified by hardrock mining production from the Seward Peninsula and the servicing needs of offshore oil and gas activity in Norton Sound. Two sites which appear to offer the best potential for mineral development are the Lost River and Kougarok Mountain tin deposits. At Lost River development plans for a major mining project which received considerable prominence in the early 1970's were shelved and the project status became mired in litigation. A large tonnage of ore containing tin, tungsten, fluorite and beryllium has been outlined by drilling and underground development on the property. The Lost River deposit represents the nation's largest known proven tin reserves and therefore assumes a significant strategic importance. Kougarok Mountain, some 40 miles to the east, is a more recent discovery which reportedly has major potential for tin and related mineralization.

Besides port expansion, an estimated 80 miles of new road construction would be needed to tie these properties into the Nome port through an extension of the existing Nome-Teller Road via Brevig Mission. DOT/PF estimated the cost of constructing a road to Lost River and Tin City at $30.9 million, however this figure would increase substantially in order to access Kougarok.

DOT/PF in an analysis of other projects which may need or request infrastructure assistance from the State drew attention to several potential mine sites in addition to those already described. Brief descriptions of these follow.

Dry Creek. This is a deposit undergoing active exploration of similar type to the Greens Creek orebody in S.E. Alaska. It is a polymetallic deposit containing precious metals and zinc, lead and copper. No tonnage or actual grade estimates have been announced. A possible development scenario would include plans to widen 21 miles of existing road, and build an extension for approximately 15 miles. The current access point of is through Ferry which is on the Alaska Railroad between Nenana and Healy.

Twin Mountain. Houston Oil and Minerals has for several years conducted exploration on a tungsten-rich district northeast of Fairbanks. Access to the area would require construction of a 62 mile extension of the Chena Hot Springs Road. No development schedule has been announced by the company. The proposed road extension would serve a broad spectrum of need including access to a potentially valuable mineral deposit, recreation and tourism as well as improve access for placer mining.

Bonanza Creek. This is another tungsten property on land owned by Doyon Ltd. No details relating to grade or tonnage have been released. Construction of a 24 mile gravel road would provide adequate access to the property.

Lignite Creek-Kantishna. This is another proposed road which would serve multiple user needs while providing access into a known mineral-rich district. Of prime importance is the access that would be provided to antimony deposits in Kantishna District. This district is also important for precious metals. The proposed access is from a point on the Parks Highway at Lignite Creek and would involve the construction of 75 miles of road which would link up with the seasonally congested Wonder Lake Road which serves Denali National Park. Opposition for such a road may be expected from the National Park Service and conservation groups although it would serve a broad public need.

Chandalar Mining District. Increased activity in the Chandalar area in recent years, with focus upon hardrock as well as placer deposits, highlights the excellent potential for expansion of mining activity. Current access during the mining season is by air using a 4500 foot runway. Construction of a 65 mile road from the Dalton Highway would provide access and enhance the prospect for more mining in the district.

Point-Lay Cape Lisbourne Coal Deposits. These coal fields would be included in the discussions of transportation to the North Slope coalfields. Major development is some years away and would be contingent upon an adequate transportation system. The Arctic Slope Regional Corporation has examined the possibility of mining 100,000-200,000 tons of coal from the Cape Beaufort area to serve local needs of communities within range of barge transport. Suggestions that this could also satisfy the energy needs of mining development in the Noatak region have not enjoyed support from Cominco officials who feel the capital costs for coal-fired generating equipment for their power requirements overshadow any savings to be realized by purchasing coal rather than fuel oil.

Another scenario for exploiting coal for local Northwest Alaska needs focuses on the Chicago Creek deposits on the north side of the Seward Peninsula. This development would require a 170 mile road to link the Chicago Creek mine site to Kotzebue, however the route would cross terrain with a high mineral potential for placer gold, uranium and a range of base metals.

There is little merit in further cataloging the hundreds of known mineral occurrences in Alaska and speculating on possible access needs. In remote regions of Alaska it is not the lack of minerals that is inhibiting industry, but the lack of transportation to allow development. Any expansion of Alaska's ground transportation system to serve major, economically viable, mining centers will enhance access to other known deposits as well as stimulate exploration for undiscovered ore deposits.

The development of transportation infrastructure is the key to the creation of an Alaskan mineral industry that will strengthen and diversify Alaska's economic base.

IV. Report of the Division of Finance and Economics: Department of Commerce and Economic Development

Red Dog Economic Analysis

Red Dog Mine Analysis

Division of Finance and Economics
Department of Commerce
and Economic Development

This report will identify the direct benefits to the State of Alaska that result from subsidization of the Red Dog Mine. The report will also identify the maximum level of expenditure the State can make on the project and still retain a positive rate of return.

The following analysis is based on a 60¢ per pound price of zinc, the most important metal produced from the mine in terms of the mine's economic viability. Sixty cents (60¢) per pound, in 1984 dollars, represents the "best estimate" in terms of expected real future zinc prices. This estimate was made by the Office of Mineral Development. A low estimate of 55¢ per pound and a high estimate of 65¢ per pound were also considered.

All quantifiable benefits are given in terms of their present value for purposes of consistency and in order to protect the confidential nature of the data supplied by Cominco Corporation. All present values are based on 30 years of mine operation regardless of when mine development begins. A 15% return on investment (ROI) was assumed to be the threshhold level needed to induce mine development and production. (This implies a capital recovery period of approximately 5 years.)

At a price level of 60¢ per pound for zinc and assuming mine development beginning in 1985, the present value to the State of taxes is $205.69 million. In addition to the tax estimate, "transfer payment" reductions have a present value of $41.61 million, for a total direct benefit of $246.85 million. The corresponding values to the State for zinc prices of 55¢ per pound and 65¢ per pound can be found in Table I.

Table I

Returns* to the State from
Red Dog Mine Development
(Millions of Dollars)

	Price of Zinc		
	55¢	60¢	65¢
Taxes	157.50	205.69	262.52
Transfers	41.16	41.16	41.16
Total	198.66	246.85	303.68

* All returns are given in terms of their present value. Only direct returns to State Government are considered.

In order to get the requisite 15% return on investment with no State involvement the price must reach a real price of 63¢ per pound.

Based on the above assumptions, to obtain a 15% return on investment at a real price of 60¢ per pound for zinc, the State would have to subsidize the capital costs of Cominco by $40.1 million. For this $40.1 million investment the State will directly benefit by $246.85 million which is a positive benefit/cost ratio to the State of 6.2:1. The ratio is high because it appears the project would not be viable without State support. Under the foregoing assumptions, the minimum level of investment the State can make in the project and have any expectation of immediate development is estimated to be $40.1 million. Higher involvement by the State through larger amounts of subsidy will increase expected rates of return to Cominco, and increase the likelihood of immediate project development. At a price of 60¢ per pound for zinc the State could subsidize the project up to $245.0 million and still have a benefit/cost ratio greater than 1, i.e., the State investment becomes increasingly marginal as it approaches $245 million.

The relationship between the return on investment and State subsidy is show in Chart I and the relationship between State subsidy and benefit/cost is shown in Chart II.

CHART I

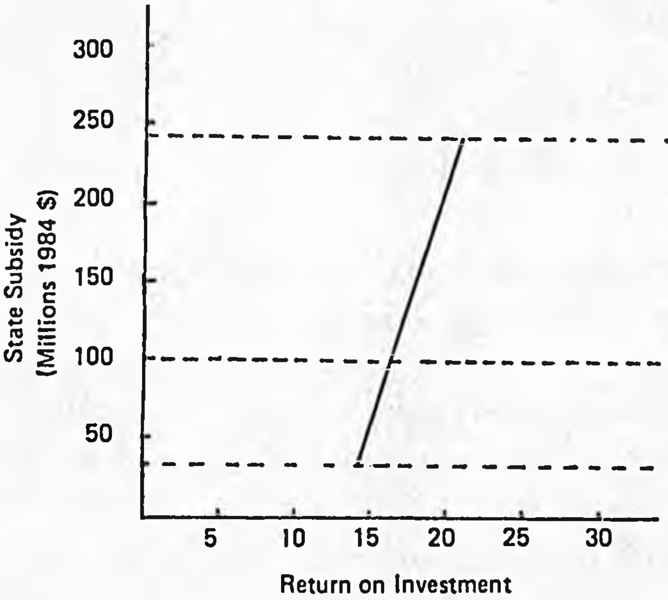
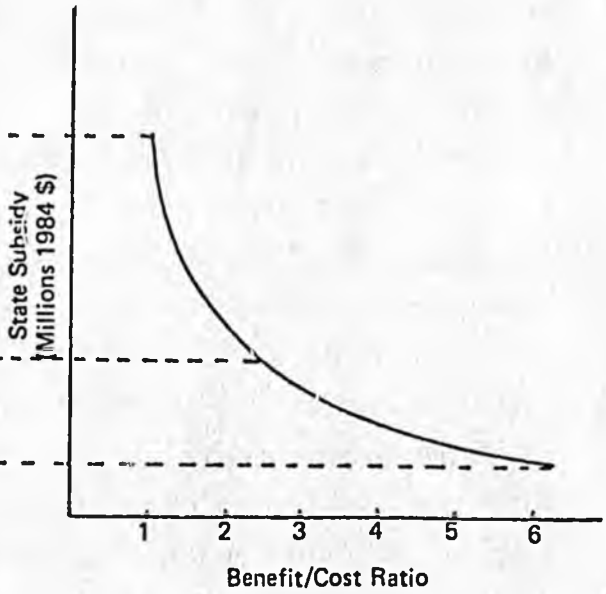


CHART II



[* Assumes a real price of zinc of 60¢ per pound.]

While the above analysis is based on what appear to be reasonable assumptions, changes in these assumptions produce different results. For example, the development of the mine is sensitive to changes in the price of zinc. If the zinc price is lowered from 60¢ to 55¢ per pound he low side of our estimated future price), the rate of return to Cominco would also fall. At the 55¢ price, to get the return to Cominco up to 15% the State might have to put a subsidy of $158.0 million in the project. Because of the lower price, the taxes are also lower; this, coupled with the higher level of subsidy, reduces the benefit cost ratio to 1.25 in comparison to the 6.2 figure generated by a 60¢ price. On the other side, if the higher price level of 65¢ per pound of zinc is attained, the return is estimated to be in excess of the requisite 15% ROI with no State subsidy and the State benefits directly by $303.48 million even with no contribution.

In addition to direct benefits to the State in the form of tax revenues and reduced transfer payments, there are gains to the public in the form of wages, reduction in freight costs and the implicit benefits of having a road and port where previously there was none. The present value of direct wage gains, freight cost reductions, and royalties to NANA are set forth below. The present value was calculated for a period of 30 years, however, the Red Dog Mine and road is anticipated to be active for at least 50 years. The benefits for the additional years are so far in the future that their present value is not included, but should be considered from a social point of view. Implied infrastructure benefits are not quantified though the existence of a State road and port offers opportunities for future expansion at Red Dog and for other mining opportunities in the region.

Table II

Private Sector Benefits* from
Red Dog Mine Development
(Million $)

Benefit	Amount
Wages	$365.25
Freight Cost Reduction	50.96
Infrastructure Gains	Not Quantified
Royalty payments to NANA**	658.56

* Present value over 30 year period.

** These monies are subject to the revenue sharing provisions of the Alaska Native Claims Settlement Act, 7(i) Clause, and could also be taxed by the State and Federal Governments.

The wages and salaries generated are a result of average annual employment increase of 500.

V. Report of the Office of Management and Budget Office of the Governor

A. Corporate Profile of Cominco Ltd. (Canada)

B. Corporate Profile of NANA Regional Corporation Inc.

C. Direct and Indirect Economic Impacts Within the State of Alaska

D. Fiscal Impacts

E. Cominco / NANA Contractual Agreements

F. Effects on State Bonding Capacity

G. Synopsis

OFFICE OF MANAGEMENT AND BUDGET
OFFICE OF THE GOVERNOR
STATE OF ALASKA

RED DOG PROJECT

Report Prepared for Part IV of the Interagency Task Force on
State Participation in Infrastructure Development
February 21, 1984

INTRODUCTION

The Office of Management and Budget participated in the State's interagency task force on the Red Dog Mine project during the period September-December, 1983. The purpose of the task force was to evaluate whether and how the State of Alaska might participate in the infrastructure development necessary for the Red Dog mine, which is located in the northwest region near Kotzebue. The Office of Management and Budget was responsible for completing the following six tasks:

(A) preparation of a detailed corporate profile of Cominco Ltd., with reference to its financial structure, operational spread and market participation;

(B) preparation of a similar corporate profile of NANA Regional Corporation, Inc.;

(C) evaluation of the direct and indirect economic impacts of the Red Dog Mine project within Alaska;

(D) evaluation of the taxation impacts of the Red Dog Mine project, utilizing Alaska's current taxation framework;

(E) examination of the contractual relationship between Cominco-Alaska, Inc. (the Alaska subsidiary of Cominco Ltd.), and NANA Regional Corporation, Inc.; and,

(F) assessment of the possible effects of various risk-sharing scenarios for total project development on the State of Alaska's bonding capacity.

The sections below present the Office of Management and Budget's findings and conclusions regarding these six tasks.

A. CORPORATE PROFILE OF COMINCO, LTD. (CANADA)

Cominco Ltd. of Canada is the parent company of Cominco-American, Inc., and its branch, Cominco-Alaska Inc., which has joined with NANA Development Corporation, Inc., to develop the Red Dog Mine near Kotzebue. This corporate profile describes the operations and relationships of Cominco Ltd.

1. BACKGROUND

Cominco Ltd. is an integrated natural resources company whose principal activities are in minerals exploration, mining, smelting and refining. Headquartered in Vancouver, British Columbia (Canada), the company with its subsidiaries constitutes one of the world's largest mining and metallurgical concerns. Cominco Ltd. employees numbered approximately 10,500 as of August, 1983, with union representation encompassing some 70% of the total. [1]

The Cominco enterprise was first incorporated in Canada in 1906 as Canadian Consolidated Mines Ltd., as a means of amalgamating the mining interests of the Canadian Pacific Railway. (The name was changed a month later to Consolidated Mining and Smelting Company of Canada Ltd.) The company was acquired and re-chartered in 1962 by Canadian Investments Ltd. (now Canadian Pacific Enterprises Ltd.), which is an investment holding corporation for Canadian Pacific Ltd., a private Canadian company. Under this arrangement, the company's name was changed to Cominco Ltd. in 1966. Finally, in 1970, Cominco Ltd. moved its executive offices from Montreal to Vancouver.

The range of Cominco Ltd. business operations is extensive. Its participation in mining and minerals industries includes exploration and mining operations (chiefly for zinc, lead, silver, copper and gold) in North America, South America, Europe, Asia, Africa and Australia, as well as the operation of major smelting and refining facilities in Canada, Japan and India. Worldwide, Cominco Ltd. and its subsidiaries operate some 14 major mines and 4 major smelting and refining complexes. Cominco Ltd. was the world's largest producer of zinc and lead in 1982, accounting for approximately 10% and 11% of the western world's mine production of those metals, respectively.[2]

Beyond its mining and metals operations, Cominco Ltd. also is one of Canada's largest producers of phosphates and chemical fertilizers, and is a major supplier of these commodities for the upper American Midwest. Additional Cominco Ltd. operations include the production of high purity metals, steel products, fabricated metals products, compound semiconductors and electronic components, and hardware specialties, as well as the distribution of electrical power in western Canada. Its Project Research Center at Sheridan Park, Ontario, is the world's largest research center for new and improved uses of lead and zinc.[3] The company also is a holding and investment concern with a relatively large number of corporate subsidiaries and affiliates.

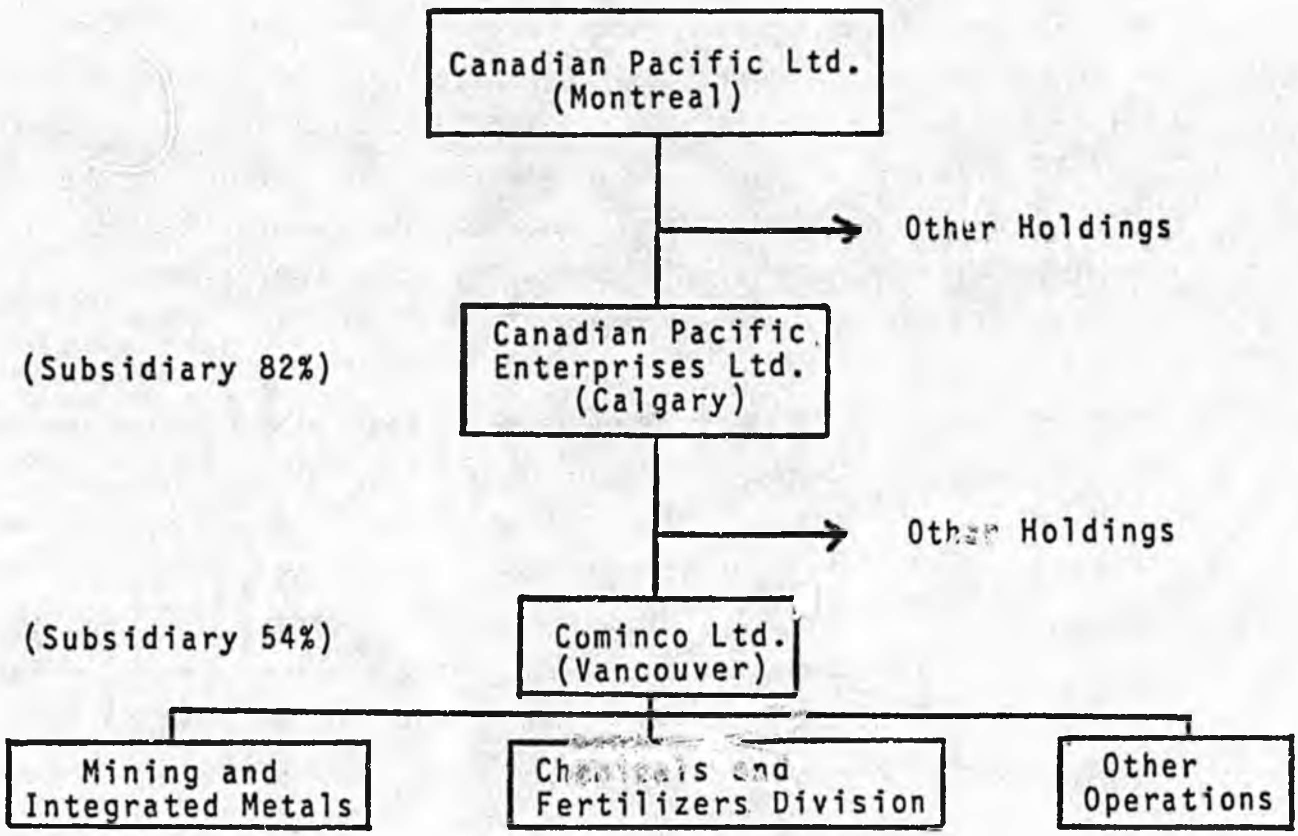
2. CORPORATE STRUCTURE AND MARKET PARTICIPATION

Diverse and large as its holdings are, Cominco Ltd. occupies a position within a yet larger corporate structure. (See Figure A-1.) Principally, it is 54% owned by Canadian Pacific Enterprises Ltd. (Calgary, Alberta), which is a large investment company with interests in oil and gas, mines and minerals, iron and steel, forest products, real estate, hotels and food services. Canadian Pacific Enterprises Ltd. is itself 82% held by Canadian Pacific Ltd. (Montreal, Quebec), a private Canadian company directly involved in various transportation services.

The corporate structure of Cominco Ltd., including its subsidiaries and affiliates, reveals a high degree of both vertical and horizontal

FIGURE A-1

COMINCO LTD. CORPORATE STRUCTURE



integration. It encompasses vertically linked operations that include exploration and reconnaissance, mining, smelting and refining, fabrication, product development and research, direct specialty hardware supply and sales. Its horizontal dimension is revealed by its many associated mining and smelting operations (including, beyond metals, the mining of coal, diamonds, potash, et al.), chemical and fertilizer production facilities, steel plants, electronics plants and network of hydroelectric power plants.

Overall, the associated companies of Cominco Ltd. participate in three broad industry segments or markets. These include mining and integrated metals, chemicals and fertilizers, and a range of "other operations" which includes the previously mentioned steel, electronics and hydroelectric plants, etc. (See Table A-1.) Among these three corporate segments, mining and integrated metals consistently has been the greatest contributor to Cominco Ltd's total revenues. It has consistently also been the greatest contributor to the company's operating profits, except during 1982, when low base metal prices and softening demand produced the company's first overall loss in fifty years. (See Table A-2.) However, it appears that mining and integrated metals operations will once again be the major contributor to its profits in the coming years, due to the potential of the Red Dog Mine, and the expected future improvement in world metal market conditions. (See Table A-3.)

3. MINING HOLDINGS AND OPERATIONS

a. Amalgamated Divisions and Operating Subsidiaries

Cominco Ltd. amalgamated (i.e., merged) in late 1982 with Bethlehem Copper Corporation and Copper Valley Mines Ltd., previously two wholly owned subsidiaries, under the name of Cominco Ltd.[4] The operations of these companies and Green Valley Mines continue as divisions of Cominco Ltd. Figure A-2 depicts the corporate linkage of these divisions and Cominco Ltd.'s operating subsidiaries, in which Cominco Ltd. ownership is greater than 50%. (See Figure A-2.)

TABLE A-1

COMINCO LTD.
SCOPE OF OPERATIONS AND MARKET PARTICIPATION

INDUSTRY SEGMENT	PRINCIPAL INVOLVEMENTS	MAJOR FACILITIES
1. Mining & Integrated Metals	Mining, processing smelting and refining of zinc, lead, copper, silver, gold, tin, et al.	*14 major mines *4 major smelting facilities
2. Chemicals & Fertilizers	Production of sulphuric acid, sulphur dioxide, potash, ammonia, urea, phosphates and nitrates	*3 mines *5 processing plants (all in Canada and USA)
3. Other Operations	Fabrication of metal products, steel, high purity metals, semiconductors and electronic components, electrical power distribution.	*3 steel plants *1 metal fabricating plant *2 electronics plants *4 hydroelectric plants (all in Canada and USA)

Source: Office of Management and Budget, State of Alaska, December, 1983.

TABLE A-2

CONTRIBUTIONS OF COMINCO LTD.
OPERATING SEGMENTS, 1978-1982

	1982 Contributions		5-Year Average Contributions	
	To Total Revenues	To Operating Profits (Losses)*	To Total Revenues	To Operating Profits (Losses)
Mining and Integrated Metals	53%	($31 million)	56%	61%
Chemicals and Fertilizers	33%	$30 million	30%	29%
Other Operations	14%	$17 million	14%	10%

* U.S. Dollars

Source: Based on data from Cominco Ltd. 1982 Annual Report and report by the Canadian investment firm Levesque, Beaubien, Inc. (July, 1983).

TABLE A-3

FORECASTED CONTRIBUTIONS OF COMINCO LTD.
OPERATING SEGMENTS, 1983-1985

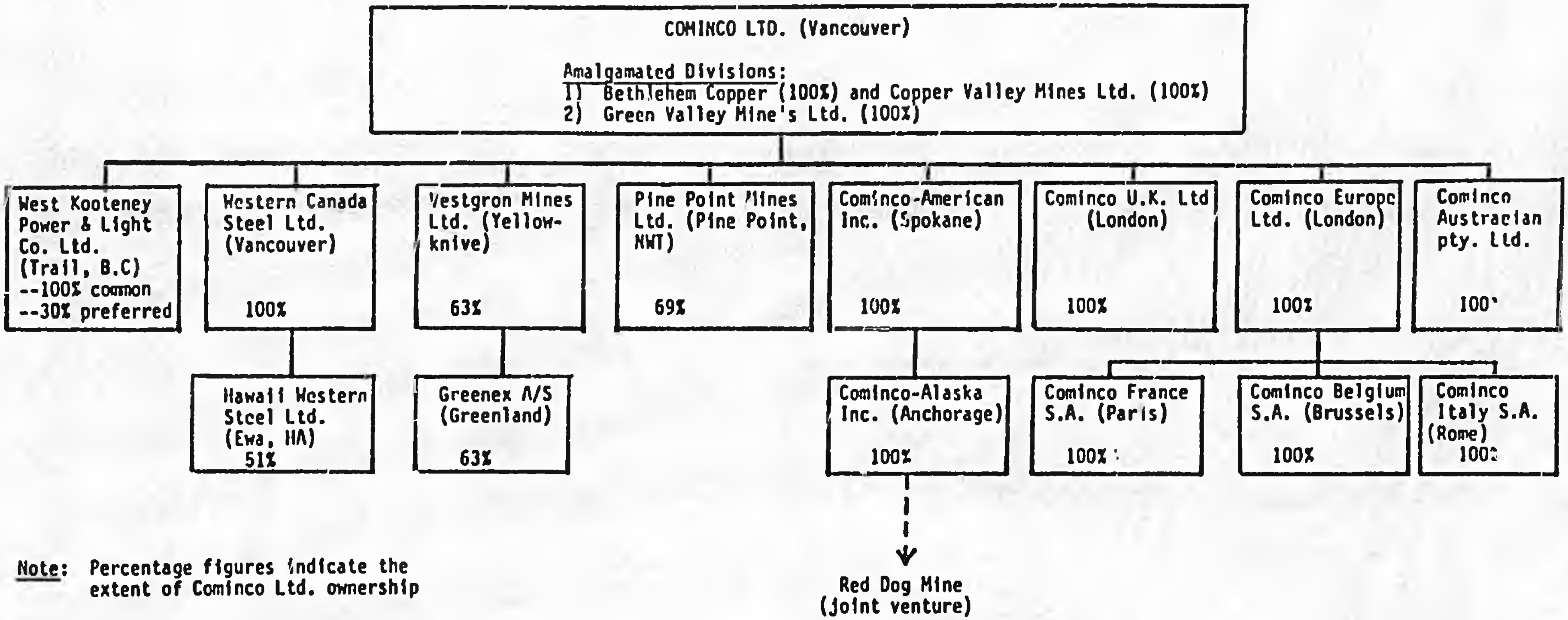
	Contributions To Total Revenues				Contributions To Operating Profits			
	1984E	1984E	1985E	$(Avg._5)$*	$(Avg._5)$*	1983E	1984E	1985E
Mining and Integrated Metals	57%	61%	62%	(56%)	(61%)	56%	76%	79%
Chemicals and Fertilizers	30%	27%	27%	(30%)	(29%)	19%	17%	15%
Other Operations	13%	12%	11%	(14%)	(10%)	25%	7%	6%

*$Avg._5$= 5-year average contribution, 1978-82.

NB: Forecast assumes inclusion of Red Dog Mine costs.

Source: Based on report by Canadian investment firm Levesque, Beaubien, Inc. (July, 1983) [illegible]RE A-2

COMINCO LTD.
OPERATING SUBSIDIARIES AND AMALGAMATED DIVISIONS
(MINING AND INTEGRATED METALS SEGMENT)



Note: Percentage figures indicate the extent of Cominco Ltd. ownership

Source: Office of Management and Budget, State of Alaska, December, 1983

b. Affiliates

The corporate affiliates of Cominco Ltd., in which a 50% or less ownership interest is held, include the following: (percentages indicate the extent of Cominco Ltd. ownership)

* Canada Metals Co. Ltd. (50%)
  Toronto: lead refining and metals products

* Mitsubishi Cominco Smelting Co. Ltd. (45%)
  Tokyo: smelter products, refined lead, concentrates from Pine Point Mines Ltd.

* Cominco Binani Zinc Ltd. (40%)
  Calcutta: electrolytic zinc smelting and refining

* Fording Coal Ltd. (40%)
  Calgary: coal mine

* Aberfoyle Ltd. (47%)
  Melbourne: minerals exploration in Australia and Tasmania, 6 tin and lead/zinc mines, metals production

* EXMINESA S/A (48%)
  Madrid: minerals exploration, zinc/lead mine

* Panarctic Oils Ltd. (7.4%)
  Undetermined: oil and gas exploration

c. Other Holdings (Unidentified)

References to a number of additional Cominco Ltd. holdings in the mining and integrated metals area have been located, but could not be investigated due to time constraints. These include the following: (percentage figures indicate the extent of Cominco Ltd. ownership)

* Vol Mines Ltd (66.7%)
* Baffinland Iron Mines Ltd. (4.5%)
* Stikine Copper Ltd. (5%)
* Sunloch Mines Ltd. (84%)
* Sunro Mines (77%)
* Cominco Holdings, N.V. (-?-)
* Cominco GmbH, Germany (100%)
* Mayak Ltd., U.K. (50%)
* Arvik Mines Ltd., Canada (100%)
* Abminco NL (38%)

d. Principal Mining Facilities

The principal mining facilities of Cominco Ltd. include 9 major mines in North America and Greenland, and the giant integrated smelting and refining complex at Trail, British Columbia, which also includes part of Cominco Ltd.'s fertilizer and chemical processing operations. These facilities, along with their approximate levels of employment as of December 31, 1982, are described below: (percentage figures indicate the extent of Cominco Ltd. ownership)

* Trail Complex (100%)
  Trail, B.C.: integrated smelting and refining complex for lead, zinc, silver, et al.; chemical and fertilizer plant; 4,036 employees

* Sullivan Mine (100%)
  Kimberly, B.C.: lead/zinc/silver mine; pig iron plant; chemical and fertilizer plant; 959 employees

* Valley Mine and Jersey Mine (100%)

Logan Lake, B.C.: Copper mines; 360 employees

* Polaris Mine (100%)
  Little Cornwallis Island NWT: Zinc/lead mine; 244 employees

* Con Mine (100%) and Rycon Mine (76%)
  Yellowknife, NWT: gold mines; arsenic recovery plant; 309 employees

* Pine Point Mine (69%)
  Great Slave Lake, NWT: Lead/zinc mine; 583 employees

* Black Angel Mine (63%)
  Maarmorilik, Greenland: Lead/zinc/silver mine; 324 employees

* Magmont Mine (50%)
  Bixby, Missouri: Lead/zinc mine and concentrator; 186 employees

4. FINANCIAL STRUCTURE

Unless otherwise specified, all figures presented below are based on the 1980-1983 annual reports of Cominco Ltd. All dollar amounts shown are in Canadian dollars for 1982. (For purposes of conversion or comparison, the average conversion rate during 1982 was: $1.234 CAN=$1.00 USA.)

a. Assets and Net Worth

As of year end 1982, the consolidated assets of Cominco Ltd. totalled approximately $2.1 billion. The larger portion (65%) was in fixed assets such as land, buildings, equipment and developed mineral properties, with a total book value of some $1.36 billion. Investments in affiliated and unaffiliated companies totalled nearly $128 million, while current assets stood at more than $575 million (over 27% of total assets). Net worth for the company as of December 31, 1982, was approximately $834.9 million. This comprised some $145 million in preferred shares, $136 million in common shares and approximately $554 million in earnings reinvested in the company. (See Table A-4.)

b. Capitalization

Capitalization for Cominco Ltd. as of the end of 1982 was approximately $1.52 billion. This comprised long-term debt of some $688 million, reinvested earnings of approximately $554 million, $145 million in preferred stock, and $136 million in common stock. (Some 5.8 million shares of preferred stock and 18.8 million shares of common stock were outstanding at the end of 1982, approximately 54% of the total value of which was held by Canadian Pacific Enterprises Ltd.) If $38 million in minority interests and $175 million in deferred income taxes are included as representing long-term debt, total capitalization for the company was actually approximately $1.74 billion.

The company's financial leverage ratio (long-term debt to total long-term capital), was 0.52 at the end of 1982, and its debt-equity ratio was 1.08, down from 1.44 earlier in the year.

The capital structure underlying Cominco's $688 million in long-term debt for 1982 included $46.8 million in notes, $101 million in debentures, $533.4 million in bank loans (approximately three-quarters of which are at variable rates, with the remainder at fixed rates of 5-3/4% to 10-3/8%), $5.4 million in bonds, and $1.4 million in other debt. The company has moved recently to reduce its reliance on bank debt through the application of some $100 million raised from a 2.2 million common share offering in April of 1983. (Canadian Pacific Enterprises Ltd. purchased 1.2 million shares of this offering, to preserve its 54% interest in the company). This was in addition to an earlier issue of 2 million preferred redeemable shares, which brought proceeds of approximately $50 million in 1982. A

TABLE A-4

COMINCO LTD.
CONSOLIDATED BALANCE SHEET
1981 - 1982

	1982	1981
	(thousands)	
Current Assets		
Cash and short-term investments	$ 31,279	$ 48,887
Accounts receivable	182,573	243,624
Inventories	352,156	334,181
Prepaid expenses	9,732	7,317
	575,740	634,009
Investments		
Associated companies	95,929	95,458
Other companies	31,941	34,614
	127,870	130,072
Fixed Assets		
Land, buildings and equipment	1,562,144	1,396,081
Less accumulated depreciation	518,682	463,791
	1,043,462	932,290
Mineral properties and development	417,975	402,365
Less accumulated depreciation	101,645	92,291
	316,330	310,074
	1,359,792	1,242,364
Other Assets	28,142	21,379
TOTAL ASSETS:	$ 2,091,544	$ 2,027,824
Current Liabilities		
Bank loans and notes payable	$161,633	$ 140,007
Accounts payable and accrued liabilities	141,411	171,220
Income and resource taxes	16,206	19,268
Long term debt due within one year	30,457	11,509
	354,707	342,004
Long-Term Debt	687,975	566,677
Income Taxes Provided, Not Current Payable	175,520	219,155
Minority Interests	38,397	45,449
Shareholder's Equity		
Capital	280,531	232,229
Earnings Reinvested in the business	554,414	622,310
	834,945	854,539
TOTAL COMMITMENTS AND LIABILITIES	$ 2,091,544	$ 2,027,824

Source: Cominco Ltd., 1982 Annual Report

TABLE A-5

COMINCO LTD. FINANCIAL POSITION
MARCH 31, 1983

	$ million	$/Share*	%
Assets:			
Working Capital (a)	161.6	8.60	
Net Fixed Assets	1,357.7	72.22	
Investments & Others	158.2	8.41	
	1,677.5	89.23	
Financed By:			
Long-term Debt (b)	667.1	35.48	39.8
Deferred Taxes	163.7	8.71	9.8
Minority Interests	36.9	1.96	2.2
Preferred Shares	144.7	7.70	8.6
Common Equity (a)	665.1	35.36	39.6
	1,677.5	89.23	100.0

* 18.8 million shares, raised to 21.0 million shares in April, 1983

(a) Increased by $100 million in April, 1983

(b) Of the $667 million in long-term debt, approximately $157 million is at fixed rates varying between 5 3/4% and 10 3/8% and the balance is at variable rates

Source: Levesque, Beaubian, Inc., Investment Research Report, July, 1983 major factor in Cominco Ltd.'s decision to issue more stock, presumably, was the 44% rise in the company's overall interest expense during 1982 to $90.4 million, up from $62.6 million at the end of 1981. (A more recent snapshot of Cominco Ltd.'s capitalization, as of March, 1983, is shown in Table A-5.)

c. <u>Liquidity and Credit Rating</u>

The company's current ratio (current assets to current liabilities) was 1.62 at the end of 1982. Its acid-test ratio (current assets less inventory to current liabilities) was 0.63. However, its cash ratio (cash plus short-term investments to current liabilities) was 0.09. The company had to sell off over 27,000 tons of its lead and zinc concentrate inventories in 1982 due to cash flow problems.[5]

During the first half of 1983, however, the company appears to have improved its liquidity position. Independent assessment of the company's operations in May of 1983 showed net working capital (current assets minus current liabilities) centered in accounts receivable and inventory, with satisfactory inventory turn-over, and adequate cash deposits and short-term investments for financing operations.[6] Analysis of the sources and uses of Cominco Ltd.'s funds during 1981 and 1982 also indicates that the company instituted an aggressive collections policy regarding receivables during 1982 (see subsection 5, below, "Sources and Uses of Funds"), helping to improve cash flow and liquidity.

Cominco Ltd.'s overall credit rating was very good as of mid-1983. Independent credit assessment of the company showed a high composite credit appraisal, a consolidated line of credit available without security to the high eight-figure range, excellent relations, and good conditions.[7] The same sources and uses analysis referred to above also shows that Cominco Ltd. started paying its own bills more promptly in 1982, which is undoubtedly responsible in part for the company's current good credit rating.

TABLE A-6

COMINCO LTD.
EARNINGS SUMMARY
1978-1982

	1978	1979	1980	1981	1982
				- - ($ millions)- -	
Mining & Integrated Metals					
Sales	515	789	850	732	641
Operating Costs	371	430	589	601	622
Depreciation & Amortization	34	40	44	52	57
Operating Profit	110	319	217	79	(38)
Fertilizers & Chemicals					
Sales	271	317	390	462	421
Operating Costs	213	239	273	342	362
Depreciation & Amortization	23	24	20	22	22
Operating Profit	35	54	97	98	37
Other Operations					
Sales	115	168	203	223	173
Operating Costs	100	138	163	181	145
Depreciation & Amortization	8	9	10	10	7
Operating Profit	7	21	30	32	21
Consolidated					
Sales	901	1274	1443	1417	1235
Operating Costs	684	807	1025	1124	1129
Depreciation & Amortization	65	73	74	84	86
Operating Profit	152	394	344	209	20
Exploration Expense	(7)	(10)	(13)	(20)	(15)
Interest Expense	(28)	(28)	(33)	(63)	(90)
Corporate Charges	(13)	(4)	(6)	(1)	(13)
Earnings Before Taxes	104	352	292	125	(98)
Income & Resource Taxes					
Current	(36)	(104)	(69)	(12)	(7)
Deferred	(9)	(30)	(50)	(39)	50
Total Taxes	(45)	(134)	(119)	(51)	43
Minority Interests	(6)	(23)	(14)	(10)	1
Equity Income	9	11	14	4	5
Currency Translation	8	(1)	(2)	(5)	(1)
Earnings Before Extras	66	205	171	65	(49)
Extraordinary Item	2	-	-	5	18
Earnings	68	205	171	70	(31)
Preferred Dividends	(6)	(7)	(8)	(8)	(10)
Net Income	62	198	163	62	(41)
EPS Before Extraordinary Item	3.51	11.57	9.54	3.04	(3.16)
EPS After Extraordinary Item	3.61	11.57	9.54	3.35	(2.20)
Cash Flow Per Share (a)	8.12	18.6[illegible]	17.54	10.49	(0.96)
Average Shares Outstanding	17.0	17.1	17.1	18.4	18.8

(a) After preferred dividends

Source: Levesque, Beaubien, Inc., Investment Research Report, July 1983

d. Earnings

Cominco Ltd. president W.G. Wilson told stockholders in April of 1983 that 1982 was "one of the worst years in the company's history." [8] 1982 was indeed not a good year for Cominco Ltd., as the company suffered an overall net loss of approximately $31.2 million (a loss of $2.20 per share). This was a dramatic slump from net earnings of $70.3 million (a gain of $3.35 per share) in 1981, and is attributed to sagging metal markets and softening world demand over the past two years, resulting in falling metal prices. The loss of $31.2 million was on sales of products and services totalling approximately $1.24 billion, down almost 14% from 1981 sales. Earnings before interest and taxes for the company reflect the same decline, dropping to a loss of approximately $7.2 million in 1982 from earnings of over $189 million in 1981. (Actually, Cominco Ltd.'s net loss in 1982 would have been much larger than $32.1 million, but the company took some $49.9 million tax in credits during the year and its Cominco-American, Inc., subsidiary sold off its oil and gas properties for an after-tax gain of approximately $18.1 million).

The 1982 net loss was something of an exception for Cominco Ltd., however, representing the company's first overall loss in the past fifty years. It should not be taken as indicative of the company's solidity or prospects. Cominco Ltd. has extensive ore reserves, is already in 1983 nearly breaking even on its mining and integrated metals operations (with an operating loss of only $800,000 in the second quarter of 1983, down from $7.5 million in 1982), [9] and is in a position to improve its earnings performance in view of forecasts of an economic upturn. (For a summary of recent years' earnings, though with a slightly different data base than that used here, see Table A-6.)

e. Sources and Uses of Funds

A funds flow analysis was conducted for this report by examining the company's annual balance sheets. The major findings of this analysis include the following: (as of year-end 1982)

(1) the company was still relying on long-term debt, but was cutting that reliance back (i.e., increases in annual long-term debt outstanding slowed from 1980 to 1982);

(2) the company was still raising new capital through share issues, but at a slower rate than in the past (e.g., the share issues totaling $48.3 million in 1982 were only half of 1981's issues of $97.5 million);

(3) the company was still acquiring new land, buildings and equipment ($166 million in 1982), but less than in 1981 ($225 million);

(4) acquisition of mineral properties dropped dramatically during 1982 ($15.6 million) compared to the year before ($166 million);

(5) the company introduced a strong collections policy during 1982, cutting accounts receivable by $61 million as opposed to a $1 million increase during 1981 (this has been offset somewhat, however, by another new policy introduced during 1982 of paying off the company's own debts more quickly); and,

(6) the company has sharply cut back its payment of dividends to shareholders (e.g., from $83 million during both 1980 and 1981 to less than $35 million during 1982).

This pattern of retrenchment also is reflected in recent announcements by the company that : (1) capital investment spending was reduced by $710 million during 1981-82, after the company spent more than $1 billion on new projects over the preceding five years; (2) modernization of the Trail, B.C., smelting complex was being delayed; (3) completion of mechanization for the complex at Kimberly, B.C., was being delayed; (4) sustaining capital was being reduced throughout the company to low but acceptable levels; (5) exploration expenditures were being reduced; and, (6) some 2,200 company employees had been laid off during the 15 months prior to June, 1983.[10]

5. CONCLUSION

Its 1982 set-back notwithstanding, Cominco Ltd. appears to be a sound company with a firm economic footing and good overall prospects. The company is backed by a large reputable parent (Canadian Pacific Ltd.), has a strong mining and metals position worldwide, and is well diversified across several broad markets. It also reportedly has excellent managers who evidently are orienting the company towards more conservative spending policies and stronger earnings performance. In these respects, Cominco Ltd. appears able to provide a solid corporate base for development and support of the Red Dog Mine project.

FOOTNOTES

1 Standard & Poor's Corporation, Standard ASE Stock Reports, Vol. 18, No. 66, Sec. 11, August 18, 1983; p. 7541.

2 Ibid.

3 Canadian Mines Handbook, 1982-83; p. 88.

4 Dun & Bradstreet Canada Ltd., Business Information Report, May 2, 1983; p.2.

5 Cominco Ltd., ORBIT: The Cominco Quarterly, June, 1983; p.18.

6 Dun & Bradstreet, op. cit.; p. 3.

7 Ibid.; pp. 1-3.

8 Cominco Ltd., op. cit.; p. 17.

9 Dun & Bradstreet Canada Ltd., Business Information Report, August 18, 1983; p. 1.

10 Cominco Ltd., op. cit. p. 2.

B. CORPORATE PROFILE OF NANA REGIONAL CORPORATION, INC.

This corporate profile describes the operations and relationships of NANA Regional Corporation, Inc., which has joined with Cominco-American, Inc., to develop the Red Dog Mine near Kotzebue.

1. BACKGROUND

NANA Regional Corporation, Inc. (NANA), is one of twelve Alaska Native regional corporations which were formed under the Alaska Native Claims Settlement Act of 1971. (A thirteenth corporation was also formed for Alaska Natives no longer residing in the State.) Company records indicate that NANA represents some 4,800 Inupiaq shareholders,[1] of whom some 4,000 or more reside in the NANA Region.[2]

The Alaska Native Claims Settlement Act of 1971 (ANCSA) provides that the regional corporations formed under it are to share jointly a settlement comprising $962.5 million in cash and 40 million acres of land; the former is distributed through the Alaska Native Fund, and the latter through federal government land conveyances. As of June of 1983, NANA had received approximately $46.3 million as its cash settlement, and interim conveyance of 945,469 acres of surface estate and 766,816 acres of subsurface estate. NANA's total land entitlement under the terms of ANCSA is approximately 1.9 million acres of land including both surface and subsurface estates, and title to subsurface estate rights only on approximately 365,000 additional acres.[3]

ANCSA provisions also govern the division of NANA's stockholders into two groups, based on village or regional affiliation. The corporation's stockholders accordingly are divided into those enrolled as residents of one of the eleven NANA Region villages (Class A common stockholders), and those enrolled as NANA Region residents but not as residents of any particular village (Class B common stockholders). Under the Act's terms, NANA is required to issue 100 shares of the appropriate class of stock to each Native enrolled in the Region. [4] The Corporation's stock generally cannot be sold or otherwise transferred except by death beneficiary until 1991, also under ANCSA provisions.

A final major ANCSA requirement[5] is that a part of NANA's resource earnings must be pooled with those of the other regional corporations similarly created and then redistributed among all twelve corporations serving resident shareholders. Under this requirement, 70% of the net revenues received by NANA from development of its timber resources and subsurface estate (notably, mineral resources) enter the pool. These are then distributed proportionally to the twelve corporations, including NANA, based on the number of shareholders enrolled in each corporation. Of the amount that NANA receives from this distribution, 50% is required under ANCSA to be distributed proportionally to nonvillage stockholders and the village corporations within NANA's designated boundaries.[6]

2. CORPORATE STRUCTURE AND BUSINESS OPERATIONS

The corporate activities of NANA comprise both non-profit and profit-oriented operations. Non-profit activities include a variety of Native culture, education, and vocational development programs. The profit-oriented side of NANA is centered in the company's single, wholly owned operating subsidiary, NANA Development Corporation, Inc.

NANA Development Corporation, Inc., is the focus for NANA's several joint venture projects and has six separately incorporated subsidiaries. These include NANA Oil Field Services (provides housing for oil field personnel at Prudhoe Bay), Arctic Utilities (supplies electrical power generation for Prudhoe Bay operations and camps), and Purcell Services (provides industrial security systems for Sohio at Prudhoe Bay). A fourth division, NANA Construction Company, Inc., was discontinued during 1982 due to losses.

NANA's operating divisions and joint ventures, as described in the company's financial report for the year ending June 30, 1983 (YE1983), included the following: (percentage figures indicate extent of NANA ownership, where given)

* 2 Reindeer Breeding Companies (100%, 20%)

* Bank Holding Company (11% in YE1983, 17% in YE 1982)

* Oil drilling and lease partnership with Sohio and four other Native regional corporations, Beaufort Sea

* Jade Mining and Exploration

* Surveying and Engineering Services, with Bell Herring Associates of Anchorage

* NANA Mannings (food service and camp operations)

* NANA Coates (minerals exploration and drilling)

* Lease for oil exploration on NANA lands

* Vehicle maintenance venture

* Nul-Luk-Vik Hotel (Kotzebue)

* Construction joint venture at Prudhoe Bay, with Morrison-Knudsen, Inc. (on a job-by-job basis)

* Red Dog Mine development project

NANA's published annual reports for prior years (i.e., the years ending at June 30 for 1980-1982) provide little additional information regarding the company's holdings, investments and joint ventures. The only reasonable conclusions which can be formed on the basis of these documents are: (a) many different ventures have been undertaken in the past four years, most of which were generally similar in nature to those listed above; and, (b) most of the ventures suggest a placement of company resources intended to achieve long-term employment benefits to NANA shareholders and other regional residents.

It is not possible to provide an accurate summary of the performance or contributions of NANA's business operations (or joint ventures) over the past few years, as the amounts shown in the company's financial statements have been reclassified in each of the two most recent years (YE1983 and YE1982). NANA's financial report for YE1983, however, does allow comparison by broad line of business for the past two corporate fiscal years. This comparison indicates that NANA's oil field and support services have by far contributed most to NANA's earnings from joint ventures (99% of all joint venture earnings in YE1983, and 73% of all joint venture earnings over the past two fiscal years). (See Table B-1) Among NANA's continuing operations, the greatest contributors to overall operating revenues both in YE1983 and over the past two fiscal years have been NANA's camp and hotels (23.7% in YE1983 and 23.3% over the past two years) and the company's contracted services operations (23.6% in YE1983 and 21.0% over the past two years).

TABLE B-1

NANA JOINT VENTURES
EARNINGS (LOSS) SUMMARY BY LINE OF BUSINESS
YEARS ENDING JUNE 30, 1983 and 1982

	YE 1983		YE 1982		
	Earnings (Loss)	%	Earnings (Loss)	%	Two-Year Contribution (%)
Oilfield & Support Services	$1,788,373	99.7%	$975,883	49.2%	73.2%
Construction	212,779	11.9	952,767	48.1	30.9
Surveying	62,126	3.5	9,183	0.5	1.9
Sales	(402,378)	(22.4)	(144,808)	(7.3)	(14.5)
Catering	133,916	7.5	189,421	9.6	8.6
Total Earnings (Loss):	$1,794,816	100.2%*	$1,982,446	100.1%*	100.1%*

*Does not total due to rounding

Source: Based on data from NANA Regional Corporation, Consolidated Financial Statements: June 30, 1983 and 1982, September 30, 1983.

3 FINANCIAL STRUCTURE

a. Assets and Net Worth

As of June 30, 1983, the consolidated assets of NANA totaled approximately $68.7 million. The greatest portion (36.9%) of these assets were investments and marketable securities, with more than two-thirds of the latter (approximately$8.0 million of a total $11.7 million) representing the purchase costs of common and preferred stocks. NANA's combined property and equipment holdings represented another 24.1% of total assets, while its current assets stood at approximately $17.4 million, or 25.2% of total assets. NANA's joint ventures had a combined asset value to the company of some $9.06 million (13.2% of total assets), representing the combined equity allocable to NANA from those ventures. (See Table B-2)

TABLE B-2

NANA REGIONAL CORPORATION, INC.
AND SUBSIDIARY

Consolidated Balance Sheets

June 30, 1983 and 1982

Assets	1983	1982
Current assets:		
Cash and temporary investments	$ 2,388,705	$ 2,748,878
Current portion of notes receivable	7,753,487	8,149,697
Receivables	5,114,907	7,106,099
Inventories	1,843,702	2,218,290
Other current assets	328,366	370,682
Total current assets	17,429,167	20,593,646
Note receivable	7,258,430	7,679,029
Investment in Beaufort Sea lease partnership	2,467,542	2,237,225
Marketable securities	11,715,201	9,359,468
Investment in bank holding company	2,103,614	2,103,614
Investment in joint ventures	9,058,137	5,947,541
Raw jade at processing plant	657,470	597,488
Property and equipment, at cost	25,808,506	25,200,941
Less accumulated depreciation	9,223,976	8,000,842
Net property and equipment	16,584,530	17,200,099
Other assets, less amortization of $110,695 in 1983 and $63,821 in 1982	1,446,972	1,886,023
	$68,721,023	$67,604,133

TABLE B-2
(Continued)

Liabilities and Stockholders' Equity	1983	1982
Current liabilities:		
Note payable	$ 11,578,000	$ 12,933,881
Current installments of long-term debt	858,263	846,314
Trade payables	2,097,748	4,270,441
Accrued payroll and other liabilities	2,032,119	2,048,068
Due to village corporation and at large stockholders	78,868	84,956
Resource revenues distributable to others	732,868	--
Total current liabilities	17,377,866	20,183,660
Long-term debt, excluding current installments	2,412,208	2,751,262
Deferred income taxes	60,000	--
Stockholders' equity: Class A common stock of $.01 par value. Authorized 2,000,000 shares; issued and outstanding 704,700 shares	7,047	7,047
Class B common stock of $.01 par value. Authorized 500,000 shares; issued and outstanding 29,400 shares	294	294
Additional paid-in capital - Alaska Native Fund distributions	43,582,871	43,582,871
Retained earnings	5,280,777	2,248,735
Unrealized loss on marketable equity securities	--	(1,169,736)
Total stockholders' equity	48,870,989	44,669,211
Commitments and contingencies		
	$68,721,063	$67,604,133

Source: NANA Regional Corporation, Inc. Consolidated Financial Statements: June 30, 1983 and 1982.

It is not currently possible to estimate NANA's actual net worth, because the company has not ascribed a value to its land rights (surface and subsurface). Also, neither its Class A common stock nor its Class B common stock can be assigned market value until at least 1991 (the earliest time when NANA's shares can be generally sold or transferred, under the terms of ANCSA). NANA's common stock is currently assigned a par value of $0.01 per share, with a total of 734,100 shares outstanding from a total of 2.5 million shares authorized. The company did report some $5.3 million in retained earnings during YE1983 (up 135% from the previous year), however, and showed a total of approximately $43.6 million in paid-in capital from Alaska Native Fund distributions.

b. Capitalization

A true statement of value of NANA's overall capitalization cannot be made, again due the fact that the company's outstanding common stock will not have a meaningful market value until at least 1991. Excluding NANA's shareholder equity and the value of NANA's overall minerals holdings, however, it can be said that NANA's reported capitalization as of YE1983 totaled approximately $7.8 million. This total comprised approximately $2.4 million in long-term debt outstanding (current portion excluded), retained earnings of approximately $5.3 million, and some $60,000 in deferred income taxes.

It would be difficult at best to say whether NANA's YE1983 debt level represents a large or small amount of debt for the company to be carrying. The current artificial value of NANA's shares, and the absence of a meaningful basis for comparing NANA with other corporate entities, combine to make any such assessment necessarily speculative at the present time.

Given NANA's current inability to raise additional share capital before 1991, it is to be expected that the company's capital structure should consist primarily of long-term notes payable. NANA's non-current long-term debt outstanding of approximately $2.4 million at YE1983, in f ct, consisted entirely of such notes, carrying interest rates ranging from 7-1/2% to 18% and payable primarily to financial institutions. Approximately 77% of NANA's total long-term debt (including the current portion) was secured by property and equipment holdings with a combined depreciated cost (sic) of approximately $6.3 million.

c. Liquidity

The company's current ratio (current assets to current liabilities) at YE1983 was 1.003, while its quick ratio (current assets less inventory to current liabilities) was 0.897. The company's YE1983 statements also show a cash ratio (cash plus short-term investments to current liabilities) of 0.137. NANA did, however, have an unused line of credit at YE1983 for approximately $4.9 million.

The financial ratios for NANA indicated above are correct as taken from NANA's financial statements. It should be noted, however, that the company is currently in the process of converting some of its short-term debt (notes payable) into longterm debt. This should improve the company's liquidity in the future, particularly over the short run.

d. Earnings

Two conclusions regarding earnings are immediately clear from NANA's consolidated earning statements. One is that the company's overall net income and earnings per share have risen steadily over the last eight corporate years (and ahead of overall revenue increases), particularly since YE1981. The second is that the most recent year, YE1983, was NANA's most profitable year ever, showing corporate net income up by 147% over the company's previous best year in YE1981. (See Table B-3.)

TABLE B-3

NANA REGIONAL CORPORATION, INC.
EARNINGS SUMMARY
YEAR ENDING AT JUNE 30, 1976-1983

	1983	1982	1981	1980	1979	1978	1977	1976
Revenues [1]	30.69 [2]	54.38	43.47	19.72	31.44	27.69	30.34	26.77
Net Income [1]	3.95	1.32	1.60	0.21	0.64	0.48	0.38	0.16
Assets [1]	68.72	67.60	64.94	66.77	59.14	61.84	58.31	26.94
Stockholders' Equity	48.87	44.67	44.75	43.97	45.20	44.93	44.57	12.08
Earnings per share	$5.38	$1.80	$2.18	$0.28	$0.87	$0.67	$0.53	$0.21
Dividends paid per share	$1.50	$1.25	$0.75	$0.75	$0.50	-	-	-

[1] Figures shown are in $ millions.

[2] Revenues from continuing operations only.

Source: Compiled from NANA Regional Corporation, Inc. published Annual Reports.

Overall net earnings for NANA during YE1983 were approximately $3.95 million, based on operating revenues totaling some $30.68 million. The company's major sources of income beyond operating revenues included approximately $2.25 million in interest income, $988 thousand in resource revenues received from other regions under ANCSA, and a $380 thousand tax benefit representing a net operating loss carry forward from the year before.

Regarding NANA's joint venture operations, the company earned a total of $1.79 million on revenues of $117 million in YE 1983. This represents NANA's total allocable share of earnings across all of its joint ventures, based on the company's combined equity investments of approximately $9.06 million.

e. Sources and Uses of Funds

Analysis of the sources and uses of NANA corporate funds over the past four years, based on the company's balance sheets for the period YE1980-YE1983, primarily shows two general trends. One, already described, is the steady expansion of NANA's overall base of operations (including assets, revenues and profits) as company activities increased. The second, which appears to indicate an emerging priority of the corporation, is the increasing proportion of corporate resources devoted to the sponsorship of joint ventures. Specifically, from YE1979 through YE1983, NANA increased its commitment to joint ventures from approximately $2.6 million to $9.06 million, representing an increase in the proportion of total corporate assets pledged to such ventures from some 4.4% in YE1979 to over 13% during YE1983. (See Table B-4)

TABLE B-4

NANA REGIONAL CORPORATION, INC.
JOINT VENTURE INVESTMENTS, 1979-1983

Year Ending June 30:	Joint Venture Investments	Total Assets	Per cent of Total Assets
1979	$2,624,354	$59,139,664	4.4%
1980	3,653,895	66,768,938	5.5
1981	4,311,939	64,939,741	6.6
1982	5,947,541	67,604,133	8.8
1983	9,058,137	68,721,063	13.2

Source: Office of Management and Budget, State of Alaska (based on NANA Regional Corporation, Inc., Annual Reports, 1980-1983.)

CONCLUSION

Overall, NANA appears to be a solvent and increasingly profitable corporation. Its growing involvement in joint business ventures within the northwest Alaska area indicates a marked attempt to provide both general economic and long-term employment benefits to residents of the region. NANA's participation with Cominco-American, Inc., to develop the Red Dog Mine appears in these respects consistent with the purposes and past activities of the corporation.

FOOTNOTES

1 NANA Regional Corporation, Inc., NANA Regional Corporation Inc., and Subsidiary Consolidated Financial Statements: June 30, 1983 and 1982: September 30, 1983. (Hereafter cited as NANA Financial Statements.) Estimate of shareholders based on comparison of stockholders equity data shown in consolidated balance sheets with information given in Note (1) of consolidated statements.

2 Based on 1980 U.S. Census data and Alaska Department of Community and Regional Affairs 1983 population estimates for the NANA Region.

3 Figures for cash and land distribution and entitlements are from NANA Financial Statements, Note (1).

4 NANA Financial Statements, Note (1).

5 Public Law 92-203, Alaska Native Claims Settlement Act of 1971, Sections No. 7(i), (j).

6 NANA Financial Statements, Note (1).

7 Consolidated Statement of Earnings, NANA Financial Statements.

C. DIRECT AND INDIRECT ECONOMIC IMPACTS WITHIN THE STATE OF ALASKA

INTRODUCTION

This analysis estimates the direct and indirect economic impacts which are likely to occur within Alaska due to the development of the Red Dog Mine, located in northwest Alaska near Kotzebue.

1. PRINCIPAL ASSUMPTIONS

The principal characteristic of the Red Dog Mine project is that its scope and scale, as a whole, depend on the successful merging of the joint goals of Cominco-American, Inc. (Cominco), and the NANA Regional Corporation, Inc. (NANA). It is important to note in this regard that these parameters, the project's ultimate scope and scale, are not fixed at the present time. According to the project sponsors, these items will be fixed only after a joint agreement is reached between Cominco and NANA regarding the project's feasibility. The sponsors expect this agreement to be reached within the next several months.

Until agreement is reached, it appears that NANA will have a greater influence than Cominco in determining the ultimate size of the mining operation and its attendant work force.[1] NANA specifically sought this provision in its contractual agreement with Cominco, for two reasons.[2] One was to guarantee that the project could not become so large that its work force requirements might result in the employment of an excessive number of people from outside of the NANA region. The other reason was to allow NANA to attain its primary goal in supporting the project, which is to extend the project's employment benefits over the longest time possible by avoiding rapid depletion of the Red Dog Mine resources.[3]

In view of this arrangement, it seems reasonable to assume that the pace and scale at which Red Dog Mine development is set (in the future feasibility agreement) will be highly subject to NANA's perceptions between now and then as to how well the project appears to be meeting NANA's expectations and long-term objectives. It is worth noting that this is quite different from a conventional business arrangement, where market and profit considerations normally are paramount. In the present case, however, the determining factors for NANA would appear to be considerations such as: (a) the extent to which vocational training efforts are likely to be successful in increasing regional residents' participation in the mine work force, both in terms of the number of NANA-region residents employed at the mine, as well as in terms of the number and type of higher-paying positions obtained; (b) the extent to which regional residents' employment at the mine appears likely to mesh acceptably with established regional subsistence patterns and lifestyles; (c) the extent to which adverse social and economic impacts deriving from the project are likely to be mitigated or avoided within the region; and, (d) the extent to which NANA's general long-term goals are likely to be accommodated by an agreement on project scope and scale which, once set, will become binding.

If NANA perceives that these concerns are likely to be met, it would seem reasonable to assume that the feasibility agreement between NANA and Cominco will set Red Dog Mine operations generally at the scale and along the timeframes projected currently by Cominco. Should there be any perception, however, that these concerns may be addressed in anything but the most successful fashion, it would seem equally reasonable to assume that development of the project may entail both a smaller scale and a more elongated timeframe than is currently projected. It is thus worth emphasizing that, at the present time, there is no firm basis for assuming that everything will go exactly as planned or hoped by NANA and Cominco--i.e., that the most successful scenario should be assumed.

In view of this, prudence would seem to require taking a somewhat conservative view of the project's scale over the long term. This analysis, consequently, assumes that Cominco's projection of total mine employment at 420 full-time equivalent (FTE) jobs is optimistic, and that a range of 350-400 FTE jobs over the life of the mine incorporates more reasonably the uncertainties described above.

A similar prudence would also seem to require acknowledging that, because there are no employment guarantees in the sponsors' contractual agreement, no adequate basis is available at present for assuming a maximum participation rate for NANA regional residents in the project's long-term work force. On this basis, therefore, the analysis assumes that regional residents are unlikely to obtain less than 50% of the total FTE mine jobs available over the life of the mine, and are likely to obtain a reasonable maximum of approximately 75% (with an indeterminate but limited probability that their participation rate might become higher over the years.

2. EMPLOYMENT

Direct employment associated with the Red Dog project will comprise the total number of jobs at the mine site, as well as eight company jobs available at the project's accounting and data processing office in Anchorage. Additional jobs will be created through the indirect employment effects of company expenditures for services and supplies, and of mine employees' spending when off site. Secondary employment, in turn, will be created through the expenditures of the employees (and their families) who take these indirectly created new jobs, the mine jobs, and the mine office jobs in Anchorage.

a. Direct Employment (Annual)

Employment at the Red Dog Mine site is planned to occur in three phases. The construction phase (including related pre-construction activities) is scheduled for the period July 1, 1985, to December 31, 1987. The initial production phase begins at start-up of the mine's operations on or about January 1, 1988, and is planned to continue through December 31, 1992. A full production phase starting on or about January 1, 1993, is thereafter planned as a steady-state operation continuing throughout the mine's estimated life of forty years.

In view of the preponderance of the full production phase (35 of the 40 years) in determining the economic benefits of the mine, this analysis focuses only on the Construction Phase (CP) and the Full Production Phase (FPP). (The fact that the weighted average for total employment over the forty years is within five jobs of Cominco's estimate of the full production phase total employment level confirms that this approach is reasonable.)

Cominco estimates that construction of the mine will provide 10-250 jobs at varying points within the Construction Phase. Inspection of Cominco's project charts shows that the manpower projections and timeframes underlying this range represent 143 full time equivalent (FTE) jobs for the period. Since this appears reasonable, and as no other estimates have been made, 143 jobs has been accepted as the total employment during this phase.

Three estimates have been used for the likely NANA-region resident participation rate in the Construction Phase work force: 33%, 43% and 45%.[4] Since two of them appear to be Cominco estimates, and the third an extrapolation therefrom, none is viewed as superior. Consequently, this analysis assumes that the average of the three estimates, or approximately 40%, represents the proportion of the Construction Phase jobs that will be obtained by NANA-region residents.

Cominco estimates that the mine's accounting and data processing office in Anchorage will employ eight people during the Full Production Phase of the mine's life. These include a controller, paymaster-senior accounting clerk, accountant, purchasing agent, buyer-expediter, data processing supervisor, data entry clerk, and clerk typist. This estimate of eight employees has been accepted in the analysis.

range of 350-400 FTE jobs over the life of the mine incorporates more reasonably the uncertainties described above.

A similar prudence would also seem to require acknowledging that, because there are no employment guarantees in the sponsors' contractual agreement, no adequate basis is available at present for assuming a maximum participation rate for NANA regional residents in the project's long-term work force. On this basis, therefore, the analysis assumes that regional residents are unlikely to obtain less than 50% of the total FTE mine jobs available over the life of the mine, and are likely to obtain a reasonable maximum of approximately 75% (with an indeterminate but limited probability that their participation rate might become higher over the years.

2. EMPLOYMENT

Direct employment associated with the Red Dog project will comprise the total number of jobs at the mine site, as well as eight company jobs available at the project's accounting and data processing office in Anchorage. Additional jobs will be created through the indirect employment effects of company expenditures for services and supplies, and of mine employees' spending when off site. Secondary employment, in turn, will be created through the expenditures of the employees (and their families) who take these indirectly created new jobs, the mine jobs, and the mine office jobs in Anchorage.

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In view of the preponderance of the full production phase (35 of the 40 years) in determining the economic benefits of the mine, this analysis focuses only on the Construction Phase (CP) and the Full Production Phase (FPP). (The fact that the weighted average for total employment over the forty years is within five jobs of Cominco's estimate of the full production phase total employment level confirms that this approach is reasonable.)

Cominco estimates that construction of the mine will provide 10-250 jobs at varying points within the Construction Phase. Inspection of Cominco's project charts shows that the manpower projections and timeframes underlying this range represent 143 full time equivalent (FTE) jobs for the period. Since this appears reasonable, and as no other estimates have been made, 143 jobs has been accepted as the total employment during this phase.

Three estimates have been used for the likely NANA-region resident participation rate in the Construction Phase work force: 33%, 43% and 45%.[4] Since two of them appear to be Cominco estimates, and the third an extrapolation therefrom, none is viewed as superior. Consequently, this analysis assumes that the average of the three estimates, or approximately 40%, represents the proportion of the Construction Phase jobs that will be obtained by NANA-region residents.

Cominco estimates th' . the mine's accounting and data processing office in Anchorage will employ eight people during the Full Production Phase of the mine's life. These include a controller, paymaster-senior accounting clerk, accountant, purchasing agent, buyer-expediter, data processing supervisor, data entry clerk, and clerk typist. This estimate of eight employees has been accepted in the analysis.

The following assumptions govern the annual direct employment estimates made in this report:

(1) total mine employment during the Construction Phase (CP) of the project will be 143 jobs (FTE);

(2) approximately 40% of those jobs will go to NANA-region residents;

(3) total mine employment during the Full Production Phase (FPP) of the project will be between 350 and 400 jobs (FTE);

(4) approximately 50% to 75% of these jobs will go to NANA-region residents;

(5) NANA-region residents will receive mine jobs in direct proportion to their populational distribution within the region; i.e., 46% will be residents of Kotzebue and 54% will be residents of the other ten communities within the region, distributed on a pro rata basis;[5] and,

(6) during both phases of the mine operation, mine employees who are not NANA-region residents will comprise the following: 40% of them will be from the Anchorage area, 40% of them will be from other parts of Alaska, and 20% of them will be from outside Alaska. (Thus, during both phases, 10%-20% of the total mine work force will be from the Anchorage area, another 10%-20% of the total mine work force will be from other parts of Alaska, and 5%-10% of the total mine work force will be from outside of Alaska.) It is assumed that all of these out-of-state mine employees will move to the Anchorage area.

Based on these assumptions, the estimated direct annual employment from the Red Dog Mine project is shown in Table C-1, below. (See Table C-1.)

TABLE C-1

RED DOG MINE

ESTIMATED DIRECT ANNUAL EMPLOYMENT

	Participation Rate		Number of Jobs Per Phase (FTE)			
	CP%	FPP%	CP	FPP@350	FPP@400	Average of FPP Range Mid-Points
NANA Region	40%	50-75%	57	175-263	200-300	235
Anchorage**	24	10-20	35	35-70	40-80	56
Other Alaska	24	10-20	34	35-70	40-80	56
Out of State	12	5-10	17	17-35	20-40	28
TOTALS:	100%	100%	1[illegible]3	350	400	375

CP = Construction Phase
FPP = Full Production Phase (@ total work force level indicated)

* Kotzebue proportion of totals shown = 46%.
** Does not include personnel at financial office in Anchorage.

Source: Office of Management and Budget, State of Alaska

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Direct annual employment estimates for the Red Dog project during the Construction Phase (CP) can therefore be summarized as follows:

- total mine employment will be approximately 143 employees;

- approximately 57 NANA-region residents will be employed, 26 (46%) of whom probably will be from Kotzebue and 31 (54%) of whom probably will be village residents;

- approximately 69 residents of other locations in Alaska will be employed, 35 of whom probably will be from the Anchorage area; and,

- approximately 17 mine employees will be hired from outside of Alaska.

Direct annual employment estimates for the Red Dog project during the Full Production Phase (FPP) can therefore similarly be summarized as follows:

- total mine employment probably will range between 350-400 employees;

- approximately 235 NANA-region residents will be employed, 108 (46%) of whom probably will be from Kotzebue and 127 (54%) of whom probably will be village residents;

- approximately 112 residents of other locations in Alaska will be employed, 56 of whom probably will be from the Anchorage area;

- additionally, 8 employees will be hired at the project's financial office in Anchorage; and,

- approximately 28 mine employees will be hired from outside of Alaska.

b. Indirect and Secondary Employment (Annual)

Indirect and secondary employment will be generated in several different locations by the direct employment at the Red Dog Mine. The locations and causes of these additional jobs are summarized in Figure C-1 below. (See Figure C-1.)

Certain assumptions were used to estimate the magnitude and distribution of indirect and secondary employment from the mine. These assumptions include the following:

(1) mine employees who are not residents of the NANA Region will commute directly between the mine and Anchorage (as stipulated in the Cominco/NANA agreement), and therefore will not impact Kotzebue or the regional villages;

(2) regional-resident mine employees will be hired proportionately from locations within the NANA Region; i.e., 46% from Kotzebue, and 54% from the region's villages;

(3) 50% of the village-resident mine employees will each spend an average of $500 per month in Kotzebue for purchases and recreation;

(4) local residents will take 50% of all new jobs created locally by the mine's effects, except in NANA-Region villages where the percentage will be 75%;

(5) 50% of local residents hired for newly created local jobs will have been unemployed prior to hiring;

(6) within the NANA Region, residents hired for local jobs who were previously unemployed probably will not be replaced by unemployed in-migrants (i.e., there will be a tangible effect on local unemployment rates in the region);

FIGURE C-1

RED DOG MINE
INDIRECT AND SECONDARY EMPLOYMENT
SOURCES AND DISTRIBUTION

Location	Jobs: Indirect	Jobs: Secondary	Cause of Jobs
Kotzebue	X		spending of village-resident mine employees in Kotzebue during two weeks off from mine
		X	spending of employees (and their families) who take new indirect jobs, above
		X	spending of Kotzebue-resident mine employees (and their families)
Villages		X	spending of village-resident mine employees and their families), adjusted for Kotzebue spending
Anchorage	X		Cominco expenditures for mine resupply
		X	spending of employees (and their families) who take new indirect jobs, above
		X	spending of 8 Cominco-office employees (and their families)
		X	spending of Anchorage-resident mine employees (and their families) including those hired from outside of Alaska who relocate to the Anchorage area
Other Alaska		X	spending of other Alaska mine employees (and their families) across the State
Out of State		X	spending of out of State employees (and their families) outside of Alaska

(7) outside the NANA Region, residents hired for local jobs who were previously unemployed probably will be replaced by unemployed in-migrants (i.e., there will be little or no effect on local unemployment rates);

(8) during both phases of the project, mine employees hired from outside of Alaska will move to the Anchorage area; only during the Full Production Phase, however, will their families accompany them.

(9) 25% of local residents' spending will go toward wages and salaries in generating new indirect jobs; for Cominco expenditures the percentage will be 50%; every $25,000 so generated will create one additional indirect job.

(10) job multipliers for the Construction Phase (CP) and the Full Production Phase (FPP) are assumed as follows:[6]

	CP	FPP
NANA Region	0.4	0.45
Anchorage	1.0	1.0
Other Alaska	0.5	0.5

(11) the statewide population multiplier is assumed to be 2.1 new residents per new employee hired.

On the basis of these assumptions, the number and distribution of jobs likely to be created by the project through indirect and secondary employment effects is estimated as shown in Table C-2, below. (See Table C-2.)

It should be noted that Table C-2 does not include any indirect or secondary employment effects resulting from Cominco annual supply

TABLE C-2

RED DOG MINE
ESTIMATED INDIRECT AND SECONDARY ANNUAL EMPLOYMENT
TOTAL NUMBER OF JOBS

	CP	FPP@350*	FPP@400*	Average of FPP Range Mid-Point
Kotzebue	12	40-60	46-69	54
Villages**	11	38-58	44-66	52
Anchorage***	52	60-113	68-128	92
Other AK.****	17	18-35	20-40	28
TOTALS:	92	156-266	178-303	226

CP = Construction Phase
FPP= Full Production Phase (@ total work force level indicated)

* Ranges shown indicate number of jobs if NANA proportion of total work force = 50% - 75%.

** Indirect and secondary job totals shown during FPP reflect a 9.4% reduction to offset spending in Kotzebue by 50% of village residents ($500 per month X 12 months X 0.5/$32,000 = 9.4%).

*** Includes 8 personnel at Cominco office in Anchorage during FPP.

**** Distributed across the State.

Source: Office of Management and Budget, State of Alaska

expenditures, as those expenditures have not been estimated by the company. (Under the NANA/Cominco agreement, long-term resupply for the mine will occur via the proposed port facility and short-term supplies will be purchased in Anchorage.) Under the assumptions made here, however, it can be estimated that every $1 million (1983 dollars) of annual Cominco expenditures made in Anchorage will create 20 indirect jobs and 20 secondary jobs, or a total of 40 new jobs in the Anchorage area.

Indirect and secondary employment effects within Alaska of the Red Dog Mine operation during the Construction Phase (CP) of the project can therefore be summarized as follows:

- total indirect and secondary employment generated in Alaska by the project will be approximately 92 jobs;
- approximately 23 (25%) of those jobs will be in the NANA Region, divided almost equally between Kotzebue and the other regional communities; and,
- approximately 69 (75%) of those jobs will be in other communities in Alaska, including 52 (57%) in the Anchorage area and 17 (18%) distributed among other Alaskan communities.

The indirect and secondary employment effects of the mine during the Full Production Phase (FPP) can therefore similarly be summarized as follows:

- total indirect and secondary employment generated in Alaska by the project will be approximately 226 jobs;
- approximately 106 (47%) of those jobs will be in the NANA Region, divided almost equally between Kotzebue and other regional communities;

- approximately 120 (53%) of those jobs will be in other communities in Alaska, including 92 (41%) in the Anchorage area and 28 (12%) distributed among other Alaskan communities; and,

- for every $1 million (in 1983 dollars) that Cominco spends in Anchorage to resupply the mine, approximately 40 additional indirect and secondary jobs will be created in the Anchorage area.

3. INCOME

Direct income will be generated by the Red Dog Mine in the form of wages and salaries paid by Cominco to the mine employees. The indirect and secondary jobs created by the project also will generate new income, in the form of wages and salaries received by the employees who take those new jobs. This section of the report estimates the magnitude and distribution of these new income gains within the State of Alaska.

a. Direct Income (Annual)

Cominco originally estimated that it would pay mine employees through annual gross payrolls of approximately $23 million in 1983 dollars during the mine's Construction Phase (CP) and $13.5 million in 1983 dollars during the Full Production Phase (FPP). Later, Cominco apparently revised its total work force estimate for the project; no revision was available, however, for the company's annual gross payroll estimate.

This analysis, consequently, estimates annual direct income on the basis of pro rata adjustments to Cominco's earlier payroll estimates, using the following assumptions:

(1) the average annual gross payroll for mine employees during the Construction Phase (CP) will be less than $23 million by an amount proportional to Cominco's revised (FTE) estimate of total

work force employment for this phase; therefore, average annual gross payroll for the phase will be approximately (143/372 X $23 million =) $8.84 million; and,

(2) the average annual gross payroll for mine employees during the Full Production Phase (FPP) will similarly be less than $13.5 million by an amount proportional to this analysis' estimate of total work force employment for this phase; therefore, average annual gross payroll for the phase will be approximately (350/420 X $13.5 million =) $11.25 million if the total work force is 350 employees, or approximately (400/420 X $13.5 million =) $12.86 million if the total work force is 400 employees.

Based on these assumptions, the direct annual income from the Red Dog Mine project (excluding the eight employees at the Company's financial office in Anchorage) is estimated as shown in Table C-3. (See Table C-3.)

Direct annual income estimates for the Red Dog project during the Construction Phase (CP) can therefore be summarized as follows:

- total annual direct income will be approximately $8.84 million in 1983 dollars;

- NANA-Region residents will receive approximately $3.54 million (40%) of this total, with approximately 46% ($1.63 million) of that going to Kotzebue residents and 54% ($1.91 million) to residents of other NANA Region communities;

- residents of other Alaskan communities will receive approximately $4.24 million (48%) of the $8.84 million, divided nearly equally between residents of the Anchorage area and residents of other communities in the State; and,

- mine employees hired from outside of Alaska will receive approximately $1.06 million (12%) of the total $8.84 million.

Direct annual income estimates for the mine's Full Production Phase (FPP) can therefore be similarly summarized as follows:

- total annual direct income will range between $11.25 million and $12.86 million in 1983 dollars (with a mid-point of $12.06 million);

  NANA-region residents will receive approximately $7.54 million (62.5%) of this total, with approximately 46% ($3.47 million) of that going to Kotzebue residents and 54% ($4.07 million) to residents of other NANA-Region communities;

- residents of other Alaskan communities will receive approximately $3.62 million (30%) of this total, divided nearly equally between residents of the Anchorage area and residents of other communities in the State;

- if the 8 employees at the mine's Anchorage office receive $35,000 per year, this would represent an additional $280,000 in direct annual income for residents of the Anchorage area; and,

- mine employees hired from outside of Alaska will receive approximately $900,000 (7.5%) of the total annual direct income generated by the mine.

TABLE C-3

RED DOG MINE
ESTIMATED DIRECT ANNUAL INCOME
(Millions--1983 Dollars)

	Participation Rate CP%	Participation Rate FPP%	CP	FPP@350	FPP@ 400	Average of FPP Range Mid-Points
NANA Region*	40%	50-75%	$3.54	$5.63-8.44	$6.43-9.65	$ 7.54
Anchorage**	24	10-20	2.12	1.13-2.25	1.29-2.57	1.81
Other Alaska	24	10-20	2.12	1.12-2.25	1.29-2.57	1.81
*** Out of State	12	5-10	1.06	0.56-1.12	0.64-1.29	0.90
TOTALS:	100%	100%	$8.84	$ 11.25	$ 12.86	$12.06
Average Annual Earnings Per Job:			$62,000	$32,000	$32,000	$32,000

CP = Construction Phase
FFP = Full Production Phase (@ total work force level indicated)

* Kotzebue Proportion of total shown = 46%.
** Does not include personnel at financial office in Anchorage.

*** Out of state employees who relocate to the Anchorage area.

Source: Office of Management and Budget, State of Alaska

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b. Indirect and Secondary Employment Income (Annual)

There is no convenient way to estimate the different wage levels and salaries received by Alaska employees in the various service and support industries. The annual income from the indirect and secondary jobs created in Alaska by the Red Dog Project has therefore been estimated on the basis of a fixed $25,000 per year for each such job created. The magnitude and distribution of these estimated income gains is shown in Table C-4. (See table C-4.)

TABLE C-4

RED DOG MINE
ESTIMATED ANNUAL INCOME
FROM INDIRECT AND SECONDARY EMPLOYMENT
(Millions--1983 Dollars)

	Jobs* During CP	Annual Income @$25K/Job	Jobs* During FPP (Avg.)	Annual Income @$25K/Job
Kotzebue	12	$ 0.3	54	$ 1.35
Villages	11	0.275	52	1.30
Anchorage**	52	1.30	92	2.30
Other AK***	17	0.425	28	0.70
TOTALS:	92	$ 2.30	226	$5.65

CP = Construction Phase
FPP = Full Production Phase (@ total work force of 350-400 employees)

* From Table C-2.
** Includes 8 personnel at Anchorage financial office.
*** Distributed across the State.

Source: Office of Management and Budget, State of Alaska

4. UNEMPLOYMENT IMPACTS

The Red Dog Mine project is expected to have a substantial effect on unemployment within the NANA region, due to the jobs made available through employment at the mine site. While the number of jobs likely to be obtained by regional residents can be estimated, however,it is not so clear what the effects of those jobs may mean in terms of regional unemployment levels. Many unemployed regional residents may be available for work, for example, but do not appear on the State's unemployment rolls. Also, some unemployed regional residents simply do not seek conventional forms of employment, preferring instead a traditional subsistence lifestyle. Identifying an overall regional "unemployment level" which would be "reduced" by the direct employment at the mine site, consequently, is complicated by the existence of these two groups of people. For this reason, and because of the time constraints surrounding preparation of this report, no estimate has been made of the unemployment impacts likely to be caused by the project's direct employment effects, other than to acknowledge that those impacts will likely be important. Given the assumptions made earlier, however, it is possible to estimate the unemployment impacts likely to occur because of the project's indirect and secondary employment effects.

Based on the assumptions made in Section "b." of this part of the report ("Indirect and Secondary Employment"), estimates have been made of the number and distribution of net unemployment reductions caused within Alaska by the indirect and secondary employment effects of Red Dog Project hiring. These estimates, representing numbers of local residents hired who previously were unemployed, are shown in Table C-5. (See Table C-5.)

TABLE C-5

RED DOG MINE
NET UNEMPLOYMENT REDUCTIONS
THROUGH INDIRECT AND SECONDARY EMPLOYMENT

	Number of Previously Unemp ,ed Residents Hirc uring:			
	CP	FPP@350	FPP@400	Average FPP Range Mid-Points
Kotzebue	5	14-21	17-25	19
Villages	7	24-35	28-41	32
Anchorage*	19	21-39	24-43	32
Other AK	7	7-13	8-14	10
TOTALS:	38	66-108	77-123	93

CP = Construction Phase
FPP = Full Production Phase (@ total work force level indicated)

* Includes 8 personnel at Anchorage Office.

Source: Office of Management and Budget, State of Alaska

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It should be noted that every $1 million spent by Cominco in Anchorage for short-term resupply of the mine is estimated to result in the hiring of an additional 14 Anchorage area residents (net) who previously were unemployed.

5. POPULATION IMPACTS

Because of the "enclave" nature of the Red Dog Mine project, population increases within the NANA region currently are expected to be limited to approximately 5%. The project sponsors also intend to emphasize the project's local hire aspect in their recruiting advertisements, which should further help to contain regional population growth. If regional population gains due to the project's direct employment effects were only 5%, however, this still would represent approximately 275 new residents in the region (5,500 population x .05), with roughly half of that growth likely to occur in Kotzebue and half in the region's other community.

Based on the assumptions made in Section "b." of this part of the report ("Indirect and Secondary Employment"), estimates have been made of the net increases in local populations caused within Alaska by the indirect and secondary employment effects of the Red Dog project. These estimates, which include net population increases due to new employees and their families, are shown in Table C-6. (See Table C-6.)

It should be noted that every $1 million spent by Cominco in Anchorage for short-term resupply of the mine is estimated to increase the Anchorage area population by an additional 55 people (net).

TABLE C-6

RED DOG MINE
NET LOCAL POPULATION INCREASES
DUE TO INDIRECT AND SECONDARY EMPLOYMENT

Net Population Gains During:

	CP	FPP@350	FPP@400	Average FPP Range Mid-Points
Kotzebue	15	55-82	61-92	72
Villages	8	29-48	38-52	42
Anchorage*	70	82-156	93-179	128
Other AK	21	23-46	25-55	36
TOTALS:	114	189-332	217-378	278

CP = Construction Phase
FPP = Full Production Phase (@ total work force level indicated)

* Includes 8 personnel at Anchorage Office.

Source: Office of Management and Budget, State of Alaska

6. REGIONAL SAVINGS IN SHIPPING COSTS

The sponsors of the Red Dog Mine project propose to use their ore-concentrate vessels to back-haul supplies of fuel and cargo to the NANA Region. These supplies would be lightered from the proposed port facility West of Noatak to Kotzebue, and then distributed to Kotzebue residents and to residents of other communities in the region. Execution of this operation would entail supplanting the shipping operation which currently provides this service to Kotzebue and regional residents, according to the project sponsors.

Cominco has estimated that this use of the port facility will save regional residents approximately $2.6 - $3.5 million a year in shipping costs, compared with the current method of shipping bulk cargo and fuel into the region. Such a level of savings would represent an annual savings of approximately $630 per regional resident, according to the estimate, or about 9% of the average regional resident's annual income.

Analysis shows this estimate to be reasonably made, although it does rest on several assumptions which are subject to change. One is that tax-exempt financing for the port facility can be obtained at 8% annual interest. A second is that no overtime expenses are incurred regarding labor costs. A third is that land for the port facility can be leased or purchased for no cost, other than an estimated $7,000 per year for land disturbance expenses A fourth is that cycle times for the port's operations will be maximally efficient and thus minimally expensive. A fifth is that shipping costs for bulk cargo and fuel will remain constant at present levels. A sixth is that the capital costs of the port facility itself will turn out to be as currently estimated.

Of these assumptions, only two could be assessed within the report's timeframe. These were the cost of tax-exempt financing, and the overtime cost for labor. After adjusting for these factors, however, and after correcting calculation errors in the estimate, only a slight difference from the original estimate was found. As an "outside" case, for example, the estimate was tested using the following assumptions: a 12% annual interest rate for financing, an overtime labor expense equalling 30% of payroll (for those labor categories likely to be affected), and imposition of a 5% import duty on bulk fuel delivered from Canada. Under these assumptions, the total annual savings in regional shipping costs would be approximately $2.3 million per year. This would represent an annual savings of approximately $418 per resident, or roughly 6% of the average regional resident's annual income.

Allowing for the other assumptions made in the Cominco estimate, therefore, an estimate of roughly $2 - $3 million saved annually would seem to be reasonable at this point.

7. SUMMARY OF FINDINGS

The principal findings of this analysis address the economic impacts which can be expected during the projected 40-year life of the proposed Red Dog Mine. These findings, based on the assumptions made, have resulted in the following overall estimates:

- total long-term mine employment probably will range between 350 and 400 full-time jobs;

- NANA-Region residents probably will obtain 50%-75% of those jobs, or approximately 220-250 jobs, with the total divided evenly between Kotzebue residents and residents of other communities in the region;

- the project probably will generate approximately 225 indirect and secondary jobs, of which approximately half (106 jobs) will be obtained by NANA-Region residents;

- approximately 92 of the indirect and secondary jobs generated by the project will be obtained by Anchorage area residents, with another 28 such jobs distributed among other Alaskan communities;

- for every $1 million that Cominco spends on supplies in Anchorage, approximately 40 additional new jobs will be created in the Anchorage area;

- total direct income generated by the mine probably will range betwee $11-$13 million per year in 1983 dollars, with NANA-Re_n residents obtaining between $7-$8 million of the total;

- residents of other parts of Alaska probably will receive approximately a third (30%) of the $11-$13 million in total annual income, divided approximately evenly between Anchorage area residents and those of other Alaskan communities;

- indirect and secondary employment deriving from the mine's effects probably will produce some $5.7 million in total annual income, of which approximately half ($2.65 million) will be received by NANA-Region residents;

- the project's indirect and secondary employment effects will cause a modest drop in local unemployment levels, causing approximately 50 previously unemployed persons to be hired within the NANA Region and an additional 30-60 persons across the rest of the State; and,

- local population increases due to the mine project's indirect and secondary employment effects probably also will be modest, totaling approximately 280 new residents and dependents across the State, but may have significant local consequences within the NANA Region (e.g., approximately 70 new residents in Kotzebue).

FOOTNOTES

1 Letter from Don Argetsinger, Vice President of NANA Development Corporation, to John Sims, Director of the Office of Mineral Development, State of Alaska, Dated November 11, 1983.

2 Ibid.

3 Ibid.

4 Estimates are by Cominco-American, Inc., Alaska Department of Community and Regional Affairs, and Kevin Waring and Associates, respectively.

5 Based on 1982 regional population estimates made in 1983 by the Alaska Department of Labor from U.S. Census data. Estimate agrees with 1982 estimate made by the Department of Community and Regional Affairs in November, 1983.

6 Job multipliers shown for the NANA Region are averages of estimates made by Kevin Waring and Associates and the Alaska Department of Community and Regional Affairs in 1983.

D. FISCAL IMPACTS

INTRODUCTION

This analysis estimates the major fiscal impacts which the State of Alaska may experience as a result of the proposed Red Dog Mine project. The fiscal impacts estimated include the magnitude of tax revenues likely to be received by the State from the earnings and operations of the project, and the potential State expenditures for the project's infrastructure (an access road and a port facility). Other potential impacts noted include the effects of the project on the State's programming costs, and the effects of the project on local unemployment costs.

1. TAX IMPACTS

The principal State taxes applicable to the Red Dog operation, and therefore the greatest potential source of tax revenues to the State, are the mining license tax (MLT) and the corporate income tax (CIT). A third tax applicable to the project is the State's motor fuel tax (MFT), though it is not a major source of tax revenues for this particular project.

For an operation the size of the Red Dog project, the applicable mining license tax rate is $4,000 plus 7% of the taxpayer's net income in excess of $100,000. An exemption from tax payments is permitted for the first three and one-half years of a new mine's operation, as is a specific depletion allowance, depending on the particular resource being extracted. In the case of the Red Dog mine, which is primarily a zinc and lead mine with associated silver ore, the applicable depletion allowance appears to be 15% (AS 43.650.010(e)(2)).

The applicable corporate income tax rate for the Red Dog mine operation is $4,500 plus 9.4% of the taxpayer's taxable income over $90,000. While calculation of this tax appears straightforward enough, however, a substantial complication arises in estimating corporate income tax payments because of the prolixities and uncertainties regarding the State's unitary tax formulas. (Alaska uses the traditional three-factor approach, which apportions a multi-state or multi-national corporation's sales, property values and salaries, and levys the tax on the proportion of those elements which are directly relatable to Alaska.) This is a particularly difficult constraint in the case of the Red Dog mine analysis, as the project sponsors have provided the only available estimate of their potential tax liability in Alaska, and this estimate has not been based on the unitary approach.

The State's motor fuel tax entails a levy of 2¢ per gallon for internal-combustion equipment which is used off-highway, and a levy of 8¢ per gallon for such equipment when used on roads. Because both the mining license tax and the corporate income tax are both net profits taxes, and therefore sensitive to taxpayers' reported earnings, a certain amount of uncertainty is involved in estimating future tax payments based on these instruments. In the case of the Red Dog operation, this necessitates a significant reliance on forecasts of future metals prices. This analysis, therefore, has used a range of 20-year average price forecasts for the Red Dog mine metals which has been provided by the Office of Minerals Development, Alaska Department of Commerce and Economic Development. These price forecasts, along with recent market prices for the Red Dog metals, are shown in Table D-1. (See Table D-1.)

Based on these forecasts, Cominco-American, Inc., has estimated that its annual tax amounts due to the State from the Red Dog Mine operation will be approximately as shown in Table D-2, below. (See Table D-2.)

TABLE D-1

PRINCIPAL METALS OF RED DOG MINE
TWENTY-YEAR AVERAGE PRICE FORECASTS

	Nov. 1983 Price (Appx.)	"Low" Avg. 20-Yr. Price	"Probable" Avg. 20-Yr. Price	"High" Avg. 20-Yr. Price
Zinc	49¢/lb.	55¢/lb.	60¢/lb	65¢/lb.
Lead	25¢/lb.	30¢/lb.	35¢/lb.	40¢/lb.
Silver	$9/Tr. oz.	$10/Tr. oz.	$18/Tr. oz.	$25/Tr. oz

Source: Department of Commerce and Economic Development, State of Alaska

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TABLE D-2

RED DOG MINE
COMINCO'S ESTIMATED AVERAGE ANNUAL TAX PAYMENTS
TO THE STATE*

(Millions--1983 Dollars)

Metal Price Forecast Scenario:	MLT	CIT	MFT	Average Total Taxes to State Per Year
"Low"	$4.09	$3.63	$0.13	$7.85
"Probable"	5.25	4.83	0.13	10.21
"High"	6.65	6.22	0.13	13.00

MLT=Mining License Tax
CIP=Corporate Income Tax
MFT=Motor Fuel Tax

*Over the first 20-25 years of the mine's life, approximately.

Source: Cominco-American, Inc. (Spokane, Washington)

As can be seen from Table D-2, Cominco-American, Inc., estimates that its tax payments to the State will average approximately $8 - $13 million per year (in 1983 dollars). Analysis of this estimate shows that the company's estimation procedure is consistent with current Alaska statues and provisions therein. Several factors should be kept in mind, however, as they will ultimately determine the actual amount of State taxes paid by Cominco-American. These include: (1) the State has not yet promulgated regulations regarding implementation of the mining license tax; (2) Cominco-American's tax estimates are based on a separate accounting method, whereas the method actually used could turn out to be the unitary tax basis; and (3) Cominco's corporate income tax liability was calculated without provision for any debt or interest costs in the base that are unrelated to a possible State loan.

A similar situation arises in attempting to assess the potential tax revenues which the State may receive from NANA Development Corporation (NANA) because of the project. Based on Cominco's projections of the royalties to be paid to NANA for the project, NANA's average annual tax payments to the State are estimated as shown in Table D-3, below. (See Table D-3.)

Table D-3 indicates that NANA may have a total State tax liability of approximately $1.4 - $3.2 million per year prior to 1991 (i.e., until its projected conversion from advance royalty payments from Cominco to net proceeds payments), and approximately $4 - $7 million per year thereafter, in 1983 dollars. In fact, NANA itself will pay a considerably lower amount of annual State taxes, as NANA representatives estimate that approximately 66% of NANA's total proceeds from the mine will be distributed to the other regional Native corporations in Alaska under section 7(i) and 7(j) of the Alaska Native Claims Settlement Act. The total amount of annual taxes received by the State should remain relatively unchanged, however, as State taxes on the distributed portion of NANA's proceeds should be recouped through tax payments from the other Native corporations.

TABLE D-3
NANA AVERAGE ANNUAL STATE TAX LIABILITY
BASED ON ROYALTIES RECEIVED

(Millions of 1983 Dollars)

	Average Annual Royalties	Average Annual CIT Due* (Begins In 1988)	Average Annual Net Proceeds Royalties	Average Annual MLT Due** (Begins In Mid-1991)	CIT and MLT Combined After 1991: Average Annual Taxes Due State During 1988-91	CIT and MLT Combined After 1991: Average Annual Taxes Due State After 1991
"Low"	$15.24	$1.43	$34.97	$2.44	$1.43	$3.87
"Probable"	25.11	2.36	48.57	3.39	2.36	5.75
"High"	33.78	3.18	58.88	4.12	3.18	7.30

CIT=Corporate Income Tax
MLT=Mining License Tax

*Payable on all royalties received over the life of the mine.
**Payable on all net proceeds royalties due (in addition to CIT).

Source: Office of Management and Budget, State of Alaska

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Several factors thus make assessment of the potential Red Dog Mine tax revenues somewhat uncertain at this point. The most important among these are the profit-based orientation of the two major tax instruments involved, the current absence of mining license tax regulations, and the as yet indeterminate effects of any unitary tax applications yet to come.

2. STATE INFRASTRUCTURE EXPENDITURES

Three financing scenarios have been discussed regarding possible State participation in the infrastructure costs for the Red Dog mine. One is the case where the State simply offers a flat grant in the amount of $135 million (1983 dollars) to build both the road ($83 million) and the port facility ($52 million). A second is the case where industrial development bond financing is provided for the project infrastructure, either through the Alaska Industrial Development Authority or through a regional resource development authority. A third is the case where the State extends a $135 million no-interest loan to Cominco for construction of the road and the port.

The first two cases require little elaboration, because the costs to the State are fairly clear. In the case of a direct grant, the cost to the State would be the full $135 million. In the case of revenue bonding, assuming the project would withstand the scrutiny of investors, the costs to the State would be limited to relatively small administrative costs incurred as handling costs for the bond issue.

The implications of a $135 million no-interest loan to Cominco, however, are not so clear. On the one hand, Cominco proposes to pay off the loan, yet still leave ownership of the road and port in the hands of the State. On the other hand, however, Cominco proposes that payback occur over a 20-year period which begins <u>after</u> a 10-year period of deferred payments. The potential cost implications of this scenario for the State should not be overlooked. Specifically, depending on how the State chooses to define its opportunity cost of capital (e.g., between 8% and 12%), and assuming overnight construction costs, the payback to the State from such a loan could be worth approximately $16-$30 million in present value. This would represent a direct State cost of approximately $105-$119 million dollars.

Table D-4, below, shows the present value to the State of a $135 million no-interest loan offered with varying periods of deferred payments. Also shown are the related direct State costs involved. As can be seen from Table D-4, State costs are not sensitive to varying deferment periods, as even with no deferment the direct State cost ($68 million in 1983 dollars) is still approximately half the cost of the original loan, or more. (See Table D-4.)

Table D-5, below, shows a broader range of options for State lending assistance to the Red dog project, and the associated direct costs to the State. It can be seen from the table that various combinations of shortening the $135 million loan's deferment period, and charging Cominco an interest rate commensurate with the State's own cost of capital, could significantly reduce the State's cost. Additionally, it might be possible to equate annual loan repayment amounts with the sum of the annual direct benefits received from the project. This latter approach might at least provide a basis for determining the loan level (or terms) which the State would be willing to offer to Cominco and NANA. (See Table D-5.)

3 STATEWIDE PROGRAM COSTS

Time constraints have prevented analysis of the potential increases in State program costs which might result from the effects of the Red Dog Mine project. However, it is possible to estimate broadly the likely magnitude and distribution of net local population increases due to the project's indirect and secondary employment effects. These estimated local population gains have been estimated as follows:

* approximately 70 new people will move into the Kotzebue area;

* approximately 40 new people (total) will move into the other ten NANA region villages.

* approximately 125-130 new people will move into the Anchorage area;

* Cominco supply expenditures could cause additional population gains in the Anchorage area, at the rate of approximately 55 new residents per $1 million spent locally; and

* approximately 40 new people (total) will move into other communities across the State.

4. STATEWIDE UNEMPLOYMENT COSTS

Time constraints have prevented analysis of the potential decreases in State unemployment costs which might result from the effects of the Red Dog Mine project. However, it is possible to estimate broadly the magnitude and distribution of net local unemployment reductions due to the project's indirect and secondary employment effects. These reductions have been estimated as follows:

* approximately 20 previously unemployed residents of Kotzebue will gain employment;

* approximately 30 previously unemployed residents (total) of the NANA region's other communities will gain employment;

* approximately 30 such individuals in Anchorage will gain employment;

TABLE D-4

COST TO THE STATE

OF NO-INTEREST LOAN OF $135 MILLION

WITH VARYING PAYBACK PERIODS*

(Millions--1983 Dollars)

Payback Deferment Options	Present Value to State of Payback @ OCC =			Direct State Costs (-NPV) OCC =		
	8%	10%	12%	8%	10%	12%
10 Years	$30	$22	$16	$105	$113	$119
5 Years	45	35	28	90	100	107
No Deferment	67	58	51	68	77	84

OCC = Opportunity cost of capital for the State.
-NPV = Negative net present value.

* Loan is to be paid back in equal installments over a 20-year period, with different deferment periods as shown.

NB: Estimates based on overnight construction costs, (i.e., initial loan is made at a single point in time, after which the deferment period or repayment period begins).

Source: Office of Management and Budget, State of Alaska

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TABLE D-5

REPAYMENT OPTIONS AND STATE COSTS FOR $135 MILLION LOAN
(1983 Dollars, In Millions)

REPAYMENT OPTIONS:

Interest Rate	Deferment	PV OF Payback	Direct Costs To State
0%	10 yr	$16-30	$105-119
	5 yr	28-45	90-107
	none	51-67	68-84
5%	10 yr	25-48	87-110
	5 yr	45-72	63-90
	none	81-107	28-54
8%	10 yr	31-61	74-104
	5 yr	57-91	44-78
	none	103-135	0-32
10%	10 yr	36-71	64-99
	5 yr	66-105	30-69
	none	0-118	0-17
12%	10 yr	41-80	55-94
	5 yr	75-120	15-60
	none	0-135	-0-

Source: Office of Management and Budget, State of Alaska

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* Cominco supply expenditures could cause additional employment of previously unemployed persons in the Anchorage area, at the rate of approximately 14 unemployed persons hired per $1 million spent locally; and,

* Approximately 10 such individuals (total) will gain employment in other Alaska communities.

E. COMINCO/NANA CONTRACTUAL AGREEMENT

The agreement appears to contain no provisions which would alter this report's assessment of the fiscal and economic impacts of the project.

F. EFFECTS ON STATE BONDING CAPACITY

Industrial development bonding, either through the Alaska Industrial Development Authority or through a yet-to-be structured regional resource development authority, is the only bonding option which has been discussed seriously to date for financing the Red Dog Mine infrastructure (the access road or the port facility). This approach, if undertaken, would essentially require the project sponsors to pledge Red Dog Project revenues toward repayment of any revenue bond financing obtained. As such, this financing method would not be "affordable" to the State only to the extent that it:

(1) increased the State's borrowing costs on other bond issues;
(2) saturated the national market for Alaska bonds; or,
(3) diluted the strength of the State's so-called "moral obligation pledge". None of these outcomes are regarded as likely.

Assuming that the Red Dog Project will be viewed as economically feasible by market investors, therefore, industrial development bonding for the project infrastructure should not in itself adversely affect the State of Alaska's overall bonding capacity.

G. SYNOPSIS

This synopsis presents the major findings of the Office of Management and Budget on the Red Dog Mine project.

Task 1 - Cominco Corporate Profile

- Cominco Ltd. is an established and sound company, with good overall prospects, and is backed by a large and reputable parent corporation.

- The company appears able to provide a solid corporate base for support and development of the Red Dog Mine project.

Task 2 - NANA Corporate Profile

- NANA Regional Corporation appears to be solvent and strongly oriented towards projects which offer long-term employment benefits to its shareholders (principally joint business ventures within northwest Alaska).

- The corporation's participation in the Red Dog Mine project appears consistent with its corporate purposes and past activities.

Task 3 - Direct and Indirect Economic Impacts

- No guarantee exists that the project sponsors' projected employment goals or local hire goals will be achieved.

- The project appears likely to create 350-400 permanent jobs at the mine site, constituting approximately $11-$13 million per year (1983 dollars) in total direct income.

- NANA region residents may obtain an estimated 220-250 (50%-75%) of the mine jobs, constituting approximately $7-$8 million per year (1983 dollars) in direct income for regional residents.

- The project may generate an estimated 225 additional jobs within the State due to indirect and secondary employment effects, constituting an estimated $5.7 million per year (1983 dollars) in additional income.

- NANA region residents may obtain an estimated 100-110 (47%) of these additional jobs, constituting approximately $2.7 million per year (1983 dollars) in additional income for regional residents.

- The project's indirect and secondary employment effects may cause approximately 50 previously unemployed persons to be hired within the NANA region, plus an additional 30-60 such persons elsewhere in the State (chiefly, in the Anchorage area).

- No basis is available at present for estimating the number of job-seeking in-migrants which the project might attract into the State, though the project sponsors will attempt to minimize such effects through advertising.

- Local population increases due to the project itself probably will be moderate, totaling an estimated 280 new residents (including dependents) across the State, exclusive of in-migration. These increases could have significant local consequences within the NANA region, however, (e.g., an estimated 70-75 new residents in Kotzebue, exclusive of in-migrants).

Task 4 - Fiscal Impacts

- The total amount of tax revenues that the State is likely to receive for the Red Dog Mine project has been estimated to be approximately $9 to $16 million per year during the years 1988 to 1991, and approximately $12 to $20 million per year after 1991 (in 1983 dollars). This estimate is reasonably made and is consistent with current Alaska tax statutes. It is necessarily speculative, however, due to the profits based nature of the taxes involved, the current absence of mining license tax regulations in Alaska and the possibility that the project sponsors' actual tax liability may be based on unitary taxation principles in the future.

- An interest-free loan to Cominco of $135 million (with a 10-year deferment of payments, to be followed by a 20-year repayment period), for construction of the mine access road and port facility, could represent a direct net cost to the State of approximately $100-$120 million (1983 dollars).

- Increases in State and local program costs due to project-caused population increases could be moderate, though not insignificant at the local level. Such costs would depend largely on the extent to which the project induced speculative in-migration into the State and into the NANA region.

Task 5 - Cominco/NANA Contractual Agreement

- The agreement appears to contain no provisions which would alter this report's assessment of the fiscal and economic impacts of the project

Task 6 - Effects on State Bonding Capacity

- Industrial development bond (revenue bond) financing of the project infrastructure, including the access road and the port facility, would not, in itself, adversely affect the State's bonding capacity.

VI. Report of the Department of Community and Regional Affairs

A. Examination of Regional Government Structure

B. Evaluation of Regional Socio-Economic Impacts

C. Regional Dependence on State and Federal Appropriations

D. Comments and Recommendations

E. Appendices

RED DOG ANALYSIS

Task Items C.1, 2, 3 and 4)

Department of Community and Regional Affairs

Municipal and Regional Assistance Division

February 21, 1984

I. TASK C-1: Examine the present and future relationship between the North Slope and project participants.

TASK C-2: Evaluate potential separation of mine properties from the North Slope Borough.

II. TASK C-3: Evaluate impact of the project on the region of influence with regard to labor, transfer payments, taxation, etc.

III. TASK C-4: Review the extent to which the economy of the region (NANA area of influence) is financed by State and federal appropriations.

IV. General Comments and Recommendations

Appendix A: list of analysis assumptions

Appendix B: results of Department of Community and Regional Affairs Developments Assessment Model (CRADAM) as applied to the Red Dog Mine and the community of Kotzebue.

Appendix C: Bibliography

I. TASK C-1 and 2: 1.) Examine the present and future relationship between the North Slope Borough and project participants (Cominco and NANA. 2.) Evaluate potential separation of mine properties from the North Slope Borough.

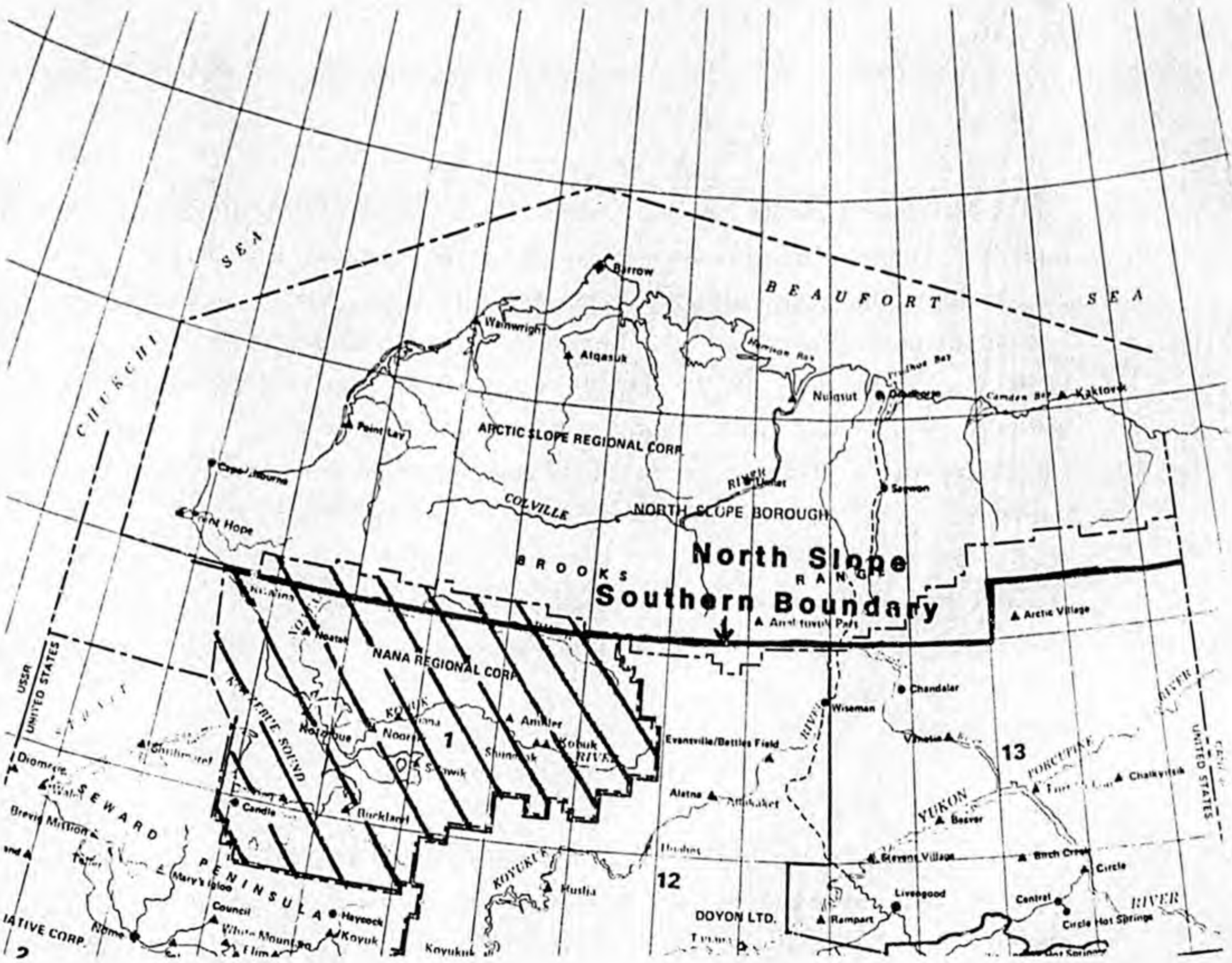
INTRODUCTION

The North Slope Borough encompasses the vast majority of the Arctic Slope Regional Corporation boundaries, and portions of the NANA and Doyon Ltd. regional corporation boundaries (see map 1). The NANA region is investigating the possibility of initiating the procedures for the incorporation of a borough coterminous with its corporation boundaries.

The section of the NANA region which is within the North Slope Borough boundaries contains a highly mineralized area. This mineralized territory includes the Red Dog Mine. It is essential to the formation of the NANA borough that it have the Red Dog Mine within its boundaries so as to provide an adequate economic base for the borough.

The Red Dog Mine and the surrounding NANA territory lying within the North Slope Borough has no population nor has it been assessed for Borough property taxes. The Borough Assessor visited the area this fall, but has not arrived at a tax assessment. This territory has not received any Borough services.

For the past year, representatives of the NANA Corporation have been discussing with the North Slope Borough the matter of detaching the portion of the NANA corporation territory remaining within the North Slope Borough. Up to this time a resolution of this issue has not been achieved between the two entities. It is the intention of the NANA Corporation to formally request that the North Slope Borough initiate detachment procedures for the territory in question at a November 30th meeting in Kotzebue.


BEAUFORT SEA
CHUKCHI SEA
Barrow
Wainwright
Atqasuk
Nuiqsut
Kaktovik
Point Lay
ARCTIC SLOPE REGIONAL CORP.
NORTH SLOPE BOROUGH
COLVILLE
BROOKS RANGE
North Slope
Southern Boundary
Arctic Village
NANA REGIONAL CORP.
Noatak
Ambler
Kobuk
Evansville/Bettles Field
Wiseman
Chandalar
1
12
13
DOYON LTD.
SEWARD PENINSULA
Buckland
Candle
Council
Nome
Koyuk
Beaver
Stevens Village
Livengood
Rampart
Birch Creek
Circle
Central
Circle Hot Springs
Chalkyitsik
USSR
UNITED STATES
Alatna
Huslia

MAP 1

The following narrative has two purposes. The first section gives a historical perspective on the creation of the North Slope Borough and the formation of the Arctic Slope Corporation and NANA boundaries. The second section explains the alternative procedures for the detachment of that portion of the NANA region remaining within the North Slope Borough.

HISTORICAL PERSPECTIVE

In Inupiat people of the Arctic Slope and NANA Region have inhabited Alaska for thousands of years. Throughout this vast homeland, Inupiat language and lifestyles are remarkably similar. Flexibility and adaptability have been the keystones to the Inupiat success in this harsh region. Their social organization promoted cooperative effort and community sharing, and this, combined with mobility, adaptability regarding diet, and sophisticated techniques of travel, hunting, and survival, produced enduring cultural traits that persist in modified form to the present day. It is this sense of cooperation that has fostered the current negotiations between the NANA region and the North Slope Borough over the detachment of the Red Dog Mine area from the North Slope Borough.

North Slope Borough

A petition proposing the incorporation of a first class North Slope Borough was received by the Local Affairs Agency on April 4, 1971. On May 7, 1971, the agency notified the representative of the petitioners - the Arctic Slope Native Association - that the petition was accepted. The Commission conducted a public hearing on the petition in Barrow on December 2, 1971. The Commission approved the petition on February 25, 1972. Following the Commission's decision, an election was conducted, resulting in the incorporation of the North Slope Borough on July 1, 1972.

In arriving at the decision to approve the petition to incorporate the North Slope Borough, the Local Boundary Commission identified the territory which would meet the standards for borough formation. The Commission found that the boundaries of the proposed organized borough conformed generally to the natural geography of the area proposed for incorporation.

The North Slope Borough petitioners proposed the incorporation of the entirety of a geographically distinct area of the State approximately bounded on the north and west by the Arctic Ocean, Beaufort and Chukchi Seas, on the south by the mountains cresting the Brooks Range. The most easterly boundary observes the State of Alaska-United States of American/Yukon Territory-Canada border.

The southerly boundary more precisely follows latitude 68°00'N from the State of Alaska Chukchi Sea boundary in an easterly direction to the point of intersection with longitude 146°00'W. At this point, the proposed boundary is extended northerly to its intersection with latitude 68°30'N from which point it follows latitude 68°30'N in an easterly direction to the State of Alaska/Canada border.

In rendering its decision, the Commission was further aware that the Congress of the United States, in the Alaska Native Claims Settlement Act of 1971 (Public Law 92-203), had required the Secretary of the Interior to form Regional Corporation in Alaska whose boundaries conformed to those of the existing Native Associations, that Congress had designated the Arctic Slope Native Association, and had characterized it as "Point Hope-Barrow," and that, in fact, the Arctic Slope Native Association did embrace the area comprehended by the petition, with the relevant provision of the Act, providing as follows:

> "For purposes of this Act, the State of Alaska shall be divided by the Secretary within one year after the date of enactment at this Act into twelve geographic region, which each region composed as far as practicable of Natives having a common heritage and sharing common interests. In the absence of good cause shown to the contrary, such regions shall approximate the areas covered by the operations of the following existing Native Associations."

On July 1, 1972, the North Slope Borough became the regional government for the entire Alaska Arctic region, with an elected mayor (three year term), a seven member assembly, and a seven member school board. As home rule borough, it has assumed all legislative powers not prohibited by State law and allowed by its charter. Mandatory powers are: taxation, education; and planning, platting and zoning. The following powers were transferred to the Borough in an April 1974 election; 1) streets and sidewalks; 2) sewers and sewage treatment; 3) water course and flood control facilities; 4) health services and hospital facilities; 5) telephone systems; 6) light, power and heating utilities; 7) transportation systems; 8) water; 9) libraries; 10) garbage and solid waste collection and disposal services and facilities; 11) housing and urban renewal, rehabilitation, and development; 12) preservation, protection and maintenance of historical sites, buildings and monuments. Areawide police powers were transferred to the Borough in a July 1976 election.

Regional Corporation Boundaries

As previously noted, Sec. 7(a) of the Alaska Native Claims Settlement Act states that within one year of the date of enactment of the act, that the Secretary of the Interior would divide the State of Alaska into twelve geographic regions. Each region was to be composed of Natives having a common heritage and sharing common interests. This section of the Act continues to identify the twelve regional Native associations the geographic regions are to follow. The Arctic Slope Native Association (Barrow, Point Hope) and the Northwest Alaska Native Association (Kotzebue) regions are specifically identified.

The formation of the regional corporation's boundaries was not completed until the end of 1972. During the time that the regional boundaries were being defined, the North Slope Borough was incorporated. Consequently, the incorporation of the Borough prior to the establishing of the corporation boundaries resulted in the inclusion of the Red Dog Mine territory within the North Slope Borough boundaries.

It was not clear until the creation of the regional boundaries was completed whether the community of Point Hope and the lands in the vicinity of Point Hope would be in the NANA or Arctic Slope regions. An election conducted in Point Hope settled the issue, as residents voted to be part of the Arctic Slope Region.

DETACHMENT PROCESS

As previously stated, the northern portion of the NANA region is within the North Slope Borough. Unless this territory is detached from the Borough, it is doubtful that the NANA region will have a sufficient economic base from which to finance the management of a borough government. The following section examines the process by which the territory can be detached from the North Slope Borough.

Detachment Process

There are two alternative approaches to initiating a detachment petition. The first approach (local action) initiates a petition that would be presented, if approved by the Local Boundary Commission (Commission), for a vote by the residents of the territory proposed for detachment. A simple majority would effect the detachment. As there are no residents in the northern section of the NANA region to be detached from the North Slope Borough, the local action process is not an alternative.

The second approach (legislative review) requires the petition to be presented, if approved by the Commission, to the Alaska Legislature for its final approval. However, both types of petition have a limited number of ways in which they can be initiated. In 19 AAC 10.470, it stated that a petition may be initiated by:

1. The governing body of a municipality whose boundaries are to be changed;

2. The governing body of an organized borough in which the territory is located;

3. At least 10 percent of the registered voters residing in the territory to be annexed or detached, in the municipality to be dissolved, or in each municipality emerged or consolidated;

4. The Commissioner.

The first and second means of initiating a detachment petition are both applicable to the North Slope Borough as it is the municipality whose boundaries are to be changed. The third means of initiating a detachment petition is not applicable in the detachment of the Red Dog Mine territory as there are no residents in the territory proposed for detachment. Consequently, the detachment process must be initiated either by the North Slope Borough or the Commissioner of the Department of Community and Regional Affairs.

Legislative Review Process

The legislative review process has established procedures for initiating and conducting a detachment (19 AAC 10.450-.620). The following describes the process:

Department Review

In accordance with 19 AAC 10.520, the Department must review the petition and brief to determine that they are substantially in proper form and contain the factual information required. If the Department determines that the petition and brief are sufficient, the petition will be submitted to the Local Boundary Commission. In addition, the Department prepares a report to the Commission on the proposed action.

Commission Review

Upon receipt of the petition from the Department, the Commission will establish a time and place for public hearing(s) concerning the proposed boundary change. The public hearing would be held in or near the territory proposed for detachment. In this instance, public hearings might be held in both the North Slope Borough and the NANA region. In accordance with 19 AAC 10.225-.250, the Commission will review the detachment petition through the application of the established standards for detachment of territory from organized boroughs.

Commission's Recommendation

Following the public hearing, the Commission will either deny or approve the petition. The Commission does have the authority to amend the boundaries proposed for detachment. If the Commission approves the petition, with or without amendments, it will forward its recommendation to the Legislature.

Legislative Review

The Commission's recommendation must be submitted to the Legislature within the first ten days of legislative session. After 45 days from the date of the Commission's recommendations submittal to the Legislature, the proposed boundary change becomes effective unless there is a concurrent resolution passed by both houses of the Legislature in opposition to the proposed boundary change.

Borough Incorporation

It should be noted that 19 AAC 10.170(c) and 19 AAC 10.240(b) state that the Commission will not consider a petition for incorporation of an area located partially or wholly within an organized borough until the petitioners have submitted, and the Commission has approved, a petition for detachment of the area from the borough.

If it is the intention of the NANA region to petition for the formation of a borough, which will include the area to be detached from the North Slope Borough, the timing of the sequence of events is crucial.

SUMMARY

A quick review of the sequences of events identifies why the Red Dog Mine is within the North Slope Borough. The 1972 incorporation of the North Slope Borough was completed several months prior to the establishing of regional Native corporation boundaries. The final land selections for the Arctic Slope Regional Corporation and the NANA Corporation were made during the 1975-76 period.

It is unclear at this time, if the area containing the Red Dog mining project will be detached from the North Slope Borough. However, it is obvious that the detachment will be a factor in the decision to proceed with the development of the project given the uncertain future taxation policies of the North Slope Borough.

The formation of the NANA Borough is dependent upon the detachment of this property from the North Slope Borough. Various organizations and leaders have supported the concept of borough formation in this area, given a tax base of this nature.

I. TASK C-3: Evaluate impact of the project on the region of influence with regard to labor, transfer payments, taxation, etc.

For the purposes of this analysis, the region of influence was taken to be the incorporated boundaries of the NANA Regional Native Corporation. Where relevant, the region was further divided into two major components: Kotzebue and the outlying villages (ten). Some further focus was placed on the communities of Kivalina and Noatak which are most closely located to the project.

The impacts here discussed include:

- regional employment (direct/secondary; resident/nonresident)
- population (resident/nonresident; Kotzebue/outlying villages)
- per capita (household) income
- area service needs (schools, medical, public safety, governmental, etc.)
- transfer payments (state, federal, etc.)
- cultural

EMPLOYMENT (AND UNEMPLOYMENT)

Existing employment patterns. A baseline description of existing employment patterns will first be presented, followed by an assessment of the likely affects of employment resulting from development of the Red Dog Mine.

It is important to note that the existing regional economy is, to a large degree, a reflection of the continuing subsistence relationship to the land maintained by a large number of the region's residents. Consequently, a number of accepted measures of "employment" or "occupation" are simply not valid when applied to the activities pursued by the NANA resident population. In particular, the use of U.S. Census measures of employment, and unemployment, is limited primarily to providing some indication of the proportion of residents who participate more directly in the region's "wage earning" economy.

Another measure of unemployment, the State's unemployment roles, reflect only those numbers of individuals who are actively seeking "wage earning" employment and are subsequently picked up by the tracking system provided by the State's job service programs. A rough calculation based on the 1980 U.S. Census information available for the outlying villages in the region indicated generally that less than 3-5% of the population were employed in "full-time" wage-earning jobs. Another 5-10% held "half-time" jobs and another 25-40% found some "part-time" employment during the year.

It should be noted that a large number of the above full and half-time jobs were teaching jobs; often occupied by non-Native persons. There are about 300-500 full-time-equivalent jobs in the outlying villages and about 250 of these jobs are education/profession related (including librarians, teacher aides, etc.). The next largest providers of employment are local government and federal programs.

In Kotzebue, based on the 1980 Census, there are about 500 full-time jobs, about 150 half-time jobs, and about 400 part-time jobs. It is estimated that there are about 600-800 full-time-equivalent jobs in the Kotzebue area. Of the full-time jobs, about 250 positions are connected with the administration and provision of services (i.e., NANA; Maniilaq, State, federal and local agencies). Another 150 jobs are connected with School District operations (both administration and teaching).

Combining the above employment estimates for Kotzebue and the outlying villages indicates a regional full-time-equivalent employment of approximately 1,200. A recent labor market study performed by Darbyshire and Associates for NANA estimated a total of 1,400 full-time-equivalent jobs in the region. That report also projected that, in the absence of the Red Dog project, there would be essentially no growth in the regional employment opportunities over the next ten years. Our review of available materials substantiates that assumption.

Estimated Red Dog Mine Employment. Figures 1 and 2 present employment estimates for the Red Dog project (onsite), including estimates of NANA resident employment. Figure 1 breaks out the employment for each of the construction and production phases, while Figure 2 combines the workers associated with these two phases to indicate the total number of jobs for a given period of time. Figure 2 includes some employment information for the early exploratory drilling activities which have already taken place (1982).

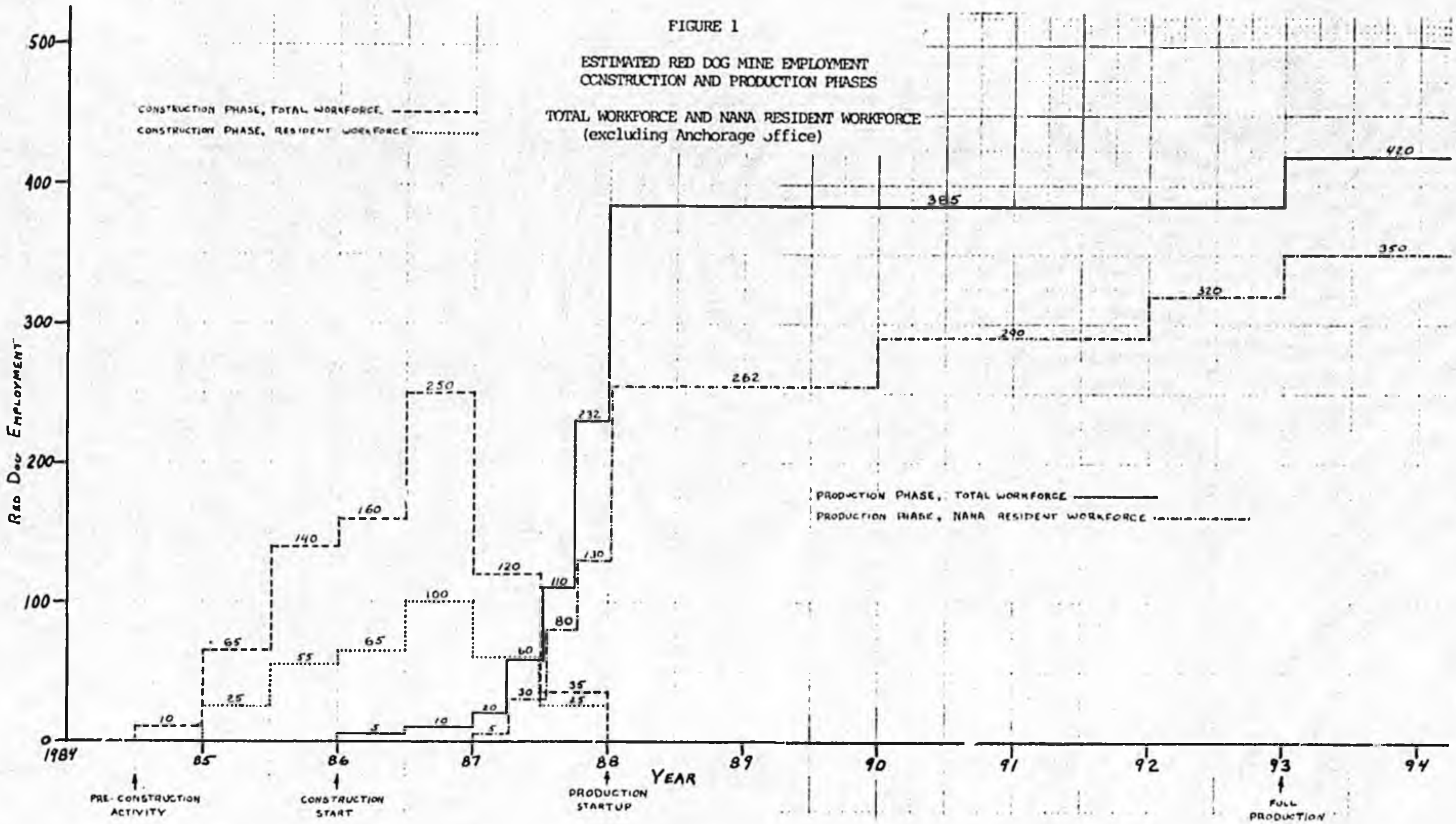
During the construction phase, it is estimated that the NANA resident workforce will rise from 35% of the total workforce at the beginning of actual construction (25 residents), to a figure of more than 50% (100 residents) during the peak of construction. Two other studies of resident employment (Darbyshire, 1982; Waring, 1983) are less optimistic and project a resident employment of 33% throughout the construction phase. The higher employment estimates proposed in this report result from a consideration of the construction phase job descriptions as provided by Cominco; the aggressive approach being taken by various training/placement agencies; the positive attitude of the residents (Berger and Associates, 1983; Cultural Dynamics, Ltd., 1983); and previous resident employment experience with the Alaskan Pipeline Project (Naylor and Gooding, 1978).

Two years before actual production begins, Cominco will begin to employ a number of managerial/technical personnel for the Red Dog Project. Many of these positions will simply transfer from other Cominco operations. At any rate, NANA residents are not likely to participate directly in this "pre-production" labor force until about a year before startup, at which time a number of entry level professions

FIGURE 1

ESTIMATED RED DOG MINE EMPLOYMENT
CONSTRUCTION AND PRODUCTION PHASES

TOTAL WORKFORCE AND NANA RESIDENT WORKFORCE
(excluding Anchorage office)



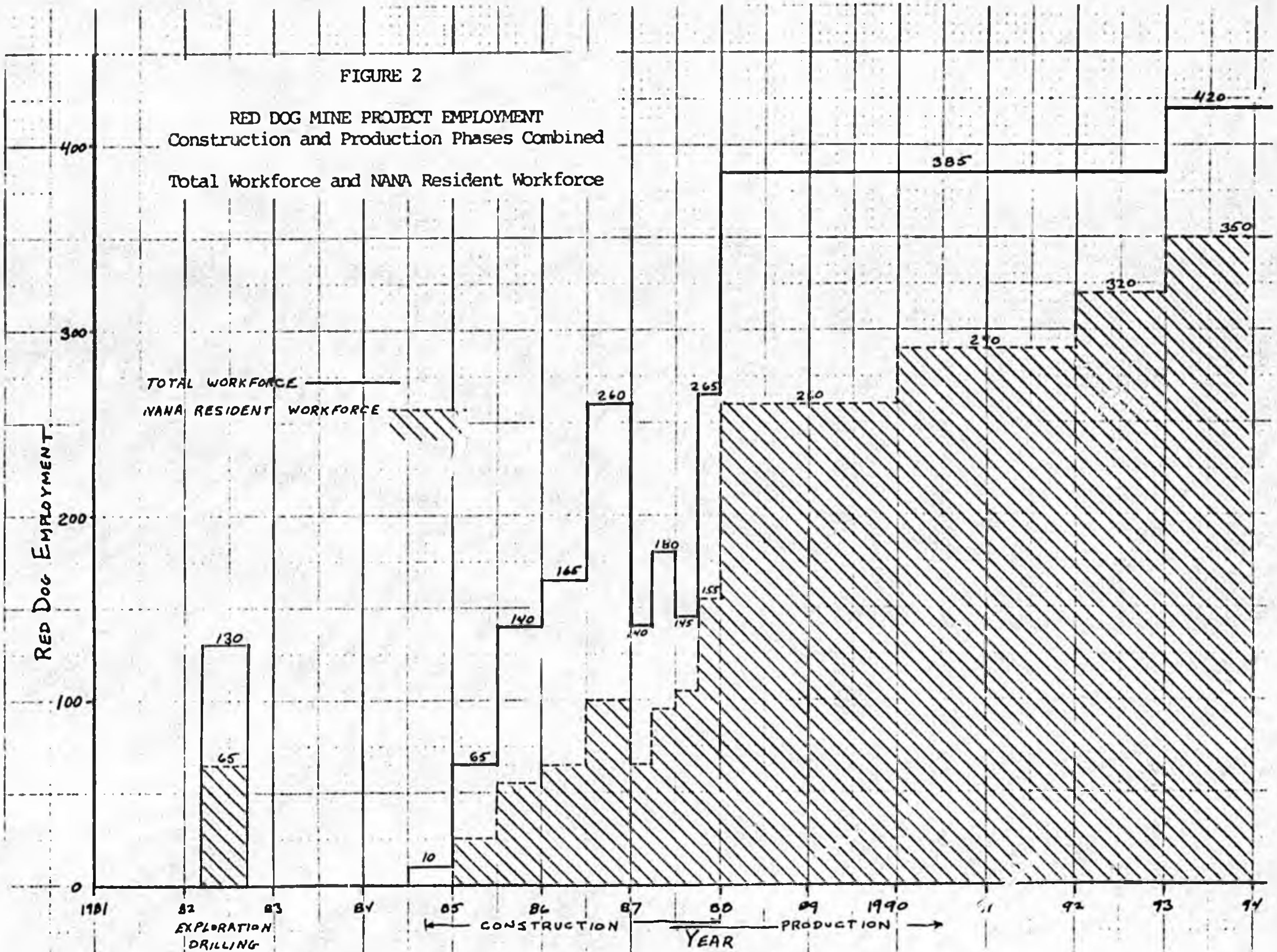


FIGURE 2

RED DOG MINE PROJECT EMPLOYMENT
Construction and Production Phases Combined

Total Workforce and NANA Resident Workforce will be required to assist in the mobilization of the plant (assistant operators, administrative assistance, etc.). At that time, NANA residents in the slowly growing production workforce should represent about 25% (5 residents) of the total production mobilization workforce. However, that number should quickly grow over the course of the last preproduction year, reaching a value of about 66% (262 NANA residents) at the time of production startup.

This number for resident employment at startup was again derived by an inspection of the individual job descriptions provided by Cominco, considering the available labor force and assuming the successful implementation of planned vocational training programs. This estimate is higher than the value of 42% assumed in the Draft EIS for the project (Waring, 1983), which was reportedly provided by Cominco. It is most likely that actual resident employment at startup (1988) will fall somewhere between these two values.

As a rough guess, 80 of the above 262 residents in the startup workforce would come from the villages of Kivalina and Noatak (40 from each community), with the remainder of jobs evenly distributed throughout the region by population (Kotzebue, 90; outlying villages, 90).

It is assumed that the proportion of resident employment will continue to increase slowly over the course of mining operations. Notable increases in resident employment should occur at about two years into production as resident graduates from trade and vocational schools come into the labor force. Again, after four to five years from startup, another increase in local employment should take place as residents obtain advanced degrees in technical fields, assisted by Cominco scholarship funds (up to $30,000 per year). A final jump in resident employment should occur when the mine steps up to full operation in year six. Most of the new jobs at that time should be obtainable by NANA residents. At that time, NANA residents should represent over 80% of the total workforce.

Further increases in the proportion of resident hire should occur slowly over the life of the mine. It is possible that NANA could achieve its stated goal of 100% resident employment; however, no time frame is here assumed.

Secondary Employment Estimates: Because of the fully enclaved nature of the proposed project, there should be virtually no direct employment away from the site (other than in Anchorage). However, there should be a substantial number of support service jobs generated as a result of the mine operations and the generally increased affluence of the population. Most of these secondary jobs will occur in Kotzebue, although there should be some small increases in service and construction employment in the outlying villages.

As many as 150 secondary jobs should occur during the transition from project construction to project operation. This number will quickly diminish to 100 within a year or two of startup, finally stabilizing between 50 and 100 jobs as the local economy absorbs the transient activity of the new development. NANA residents should capture most of the secondary employment resulting from the mine, although there are certain to be at least a small number of nonresidents who find work in Kotzebue, particularly during the construction/early production phases.

POPULATION

The current population of the NANA region is approximately 5,200. Of these, approximately 4,500 are Native (86%). The population of Kotzebue is estimated to be 2,400, of which 1,800 (79%) are Native.

Table B.1, Appendix B, presents a projection of the population of Kotzebue as it would be expected to grow without the Red Dog development, and as it would grow as a result of developing the mine. The variance between the "base case" and the "operations" case is the estimation of the effect of the mine's presence. According to this scenario, Kotzebue's population would jump by about 125 people (5%)

during the construction phase, and increase another 125 (10% total) during initial production phases. Many of these people would be current NANA residents that will have moved into Kotzebue, perhaps as many as 75% of the total number of inmigrants. Therefore, the net effect of the mine on the population within the region as a whole should not be significant.

INCOME

According to the 1980 Census, the mean average household income in the region varies from $8,000 to $20,000 between the outlying villages, and is about $30,000 in Kotzebue.

On the basis of earlier (Summer 1983) Cominco employment estimates, annual gross payroll was initially estimated at about $23 million (372 employees) during the construction phase, $13 million during operating years one through five, and about $13.4 million dollars from year six onwards (424 employees).

Since that time, employment estimates for the construction phase have been revised considerably downwards; however, revised payroll estimates were not included with the updated information. To provide a rough estimate of direct income during the construction phase, it is assumed that actual construction payroll will be reduced in proportion to the revised reduction in construction workforce. On this basis, it is assumed that the construction phase payroll will peak at about $15.5 million (250 employees), averaging about $9 million a year for the overall construction phase (143 full-time-equivalent employees). On this same basis, the payroll during the first five project years is estimated to be about #12 million (385 employees), and would increase to about $13.4 million for years six onwards (420 employees).

It is difficult to assess what portion of these wages will go to NANA residents, who will first tend to occupy lower paying positions, particularly during the construction stage. It is here estimated that during construction an average of approximately $4 million dollars a year will be paid in gross wages to residents.

Again, during the initial phases of production, NANA residents will largely be occupied at the lower end of the wage scale. Of the $12 million annual Cominco gross salary, it is estimated that initially about $7 million will go to about 260 NANA residents. This number would increase constantly over time as NANA residents moved into professional and technical positions with the mine.

AREA SERVICE/FACILITIES IMPACTS

Because of the stringent requirement that the Red Dog be a fully enclaved development, there are not expected to be substantial additional demands placed upon the regions service delivery.

The Department's development impact model (CRADAM, Appendix B) was applied to the Kotzebue/Red Dog development. The facility needs component is driven by the Demographic component already discussed above. In brief summary, the additional 100 jobs which will occur in Kotzebue, and accompanying overall population increase of some 10%, should not stress existing facilities (i.e., schools, public safety, fire, electrical, etc.) in the near future, and do not represent a significant planning component in comparison to the increase in population which would occur with or without the project. One possible exception is the present water system which is reported to be operating at near to full capacity.

It is likely that many mine workers from the outlying villages would wish to pass through Kotzebue while traveling between home and the mine. Depending upon the policy that NANA/Cominco develop concerning the air chartering of mine workers, this could result in a significant impact to several service delivery sectors. However, it is not possible to predict at this time the level of increased service delivery.

The outlying villages are also likely to require some increased social service delivery, at least transiently, in the wake of a degree of social disruption that will accompany the region's sudden increase in affluence (about 30% in regional income; Waring, EIS) and the introduction of an absentee-parent lifestyle that will occur in many village homes with workers at the mine. No attempt is made here to place a dollar value on the increase in social service delivery.

TRANSFER PAYMENTS

It was not possible in the time permitted for this study to link in a logical manner the potential increase in regional affluence to a possible decrease in State, federal and private transfer payments going into the region. Even before considering the possible effects of the mine's wages within the economy, there is a phenomenon presently occurring in program use which remains unexplained by the servicing agencies. Interviews with the State's Department of Health and Social Services indicated that the Department's two main transfer payment programs (i.e., AFDC, food stamps) have shown an unexplained dramatic 50% decrease in use the last two years.

The total transfer payments into the NANA region in 1980 amounted to $11,517,363, or $6,274,254 federal; $4,203,609 State; and $679,500 in private funds (Darbyshire, 1982). It was reported that the two distributions of the Permanent Fund Dividend were followed by periods of marked decrease in State program use. It is certainly likely that the continued incomes derived from mine wages in the extended family will have some positive effect on reducing transfer payments.

III. TASK C-4: Review of the extent to which the economy of the region (NANA area of influence) is financed by State and federal appropriations.

The primary source of information relevant to this task has been the documentation prepared by Darbyshire and Associates (1982) for the NANA Coastal Resource Service Area - Coastal Management Plan (CMP) in conjunction with follow-up interviews with Darbyshire staff responsible for producing these documents.

Figures presented in the CMP were cross-checked with a recent House Research Agency document (DeVries and Pomeroy, 1982) which examined the distribution of State appropriations by Election District. Since the Kotzebue Election District also includes the communities within the North Slope Borough, the Borough's annual financial reports were used to subtract out the bulk of State appropriations to the Arctic Slope Region, leaving an approximation of State appropriations going into the NANA region.

The CMP figure for State Appropriations (1980) were $31,482,815. The alternative method produced a figure of $32,500,000. This figure does not include the State's capital budget which varies radically from year to year for a given region. The capital budget appropriations for the Kotzebue Election District for FY '81 and FY '82 were respectively 20 and 50 million dollars.

Federal funds going to the NANA region in 1980 totaled about 24 million dollars - private transfer payments totaled about $700,000.

Important findings reported in the CMP documents included:

"The combined federal and State revenues are, by far, the most imports important source of demand on all three levels of the regional economy. Of the $63 million earned in the total NANA region, State and federal revenue sources support (i.e., directly and indirectly) approximately $55.5 million (88%), while private sources support the remaining $7.8 million;"

- "State revenues to education, construction, social services and so on alone support 31.5 million (50%) of the total income earned throughout the NANA region;"

- "Mining and exploration activities are the largest private contributors to the economic base of the outlying villages (8%);" and

- "The largest single contributing source to the regional economy are the State revenues supporting schools and local government throughout the NANA region."

III. General Comments and Recommendations

With regard to the fulfillment of the NANA/Cominco agreement, there are several unstated policies, or potential policies, which could have significant effects on the distribution of the impacts of the Red Dog Mine development:

- One possible policy that may need to be clarified is the air charter transfer of residents from outlying communities (or other Northwest Alaska communities) to the mine site and back. The frequency of visit and duration of stay of these transients through the City of Kotzebue will play a determining factor in the total impact of the project upon the service delivery provided by the city, including transient housing, police and containment facilities, the recreational/entertainment economy, etc.

- Another policy, which will probably become highly sensitive, is the actual distribution of jobs among and within the communities throughout the region. NANA could develop a formula that would provide increased economic leverage for the more economically depressed villages, or a policy could be established strictly on a per capita basis, or the policy could be one of laissez faire. At any rate, existence or lack of existence of such a policy will be a determining factor in the ultimate distribution of the economic product of the Red Dog Mine in the NANA region.

- It might be advisable for some of the smaller communities to establish rotating labor pools through which all eligible residents could participate directly in the Red Dog's workforce. This would also provide increased flexibility in relation to subsistence lifestyles.

- Beyond training and placement, the various critical agencies in Kotzebue should be preparing for an extended service of counseling in support of residents who will be experiencing industrial employment for the first time.

Appendix A

Analysis Assumptions

A. The Red Dog mine construction and production schedules, as provided by Cominco in its engineering reports, will be essentially adhered to with regard to time and labor force requirements.

B. The goals of the NANA/Cominco operating agreement (N/C Agreement) of October 1982 will be aggressively pursued with regard to hiring and operating policies (goal = 100% local employment within 12 years of mine startup). That is, the several agencies and committees responsible for the training and placement of NANA residents will have a substantial effect (within several years) on the skills available in the local labor force and the placement of those skills at the minesite. Within five years of startup, resident skills will include increasing numbers of "professional occupations" as residents matriculate through the proposed scholarship program (up to $30,000 per year).

C. More specifically, regarding the phasing of local hire, it is assumed that, within two years, an additional 30-40 residents would become eligible for placement at the mine as a result of trade school/vocational training offered in Kotzebue. These people would probably move into positions vacated by residents moving up the scale of positions at the mine site, as they progress through on-the-job experience. Another 15-30 local residents would become eligible for professional range jobs (geology, lab technicians, etc.) at the completion of university level education. Finally, it is assumed that the jobs resulting from the planned increase in production at year six will be taken almost entirely by residents, that is, 30 more jobs.

D. In accordance with the N/C agreement, the Red Dog development will be as strictly isolated in its effects as possible; that is, fully enclaved.

E. NANA/Cominco will make special efforts to "broadly advertise" both the enclave and resident hire aspects of the Red Dog operation, thereby discouraging speculative inmigration into the region, and into Kotzebue in particular. However, it is assumed that a certain degree of speculative inmigration will still occur in anticipation of employment in secondary (mine support and service sector industries) and in anticipation of filling job vacancies which will occur as presently employed residents take positions with the mine. In particular, this will probably result in a temporary acceleration of intraregional migration, as people gravitate into the regional service center of Kotzebue; however, no estimate as to the degree of this movement has been assumed for the purposes of this analysis.

F. It is assumed that there will be some impact on service provision in Kotzebue as a result of resident mine employees preferring to travel through Kotzebue on the way to their home villages after their two-week stint at the mine.

G. The actual secondary employment multiplier applied to Kotzebue as a result of the Red Dog operations is assumed to be 0.5 for both the construction and production phases.

H. There will be a very small increase in secondary employment in the outlying villages as a result of the generally increasing affluence of the population. It is assumed that all such employment opportunities will be absorbed by the resident populations.

I. On the basis of several recent regional attitude surveys, and the precedent of NANA resident employment on the Alaskan pipeline project, it is assumed that there is a strong desire amongst NANA residents to get a job at the mine and keep it.

J. The residents of Kivalina and Noatak may be offered some degree of preference in hiring in compensation for the disruptive physical presence of a mine and road in their proximity. Otherwise, it is assumed that attempts will be made to distribute employment opportunities evenly throughout the region.

K. Lacking more direct information, the anticipated annual gross payrolls during construction and production were taken from the draft Environmental Impact Statement (EIS) for the project (Socioeconomic section; Kevin Waring).

L. Levels of annual State financing of the regional and local economies were derived through a cross referencing of the NANA region draft Coastal Management Program document; a House Research Agency document of Appropriation by Election District (which includes the North Slope Borough); and the Annual Reports of the North Slope Borough.

M. The 1983 population of Kotzebue is assumed to be 2,400 which is the number arrived at after extended discussion between the City and the Census Bureau (which had placed the number at 2,054). The present City Planner has initiated a statistical survey of the community and preliminary results indicate a community population possibly as large as 2,900. The NANA region population is assumed to be approximately 5,200, reflecting the increased number in Kotzebue.

N. A number of specific baseline assumptions have been made in order to run the Department's CRADAM development assessment computer model (facilities needs component). These values, which are listed in Appendix B, were determined on the basis of information provided by the City of Kotzebue.

APPENDIX B

Community and Regional Affairs Development Assessment Model
Kotzebue/Red Dog Project

CRADAM is an interactive computer model which projects community response to specific development projects over a 20 year period. The model is community oriented and, therefore, is not directly applicable to projections for the NANA region as a whole. It has been applied in this case to the community of Kotzebue in its relationship to the prospective Cominco/Red Dog Mine development. Two components of the model have been run in this case: a demographic projection, and a facilities needs projection (which is driven by the demographic component's output). Tables B.1 and B.2 present the results of two elements of the demographic components: population and school age population. The results of the facilities needs component are extensive and are not reproduced here.

Specific assumptions for the demographic run included:

- Fully enclaved development project
- Construction start: January 1986
- Production start: February 1988
- Current annual rate of population increase: Kotzebue, 0.2%
- Construction phase, total workforce: 250
- % of these skilled labor: 62%
- Production phase, total workforce: 384 (onsite)
- % of these skilled labor: 67%
- Secondary employment multiplier: 0.5
- Average household size: 4.7
- Current population, by age cohorts: 0-4, 275; 5-9, 286; 10-14, 235; 15-19, 262; 20-24, 224; 25-29, 274; 30-34, 190; 35-39, 127; 40-44, 117; 45-49, 117; 50-54, 76; 55-59, 37; 60-64, 53; 65 and over, 123; total: 2,396
- Current effective unemployment: 50%

Specific assumptions for the facilities needs computer run include:

- Municipal acreage: 3,200
- Industrial acreage: 20
- Residential acreage: 200
- Elementary school (square feet): 50,000
- High School (square feet): 55,000
- Police department (square feet): 20,000
- Police vehicles: 6
- Fire department (square feet): 22,000
- Fire vehicles: 4
- Medical facilities (square feet): 40,000
- Residential buildings: 570
- Remaining Municipal buildings (square feet): 250,000
- Electrical demand (kwh/capita/day): 18
- Water demand (gallons/capita/day): 100
- Proposed residential density (units/acre): 8

Outputs from the computer run include:

- Total population estimates for the 20-year period (base case, development and production phases (table B.1)
- Number of school aged children for the 20-year period (table B.2)
- Number of high school students for the 20-year period
- Number of elementary students for the 20-year period

- Elementary school floor space demand
- High school floor space demand
- High school floor space surplus/deficit
- Police department floor space demand
- Police vehicle demand, surplus, deficit
- Fire department floor space demand, surplus, deficit
- Fire department vehicle demand, surplus, deficit
- Medical facility floor space demand, surplus, deficit
- Hospital beds required

- Municipal space requirement
- Average daily water demand
- Average daily electrical demand
- Residential housing demand
- Residential acreage demand

Table B.1

Demographic Projections

Kotzebue Population (base case, construction, operation)

Year	Base Case	Construction	Operations
0 (1983)	2396		
1	2429		
2	2483	2608	
3	2553	2681	
4	2637		2879
5	2646		2698
6	2751		2803
7	2808		2857
8	2997		3049
9	3138		3190
10	3293		3344
11	3460		3509
12	3226		3436
13	3840		4057
14	4454		4679
15	4285		4502
16	4534		4744
17	4804		5022
18	5096		5313
19	5410		5623

Table B.2

Demographic Projections

School Aged Children (base case, construction, operations)

Year	Base Case	Construction	Operations
0 (1983)	783		
1	794		
2	812	852	
3	834	876	
4	862		945
5	865		886
6	899		920
7	937		958
8	979		1000
9	1026		1046
10	1076		1097
11	1131		1152
12	1190		1211
13	1255		1276
14	1325		1346
15	1400		1421
16	1482		1494
17	1570		1591
18	1665		1686
19	1768		1789

APPENDIX C

Bibliography

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North Slope Borough, 1981-82, Annual Financial Reports, FY '81 and FY '82.

Oral Communications:

Matt Conover, November 1983, Planning Director, Maniilaq

Carol Dellahanty, November 1983, Planner, City of Kotzebue

Jake Rogers, November 1983, Assistant Administrator, Northwest Arctic School District

VII. Report of the Department of Transportation and Public Facilities

A. Review of Cominco's Road Design and Cost Estimates

B. Review of Cominco's Port Design and Cost Estimates

C. Alaskan Extractive Resource Projects

D. Qualification Matrix for State Transportation Projects

E. Impact of the Jones Act

F. Synopses of Two Canadian Mining Projects with Joint Public / Private Sector Participation

MEMORANDUM

State of Alaska
Department of Transportation & Public Facilities

TO: Robert Venusti
Deputy Director
Design and Construction

DATE: November 10, 1983

FILE NO:

TELEPHONE NO:

FROM: Ronald E. Olmstead, P.E. REO
Assistant Construction Chief
Aviation Design and Construction

SUBJECT: Red Dog Mine Project

A. Review of Cominco's Road Design and Cost Estimates

At your request, I have reviewed preliminary conceptual engineering data and cost estimates furnished by Cominco Alaska, Inc. for various roadway alternates from proposed port facilities north of Kotzebue to the Red Dog Mine. Data reviewed included the following:

REPORT	AUTHOR
Red Dog Mine Access Ground Transportation Study	R & M Consultants, Inc.
Preliminary Hydrology Report (Appendix 1)	R & M Consultants, Inc.
Geotechnical Report (Appendix 2)	R & M Consultants, Inc.
Preliminary EIS Red Dog Mining Site U.S.	EPA Region 10
Engineering Report on the Red Dog Project Vol 1 & Vol 2	Cominco Engineering Services
Engineering Estimate for the Red Dog Project Vol 1 and Vol 2	Cominco Engineering Services

ENGINEERING ANALYSIS

I. ROUTE SELECTION

From an engineering perspective, major items which should be considered in route selection for this region are as follows:

o Minimize alignment length

o Consider material site availability and haul

o Consideration of future maintenance, including drifting snow

o Consideration of construction problems and scheduling

- o Maintain fill section to the extend possible, avoiding problems associated with cuts in permafrost areas, especially on side hills
- o Minimize environmental disturbance
- o Minimize potential problems with drainage, ground water flow and and aufeis
- o Minimize roadway alignment on ice rich, high moisture content silts, organics, and poor route soils conditions
- o Avoid known areas of soil instabilities and/or movement
- o Efficient use of fill, especially in areas of mineral material shortage
- o Bridge siting
- o Future or proposed route expansion
- o Land ownership

Analysis of data furnished by Cominco Alaska, Inc. indicate that routes were selected and evaluated based on criteria similar to that mentioned above. The data utilized is preliminary in nature, however, with limited field verification and must be viewed as such. Alternate routes were delineated utilizing on U.S.G.S. mapping expanded to a 1" = 2000' scale for the plan portion of plan-profile sheets. Route alignments and profiles were plotted on these sheets utilizing the above mentioned criteria and engineering geometrics developed for the proposed routes.

II. Design Geometrics

Design criteria developed for the proposed roadway are as follows:

Design speed	30 mph
Road width	30 feet
Maximum grade	4%
Minimum radius	400 feet
Passing turnouts	2 mile intervals
Fill depth	6.5 feet based on thermal considerations
Alternate fill	2 feet minimum on 3 inches rigid insulation
Design vehicle	GVW 443,000 lbs
Maximum tandem axle loading	109,500 lbs

Roadway width and maximum grades are conservative due to the size of the design vehicle. Under normal usage conditions, a roadway width of 28 feet or even less may be adequate, with maximum desirable roadway grades up to 5% on rolling or 7% in mountainous terrain.

The fill depth of 6.5 feet assumes some thaw into the existing terrain, thus some settlement will result depending on soil type. This method is consistent with existing practice, with the final depth/depths selected being dependent on soil groupings or 'terrain units" and foundation conditions. The final typical sections developed for the roadway design would be a major engineering decision for the project with the governing factor being allowable thaw into the subgrade. The 6.5 foot fill depth is considered adequate for preliminary engineering purposes. In reality, it could be expected that depths would vary, with lesser depths being utilized should actual soil conditions warrant or deeper sections utilized should more protection be required in other locations. The alternate insulated fill section consisting of 2 foot of fill placed on 3 inches of rigid insulation board was utilized to a very limited extent in the preliminary analysis (approximately 1.3 miles total length in the preferred route) and appeared to be utilized primarily through vertical curve areas where it was desired to reduce the depth of fill for short stretches of roadway. This method of construction has been tested and utilized for heavy haul vehicles on the Trans Alaska Pipeline System with some success. Final design should consider carefully the exact placement and bedding methods for insulation.

III. Quantities

Fill quantities were computed utilizing the 6.5 foot of fill, or alternate section and providing for addition fill material for those sections going into and out of vertical curve locations and cross slope areas, utilizing factors developed for that purpose. Haul distance was determined by plotting material sites, selected by limited field examination and aerial photo interpretation. Drainage structures, types and sizes were developed based on drainage size and other hydraulic considerations. All data furnished by Cominco Alaska, Inc. was examined and appeared to be adequate for preliminary quantity determination.

IV. Cost

Cost figures for the proposed roadway were initially developed by R & M Consultants and provide the basis for those cost figures presented by Cominco Alaska, Inc. Base-line cost figures developed for major bid items are as follows:

Item	Estimated Cost
Embankment (c.y.)	\$9.20 c.y.
Cubic Yard-mile (c.y.m.)	\$1.30 c.y.m.
Drainage culverts (ea) 24"-120" dia.	\$6,400 - 61,200 ea.
Bridge (l.f.)	\$1,800 - 5,760 l.f.
Insulation	\$0.80 bd. ft.
Turnouts	Approx. \$5000/mile

Cost estimates prepared for the state for the proposed 170 mile route from Kotzebue to Chicago Creek indicate estimated embankment costs of $10.00 c.y. with haul being estimated at $1.00 per c.y.m. after the first two miles. At a much smaller scale, embankment costs for the current Kotzebue Airport Improvements Project was bid at $6.74 c.y. Embankment costs at the new Buckland Airport was bid at $13.50 c.y., with similar type embankments running $4.00 c.y. in Fairbanks.

Culverts were estimated to be 80 l.f. in length with sizes from 24" to 120" in diameter being estimated. Estimated costs appear reasonable based on review of available bid tabs.

Bridge costs were checked with the DOT/PF bridge design section in Juneau and also appear to be reasonable estimates.

Costs not included in the original base line cost estimates by R & M consultants were additional costs for processing surfacing material, mobilization and de-mobilization costs, royalties on borrow material, engineering and contingencies. I have attached sheets summarizing the estimated costs for all the proposed routes. The preferred route estimated costs prepared by Cominco appear to be reasonable estimated roadway construction costs.

V. Comments and Conclusions

Methodology utilized for preliminary route selection and cost estimates appear to be reasonable and consistent with other state preliminary route selection efforts. The data presented by Cominco is based on very limited field efforts. It would be expected that substantial refinement would be made to the selected alignment and design assumptions after centerline drilling, material site exploration and evaluation and other design level field work is completed.

MEMORANDUM State of Alaska

TO: Robert Venusti
Deputy Director
Design and Construction

DATE: November 22, 1983

FILE NO:

TELEPHONE NO: 452-1911

FROM: Ronald E. Olmstead, P.E.
Assistant Construction Chief
Aviation Design and Construction

SUBJECT: Red Dog Mine Project

B. Review of Cominco's Port Design and Cost Estimates

At your request, I have reviewed preliminary conceptual engineering data and cost estimates furnished by Cominco Alaska, Inc. for proposed port facilities north of Kotzebue. Data reviewed included the following:

REPORT	AUTHOR
Preliminary EIS Red Dog Mining Site U.S.A.	EPA Region 10
Engineering Report on the Red Dog Project Vol. 1 & Vol. 2	Cominco Engineering Services
Engineering Estimate for the Red Dog Project Vol. 1 & Vol. 2	Cominco Engineering Services

The proposed recommended port facility for the Red Dog Mine is composed of 3 major component parts:

1. Deep Water Dock Facility (off shore)
2. Shallow Water Dock (on shore)
3. Concentrate Storage Facility at Mile 2.5 (Roadway Borrow Site)

My review consisted primarily of listing major items/quantities taken from the Cominco Alaska, Inc. reports and "backing into" the engineers estimate as independently as I could to confirm the estimated costs. My comments for each major division are as follows:

I. SITE DEVELOPMENT

Cost figures utilized for the port site development are the same as those utilized for the roadway portion of the project. Using Cominco's estimated quantities of 63,500 c.y. of fill for the pad on shore and a 7 foot fill height works out to approximately a 5.5 acre site.

02-001A(Rev. 10/79)

It was assumed by Cominco that the concentrate storage site at 2.5 mile would be graded during borrow operations from construction of the roadway.

II. BUILDINGS

Estimated costs for the concentrate storage building were taken from the 1983 Means estimating guide and projected for Anchorage, then the remote siting as shown on the attached sheets. The median unit price given was utilized. The smaller buildings were estimated at $250.00 s.f. which may be slightly high but are currently being utilized by our staff, for estimating purposes

III. SHALLOW WATER DOCK

The Means estimating guide was utilized for the sheet piling. The remaining estimated costs were judgement calls.

IV. CONCENTRATE HANDLING (SHORE BASED)

Equipment costs were obtained from N.C. Machinery, FOB the factory, with exception of the lightering barge, and loading equipment which were estimated, along with miscellaneous costs shown.

V. DEEP WATER DOCK

Per ton costs for modification of a used tanker were obtained from Todd Shipyards in Seattle. I was unable to obtain a figure for a used tanker, however a review of costs supplied for new steel modifications make the tanker costs estimated, seem not unreasonable. The remaining costs were estimated by judgement.

VI. CONCENTRATE HANDLING (DEEP WATER DOCK)

Equipment costs were obtained from N.C. Machinery, FOB the factory. The remaining costs were estimated.

VII. SUPPLIES HANDLING EQUIPMENT

Some equipment costs were obtained from N.C. Machinery, others were estimated. The fuel pipeline costs were taken from in house bid tabs from Galena. The pipeline consists of two lines, one nestled inside the other.

VIII. SERVICES

The estimated costs for generator sets were obtained from N.C. Machinery. It was estimated that the cost of the units in place and operating would be approximately twice the costs of the bare bones units at the factory.

IX. ACCOMODATIONS

It was assumed that the construction camp utilized during construction of the road would be utilized, thus some costs were allotted to refurbish it, by Cominco.

X. COMMENTS AND CONCLUSIONS

Estimated costs for the proposed scheme appear reasonable. They are somewhat less than those proposed for the proposed facility at Port Blossom. Port Blossom costs were estimated at approximately $34,861,000 for Phase I and $51,458,000 for Phase II for a total of $86,319,000. In addition, facilites on shore were estimated at $14,932,000. Concepts between the two are substantially different, with Port Blossum having a structural dock to deep water vs. an island with lightering required. Depending on the states involvement, it is recommended that thorough conceptual review be performed. Other items that may need additional consideration depending on overall use of the facility are:

1. Air Port Facilities
2. CFR Vehicles/Facilities
3. Land Requirements
4. Storage Facilities
5. Security

C. Alaskan Extractive Resource Projects

Lost River Mine: The U.S. Bureau of Mines estimates the size of the Lost River flourspar-tin deposit near the community of Lost River on the Seward Peninsula, to be in excess of 10 million tons. The current market value per ton of tin ore is $9,660. The mine has the potential of exporting 304,000 tons of tin, flourite, and tungsten annually. Transportation infrastructure required to mine development is a 60 mile extension of the Nome-Teller Road that will tie into the proposed Nome port for exporting the ore out of the region.

Slate Creek Asbestos: Asbestos reserves at Slate Creek are believed to range from 50 to 100 million tons. Doyon Corporation is actively pursuing development of this deposit and have estimated that the most likely level of production would be 150,000 tons per year. The current market value per ton of asbestos is $600. Transportation requirements for development of a mine is a 43 mile road to connect to the Taylor Highway near Chicken.

Delta Belt: Large high grade copper deposits have been located near the Robertson River, southeast of Delta Junction. Anaconda Copper, Resource Associates of Alaska and Cook Inlet Native Corporation have done exploratory drilling. Production estimates vary from 250,000 to 1,000,000 tons annually with an estimated project life of 50 years. The current market value per ton of copper is $482. A 90 mile extension of the Alaska Railroad would provide access to the copper deposits as well as providing service to the Delta Agriculture Project.

Dry Creek Deposit: Dry Creek has been identified as being a large lead deposit with lesser amounts of copper, zinc, silver and gold. Production potential is estimated to be approximately 68,000 tons of lead ore annually, which would provide an annual revenue of approximately $11 million. Widening the existing 21 mile road to 18 feet and a 15 mile extension of the road would provide adequate access to the deposit.

Lignite-Kantishna: The Kantishna antimony deposit has an estimated production potential of 33,000 tons per year. In addition, 1981 production of placer gold deposits was 3,000 oz. The estimated annual revenue resulting from development of the antimony deposits is $12.5 million. Access to the mine area would consist of a 75 mile road from the Parks Highway near Lignite. It has been proposed that this access road could also serve as an alternative route for Denali National Park visitors.

Bonanza Creek: Tungsten deposits of unknown quality and quantity at Bonanza Creek are owned by Doyon Ltd. Based on the limited information, it is assumed that yearly concentrate production could be 6,540 tons, with an estimated annual revenue of $1.3 million. Construction of a 24 mile gravel road from the Dalton Highway would provide access to the deposit.

Ambler Mining District: There are two major copper mine areas that have been identified in the Ambler Mining District. The Kennecott Area consists of two large deposits, the Arctic Mine with deposits of approximately 37 million tons and the Ruby Mine with deposits of approximately 4 million tons. The Anaconda Area consists of two deposits, the Sun Mine with deposits of approximately 25 million tons and the Smucker Mine with deposits of approximately 10 million tons. Bear Creek Mining Company has estimated that the Arctic Mine alone has the capability of producing 400-500,000 tons per year with an estimated mine life of 20 years. The best estimate of the value of the known resources in the ground is $18 billion. Long-term jobs, as a result of development, are estimated to be 1,350 by the year 2000 and 2900 in the post 2000 time frame.

In addition to the copper deposits, NANA Development Corporation currently has a jade mine in operation which has a limited production rate because of the lack of an adequate transportation system. Several alternative access routes have been examined for both rail and road. In addition to the necessary road or rail construction, a port on the coast would be required in either the Krusenstern area or along the coast of the Seward Peninsula.

Chandalar Mining District: Extensive gold and silver deposits are present in the Chandalar Mining District; 100 placer lode claims, 2 operating mines and one ore processing mill currently exist in this area. Estimated gold production of known deposits is 3,000 oz. per year, with potential annual revenues of $1.2 million. Construction of a 65 mile road would provide access to supplement the existing 4,500 foot runway.

Chicago Creek Coal: Coal in this area is known at four locations. These include the Chicago Creek Mine, Kugruk (Wallin) Mine, Superior Mine, and an 1.5 million tons of fairly low quality coal. Coal development at site has been considered as a means of reducing heating costs in the villages of Kotzebue, Buckland, Deering, and the mining and reindeer herding activities at Candle. The cost of heating by coal would equate to a $.51 per gallon fuel oil price. The current price per gallon of fuel oil (in the NANA Region) is $2.40. Therefore, development of the resources at Chicago Creek is viewed as being economically justified. The transportation infrastructure required is a 170 mile road from Chicago Creek to Kotzebue. This road would also facilitate access to several other mineral resources that are located in close proximity to the route (uranium, placer gold, lead, zinc, silver, molybdenum).

Pt. Lay-Cape Lisburne Coal: There are several occurrences of coal deposits throughout the northwestern section of the State. On-shore sources for the Cape Beaufort area, 55 miles south of Pt. Lay, are calculated to be 35 million tons of inferred resources. Within a 50 mile radius of Pt. Lay, there are several deposits that appear to be of the best quality. Total indicated resources are 236 million tons and 2,769 million tons of inferred resources. The Corwin-Thetis mines, 80 miles from Pt. Lay, have indicated deposits of 49 million tons and 848 million tons of inferred deposits.

The Arctic Slope Regional Corporation has indicated that a mine in the Cape Beaufort Area could produce approximately 100,000 to 200,000 tons per year and be in production in 3 years. The use of coal is forecasted to reduced heating costs in Northwest Alaska by about $10 million per year. The Alaska Power Authority has determined that the quality and quantity of the coal resources make it economically feasible to barge coal as far south as Unalakleet. To facilitate development of the resources, the preferred transportation needs would be the development of a resource export and coal loading port capable of handling 500 ton coal barges. In addition, a road transportation network to link various coal deposit sites to a common corridor to the coast should be considered.

Lik Deposits: The Lik lead and zinc deposits are located 12 miles north of Red Dog and owned by GCO Minerals. If a transportation corridor was established, it would take 6 years to bring a mine into production. Estimated annual production would be 150,000 tons. Transportation infrastructure requirements are a road to the coast and a port facility to deliver the ore to market. The most likely scenario is linkage to the access developments at Red Dog.

Twin Mountain: There are significant tungsten deposits located in the Twin Mountain Area. additionally, several placer gold mines are in operation at Van Curlers Bar. Houston Oil and Minerals, Inc. has been conducting exploration work in the area and, to date, ore grades and tonnages are unavailable. The current market value per ton of tungsten is $200. Access to the Twin Mountain area would require construction of a 62 mile extension of the Chena Hot Springs road.

ALASKAN EXTRACTIVE RESOURCE PROJECTS

NAME	RESOURCE TYPE	LOCATION	POSSIBLE TIME	COST ESTIMATE
Lost River Mine Extension of the Nome-Teller Road from Teller-Wales (60 miles), via Brevig Mission, Lost River Mine and Tin City	Flourspar, Tin	Seward Peninsula	* 2000	$30.9 million
Slate Creek Asbestos Development Extension of the Taylor Highway near Chicken (43 miles)	Asbestos	Between Delta Junction and Eagle	1987	$33 million
Delta Belt Rail Extension Extension of the Alaska Railroad (90 miles)	Copper, Lead, Zinc	Southeast of Delta Junction near the Robertson River	1986	$643 million
Dry Creek Deposit 15 mile road extension	Lead, Copper, Zinc, Silver, Gold	35 miles east of Ferry (North of Healy)	2000	$9 million
Lignite-Kantishna 76 mile road construction	Antimony, Placer Gold	Adjacent to Denali Park	2000	$64 million
Bonanza Creek 24 mile road construction	Tungsten	200 miles northeast of Fairbanks	2000	$15 million

*Timeframe has not been forecasted. Year 2000 has been arbitrarily set.

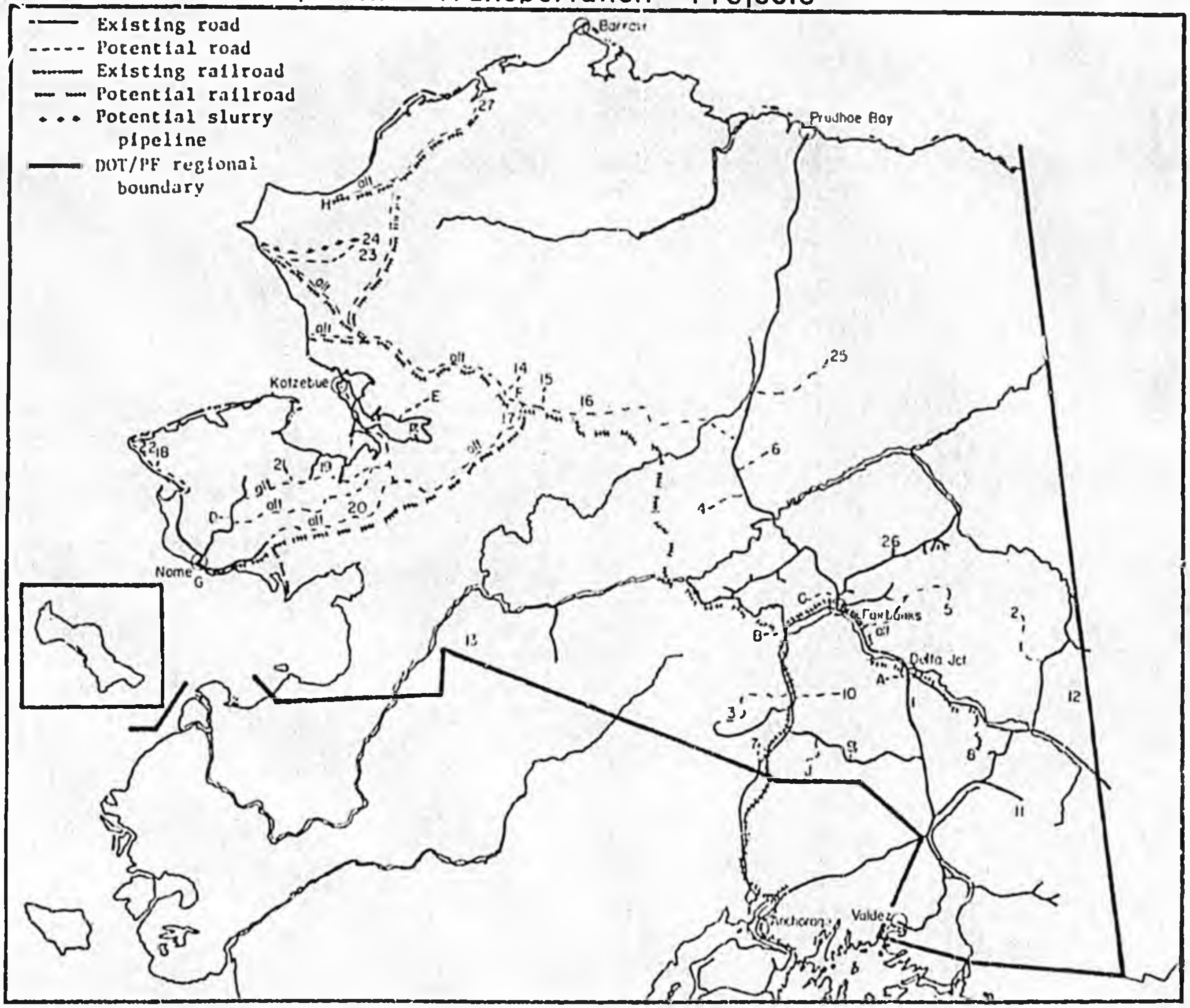
ALASKAN EXTRACTIVE RESOURCE PROJECTS

NAME	RESOURCE TYPE	LOCATION	POSSIBLE TIME	COST ESTIMATE
Ambler Mining District	Zinc, Copper, Silver, Gold, Jade, Lead	160 miles northeast of Kotzebue	2000	
I Haul Road System				
a) Ambler to Cape Krusenstern (225 miles)				Ia) $350 million
b) Ambler to Golovin Bay (322 miles)				Ib) $315 million
c) Ambler to Nome (434 miles)				Ic) $613 million
d) Ambler to Prudhoe Bay Haul Road (203 miles)				Id) $275 million
II Rail Transportation System				
a) Ambler to Nenana (390 miles)				IIa) $800 million
b) Ambler to Cape Krusenstern (225 miles)				IIb) $450 million
c) Ambler to Nome (434 miles)				IIc) $786 million
d) Ambler to Cape Darby (322 miles)				IId) $622 million
Dalton Highway to Chandalar Mining District	Gold, Siver	Coldfoot to Toblin Creek	2000	$39.7 million
65 mile road construction				

ALASKAN EXTRACTIVE RESOURCE PROJECTS

NAME	RESOURCE TYPE	LOCATION	POSSIBLE TIME	COST ESTIMATE
Kotzebue to Chicago Creek Road Construction (170 miles)	Coal	15 miles west of Candle	1990	$204.1 million
Pt. Lay-Cape Lisburne Coal Port Construction of a port to access several large deposits	Coal	Cape Beaufort area	2000	$100 million
Twin Mountain 62 mile extension of th[illegible]ena Hot Springs Road	Tungsten		2000	$40 million
Sithylemenkat Road 39 mile road construction	Tin, Tungsten	170 miles northeast of Fairbanks	2000	$23 million

Resource Development Transportation Projects



POSSIBLE MINING SITES

1. Jarvis Creek
2. Slate Creek
3. Kantishna
4. Sithylemenkat
5. Twin Mountain
6. Bonanza Creek
7. Golden Zone
8. Delta Belt
9. Denali (Valdez Creek)
10. Dry Creek
11. Orange Hill
12. Tarus
13. Illinois Creek

Ambler District

14. Smucker
15. Arctic Camp
16. Picnic Creek
17. Bornite

Seward Peninsula

18. Lost River
19. Chicago Creek
20. Granite Mountain
21. Hannum Lode
22. Tin City

Noatak District

23. Red Dog
24. Lik

25. Chandalar District

Circle Mining District

26. Home Creek Uranium

27. Pt. Lay-Cape Lisburne Area Coal

OTHER DEVELOPMENT

A. Delta Creek Ag & Forestry area
B. Nenana-Totchaket Ag & Forestry area
C. Goldstream Ag & Forestry area
D. Pilgrim Hot Springs Geothermal Development and Ag area
E. Siilivitchaq--Selawik Lake Ag & Forestry area
F. Ambler Ag area
G. Nome Port Development
H. Pt. Lay-Cape Lisburne Port Devl.
J. Susitna Hydro Access Roads

D. Qualification Matrix for State Transportation Projects

QUALIFICATION MATRIX with scoring feature
check highest category

ISSUE	HIGH ←				→ LOW
Type of major state benefit	Includes royalty payments	Includes taxes	Includes direct economic	Includes indirect economic	No benefit
State investment payback period for royalties/taxes	Less than 5 years	5 - 10 years	10 - 15 years	15 - 20 years	over 20 years
State investment payback period for economic benefits	Less than 5 years	5 - 10 years	10 - 15 years	15 - 20 years	over 20 years
Degree of state investment being considered	Less than 20% of transportation facility	20 - 40% of transportation facility	40 - 60% of transportation facility	60 - 80% of transportation facility	over 80% of transportation facility
Project viability as related to payments to third parties (royalties)	No payment to 3rd party	State requirement reduced by 0 - 30% if payment eliminated	State requirement reduced by 30 - 60% if payment eliminated	State requirement reduced by 60 - 99% if payment eliminated	No state requirement if payment to 3rd party reduced or eliminated
Transportation need other than resource development	Provides new highly needed service	Replaces existing inadequate service	Provides new convenient service	Replaces existing service with more convenient service	No effect
Area effected by facility	Provides full statewide service	Provides partial statewide service	Provides regional service	Provides local service only	Provides no service
Bonding authority to provide support (regional or municipal)	Yes, tolls/fees to be collected (revenue bonds)	Commited to create bonding authority	May create bonding authority	Not feasible to create bonding authority	Not willing to create bonding authority
Potential to support future resource development	Commitments already made	High potential	Some potential	Low potential	No potential
Facility open to public	Yes, no charge	Yes, but only for commerce	Yes, with tolls or fees	Yes, but only for commerce with tolls or fees	Not open to public
Ground work: EIS, permits, ROW	Yes, all permits etc. in hand no state work required	Commitment to obtain permits, no state work required	Asking for partial state involvement	All work must be done by state	No cooperation

RED DOG PROJECT: Relationship of the Jones Act

The Jones Act, established in 1920 as an amendment to the Shipping Act of 1916, restricts the shipment of American goods. between U.S. ports to vessels built in the U.S. and operated by U.S. crewmembers.

Cominco/NANA intends to use foreign-built, owned and operated ships to transport the ore to destinations in Canada, Japan, and Europe. They have proposed using the port at Red Dog as a public port and backhauling fuel and cargo for the NANA region on their ships that have off-loaded the ore in Vancouver. However, goods destined for the NANA Region are now normally purchased in the Pacific Northwest, U.S.A. and the Jones Act would preclude routing of ships from the U.S. west coast ports to Vancouver. There are two options available to circumvent the shipping restrictions.

One alternative is for goods normally purchased in the Lower 48 for shipment out of Seattle to Northwest Alaska, to be purchased instead in Canada and shipped direct to the Red Dog port from Canadian ports. This option, therefore, creates an incentive for Alaskans to spend their money on Canadian goods rather than U.S. goods. The goods may actually be cheaper in Canada. In fact, Cominco's evaluation of the use of the Red Dog port as a regional port indicates that the transportation costs of fuel purchased and shipped from Vancouver are $30 cheaper per ton than fuel purchased and shipped from Seattle. However, there is a potential political issue regarding the expenditures of Alaskan dollars in a foreign country, for goods readily available in the U.S.

The second alternative is to make use of a provision of the Jones Act (known as the Third Proviso), which allows for intermodal transporting of American goods into foreign countries. This option would allow for rail shipments from the U.S. to Vancouver where the goods would be transferred onto the Cominco ships and backhauled to the Red Dog port. There currently is a bill in Congress that will eliminate the Third Proviso which would, therefore, eliminate this alternative.

Another shipping aspect that relates to the Red Dog project is Senate Bill 1624, Cargo Preference Legislation. This bill is currently being discussed in Congress and is backed by Senator Stevens. SB 1624 proposed to require that 50% of all U.S. bulk exports be transported on U.S. flag carriers. The State of Alaska DOT&PF has expressed to Senator Stevens their opposition to the cargo preference requirements. DOT&PF contends that the high costs of using U.S. flag carriers would severely impact potential exports and place Alaska at a competitive disadvantage relative to other Pacific Rim exporters.

If Senate Bill 1624 is enacted into law, Cominco/NANA would be required to ship their ore on U.S. flag carriers and the transportation costs of freight for both the Red Dog Project and NANA Regional goods that are backhauled on the ships serving the Red Dog Project, are forecasted to increase.

F. Synopses of Two Canadian Mining Projects with Joint Public / Private Sector Participation

Two resource development projects that evolved through joint public/private sector participation are summarized in this report:

1. Northeast Coal Development

2. Pine Point Mines Ltd.

Three companies, Societe Quebecois d' Exploration Miniere (SOQUEM), Elf Aquitane and the Potash Company of Saskatchewan (PCS), were also looked at. However, though they represent cases of investment by the public sector in mineral developments, the nature of this investment was viewed as being far removed from the Red Dog proposal and, therefore, not applicable to the purpose of this report.

1. NORTHEAST COAL DEVELOPMENT

Located at the Peace River coal field in British Columbia. The size of the northeast coal deposit is estimated to be 8 billion tons. The center of the deposit is located approximately 78 miles southwest of Dawson Creek (the nearest highway and railway lines) and 400 miles from the Port of Vancouver.

In 1975, the Provincial Government of British Columbia, which owned substantial coal reserves, decided that development of these resources was the economic priority of the government. Approximately $15 million was spent by the government on 77 studies relating to the mine and its potential impact.

Three main parties have participated and have an interest in the development of the mine. They are the Provincial Government who owns the resources; the Federal Government which has an interest in the regional economic policy, is owner of the national railway (CN Rail), has jurisdiction over ports and their development, and has constitutional responsibility for international trade; and private industry that has expertise in mine development.

In June 1980, the Provincial Government informed major coal producers that the Province would develop the rail and highway systems, organize a town at the site, provide power transmission facilities, and negotiate with the Federal Government for construction of a terminal facility if the producers would develop the mine. No tax or royalty concessions were offered, freight rates would be commercially negotiated with a special rate prevailing until 1989, and complex cost recovery techniques would be developed to meet a sales contract and then the necessary infrastructure would be put in place.

In January 1981, two companies, Quintette Coal Ltd. and Teck Corporation, negotiated contracts with the Japanese steel industry for an annual supply of 7.7 million tons of coal. The price was negotiated at $76.00 and $76.50 per ton, plus escalation, with deliveries commencing in December, 1983.

The development responsibilities among the three parties consisted of the following tasks:

Private Industry

1. Quintette Coal Ltd. would develop an open pit coal mine capable of producing 6.3 million tons per year.

2. Teck Corporation would reestablish operations at their Bullmoose Mine to be capable of shipping 1.7 million tons per year.

Provincial Government

1. The Highway Department would build a new 57 mile road and upgrade other area roads.

2. The Provincial railroad would build 80 miles of new track with two major tunnels (3.7 miles and 5.5 miles).

3. A new substation for electrical power would be constructed and 79 miles of new power lines i. lled.

4. The Province would establish a new community near the mine site to accommodate a population of 6,000 people.

Federal Government

1. The federally owned railway would upgrade 677 miles of its system.

Federal Government and Private Industry

1. A new coal terminal would be constructed, funded jointly by the Federal Government and private industry. The facility would be capable of handling 12 million tons of coal per year and berthing vessels up to 250,000 dwt.

Total capital expenditures for the project are estimated to be $3 billion. Approximately 10,000 permanent jobs have been created. The estimated present value of taxes and other government revenues resulting from this project is $1.7 billion over a 20 year project life. These revenues, which are shared by the Provincial and Federal Governments, consist of income taxes, mining taxes and coal royalties paid by the mining companies, as well as sales taxes on goods and services and the personal income taxes paid by construction and operating employees.

2. PINE POINT MINES

The Pine Point lead and ore deposit is located near the Great Slave Lake in the Mackenzie District of the Northwest Territory, Canada. Cominco Ltd. began staking the property in 1928 and in 1951 Pine Point

Mines Ltd. was formed with Cominco owning a 78% interest. In 1955, the estimate of the size of the deposit was 5 million tons or ore averaging 4% lead and 7% zinc. At that time, the company determined that it was impractical to develop a mine until adequate transportation facilities were established.

In 1955, The Deputy Minister of Northern Affairs advocated the construction of a railway, 438 miles long, from Grimshaw, Alberta, to the Great Slave Lake as a project of national interest and to serve the Pine Point Mine. In 1961 an agreement was reached between the Federal Government, Pine Point Mines Ltd., and the Canadian National Railway Company (CNRC). The agreement called for the Federal Government to construct the railway, the Northern Canada Power Commission to build a hyro plant for supplying power to the mining area, and for Pine Point Mines Ltd. to bring the mine into production. The mining company guaranteed shipments of 215,000 tons per year for 10 years to CNRC, and the cost of the hydro plant construction was underwritten by Pine Point Mines Ltd.

Mining operations began in 1963 with a planned production capacity of 5,000 tons/day. The railroad reached Pine Point in 1964 and ore shipments began in 1965. Additional mineral leases were acquired and in 1968 the company increased its concentrating capacity to 10,000 tons per day.

Following are the key points outlined in the agreement between the Federal Government, CNRC, Pine Point Mines, and Cominco:

1. CNRC agreed to complete construction of the 438 mile rail line by December 31, 1966.

2. Pine Point Mines Ltd. agreed to ship exclusively on the rail for 10 years at least 215,000 short tons per year at a rate of $7.75 per short ton (subject to any increase or decrease in rates). If more than 215,000 short tons were shipped in a

particular year, CNRC will credit the surplus to the mining company, and vice versa.

3. All rates that apply to the Point Point Mines Ltd. shall apply evenly to any new operations established along the rail route.

4. No mineral rights will be transferred to CNRC for lands leased by Cominco that are crossed by the railway.

5. All income taxes paid by Pine Point Mines Ltd. are subject to the "Income Tax Act" and all royalties paid to the government are established according to the Canada Mining Regulations.

As a result of the payment schedule established in the agreement, the capital costs for the new railroad line ($79 million) were paid off after 7 years of the mines' operation. Power costs were subject to an agreed surcharge. Public investment in the hydroelectric power plant has long since been amortized. The current production rate is 11,000 tons per day and the mine operation and production is expected to continue for at least another 10 years. There are a total of 640 employees at Pine Point Mines with Pine Point community members having the second highest per capita income rate in the Northwest Territory.

VIII. Report of the Division on Land and Water Management Department of Natural Resources

A. Summary of DLWM Involvement in Red Dog Project

B. Outline of Topics to be Considered in a Right-of-Way Agreement

C. Commissioner's Response to Cominco and GCO Minerals Right-of-Way Applications

MEMORANDUM State of Alaska

TO: John Sims, Director
Office of Minerals Development
Department of Commerce and
Economic Development

DATE: February 23, 1984

FILE NO:

TELEPHONE NO: 465-2400

FROM: Esther C. Wunnicke
Commissioner
Department of Natural Resources

SUBJECT: Red Dog Project

Esther C Wunnicke

I am responding to your recent request for comments from the Department of Natural Resources on the proposed Red Dog project. I am strongly supportive of the proposed development and offer the Department's resources in your review.

To encourage optimum eventual development in the area, all landowners and users must cooperate in providing for multiple industrial use of rights-of-way, development areas, and tidelands. We have proposed a reciprocal use agreement that would cover tidelands, the port and uplands, rights-of-way, material uses, and other matters of public concern. The attached memoranda to you from the Northcentral District staff of the Division of Land and Water Management indicate our concerns about the right-of-way and other development areas.

I strongly urge that affected landowners and users be brought together soon to discuss reciprocal use. The Department will be prepared for preliminary discussions within two weeks and has so informed NANA. We have been assisted by the Attorney General's Office in drafting a reciprocal use agreement.

In the executive summary I have noted a few points that I would recommend rewording. I am sending my suggestions under separate cover.

Thank you for requesting the Department's involvement. My staff and I are available if you have any further questions.

Attachments

02-001A (Rev. 10/79)

MEMORANDUM State of Alaska

DEPARTMENT OF NATURAL RESOURCES - DIVISION OF LAND AND WATER MANAGEMENT
NORTHCENTRAL DISTRICT - 4420 AIRPORT WAY, FAIRBANKS, ALASKA 99701

TO: John Sims
Director, Office of Minerals Dev.
Dept. of Commerce & Economic Dev.

DATE: November 18, 1983

FILE NO:

THRU: Jerry L. Brossia
District Manager

TELEPHONE NO: 479-2243

SUBJECT: Summary of DLWM Involvement in Red Dog Project

FROM: Michael E. Vediner
Natural Resource Officer
Classification & Coordination

Initial involvement of this division in the Red Dog project dates to August, 1982 with receipt of a ROW application from GCO Minerals to develop their Lik deposit. In January, 1983 Cominco applied for a different ROW to develop Red Dog.

In response to this potential for multiple facilities and in support of CZM mandates Commissioner Wunnicke issued the following general policy statements to both GCO and Cominco:

1. The State of Alaska will authorize the development of a single transportation corridor. The route will be public and available to multiple use by other future resource developments in the region. As a public route, reciprocal right-of-way agreements must be acquired wherever private or corporate ownership is encountered.

2. Tideland (and associated upland) port development will also be available to support multiple users such as oil and gas, coal exploration, or support services development.

3. Local concerns, particularly subsistence use must be accommodated to the maximum extent possible.

4. One EIS should be produced that considers all potential options. To this end, the research data collected by both companies should be available to all participating agencies.

For the project proposed by Cominco the division anticipates issuance of tideland lease(s), tideland permit(s), right-of-way permit, material sales, water appropriation certificates, dam safety permits, and possibly, instream flow reservation. To date only the right-of-way application has been received and at the request of the other state reviewing agencies further action is awaiting completion of the EIS.

We will be working closely with OMB on permit coordination regarding the CZM consistency determination. OMB has indicated that a single determination to cover all permits may be possible.

02-001A(Rev. 10/79)

Several issues have been identified by this division that through the EIS process remain unresolved, particularly with respect to your task force objectives and possible direct state involvement. These are summarized below.

1. Land ownership status was not considered in assessing the regional, multiple use perspective, during the EIS process. As a result the preferred (southern) alternative crosses a variety of land owners and terminates at tidewater on native corporate land. Since the applicant is in partnership with the native corporation they obviously have no objections.

   From the Department of Natural Resources' stated objective of one, multiple use, public road however the ownership status is of greater concern. Certainly we can insist on reciprocal rights-of-way for the primary road but upland facility land needs for possible future developments are not readily obvious. By comparison the northern (GCO) alternative crosses and terminates on public owned land. In fact the northern port site location is within the only stretch of accessible, unencumbered, public land along the northwest coast.

   If the state builds the road we may well consider a route that traverses a national monument and ends on private land as a greater barrier to public, multiple use than the number of bridge crossings, particularly since the environmental concerns of river crossings can be mitigated by appropriate construction techniques.

2. Both Cominco and GCO have investigated the preliminary engineering and costs associated with road construction. Their costs per mile vary from $1.5M to $800K, respectively, even though both roads are designed to support 222,000 pound loads. These cost differences are significant when considering state funded construction. The shorter southern route costs less to build for any given set of standards. Yet in absolute costs GCO could build their northern route for less than Cominco could build their southern route. Two questions that arise are: would state construction follow state highway standards and are the cost factors more important than land availability?

3. Design of port facilities should emphasize availability to other users. Items such as location of artificial islands and upland facilities should allow easy access to multiple users.

B. Outline of Topics to be Considered in a Right-of-Way Agreement

MEMORANDUM State of Alaska

DEPARTMENT OF NATURAL RESOURCES - DIVISION OF LAND AND WATER MANAGEMENT
NORTHCENTRAL DISTRICT - 4420 AIRPORT WAY, FAIRBANKS, ALASKA 99707

TO: John Sims, Director
Department of Commerce
Office of Minerals Development
Fairbanks

DATE: December 20, 1983

FILE NO: Red Dog

TELEPHONE NO: 479-2243

FROM: Jerry Brossia
District Manager

SUBJECT: Red Dog R/W

This memorandum outlines topics that should be considered in a Rightof-Way agreement for the Red Dog project. This information has not been reviewed by the Commissioner's office; therefore, these topics are considered as a draft. This information will also need to be reviewed by the Department of Law prior to meeting with NanaCominco.

We have been actively meeting with the Attorney General in Fairbanks and hope to receive further policy guidance from him and the task force in the near future.

In order to complete a Right-of-Way agreement it is necessary to determine land ownership for the entire route. There may be a variety of land owners along the proposed road (ie. National Park Service, Nana, Kivalina, Native Allotments, or mining claims). This review is currently underway and should be complete by late January 1984.

The RightofWay with Nana should include the following sections:

1. General discussion of grant
    a. Purpose
    b. Definitions
    c. Location
    d. Third parties interests.

2. Reciprocal agreements with Nana

3. Late comers' user agreements

4. Port and tideland use

5. Upland expansion for industrial purpose.

6. Availability of road use
    a. Industrial
    b. Public
    c. Subsistence

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7. <u>Alignment/realignment for engineering or environmental purposes</u>

8. <u>Mitigative measures</u>

   a. Environmental
   b. Maintenance

9. <u>Liability</u>

10. <u>Indemnification of State</u>

11. <u>Bonding</u>

12. <u>Insurance</u>

13. <u>Books/Accounting record access</u>

14. <u>Reservations</u>

   a. State
   b. Nana

15. <u>Compliance with Notice to Proceed and Stop Work</u>

16. <u>Forfeiture/Breaches</u>

17. <u>Termination Plans</u>

Other Items:

<u>Land Exchanges</u>

<u>Cost Reimbursement Schedules</u> (if State financed)

<u>Toll Charges</u>

Nana has been advised, on December 20, 1983, that we are willing to discuss the R/W with them. Don Argestinger will contact me to set up a time.

cc: Jim Barnette
    Tom Hawkins
    Esther Wunnicke

C. Commissioner's Response to Cominco and GCO Minerals Right-of-Way Applications

STATE OF ALASKA

BILL SHEFFIELD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF THE COMMISSIONER

POUCH M
JUNEAU, ALASKA 99811
PHONE: (907)465-2400

March 9, 1983

Mr. W. H. Tonking
Executive Vice President
GCO Minerals Company
P. O. Box 4258
Houston, TX 77210

Mr. H. M. Giegerich
President and General Manager
Cominco Alaska
5660 "B" Street
Anchorage, AK 99502

Dear Mr. Tonking:

The Department of Natural Resources has now received applications and supporting documentation for rights-of-way from both Cominco Alaska and GCO Minerals Company to connect mineral deposits in the Western Delong Mountains with tidewater. We are pleased to see the significant effort that is underway to develop these mineral resources with due regard for engineering and environmental concerns. As the Department's involvement in this project gets underway, it is appropriate to provide both companies with our position on several key issues.

1. The State of Alaska will authorize the development of a single transportation corridor. The route will be public and available to multiple use by other future resource developments in the region. As a public route, reciprocal right-of-way agreements must be acquired wherever private or corporate ownership is encountered.

2. Tideland (and associated upland) port development will also be available to support multiple users such as oil and gas, coal exploration, or support services development.

3. Local concerns, particularly subsistence use must be accommodated to the maximum extent possible.

4. One EIS should be produced that considers all potential options. To this end, the research data collected by both companies should be available to all participating agencies.

In consideration of these points and as an aid to the various agencies that will participate in this project a unified industry position is desirable. Since the primary objective of both companies is to ship mineral commodities, and consolidation of support facilities in the coastal zone is required under State law, you should strive to resolve any differences you may have and mutually support a common right-of-way and port site development.

The Department will be an active review agency during the EIS process and will be prepared to provide the requested permits and/or leases within six months of EIS adoption.

I am hopeful that these points provide better direction at the outset of this project and I look forward to a successful venture. We also will be available to meet with all involved parties in Anchorage at your earliest convenience.

Sincerely,

Esther C Wunnicke

Esther C. Wunnicke
Commissioner

cc: Commissioner Dan Casey, DOT/PF
Curt McVee, BLM
Bill Riley, EPA
Harris Saxon, Ely, Guess & Rudd
Jerry Brossia, NCDO
Tom Hawkins, DLWM
Don Argetsinger, NANA

IX. Appendices

Appendix A: Project Description from Preliminary Draft Environmental Impact Statement

Appendix B: Red Dog Fact Sheet

Appendix C: Project Permitting Time-Line

Appendix D: Permit Flow Chart

Appendix E: Base Metal Markets (Cu, Pb, Zn): Alaskan Opportunities (Paper by Gordon H. Laurie, Cominco, Ltd.)

Appendix A: Project Description from Preliminary Draft Enviromnmental Impact Statement

INTRODUCTION

Development of the Red Dog mining project would involve an open pit lead/zinc mine located 131 km (82 mi) north of Kotzebue. The ore would be crushed and the metallic sulfides concentrated in a mill near the mine site, with the concentrates transported to the coast for shipment to market. While the deposit has not yet been fully defined by geologists, at least 77 million Mg (85 million tons) of ore exist. The ore contains approximately 5.6 percent lead, 17.1 percent zinc, 75 g/Mg (2.4 oz/ton) silver and measurable levels of barite. The project has a potential life of at least 40 years under expected production rates, with the possibility of extension if additional ore is found. The mine would be developed in two phases. The "initial" phase of production would extend five years and produce approximately 434,450 Mg/yr (479,000 tons/yr) of combined concentrates (Table II-1). The "expanded" phase of production would extend from the sixth year of development through the life of the project. Approximately 683,878 Mg/yr (754,000 tons/yr) of combined concentrates would be produced during this phase (Table II-1).

The mine, tailings pond, mill, power plant, worker housing and water reservoir would all be located within a 8,975 ha (22,176 ac) parcel of private land in Red Dog Valley. The port site would also be on private land if located at VABM 28, but on public land if located at Tugak Lagoon. The transportation corridor would be almost totally on public land.

PROJECT COMPONENTS AND OPTIONS

In reviewing this document, it is important that the reader understand the relationship among the terms "component", "option" and "alternative". The project has several components, each one a necessary part of an entire viable mining project (e.g., the mine, mill site, tailings pond*, transportation system, port site, etc.). For each component there may be one or more options (e.g., a northern or a southern transportation corridor option). An alternative is a combination of options (one for each component) that constitutes an entire functioning project.

Table II-1

CONCENTRATE PRODUCTION SCHEDULE

Daily Production (Average Amount/Day)	Initial Production Rate		Expanded Production Rate	
	Mg[1]	Tons	Mg[1]	Tons
Ore	2,721	3,000	5,079	5,600
Lead Concentrate	204	225	308	340
Zinc Concentrate	907	1,000	1,515	1,670
Barite Concentrate	127	140	127	140
Tailings*	1,678	1,850	2,766	3,050
Annual Production				
Ore	958,700	1,057,000	1,779,534	1,962,000
Lead Concentrate	71,650	79,000	107,933	119,000
Zinc Concentrate	317,450	350,000	530,595	585,000
Barite Concentrate	45,350	50,000	45,350	50,000
Tailings	524,250	578,000	1,095,656	1,208,000

[1] 1 Mg (megagram) = 1.102 tons
1 ton = 0.907 Mg

Source: Cominco Alaska, Inc.

* Defined in Glossary.

The EIS scoping process initially identified at least two, and often several, options for each component. The process by which this large number of options was screened to reduce the number to a manageable level, and the ultimate project alternatives were selected, is described in detail in Chapter III. The following description of each project component, therefore, addresses only those component options which were ultimately retained and are specifically addressed in at least one of the three action alternatives.

Mine

The Red Dog deposit is located on a side hill on the main fork of Red Dog Creek. The immediate topography generally consists of rolling hills with wide valleys. The zone of mining influence would impact the main stem of Red Dog Creek (Fig. II-1).

The outcropping ore body and its geological configuration dictate that a conventional underground mine would not be feasible. Open pit mining would require overburden (waste rock) removal from the surface of the ore body, followed by drilling and blasting of the ore in benches within an open pit. Overburden material not suitable for mill processing would be stockpiled near the tailings pond.

The mine pit would be developed in two stages: preproduction followed by production mining. During preproduction, overburden would be removed from the pit, and access roads, pit ramps and the initial benches would be established. Unmineralized waste would be used for road and tailings dam construction. Mineralized waste would be stockpiled in a catchment area above the tailings pond. During preproduction, it is estimated that a total of 1,242,000 Mg (1,365,000 tons) of material would be removed.

Ore production rates are an important economic factor and are normally based on the extent of services and the estimated quantities of concentrates that would be accepted in the markets. Initial production mining would involve the annual extraction of 958,700 Mg (1,057,000 tons) of ore. On an initial operating basis, an average of 2,721 Mg (3,000 tons) of ore would be

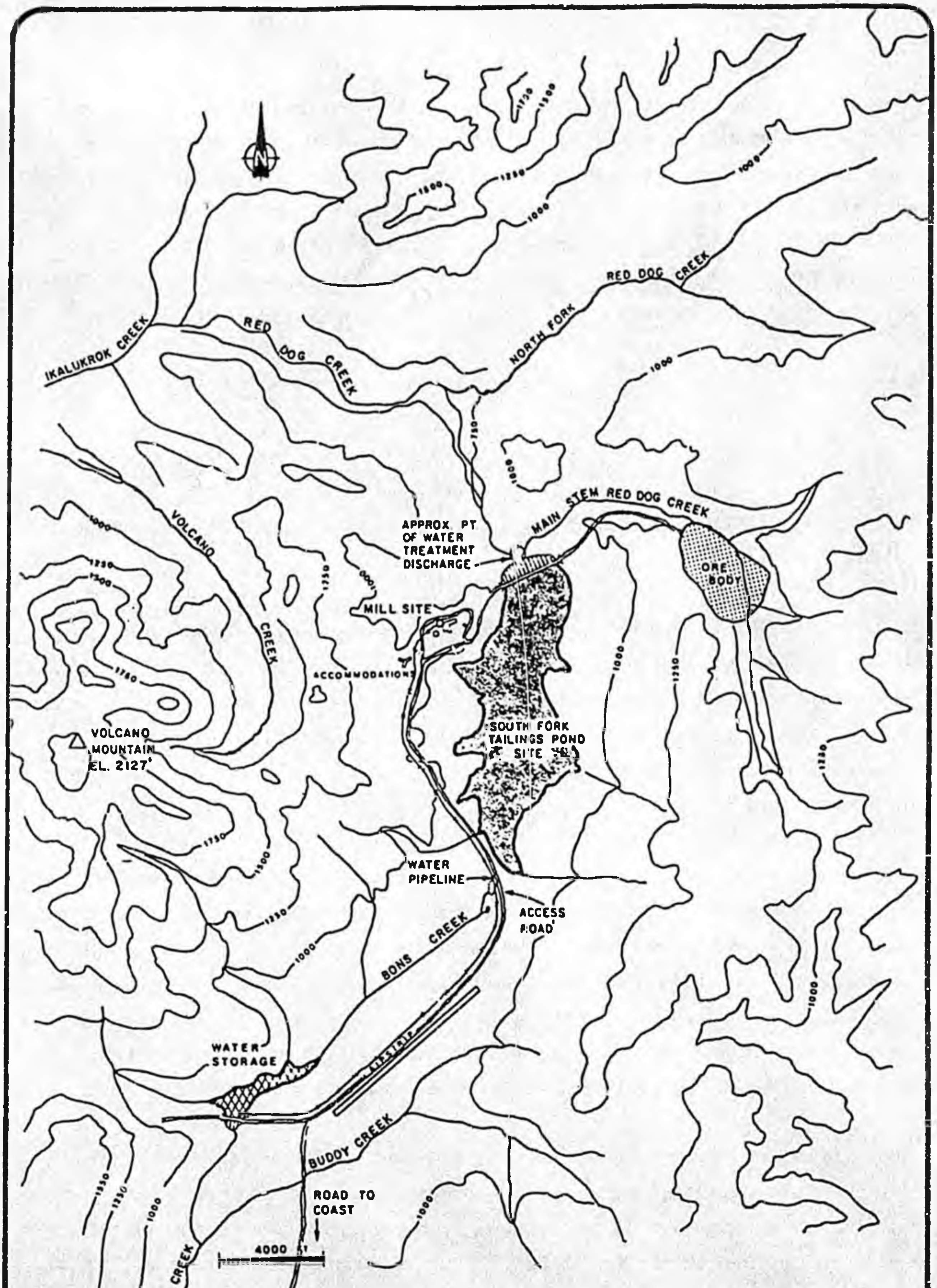

FIGURE II -1 RED DOG VALLEY MAP

sent each day to the concentrator (mill) for upgrading (Table II-1). Drilled and blasted ore would be loaded into mine type trucks using front-end loaders. The mine trucks would transport the ore to a crushing facility adjacent to the mill. The same loaders and trucks would be used to transport low grade ore and waste materials to stockpiles at the tailings pond.

The open pit would be designed to optimize ore recovery with due consideration given to protection of the Red Dog Creek watershed adjacent to the pit area (Fig. II-2). Pit slopes would be designed at 35 degrees and would be confirmed by rock mechanics design. Benches would be 7.6 m (25 ft) high and access ramps 18.3 m (60 ft) wide at an eight percent grade. The initial pit would be approximately 244 m (800 ft) in diameter and would contain seven benches down to the 297 m (975 ft) elevation. The final pit could be 853 m x 305 m (2,800 ft x 1,000 ft) in area and contain up to 28 benches to the 152 m (500 ft) elevation.

A diversion ditch would be constructed between Red Dog Creek and the open pit to collect runoff from the mine area. The ditch would initially intercept runoff from an approximate area of 0.65 km^2 (0.25 mi^2). The depth of the ditch would be sufficient to ensure that it would collect most of the ore zone runoff from the south side of the creek. If significant subsurface inflow from the creek occurred, a seepage cutoff wall would be added where necessary to block this inflow.

The drainage ditch would also collect surface erosion sediment originating from the open pit and the associated ore haul road to the mill. A pump station would route runoff from the open pit to the tailings pond. The ditch, collection sump and pump to the tailings pond would be sized for a 10-year recurrence 24-hour storm event. Adequate capacity would be allowed for winter icings and snow accumulation. The ditch would be cleaned of ice and erosion debris, if necessary, in late winter or spring to retain capacity for spring breakup and summer storm runoff.

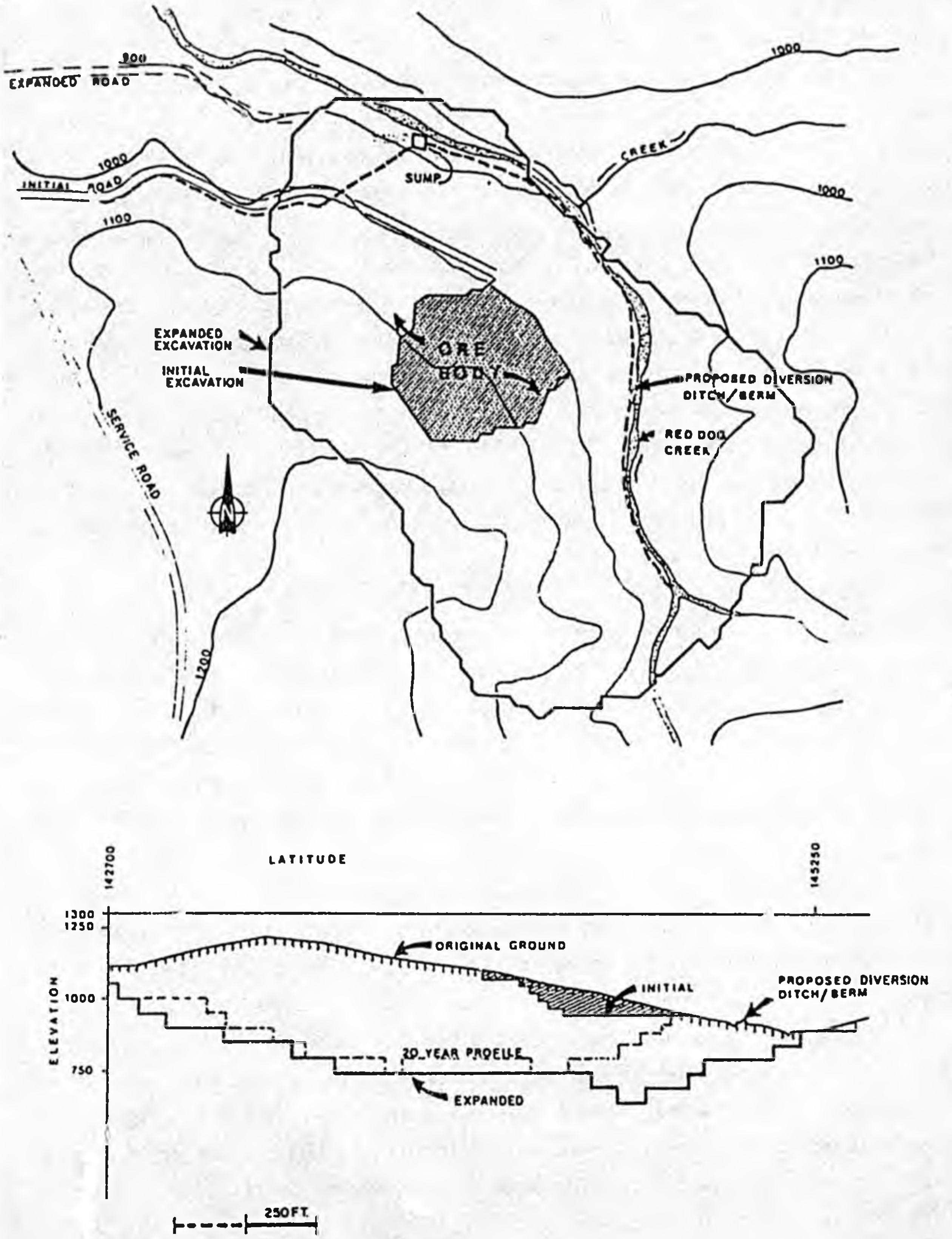

FIGURE II -2 MINE PIT LAYOUT

Tailings Pond

The location of the South Fork tailings pond in Red Dog Valley is shown on Figure II-1. A detailed diagram of the approximately 237 ha (585 ac) tailings pond facility is shown on Figure II-3. The tailings pond dam would be in the form of an impervious earth-filled structure with a spillway designed to maintain structural competency in the event of an overflow. The earth-filled dam would be constructed in stages. Prior to full production, the dam would be constructed to contain five years of production tailings. The dam would then be raised to its final elevation in stages which may take 15 years to complete. The top of the dam would be used as a road to haul ore from the pit to the mill complex.

Thickened tailings slurry from the mill concentrating process would contain about 60 percent solids by weight, with the liquid portion consisting of excess process water, dissolved minerals and residual reagents. The slurry would flow by gravity from the mill into the tailings pond. An internal process using a thickener would be used to return water directly to the mill process circuit as a step in minimizing process water loss. It is estimated that approximately 64 percent of mill process water could be recirculated directly in the mill in this way. Additional mill process water would be recycled from the tailings pond (25 percent) or from the freshwater source (11 percent). These recycle estimates are based upon water balance flowsheet data (Cominco Engineering Services, Ltd., 1983). Tailings in the form of a sand slurry would be deposited behind the dam.

Red Dog Creek tributaries with known metal content of toxic concentrations would continue to drain into the tailings pond for treatment, as would precipitation-related runoff. Diversion structures and ditches would be built to control or prevent excess surface drainage of uncontaminated water into the tailings pond. The surface water would be routed into the Bons Creek drainage, thus reducing the amount of water accumulating in the tailings pond. Chemical treatment and metals removal of tailings pond water would take place in a treatment plant prior to discharge to the presently minerals-contaminated Red Dog Creek. A seepage contingency dam would be con-

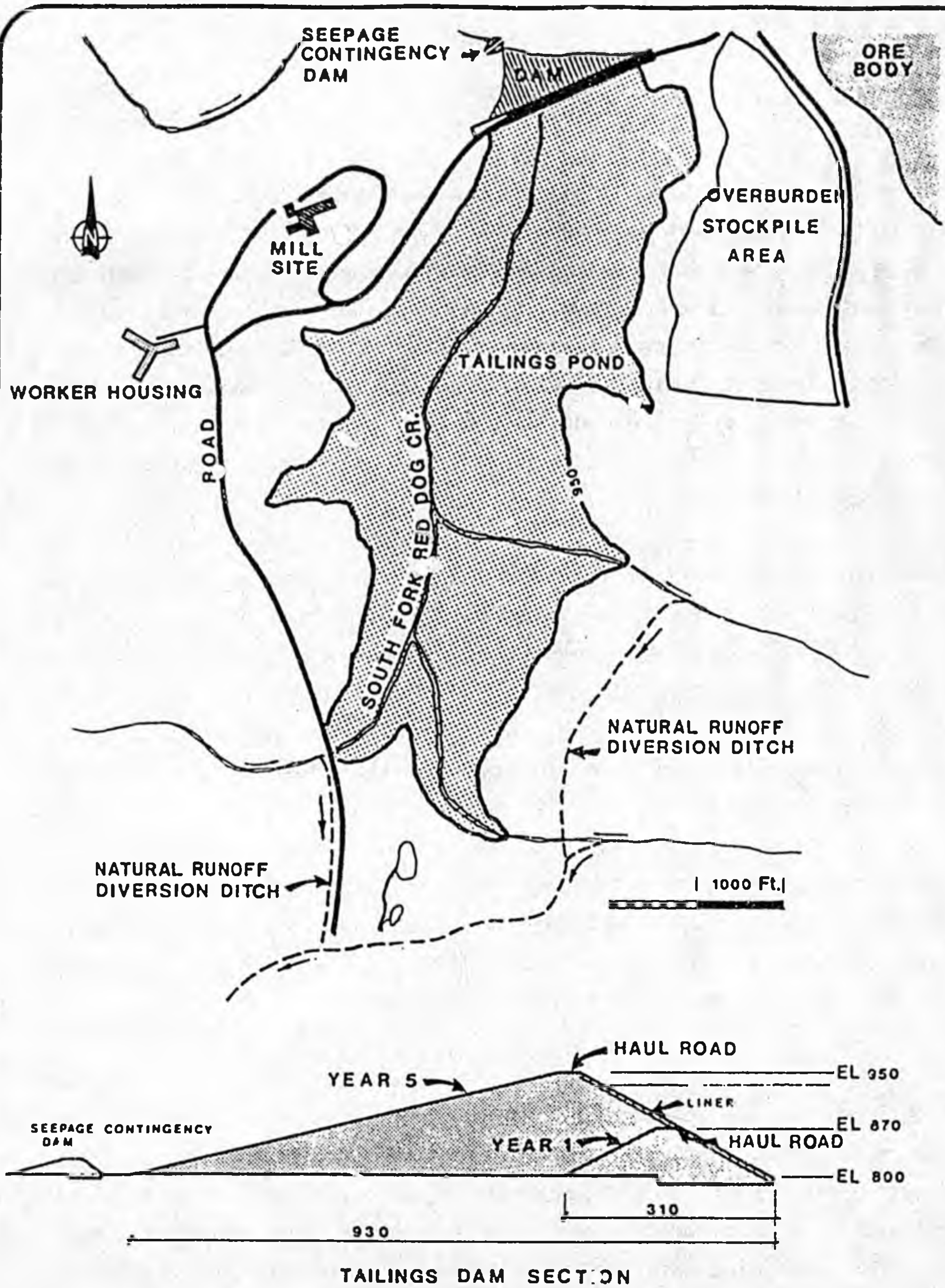

FIGURE II -3 SOUTH FORK TAILINGS POND

structed downstream of the main tailings pond dam to collect any seepage and return it to the tailings pond.

Mill

Proximity to the mine and tailings pond were determining factors in mill location. The proposed mill site would be on a small hill of bedrock outcrop located opposite the ore body on the northwest side of the South Fork tailings pond (Fig. II-1). This site would be located within the pond catchment area so that tailings slurry could flow by gravity from the concentrator complex to the tailings pond. In addition, worker housing facilities would be located within a reasonable distance of the mill site so that waste heat produced in the power generation process could be used to heat the accommodations.

The proposed mill complex is shown on Figure II-4. The approximately 14 ha (35 ac) complex would include a water treatment plant, a diesel-based power plant, fuel storage and distribution facilities, and a vehicle maintenance/warehouse structure in addition to facilities integral to the milling process.

The project would use a selective flotation milling process to concentrate valuable minerals. The flotation process would consist of three major steps: size reduction, selective mineral concentration and moisture reduction of the concentrates. During the milling process, lead, zinc and barite minerals would be separated and concentrated, while the residual tailings slurry containing waste rock would be directed to the tailings pond. Silver complexes with the lead and zinc concentrates in the milling process, and would be separated out later during smelting.

After grinding, the ore would be suspended in a water slurry and transported to flotation cells (tanks) where the valuable minerals would be separated from waste materials in a froth flotation process. In this process, valuable minerals adhere to air bubbles that rise to the surface of the tanks and are removed. To make the process work efficiently, it is necessary to

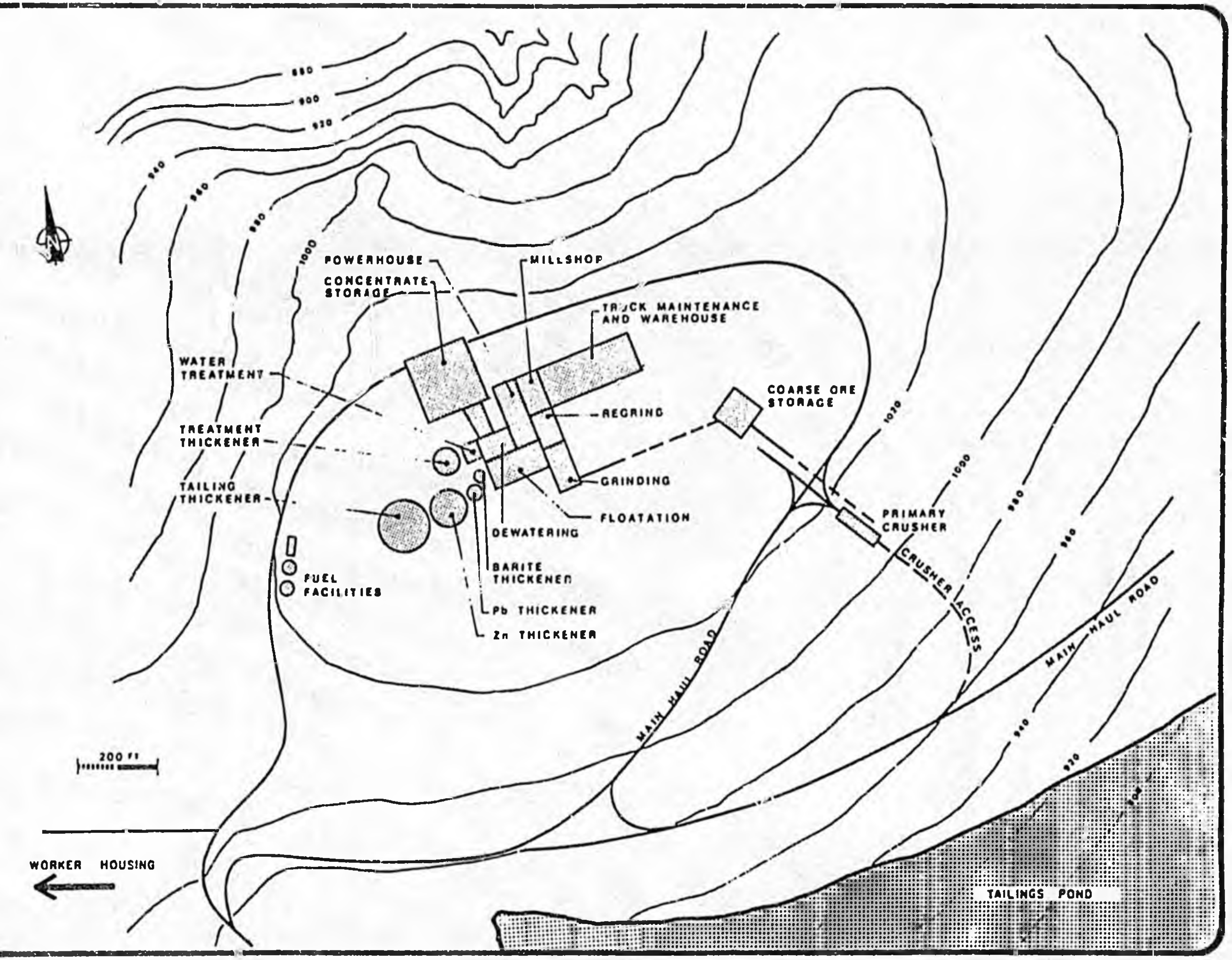

FIGURE II - 4 MILL SITE FACILITIES

add air and various reagents. The reagents either aid flotation of valuable components or suppress flotation of waste material. This allows the bubbling and frothing action to float different ore minerals selectively so that metal concentrates can be produced. The ore minerals would be separated as sulfide concentrates of lead and zinc, with barite recovered in the last stage of the process as barium sulfate. Waste would include silicate minerals and small concentrations of sulfides.

Following separation of the ore minerals from waste rock, dewatering of the concentrates would take place using lead and zinc thickeners, followed by filtration and thermal drying. Wherever possible, waste heat from the diesel-based power generation would be used for drying the concentrates.

No reduction of sulfides to base metals or other changes in the chemical composition of ore minerals would take place in the concentrator or at the project site. The upgraded lead and zinc concentrates (which would also contain silver) would be shipped to smelters outside of Alaska for processing to refined metals. Barite concentrate would be dried and bagged locally for possible use in formulating oil well drilling mud.

The mill would be a major consumer of water and, as such, recirculation of process water would be used to the fullest extent possible. In addition to concentrate thickeners, a tailings thickener would be used to recycle water, thus decreasing the volume of tailings slurry produced. This would decrease the amount of water that would have to be treated, and would reduce annual water demand by approximately 49 million ℓ (13 million gal).

Reagents are an integral part of mill operation and sufficient quantities for a year's operation would be stored at the mill site. Reagents to be used for the Red Dog project are shown in Table II-2. These materials would be supplied in annual shipments and stored in a secure area at the port site.

The zinc ($ZnSO_4$) and copper ($CuSO_4$) sulfates used as conditioners in flotation would be handled in polylined and sealed palletized cartons of approximately 0.9 Mg (1 ton) capacity. These materials could be compatibly stored together and their toxic environmental hazards are well known.

Table II-2

RED DOG CONCENTRATOR REAGENTS

	Initial Production		Expanded Production	
	Mg/yr	tons/yr	Mg/yr	tons/yr
Zinc sulfate ($ZnSO_4$)	480	529	1,401	1,544
Copper sulfate ($CuSO_4$)	480	529	2,505	2,761
Sodium cyanide (NaCn)	96	106	299	330
Methylisobutyl carbinol (MIBC)	48	53	199	220
Sodium isopropyl xanthate	480	529	1,766	1,947
Sodium cetylsulfonate (EC-111)	72	79	148	163
Sulfuric acid (H_2SO_4)	959	1,057	3,002	3,309
Hydrated lime [$Ca(OH)_2$]*	2,396	2,642	9,018	9,941
Polyacrylamide flocculant* (Percol 730)	5	6	5	6

* Note: Part of the lime and all of the flocculant supply would be used in the wastewater treatment process.

Sodium cyanide (NaCn) is a toxic reagent and must, at all times, be stored and handled in isolation from other chemicals, particularly those which are acidic in nature, including the sulfate salts. This material would be shipped in 102 kg (225 lb) sealed drums on pallets. The reagent is essential to the metallurgical process as a depressant of iron minerals.

Methylisobutyl carbinol (MIBC) is an aliphatic liquid alcohol which has only a moderate solubility in water. It is moderately toxic to aquatic life and comparable in this respect to most intermediate molecular weight liquid alcohols. This chemical would be shipped in 181 kg (400 lb) steel drums and could be safely stored with the other chemicals.

Sodium isopropyl xanthate is an essential sulfide mineral collector in the flotation process, and is very toxic in the environment. It would be shipped in approximately 0.9 Mg (1 ton) sealed, palletized containers which preferably would be stored apart from acidic materials. A potential problem with xanthate is that it may deteriorate from prolonged contact with moisture and then would require disposal as it would be unusable as a reagent.

Sodium cetylsulfonate (EC-III) is a paste-like surface active agent used for barite flotation that has only a moderate solubility in water. It is essentially non-toxic and has been approved for use in food applications. This material would be shipped in 181 kg (400 lb) steel drums on pallets and would be compatible with all other reagents.

Sulfuric acid (H_2SO_4) is a hazard to aquatic life by virtue of pH reduction effects. Because of its liquid nature, spills would be difficult to contain and the chemical could have long lasting impacts on vegetation recovery unless lime were applied as a neutralizing agent. Sulfuric acid would be stored at the port in an isolated, berm-protected bulk tank and hauled to the mine in acid standard tank trailers of 24,227 ℓ (6,400 gal) capacity.

Lime would be used as a pH modifier in the mill flotation process and in the wastewater treatment plant. It is only toxic in concentrations which result in high alkalinity and would be relatively safe to manage in the hydrated form. It would be shipped and stored in heavy-wall plastic bags of about 1.8 Mg (2 tons) capacity. There would be no constraints on its storage with other reagents.

Polyacrylamide flocculant (Percol 730) is a slowly water soluble, high molecular weight, acrylamide-based polymer that would be used as a solids settling aid in the wastewater treatment plant. This material is relatively nontoxic. It would be shipped in 23 kg (50 lb) sacks on pallets and must be protected from temperature extremes in storage or its effectiveness might deteriorate.

The mill would produce lead, zinc and barite concentrates. Lead and zinc concentrates would be shipped to the port site in covered gondola-type trailers while barite would be moved in sealed containers on flat bed units.

The mill would operate on a continuous, round-the-clock basis for an estimated 350 days per year. Initial and final mill production rates are shown in Table II-1. Concentrates would be transported from the mill site to the main storage terminal at the port site in truck/trailer units. Approximately nine to 12 daily truck trips to the seaport would be required to handle the estimated daily production rate. Six weeks' production of concentrates could be stored at the mill to allow for transportation delays during periods of bad weather, when the roads were unsafe for travel, or if transportation activities were temporarily suspended to protect subsistence activities or animal migrations.

Worker Housing

A campsite or hotel-style facility would be constructed a reasonable distance from the mill site complex. The actual location of the accommodations would be more specifically defined during the detailed design stage of the project in accordance with Mining Safety and Health Administration (MSHA) regulations that mandate specific criteria for worker safety and comfort.

Approximately 225 to 250 full-time employees would comprise the project site workforce at any given time. Workers would be scheduled on a rotation of approximately two weeks on and two weeks off so the total project workforce would be twice that figure. The projected mine/mill workforce breakdown would be as follows:

Miners/Mill Operators	50 percent
Mechanics/Electricians	15 percent
Support	15 percent
Supervisory/Management	20 percent

Water Supply

The mill would be a major consumer of water so a guaranteed year-round water source would be essential to the project. Wells would not be feasible since the permanently frozen ground prohibits free-flowing water aquifers. An approximately 25 ha (63 ac) water storage reservoir located on Bons Creek at the south end of Red Dog Valley would serve as the water supply (Fig. II-5). A rock-filled dam would be constructed on bedrock foundation near the existing airstrip, and a pipeline would follow the existing road system to the mill site. The reservoir would also serve as a domestic water supply. It would have a capacity of 1,462 dam^3 (1,185 ac-ft) of water to meet an expected total daily consumption rate of 1,136 ℓ/min (300 gal/min) for all the mine area facilities.

Power Generation

For the concentration of minerals to take place, a large amount of power would be expended in grinding to achieve a fineness which allows adequate liberation of lead sulfide, zinc sulfide and barite particles from waste particles. On an average basis, electric power at a rate of 19.3 kWh/Mg (17.5 kWh/ton) of mill feed would be required for the grinding process. In order to meet this and other support facility demands, a dedicated power plant would be necessary The Red Dog project would consume approximately 10.2 MW, and an 18 MW diesel-based power plant would be installed to allow for down time of some generators.

It was desirable to minimize both the loss of waste heat and air pollutant discharge by designing a system whereby waste heat would be used for concentrate drying, with the dryer exhaust treated in a scrubber or other type of pollutant control device. Diesel fuel storage and distribution facilities would be provided at the mill site. Fuel storage units (capacity of 4,800 bbls) would periodically be replenished from the main fuel depot at the coast by tanker trucks or by ore trucks specially fitted with tanker units.

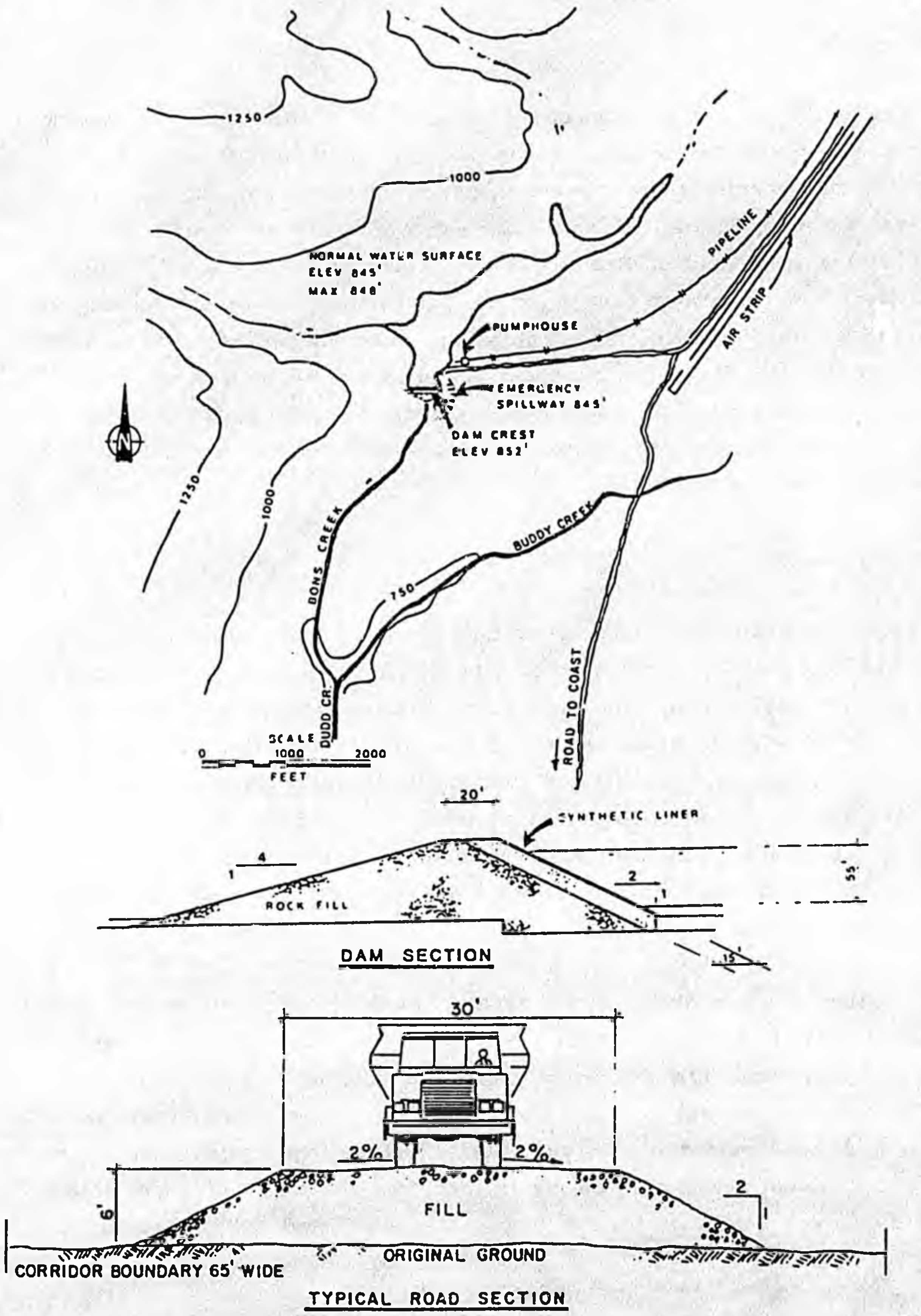

FIGURE II -5 WATER STORAGE RESERVOIR

Transportation Corridor

A transportation corridor would link the Red Dog Valley mine facilities with the Chukchi Sea coast. Two corridor options are included in the alternatives: a northern and a southern corridor (Fig. II-6). For the first 11.8 km (7.4 mi) the two corridors follow a common alignment. At a point near Dudd Creek, the northern corridor swings westward across the Wulik, Kivalina and Asikpak River drainages to a port site near Tugak Lagoon 24 km (15 mi) northwest of Kivalina. At Dudd Creek the southern corridor continues southwest along the flanks of the Mulgrave Hills to a port site near VABM 28, approximately 25.6 km (16 mi) southeast of Kivalina. The topography of both corridors would be gentle enough to handle railroad grades. Both corridors have therefore been laid out to accommodate a railroad at some future time.

Northern Corridor

The northern transportation corridor would be approximately 117.0 km (73.1 mi) long and would require the construction of six major (greater than 30.5 m [100 ft]) multiple-span bridges, seven minor bridges and approximately 300 culverts. The route would traverse the main stems of Ikalukrok Creek, and the Kivalina, Wulik and Asikpak Rivers (Fig. II-6). It would cross approximately 12 streams which contain fish.

Southern Corridor

The southern transportation corridor would be 89.9 km (56.2 mi) long and would require the construction of one major bridge, four minor bridges and approximately 182 culverts. The corridor would cross tributaries of the Wulik, Noatak and Omikviorok Rivers near their headwaters, and would generally stay at a higher elevation than the northern corridor until its terminus at the VABM 28 port site (Fig. II-6). It would cross approximately 11 streams which contain fish.

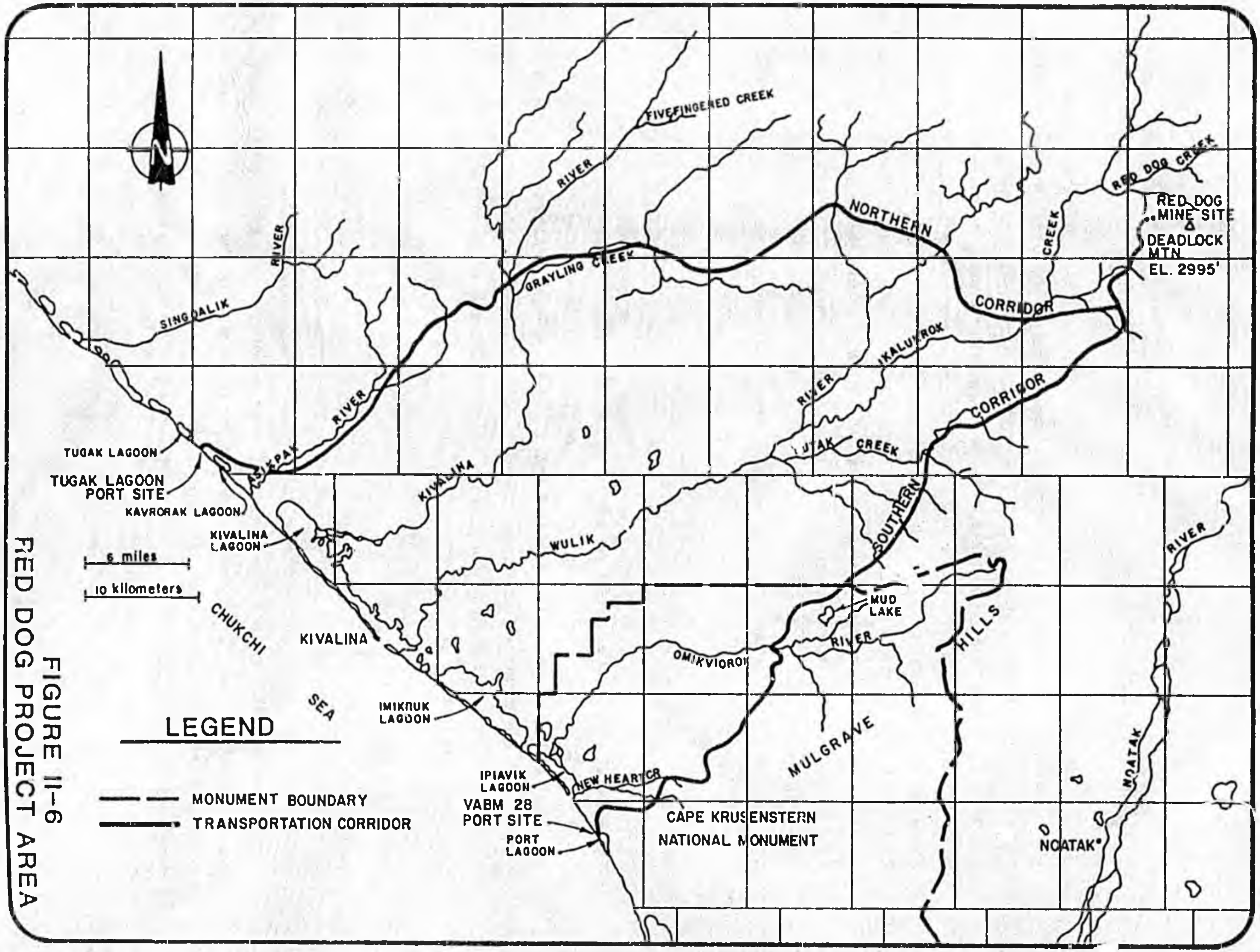

FIGURE II-6
RED DOG PROJECT AREA

Road Transportation System

The road haulage system would be comprised of a gravel surfaced road and double truck/trailer haulage units similar to normal highway vehicles, but over-sized. The roadbed or subbase would be composed of granular fill 2.0 m (6.5 ft) thick to prevent degradation of permafrost. The majority of the fill needed for construction would come from quarry sources as few gravel sources have been located along the corridors.

The top surface of the road would be 9 m (30 ft) in width as shown in Figure II-5. Turnouts and passing places would be provided along the route. Curvature and grade would generally be limited to 10 degrees and three percent, respectively, to permit eventual construction of a railroad. Bridge structures and culverts would be designed to accommodate year-round concentrate haulage by combined truck/trailer units. A truck and a trailer would weigh approximately 103 Mg (114 ton) and 90 Mg (108 ton), respectively, or 201 Mg (222 tons) for one combined truck and trailer unit. Nine to 12 daily truck/trailer round trips to carry concentrates to the port site would be required for the first five years at initial production rates. Following proposed expansion of production after five years, daily trips would average between 16 and 20.

Inbound freight would likely be containerized, though some specialized trailers such as tanker units (to haul fuel oil to the mill site) would be required. Periodic maintenance of the roadway would be necessary, thus requiring a full complement of road maintenance and repair equipment.

Port Site

Though operations at the mine would continue year-round, activity at the deep-draft port site would be limited to the receipt of supplies and fuel during the summer sealift, and the shipment of concentrates from late June until early October. Climatic constraints on shipping activities thus require that adequate storage facilities for concentrates, fuel and other supplies exist at the port site. Using an all-weather road, it is estimated that eight and a half months of concentrate storage capacity would be required at the port site.

Schematics of the approximately 20 ha (50 ac) proposed port site facilities are shown on Figures II-7 and II-8. Depending upon the type of transfer facility (described below), fuel would be stored either onboard the "offshore island" or in tanks on land at the port site. In either case, a year's supply would be kept there to serve as the main fuel depot for the project. Fuel would be periodically hauled to the mine site as required. A short causeway/dock structure would be required to receive incoming freight and supplies, and for transfer of the concentrates for shipment.

Only emergency and temporary ship loading crews would be housed at the port site. A small accommodation complex would be provided to support activities during the summer shipping season. Domestic sewage would be collected and treated using a package treatment facility before discharge into the sea. A small diesel-based 1.5 MW power plant would be required to operate conveyor equipment and life support facilities. In addition to the facilities located immediately at the coast, the main concentrate storage building would be located approximately 4.0 km (2.5 mi) inland, adjacent to the transportation corridor. This structure would be constructed on an excavated borrow site* to minimize habitat destruction, and to take advantage of foundation materials and protection from the wind.

Transfer Facility

Two methods to transfer concentrates from the port site storage facility to ocean going vessels are included in the alternatives: a short causeway/lightering* transfer system and a short causeway/offshore island transfer system. Both systems would use a 122 m (400 ft) causeway/dock structure as an interface between the shore and the concentrate loading vessels or offshore island. The causeway/dock structure would extend to the 4.6 m (15 ft) water depth. Concentrates would be transferred by conveyor belt

* Defined in Glossary.

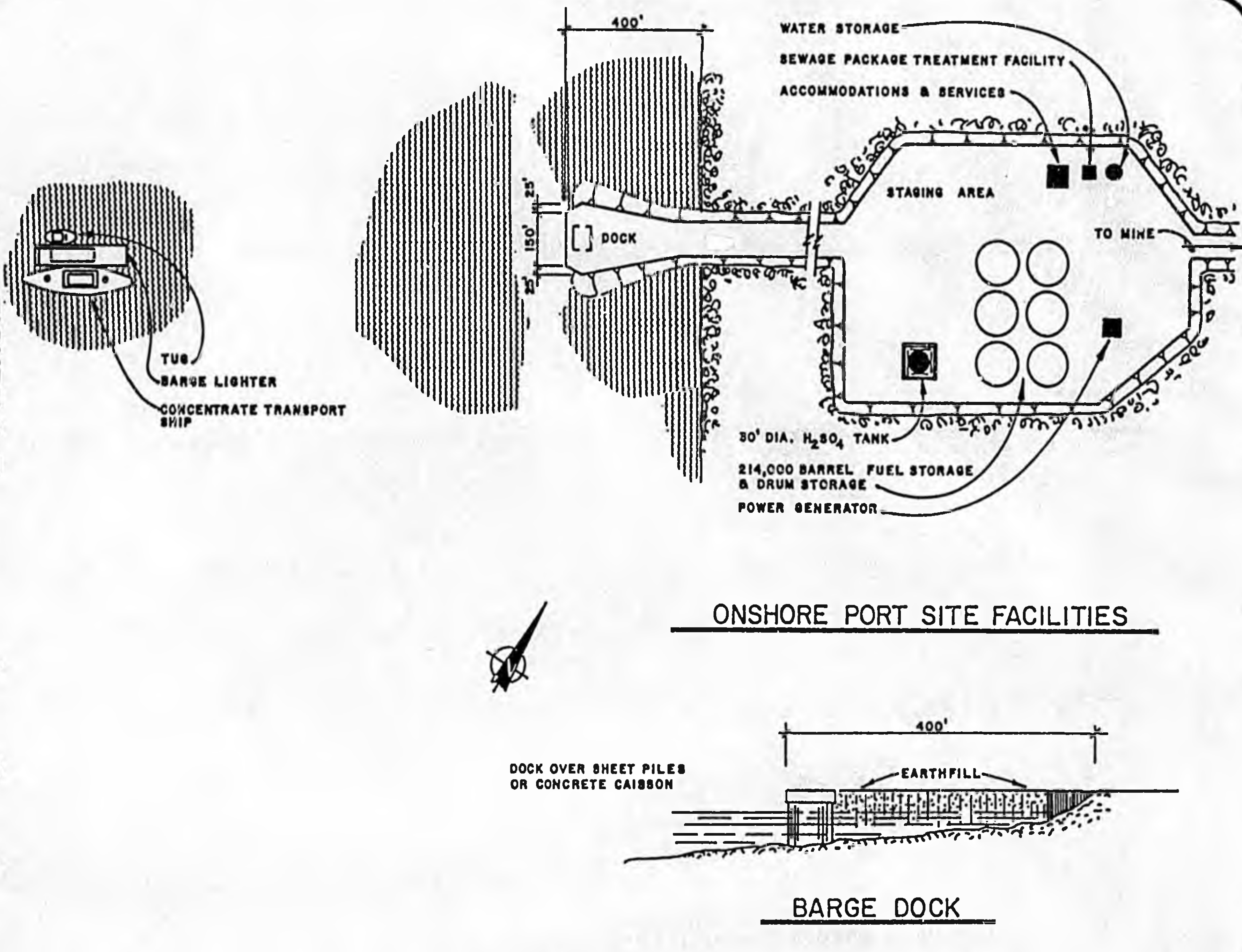

FIGURE II-7 CONCEPTUAL DIAGRAM OF A SHORT CAUSEWAY/LIGHTERING TRANSFER FACILITY

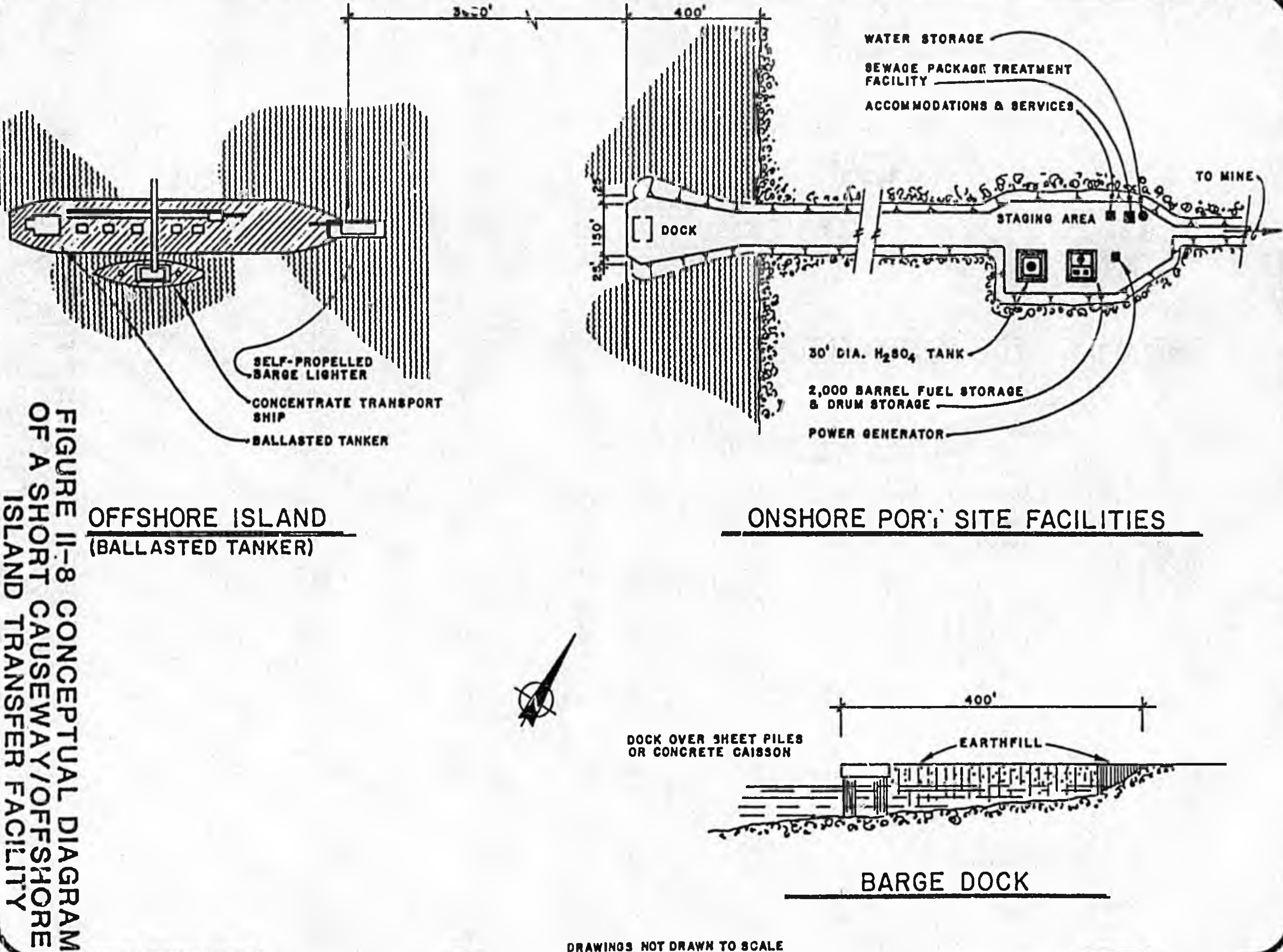

FIGURE II-8 CONCEPTUAL DIAGRAM OF A SHORT CAUSEWAY/OFFSHORE ISLAND TRANSFER FACILITY from a storage building, along the causeway, to a barge loader structure mounted on the dock face.

The causeway structure would be constructed of sheet pilings with solid earth fill (Fig. II-7). It would be suitably capped and faced to allow lighter* barges to tie up at its seaward face. Depending on the transfer facility option selected, lighter barges ranging from 907 to 4,535 Mg (1,000 to 5,000 tons) would be used.

Short Causeway/Lightering System

This transfer method would use two 4,535 Mg (5,000 ton) lighters and two support tugs to transfer concentrates from the dock directly to the side of a moored ocean going bulk-handling ship. The ocean going vessel would load concentrates with clam shell cranes, though rough sea conditions might make this transfer method unreliable. Winter shelter for the two large-capacity lighters and their tugs would be provided in a coastal lagoon located adjacent to the port facilities.

Short Causeway/Offshore Island

This transfer method would use a 226,750 Mg (250,000 ton) surplus oil tanker with an ice-strengthened hull which would be ballasted to the bottom perpendicular to shore (Fig. II-8). The landward end of the tanker would be in approximately 7.6 to 8.5 m (25 to 28 ft) of water and the seaward end in 10.6 to 12.1 m (35 to 40 ft) of water. Depending upon the port site selected, the landward end of the tanker would be approximately 1,213 m (4,000 ft) from shore. This 305 m (1,000 ft) tanker "island" would serve as an offshore dock for the smaller, ocean going bulk carriers. The tanker would be large enough to accommodate storage of concentrates, fuel and supplies. Onboard concentrate storage capacity would be sufficient to load three to five ocean going bulk carriers.

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* Defined in Glossary.

The bow of the ship would be modified to accommodate a 907 Mg (1,000 ton), self-unloading lighter which would discharge directly by conveyor belt into the ship (Fig. II-8). Only one self-propelled lighter would be needed to transport concentrates because of the storage capacity onboard the tanker. Shelter for the single, smaller lighter could be provided in the lee of the tanker if necessary during bad weather. Winter shelter would be provided in a coastal lagoon adjacent to the port site. If ice conditions were suitable, winter transfer of concentrates to the tanker island might be accomplished by trucks driven directly over the ice.

Transfer of concentrates from the ballasted tanker to bulk carriers would be accomplished using moveable conveyors between ships which would be loaded from storage by a clam shell bucket. Similar to the shore-based system, conveyors would be covered, and the end of the loader would be fitted with a telescoping spout or "elephant's trunk", to direct the concentrate into the receiving ship's hold below deck level. Conveyor return belts would be brushed in an enclosure to prevent losses to the sea. Sealed barite containers would be loaded by crane.

Fuel Storage

Location of the major fuel storage depot for the project would depend upon the transfer facility selected. For the short causeway/lightering option a full year's supply of fuel for the project, as well as fuel to meet the annual needs of the region's villages, would be stored in tanks on land at the port site. The fuel would be lightered to the dock from ships moored offshore. Storage capacity would be approximately 214,000 bbls with about 56 percent of that (120,000 bbls) being for the project. Fuel would be hauled to the mine area facilities by tanker truck as needed during the year. It would be distributed to the villages from the port site using the same smaller barges as used presently by local barge services to navigate the rivers.

For the offshore island option, the same amount of fuel would be transferred directly into the ballasted tanker and stored in tanks aboard the ship. It would be moved to shore year-round through a buried 10 to 15 cm (4 to

6 in) pipeline designed to withstand wave and ice forces and scour in the surf zone. The pipeline would be pressure tested for leaks prior to fuel transfers. Fuel would be stored at the port site to a capacity of approximately 2,000 bbls. It would then be transported to the mine area facilities by tanker truck as needed. Regional village fuel would be distributed by barges directly from the tankers.

DEVELOPMENT SCHEDULE

As is th case with any endeavor in the Arctic, the critical factor affecting the development schedule is the limited shipping season (generally July through September). Within these confines and assuming a project start-up date of January 1985, key periods in the development schedule are discussed below.

Construction equipment for road building activities would be landed at the port site during the summer of 1985. This equipment would be idled until freeze-up occurred prior to moving inland to the first borrow site. From January to July of 1986, a road would be built inland from the first borrow site, as well as back to the port site.

The first major construction sealift of equipment and materials would be made in the 1986 shipping season. The equipment for constructing the main road, as well as the mining equipment, would be brought in at that time. A 100-person barge-mounted camp would be located in a lagoon at the port site to support construction activity during the same sealift. A small 20-person "fly-in" construction camp would be set up at the Red Dog mine site.

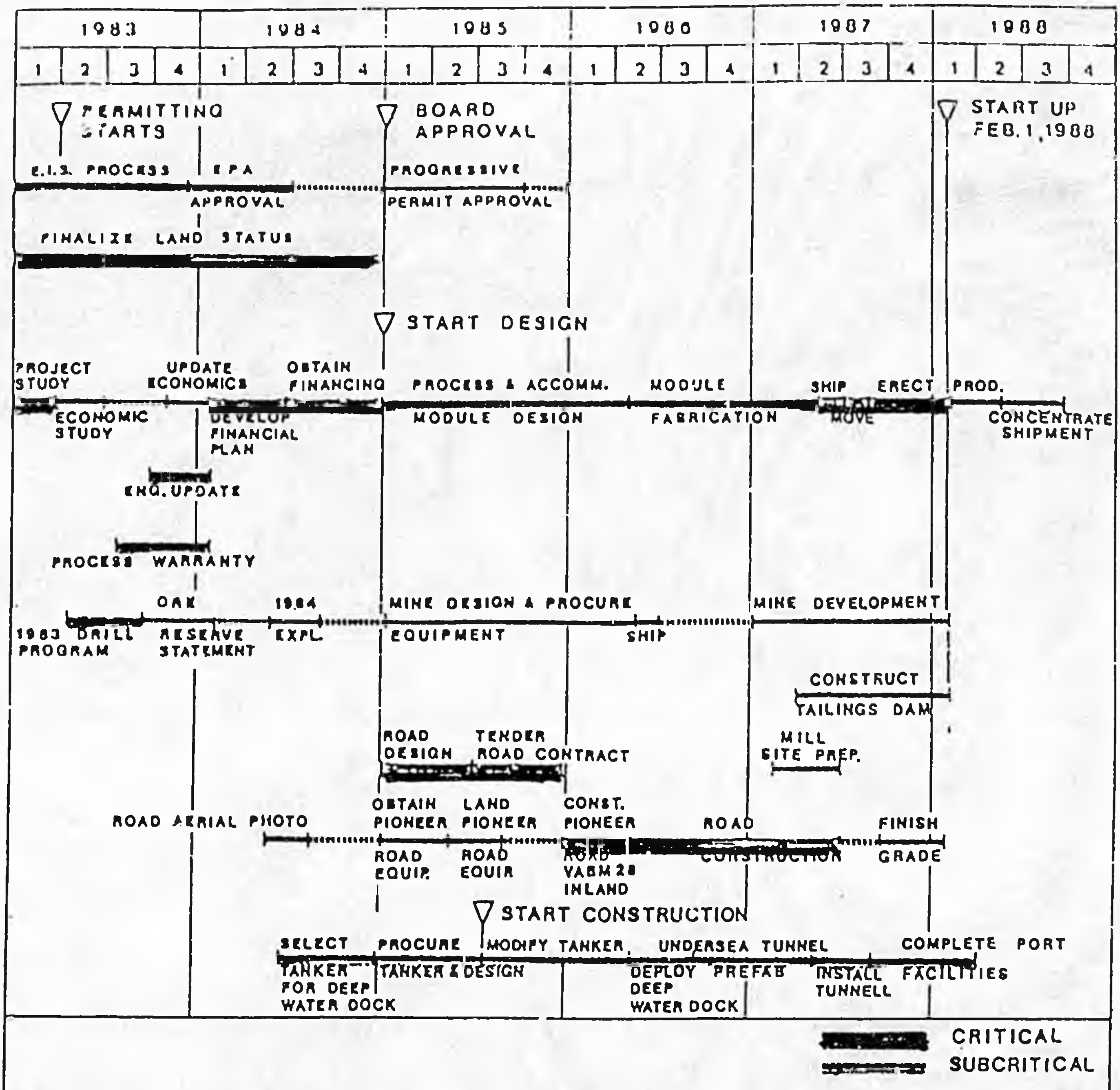
In January of 1987 the main road would be completed from the port site to Red Dog Valley. Construction equipment to prepare the mill site, as well as mining equipment to begin development work, would then be moved to the site. Additional camp facilities (for 50 people) would also be moved over the road to the Red Dog site at that time. Mine development would continue through 1987 to the time of production mining start-up in early 1988. Suitable mine waste would be used to construct the tailings pond dam during this period. To the extent that schedule constraints would allow, initial mine work would be carried out by permanent crews so that fully trained personnel would be available by the commencement of full operation.

A permanent dockface (in 3 m [10 ft] of water) and short causeway would be constructed prior to the 1987 sealift. This facility would be used to offload ore concentrator and worker housing modules, as well as other mine equipment. During the 1987 sealift the worker housing modules would be the first to be moved to the mine site. These living quarters would be commissioned as quickly as possible for use by construction crews, and later by operating personnel during the project start-up period. In this manner, the additional expense of a larger construction camp would be avoided.

During the summer and early fall of 1987, the concentrate storage building and other port site facilities would be constructed. If the offshore island transfer facility were approved, the modified tanker would be towed to the site and ballasted to the bottom during the 1987 shipping season.

During the period September to December 1987, the concentrator complex modules at the mine site would be joined and services installed. The facilities would be ready for commissioning (start-up) in December. Once commissioned, operations would commence in February 1988. Construction activities would be completed prior to the 1988 sealift. Construction surplus and equipment would be shipped out at that time.

The first movements of concentrates to market would probably be during the 1988 shipping season, though this would depend on project financing and the status of world-wide lead and zinc markets.



PROJECT SUMMARY SCHEDULE - 1988 PRODUCTION

RED DOG FACT SHEET

November 1983

1.0 LOCATION

A. Orebody/Mill Complex

The orebody is located 55 miles from the Chukchi Sea, east-northeast of Kivalina at the based of Deadlock Mountain; and 90 miles north of Kotzebue. Red Dog is approximately 440 air miles northwast of Fairbanks.

B. Seaport

The proposed location of the seaport is in the vicinity of VABM-28 about 17 miles southeast of Kivalina on the Chukchi Sea.

2.0 CLIMATIC DATA

Temperature (°F):	Summer -- mean daily	maximum	65
		minimum	35
	Winter -- mean daily	maximum	3
		minimum	-21
	Extremes		75 to -60

Precipitation* -- 11 inches.

NOTE: The above information has been extracted from the Climatic Atlas for Noatak.

* Recent measurements at the site indicates precipitation in the order of 18 inches per year.

3.0 EXPLORATION HISTORY

The first report of mineralization in the Red Dog area was in a 1970 U.S. Geological Survey open file report. Further exploration done by the U.S. Bureau of Mines provided a more detailed description of mineralization significance in a press announcement in the fall of 1975. Cominco American geologists explored the area and staked claims on adjoining areas soon after the USBM announcement.

4.0 EXPLORATION CAMP

Cominco American has operated temporary camps on land adjoining the Red Dog deposit every summer since 1976 with 25-50 employees.

5.0 OWNERSHIP

At different times there have been numerous federal, state, regional, and corporate claims to land adjoining the Red Dog deposit. As of February 5, 1982, Cominco American Incorporated and the NANA Regional Corporation reached agreement for evaluation and potential development of the deposit by Cominco American, with NANA retaining a carried interest.

6.0 GEOLOGY AND ORE RESERVES

A program of core drilling in 1981 defined a deposit estimated to contain, as calculated in place without mining dilution, 85 million tons of 17.1% zinc, 5.0% lead and 2.4 ounces/ton silver. The tons and grade are inferred from 14,700 feet of drilling in 39 holes, generally located on grid spacings of 400 feet in north-south and east-west directions, and are calculated to include contiguous mineralization averaging more than 3% zinc/lead. In 1982 CAI drilled an additional 14,600 feet in 32 holes to further define the orebody on a 200 foot grid spacing. This work confirmed the 1981 results. The 1983 drill program includes additional infill drilling for metallurgical testwork as well as diamond drilling in the Hilltop deposit one-half mile to the south of the main deposit.

The deposit is nearly flat-lying and suitable for open-pit mining, with upper portions exposed at the surface. The deposit in a north-northwesterly direction is approximately 4,400 feet long, varying in width from 200 feet up to 1,400 feet and is commonly 100 feet in thickness.

Current information ranks the Red Dog zinc-lead-silver deposit among the largest deposits of its type in the world. Although the orebody has not been completely defined, current reserves and mining plans gives a mine life of 50 years.

7.0 ENVIRONMENTAL ISSUES AND PERMITTING

In anticipation of the regulatory requirements applicable to the project development, environmental baseline studies were initiated in 1981 and continued through to the end of 1982. This comprehensive program of work included an evaluation of water quality and hydrology, fresh water and marine biology with emphasis on fish resources, archaeology and cultural values, terrestrial biology, socioeconomics and subsistence uses in all areas potentially affected by project components. In addition, metereological monitoring at the mine site commenced in 1982 and will continue as the project progresses.

7.0 ENVIRONMENTAL ISSUES AND PERMITTING (continued)

The findings from these studies have played an important role in regulatory planning, the development of a the project, and the designing of facilities and operating plans which are consistent with the social and economic objectives of NANA and the communities of the region. Therefore, the project as currently envisioned satisfies engineering, economic and environmental criteria to ensure its acceptance by the regulatory agencies and the NANA people.

Since the project is classed as a "major federal action" under criteria of the National Environmental Policy Act (NEPA), an Environmental Impact Statement (EIS) is necessary and work on its preparation was initiated in January, 1983 under the Environmental Protection Agency (EPA). This is expected to be completed in the spring of 1984. It will contain an overall impact assessment of the project alternatives with specific endorsement of the facilities to be constructed. Simultaneous with the development of the EIS, applications will be made for key permits requiring substantial lead times to obtain. Once the EIS is complete, the way is cleared for the issuance of the various federal and state permits required for both construction and operation according to the present project schedule.

8.0 PROJECT COSTS AND SCHEDULE

Project costs through to the end of 1983 are estimated to be $19 million. Capital outlays for constructing the project are expected to be in the $300 to $500 million range.

Construction could take 2 to 2-1/2 years with operation beginning in 1988. The actual beginning of construction will depend on world economic conditions, ability to complete detailed engineering design, and the completion of the environmental permit process.

9.0 CONSTRUCTION TECHNIQUES

Early engineering studies established that the cost of conventional on-site construction of the concentrator and related facilities at Red Dog would be expensive. Current engineering studies are based on the concept of modularization wherein completed building blocks are fabricated away from the site where access to a large and relatively inexpensive work force is possible. The success of modular projects for Alaskan North Slope Oil and elsewhere in the world clearly indicate cost and schedule advantages to this construction technique. For Red Dog, portions of the process plant and accommodations would be built outside of Alaska (where the constraints of Arctic construction would not apply), be barged to the Red Dog port, transported

9.0 CONSTRUCTION TECHNIQUES (continued)

inland to the mine on specialized transporter vehicles and then placed on their respective foundations. Buildings or service facilities that are not equipment intensive, such as warehouse and repair shops, will be site erected using conventional construction techniques.

10.0 EMPLOYMENT

The operation is expected to generate approximately 400 jobs involving a cross-section of mining, milling, maintenance, managerial and administrative skills. In keeping with NANA's desire to avoid the establishment of a townsite near the mine, a hotel-type accommodation complex will be used to serve a rotational work force which will transport from the local villages or Kotzebue to the site.

11.0 MARKETS

There are zinc and lead smelters in several Pacific Rim countries where concentrates from Red Dog could be sent. Cominco Ltd.'s Trail, B.C. smelter is one consideration, while Japanese smelters present other possibilities. European smelters are also being considered.

12.0 PRODUCT USES

a) Zinc is a shiny, bluish-white metal with two major industrial uses: galvanizing and die-casting. Galvanizing is a zinc coating which is a very effective rust prevention agent for use in products such as chain-link fencing, steel siding, household products, automobile bodies, structural steel coatings, and marine hardware. In the die-casting process, molten zinc is injected or poured into a metal mold where it hardens. Products such as plumbing fixtures, power tools, carburetors, and electrical appliances are typical applications.

b) Lead is a metal with many industrial uses, the largest one being storage batteries for all types of vehicles. Other uses include an anti-knock additive to gasoline, lead shielding, and cable coverings. Lead is also mixed with other metals to make various products such as solder, munitions and for use in making fine crystal tableware and glaze for pottery.

c) Silver is used in various industries and in many products, the largest user being photographic industry where it is employed to coat film as well as in the development of film. As a precious metal, it is used for jewelry, silverware, tableware, and ornaments. It is also used in surgery and dentistry.

13.0 PRODUCTION SCHEDULE

Years	FEED TONS Day	FEED TONS Year	FEED GRADE % Pb	FEED GRADE % Zn	CONCENTRATE TONS/YR Pb	CONCENTRATE TONS/YR Zn	CONCENTRATE TONS/YR Total	DESIGN Tons/Day
1 to 5	3,000	1,057,000	6	21	79,000	350,000	429,000	3,400
6 +	5,600	1,962,000	5	19	119,000	585,000	704,000	6,300

14.0 WORK SCHEDULES -- OPERATIONS

a) All employees:

-- 7 days per week

b) Mine:

-- 10 hours per shift, 2 shifts per day, 700 shifts/year

c) Concentrator:

-- 12 hours per shift, 2 shifts per day, 700 shifts/year

d) Power Plant:

-- 12 hours per shift, 2 shifts per day, 730 shifts/year

e) Seaport:

-- 12 hours per shift, 2 shifts per day, 240 shifts/year Summer operation.

-- 12 hours per shift, 1 shift per day, 60 shifts/year Winter operation.

15.0 MINE FACILITIES

	Length feet	Width feet	Height feet	Wt. tons	Plan Area Sq. Ft.
Primary Crusher Module	66	32	62	600	2112

16.0 CONCENTRATOR

Modules	Length feet	Width feet	Height feet	Wt. tons	Plan Area Sq. Ft.
Grinding	132	67	73	1390	8844
Regrind	104	67	73	870	6968
Flotation(3)	150	68	83	1700	10200

16.0 CONCENTRATOR (continued)

	Length feet	Width feet	Height feet	Wt. tons	Plan Area Sq. Ft.
Dewatering	136	64	71	1220	8704
Drying	79	40	61	500	3160
Power Plant(3)	136	71	55	1600	9656
Subtotal				7280	47532
Conventional Construction					
Water Treatment Plant	78	65	56	--	5070
Workshop	109	67	47	--	6970
Warehouse (incl. space under modules)	--	--	--	--	50600
Changehouse (1)	136	64	--	--	8700
Offices (2)	--	--	--	--	10000
Vehicle Repair	200	80	--	--	16000
Subtotal					97340

NOTES: (1) Changehouse is part of dewatering module.
(2) Office space allowed for in modules.
(3) May be reduced in size at the detail design stage.

17.0 CONCENTRATE STORAGE — MILL SITE

Dome Structure 180 ft. diameter x 70 ft. high for Zn (adequate for 6 weeks storage).
Dome Structure 100 ft. diameter x 42 ft. high for Pb (adequate for 6 weeks storage).

18.0 MISCELLANEOUS MILL SITE FACILITIES

Fuel Storage	2 x 200,000 USG
Fresh Water Storage	350,000 USG
Coarse Ore Storage	10,000 ton

19.0 THICKENERS

Pb	45 ft. dia.
Zn	110 ft. dia.
Tailing	125 ft. dia.
Water Treatment	90 ft. dia.

20.0 POWER SYSTEM

Demand:	Average	7825 kW
	Peak	9530 kW

20.0 POWER SYSTEM (continued)

Generators:	Main	Emergency
Number of units	6	3
Cylinders/unit	8	12
BHP -- full load	4225	
Kw -- full load/unit	3000	500
-- total installed	18000	1500
RPM	720	1800
Voltage	4160	480

21.0 ACCOMMODATIONS

Modules	Length feet	Width feet	Height feet	Weight tons
Living (4 modules)	144	55	50	1150 x 4
Communal	164	78	50	1400
Services	130	78	50	1100
TOTAL				7100

Facilities

- 111 single rooms
- 112 single (or 56-2 room suites), 8 two-roomed suites
- Dining capacity -- 235 people
- Gymnasium -- 90' x 78' x 24' high

AREA	SQ. FT.
Building Services	7,500
Storage	10,900
Laundry	1,100
Accommodations	59,150
Commons	39,370
Dining & Serving	3,520
Kitchen	1,600
Kitchen Storage	1,280
Administration	2,300
Infirmary	960
Gymnasium	7,000
Changerooms & Sauna	2,850
Hobby Rooms	3,800
Commissary	800
Lounges	1,970
Library	400
Radio/Communications	400
Post Office	140
Janitors' Rooms	420
TOTAL AREA	145,460

22.0 LAND TRANSPORTATON

a) Route from mine to VABM 28 through Cape Krusenstern National Monument:

Distance 57 miles
Elevation @ Mine + 1030 ft.
Elevation @ Port + 10 ft.
Maximum grade 4%
Road Width 30 ft.
No. of bridges -- 5
Passing lanes @ 2 mile intervals

b) Concentrate Haulage Trucks

Years 1 to 5 -- 4 - 700 HP tractors each with 2 side-dump or end dump
Trailers each with a 36 cu.yd. capacity.

Years 6 + -- 6 units as per above.

23.0 PORT

a) Shallow Water Dock

Sheetpile dock face in 10' water depth
Earthfill causeway 400' long

b) Deepwater Dock

(i) Ship ballasted to seabed in 35' water depth with storage capacity for: 71,000 tons of Zn concentrate
38,000 tons of Pb concentrate
9,400,000 USG of Fuel
Deck storage for 400 - 8'x8'x20' containers

(ii) 1000 ton self-propelled lighter barge -- summer operation

c) Shore Facilities

(i) Truck dump pad and barge loading facility.

(ii) Sulphuric acid storage tank (155,000 USG) and truck loading facility.

(iii) Fuel transfer tank (50,000 USG) and truck loading facility.

(iv) Accommodations for 20 - left over construction camp.

23.0 PORT (continued)

c) Shore Facilities

(v) Small 250 kW power plant.

(vi) Small storage building: 40' x 40'.

d) Facilities at Mile 2.5

(i) A-frame structure 180' x 912' x 80' high to store 55,900 tons of Pb concentrate and 247,900 tons of zinc concentrate.

(ii) Small 250 kW plant.

24.0 WATER SYSTEM

Fresh Water Consumption

° Process -- Avg. = 328,320 USGPD
-- Max. = 864,000 USGPD
° Domestic -- Avg. = 34,560 USGPD
-- Max. = 208,800 USGPD

Recycled Water Consumption = 2,645,280 USGPD

Fresh Water Supply

° Bons Creek Reservoir
° Drainage area -- 3.7 sq.mi.
° Daily usage -- 362,880 USGPD
° Dependable yield (based on 3 consecutive drought year @ 25% annual mean) -- 481,000 USGPD
° Dam height -- 37 ft. (30' for minimum storage)
° Dam crest length -- 280 ft.
° Total storage -- 630 ac.-ft.
° Live storage -- 246 ac.-ft.
° Dam crest elev. -- 852 ft.
° Normal water surface elev. -- 845 ft.

Fresh Water Facility Specs.

° Floating raft -- 16 ft. x 9 ft.

° Pumps: Type -- Vertical turbine
No. -- 2 operating and 1 standby
HP -- 75 each pump

24.0 WATER SYSTEM (continued)

Fresh Water Facility Specs. (continued)

- Pipeline: Material -- high density polyethelene (SCLAIR)
  - Length -- 18,000 ft.
  - Diameter -- 10 in. to main storage tank
  - Heat Tracing -- 110 volt
  - Insulation -- 2 inch styrofoam

Fresh Water Tank

- Elevation -- 1,030 ft.
- Dimension: Diameter -- 46 ft.
  - Height -- 30 ft.
- Volume -- 350,000 USG

25.0 TAILING SYSTEM

	% Solids	Volume
Tailing -- from process to thickener	17	2,203,000 USGPD
-- from thickener to pond	60	298,000 USGPD
-- recycle - thickener overflow	0	1,905,000 USGPD

Tailing Embankment:

- Height -- 150 ft.
- Length -- 2,200 ft.
- Fill Volume -- 265,000 cu.yd. starter dam (2 million cu.yd. to Elev. 950)

Tailing Impoundments @ 950 Elev.

- Area -- 25,472,000 ft^2
- Volume -- 29,860 ac.-ft.

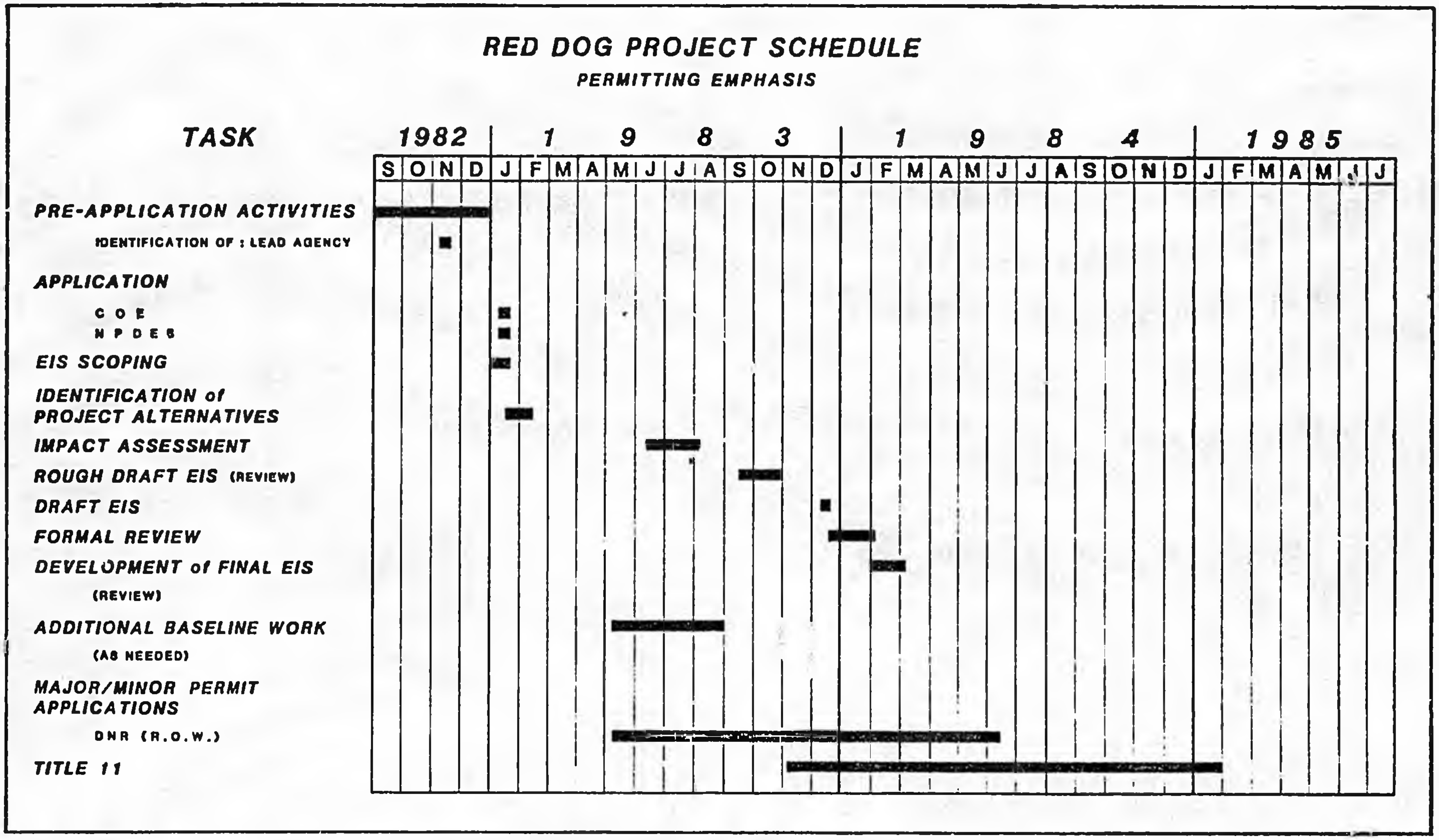
Tailing Thickener -- 125 ft. dia.

Tailing Facility Specs.

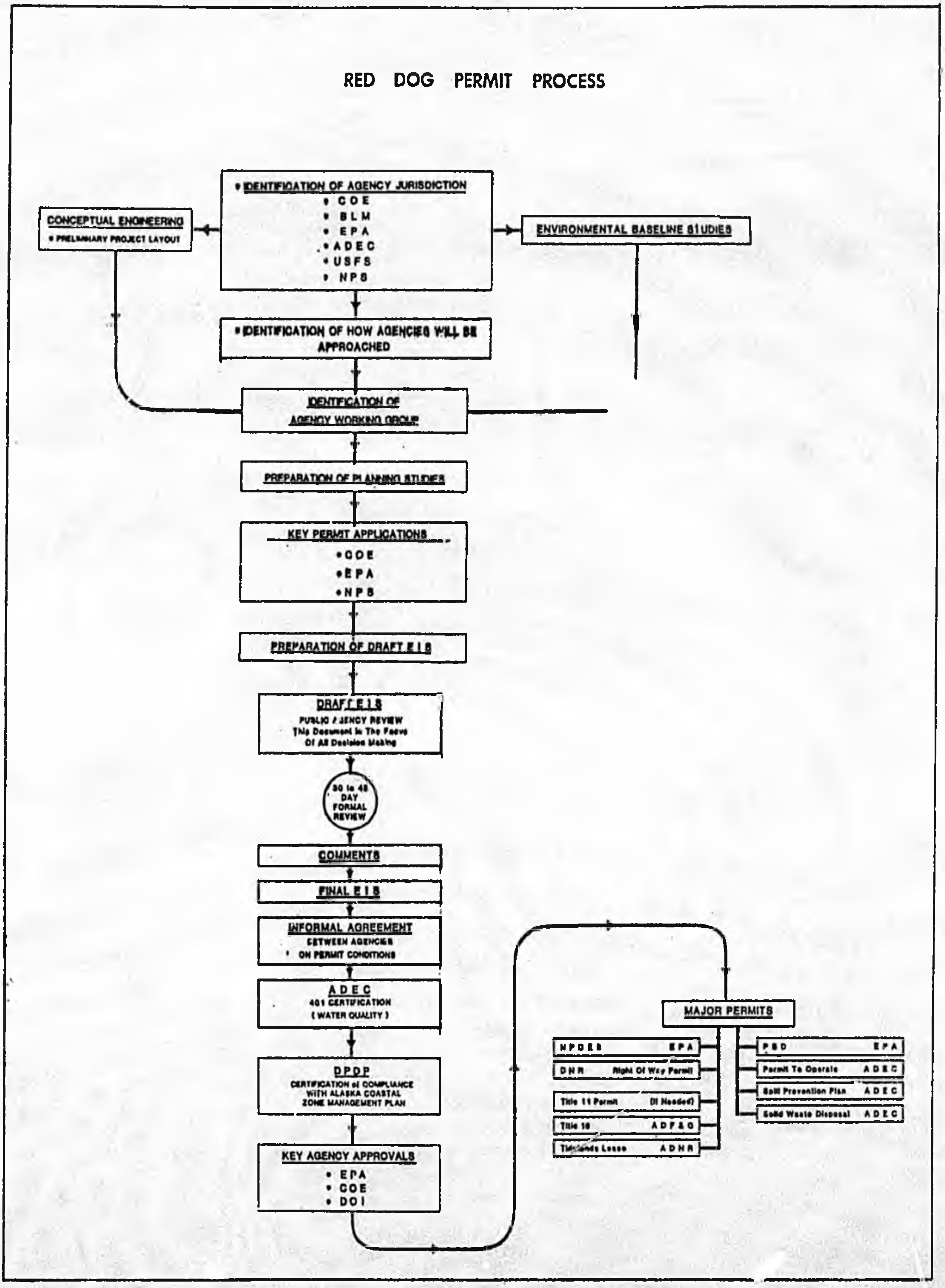
- Tailing line: Material -- H.D.P.E. (SCLAIR series 80)
  - Length -- 3,500 ft.
  - Diameter -- 6 inches
  - Insulation -- 2 inches styrofoam
  - Heat tracing -- 110 volt

RD05/b

IX.C. Appendix C: Project Permitting Time-Line


RED DOG PROJECT SCHEDULE
PERMITTING EMPHASIS
TASK
1982
1983
1984
1985
S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J
PRE-APPLICATION ACTIVITIES
IDENTIFICATION OF : LEAD AGENCY
APPLICATION
C O E
N P D E S
EIS SCOPING
IDENTIFICATION of PROJECT ALTERNATIVES
IMPACT ASSESSMENT
ROUGH DRAFT EIS (REVIEW)
DRAFT EIS
FORMAL REVIEW
DEVELOPMENT of FINAL EIS (REVIEW)
ADDITIONAL BASELINE WORK (AS NEEDED)
MAJOR/MINOR PERMIT APPLICATIONS
DNR (R.O.W.)
TITLE 11

Appendix D: Permit Flow Chart



Appendix E: Base Metal Markets (Cu, Pb, Zn): Alaskan Opportunities (Paper by Gordon H. Laurie, Cominco, Ltd.)

Presented at:
Alaska Miners Association
Eighth Annual Convention
"Alaskan Minerals for Pacific Rim Markets"

October 19-22, 1983
Anchorage, Alaska

Cominco Ltd./Suite 1500-120 Adelaide St. West/Toronto, Ontario M5H 1T1/Canada/Tel. (416) 869-1850

BASE METAL MARKETS (Cu, Pb, Zn),

:ALASKAN OPPORTUNITIES

(Long Abstract)

Metals Market Research

By: G.H. Laurie/Cominco Ltd.

Alaska appears to be on the verge of becoming one of the world's important mineral suppliers. In the case of base metals, Cominco's Red Dog discovery is already recognized as being a very major future zinc and lead producer. Geologists have high expectations for other discoveries of commercially viable copper, lead, and zinc mines. The question addressed in this paper is how do these Alaskan opportunities match the world's future needs for copper, lead, and zinc.

Examination of the historical demand in the Western World for these three base metals brings us to the conclusion that all are in a state of maturity with saturation of use occurring in the developed nations. Growth in consumption will more and more depend upon the increases in the living standards of the newly industrializing countries. Fortunately for the Alaskan resources, the economies in the Pacific Rim have shown substantial growth. Long-term prospects in this area of the world look promising.

Copper consumption in the Western World grew at a rate of about 4½% per year from 1960 to the energy disruption of the mid 1970's. We expect that the resumption of demand growth will be in the order of 1½% once the economies of the world recover but that this will mean the 1979 consumption peak will not be regained until the mid 1980's. After the mid 1980's, we expect increasing Western World consumption and mine exhaustion to create a demand of over 150,000 tonnes/year of new mine production. Copper prices have weakened since 1979/80 and we, along with most forecasters, have revised our long-term expectations. World-wide distribution of copper concentrates will be influenced as some of the LDC's establish smelter/refinery facilities and consume their domestic mine production.

Lead consumption in the Western World grew at about 3½% per year from 1960 to 1973 but is expected to show a resumed growth of only about 1% in the future. The peak consumption of 4.2 million tonnes in 1979 is not expected to be reached again until near the end of this decade. Mine production of lead has continued at approximately 2.5 million tonnes since 1973 whereas lead metal from secondary sources increased from near 1.0 million tonnes in 1973 to close to 1.9 million tonnes in 1979 and since then has dropped back to approximately 1.5 million tonnes during the current recession. It is difficult to predict the need for new lead mine production due to the uncertainties of secondary lead. However, it is safe to say that without the introduction of any new significant end-uses for lead the mines which are brought into production to satisfy zinc and silver requirements will provide enough new lead as a co-or by-product to satisfy needs. In this regard, the Red Dog property, which has a zinc to lead ratio of 3½ to 1, better matches the expected new mine zinc and lead needs than higher ratio lead properties.

Zinc consumption in the Western World grew at approximately 4.8% per year from 1960 to 1973 where it peaked at about 4.8 million tonnes. With economic recovery, a growth rate of near 2% per year should see the 73 and 79 peaks in consumption re-established in the mid to late 1980's starting from the current level of near 4.2 million tonnes. Future new mine demand, to satisfy consumption growth and mine exhaustions, is estimated to be somewhat less than 150,000 tonnes per year after about 1985. Zinc prices have weakened since the 1973/74 bullish period and the 1979/80 highs but, with expected reasonable balance between demand and supply, longer term strengthening is expected. World-wide demand for concentrates should result in the need for future supplies from Alaska.

GHL:hmw
October 7, 1983

BASE METAL MARKETS (Cu, Pb, Zn)

: Alaskan Opportunity

By: G.H. Laurie/Cominco Ltd.

Market Overview

The world shall continue to need base metals and from our analysis there is an opportunity for Alaska to become an important supplier of copper, lead and zinc concentrates. Markets for these materials will depend upon the overall growth of the world's economy, the specific requirements for capital and consumer goods, and the availability of competitive concentrate supplies.

Slides

- OECD IPI
2. Growth in IP & Major Metal Consumption
3. Metal Prices & Ind. Bus. Cycle

Note: The slides marked (MMRS) are taken from "Metals Analysis and Outlook" published by Metals & Minerals Publication Ltd.

Metals consumption growth has often been related to various industrial production indexes rather than to overall GNP-type of economic growth measurements[1,2,3]. As our western world's growth has progressed an increasing proportion of the GNP has been from the service sectors with corresponding less growth from the basic industrial sectors. Therefore, as our industrial societies have matured the rate of new capital investment for plants has tended to decline. Furthermore, various measures show a declining relationship between metals consumption and overall industrial production as substitute materials are used and as end uses make more efficient use of the materials of construction. Another factor which negatively affects the need for mined metal is the increased recycling of scrap. This movement towards more secondary metal has been supported by both the conservation and environmental priorities of the last number of years.

Offsetting the above trend to a state of maturity for the basic industries in the developed nations of the world, is the exciting prospects for the emerging developing nations[4]. Many of these are the markets that can be served by suppliers adjacent to the Pacific. I recently reviewed economic growth forecasts made by a major USA research group. Their data pointed out the following differences for the period up until year 2000.

Slide

4. • Zinc Consumption by Region

Area	GNP Growth
Western Europe	2.3%
Eastern Europe	2.3%
North America	2.8%
Latin America	4.3%
Africa	4.2%
Asia and Far East	3.9%
Total World	3.0%

Other forecasts will be different depending on the respective views of economic opportunities or problems. However, I don't know of one forecast that doesn't indicate the maturing of the current industrial countries with lower basic materials consumption growth rates and considerably higher rates for the newly developing countries - despite their balance of payments and other economic problems.

Our company, like most in the mining business, assesses the current concentrate supply and also makes judgements on future supply requirements due to consumption growth and mine exhaustions. This expected demand on the mines will be met by some expansions and by new mines. The main interest in this meeting is obviously what new mines can be found and opened in Alaska. Cominco has one we feel will be economically viable, other companies are equally optomistic and still others are no doubt going to find suitable economic deposits.

Demand on the Mines

	(Growth) Consumption	+ Closures	= Total
Cu	100	60	160
Pb	nil	10/15	10/15
Zn	60	70	130

A major consideration we have in assessing our opportunities is where do we believe our potential mine is on an estimated cost-curve of the Western Worlds' mines for any particular metal[5]. With the current and expected future economic growth we firmly believe any proposed operation should be in the lower half and preferably the lower third of the cost-curve. To some extent new mines which open may act in a predatory manner and hasten the death of marginal producers.

Slide

5. • Cost-curve

To rank the opportunities for future mines for copper, lead and zinc one's crystal ball must assess the consumption demand, the competitive mines (both existing and those known to be likely new entrants and those expected to be near reserve or economic exhaustion), and the competition from secondary supplies. I personally have no difficulty in ranking the three metals based on what I know and what my crystal ball tells me. All other factors being equal I would first want to find a good zinc mine, next a quality copper mine would be attractive, and finally if I felt I had a really low cost producer I would deal with a lead mine.

The factors which lead me to my choice are:

1) Known ore bodies - I feel there are a good number of copper deposits in the world that have a good chance to be reasonably low-cost producers. There are fewer zinc ore bodies in the same category as far as I can see. Lead is rapidly becoming a by-product of zinc and will come to market as zinc requirements are met.

2) Depletions/exhaustions - It is difficult to get a definitive picture of this factor but it appears there may be more of the existing large zinc bodies coming closer to exhaustion over the next 20 years than is the case for copper - time will tell.

3) Consumption - The growth rates we predict for all three metals are very modest and we all hope we are proven to be overly conservative. However, I

believe our forecasts of zinc at 2%, copper at 1.5% and lead at 1% are in the right order. Of the above base metals, zinc is expected to continue to have the smallest part of its supply as secondary metal.

4) Ownership - The zinc industry currently is, and is expected to remain, more in the hands of free enterprisers than is the case for copper. We believe this supports a better long-term pricing structure - in particular, as metal stock levels can be kept in better balance [6].

Slide

6 Metal Stocks & Metal Prices

Despite my preferences as outlined above it goes without saying that any mine, whether a copper, lead or zinc mine, that is determined to be a low-cost producer is likely to be brought into production.

Copper Markets

The recognition that copper is a mature metal should not be taken too negatively. It can be said it is our oldest mature metal but one which continues to fulfill mans' needs with renewed bursts of consumption as new technologies such as electricity implant new life. The slides I have gathered for you today give you some idea of the consumption patterns, mined production and prices for copper.

Slides

7. • Cu Mine Production
8. • WW Copper Consumption
9. • Consumption/Prod. & Stocks
10. • Copper Prices
11 Copper Prices with Highs/Lows

Slides on Copper - here [7-11]

The events which are likely to affect the opportunities for any future copper properly in Alaska are:

- the cost influences of remote locations with or without state infrasturucture support;
- overall supply needs for United States demands;
- new smelters built by previous suppliers of concentrates; and
- the expansion of the copper industry in Chile and other known regions possessing good copper properties.

Any new domestic world-class copper operation that may be developed in Alaska would help offset the decline of the USA copper industry. The reduction of concentrate shipments from the Phillipines to Japan with the start-up of the Phillipine smelter creates an opportunity for new concentrate suppliers - especially as there seems to be a relatively over capacity of copper smelters in the world. The expansion of Chile's copper industry which some claim has a goal of nearly 2 million tonnes capacity will, on the other hand, have a negative overall effect on the copper industry and in particular if world over-capacity is the result.

The copper concentrate suppliers and the smelter customers as outlined by the World Bureau of Metal Statistics are more or less as follows:

- Africa supplies to Western Europe and Japan
- Canada supplies to Western Europe, South Korea, Taiwan, and Japan

- South America supplies to Western Europe, South Korea, Taiwan and Japan
- Australia supplies to Japan
- South East Asia supplies to Western Europe, South Korea, Taiwan and Japan
- USA supplies to Japan

Lead Markets

Lead is also a very old metal which has benefitted by easy extraction and fabrication. Again we have an example of a mature metal which regained vigour with technological break-throughs such as the lead-acid battery and the internal combustion engine and its ignition system with the use of high octane fuels. Currently this metal is in a stable stage with some uses actually in decline. The most significant changes have been the growth of the recycled lead supply and, somewhat related, the tendency for lead to have become a by-product of zinc and silver production. The slides shown of lead's historical supply, demand and prices give you some insight into leads future.

Slides

12. Lead Production - Metal
    - Mine
    - 2nd

13. WW Consumption

14. Pb Prices

15. Pb Prices with Highs/Lows

16. Prices & Stocks

Slides on Lead - here[12-16]

The shipment of lead concentrates as outlined by the WMBS shows significant movements as follows:

- Africa supplies to Western Europe, North America, and Japan
- Canada supplies to Western Europe and Japan
- South America supplies to Western Europe, North America and Japan

- Australia supplies to Western Europe and Japan.

Zinc Markets

Compared to both copper and lead, zinc is a much younger metal. The significant role zinc plays in protecting steel in a sacrifical manner ensures the continuing need for a large part of the metal supply being new mined metal, as scrap recovery from this use is minimal. The market discipline of zinc suppliers coupled with somewhat better market support is emphasised by the relatively low level of metal stocks. This fact and other trends are shown in the following slides:

Slides

17.• Zinc Mine Production

18.• WW Zinc Consumption

19.• Zn Price

20.• Zn Price & Highs/Lows

21.• Prices & Stocks

Slides of Zinc - here 17-21

The most significant fact about the zinc market has been the rapid decline of the USA zinc industry over the 1970's and since the economic downturn of 1979/80. Since it's heyday in the late 1960's/early 1970's the US zinc industry has been reduced to about 1/4 to 1/3 of its maximum. Although consumption has also declined it still remains the largest market in the Western World. Cominco Alaska's planned entry into the world's zinc markets will help reverse the domestic supply situation.

Zinc concentrate movements as reported by the WBMS are as follows:

- Africa supplies to Western Europe
- Canada supplies to Western Europe, USA and Japan
- South America supplies to Western Europe, USA and Japan
- Australia supplies to Western Europe and Japan

Prices

The presentation today is not focused on prices for metal. Cominco's long-range price forecasts are confidential and furthermore my group are currently deeply involved in our annual up-date forecast so I am without firm numbers in any case.

Of greater value I believe, are some qualitative comments about the mine returns realized for concentrates. The treatment charges negotiated for metal concentrates are quite variable as each concentrate is in fact an unique product with different advantages and disadvantages. The location of the concentrate is also a factor in its price (via differing treatment charges as well as different transportation etc. costs). I am told by our concentrate sales people that the factors that enter into the determination of treatment charges are as follows:

- Concentrate quality
  - low quality concentrate will result in higher treatment charges.
- Smelter customer location
  - if far away and without alternate near-by concentrate this will normally result in lower treatment charges (i.e. the smelters have to compete).
  - close by smelters will use their location to obtain somewhat higher treatment charges.
- Smelter capacity
  - if the world's smelter capacity is in surplus (i.e. concentrates in relative shortage) this will result in lower treatment charges.
  - if the world's smelter capacity is in shortage this will result in higher treatment charges.
- Mine location
  - for northern mines or any others that have restricted shipping seasons the extra costs involved in storage by the receiving smelter will either be reflected by higher treatment charges or the seller would tend to have to cover the financing charges directly.

Conclusions

- From what I have been told Alaska is proving to be a valuable storehouse of needed mineral resources
- Despite high infrastructure costs it appears various deposits will become economic mines. This may be positively assisted by the development of the state's transportation system.

- Being located on the Pacific Rim will be beneficial as larger growth of metal consumption is forecast for many countries bounding the Pacific.
- World-class deposits of the base metals copper, lead and zinc will become viable mines if they are able to establish low operating costs.
- It appears the opportunities to supply can be ranked zinc, first; copper, second; and lead, third.

GHL:hmw

October 18, 1983

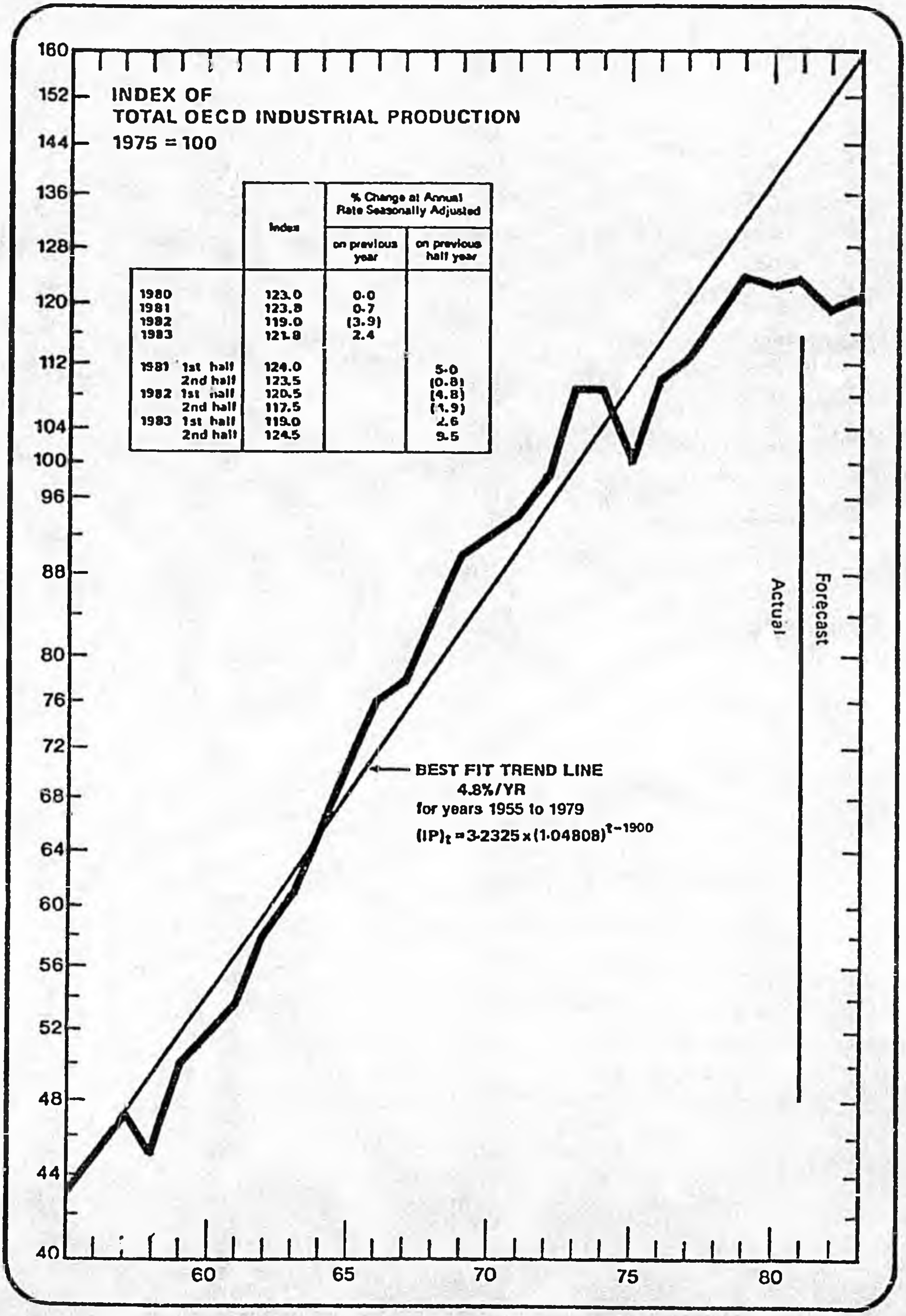
BASE METAL MARKETS (Cu, Pb, Zn)

: ALASKAN OPPORTUNITIES

By: Gordon H. Laurie
Cominco Ltd.

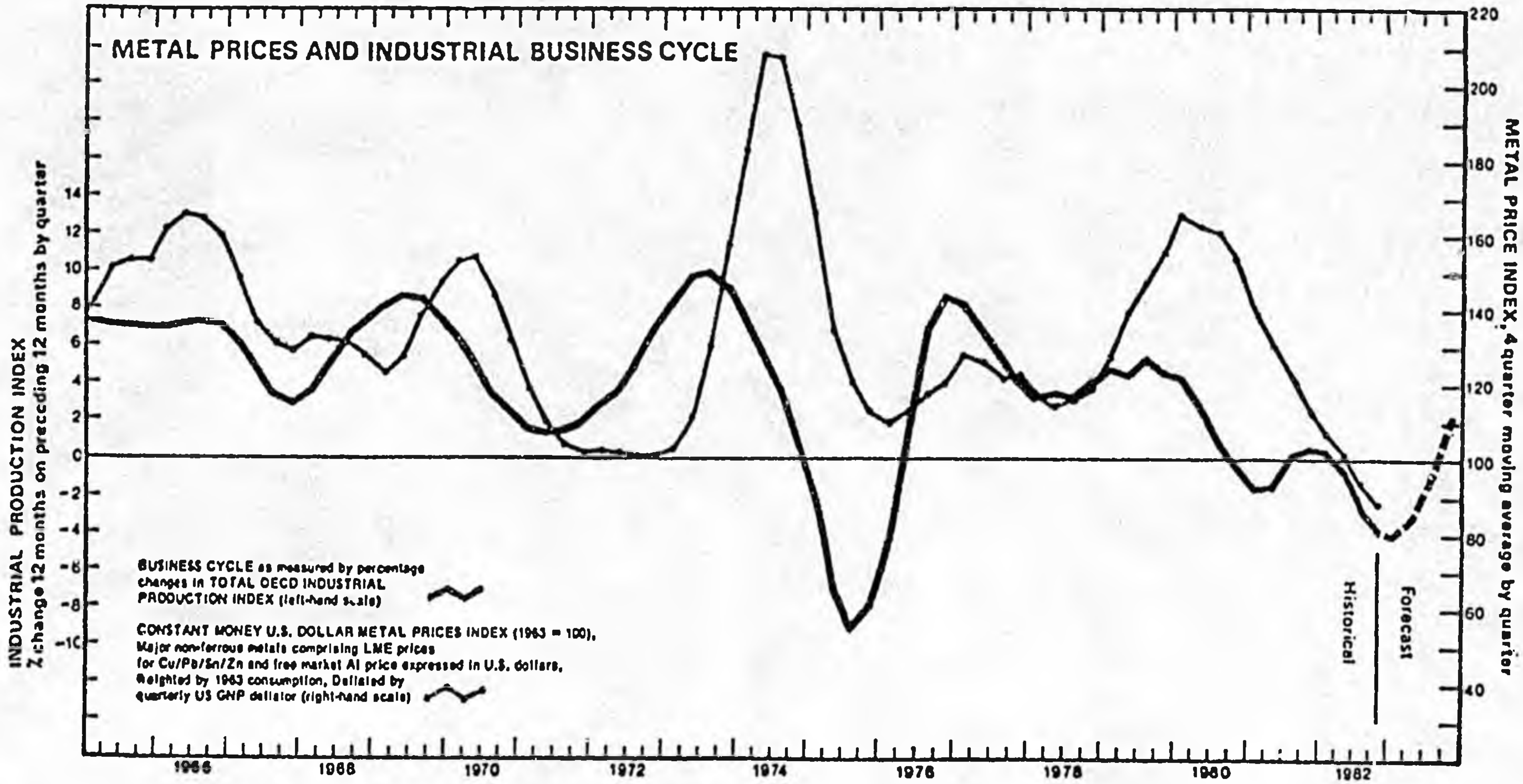
PRESENTATION SLIDES

1. Index of Total OECD Industrial Production
2. Growth in Industrial Production and Major Non-Ferrous Metals Consumption
3. Metal Prices and Industrial Business Cycle
4. Zinc Consumption by Region
5. Western World Zinc Mines Cumulative Production[2] VS. Costs[1]
6. Metal Stocks and Metal Prices
7. Copper Mine Production
8. Western World Copper Consumption
9. World Refined Copper Consumption less Production Commercial Stocks
10. Copper Prices - Cathode Settlement
11. LME Cash Wirebar Copper Price in 1983 US $ Per Lb*
12. Western World Lead Mine Production
13. Western World Lead Consumption
14. LME Lead Price
15. LME Cash Lead Price in 1983 US $ Per Lb
16. Lead Metal Prices + Stocks
17. Western World Zinc Mine Production
18. Western World Zinc Consumption
19. LME Cash Zinc Price
20. LME Cash Zinc Price in 1983 US $ Per Lb
21. Zinc Metal Prices + Stocks



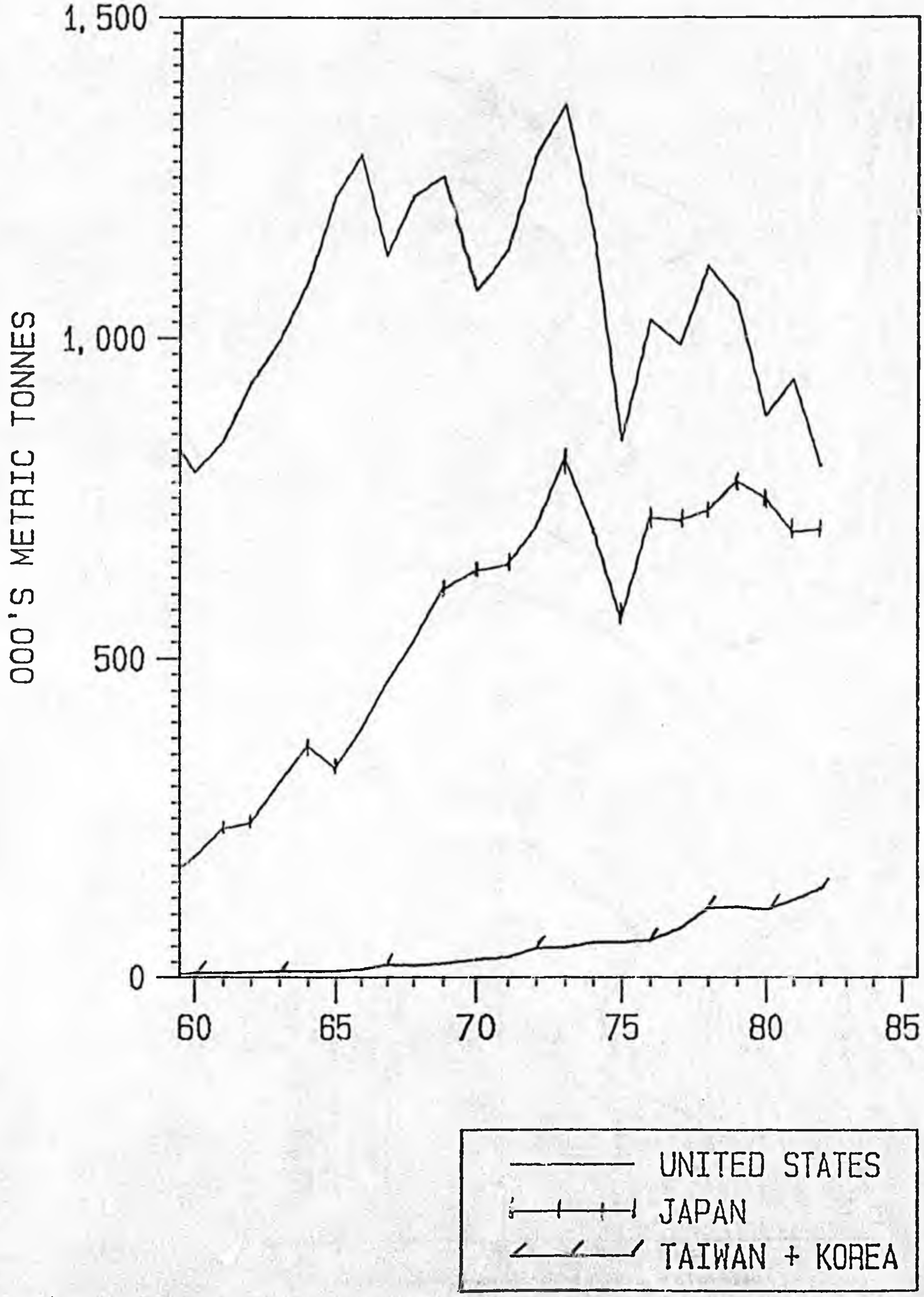
		Index	% Change at Annual Rate Seasonally Adjusted	
			on previous year	on previous half year
1980		123.0	0.0	
1981		123.8	0.7	
1982		119.0	(3.9)	
1983		121.8	2.4	
1981	1st half	124.0		5.0
	2nd half	123.5		(0.8)
1982	1st half	120.5		(4.8)
	2nd half	117.5		(1.9)
1983	1st half	119.0		2.6
	2nd half	124.5		9.5

SLIDE 1
(MMRS)


METAL PRICES AND INDUSTRIAL BUSINESS CYCLE
INDUSTRIAL PRODUCTION INDEX
% change 12 months on preceding 12 months by quarter
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
METAL PRICE INDEX, 4 quarter moving average by quarter
220
200
180
160
140
120
100
80
60
40
BUSINESS CYCLE as measured by percentage changes in TOTAL OECD INDUSTRIAL PRODUCTION INDEX (left-hand scale)
CONSTANT MONEY U.S. DOLLAR METAL PRICES INDEX (1963 = 100), Major non-ferrous metals comprising LME prices for Cu/Pb/Sn/Zn and free market Al price expressed in U.S. dollars, weighted by 1963 consumption, Deflated by quarterly US GNP deflator (right-hand scale)
Historical
Forecast
1966
1968
1970
1972
1974
1976
1978
1980
1982

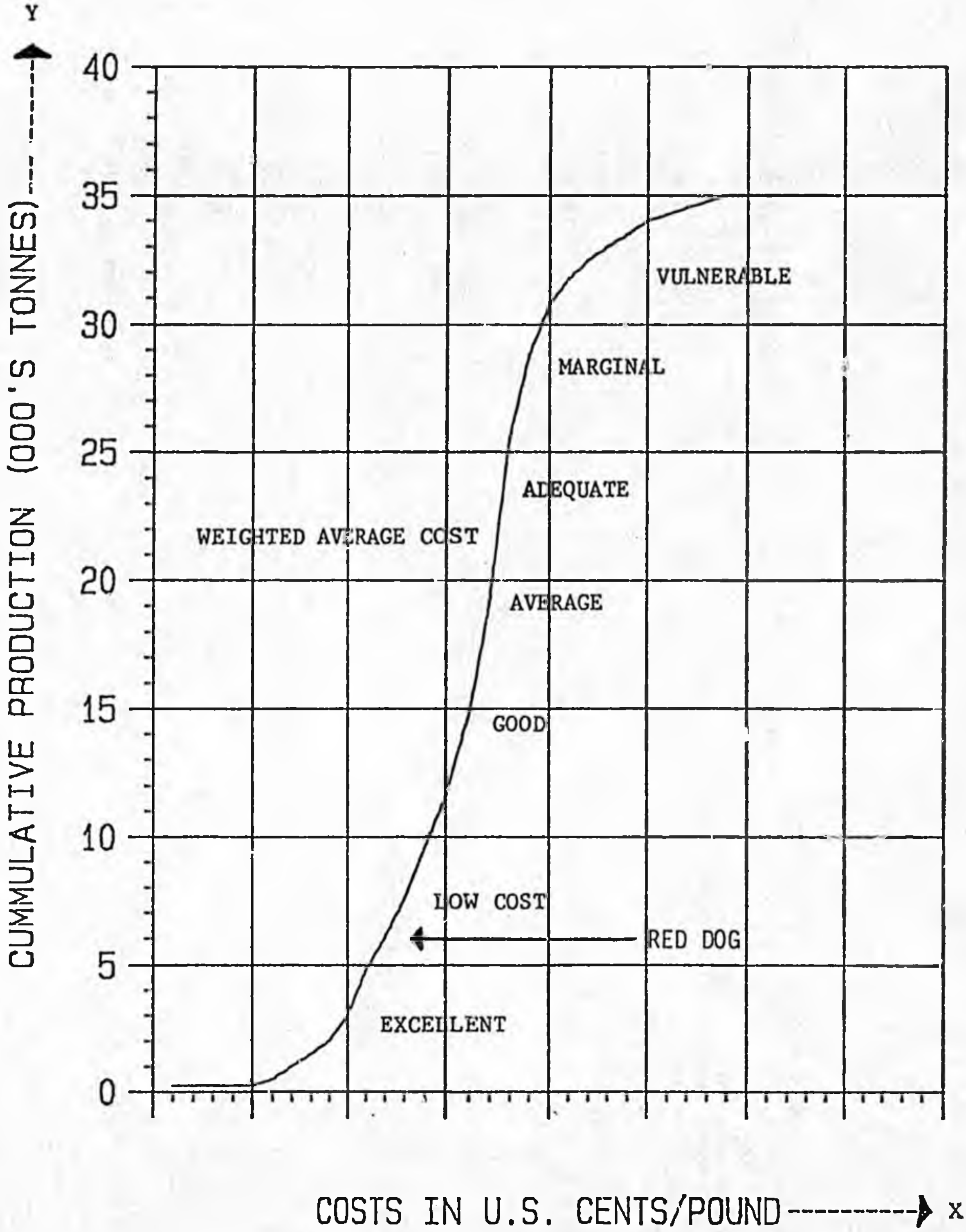
SLIDE 3
(MMRS)

ZINC CONSUMPTION BY REGION



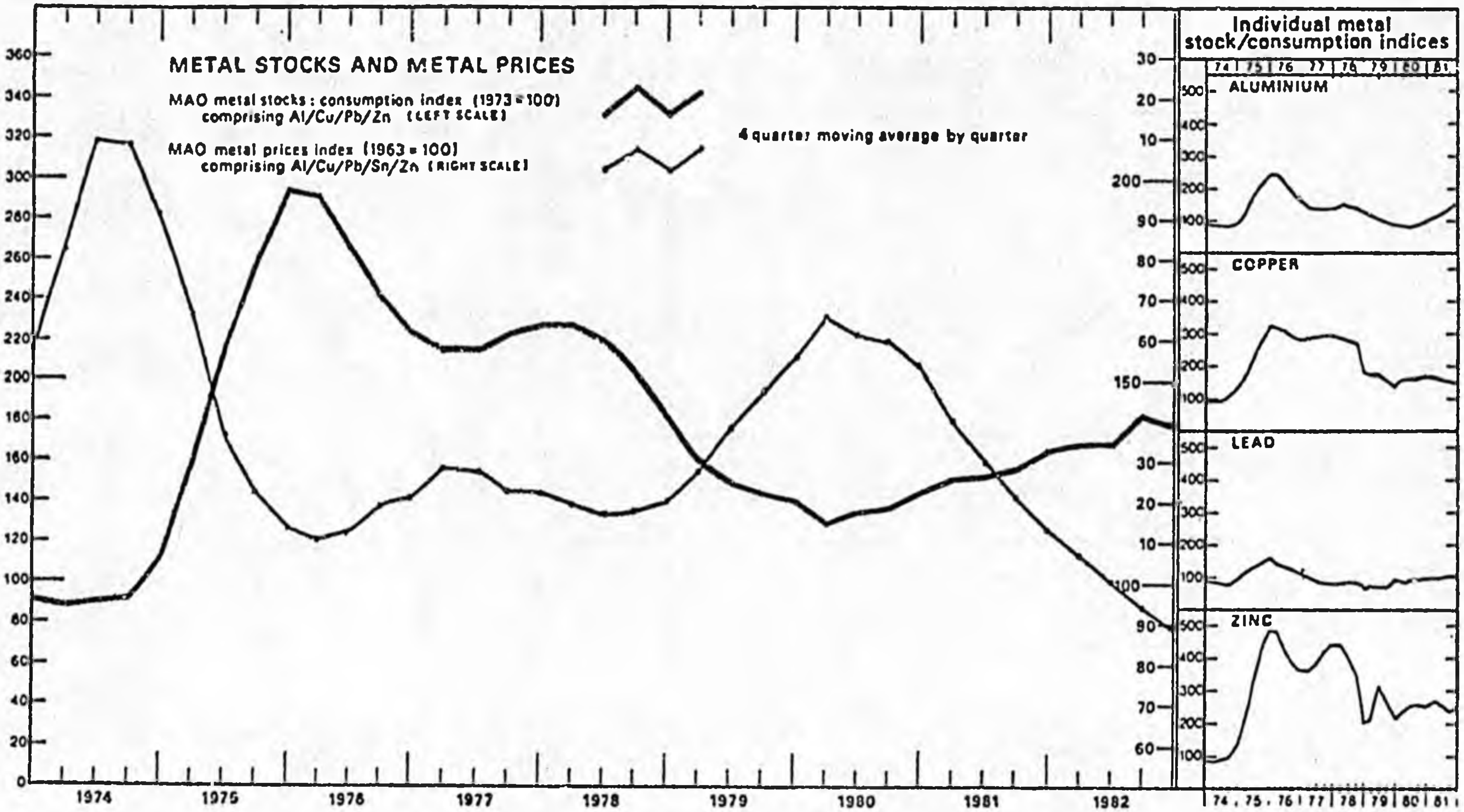
SLIDE 4

WESTERN WORLD ZINC MINES
CUMULATIVE PRODUCTION[2] VS. COSTS[1]



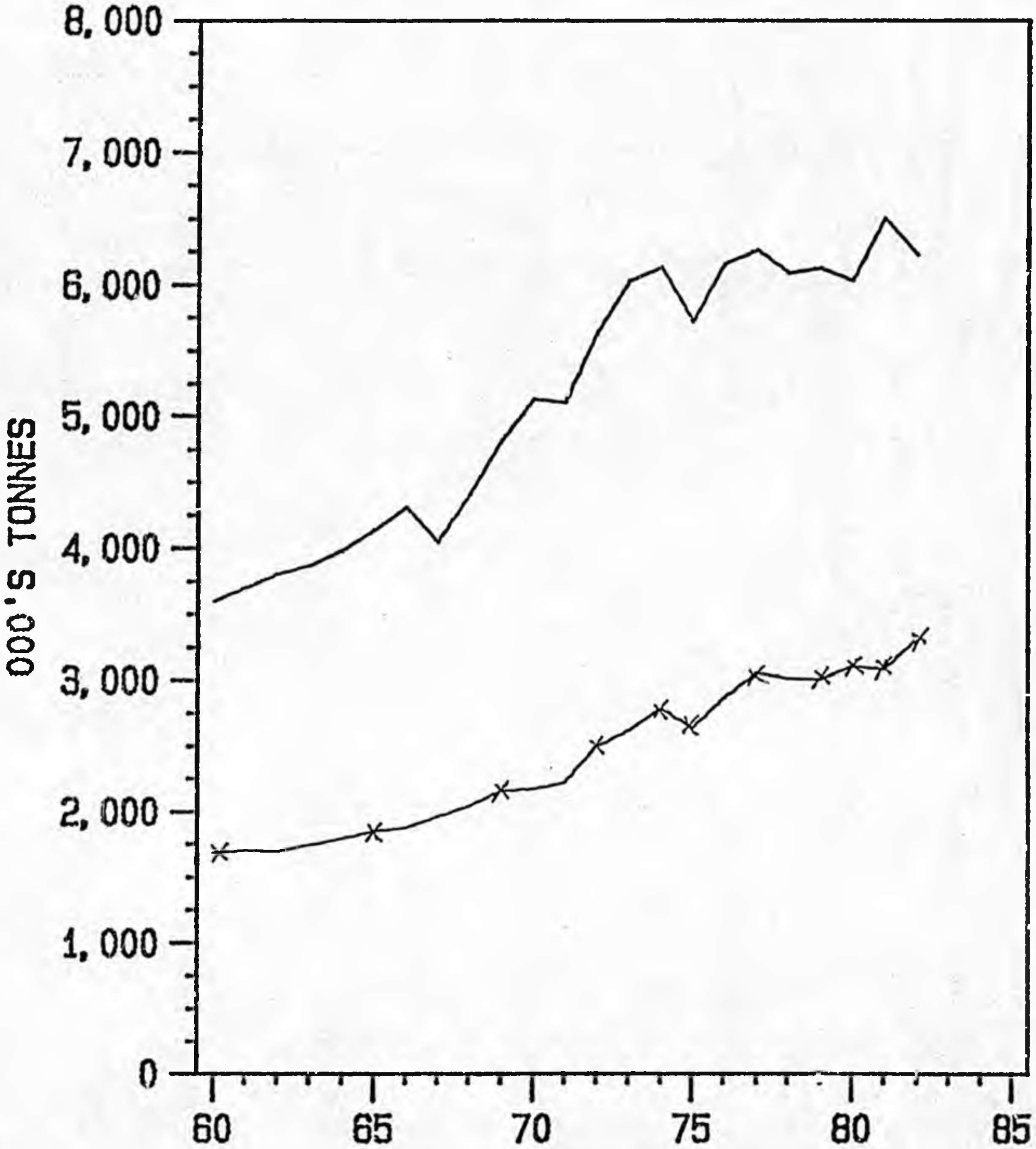
1) including depreciation and delivery to market.

2) represents X% of total Western World = Y thou. tonnes.


METAL STOCKS AND METAL PRICES
MAO metal stocks : consumption index (1973 = 100) comprising Al/Cu/Pb/Zn (LEFT SCALE)
MAO metal prices index (1963 = 100) comprising Al/Cu/Pb/Sn/Zn (RIGHT SCALE)
4 quarter moving average by quarter
1974
1975
1976
1977
1978
1979
1980
1981
1982
Individual metal stock/consumption indices
ALUMINIUM
COPPER
LEAD
ZINC

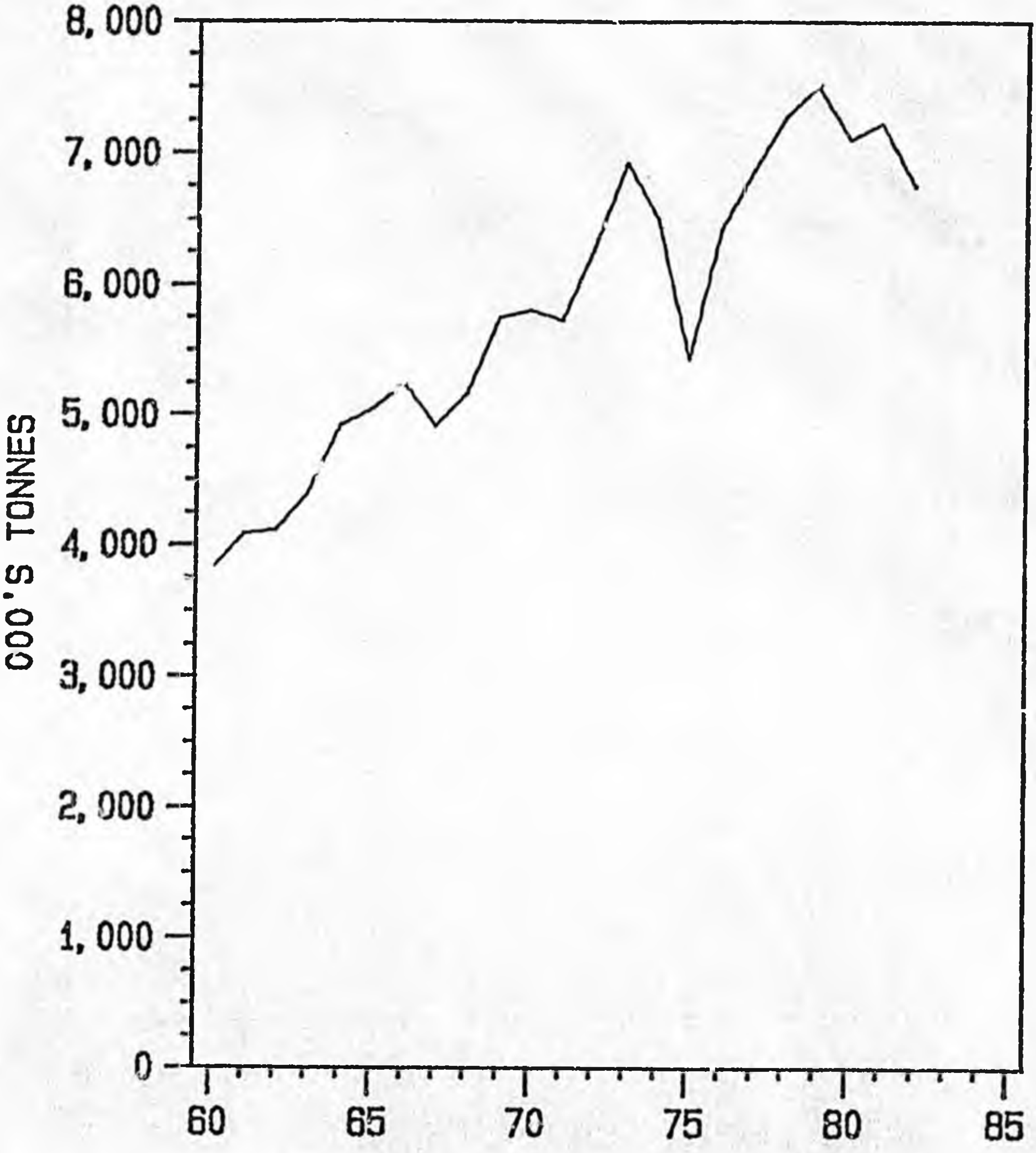
SLIDE 6
(MMRS)

COPPER MINE PRODUCTION

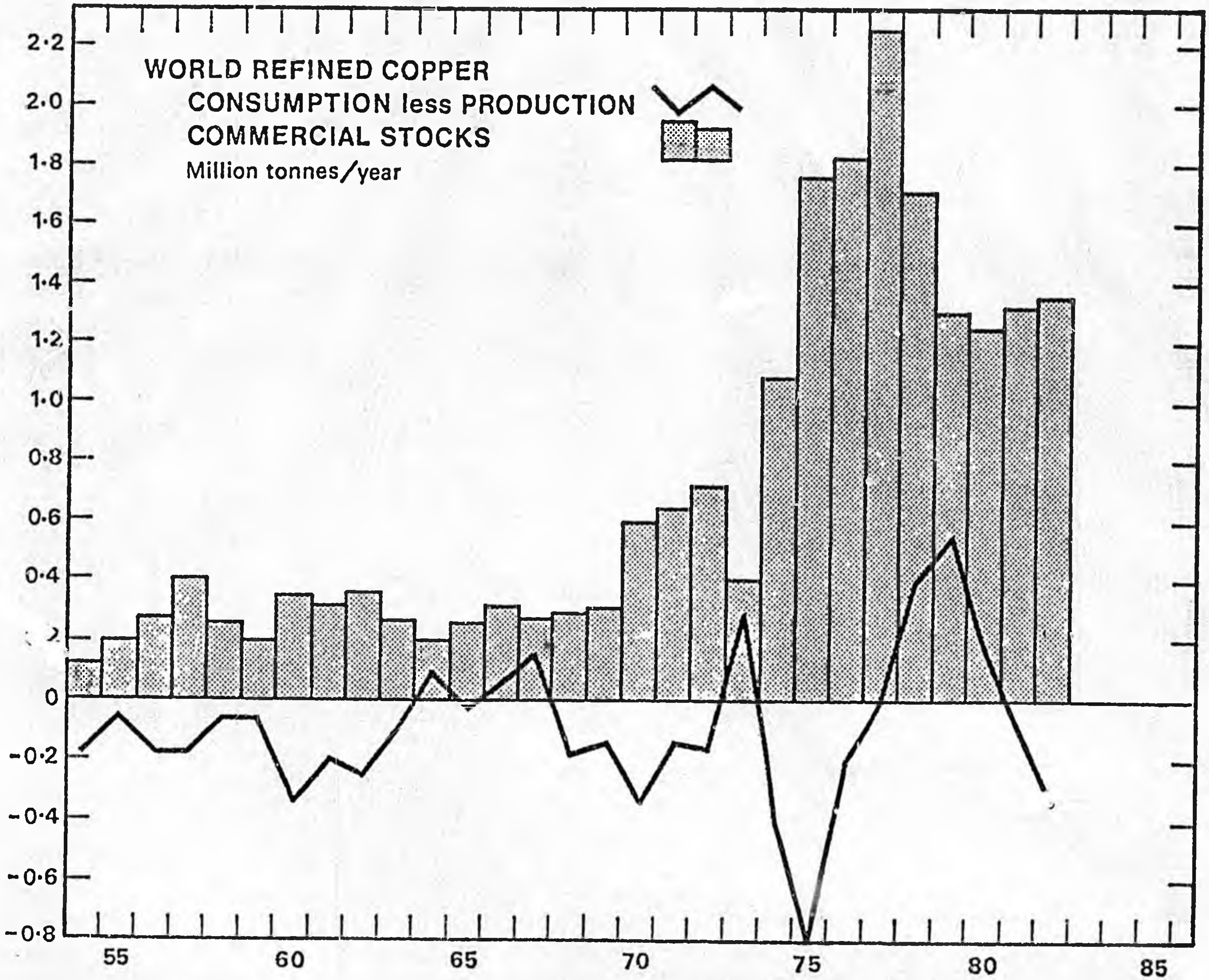


* ZAIRE, ZAMBIA, PHILIPPINES, CHILE, MEXICO, PERU, PAPUA NEW GUINEA

WESTERN WORLD COPPER CONSUMPTION

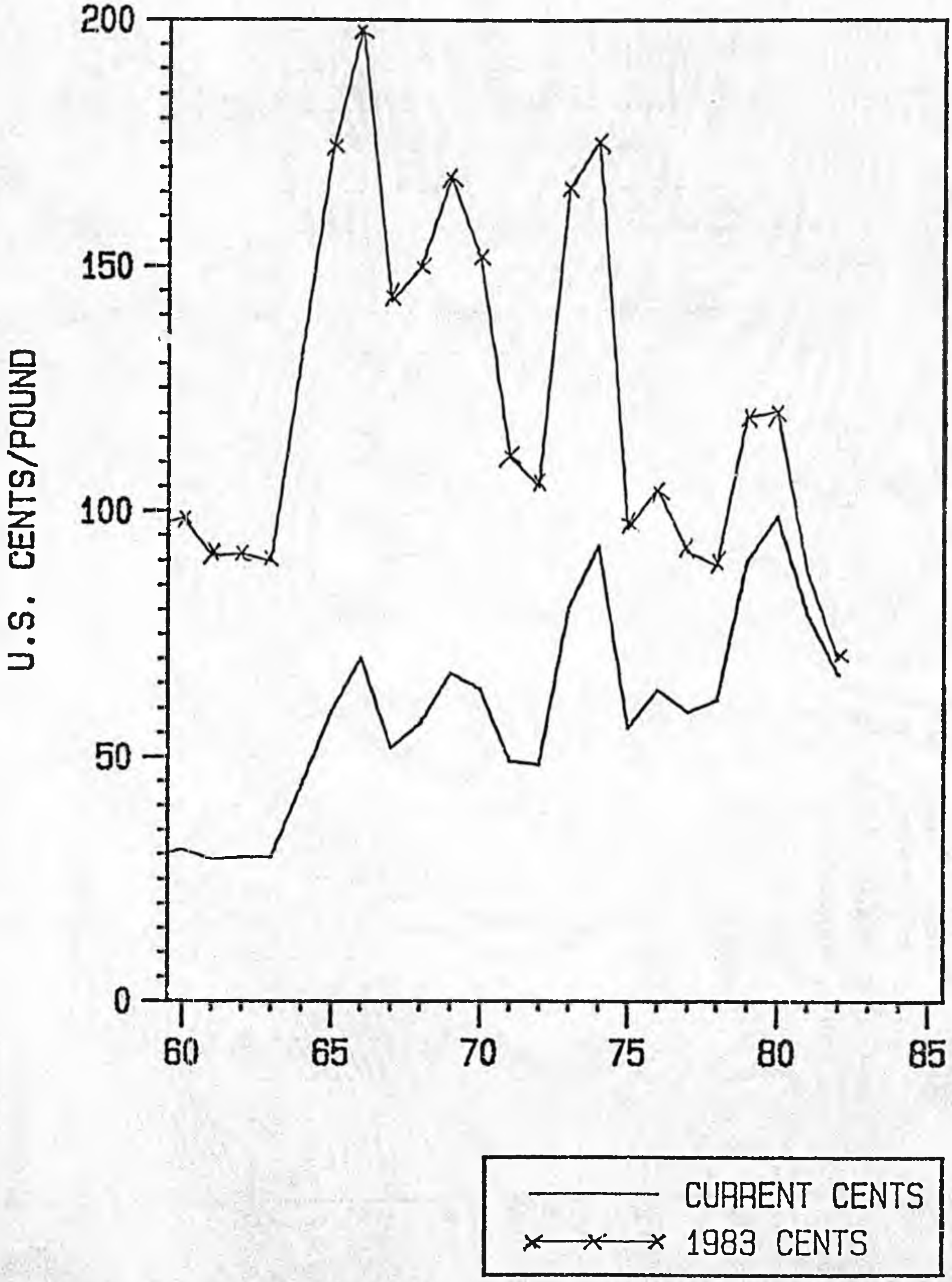


SLIDE 8

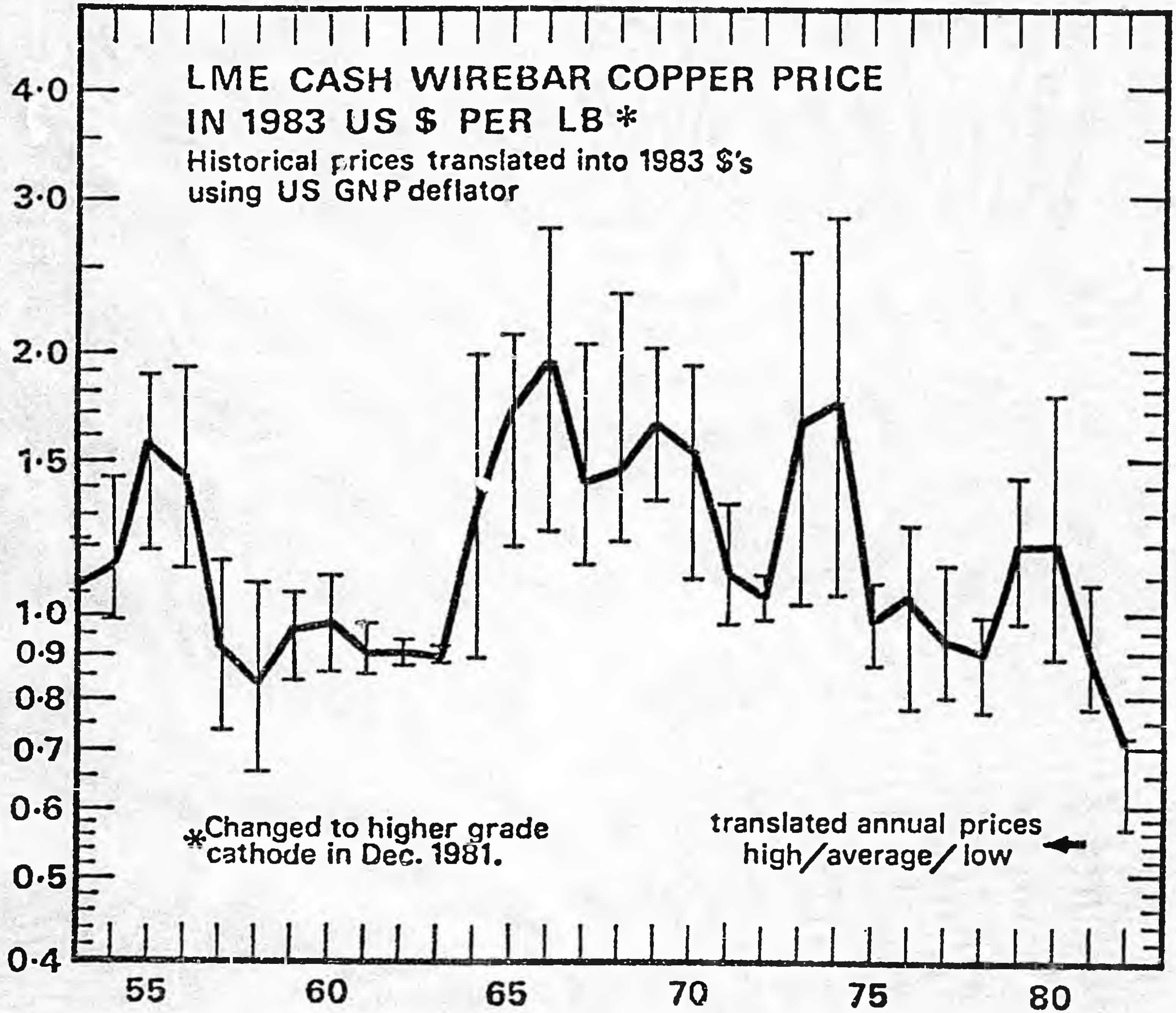


SLIDE 9 (MMRS) A-69

COPPER PRICES - CATHODE SETTLEMENT

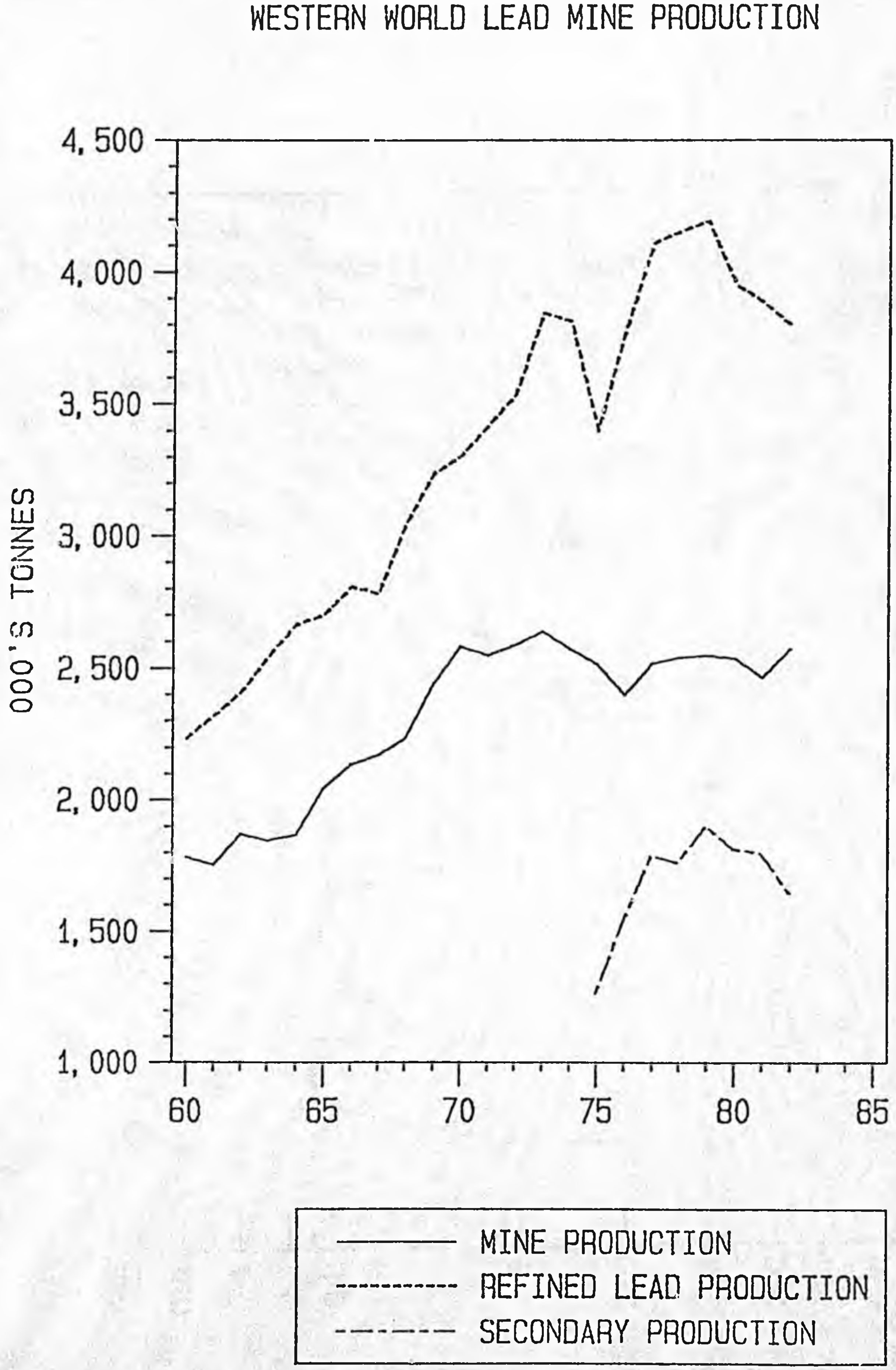


A-70



SLIDE 11
(MMRS)

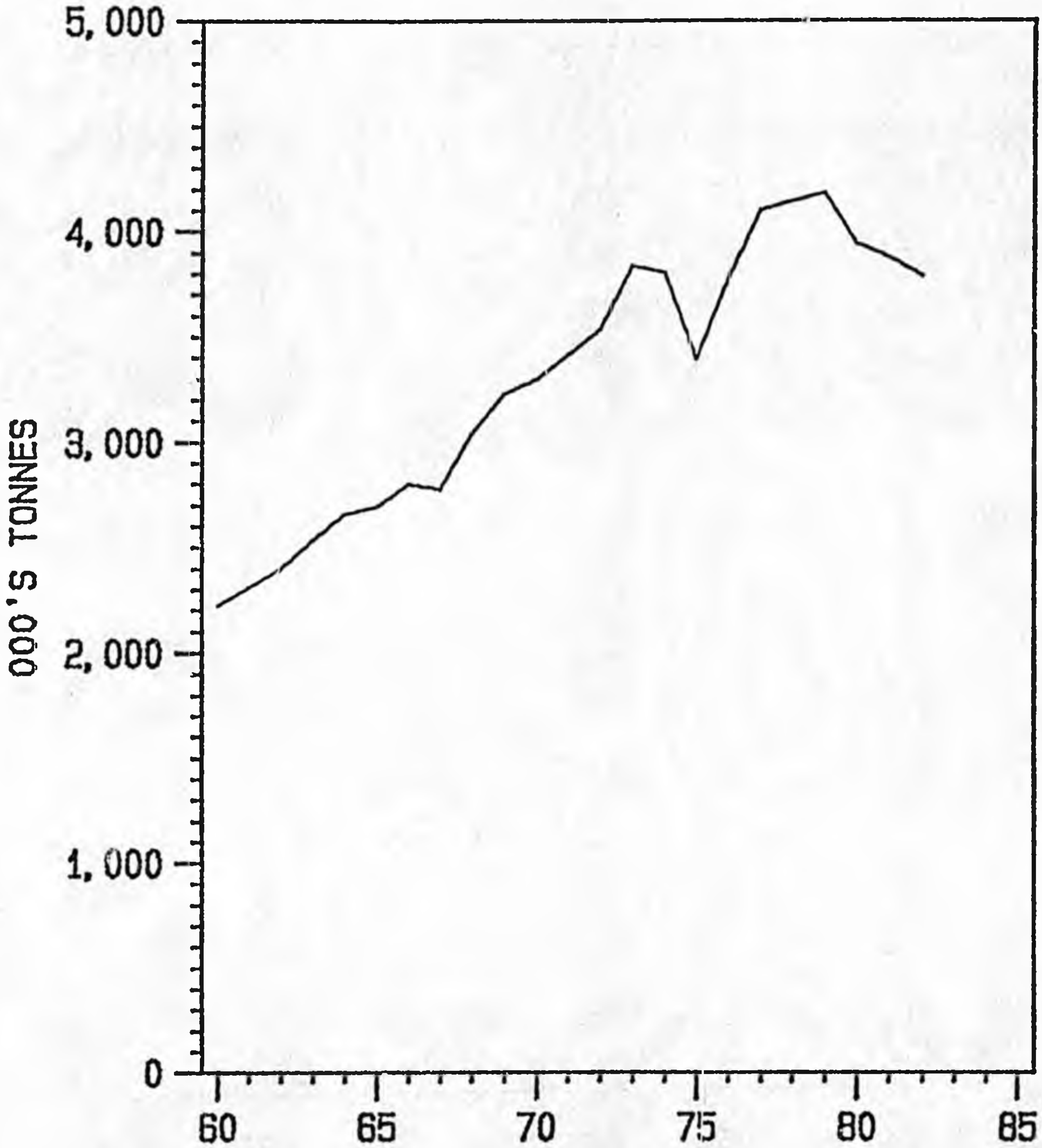
A-71



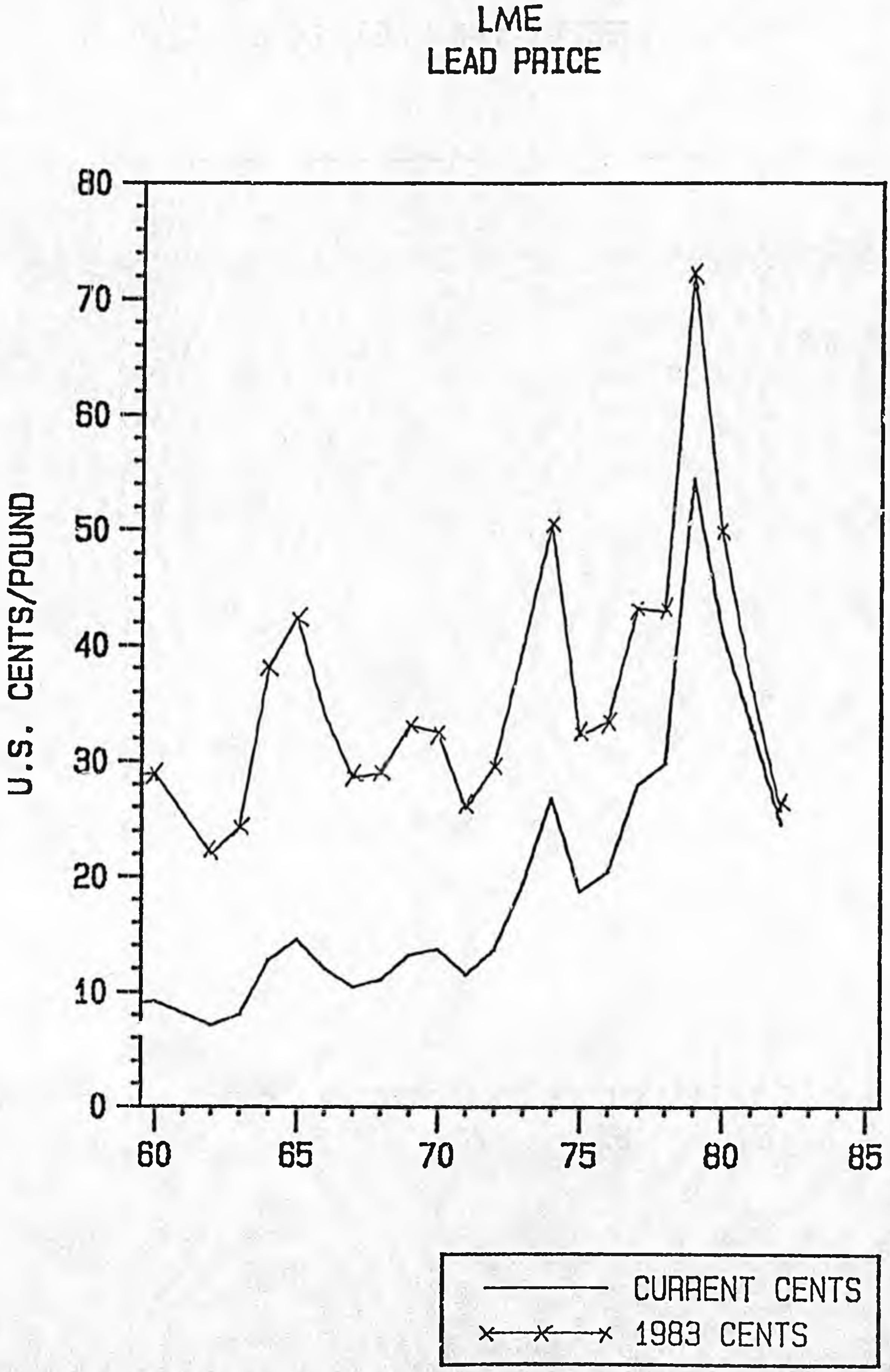
WESTERN WORLD LEAD MINE PRODUCTION
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
000'S TONNES
60
65
70
75
80
85
MINE PRODUCTION
REFINED LEAD PRODUCTION
SECONDARY PRODUCTION

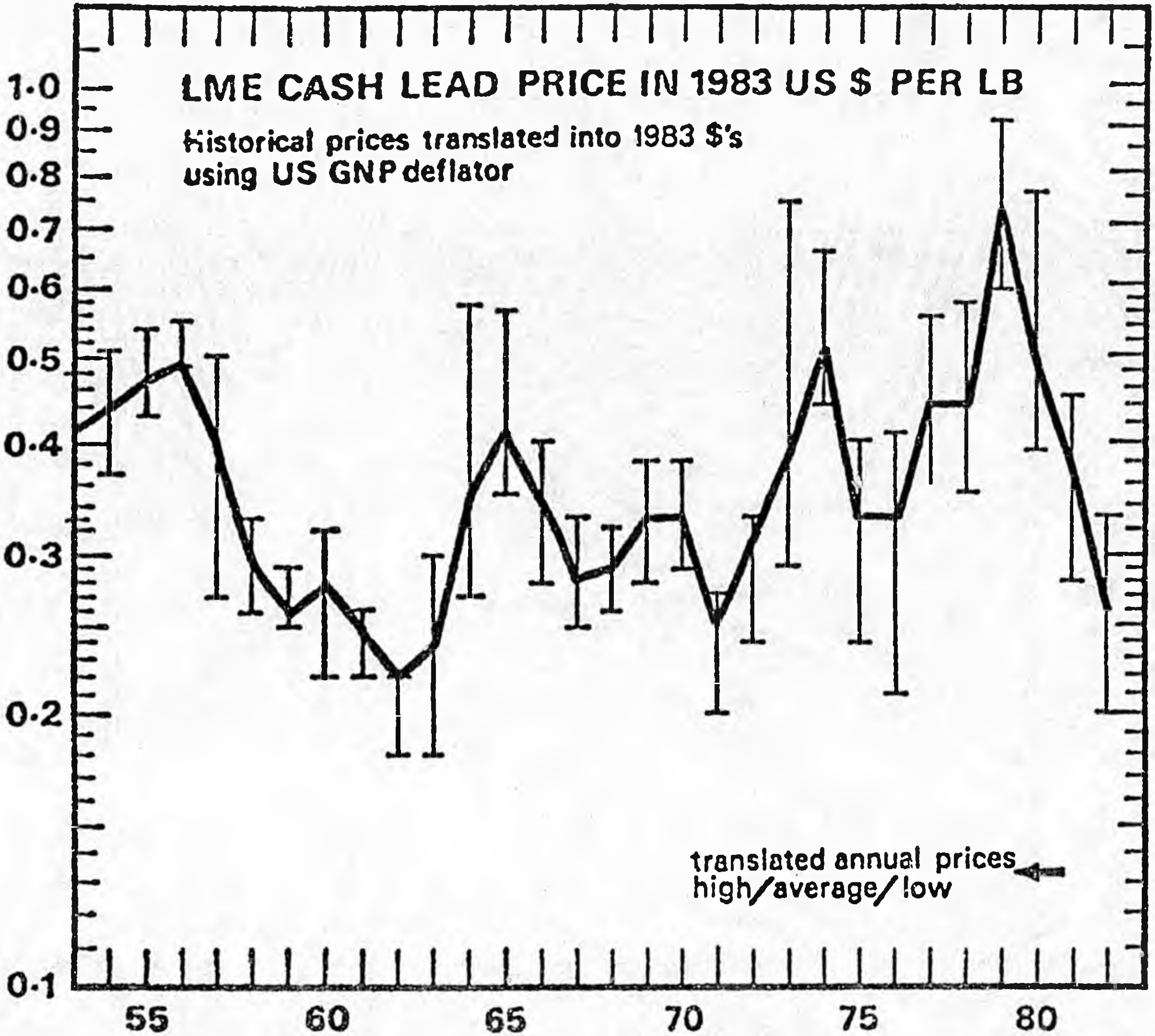
SLIDE 12

WESTERN WORLD LEAD CONSUMPTION



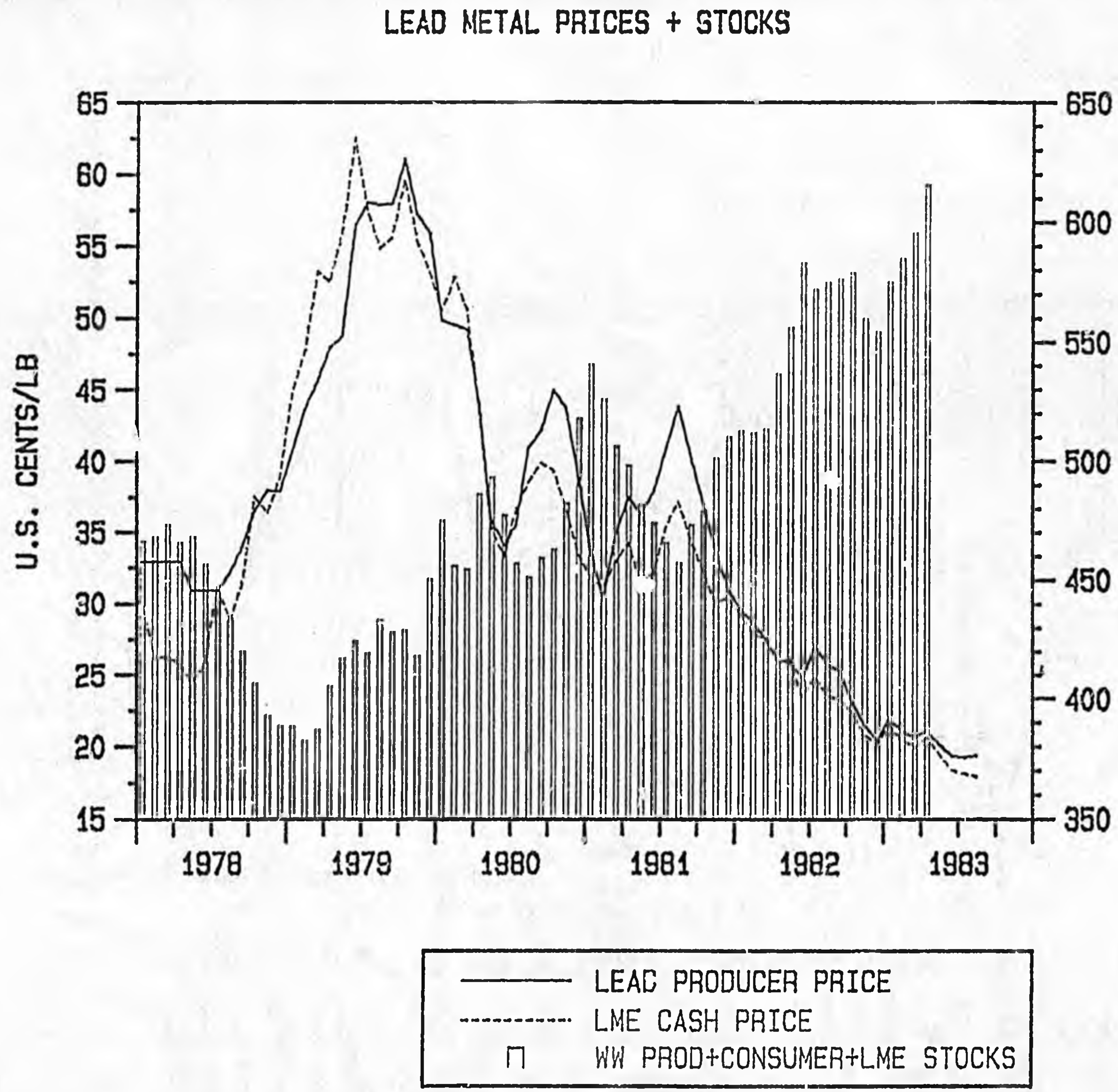
SLIDE 13


LME
LEAD PRICE
U.S. CENTS/POUND
0
10
20
30
40
50
60
70
80
60
65
70
75
80
85
CURRENT CENTS
1983 CENTS



SLIDE 15
(MMRS)

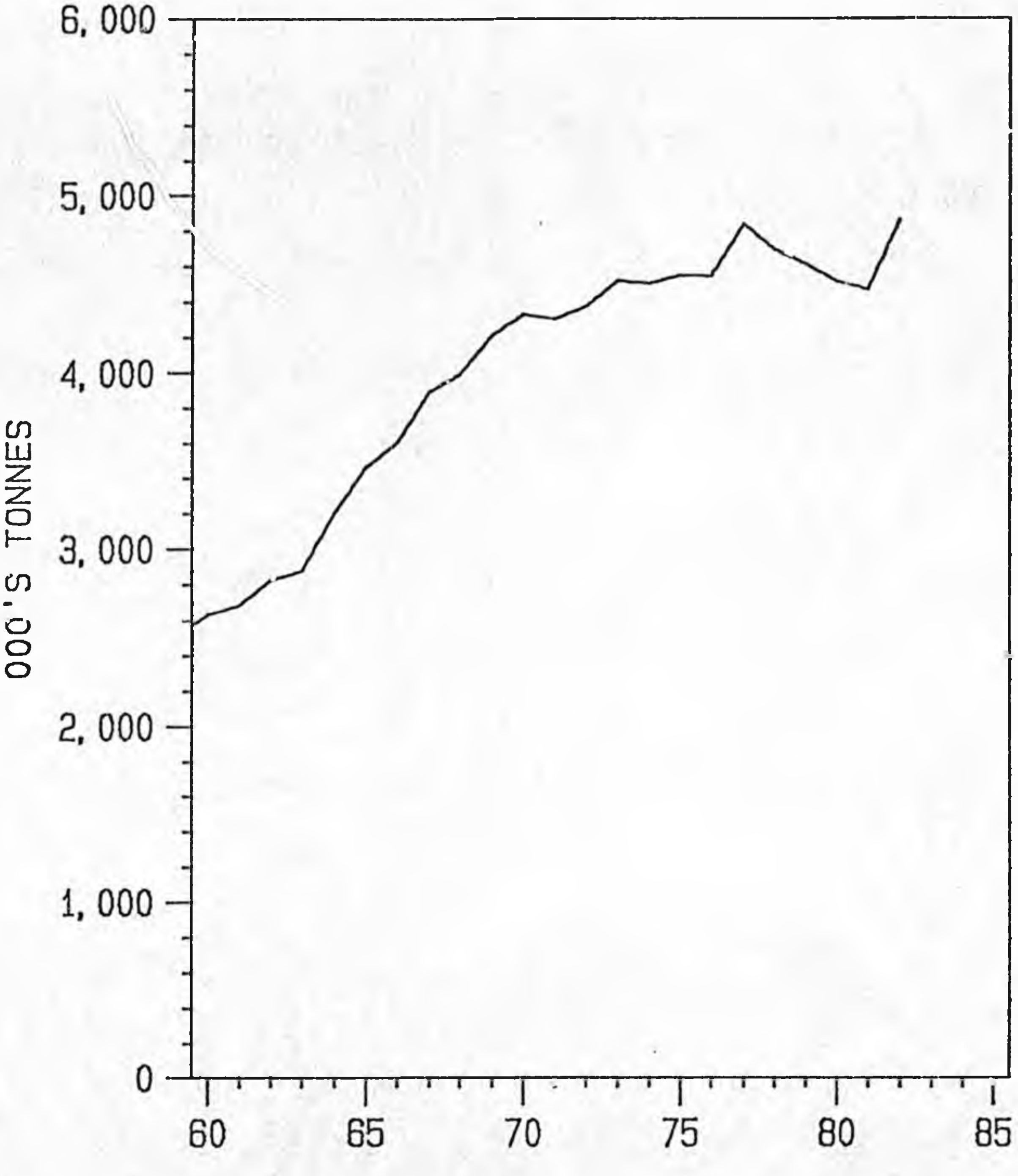
A-76



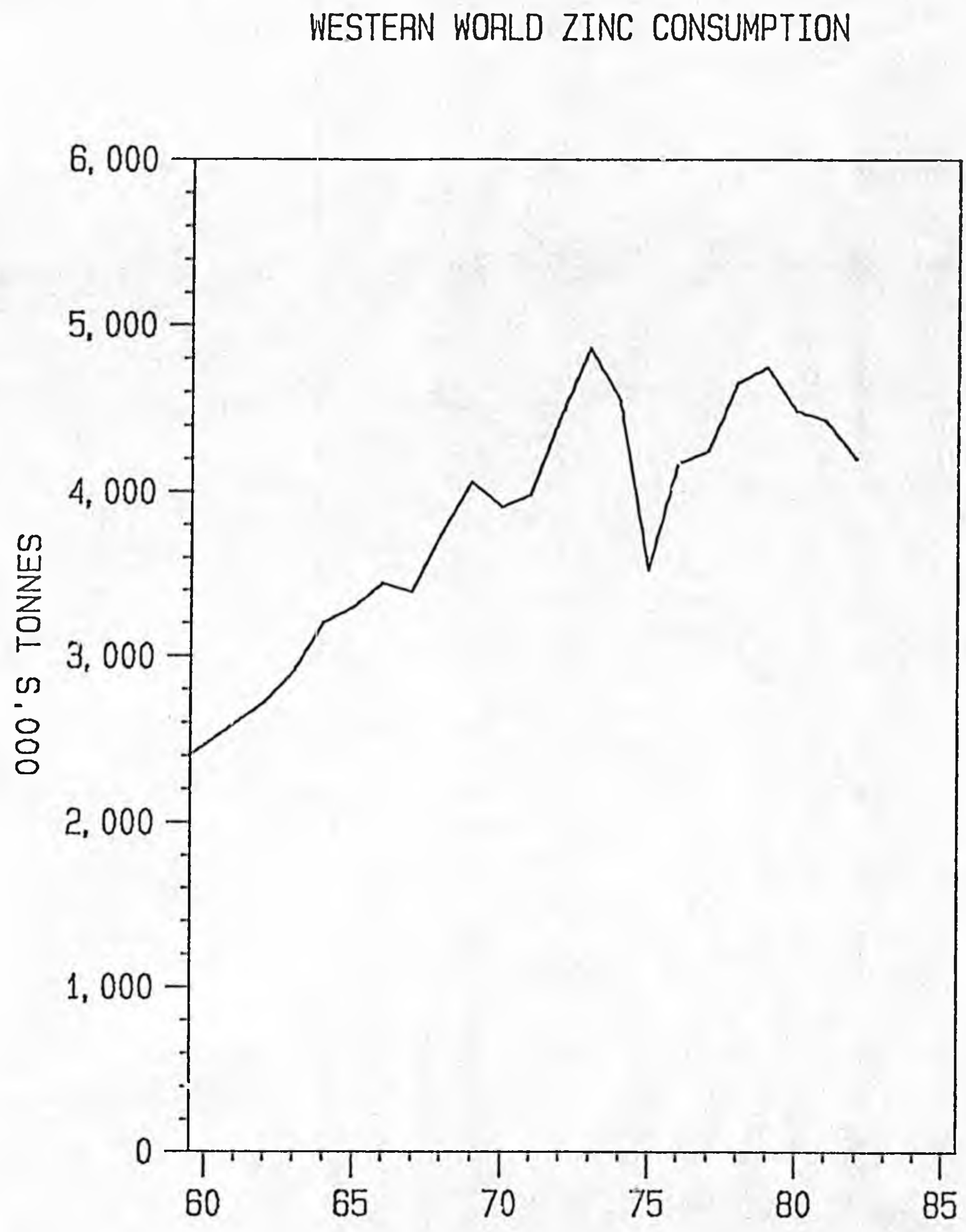
LEAD METAL PRICES + STOCKS
U.S. CENTS/LB
000'S TONNES
65
60
55
50
45
40
35
30
25
20
15
650
600
550
500
450
400
350
1978
1979
1980
1981
1982
1983
LEAD PRODUCER PRICE
LME CASH PRICE
WW PROD+CONSUMER+LME STOCKS

SLIDE 16

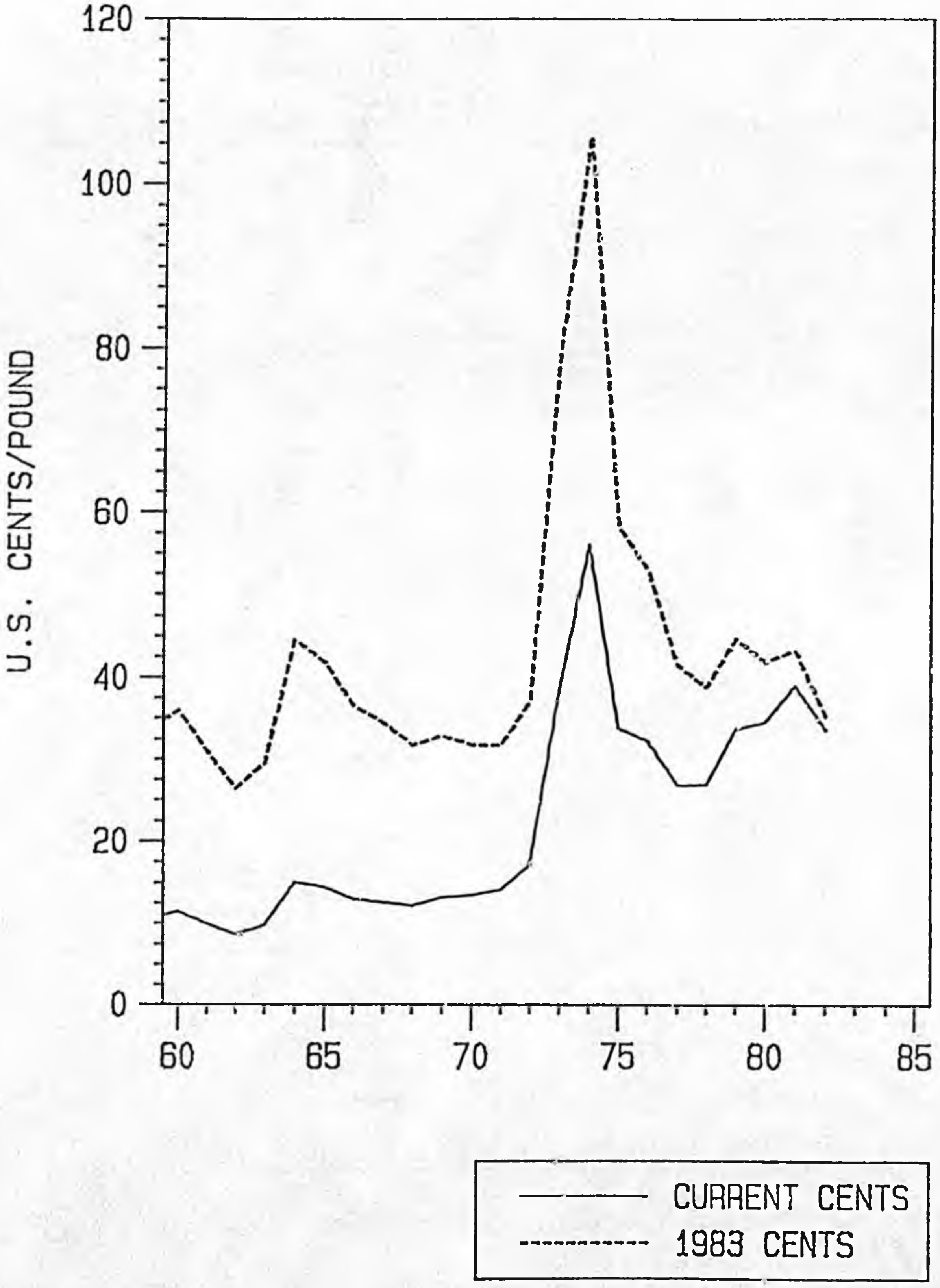
WESTERN WORLD ZINC MINE PRODUCTION

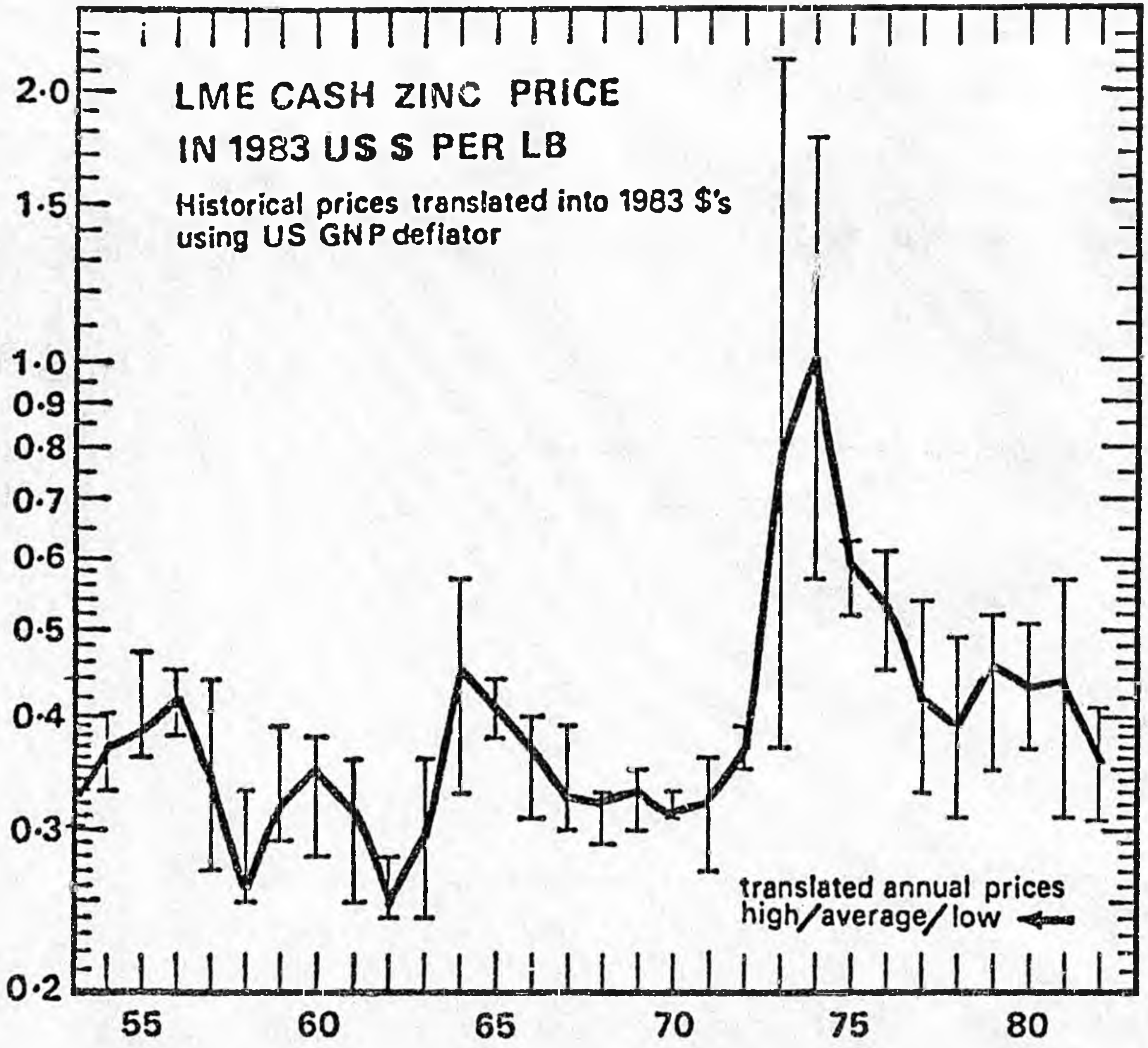


SLIDE 17


WESTERN WORLD ZINC CONSUMPTION
6,000
5,000
4,000
3,000
2,000
1,000
0
000'S TONNES
60
65
70
75
80
85

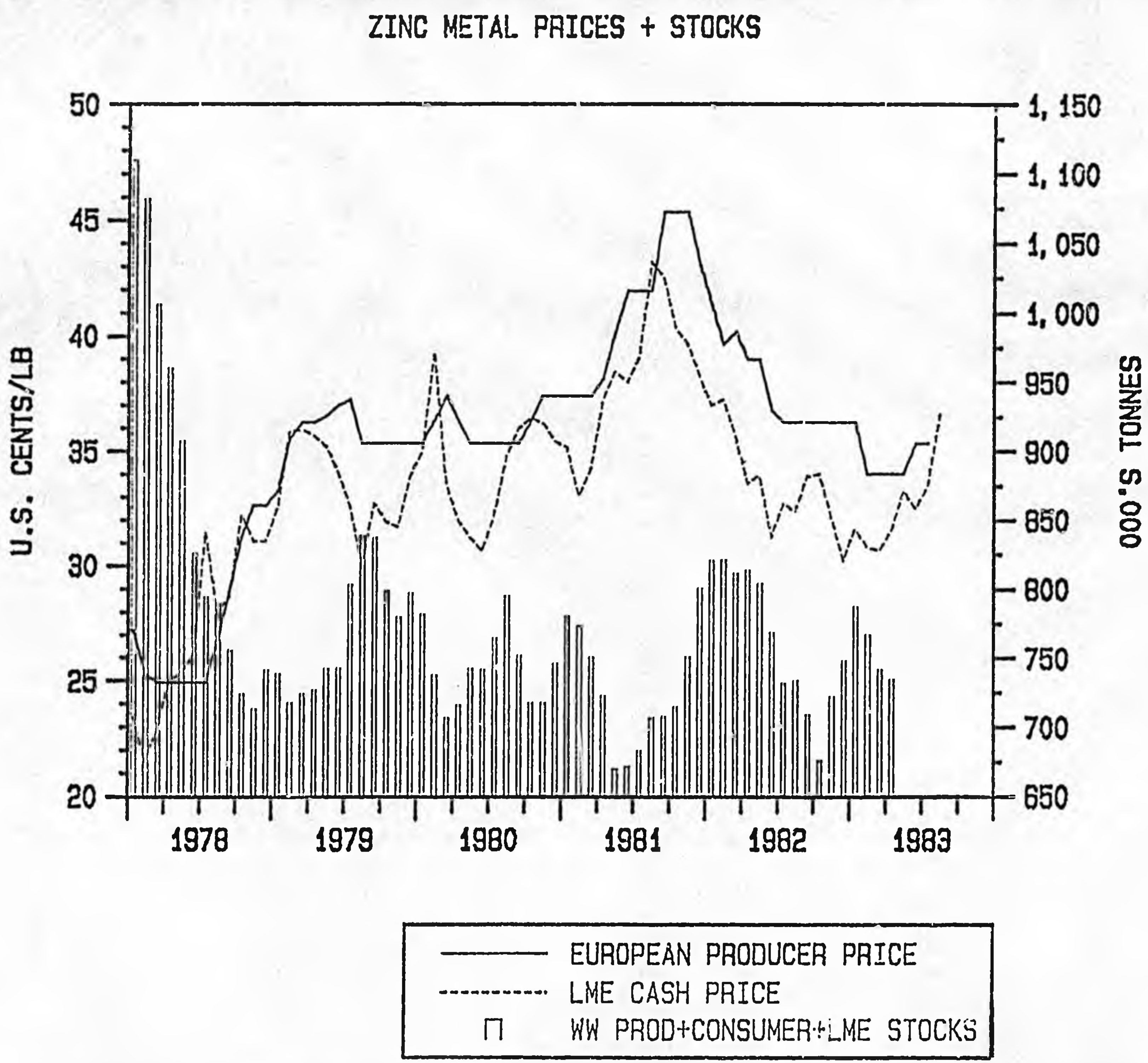
LME CASH ZINC PRICE





A-80

SLIDE 20 (MMRS)


ZINC METAL PRICES + STOCKS
U.S. CENTS/LB
50
45
40
35
30
25
20
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
000'S TONNES
1978
1979
1980
1981
1982
1983
EUROPEAN PRODUCER PRICE
LME CASH PRICE
WW PROD+CONSUMER+LME STOCKS

SLIDE 21

A-81