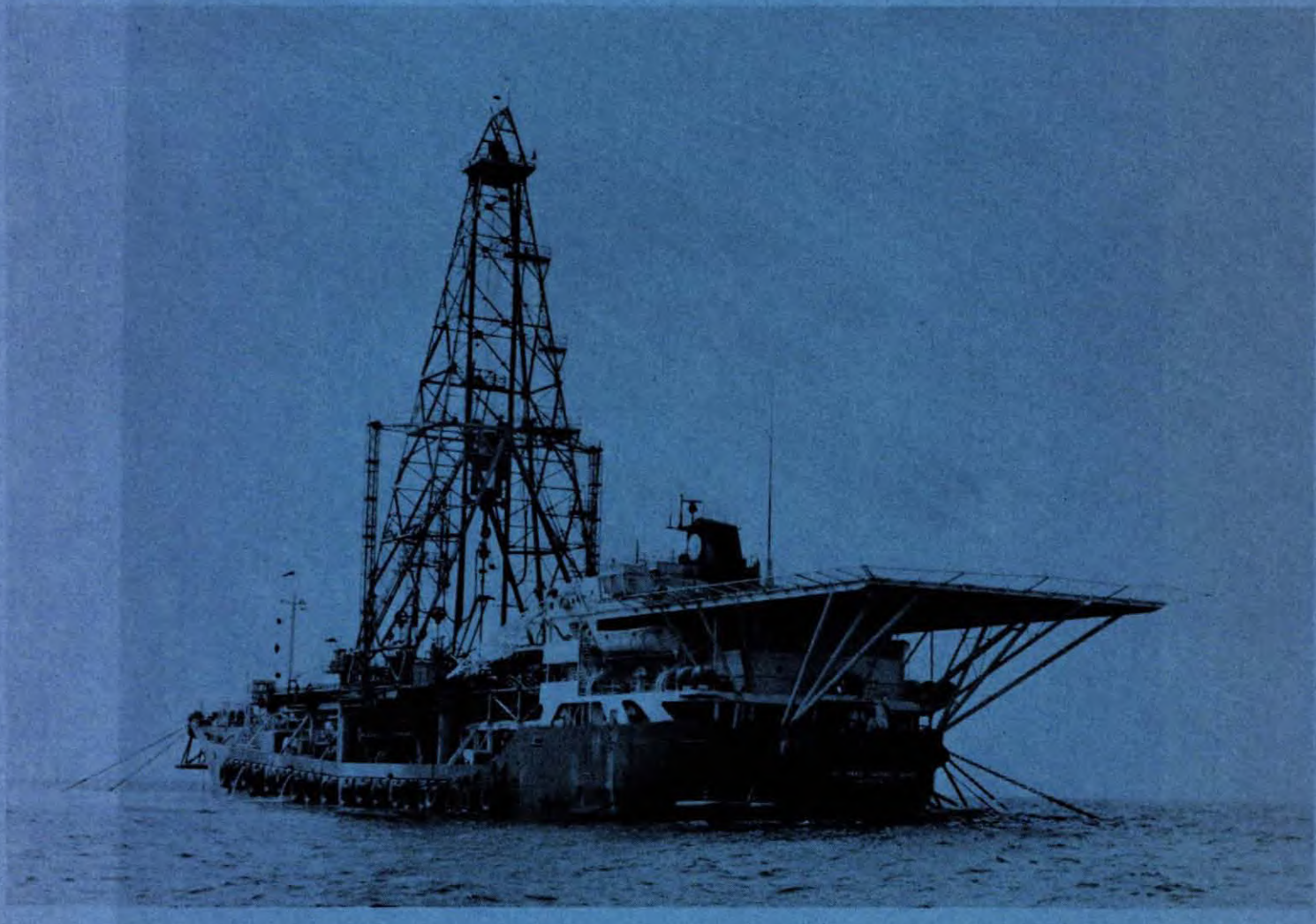
An Evaluation of the Canada - Nova Scotia Mineral Development Subsidiary Agreement



tment of Regional Economic Expansion

Scotia Department of Mines

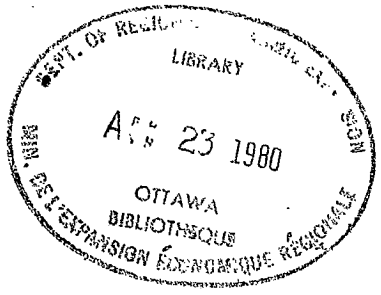
NOVA SCOTIA DEPARTMENT OF MINES

NOVA SCOTIA DEPARTMENT OF DEVELOPMENT

DEPARTMENT OF REGIONAL ECONOMIC EXPANSION

DEPARTMENT OF ENERGY MINES & RESOURCES

AN EVALUATION OF THE CANADA/NOVA SCOTIA MINERAL DEVELOPMENT SUBSIDIARY AGREEMENT



SEPTEMBER 1979

PROJECT TEAM

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An Evaluation of the Canada-Nova Scotia
MINERAL DEVELOPMENT SUBSIDIARY AGREEMENT

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EXECUTIVE SUMMARY

In 1974, the Governments of Canada and Nova Scotia signed the Mineral Development Subsidiary Agreement. The purpose of this report is to summarize and review the activities conducted under this agreement and covers essentially the five-year period from the beginning of the agreement in 1974 to March 31, 1979.

The study was commissioned by the Joint Management Team for the agreement comprising of representatives from the Nova Scotia Department of Mines, the federal Department of Energy, Mines & Resources and the Department of Regional Economic Expansion, to evaluate the performance of the agreement.

The overall conclusion of this evaluation is the agreement has been of benefit to Nova Scotia both in providing an improved data base for industry use and in progress towards the job creation target.

The results of a survey conducted among those knowledgeable of the Nova Scotia mineral climate concluded the work performed under the subsidiary was highly successful and useful to participants in the industry.

Private sector use of published results has been high while the socioeconomic impact results indicate the agreement has the potential to create $1.23 worth of benefits for each $1.00 spent.

The evaluation was conducted within the context of the overall objectives of the Canada/Nova Scotia General Development Agreement. The Mineral Sub-Agreement objectives were viewed more as a strategy towards attaining GDA objectives rather than an objective in itself.

CHAPTER I

1.1 Introduction

Prior to signing this agreement in 1974, it was generally agreed Nova Scotia did not have much of the basic geoscientific information necessary to stimulate its mineral industry.

The provision of geoscientific surveys (including geological, geophysical and geochemical coverage), geoscientific studies and correlations, evalustion of resources and related work by govermental agencies are prerequisite to effective mineral resource exploration and development Three out of the five projects carried under this Agreement were oriented specifically toward providing basic geoscientific information to the private as well as to the public sector.

The purpose of project number one is to identify development opportunities and generally promote exploration of the mineral resource. Three resource studies were initiated under this project.

Project number two is aimed at the construction of a Mineral Resource Inventory for the metallic mineral occurrences of Nova Scotia. While it is primarily a catalogue of known mineral occurrences and deposits, such an inventory constitutes a critical first step in the preparation of mineral deposit distribution maps, mineral potential maps and metallogenic maps, as well as provinding an important input to general metallogenic studies. The main applications

of such products is the evaluation of the mineral resource base and the provision of baseline data and interpretation used in the identification of exploration target areas and in the selection and orientation of exploration programs by the private sector. By documenting in an organized fashion, the results of past exploration efforts, a mineral inventory also aids in the organization of present and future exploration work. Once an inventory is set up and a good updating system is in place, it becomes easy and inexpensive to maintain and the benefits gained from the ready availability of such an information base far outweigh the costs of maintaining it.

Of a similar nature but focusing on industrial minerals was project number three: Mineral Evaluation Surveys. Given the growing importance of industrial and construction materials in mineral economics and the necessity to have a good data base on these materials, for example in land use planning and policy areas, the project can yield important benefits in the future.

For both the mineral inventory projects, most of the occurrences on file have been verified in the field; an important prerequisite to useful interpretation of the raw data. This data, coupled with other geoscientific survey

results (geological mapping, geochemical surveys, etc.) and metallogenic studies serve as the base on which to build evaluations and estimates of the size and distribution of, as yet, undiscovered deposits that may exist in given geological environments and thus yield estimates of the likely economic significance of the resource base.

Project number four, Geological and Geochemical Surveys, also has the dual purpose of building a mineral resource information base and of providing baseline data to industry.

Because of their wide scope, both in terms of area covered and of methods used, such surveys can most usefully be undertaken by governmental agencies. Although larger mining and exploration firms commonly conduct such regionally-oriented surveys (geochemical, geophysical and geological) over large areas, the results of these surveys are generally held confidential and are unavailable to the public and to other explorationists. It is through the integration and application of a variety of different geological and metallogenic interpretations that the best results are achieved and in order to stimulate exploration, these results should be available to all. In such studies, it is generally useful to cover relatively large areas in order to develop an understanding of the broad geological and metallogenic picture

which can then later be interpreted and applied by exploration and mining companies working at the scale of individual properties and prospects.

Since the results of the geoscientific work carried out by the Nova Scotia Department of Mines are made public, duplication of effort is avoided that might otherwise occur if the work was done privately and the results kept confidential.

Geoscientific work such as that described above also serves the extremely useful purpose of isolating areas that are considered to have relatively low mineral resource potential, thus allowing private-sector exploration expenditures to be focused on those areas that are more likely to yield significant returns on exploration investment.

The fifth project, Laboratory Services, is essentially a support to the field components of the previous ones. To a large degree, the quality and quantity of the results produced by the field project were dependent on the capability of the laboratory to provide accurate analytical services. An indirect benefit of the project is the strengthening, through improved equipment and more staff,

of the laboratory's position as a centre of chemical and mineralogical expertise on Nova Scotia's geological environment.

Project six covers the Management and Administrative functions and includes expenditures relating to the purchase of capital items and the publication and circulation of data arising from activities conducted on other projects.

1.2 Structure of the Report

The study methodology included a review of activities conducted under the agreement and an analysis of the output and results achieved. Table 1.1 presents the total agreement budget and actual expenditures during this period.

Chapter II of the report provides a brief review of the Mineral Industry in Nova Scotia.

The projects and activities funded under each of these programs were examined in detail in Chapter III. This chapter also reports the results of the subsidiary as viewed by the mineral industry.

The socioeconomic impact of the sub-agreement is analyzed in Chapter IV. This chapter measures the household income created by the programs and hence their contribution to regional development.

The results of Chapters II to IV are summarized in Chapter V, together with some concluding comments.

Table 1.1

BUDGET

PROJECT NAME AND NUMBER	TOTAL BUDGET	1974-75	1975-76	1976-77	1977-78	1978-79	TOTALS
Resource Development Planning							
107101 Authorized	$ 43,000.00	23,175.00	10,000.00	85,000.00	(13,375.00)	(61,800.00)	43,000.00
Actual Expenditure		16,540.99	8,990.46	5,804.64	1,618.05	-	32,954.14
Balance		6,634.01	1,009.54	79,195.36	(14,993.05)	(61,800.00)	10,045.86
Mineral Resource Inventory							
107102 Authorized	228,800		32,500.00	30,480.00	85,220.00	80,600.00	228,800.00
Actual Expenditure			25,418,67	35,069.93	90,141.19	52 270.21	202,900.00
Balance			7,081.33	(4,589.93)	4,921.19)	28,329.79	25,900.00
Mineral Evaluation Survey							
107103 Authorized	15,971,500.00	547,951.48	1,112,370.00	259,678.52	6 064,200.00	6,668,839.00	14,653,039.00
Actual Expenditure		284,564.40	1,243,473.61	337,901.05	5,622,899.67	7,288,091.27	14,776,930.00
Balance		263,387.08	(131,103.61)	(78,222,53)	441,300.33	(619,252.27)	(123,891.00)
Geological-Geochemical Survey							
107104 Authorized	2,825,300.00	476,664.92	478,800.00	641,863.00	531,272.08	696,700.00	2,825,300.00
Actual Expenditure		418,703.47	462,042.29	516,736.86	471,059.29	518,963.09	2,387,581.00
Balance		57,961.45	16,757.71	125,126.14	60 212.79	177,736.91	437,795.00
Laboratory Services							
107105 Authorized	266,900.00	165,000.00	15,000.00	5,000.00	(23,900.00)	105,800.00	266,900.00
Actual Expenditure		138,617.69	12,570.56	4,895.19	11,730.84	13,315,72	181,130.00
Balance		26,382.31	2,429.44	104.81	35,630.84	92 484.28	85,770.00
Administration and Management							
107106 Authorized	502,500.00		124,500.00	147,068.00	62,332.00	168,600.00	502,500.00
Actual Expenditure			97,229.10	82,050.06	124,323.09	136,837.75	440,440.00
Balance			27,270.90	65,017,94	(61,991,09)	31,762.25	62,060.00
Totals Authorized		1,272,791.40	1,773,170.00	1,169,089.52	6,705.749.08	7,658 739.00	18,519,539.00
Actual Expenditure		858,426.55	1,849,724.69	982,457.73	6,321,772.13	8,009,478.04	18,021,859.00
	$19,838,000.00	354,364.85	(76,554.69)	186,631.79	383,976.95	(350,739.04)	497,680.00

CHAPTER II

NOVA SCOTIA'S MINERAL INDUSTRY

2.1 Overview

The quantity of Nova Scotia's mineral production has remained relatively stable over the years. Table 2.1 reveals that the Province's production was 11.2 million tons in 1973, growing to 13.7 million in 1977. The value of mineral production has increased, however, over the same time period reflecting increased labour costs and stronger markets particularly for coal. Table 2.2 outlines the value of mineral production from 1973 to 1977. In 1973, mineral production in the Province was valued at $62.3 million compared to $150.3 in 1977.

In 1973, 4,040 persons were employed in the Province's mineral industry. In 1977 this figure dropped by about 10 per cent to 3,543. Table 2.3 sets out employment by mineral. Table 2.3 reveals that the coal industry is the Province's major mineral employer representing some 77 per cent of the total in 1973 and 74 per cent in 1977.

Table 2.1

QUANTITY OF MINERALS PRODUCED
NOVA SCOTIA, 1973-77

	1973	1974	1975	1976	1977
METALS					
Lead (tons conc.)	1,155	-	-	-	-
NON-METALS					
Anhydrite	243,621	280,725	217,832	228,518	245,117
Barite	55,592	56,934	41,195	63,259	75,672
Celestite (tons conc.)	50,946	69,107	39,403	-	-
Dolomite	102,566	96,679	99,219	32,964	88,710
Gypsum	5,836,459	5,577,910	3,991,072	4,363,229	5,137,642
Industrial Sand	-	1,300	3,589	11,135	33,725
Limestone	586,355	629,418	396,037	509,518	426,934
Peat	2,000	51	(no longer under Department of Mines		
Salt	791,838	835,859	908,161	1,020,174	1,003,286
Silica	-	916	-	-	-
STRUCTURAL MATERIALS					
Clay and Shales	62,116	55,696	46,595	47,600	56,600
Crushed Stone	1,300,155	2,063,210	2,423,371	2,401,670	2,614,970
Granite	670	820	890	840	780
Sand and Gravel	1,040,945	1,171,378	1,065,141	1,258,206	1,141,268
Sandstone	385	-	-	-	-
FUEL					
Coal	1,158,070	1,410,257	1,948,011	2,488,457	2,913,267
TOTALS	11,232,873	12,250,260	11,180,516	12,425,570	13,737,971

Note: all figures given in tons unless otherwise noted
Source: Nova Scotia Department of Mines Annual Reports

2.2 Importance to the Provincial Economy

The mineral sector in 1974 represented some 1.6 per cent of the Province's employment and 1.8 per cent of its gross domestic product. Hence, the direct contribution of the sector to the Provincial economy is small. A measure of the total importance of the sector to the Provincial economy is provided by comparing its total household income contribution in terms of the wages and salaries it pays out directly and indirectly by purchasing from Provincial firms. This measure is available from the Nova Scotia 1974 Input-Output Tables, Model 2. The model reveals that an expansion of the output of the mineral sector by one dollar creates 0.95 household income dollars in the Provincial economy, if it takes place in the "coal mining" sector and 0.62 household income dollars if it takes place in the "other mining" sector. The coal mining multiplier is somewhat higher than the average provincial multiplier of 0.63 dollars and the "other mining" sector is slightly lower.

Table 2.2

VALUE OF MINERAL PRODUCTION

NOVA SCOTIA 1973-1977

	1973 $	1974 $	1975 $	1976 $	1977 $
METALS					
Lead[1]	372,936	-	-	-	-
NON-METALS					
Anhydrite[1]	730,863	842,175	653,496	685,554	735,351
Barite[2]	767,247	464,671	941,291	1,235,904	1,647,891
Celestite[1]	2,547,300	3,455,350	1,970,150	-	-
Dolomite[1]	410,264	386,716	396,876	131,856	354,840
Gypsum[2]	14,448,797	15,495,506	12,806,185	14,961,027	20,817,065
Industrial Sand[1]	-	13,000	35,890	111,350	337,250
Limestone[1]	2,345,420	2,517,672	1,584,148	2,038,072	1,707,736
Peat[2]	418,417	354,000	(no longer under Department of Mines)		
Salt[2]	8,316,340	11,179,065	14,509,494	17,631,099	17,432,324
STRUCTURAL MATERIALS					
Clay Products[2]	2,101,071	2,762,749	3,155,284	3,900,046	4,547,340
Crushed Stone[2]	1,732,872	4,585,868	4,637,276	4,843,827	6,919,179
Sand and Gravel[2]	12,524,342	16,168,868	14,043,281	15,727,399	18,214,302
FUEL					
Coal	15,568,013	24,524,000	44,586,000	57,755,700	77,575,000
TOTALS	62,283,882	82,749,640	99,319,371	119,021,834	150,287,978

1. Estimates based on average value per ton
2. Statistics Canada figures (catalogue #26-202)

Table 2.3

EMPLOYMENT IN MINES

NOVA SCOTIA, 1973-77

	1973	1974	1975	1976	1977
INDUSTRIAL MINERALS OR NON-METALS					
Barite	41	43	36	38	38
Celestite	44	49	33	24	-
Dolomite	38	37	35	32	32
Gypsum/Anhydrite	347	353	281	308	348
Industrial Sands	-	3	2	2	6
Limestone	63	76	70	66	66
Peat	13	20	(no longer under Dept. of Mines)		
Salt	235	217	229	225	223
TOTAL	781	798	686	695	713
FUELS					
Coal	3,116	3,168	3,375	2,197	2,632
STRUCTURAL MATERIALS					
Clay and Shale	11	7	5	4	4
Crushed Stone	70	90	123	118	131
Granite	7	5	5	5	5
Sand and Gravel	48	67	66	49	58
Sandstone	7	-	-	-	-
TOTAL	143	169	199	176	198
GRAND TOTAL	4,040	4,135	4,260	3,068	3,543

- nil or zero

Source: Nova Scotia Department of Mines Annual Reports

The mining sector's contribution to the Provincial economy is currently projected to decrease slightly on a relative basis in spite of expected revitalization of the coal sector It is projected that by 1984 employment will be 5,000 and represent 1.4 per cent of total employment. The sector's gross domestic product contribution is expected to be 1.3 per cent by 1984.

2.3 Recent Activity

Mineral activity in Nova Scotia since 1974 has been largely concentrated in mineral exploration. With the Gays River zinc deposit discovery in 1974, base metal exploration in similar deposit-environments has greatly increased. Major areas of activity have been in the Gays River area, Antigonish County and Cape Breton. In 1977 the southwestern part of the Province also received attention for base metal exploration Uranium licenses cover a great deal of mainland Nova Scotia in a new surge of interest in that mineral. The total number of licensed claims for mineral exploration has almost tripled since 1973. Table 2.4 shows that some 122,456 exploration claims were taken out in 1977.

On June 1, 1975 the Mines Act of Nova Scotia was repealed and replaced with the Mineral Resources Act. In general, the new Act has provided greater stability and control in mining and exploration ventures in Nova Scotia. Royalties and license fees were increased, short ton production figures introduced, and the gypsum tax amended. A section on resource management was introduced in order to have greater control over this phase of mining.

Table 2.4

Exploration Statistics

Year	Claims Staked	Money Expended in Exploration	Drilling Footage
1973	50,000	$2,437,328	N.A.
1974	61,000	3,242,741	208,495
1975	34,517	4,259,152	108,699
1976	58,913	1,614,349	81,957
1977	122,456	3,782,295	91,460

CHAPTER III

PROJECT DESCRIPTIONS AND MAJOR RESULTS

3.1 PROJECT 1 - RESOURCE DEVELOPMENT PLANNING

3.1.1 Objective

The purpose of resource development planning is to identify development opportunities and devise programs to optimize governmental efforts in promoting exploration and exploitation of the mineral resource. The formulation of long-term policies and legislation is necessary to maximize the opportunities for increased employment, income and revenues to the Province.

3.1.2 Description

Under this project, three resource studies have been initiated:

(1) A study of gypsum deposits in Nova Scotia was carried out in order to assemble data available on the major gypsum areas and to suggest areas of economic potential beyond the limits of the present mining operation. The result of this study is a 61 page report completed in 1974 by a consultant.

(2) A study of salt in Nova Scotia was initiated in order to develop plans for the use of salt deposits. A 12 page report on the first phase of this study was completed in 1977.

(3) A third resource study was on the feasibility of establishing a zinc smelter in Nova Scotia. The results of this study are compiled in an 88 page report that includes conclusions and recommendations, and was done in 1974.

3.1.3 Major Results Achieved

(1) Salt Study

There are several different uses of salt: 1) as a commodity, 2) underground petroleum storage, 3) underground storage for electrical power generation, 4) underground storage of waste materials. Because of these different uses, a study was carried out to identify the proper procedures for achieving maximum use of this mineral resource. These procedures are now being followed and at this stage most of the geological information has been obtained on the various salt deposits throughout the Province. This information will enable the Province of Nova Scotia to make a decision on the best method of exploiting a particular salt deposit.

(2) Zinc Smelter Study

This study outlined the suitability of setting up a zinc smelter in Nova Scotia. Although the recommendation of the report was negative, the basic information on a zinc smelter is now available and can be used if other base metal deposits are developed in the Province.

(3) Gypsum Study

This study gives an outline of the mineable gypsum deposits in the Province and can be used for formulating policies pertaining to the gypsum industry.

3.2 PROJECT 2 - MINERAL RESOURCE INVENTORY

3.2.1 Objective

In order to provide a base for formulating policies and programs regarding mineral exploration and development, a complete and comprehensive data and information system on the nature, extent and location of known mineral occurrences is required. An inventory of known resources is the first step in developing priorities of action.

3.2.2 Description

This project includes the compilation of information on metallic mineral occurrences in Nova Scotia, computer indexing of departmental documents, compilation of index maps to assessment file coverage and microfilming of assessment files.

The metallic mineral inventory, as of March 1978, contained 700 data file cards on occurrences with 60 per cent of the occurrences verified. Each card contains concise information on the occurrence type, its location and history. The entire data file collection is on open file, and maps of 1:250,000 scale with the occurrences plotted are available to interested persons. Over 2,500 documents have been entered into the Canadian Index to Geoscience Data. This represents approximately 60 per cent of the documents that will be entered. Retrievals from the Index are available through the Provincial Department of Mines or the Canada Centre for Geoscience Data. Two indexes to library documents have been published.

3.2.3 Major Results Achieved

The major result of this project has been the compilation of the Mineral Occurrence Data File cards for metallic minerals,

with accompanying preliminary location maps at 1:250,000 scale. Both the data cards and the maps have been announced as being available in the Reports of Activities. Approximately fifty companies and individuals have requested sets or individual maps, and the file cards have been used and copied by departmental staff and the private sector.

Nova Scotia joined the Canadian Index to Geoscience Data in order to have a complete catalogue of geoscience documents held by the department. This project has resulted in the entry of all departmental documents into the C.I.G.D. computer file and the publication of Report 77-2, "Index to Assessment File Reports". Over one-third of the printed copies have been sold or given as complimentary copies. The private industry personnel working in Nova Scotia have used this Index extensively for their research into exploration in this Province. Other retrievals of indexes have been made for departmental staff, involving selected subjects, and for the departmental library. Indexes covering broad areas such as author and commodity have been used as research aids in the library.

3.3 PROJECT 3 - MINERAL EVALUATION SURVEYS

3.3.1 Objective

The examination, mapping and evaluation of known mineral occurrences and the search for new deposits of industrial minerals provides a direct means of encouraging mineral development and the use of Provincial resources. The rapid publication of data is a necessary prerequisite to maximize the benefits of such a program.

3.3.2 Description

The Mineral Evaluation Survey project contains three distinct areas of study: (1) industrial mineral surveys, (2) energy surveys - coal and oil shales, and (3) surficial deposit surveys.

The Industrial Mineral Survey has included the compilation of all available data on industrial mineral occurrences in Nova Scotia with information on location, type and history recorded on data file cards. The total number of occurrences recorded is 997 with 50% verified. A detailed survey of Barite-Celestite-Flourite occurrences was conducted including sample collection analyses. The result of this survey has been published (Bulletin 4). A commodity usage survey of the Glencoe limestone deposits was conducted in 1975-76 with 28,668 feet of

diamond drilling done to outline the reserves of the deposit. Reserves calculated for the deposit amount to 175 million tons of metallurgical grade limestone and 345 million tons of cement grade limestone. Preliminary reports on this project are available on open file. Additional drilling in this program was carried out under the Canso Strait Subsidiary Agreement.

The Surficial Deposits Survey included the mapping and sampling of sand and gravel deposits in Nova Scotia as well as glacial till deposits. The former program produced 241 samples for analyses and 1:50,000 location map sheets. The till survey covered the Eastern Shore area of Nova Scotia, with the collection of 525 samples for analyses and the preparation of three 1:100,000 map sheets showing distribution of deposit types. Publications based on these surveys are in preparation.

The Coal Inventory Survey has involved two major areas of work. The onshore coal survey included drilling and seam sampling in all of the coalfields except Sydney. From 1974 to 1978, 142 holes (88,565 feet) were drilled and 1,329 samples collected for analyses. This survey outlined resources of 89,235,000 short tons (measured), 72,594,000 short tons (indicated), and 53,894,000 short tons (inferred).

Offshore drilling to test submarine coal reserves off the Sydney coalfield commenced in 1977 and continued in 1978. The drill ship Glomar Conception drilled five holes totalling 13,201 feet and the Glomar Grand Banks drilled 9 holes with a total footage of 21,756 feet.

A survey of oil shales was carried out in Pictou and Antigonish Counties to outline deposits of oil shales and to study the potential of extracting oil from these shales. Eleven holes were drilled for a total of 3,850 feet.

3.3.3 Major Results Achieved

Sub-project 3-1 - Industrial Mineral Survey

The information (cards and maps) compiled through this survey is made public on an open file basis. Considerable benefit is derived by those involved or associated with the mineral industry requiring accurate information on mineral occurrences to successfully undertake exploration or development programs.

Sub-project 3-2 - Sand and Gravel Project

Information collected has been compiled on 1:50,000 N.T.S. sheets indicating the extent of deposits, the type of material

available (sand, gravel or sand and gravel) and the classification of the deposits (outwash, ice-contact, stream alluvium and eskers). These sheets are made available to the public on an open file system.

Demand for this information comes from aggregate producers, land use planners, highway construction firms, ready-mix plants agencies involved in locating community water supplies and several government departments such as the Departments of Highways, Lands and Forests, Municipal Affairs and Environment.

Sub-project 3-3 - Surficial Mapping and Geochemistry Project

Information from this project will benefit mineral exploration companies as a regional geochemical survey undertaken in a medium not yet used in this area for exploration. The maps will meet the demand of companies that require information on directions of glacial flow and thickness of till deposits (i.e., exploration drilling programs). The stratigraphy and geochemistry of these Pleistocene deposits is also of interest to water management agencies dealing with surficial aquifers. The data can be used by soil scientists in determining what plant micronutrients (Co, Cu, Zn) are available to the soils developed on the tills in the areas studied.

Sub-project 3-4 - Onshore Coal Inventory

In 1974, the Nova Scotia Government and the Federal Government initiated a coal inventory program to identify the coal resources of the Province. This survey was developed to allow the Province and Canada to ascertain what the future potential of the coal industry is in Nova Scotia and what role Nova Scotian coal will play in meeting the energy needs of Canadians.

Some 200 million tons of coal resources have been identified throughout the various coal basins within the Province. The near surface coal drilling program in the Sydney basin area has shown resources of 16 million tons of various quality coal. A study has been completed at Point Aconi and 1,100,000 tons of recoverable coal have been identified. A contract is now being negotiated with the Power Corporation for a 200,000 tons per year operation. This deposit is expected to supply coal to the Nova Scotia Power Corporation at a price of $20 to $25 per ton.

Studies are now being done on the seams that would appear to have the greatest potential for mining in the near future.

In underground mining situations, 15 million tons of high sulphur coal has been outlined at Port Hood. Also identified is a block of very deep low volatile coal in the Acadia seam under the Stellarton field. The in place resources are estimated at 25 million tons.

In conjunction with the coal drilling in the Springhill area, lead and uranium were identified in various sections within the coal measures in the drill core. As a result of this drilling, the area was closed to staking and put out to tender. The ground was given to Cominco Ltd. to do exploration work for lead and uranium. Cominco plans to spend $750,000 over a 3 year period on this project. The lead is found in an environment similar to that found in the recently opened Pb mine (Yava Mines Ltd.) in Salmon River, Cape Breton. Lead has also been found in the coal drilling from other areas and thus has stimulated a staking rush and expanded exploration in similar areas.

Some of the direct benefits to the Province are:

(1) the providing of industrial activity to private drill contractors as well as the government-owned diamond drills;

(2) the generation of interest in the development of the near surface coal at Stellarton and Sydney;

(3) identification of several coal areas in the Province that have potential for both underground and surface coal;

(4) the preparation of a data base whereby the remaining coal resources of the Province can be used to their maximum potential;

(5) identification of Pb and U in the coal drilling at Springhill and other locations.

Sub-project 3-5 - Offshore Coal Exploration Program

As a result of an offshore drilling program during the summers of 1977 and 1978, the following results were achieved:

(a) Donkin Area

The drilling programs have outlined 2.1 billion short tons of coal resources in 5 coal seams. The major coal seam outlined is the Harbour seam, from which 740 million short tons of resources have been identified. The average analysis for the Harbour seam from the 1977 information is approximately 4% ash and 2.5% sulphur. The calculated mineable metallurgical coal resources in place are 574 million tons. The remainder of the coal is thermal quality.

As a result of the drilling, it would appear that a new underground mine at Donkin is imminent. Employment estimates are approximately 3,000 persons.

If the Donkin mine goes into production then 2 coal fired generating stations will be built (Lingan III and IV) by the N. S. Power Corporation at a cost of approximately $500 million ($250 million per 300 megawatt unit).

(b) Point Aconi Area

The drilling program in this area (3 holes) has outlined an area of good quality coal to the west of the block that was being mined in the Prince Mine. The Prince Mine had stopped production mining because of roof and floor problems and because of poor quality coal. When the results of the drilling were tabulated, the direction of the slope was changed to the west to mine the better quality coal.

Previous to the closing of the Prince Mine in 1977, 259 people were employed. After the closing, staff was reduced to 119 people. Beginning in late summer or fall of 1979, DEVCO will begin a shortwall operation and at that time will employ approximately 700 persons and will have an estimated production rate of 1 million short tons of coal per year.

Estimated recoverable reserves are 70 million short tons from a 7.5' thick coal seam (Hub) with an average analysis of 6.7% ash and 3% sulphur.

The offshore coal drilling program has provided many additional benefits to the Province of Nova Scotia and Canada:

(1) has trained 35-40 people as competent oil field workers either onshore or offshore in what is a high demand, well-paying profession;

(2) has identified in excess of 3.2 billion additional tons of coal resources in-situ in the Sydney coalfield. The 2.1 billion tons in the Donkin area have already precipitated a $1 million feasibility study to develop a new mine that could employ upwards of 3,000 people;

(3) has provided coal quality information seaward of the New Prince Mine at Point Aconi that will allow for orderly, realistic planning to proceed at this location;

(4) has identified sufficient reserves seaward of the existing workings at Lingan and No. 26 to allow long range mine planning and development to occur in these areas;

(5) has provided opportunities for numerous Canadian service and consultant companies to gain expertise in offshore drilling techniques;

(6) through the positive results obtained from this drilling program, a $265 million commitment has been made for the revitalization of the coal industry in Cape Breton.

Sub-project 3-6 - Oil Shales

All of the occurrences of oil shales in the Province have been located and sampled. Although none of the occurrences or deposits studied showed a sufficient quantity or quality to make a viable operation, the information is available should the technology or the economics change.

Sub-project 3-7 - Glencoe Limestone Survey

Sufficient reserves of metallurgical and cement grade limestone have been outlined to sustain a 1 million ton a year cement operation and/or a large scale steel operation.

The essential element of any remodernization of the Sydney Steel Plant is the availability of raw materials such as coal and limestone. These raw materials have been outlined by this program.

This deposit is now being assessed by a large cement company for the purpose of setting up a cement operation. The

feasibility study is in its final stages and the outlook is promising that a large cement operation will be in progress at Glencoe and Port Hawkesbury within the next 2 to 3 years.

Copper-tungsten mineralization was also identified in the Glencoe drill core in the contact areas of this limestone deposit. Several companies have shown an interest in the mineralization and some drilling has been done to date.

3.4 PROJECT 4 - GEOLOGICAL AND GEOCHEMICAL SURVEYS

3.4.1 Objective

One of the most useful functions in stimulating continuing exploration activity by private industry is the provision of basic geological data. The program was designed to meet the specific requirements of selected priority areas, with the objective of carrying out a comprehensive and coordinating approach using a broad range of geological, geochemical and geophysical techniques.

3.4.2 Description

Project 4 is divided into nine sub-projects, which involve geological, geochemical, and geophysical surveys or combinations of these.

Geological investigations have taken place over several wide areas of the Province, including the Eastern Shore and south-western Nova Scotia where the purpose of the surveys was to produce an evaluation of the mineral resource potential and to stimulate exploration activity. A complete geological survey has covered the Cobequid Mountains with the end result being a detailed geological map of this 1800 km^2 area. A comprehensive study of the Windsor Group stratigraphy and paleontology throughout Nova Scotia has resulted in thorough documentation on a 1500 km^2 area. Metallogenic and structural studies with associated geological mapping have resulted in detailed studies of type metallic mineral deposits and specific areas of structural significance. These latter studies will result in the compilation of metallogenic and metamorphic maps of Nova Scotia. A metallogenic survey of tungsten deposits was carried out at three specific places in Cape Breton and the resulting announcement of this study produced a minor claim staking rush in areas of similar rock types.

Two major types of geochemical surveys have been conducted. Stream silt geochemistry has been done in Cape Breton and the Antigonish Highlands with a coverage of 10,700 km^2 resulting in 27,056 samples being collected for analyses. The locations and results of these surveys have been computer plotted on

1:50,000 maps and are available as Open Files. Where stream sampling was impractical a lake sediment geochemistry was initiated in 1977. The Eastern Shore area (11,520 km^2) produced 1,711 samples, the analysis of which will be released as maps in the Open File category.

Airborne geophysical surveys of high resolution magnetometer and gradiometer were completed, covering 9,740 km^2 of the Province in parts of southeastern Cape Breton Island and the Yarmouth, Halifax-Shubenacadie and Antigonish Highlands areas. These surveys were done under subcontracts by geophysical firms and the resulting maps have been released by the Geological Survey of Canada as Open Files. A ground magnetometer survey was carried out at MacMillan Brook, Victoria County to provide extra data on a mineral deposit in that area.

3.4.3 Major Results Achieved

The principal objectives of Project 4, which were to stimulate and provide assistance to continuing exploration activity by private industry, have been very successfully achieved. The contribution of each of the sub-projects discussed in subsequent paragraphs varies according to the nature of the sub-project. Some contribution is immediate; other activities support the overall project objectives over a long term. The

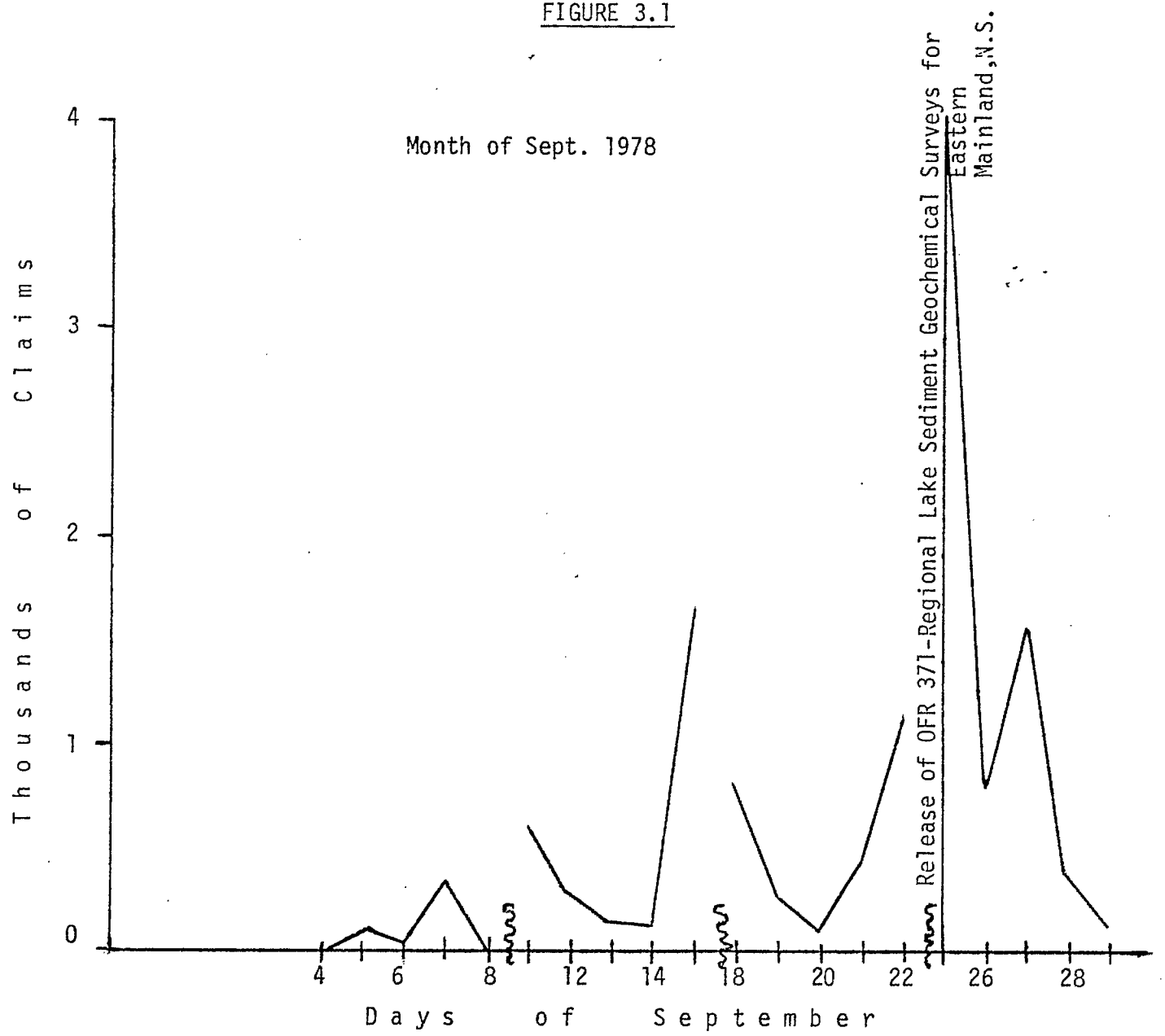
success of the project and of its component sub-projects is best documented by the record high level of exploration activity in Nova Scotia, due in part to the stimulation and support supplied by the activities of the Nova Scotia Department of Mines.

Sub-projects 4-1, 4-2 and 4-3 - Geochemical Surveys and Eastern Shore Project

The prime role of the regional stream-sediment and lake-sediment sampling programs pursued under the present General Development Agreement has been to stimulate mineral exploration by the private sector. Geochemical maps which comprise the main product of these surveys, outline specific geochemical anomalies which lead to very direct mineral exploration, and also delimit areas of interest for exploration on a larger scale. The response from industry has been quite apparent as reflected by claim-staking; with some dramatic small staking rushes, such as for example, the rush following the release of the latest lake-sediment geochemical survey results (see Figure 3.1). In the latter instances, approximately 5,000 new claims were staked on the day of release of the data.

From 1974 to 1976, inclusive, geological surveys of a large part of the Eastern Shore area were completed, contributing to our knowledge of both geology and mineral deposits in that

FIGURE 3.1



Claims staked during the four weeks of September, showing the effect of the OFR 371 release on September 25.

area. Dissemination of the data relating to this project has not been accomplished, due largely to the resignation of the project leader in 1976. At that time, geochemical surveys were initiated in the area, the results of which have proven highly successful in stimulating the mineral industry.

Sub-project 4-4 - Metallogenesis and Mineral Deposits

This sub-project has functioned as both a stimulant and an assist to companies engaged in mineral exploration in Nova Scotia. Considerable time has been devoted to direct assistance in advising corporate geologists, at their request, in matters relating to specific commodities and deposits throughout Nova Scotia. The expertise of the project leader in ore-deposit geology has been shared with industry in numerous informal discussions. More significant in the long term, is the formulation of models relating geology of ore-deposits, known comparable orogenic belts, to settings in Nova Scotia. Models of this type can provide the impetus for entire exploration programs, and have been enthusiastically received by industry.

Activities of project staff have been directly responsible for the documentation of tungsten as a resource commodity in Nova Scotia. Exploration for tungsten is presently intense, and was initiated upon public release of project data.

Exploration for uranium, currently of considerable interest in Nova Scotia, was assisted by the formulation of models governing the localization of this element in a variety of potential environments throughout Nova Scotia. These models were presented orally by project staff, and were highly praised by industry representatives.

Sub-project 4-5 - Carbonate Stratigraphy

Rocks of the Windsor Group provide much of the industrial mineral base for Nova Scotia, and are presently under exploration for base metal deposits. This project has attempted to assist this activity in providing basic geological (stratigraphic) data, gathered throughout Nova Scotia, with an emphasis on mainland basins. Geological mapping of these rocks, successfully completed for much of mainland Nova Scotia, provides an essential data base for industrial mineral development in time to come. As the first phase of the project nears completion, it is possible to set known base metal deposits in their proper stratigraphic and paleographic framework.

Assistance to the mineral industry has been only partially achieved, since major publications have not yet been completed. It is anticipated that publication of project results in the

near future will provide a high level of assistance to many facets of the mineral industry.

Sub-project 4-6 - Structural and Metamorphic Geology

This project has achieved an overview of the geology and tectonic history of Nova Scotia, with the resulting publication of regional tectonic syntheses. Major compilations of regional data pertaining to isotopic age dates and rock geochemistry are in progress and will be available in preliminary form for use by all interested parties before completion of the present General Development Agreement. Work done by staff of this project, supplemented by data from other GDA projects, will be used to prepare a Time of Deformation Map for Nova Scotia, a Metamorphic Map of Nova Scotia, and a revised Geological Map of Nova Scotia. Preliminary versions of these maps are complete, and final versions are in preparation, to be completed in March 1980.

The major achievement of the project has been to gain an improved understanding of the structural and tectonic history of Nova Scotia which, in combination with metallogenic models, leads to new concepts in mineral exploration and a new awareness of mineral potential. A valuable contribution has also

been made during this Province-wide study, in realizing the marked inadequacies of our present geological data-base, and in initial attempts to resolve several outstanding problems.

Publications by senior project staff have received widespread attention and have publicized the high calibre of work being done under auspices of DREE and the Province of Nova Scotia.

Sub-project 4-7 - Cobequid Highlands Survey

Detailed geological study of the Cobequid Highlands region of Nova Scotia has provided critically important data in an area where the understanding was previously lacking. A preliminary geological map of this large area is now in press, and a final, comprehensive report dealing with the area is in preparation for release in March 1979. This report will be accompanied by final versions of geological maps of the area.

Information released publicly during the course of this survey, has assisted industry, otherwise severely hampered in their exploration activities by the lack of basic geological data. The full value of the project will not be appreciated in concrete terms until all data are publicly available for assessment by the mineral industry.

Sub-project 4-8 - Geophysical Surveys

Under the General Development Agreement, Gradiometer Surveys have been completed in parts of Yarmouth, Hants-Halifax-Colchester, and Antigonish Counties. A high-sensitivity aeromagnetic survey was completed in a large area of south-eastern Cape Breton Island.

Airborne geophysical surveys of this type are designed mainly to assist in geological interpretation. In areas where departmental staff is active, they play an essential supporting role. They can be and are used by industry as a tool in geological interpretation, and by virtue of the large areas covered, provide valuable assistance in areas which could not possibly be examined geologically by more traditional surveys due to limitations in available manpower.

Those corporations which believe that a full understanding of all geological parameters is essential to mineral exploration, have responded well to the release of the geophysical survey data.

Sub-project 4-9 - Computer Terminal Studies

The installation of a computer terminal in the Stellarton office has enabled staff involved in sub-projects 4-1, 4-2

and 4-3 to process and manipulate geochemical data without the necessity of commuting to a larger centre such as Antigonish or Halifax. The value in terms of time and cost-efficiency is high. Potential future application to other data sets, generated by departmental activities unrelated to geochemistry, adds even more dimension to the terminal's future worth.

3.5 PROJECT 5 - LABORATORY SERVICES

3.5.1 Objective

The Department of Mines operates a laboratory to perform analytical services, ceramic testing and small scale mineral dressing tests. The laboratory has been a valuable asset to the Department and to prospectors and mining companies. At the time when this agreement was initiated major analytical equipment was obsolete and of insufficient capacity to meet increasing demands of the Department and of industry. The objective of this project was to improve the capabilities of the laboratory to better support the overall program objectives.

3.5.2 Description

The A.I.R.I. Laboratory at Nova Scotia Technical College has been upgraded through this agreement and has purchased

sufficient equipment to allow the lab to produce the quantity and quality of analyses that will permit the technical projects under this agreement to function properly.

Also included in Project 5 is the implementation of core storage facilities at Debert to handle as much as possible of the enormous volume of core which critically demands storage. Renovation of acquired space, including the setting up of racks and pallets for systematic core storage is currently underway.

3.5.3 Major Results Achieved

Laboratory facilities of CLIM located on the campus of the Nova Scotia Technical College in Halifax provide an essential support to programs of the Nova Scotia Department of Mines. Under the terms of the present General Development Agreement, these facilities have been substantially improved. Detailed cost-effectiveness figures are appended to this evaluation. The results of this analysis are summarized below. The GDA funding of laboratory services commenced in 1974, whereas the figures used compare pre-GDA and post-GDA performance to the present date.

During the period 1970 to 1978:

(1) staff increased by a factor of 3

(2) total productivity of laboratory increased by a factor of 12

(3) productivity of individual staff members increased by a factor of 3.5

(4) total budget increased by a factor of 2.5

(5) cost-per-work unit performed (to be defined in detailed cost analysis) decreased by a factor of 6.

During the period of 1970 to 1978, the volume of analyses substantially increased. In addition, and equally important, the calibre of analyses has been upgraded so that the analyses reported are on a par with other similar labs. These improvements have been implemented with GDA funds, and have permitted GDA-funded projects to maintain a high standard of quality otherwise not possible.

The Nova Scotia Department of Mines has acquired, at minimal expense, a large building in Debert with the intention of adding to our core-storage capability. Diamond-drill core comprises an extremely valuable data source for our staff and for representatives of the mineral industry. The application of DREE funds to assist in repairing and renovating the existing structure has permitted the concept

to proceed. Continued investment to maintain and expand the repository role is a necessity, and provides continuing direct support to the mineral industry in data storage and centralization. Efforts to date represent only the initial step in implementation and maintenance of this service.

3.6 PROJECT 6 - MANAGEMENT AND ADMINISTRATION

3.6.1 Objective

The proposal envisages a five-year agreement commencing in the fiscal year 1974-75 and terminating in the fiscal year 1978-79. The Provincial Department's budget submission for the 1974-75 fiscal year provides for key professional positions who would act in a supervisory role.

3.6.2 Description

Areas administered under this project are accounting procedures, cartographic and stenographic services, capital equipment costs and publication costs.

3.6.3 Major Results Achieved

Under this project heading, essential support services were maintained, evaluated below as indicated by appropriate headings.

Isotopic Age Dates

Under the DREE program, Rb-Sr isotopic age dates were successfully obtained on six plutonic rock units, the age of which was previously unknown. In addition, numerous samples were attempted, but ages could not be determined due to chemical limitations of those rocks.

It is no exaggeration to say that the major geological stumbling block in Nova Scotia is the documentation of both absolute and relative age relationships between rock units. Many rocks can be dated only through isotopic studies, and the program is thus of great value to all people concerned with the relationships between rock units and their constituent mineral deposits.

Capital Expenditure

Major equipment purchase is of fundamental importance to support the DREE program. Vehicles are essential for obvious reasons, and have been purchased periodically so that an effective fleet has been available at all times.

Scientific equipment, including petrographic microscopes and instruments for air-photo interpretation, are basic tools

which were purchased to support the various programs. Support equipment to enable efficient data storage and processing has been added to inventory during the program. These items include map and rock storage units, map preparation and photographic equipment.

Capital purchases were also made of several items of geophysical equipment, used in the program mainly in studies of mineral deposits. Upgrading of the CLIM lab also involved significant capital expenditure.

All equipment purchased has enhanced the capabilities of the Nova Scotia Department of Mines to undertake independently the various major projects which make up the GDA-funded program.

Publication

Dissemination of any and all data relevant to the mineral industry is best achieved through formal publication of these data, which are then available to all interested parties. DREE funding has supported this publication throughout the program. Without this support, the data would be much less accessible than at present.

3.7 INDUSTRY'S VIEW

An essential component of any evaluation is the usefulness of the project as seen by those who directly use the product, in this case, the mineral industry. To assess the subsidiary from this perspective, a survey of those knowledgeable of the Nova Scotia mineral sector was conducted. The survey attached as Appendix C was sent to some 50 potential respondents, 29 were returned.

Different projects of the Mineral Subsidiary are, of course, directed at different members of the mineral industry. In order to assess the usefulness of the survey, the sample population was first stratified by asking respondents if they were familiar with the project. The respondents were then asked if they used the projects and the extent to which the study was useful. Table 3.1 presents our results. Column 1 shows the number of respondents familiar with the project; column 2 shows the percentage of these using the results; column 3 shows the percentage of respondents intending to use the results. Column 4 presents the percentage of respondents who recorded a yes in column 2 that gave a high rating to the project. A review of Table 3.1 shows that the industry in general exhibits a high utilization rate of the results of the subsidiary. Indeed, those areas with a poor response,

Table 3.1

MINERAL INDUSTRY SURVEY RESULTS

PROJECT	No. of Respondents Stating Knowledge of Project	Percentage of Respondents That Used the Results	Percentage of Respondents That Expected to Use The Results	Percentage of Using Respondents That Rated Value of Results as High
MINERAL RESOURCE INVENTORY	21	81.0	0.0	52.9
MINERAL EVALUATION SURVEY				
- Industrial Mineral Survey	15	40.0	0.0	-
- Sand and Gravel	17	23.5	0.0	50.0
- Oil Shales	16	0.0	6.3	-
- Glencoe Limestone	13	23.1	23.1	33.3
GEOLOGICAL AND GEOCHEMICAL SURVEYS				
- Eastern Shore and C.B.	19	63.2	26.3	75.0
- Antigonish Highlands	18	50.0	16.7	66.7
- Metallogenesis and Mineral Deposits	19	73.7	10.5	57.1
- Carbonate	21	47.6	19.1	40.0
- Structural and Metamorphic	16	31.3	18.8	-
- Cobequid Mountains	17	23.5	23.5	75.0
- Geophysical	12	100.0	58.3	58.3

e.g., oil shales survey, are more a result of the negative conclusions of the report than the lack of industry interest in the work.

The industry also provided suggestions on future improvements to the work. Those suggestions made by two or more respondents are listed below as Table 3.2. The suggestions are for the most part of a supportive nature in that they request additional work along the lines already being done, but at a fine disaggregation.

Table 3.2

N = 19

1) Update base geological and compilation maps of the entire Province so as to include latest geochemical and geophysical findings

15/19 79%

2) To decrease the time delay between geological survey and public access to findings

4/19 21%

3) Create an information system designed to provide detailed description of exploration activity, company involved, detailed results, etc., for specific locations throughout the Province

4/19 21%

4) Geological/geochemical and geophysical mapping should be more detailed; i.e., 1:25,000

3/19 16%

5) Hire an economic geologist to act as a government-industry liaison person

2/19 11%

6) Study the effects of environment on technique and methodology of geological/geophysical surveys

2/19 11%

Others (one response each)

a) More detail on Meguma-Carboniferous-Cobequids.

b) Geophysical survey details of entire East N.S. and Cape Breton Island.

c) Complete radiometric coverage of Northern N.S.

d) Coarser fraction analyzed for Sn & W on till sampling project.

e) Hire a gold expert and bring a pilot gold mill to the Province.

f) A sample analysis program on background Uranium content of Appalachian granitic rocks.

g) Detailed studies of all abandoned mineral deposits to determine controls of mineralization.

h) Too much land is perhaps uselessly tied up by current map staking.

i) Improve core storage, retrieval and reviewing facilities with a readily available list of logs of cores in storage.

j) Pioneer new exploration methods for Carboniferous Basin.

k) Detailed geological and structural studies in the Avalonian rocks on Cape Breton Island and Cobequid Mountains.

l) A regional rotary drilling program in the Carboniferous Basin with follow-up Down Hole Studies with a view to Uranium roll-front deposition.

m) Economic geology report of the Cambrian rocks of Cape Breton Island.

Respondents Suggestions

1. More updated base geological maps.

2. -

3. More geological mapping of unmapped areas; Remapping the 1950 - 1960 mapped areas incorporating latest geochemical and geophysical surveys.

4. a) More detailed geological mapping - Meguma-Carboniferous-Cobequids on a 1:20,000 scale.

   b) Airborne geophysical surveys of entire E. N.S. and Cape Breton.

c) Complete radiometric coverage of N. N.S.

d) Updated compilation maps of the Province showing all mineral showings and all previous exploration results - diamond drilling, geophysics, geochemistry.

5. a) Base geological maps for S.E. N.S.

b) Faster turn-around time on regional geochemical analyses surveys - open file report prior to publishing.

c) Coarser fraction analyses for Sn & W. on till sampling project.

6. -

7. a) Hire a gold expert and bring a pilot gold mill to the Province.

b) More work similar to N.B. Mines Branch (Ruitenburg's - Hamilton's) relate showings to geology and to geochemistry on a 1:50,000 scale.

8. A sample analysis program on background Uranium content of Appalachian granitic rocks.

9. a) Updated compilation maps.

b) Updated base geological maps showing geochemistry and gamma survey.

10. a) More detailed mapping for entire Province.

b) Faster turn-around time for survey results.

11. -

12. -

13. a) Closer control of diamond drilling - location, purpose, results, etc.

b) Debriefing and evaluating geologists and his findings.

c) Faster turn-around time on survey results.

d) Hire an economic geologist as a liaison with industry.

e) More mapping.

14. a) Too much land is tied up by map stakes.
    b) More mapping and geochemical surveys.

15. More geochemical mapping.

16. -

17. a) Initiate a filing system by location containing records of work done, by whom, and detail data that can be traced.
    b) Detailed studies of all abandoned mineral deposits to determine controls of mineralization.
    c) Updated compilation maps.
    d) Better core storage, retrieval and reviewing facilities with a readily available list of logs of cores in storage.

18. a) Updated base geological maps.
    b) Maps of all Province.
    c) Faster turn-around time on survey results.

19. -

20. -

21. -

22. a) Establish geochemical base for different geological and environmental conditions in N.S.
    b) Pioneer new exploration methods for Carboniferous Basin.

23. a) Detailed geological and structural studies in the Avalonian rocks on Cape Breton Island and Cobequid Mountains.
    b) Regional rotary drilling program in the Carboniferous Basin with follow-up Down Hole Studies with a view to uranium roll-front deposition.

24. a) Update mineral resource inventory.
    b) Hire economic geologist.

25. a) More detailed geochemical survey.
    b) A model study of effects of salt climate on geophysical surveys.

26. -

27. a) Economic geology report for the Cambrian rocks of Cape Breton Island.

    b) Better records of exploration program results.

28. -

29. a) Mapping on 1:25,000 scale.

    b) Updated compilation maps on 1:25,000 scale showing geochemical and geophysical findings.

CHAPTER IV

SOCIOECONOMIC IMPACT

4.1 Objective

The $18.0 million expenditure made by the Federal and Provincial Governments under the Mineral Subsidiary created jobs and incomes in the provincial economy that would not have occurred if these expenditures were not made. The primary purpose of this chapter is to measure these job and income benefits.

Job and income creation is only one objective of the Subsidiary Agreement. The objectives of the Subsidiary are more explicitly stated in the General Development Agreement as:

(a) encourage the expansion or maintenance of viable, long-term employment opportunities and optimum quality of life within Nova Scotia;

(b) increase the earned incomes of the people in Nova Scotia, and

(c) assist in the development of a dynamic and creative Provincial economy which will encourage the growth and stability of economic activity in Nova Scotia.

The objective as stated in the Mineral Agreement, namely: "the objective of Canada and the Province under this Agreement is to enable the Province to undertake a program of mineral development planning, evaluation and surveying", refers more to an action plan for attaining GDA objectives than to an objective in and of itself.

Job and income creation occurs in two distinct ways under the Subsidiary. First, by spending the money allocated to the programs the Provincial and Federal Governments are injecting money into the Provincial economy that would not be injected into the economy in the absence of the Agreement. This spending creates jobs and incomes during the life of the Agreement. We call this aspect of the benefits created the expenditure side of the Agreement.

The programs themselves provide a strategy or development plan for the mineral sector and as such are designed to change the particular sector in such a way as to create development opportunities. The estimation of the extent to which the programs have been successful in the development plan attaining the regional objectives of the development plan is called the development impact benefits.

Basically, the development plan carried out under the Subsidiary Agreement involves two major strategies: (1) general exploration, and (2) commodity specific investigations. Table 1.1 of Chapter I lists the programs undertaken in the Agreement, their expenditures, and their general development strategy.

The development strategy undertaken in the general exploration program was to increase the amount of geoscientific data available with the hope that a number of companies would be encouraged to do further exploration work and hopefully to have a significant enough find to undertake commercial exploitation. We will evaluate the program from this perspective and its resulting impact on the economy.

Specific commodity investigations represent the second phase of the exploration cycle. There is no requirement for general exploration. The commodity is known to exist; it is the volume and quality of the deposit that are not known. Government funds for this stage do not, in general, create additional exploration expenditure dollar spin-offs. The desired outcome is a mine development; hence, the effectiveness of this program is judged by the amount of new mine development created.

The specific commodity investigations conducted under the Subsidiary relate primarily to coal exploration. Our assessment of the government contribution to this sector will also net out the total government contribution required to develop the mine.

4.2 Methodology

The methodology for assessing the income and job creation impact of the Mineral Subsidiary is based upon delineating two elements: (1) the primary injection, and (2) the spin-offs occurring from the primary injection.

The primary injection is estimated by measuring the incremental mineral exploration and development expenditures created by the Subsidiary. For the general exploration expenditures, this is done by comparing the amount of exploration in the Province before and during implementation of the Mineral Subsidiary. We do this comparison several different ways to crosscheck our figures. This is outlined more fully in the next section where we derive our estimates.

The primary injection for the coal program is defined as the incremental amount of new coal development brought on as a result of the program.

Once we have estimates of the new expenditures created by the program, we then convert these estimates into estimates of income and employment creation in the Province. The primary tool for doing this is the 1974 Nova Scotia input/output model.

Since the input/output model records the interactions between various sectors, it can provide us with an estimate of the total impact on incomes resulting from a given exogenous increase in a particular sector. The total impact results from three effects:

(1) the direct impact - which is the result of the direct wage and salary payments made by the original sector with the exogenous increase;

(2) the indirect impact - which is the result of the wage and salary payments made by each sector selling to the original sector as well as payments made by each following round of sector purchases made by those sectors supplying the original sector. This wage and salary creation occurs in decreasing amounts at each succeeding round as the purchases in the local economy decrease at each round due to import and other leakages.

(3) the induced impact - this is a result of the household sector's respending of the wages and salaries earned from the direct and indirect stages.

The income impacts provided by the input/output model are optimistic estimates. This is because the model does not subtract out counteracting income losses. As an example, hiring a previously unemployed worker results in a new wage income injection into the economy but a corresponding loss in, say, UIC payments so that the total effect of the income generation must subtract out any income losses.

There is no generally accepted methodology for applying adjustment factors to arrive at a net wage and salary generation. For the purposes of this report, we will follow a methodology suggested by Haveman and Krutilla[1] which we have applied to Nova Scotia. This approach states that the extent to which the additional demand for workers will come from unemployed resources as a function of the existing unemployment rate is a sine curve.

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[1] Haveman, R. and Krutilla, J., Unemployment, Idle Capacity, and the Evaluation of Public Expenditures: National and Regional Analyses. John Hopkins Press, New York, 1968.

The curve is drawn within two limits: the lower limit, where it is assumed that all labour will be bid away from other work, which is the unemployment rate that exists when the economy has attained its maximum sustainable employment level; and an upper limit where it is assumed that all labour will come from the ranks of the unemployed, which is taken as the unemployment rate during the "Great Depression". The interested reader is referred to the above-noted Haveman and Krutilla for a fuller explanation of the methodology. Table 4.1 provides, by occupation, the 1977 incremental labour income estimated for Nova Scotia. Appendix A provides an explanation of the specifics in calculating the incremental labour income adjustment factor.

Table 4.1

LABOUR INCOME ADJUSTMENT FACTORS

Occupation	Existing Unemployment Rate[1]			Minimum Unemployment Rate	Rate at Which All Demands Are Met From Unemployment Pool	Incremental Labour Income Adjustment Factor
	1975	1976	1977			
Managerial/ Professional	.032	.047	.045	.014	.25	.04
Clerical	.058	.089	.075	.035	.25	.08
Sales	.054	.056	.086	.035	.25	.13
Services	.075	.114	.125	.035	.25	.37
Primary Occupations	.083	.136	.095	.04	.25	.16
Processing	.093	.095	.111	.045	.25	.23
Construction	.133	.133	.2	.052	.25	.85
Transportation	0	.059	.059	.051	.25	0
Material Handling	.154	.077	.077	.045	.25	.06

Source: SC 71-001, the Labour Force, June 1976, December 1976, December 1977.

To summarize the above, the analysis proceeds by first calculating the income impact generated from the expenditures. Next, the income generated is adjusted for the fact that it does not represent all new income to the Province. Much of the income generated could in fact come from diversion of resources to this activity away from other activities; for instance, the labour employed could be diverted from other jobs in the economy, the materials and supplies could be diverted from other uses. There is no clear-cut way to measure this at present. Hence, we have adopted a reasonable assumption put forward by Haveman and Krutilla. The basis of this assumption states that any given new activity will draw its labour from the existing employed labour force and unemployed labour force depending on the size of the employment rate. Of the total labour hired for the project, the per cent coming from unemployed persons represents the amount by which the actual wage bill paid should be adjusted; i.e., the net income benefit of the project is the incremental labour income adjustment factor multiplied by the wage bill. This reflects the fact that the unemployed labour has no alternative source of income and the job is a total income benefit to him. Clearly, this is a biased downward assumption since the labour could be drawing U.I.C., have a value of leisure greater than zero, etc. However, the alternative assumption is of no benefit to labour presently employed. This labour will probably be coming from jobs which paid lower wages than the present job. Hence, in practice, the two assumptions would tend to cancel each other.

4.3 Analysis

Expenditures impact - an analysis of the extent to which the implementation of the Subsidiary Agreement has provided job and income creation in the Province is provided by breaking down the subsidiary expenditures into the impact purchases conformable to the Nova Scotia 1974 input/output table. This breakdown is estimated by two independent methods. First, percentages of use by type in the "services incidental to mining" section in the national input/output table was used. This was adjusted to the Nova Scotia setting by assuming that if the purchasing industry was available in Nova Scotia, it was used; otherwise, the purchase was assumed to be zero from the Nova Scotia economy. The second method used was the key informant approach. Subsidiary team members familiar with the programs were asked their opinion as to the type and amount of local purchases made. These two approaches were then compared and the number judged most reliable was accepted. In practice, both methods produced fairly similar results.

Table 4.2 provides our estimates of the purchases made by the Mineral Subsidiary by type of purchase. The table reveals that of $18.0 million spent, 67 per cent remained in the Province. This is a higher than normal ratio and is

Table 4.2

Estimates Direct Purchases Requirements
Exploratory Drilling Sector
Nova Scotia

Mineral Sub Agreement

Industry	Expenditure, N.S.
Printing & Publications	$ 136,000
Iron & Steel Mills	18,000
Machinery & Equipment	185,000
Cement Manufacturers/Clay & Concrete	36,000
Petroleum Refineries	470,500
Misc. Chemicals	18,000
Transportation	271,000
Travel & Entertainment	452,000
Hotels - Restaurant	-
Business Services	286,000
Wages & Salaries	10,269,000
Total N.S. Purchases	$12,141,500
Total Expenditures	$18,022,000

Source: Computed from discussion with officials and review of Canadian Input/Output Coefficients.

accounted for by the high wage and salary component of the expenditures. The high percentage for the labour input into the project is reassuring from the viewpoint of data reliability since this estimate is probably more reliable than the others.

Taking into consideration the major purchases made as a result of implementing the Agreement, we are now in a position to measure its income impact on the local economy. First, the total expenditures shown in Table 4.2 are multiplied by the appropriate multipliers given in the Nova Scotia input/output table. The adjustments outlined in the methodology section are then applied. The specific adjustments used in this study for the direct effect is 0.69. This is derived by applying a 20 per cent managerial and 80 per cent construction occupation weighting to the labour income adjustment factors of Table 4.1. The use of construction as an occupational component is justified because we are mainly concerned with the exploration phase of mineral activity which is akin to construction. The direct impact adjustment factor is estimated to be 22 per cent. This was computed as the average ratio existing in the Provincial economy. The 1971 census provides incomes earned by occupation. This income distribution was used as

a weighting factor applied to the occupational labour income adjustment factors of Table 4.1 to derive the average. The induced impact is estimated as 5 per cent of the direct and indirect impact.[1]

Using the confidential version of the Nova Scotia input/output model, we find that the direct and indirect impact of the expenditures creates gross incomes in the Provincial economy of $10.91 million. Applying our adjustments gives a net income generation of $7.22 million from the direct and indirect stages. Applying the induced adjustment gives us our total impact figure of $7.58 million, or a ratio of 0.42 dollars for every dollar spent.

To find the household income induced by the net direct and indirect benefits, we use the household income multiplier from the input/output tables: 1.2772. This is a recursive multiplier; it takes into account the infinite spending and respending of household income. But it must be adjusted at each stage of this recursive process to include only the

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[1]Applying the adjustment factor for the household sector differs from the direct and indirect impact in that it must apply at each round of spending.

net induced benefits. The first-round multiplier can be calculated from our knowledge of the finite series formula:

$$\frac{1}{1-m} = 1.2775 \qquad m = 0.2172$$

For each year this is simply adjusted by the proportions which will be drawn from the unemployed pool, derived above. The recursive net household income multiplier is, therefore:

$$1977 \qquad \frac{1}{1 - (.2304)(0.2172)} = 1.0527$$

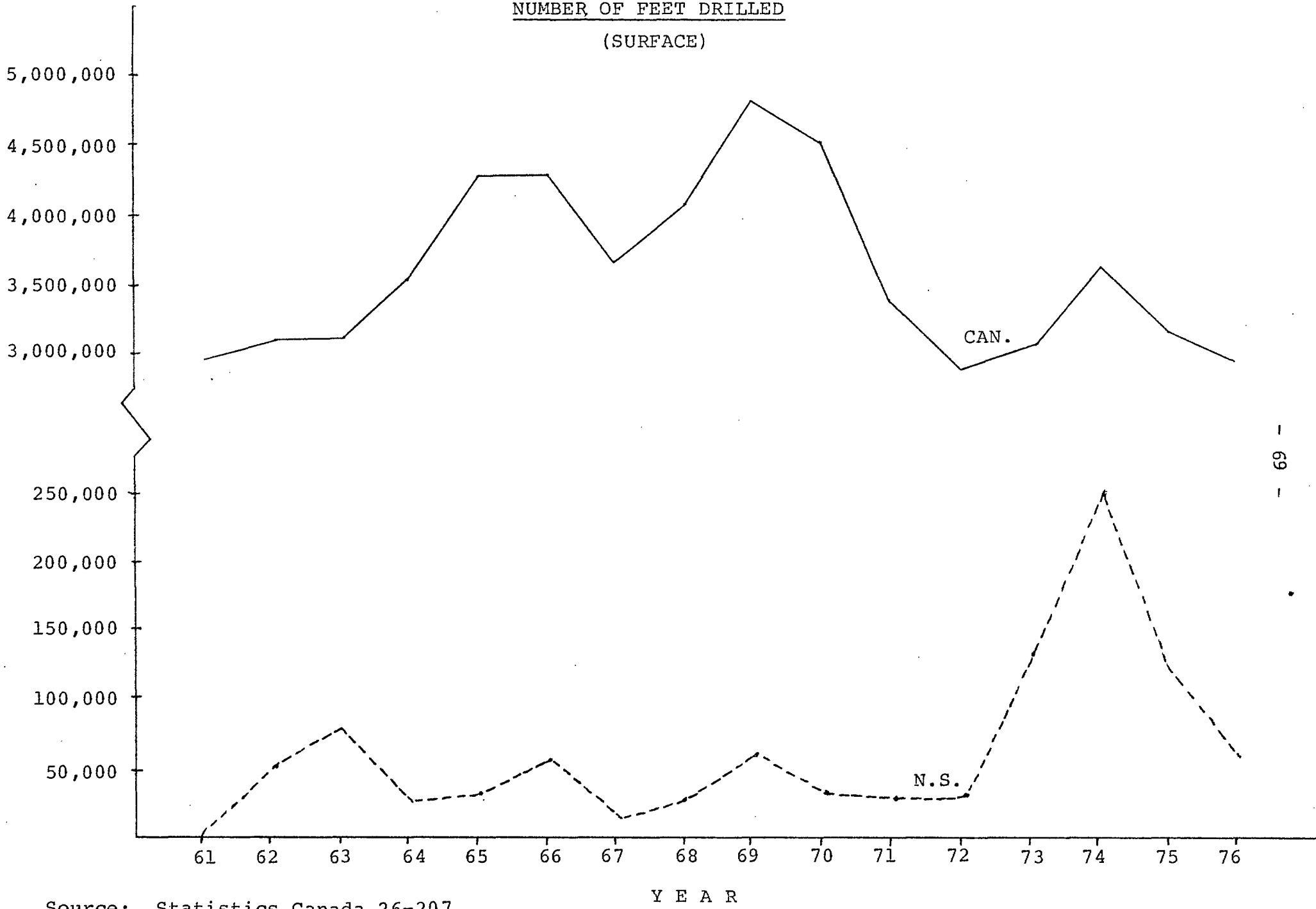
Development Impact - the development impact resulting from the general exploration program as stated above is primarily an assessment of the extent to which the program acts as a catalyst to private exploration.

Assessing the extent to which expenditures under the Mineral Subsidiary have increased private exploration activity is a hazardous occupation. Data are scarce on the amount of private exploration occurring in a province. For our purposes, we have relied on Statistics Canada's Diamond Drilling Operations as our measure of private exploration activity. The data provide a long enough series to do some

statistical manipulations and accounts for the majority of the private exploration activity. Figure 4.1 plots the number of surface feet drilled for drilling operations conducted by contractors who employed diamond drills only and which were confined chiefly to the testing of metalliferous deposits for the years 1961 to 1976 for Nova Scotia and Canada.

Figure 4.1 reveals a fairly volatile series both for Canada and Nova Scotia. The figure also reveals a significant increase in exploration activity during the life of the Agreement. We have attempted to measure this difference by two methods: (1) relating Nova Scotian drilling to various combinations of Canadian drilling, time trends and lagged Nova Scotian drilling for the time period exclusive of the subsidiary expenditures. A comparison of the difference between actual drilling and predicted drilling for the period when the subsidiary was in operation would then give us one measure of the extent that the subsidiary contributed to the drilling; (2) inclusion of subsidiary expenditures directly into the estimating equation provides another measure of its effectiveness. A strict interpretation of the coefficient associated with the GDA expenditure is that it states the amount of additional footage drilled per dollar of GDA expenditure.

Figure 4.1



Source: Statistics Canada 26-207

After trying several combinations of variables for the two methods, the following equations gave the best fits:

Method 1 $y = 63524 + 1929.8t - 781y_{t-2}$ $R^2 = .33$

where y = number of feet drilled in Nova Scotia

t = time, 1961 = 1

Method 2 $y_t = y_{t-1} = 42459 + .1148GDA - .1054y_{t-2}$ $R^2 = .44$

where GDA = Mineral Subsidiary expenditures

Table 4.3 provides the results of applying the two equations to estimating the incremental response. For the first method, actual data were used in the lagged Nova Scotia drilling variable for 1972 and 1973. Thereafter, the predicted values were inserted.

A comparison of the results shows significant differences in individual years, but are fairly close in total: 359,000 versus 334,000 feet. At any rate, the figures must be regarded as only a rough approximation given the quality of the data and susceptibility of the parameters to large changes for small corrections in data. We have conservatively estimated the incremental effect for the remaining two years at 22,000 feet per year as given in 1976 and have taken the lower estimate for 1974-1976. Hence, we

estimate that in total from 1974-1979, the subsidiary will have provided an estimated 400,000 additional exploratory footage.[2] Working with the 1976 average expenditure per foot of $13, this implies a total additional expenditure of $5.2 million.

The multiplier derived in the expenditures impact can be used to determine the net income impact of the private exploration work. The multiplier, defined as the amount of net household income created per million dollars of exploration expenditure, is calculated at 0.42. Hence, the subsidiary has created $2.2 million in household income by stimulating private exploration to date, nor does it seem unreasonable that a further $2.0 million could be attributable to the program from future private exploration work. Hence, our total estimate for this program is $4.2 million in household income generated.

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[2]As a further cross-check on this figure, respondents representing a sample from the total exploration population and who completed the industrial survey reported in Chapter III, were asked the extent that additional exploration work was done because of the subsidiary. A tabulation of the results conservatively estimates some 0.75 million dollars spent on exploration. This figure is not directly comparable to our estimates, since the survey consisted of only a sample of the total population

Table 4.3

YEAR	Actual	Method 1		Method 2	
		Trend Prediction	Incremental Effect	Trend Prediction	Incremental Effect
1974	285,056	70,041	214,655	176,096	108,960
1975	122,095	0	122,195	49,292	72,803
1976	61,778	39,472	22,306	-90,396	152,174
TOTAL			359,156		333,937

The ultimate logical stage after general exploration work is to end up with a commercial operation. It seems reasonable that one could apply, for example, an average discovery figure per million dollars of exploration conducted. Unfortunately, such a figure is subject to such wide variation that the figure is nearly meaningless. A review of existing studies and rules of thumb currently used is provided in Peters[3]. The figures given show wide deviations and low probabilities of payoff. So that although Nova Scotia, given her geological structure and relative accessibility, likely has a larger than average exploration payoff, we estimate this is not sufficient to create any sizeable commercial exploration from the subsidiary expenditures to date.

The second major activity to evaluate is the net benefit of the coal exploration program. This particular program has been very successful in discovering coal reserves of a greater amount than was originally felt available and there appears to be a high probability that a new mine will be located at Donkin, Cape Breton to commercially exploit these reserves. The surface coal program has met with limited

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[3]Peters, W.C., Exploration and Mining Geology, Department of Mining and Geological Engineering, University of Arizona, 1978.

success. Sufficient reserves of medium quality thermal coal have been identified to supply the Nova Scotia Power Corporation with 1,000,000 tons for 4 - 5 years and will replace any shortfall from the Lingan mine during this period.

The data, on potential job and income creation resulting from the mine development at Donkin as well as potential further government aid, are only approximately known. Engineering costing and marketing analyses have not as yet been completed. Hence, our socioeconomic impacts are only approximate at this time. It is estimated that the mine will employ 1,000 persons directly and a further 1,000 in spin-off related activity. Given an average wage of $11,029 for Nova Scotia, we get a total gross direct and indirect income creation estimate of $22.1 million. We have applied only the average Nova Scotia wage to the coal miners instead of their larger actual wage to account in part for a continuing subsidy of their wage rate. We adjust the $22.1 million to account for the fact that the labour is not all going to be drawn from previously unemployed resources. We have applied the above-noted adjustment

methodology, but in the case of the coal miners we felt we had no accurate unemployment rates so we have used the Cape Breton unemployment rates. The computed incremental labour income is 0.38. We maintain the original indirect adjustment of 0.22 for the indirect effect. Applying our adjustment factors ((11.03 x .38 + 11.03 x .22) x 1.05), we estimate a total net income generation resulting from the program of $6.95 million per year. We assume a project life of 30 years and discount this back to the present with a discount factor of 10 percent, giving us a net present value figure of $72.1 million. There will also be construction income benefits associated with the project. Assuming construction costs of $200 million, we can apply the net construction multiplier[5] of 0.326 to obtain construction income benefits of $65.2 million. The remaining adjustment on this figure is the portion the subsidized coal program represents of the total required subsidization of the mine. We have assumed this to be 7.5 per cent. Hence, applying the 7.5 per cent figure to the operations and construction income benefits results in income benefits attributable to the subsidiary of $10.3 million.

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[5]The net construction multiplier is defined as the gross income multiplier available from the input/output table adjusted by our labour income adjustment factor.

4.4 Total Benefits and Costs

From the viewpoint of regional development, the net household income created by the projects represents the benefits of the subsidiary. The costs of the program are the funding required to bring the program about; i.e., the subsidiary payments. Table 4.4 summarizes the household income benefits and subsidiary costs that have been associated with the subsidiary.

Table 4.4

HOUSEHOLD INCOME BENEFITS
AND SUBSIDIARY COST

MAJOR ACTIVITY	MILLION $
Expenditure Benefits	7.58
Development Benefits	
General Exploration Program	4.20
Coal Exploration Program	10.30
Total Benefits	22.08
Costs:	
Total Subsidiary	18.02

Table 4.4 shows that the subsidiary has the potential to create $22.08 million of household income in the Province. Total expenditures under the subsidiary are $18.02 million. Hence, the subsidiary created $1.23 worth of benefits for every dollar of cost.

CHAPTER V

SUMMARY AND CONCLUSIONS

5.1 Summary & Conclusions

The expenditure by the Government of Canada and the Province of Nova Scotia of some $18.0 million on a Mineral Subsidiary Agreement should be regarded as a success. The subsidiary has improved the mineral industry in Nova Scotia and contributed to the Provincial economy. We estimate this contribution to be some $22.08 million in new household income for the Province. If we assume Nova Scotia's exploration and development work is not at the expense of other areas, a reasonable assumption, given the small size of the Nova Scotian mineral industry, then this represents $22.08 million in new household income for Canada also.

It is useful to summarize the development opportunities that have arisen over the past five-year period as a result of the Mineral Agreement. These are summarized as follows:

1. Glencoe Limestone Survey

Sufficient reserves of metallurgical and cement grade limestone have been outlined to sustain a one million ton per year cement operation and/or large scale steel operation.

The essential element of any remodernization of the Sydney Steel Plant is the availability of raw materials such as coal and limestone. These raw materials have been outlined by this program.

This deposit is now being assessed by a large cement company for the purpose of setting up a cement operation. The feasibility study is in its final stages and the outlook is promising that a cement operation will be in progress at Glencoe and Port Hawkesbury within the next 2 to 3 years.

Copper-tungsten mineralization was also identified in the Glencoe drill core in the contact areas of this limestone deposit. Several companies have shown an interest in the mineralization and some drilling has been done to date.

2. Offshore Coal

As a result of an offshore drilling program during the summers of 1977 and 1978, the following results were achieved:

(a) Donkin Area

The drilling programs have outlined 2.1 billion short tons of coal resources in 5 coal seams. The major coal seam outlined is the Harbour seam, from which 740 million short

tons of resources have been identified. The average analysis for the Harbour seam from the 1977 information is approximately 4% ash and 2.5% sulphur. The calculated mineable metallurgical coal resources in place are 574 million tons. The remainder of the coal is thermal quality.

As a result of the drilling, it would appear that a new underground mine at Donkin is imminent. Employment estimates are approximately 3,000 persons.

If the Donkin mine goes into production, then two coal fired generating stations will be built (Lingan III and IV) by the Nova Scotia Power Corporation at a cost of approximately $500 million ($250 million per 300 megawatt unit).

(b) Point Aconi Area

The drilling program in this area (3 holes) has outlined an area of good quality coal to the west of the block that was being mined in the Prince Mine. The Prince Mine had stopped production mining because of roof and floor problems and because of poor quality coal. When the results of the drilling were tabulated, the direction of the slope was changed to the west to mine the better quality coal.

Previous to the closing of the Prince Mine in 1977, 259 people were employed. After the closing, staff was reduced to 119 people. Beginning in late summer or fall of 1979, DEVCO will begin a shortwall operation and at that time will employ approximately 300 persons. Within the next 2 years they will switch to a longwall operation and will employ approximately 700 persons and will have an estimated production rate of 1 million short tons of coal per year.

Estimated recoverable reserves are 70 million short tons from a 7.5' thick coal seam (Hub) with an average analysis of 6.7% ash and 3% sulphur.

3. Coal - Onshore

(a) Sydney Basin

The near surface coal drilling program in the Sydney basin area has shown resources of 16 million tons of various quality coal. A study has been completed at Point Aconi and 1,100,000 tons of recoverable coal have been identified. A contract is now being negotiated with the Power Corporation for a 200,000 ton per year operation. This deposit is expected to supply coal to the Nova Scotia Power Corporation at a price of $20 to $25 per ton.

Studies are now being done on the seams that would appear to have the greatest potential for mining in the near future.

(b) Port Hood and Stellarton Basins

In underground mining situations, 15 million tons of high sulphur coal have been outlined at Port Hood. Also identified is a block of very deep low volatile coal in the Acadia seam under the Stellarton field. The in place resources are estimated at 25 million tons.

In conjunction with the coal drilling in the Springhill area, lead and uranium were identified in various sections within the coal measures in the drill core. As a result of this drilling, the area was closed to staking and put out to tender. The ground was given to Cominco Ltd. to do exploration work for lead and uranium. Cominco plans to spend $750,000 over a 3 year period on this project. The lead is found in an environment similar to that found in the recently opened Pb mine (Yava Mines Ltd.) in Salmon River, Cape Breton. Lead has also been found in the coal drilling from other areas and thus has stimulated a staking rush and expanded exploration in similar areas.

4. Geochemical-Geological Surveys

Within the last 5 years new commodities have been identified under this program in Nova Scotia that have a high demand on the world market. These commodities are tin ($9/lb.), tungsten ($8/lb.), uranium ($50/lb.), silver ($11/oz.), molybdenum ($9/lb.), and cobalt ($28/lb.). As more and more work is done on these commodities, it has become increasingly apparent that economically viable tin and tungsten deposits will be found within the next few years.

The following commidities have either been identified for the first time in certain environments or the environment in which a commodity is found has been greatly expanded:

Tungsten

Tungsten was identified for the first time in the George River rocks of Cape Breton Island and this identification of tungsten sparked a claim staking rush and a large scale exploration program in Cape Breton Island. Several million dollars have already been spent with the exploration still continuing.

Tin

Although the initial identification of tin in southwestern Nova Scotia was announced by private enterprises, the

expansion of the data base and the identification of tin in several previously unknown environments has been done under this program. When this announcement is made, the exploration for tin should be greatly expanded to cover all of Nova Scotia and by a greater number of exploration companies.

Cobalt, bismuth, antimony, berylium, lithium and rare earths have been identified in ore grade amounts from selected samples.

Uranium

Various technical papers were presented on uranium which greatly increased the knowledge of environments and interest in uranium exploration in Nova Scotia.

Work carried out on the Windsor Group of rocks has greatly expanded the data base on salt and potash and may be directly responsible for expanded interest in underground storage in various areas of the Province.

Clearly, the mineral subsidiary has been an active force in the Province's mineral sector for the past five years. If all the projects outlined were realized, the Province's mineral sector would become a dominant force in the Provincial economy.

The basis of our analyses has been to adopt a conservative approach to the extent that the subsidiary might provide employment and income opportunities for the Province. We have analyzed the extent of private exploration resulting from government exploration and the anticipated coal developments at Donkin in Cape Breton. There could well be additional income and employment generation opportunities as a result of the subsidiary. This conservative approach seems reasonable, given that the development opportunities outlined above are still expected opportunities and have not been developed as yet.

APPENDIX 'A'

PUBLICATIONS

PUBLICATIONS

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		No. of sets sold
OFR 260	Geochemical Reconnaissance Program - Margaree and Lake Ainslie Map Areas, Pictou County, N.S., by J. M. Bingley. To accompany Paper 77-4. Released July 25, 1977.	3
OFR 261	Geochemical Reconnaissance Program - Cape George Map Area & Antigonish Map Area, Antigonish and Pictou Counties, by J. M. Bingley, 1977. Released August 25, 1977.	15
OFR 325	Geochemical Reconnaissance Program - New Glasgow Map Area, Pictou County, by J. M. Bingley. To accompany Paper 77-2. Released September 19, 1977.	13
OFR 331	Geochemical Reconnaissance Program - Whycocomagh & Wreck Cove Map Areas, by J. M. Bingley. To accompany Paper 77-2. Released December 12, 1977.	23
OFR 332	Aeromagnetics and Gradiometer Surveys - Halifax and Yarmouth, Geological Survey of Canada.	11
	Aeromagnetics and Gradiometer Surveys - Cape Breton, Geological Survey of Canada. Released December 21, 1977.	11
OFR 378	Regional lake sediment geochemical surveys for eastern mainland Nova Scotia. Released September 25, 1978.	35
OFR 379	Geophysical Series - Yarmouth, Halifax and Cape Breton Counties. Released April, 1978.	20

* many people bought only individual maps out of these sets.

DISTRIBUTION OF NSDM PUBLICATIONS

PAPER 76-1 (750 copies printed May 1976)			
May 1976 - March 31, 1977	cost	52	
	comp.	114	166
April 1, 1977 - March 31, 1978	cost	15	
	comp.	11	26
Total			192
PAPER 76-2 (750 copies printed April 1976)			
April 1, 1976 - March 31, 1977	cost	77	
	comp.	40	117
April 1, 1977 - March 31, 1978	cost	18	
	comp.	10	28
Total			145
PAPER 76-3 (750 copies printed April 1976)			
April 1, 1976 - March 31, 1977	cost	77	
	comp.	59	136
April 1, 1977 - March 31, 1978	cost	17	
	comp.	29	46
Total			182
PAPER 76-5 (750 copies printed April 1977)			
April 1, 1977 - March 31, 1978	cost	90	
	comp.	94	184
PAPER 77-1 (750 copies printed July 1977)			
July 1, 1977 - March 31, 1978	cost	87	
	comp.	81	168
PAPER 77-3 (750 copies printed July 1977)			
July 1, 1977 - March 31, 1978	cost	125	
	comp.	81	206

REPORT 76-1 (250 copies printed May 1976)

May 1, 1976 - March 31, 1977	cost	32	
	comp.	-	32
April 1, 1977 - March 31, 1978	cost	10	
	comp.	3	13
Total			45

REPORT 76-2 (500 copies printed May 1976)

May 1, 1976 - March 31, 1977	cost	87	
	comp.	10	97
April 1, 1977 - March 31, 1978	cost	17	
	comp.	12	29
Total			126

REPORT 76-3 (250 copies printed May 1976)

May 1, 1976 - March 31, 1977	cost	43	
	comp.	1	44
April 1, 1977 - March 31, 1978	cost	21	
	comp.	9	30
Total			74

REPORT 77-1 (500 copies printed July 1977)

July 1977 - March 31, 1978	cost	106	
	comp.	76	182

REPORT 77-2 (500 copies printed May 1977)

May 1977 - March 31, 1978	cost	88	
	comp.	59	147

APPENDIX 'B'

Statistics and Financial Summary

LABORATORY FOR THE INVESTIGATION OF MINERALS

1969-1978

M. A. K. Grice

I N D E X

1.0 INTRODUCTION

For many years prior to 1965, Nova Scotia Technical College undertook analytical services for the Provincial Department of Mines.

To formalize this service the Committee for the Investigation of Minerals (C.L.I.M.) was formed in 1965. Its members were either from the College or the Provincial Government. The major funding was a grant but other funding came from teaching and science service testwork.

The next major change was in 1967-68 when the laboratory came under the administration of the Atlantic Industrial Research Institute (A.I.R.I.). The only change to the committee was the addition of a representative of A.I.R.I.

In 1974, it was decided to upgrade the laboratory facilities; this included moving into a different building. This change enable the productivity to be increased and the cost per work unit to be drastically reduced.

2.0 BUDGET SUMMARIES

The CLIM budgets are included in the A.I.R.I. budgets but separate cost centres were used so that the CLIM accounts could be extracted and a separate review prepared.

For convenience the annual budget summaries are divided into two sections. The first for the period 1969-74 when the basic funding was by an overall grant and a surplus or deficit was allowed. The second is for the period 1974-78 when the basic funding was by billing on the work done and the grant was used to balance the books at the year end.

Since 1974, A.I.R.I. has been credited with the amount listed under overhead to cover office and accounting support.

No figures for 1978 are reported. The accounting system is being changed over to a computerized method which has not settled down yet. As soon as the problems are solved the Department of Mines will get monthly statements.

CLIM BUDGETS

Pre-1974

Income	1969-70	1970-71	1971-72	1972-73	1973-74
Department of Mines Cost Shared	58,000	56,400	50,000	53,500	53,000
Work Orders	5,010	22,945	14,034	15,644	19,063
Teaching	3,000	3,000	3,000	3,000	4,000
	66,010	82,345	67,034	72,144	76,063
Expenditures					
Salaries	47,414	51,179	50,906	50,380	54,452
Benefits	2,254	2,747	3,054	3,484	4,043
Supplies	6,448	16,442	7,919	6,289	9,609
Travel	1,561	1,880	420	900	1,481
Misc.	-	-	2,190	1,978	506
Computer	-	-	-	-	-
Overhead	-	-	-	-	1,000
	57,677	72,248	64,489	63,031	71,092
Surplus to A.I.R.I.	8,333	10,097	2,545	9,113	4,971

Post 1974

Income	1974-75	1975-76	1976-77	1977-78	1978-79
Department of Mines	56,000	14,471	27,222	28,141	
DOM Cost Shared	42,166	155,400	73,014	120,350	
Science Services		2,558	1,440	4,256	
Teaching	5,000	5,509	6,058	6,544	
	103,163*	177,937*	107,734	159,291	
Expenditures					
Salaries	63,368	86,306	92,969	110,901	
Benefits	4,974	6,262	7,848	8,613	
Supplies	11,681	20,181	21,082	25,007	
Travel	1,846	1,426	1,393	803	
Computer	-	1,097	1,242	611	
Outside Lab.	-	-	4,173	6,070	
Misc.	2,266	1,476	400	875	
Overhead	2,000	3,502	1,984	3,528	
	86,146*	120,250*	131,091	152,880	
Work in Progress b/f	-	47,958*	24,601	27,484	
c/f	-	-	47,958	24,601	

* Difference to Capital Equipment Purchases

3.0

COST SHARED PROGRAMS

April 1974 to March 1978

The following tabulations give, for each project cost centre, the total amount billed to that project and a summary of the work done for that project to March 1978.

Eastern Shore Mineral Resources Survey

Account No. 619-81-18-01

Total Billing to March 1978 - $30,897.20

Summary of Work Done:

No.		No. of Analyses/Sample	Total Analyses
144	Petrographic Sections		
85	Silt Samples	6	510
23	Silt Samples	3	69
1948	Lake Sediments	15	29,220
			30,378

Data Processing - $500.00

Cape Breton Mineral Resources Survey

Account No. 619-81-18-02

Total Billing to March 1978 - $87,733.24

Summary of Work Done:

No.		No. of Analyses/Sample	Total Analyses
9434	Silts	14	131,076

Data Processing - $500.00
Supplies - $231.74

Antigonish Highlands Survey

Account No. 619-81-18-03

Total Billing to March 1978 - $88,137.50

Summary of Work Done:

No.		No. of Analyses/Sample	Total Analyses
7550	Silts	14	105,700
5000	Silts	4	20,000
			125,000

Sand, Gravel and Clay Survey

Account No. 619-81-18-04

Total Billing to March 1978 - $ 9,575.01

Summary of Work Done:

No.		No. of Analyses/Sample	Total Analyses
99	Size Analyses Gravels		
537	Glacial Tills	11	5,907
537	Glacial Tills	4	2,148
			8,055

Data Processing - $269.43

Industrial Minerals Survey

Account No. 619-81-18-05

Total Billing to March 1978 - $11,141.00

Summary of Work Done:

No.		No. of Analyses/Sample	Total Analyses
159	Petrographic Slides		
268	Barium/Strontium Analyses	2	536
295	Whole Rock Analyses	12	3,540
			4,076

Metallogenesis

Account No. 619-81-18-07

Total Billing to March 1978 - $27,372.56

Summary of Work Done:

No.		No. of Analyses/Sample	Total Analyses
128	Whole Rock	30	3,840
100	Traces	16	1,600
35	Major Oxide	14	490
44	Spectrographic Scan	-	-
249	Uranium Analyses	1	249
2110	Petrographic Slides	-	-
			6,179

Data Processing - $ 120.00
Supplies - $ 123.06
Special Project - $1,680.00

Carbonate Stratigraphy

Account No. 619-81-18-08

Total Billing to March 1978 - $32,903.90

Summary of Work Done:

No.		No. of Analyses/Sample	Total Analyses
1925	Petrographic Slides		
651	Whole Rock Analyses	14	9,114
203	Uranium Analysis	1	203
201	Carbonate Analysis	1	201
			9,518

Supplies - $43.95

Structural Geology

Account No. 619-81-18-09

Total Billing to March 1978 - $12,607.12

Summary of Work Done:

No.		No. of Analyses/Sample	Total Analyses
35	Whole Rock Analyses	14	490
2023	Petrographic Slides		
44	Palynological Investigation		
82	Slabs		
			490

Data Processing - $1,288.00
Supplies - $ 210.12

Oil Shales

Account No. 619-81-18-10

Total Billing to March 1978 - $10,680.00

Summary of Work Done:

No.		No. of Analyses/Sample	Total Analyses
479	Distillations		
10	Whole Rock Analyses	10	100

Cobequids

Account No. 619-81-18-16

Total Billing to March 1978 - $ 8,904.11

Summary of Work Done:

No.		No. of Analyses/Sample	Total Analyses
809	Petrographic Slides		
81	Whole Rock Analyses/Trace	30	2,430

Supplies - $1,339.13

4.0 CAPITAL EQUIPMENT PURCHASES

4.1 Amount Received

Cost Shared	$
1974-75	138,617.64
1975-76	12,570.56
1976-77	4,895.19
1977-78	4,906.59
	160,989.98
Other sources	28,835.80
Total	189,825.78

4.2 Purchases by Supplier and Year

All items were purchased via Canadian companies except P.O.N.'s 2078, 2725, and 4028.

SUPPLIER - FISHER, DARTMOUTH, N.S.

P.O.N.	Year	Item	Amount
2076	1974-75	Atomic Adsorption Unit	15,300.00
2077	1974-75	Water Still 6 Hot Plates Electrophometer Drying Oven 8 Magnetic Stirrers Calormeter Platinum Crucibles Mettler Balance pH Meter Vacuum Pump Recorder	11,477.41
2079	1974-75	Laboratory Furnishings	7,197.33
2080	1974-75	Laboratory Furnishings	20,924.82
2082	1974-75	Laboratory Furnishings	4,414.30
2084	1974-74	A. A. Lamps	1,284.00
2085	1974-75	Glassware Tubing First Aid Kit Minor Supplies	2,634.85

2086	1974-75	Chemicals	1,997.42
2092	1974-75	Shaker Unit Electrodes Pellet Press 3 Furnaces	3,631.30
2236	1975-76	Spectrophometer Vacuum Pump Automatic Diluters Furnace	5,450.60
2352	1976-77	A. A. Lamps Pipette Units Ultrasonic Cleaners	655.47
2357	1976-77	A. A. Lamp	208.00
2719	1977-78	4 A. A. Lamps	729.50
4026	1977-78	5 Magnetic Stirrers	313.25

SUPPLIER - JARREL ASH, BOSTON, U.S.A.

P.O.N.	Year	Item	Amount
2078	1975-75	Ebert Spectrograph	67,622.29
2097	1974-75	Supplies for above	1,906.17
4028	1977-78	Stallwood Jet	380.00

SUPPLIER - CANLAB, DARTMOUTH, N.S.

P.O.N.	Year	Item	Amount
2308	1975-76	Mercury Analysiser	810.00
2237	1975-76	Blender 2 Magnetic Stirrers	1,405.46
2355	1976-77	A. A. Lamp Sartorius Balance	1,027.50
2356	1976-77	6 Ball Mills	412.02
2704	1977-78	4 Water Baths Supplies for above	1,483.40
2706	1977-78	6 Repipet Units	543.25

SUPPLIER - ABOR SCIENTIFIC, PORT CREDIT, ONTARIO

P.O.N.	Year	Item	Amount
2081	1974-75	Petrographic Equipment	7,620.65
2100	1974-75	Petrographic Supplies	301.29
2353	1975-76	Diamond Cup Wheel	363.50
2705	1977-78	Mineralite Lamp	387.26

SUPPLIER - DENVER EQUIPMENT, TORONTO, ONTARIO

P.O.N.	Year	Item	Amount
2083	1974-75	Jaw Crusher	3,211.00

SUPPLIER - A. H. ELECTRIC, DARTMOUTH, N.S.

P.O.N.	Year	Item	Amount
2087	1974-75	Electrical Installation	3,489.56

SUPPLIER - LECO, MISSISSAUGA, ONTARIO

P.O.N.	Year	Item	Amount
2088	1974-75	Carbon Analysiser	4,333.55
2246	1975-76	Sulphur Titrator	1,622.50

SUPPLIER - MARITIME TILE, HALIFAX

P.O.N.	Year	Item	Amount
2090	1974-75	Tiling Lab Floor	50.00

SUPPLIER - HALIFAX PRECAST CONCRETE, WINDSOR JUNCTION

P.O.N.	Year	Item	Amount
2091	1974-75	Balance Tables	225.00

SUPPLIER - STAIRS, HALIFAX, N.S.

P.O.N.	Year	Item	Amount
2093	1974-75	Plumbing Items	1,019.65

SUPPLIER - N.S.T. COLLEGE, HALIFAX, N.S.

P.O.N.	Year	Item	Amount
2094	1974-75	Installation of Services	675.00
2358	1976-77	Calculator	850.00

SUPPLIER - SALA, MISSISSAUGA, ONTARIO

P.O.N.	Year	Item	Amount
2089	1974-75	3 Pumps	2,661.60

SUPPLIER - C.G.E., HALIFAX, N.S.

P.O.N.	Year	Item	Amount
2095	1974-75	8 Starters	171.60

SUPPLIER - E.M.R., OTTAWA, ONTARIO

P.O.N.	Year	Item	Amount
2096	1974-75	Standard Reference Samples	450.00

SUPPLIER - OLIVETTI, HALIFAX, N.S.

P.O.N.	Year	Item	Amount
2098	1974-75	Calculator	341.52

SUPPLIER - F. L. WORTH, HALIFAX, N.S.

P.O.N.	Year	Item	Amount
2099	1974-75	Ductwork	2,073.00

SUPPLIER - C. W. HUBBARD, DARTMOUTH, N.S.

P.O.N.	Year	Item	Amount
2238	1975-76	Dehumidifier	4,950.00

SUPPLIER - RUYNOR SCIENTIFIC, DARTMOUTH

P.O.N.	Year	Item	Amount
2242	1975-76	Petrographic Lap	341.00

SUPPLIER - SHERMAN WILLIAMS, HALIFAX

P.O.N.	Year	Item	Amount
2354	1976-77	Shakers	970.00

SUPPLIER - SPEX, METUCHAN, N.J., U.S.A.

P.O.N.	Year	Item	Amount
2725	1977-78	Shatterbox Container Mixers	1,207.80

4.3 Laboratory Inventory

MINERAL PROCESSING EQUIPMENT INVENTORY

INVENT. NO.	ITEM	SER. NO.	COST	YEAR	FROM
58 2001	CRUSHER JAW BLAKE 10' x 7'	M351	1	1963	ALLIS CHALM
58 2002	CRUSHER JAW CHIPMUNK	32871	17	1963	BRAUN CORP
58 2003	CRUSHER CONE 12'	128	-	1970	PEACOCK
58 2004	CRUSHER CONE MASSCO	FG685	501	1963	WILL & WILL
58 2005	CRUSHER ROLLS 20' x 12'	0T115520	7692	1969	DENVER
58 2006	CRUSHER BALL MILL 36' x 12'	JT45670	1200	1963	DENVER
58 2007	CRUSHER BALL MILL 30' x 36'	949	624	1963	MIN & SMLT
58 2009	CRUSHER SHATTERBOX 8500	1073	2252	1971	SPEX IND
58 2020	CLASSIFIER AKINS SPIRAL 12'	M82240	343	1963	CDN LOCO
58 2021	CLASSIFIER SPIRAL 7'	45670	600	1963	DENVER
58 2022	CLASSIFIER CYCLONE 3'	-	-	1968	HUMPHREY
58 2023	CLASSIFIER SCREEN (VIB) 35-18-4	460-44	-	1970	DILLON
58 2024	CLASSIFIER SCREEN (VIB) 35-18-4	592-47	84	1963	DILLON
58 2025	CLASSIFIER SCREEN (VIB)	4607	-	1972	GILSON
58 2026	CLASSIFIER SCREEN SHAKER RO-TAP	11567	238	1963	TYLER
58 2040	CONCENTRATOR JIG 10' x 12'	CN-1928	42	1963	DENVER
58 2041	CONCENTRATOR JIG 4' x 6'	BTi3922	109	1963	DENVER
58 2042	CONCENTRATOR JIG 1' x 1'	469A	14	1963	DENVER
58 2043	CONCENTRATOR TABLE 42' x 94'	-	15	1963	WILFLEY
58 2044	CONCENTRATOR TABLE 18' x 40'	VA15671	10	1963	WILFLEY
58 2045	CONCENTRATOR HUMPHREY SPIRAL	24AMRL	-	1968	HUMPHREY
58 2046	CONCENTRATOR HEAVY MEDIA	ST84029-1	-	1967	DENVER
58 2047	CONCENTRATOR ELECTROSTATIC	HP16-189	1200	1963	CARPCO
58 2048	CONCENTRATOR MAGNETIC	M12-193	1200	1963	CARPCO
58 2049	CONCENTRATOR ISODYNAMIC L1	43	506	1963	FRANZ
58 2050	CONCENTRATOR SUPERPANER	-	1100	1963	INFRANSIZER
58 2051	CONCENTRATOR MAGNETICWET	19256	1850	1974	SALA
58 2070	FLOTATION CONDITIONER 18' x 18'	-	8	1963	DENVER
58 2071	FLOTATION CONDITIONER 18'	DT21619	84	1963	DENVER
58 2072	FLOTATION CONDITIONER 12' x 18'	-	6	1963	DENVER
58 2073	FLOTATION CELLS (SIX) NO. 7	H128AA	41	1963	DENVER
58 2074	FLOTATION CELLS (SIX) NO. 7	H128AA	448	1963	DENVER
58 2075	FLOTATION CELLS (SIX) NO. 7	TY26939	3300	1971	DENVER
58 2076	FLOTATION CELL (FIVE)	ON LOAN FROM ELDORADO			
58 2077	FLOTATION CELL BATCH 500G	TM16549	486	1963	DENVER
58 2078	FLOTATION CELL BATCH 1000G	TN16657	364	1963	DENVER
58 2079	FLOTATION CELL BATCH	5365	818	1967	WEMCO
58 2090	FEEDER BELT ORE	TY-26833	1742	1969	DENVER
58 2091	FEEDER BELT ORE 6' x 48'	-	-	-	DENVER
58 2093	FEEDER BELT ORE 6' x 18'	45G70-5	360	1963	DENVER
58 2094	FEEDER REAGENT E1	17012	225	1970	CLARKSON
58 2095	FEEDER REAGENT E1	17013	225	1970	CLARKSON
58 2096	FEEDER REAGENT E1	17014	225	1970	CLARKSON
58 2097	FEEDER REAGENT E2	17016	225	1970	CLARKSON
58 2098	FEEDER REAGENT E2	17017	225	1970	CLARKSON

INVENT. NO.	ITEM	SER. NO.	COST	YEAR	FROM
58 2099	FEEDER REAGENT E4	17018	225	1970	CLARKSON
58 2100	FEEDER REAGENT E4	17019	225	1970	CLARKSON
58 2101	FEEDER REAGENT E	17495	225	1970	CLARKSON
58 2103	FEEDER REAGENT E	18215	225	1970	CLARKSON
58 2102	FEEDER REAGENT E	17509	225	1970	CLARKSON
58 2104	FEEDER REAGENT E	18216	225	1970	CLARKSON
58 2120	PUMP SALA SPV-180A	2376-2	608	1969	SALA
58 2121	PUMP SALA SPV-180A	2376-3	608	1969	SALA
58 2122	PUMP SALA SPV-180A	2376-4	608	1969	SALA
58 2123	PUMP SALA SPV-180A	2376-5	608	1969	SALA
58 2124	PUMP SALA SPVF-180	2606-17	725	1970	SALA
58 2125	PUMP SALA SPVF-180	2606-18	725	1970	SALA
58 2126	PUMP SALA SPVF-180	2606-19	725	1970	SALA
58 2127	PUMP SALA SPVF-180	2606-19	725	1970	SALA
58 2131	PUMP HORIZONTAL 1-1/2'	-	-	1968	NAGLE
58 2132	PUMP SALA SPV-180	9911-1	880	1975	SALA
58 2133	PUMP SALA SPV-180	9911-2	880	1975	SALA
58 2134	PUMP SALA SPV-180	9911-3	880	1975	SALA
58 2181	MISC SPLITTER	SS100		1974	TYLER
58 2182	MISC SPLITTER	CL-280-A		1974	TYLER
58 2183	MISC SPLITTER	16-1		1974	TYLER
58 2184	MISC HOPPER (SKIP)	-		1974	HFX MET
58 2185	MISC SPLITTER MICRO			1976	
58 2150	MISC AGITATOR ROLLS	JT45143	175	1963	DENVER
58 2151	MISC BALANCE P(K) 1000	390543	-	1970	METTLER
58 2152	MISC BALANCE P3	228531	-	1970	METTLER
58 2153	MISC BALANCE 20KG	-	-	1968	OHAUS
58 2154	MISC BALANCE 20KG	-	-	1968	OHAUS
58 2155	MISC CRANE HYDRALLIC 272-SP	C-1684	1231	1972	HAND SPEL
58 2156	MISC OVEN DRYING	BT-13871	-	1963	DENVER
58 2157	MISC FAN SCRUBBER	-	200	1970	UNKNOWN
58 2158	MISC FAN SCRUBBER	-	200	1970	UNKNOWN
58 2159	MISC FAN VENT E	S-509	-	-	INDUST ENG
58 2160	MISC FILTER TWIN DISC	JK45750	1080	1963	DENVER
58 2161	MISC FILTER PRESSURE 8'	-	245	1963	DENVER
58 2162	MISC GENERATOR STEAM	1185	-	1970	C G E
58 2163	MISC HOIST AND SKIP	-	4	1963	UNKNOWN
58 2164	MISC HOPPER	-	150	1969	HFX METAL
58 2165	MISC HOPPER	-	150	1969	HFX METAL
58 2166	MISC HOPPER	-	150	1969	HFX METAL
58 2167	MISC HOPPER	-	150	1969	HFX METAL
58 2168	MISC HOPPER	-	150	1969	HFX METAL
58 2169	MISC HOPPER	-	150	1969	HFX METAL
58 2171	MISC MONORAIL	-	6880	1969	CHOWEN
58 2172	MISC SAMPLER	N284	43	1963	GALIGHER
58 2173	MISC SAMPLER	N344	43	1963	GALIGHER
58 2174	MISC SCALE	F955492	-	-	FAIR MORSE
58 2175	MISC SCALE	PQ12	8	1963	FAIR MORSE
58 2176	MISC STIRRER	C1431	-	-	GALLENKEMP
58 2177	MISC THICKENER 36'	JT-45750	480	1963	DENVER
58 2178	MISC THICKENER 48'	-	2413	1970	DENVER
58 2179	MISC BARREL CART	-	160	1970	IND SUPP
58 2180	MISC DRYING OVEN	-	200	1970	HFX METAL

ANALYTICAL LABORATORY

INVENT. NO.	ITEM		SER. NO.	COST	YEAR	FROM
58 2203	ANAL	SPECTOGRAPH 26000 - ACC	203/10/3	6535	1970	A R L
58 2204	ANAL	SPECIFIC ION 801	5541	1074	1967	ORION
58 2206	ANAL	BEND TESTER	270/174/68	1490	1969	TONINDUST
58 2207	ANAL	DRYING OVEN POM-1336	CD6638	1501	1967	BLUE M
58 2208	ANAL	EXTRUDER	1415	1405	1967	RAWDEN
58 2209	ANAL	P C E FURNACE	1800	2010	1969	BICKLEY
58 2210	ANAL	TEMP GRAD FURNACE TG-DA	151	2500	1969	STONE
58 2211	ANAL	KILN D 2 H	116	1835	1969	DENVER F C
58 2212	ANAL	TRIM SAW TS 1	71537	298	1967	HYLAND
58 2213	ANAL	BALANCE 20 KG	-	123	1967	OHAUS
58 2214	ANAL	GRINDER 4 E	-	300	1968	STRAWB
58 2225	ANAL	TURBIDIMETER HELLIGE	9085	350	1970	FISHER
52 2227	ANAL	COND BRIDGE MODEL 31	1472	153	1970	FISHER
58 2230	ANAL	BALANCE METTLER H 20	374060	485	1970	FISHER
58 2231	ANAL	BALANCE METTLER P 1200	390446	435	1970	FISHER
58 2233	ANAL	BALANCE METTLER P 1200	459268	435	1970	FISHER
58 2241	ANAL	MUFFLE FURNACE M30A-1C	1348	533	1973	FISHER
58 2242	ANAL	PH METER METRHOM E488	15/1725	250	1970	FISHER
58 2243	ANAL	ATOMIC ABSORPTION	1171	6046	1972	JARRAL ASH
58 2244	ANAL	MERCURY ANAL COLE 50	0-5636	1074	1972	PER ELMER
52 2245	ANAL	HOT PLATE MULTIPLE 12	99707	90	1970	-
58 2246	ANAL	DILUTAMAT	1105	600	1975	FISHER
58 2247	ANAL	DILUTAMAT	351	580	1975	FISHER
58 2248	ANAL	DILUTAMAT	1149	580	1975	FISHER
58 2249	ANAL	BALANCE METTLER	532187	850	1975	FISHER
58 2250	ANAL	BALANCE METTLER	532193	850	1975	FISHER
58 2251	ANAL	HOT PLATE LINBERG	741085	193	1975	FISHER
58 2252	ANAL	HOT PLATE LINBERG	741085	193	1975	FISHER
58 2253	ANAL	HOT PLATE LINBERG	741085	193	1975	FISHER
58 2254	ANAL	HOT PLATE LINBERG	741085	193	1975	FISHER
58 2255	ANAL	HOT PLATE LINBERG	741085	193	1975	FISHER
58 2256	ANAL	HOT PLATE LINBERG	741085	193	1975	FISHER
58 2257	ANAL	MUFFLE FURNACE 1730A	1579	482	1975	FISHER
58 2259	ANAL	DRYING OVEN ISOTEMP 501	-	715	1975	FISHER
58 2260	ANAL	VACUUM PUMP WELCH	84336	567	1975	FISHER
58 2261	ANAL	ELECTROPHOTOMETER	2580	618	1975	FISHER
58 2262	ANAL	CONDUCTIVITY BRIDGE YS131	1472	-	1975	FISHER
58 2263	ANAL	CALCULATOR OLIVETTI	3726859	342	1975	OLIV
58 2264	ANAL	D.T.A DELTA THERM	2PW2-23	-	1962	N.R.C
58 2265	ANAL	FURNACE LECO	5355	2320	1975	LECO
58 2266	ANAL	ANALYSER CARBON LECO	1218	1849	1975	LECO
58 2267	ANAL	ANALYSIER SULPHUR LECO	3524	1623	1975	LECO
58 2268	ANAL	SPECTROPHOTOMETER B & L	322	3092	1975	FISHER
58 2270	ANAL	ATOMIC ABSORB JARREL ASH	-	15060	1975	FISHER
58 2271	ANAL	HYDRALLIC PRESS JARREL ASH	4451/0231	4335	1975	FISHER
58 2272	ANAL	MUFFLE FURNACE HOSKINS	C2373	-	1975	D.O.M.
58 2273	ANAL	CALORIMETER PARR	3578	1210	1975	FISHER
58 2274	ANAL	MIXER PITCHFORD 3800	635	605	1975	
58 2275	ANAL	EMISSION SPEC JARREL ASH	VARIOUS	46985	1975	FISHER

INVENT. NO.	ITEM		SER. NO.	COST	YEAR	FROM
58 2276	ANAL	DENSITOMETER JARREL ASH	16575	10780	1975	FISHER
58 2277	ANAL	DEVELOPER JARREL ASH	19572	2365	1975	FISHER
58 2278	ANAL	LAB FURNISHINGS	-	30464	1975	FISHER
58 2279	ANAL	SHARPENER ELECTORDE	5KH19FGR300	340	1975	FISHER
58 2280	ANAL	MIXER WIGGLEBUG	Y59206	100	1975	FISHER
58 2281	ANAL	GRINDER MORTER	1969A	-	1975	GOVT
58 2282	ANAL	OVEN DRYING	YA6504	-	1975	FISHER
58 2283	ANAL	REFRIGATOR	-	-	1975	-
58 2284	ANAL	REFRIGATOR	-	-	1975	-
58 2285	ANAL	SHAKER EBERBACH	-	565	1975	FISHER
58 2286	ANAL	FURNACE TUBE LINBERG	757121	1458	1975	FISHER
58 2287	ANAL	SAW CUT OFF 137-U	-	3830	1975	ARBOR
58 2288	ANAL	GRINDER SECTIONS 400-U	-	3830	1975	ARBOR
58 2289	ANAL	POLISHER GRANTON J100	-	-	1975	D.O.M
58 2290	ANAL	GRINDER SHATTERBOX	1288A	-	1975	SPEC
58 2291	ANAL	CRUSHER JAW DENVER	164166	3156	1975	DENVER
58 2292	ANAL	BLENDER WARING 91-215	-	508	1975	FISHER
58 2293	ANAL	STILL BARNSTEAD	-	788	1975	FISHER
58 2294	ANAL	RECORDER OMNISCRIBE	-	585	1975	FISHER
58 2295	ANAL	MAGNETIC STIRRER		57	1975	FISHER
58 2296	ANAL	MAGNETIC STIRRER		57	1975	FISHER
58 2297	ANAL	MAGNETIC STIRRER		57	1975	FISHER
58 2298	ANAL	MAGNETIC STIRRER		57	1975	FISHER
58 2299	ANAL	MAGNETIC STIRRER		57	1975	FISHER
58 2300	ANAL	MAGNETIC STIRRER		57	1975	FISHER
58 2301	ANAL	MAGNETIC STIRRER		57	1975	FISHER
58 2302	ANAL	MAGNETIC STIRRER		57	1975	FISHER
58 2303	ANAL	FISHER THERMIX		125	1975	FISHER
58 2304	ANAL	FISHER THERMIX		125	1975	FISHER
58 2305	ANAL	PARR PELLET PRESS		244	1975	FISHER
58 2306	ANAL	PLATINUM, VARIOUS		3000		
58 2307	ANAL	SLIDE WARMER		130	1975	ARBOR
58 2308	ANAL	SLIDE GRINDER 12L	761	375	1976	ARBOR
58 2309	ANAL	A-A LAMPS		3700	PRE 1976	VARIOUS
58 2310	ANAL	ULTRA SONIC CLEANER 32		292	1976	CANLAB
58 2311	ANAL	BALANCE SATORIOUS 2600401		1027	1976	CANLAB
58 2312	ANAL	SHAKER RED DEVIL 33426		485	1976	SH WIL
58 2313	ANAL	SHAKER RED DEVIL 33427		485	1976	SH WIL
58 2314	ANAL	CALCULATOR HP 97		830	1976	H P
58 2315	ANAL	CARPET		210	1976	CPT MKT
58 2316	ANAL	A-A LAMP YTTER		145	1976	CANLAB
58 2317	ANAL	A-A LAMP CALCIUM		208	1976	CANLAB
58 2318	ANAL	A-A LAMP CADMIUN		100	1976	CANLAB
58 2319	ANAL	A-A LAMP IRON		100	1976	CANLAB
58 2320	ANAL	A-A LAMP MAGNESIUM		100	1976	CANLAB
58 2321	ANAL	A-A LAMP RUBIDIUM		145	1976	CANLAB
58 2322	ANAL	REPIPET		85	1976	CANLAB
58 2323	ANAL	A-A LAMP MANGANESE		85	1976	CANLAB
58 2324	ANAL	A-A LAMP RHODIUM			1976	CANLAB
58 2325	ANAL	A-A LAMP CAESIUM		145	1976	CANLAB
58 2326	ANAL	A-A LAMP CA MG AL		145	1976	CANLAB
58 2327	ANAL	A-A LAMP HYDROGEN		257	1976	CANLAB

INVENT. NO.	ITEM	SER. NO.	COST	YEAR	FROM
58 2329	TUNGSTEN CARBIDE GRINDING DISC		955	1977	SPEX
58 2330	WIGG-L-BUG		120	1977	SPEX
58 2331	WIGG-L-BUG		133	1977	SPEX
58 2332	WATER BATH W3500-20		410	1977	CANLAB
58 2333	WATER BATH W3500-20		410	1977	CANLAB
58 2334	WATER BATH W3500-10		299	1977	CANLAB
58 2335	WATER BATH W3500-10		299	1977	CANLAB
58 2336	MINERAL LIGHT 29W 4326		120	1977	ARBOR
58 2337	MINERAL LIGHT 29W 4326		120	1977	ARBOR
58 2339	REPIPET 50ML		93	1977	CANLAB
58 2340	REPIPET 50ML		93	1977	CANLAB
58 2341	REPIPET 50ML		93	1977	CANLAB
58 2342	REPIPET 50ML		93	1977	CANLAB
58 2343	REPIPET 50ML		93	1977	CANLAB
58 2344	REPIPET 50ML		70	1977	CANLAB
58 2245	A A LAMP JA45-316		303	1977	FISHER
58 2346	A A LAMP JA45-439		213	1977	FISHER
58 2347	A A LAMP CHC-6021		85	1977	FISHER
58 2348	A A LAMP CHC-6014		128	1977	FISHER
58 2349	SMALLWOOD JET 19-321		380	1977	JARREL A

5.0 LABORATORY STAFF

The level of staffing of the laboratory is dependent on the work load so there are four types of appointments. Firstly, a yearly one effective April 1st to March 31st of the following year for the basic staff. Secondly, a monthly appointment when it can be seen that extra help is required for two or more months. This type of appointment is also used for new employees so they can be evaluated prior to annual appointments. The third type is for summer students for the period May to September when the work load peaks. The fourth type is casual which is hourly pay on a day-to-day basis when the work load requires extra help for a short period.

Laboratory Staff

Pre 1974

	1969-70	1970-71	1971-72	1972-73	1973-74
Yearly Appointments					
Supervisor	1	1	1	1	1
Technician-Technologist	3	3	3	3	3
Monthly Appointments					
Technician	-	-	-	-	-
	4	4	4	4	4
Summer Students	3	3	3	3	3
Casual	-	-	-	-	-

Post 1974

	1974-75	1975-76	1976-77	1977-78	1978-79
Yearly Appointments					
Supervisor	1	1	1	1	1
Technician-Technologist	3	6	6	6	6
Monthly Appointments					
Technician	1	-	-	-	1
	5	7	7	7	8
Summer Students	3	3	3	3	4
Casual	-	-	3	5	1

6.0 COST EFFECTIVENESS

To enable the effect of the input of capital to the laboratory the following tables were prepared. The first tabulation gives a summary of the Annual Workload 1969-74 and the second the Annual Workload 1974-77.

To enable a single cost figure to be arrived at, the various activities were weighed on a time basis using an analytical determination as one unit.

The final tabulation gives the Units/man month which is a good indication of productivity and which increased 400% in the period under review; and also the cost/unit, which shows a drastic decline in 1973-74. Since that time increase in produc vity has been nullified by the effect of inflation.

Annual Workload

Pre 1974

	1969-70	1970-71	1971-72	1972-73	1973-74
Analytical					
Determinations	7,355	8,240	23,015	19,910	32,204
Spec. Scan	100	157	51	52	210
Water Analyses	1	8	157	306	786
Ceramics					
Clays Tested	93	-	6	10	105
Sand-Gravel	-	-	-	-	-
Oil Shale	-	-	-	-	-
Work Orders					
Completed	24	62	18	15	24

Post 1974

	1974-75	1975-76	1976-77	1977-78	1978-79 (to date)
Analytical					
Determinations	65,159	89,947	48,252	110,085	27,576
Spec. Scan	125	24	12	42	73
Water Analyses	595	170	91	50	33
Ceramics					
Clays Tested	134	4	1	-	-
Sand-Gravel	70	61	20	-	-
Oil Shales	84	313	45	-	-
Petrographic Slides	-	1,508	3,136	2,588	691
Work Orders					
Completed	30	12	23	31	41

Using the following weighing indexes:

Item	Weighting
Analytical Determination	1
Spectographic Scan	5
Water Analyses	10
Sand and Gravel	5
Oil Shales	10
Petrographic Slides	5
Clay Analyses	25
Work Orders	15

Year	Man Months	Total Budget $	Work Units	Units/ Man Month	$/Unit
1969-70	44*	66,010	10,550	279	6.26
1970-71	44*	82,345	10,035	228	8.21
1971-72	66	67,034	25,260	382	2.65
1972-73	66	72,144	23,705	359	3.04
1973-74	66	76,063	44,099	668	1.72
1974-75	78	86,146	76,274	977	1.13
1975-76	102	120,250	98,555	966	1.22
1976-77	120	131,091	53,202	443	2.46+
1977-78	132	152,880	124,200	940	1.23

\+ Very few geochemical samples in 1976-77.

* 2 lab staff were full time on Mineral Processing, namely in connection with the Lake Ainslie and Loch Lomond Projects, this effects $/Unit.

APPENDIX 'C'

SURVEY OF THE MINERAL INDUSTRY

CONFIDENTIAL

NOVA SCOTIA DEPARTMENT OF MINES

Survey of the Mineral Industry

Name of Company | Position of Respondent

Check area of Company's interest:
- Industrial Minerals ☐
- Base Metals ☐
- Uranium ☐
- Others - specify ☐

Are you aware of the existence of the 1974-79 Canada/Nova Scotia Subsidiary Agreement on Mineral Development? YES ☐ NO ☐

PROJECTS (Please check if applicable)	Do you know project	Did you consult with geologist involved	Did you make use of results (1)	Do you expect to make use of results
Mineral Resource Inventory Diane Gregory	___	___	___	___
Mineral Evaluation Surveys				
Industrial Minerals Survey D. Murray	___	___	___	___
Sand and Gravel Survey J. Fowler	___	___	___	___
Oil Shales Survey W. Potter	___	___	___	___
Glencoe Limestone D. J. MacNeill	___	___	___	___
Geological/Geochemical Surveys				
Eastern Shore-Cape Breton Geochem. J. Bingley & G. Richardson	___	___	___	___
Antigonish Highlands J. Bingley	___	___	___	___
Metallogenesis & Mineral Deposits A. K. Chatterjee	___	___	___	___
Carbonate Stratigraphy P. S. Giles	___	___	___	___
Structural and Metamorphic J. D. Keppie	___	___	___	___
Cobequid Highlands H. Donohoe	___	___	___	___
Geophysical Surveys	___	___	___	___

4) If you made use of results:

of what value were these results to you?

Sub-project Title	High	Low	None
	____	____	____
	____	____	____
	____	____	____
	____	____	____

did you undertake any work on the basis of these results?

If yes, please specify (verification - exploration ($) - acquisition of property (acreage, type of deposition)) - relate to sub-project

5) you have any suggestions as to any additional work that the Nova Scotia partment of Mines might undertake?