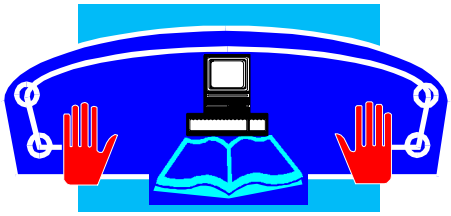


An Evaluation Of The Economic Impact Of A Mackenzie Valley Gas Pipeline On The Northwest Territories

Date of Report: 1973

Author: Canada - Indian & Northern Affairs

Catalogue Number: 6-2-15

AN EVALUATION OF THE ECONOMIC IMPACT OF A MACKENZIE VALLEY GAS PIPELINE ON THE NORTHERN TERRITORIES

Indian and Northern Affairs
Affaires Indiennes et du Nord

North of 60
Au nord du 60e

AN EWALUATION OF THE ECONOMIC IMPACT OF A MACKENZIE VALLEY GAS PIPELINE ON THE NORTHERN TERRITORIES

P.M. Manders
Northern Program Planning
Division
Northern Policy and Program
planning Branch
Department of Indian Affairs
and Northern Development

August 1973

Indian and Northern Affairs
Affaires indiennes et du Nord

Ottawa, Ontario K1A 0H4
September 28, 1973

Your file Votre référence

Our file Notre référence R 1582-2

FOREWORD

This study, "An Evaluation of the Economic Impact of a Mackenzie Valley Gas Pipeline on the Northern Territories" was prepared as a brief synopsis of the major economic impacts resulting from the construction of the Mackenzie Valley Gas Pipeline. As such it draws upon the major study on this topic "Regional Impact of a Northern Gas Pipeline", prepared jointly by the Department of Indian Affairs and Northern Development and MPS Associates Ltd. of Winnipeg. As explained in the text of this study, certain modifications to the larger report have been made to the estimates of the participation of native labour in the construction and Operation of the pipeline.

These statistics are not regarded as being any more or less accurate than those made in the larger study, given the general assumptions that were necessary to derive them. The smaller study predicts a little less native employment in the construction stage and a little more in the operation stage, compared to the larger study. Neither can be regarded as definitive.

A section dealing with Territorial Government Revenues is included in the synopsis. This aspect of the economic impact of the pipeline is a useful addition to the study as this analysis was not undertaken in the same detail in the larger study.

. . . . 2

The reader is referred to the Summary Volume of the "Regional Impact of a Northern Gas Pipeline" for the more comprehensive analysis of the impact of the construction and operation of the Mackenzie Valley Gas Pipeline, as it affects traditional pursuits, transportation, resource development, communities, oil and gas exploration and development, regional infrastructure, transient workers and local business, as well as employment of native and non-native workers.

A.T. Jordan,
Chief,
Northern Program
Planning Division.

LIST OF TABLES

and the incremental revenue streams accruing to labour as a result of pipeline employment. Included in the discussion of revenues to the respective territorial governments are estimated property taxes on a pipeline and ancillary installations, territorial fuel taxes, and possible increased territorial liquor profits.

(b) Methodology and Data Sources

Methodology

This study does not attempt to predict" the total level of economic activity in the northern territories in future years; the projections refer only to the (estimated) incremental changes generated specifically by the construction and operation of a major gas pipeline. Accordingly, the resultant economic effects are broken down into three categories : direct, secondary and indirect.[1] A direct effect would be the incremental labour income directly resulting from pipeline employment activities. As some portion of this direct income flow is spent and respent within the northern territories, secondary economic effects are generated in the form of induced income and labour demand.

All money values used in the analysis are expressed in 1973 dollars. In addition, the estimated revenue streams were discounted by 6%, 8% and 10%, representing the low, medium and high estimates, respectively, of an appropriate social rate of discount.

---

1. Unfortunately there was insufficient time to evaluate the indirect effects.

The-use of a range of discount rates is necessitated by the fact that at this time there are no hard and fast rules on what constitutes a "correct" social rate of discount, and the choice of any one discount rate over another is of necessity an arbitrary one. It should be noted here that., while some of the estimates and projections contained in this study may be a useful input in future benefit-cost analysis, this report is not to be interpreted as being a benefit-cost analysis of a gas pipeline.[1.]

A concerted effort has been made to write the text of the paper in non-technical language. To this end, various technical aspects as well as much of the underlying methodology used, are presented in footnote form as well as in a set of accompanying appendices. In interpreting or using the projections contained herein, the reader should bear in mind at all times the underlying assumptions of the study.

A major difficulty encountered in writing on the topic of a future large diameter northern gas pipeline has been the fact that the final pipeline scenario is not known with certainty at the present time. Some of the presently unresolved questions include: (1) where will the gas be marketed? (2) how much gas will flow through the line? (3) what will the final capital cost of the line be? (4) when will construction begin, and how much of the

gas line will be buried? (5) will the pipeline be looped or expanded in future years (thereby resulting in a more or less constant. level of construction activity) or will gas reserves only prove sufficient to justify one pipeline? The above list is by no means all inclusive and could easily be extended at great length. In other words, the precise final configuration of the gas pipeline remains uncertain at present. Consequently, given the above mentioned uncertainties, the majority of projections in the study have been presented in terms of a range of possible results. Thus , for example, incremental labour income from pipeline employment-is presented as a mean or most likely value with-low and high estimates of plus and minus 20% being included to allow for prediction error.

In conclusion., given the assumptions of this analysis and using the base case pipeline, this paper aims at clearly laying out a framework or methodology for determining the* economic impact of a gas pipeline on the northern territories.

Sources

With respect to data sources for the analysis, there were two main approaches that could have been taken; namely (1) develop an original set of data for a base case

pipeline, or (2) develop pipeline data by adapting available information from other pipeline studies. The first alternative was rejected primarily because, as there has been no decision taken as to final pipeline scenario, the time consuming exercise of collecting yet another set of hypothetical data and thereby in a large part duplicating the work of others was not considered to be justifiable. Instead, the approach taken was to assemble data for a base case pipeline from a number of existing reports and studies (a complete list of references is given at the back of this paper). A major source of information for the present analysis was the seven volume study "Regional Impact of a Northern Gas Pipeline" (hereafter referred to as the MPS Impact. Study) prepared in 1972 by the Economic Staff Group of the Department of Indian Affairs and Northern Development and MPS Associates Limited. Data taken from existing sources was not necessarily incorporated in its original form, and in many instances necessary changes and corrections have been made. Data sources and changes are clearly indicated at all points in this paper.

(c) Base Case Pipeline

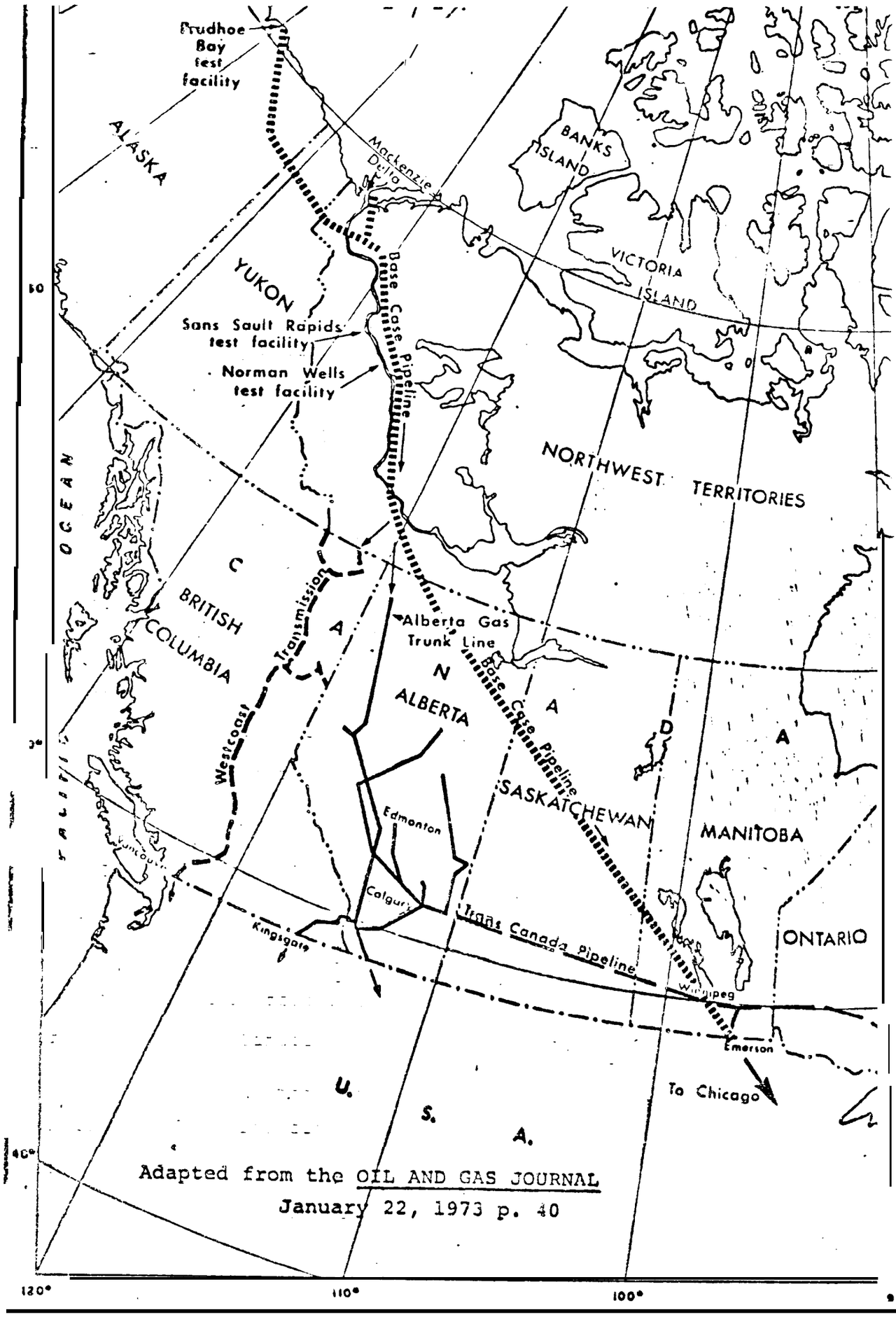
The Route

As there have been numerous routes suggested for a major gas pipeline to bring northern gas reserves to southern markets the choice of one pipeline route for analysis must of necessity be somewhat arbitrary. The base case pipeline chosen for

analysis in this study is a 48" gas pipeline designed to transport Prudhoe Bay and Mackenzie delta gas to the Emerson, Manitoba area for furtherance to Canadian and U.S. markets. The section of the line running from Prudhoe Bay to Emerson, Manitoba would form the spine of the gas transmission system and a short 48" branch line would connect the Mackenzie Delta gas fields to the main trunk line. These two pieces together form the base case pipeline, as shown on the map on page 8. The spine of the base case pipeline running from Prudhoe Bay to Emerson will be approximately 2,500 miles long, with 155 miles estimated to be in the Yukon and 780 miles in the Northwest Territories.[2] With the branch line to the Mackenzie Delta gas reserves estimated to be 120 miles long, the Northwest Territories will eventually contain 900 miles of the total mileage of the base case pipeline.

Corporate Structure

It appears likely that some sort of corporate structure will be set up to construct, own and operate the Canadian portion of the gas pipeline. A major component of this corporate structure is expected to be provided by the Canadian Arctic Gas Study Group,[3] many of whose members have been actively studying a Mackenzie Valley Gas Pipeline since 1970. The Honorable D. MacDonald, Canada's Minister of Energy, Mines and Resources, has indicated that Canadian interests will control the Canadian



Adapted from the OIL AND GAS JOURNAL
January 22, 1973 p. 40

... portion of the pipeline:

> ". . . ..the Canadian Development Corporation, Alberta Gas Trunk Pipeline, as well as Canadian National and C.P. Rail will take an equity position. We've made it clear that we expect management and majority shareholding to remain Canadian." [4]

The Alaskan portion of the pipeline will be constructed and operated by American interests.

Legal Requirements

Under Canadian law, the National Energy Board has jurisdiction over interprovincial and international pipelines, as well as the export of gas. Therefore, any interested pipeline company will have to apply to the Board for a Certificate of Public Convenience and Necessity to cover the construction of the pipeline, permission to carry U.S. gas through Canada, and permission to move Canadian gas to Canadian markets.[5] It is expected that an application for a construction certificate with respect to a northern pipeline will be submitted by the Canada Arctic Gas Study Group to the National Energy Board in late 1973 or early 1974. Consideration of the application and attendant hearings are expected to take between one and two years.

Simultaneously with that submitted to the National Energy Board, the pipeline company will then be required to file an application under the Territorial Lands Act with the Department of Indian Affairs and Northern Development to obtain the necessary permanent right-of-way over Territorial Crown lands. The Honorable Jean Chrétien has announced that subsequent to receipt of such an

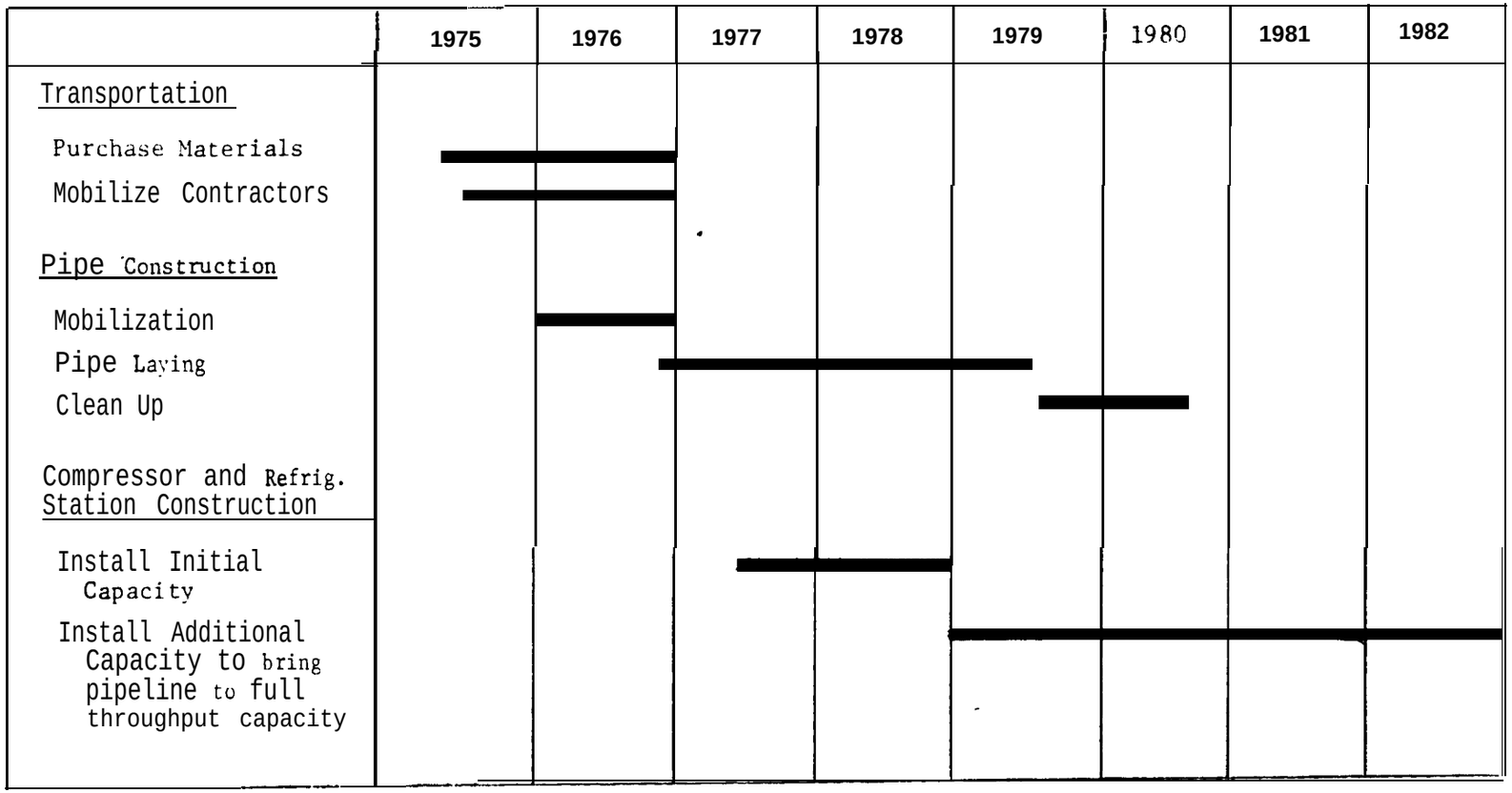
application, there will be a public enquiry to assess the regional socio-economic and environmental implications arising out of the construction and operation of a northern pipeline and that any easement agreement granted to the applicant would be conditional on a number of concrete undertakings on the part of the applicant with respect to the minimization of the social and environmental consequences involved. Land requirements which are of a more temporary nature (i.e. construction camps etc.) will be, in all probability, covered under renewable two-year permits issued under the Territorial Lands Act.

Expected Schedule of Construction

Assuming the granting of both a Certificate of Convenience and Necessity and a permanent Territorial right-of-way within two years of the date of application and the securing of financing arrangements by July 1975, the most likely construction schedule will resemble that shown on page 11.

Subsequent to construction approval a minimum 15 month interval will be required for the manufacture and delivery of materials, and mobilization of contractor forces and equipment. The pipeline itself will be constructed in two stages, with the Canadian

CONSTRUCTION SCHEDULE 48" BASE CASE GAS PIPELINE



Sources: Adapted from -

(1) MPS Associates Limited Study, Regional Impact of a Northern Gas Pipeline 1972, See Volume 2, pages 2-11, and

(2) Speech by W. Wilder, Chairman Canadian Arctic Gas Study Limited, to the Ad Hoc Committee on U.S. - Canada Energy Supply of the National Association of Regulatory Utility Commissioners, Washington, D.C. February 27, 1973.

portion to the Mackenzie delta being completed in the first two years of construction, and the portion to Prudhoe Bay in the third year. Consequently, the construction schedule assumed for the economic impact analysis in this paper is as follows:

December 1973 - March 1974	application for a pipeline construction certificate submitted to the National Energy Board
Early 1974 - July 1975	public hearings on the pipeline proposal. Present indications are there will be two sets of hearings: one conducted by the Department of Indian Affairs and Northern Development to consider the easement agreement, and a separate set to consider the various applications to the National Energy Board.
July 1975	permission to build granted and financing arrangements secured
July 1975 - November 1976	purchase of materials and supplies, mobilization of contractors
November 1976 - April 1979	construction of the pipeline and installation of initial pumping capacity. The section to the Mackenzie delta is assumed to be constructed in the winter seasons of 1976-77 and 1977-78 while the section to the Alaska border would be completed in the winter of 1978-79. Southern sections would be completed during the summer and fall months.

1979 - 1982	installation of additional compressor facilities to bring the pipeline to full throughput capacity
1983 - 1999	full capacity operation of the pipeline.

Additional specific assumptions are introduced in the study as they become appropriate.

II LABOUR EMPLOYMENT AND INCOME

This section of the paper attempts to estimate incremental additional) labour income accruing to northern residents as a result of direct pipeline employment and presents results in a series of tables. Discussion is in general terms only, and the reader is referred to appendices 1 and 2 for a more detailed examination of the underlying methodology and data sources.

(a) Demand for Labour

Tables 1 to 3 show the estimated demand for labour created by the construction and operation of a gas pipeline in the northern territories. Table 1 breaks down 1975-1983 labour requirements into five broad types of activity. Although no actual pipeline construction is assumed to take place in 1975,

this year (which is a preparatory year) has been included as part of the overall construction period (1975-82) which is defined here as the period required. to construct the pipe and bring it to the capacity throughput level of operation. The first year of the assumed capacity operation schedule is 1983 and the demand for labour in this year is assumed to remain constant over the capacity operations period 1983-99.

Tables 2 and 3 show the estimated demand for labour in terms of man years broken down by occupational category. Table 2 shows the total demand for the overall construction period 197.5-82, and the total demand for the 17 year capacity operations period 1983-99. Table 3 shows the estimated demand for labour by occupation in terms of man years for a representative or profile year for each of the three periods under study. Referring to Table 3, it can be seen that there is expected to be a demand for 81 (6) administrative trainees per year on average during the 3 year (4 year) construction period (build up to capacity throughput period) . The total estimated demand for administrative trainees during the overall construction period is therefore 267 (3 x 81+ 4 x 6) which checks with Table 2. It must be noted that the construction period itself is not likely to be 3 years of evenly spaced effort, however, the total demand for labour during the construction

TABLE 1

LABOUR REQUIREMENTS FOR A MACKENZIE VALLEY GAS PIPELINE
(MAN YEARS)

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Pipeline Construction		3,913	5,390	5,390	2,471				
Compressor Station and Facility Construction			380	760	1,156	641	446	446	
Operation of Construction Camps	26	526	764	808	477	92	67	67	
Off Site Transportation Plus Material Handling	300	426	467	374	59	59	59	54	
Operation and Maintenance		-			118	130	143	157	222
Total Direct Labour Required	326	4,865	7,001	7,332	4,281	922	715	724	222
Minimum Estimate @ 80%	261	3,892	5,601.	5,866	3,425	738	521	493	178
Maximum Estimate @ 120%	391	5,838	8,401	8,798	5,137	1,106	859	877	266

Source: Adapted from table 9, p. 57, volume 1 of the MPS Study Regional Impact of a Northern Gas Pipeline

See Appendix I for description of modifications

TABLE 2

POTENTIAL PIPELINE DEMAND FOR GENERAL SKILLS
THAT COULD BE FILLED BY NORTHERN LABOUR FORCE

	Occupation	Total Man Years Required Construction Period	Total Man Years Required Operations Period
1.	Administrative Trainee	267	
2.	Carpenter	565	134
3.	Carpenters Apprentice	291	
4.	Cooks Helper	808	
5.	Drivers (Trucks & Bus)	2,413	134
6.	Electricians Apprentice	291	
7.	Engineers (Prof.)	153	172
8.	Foreman	689,	,172
9.	Labour	'6,416	480
10.	Mechanics	485	249
11.	Mechanics Helper	501	
12.	Millwright	781	
13.	Oilers	497	
14.	Office Assistants	273	326
15.	Plumbers Apprentice	287	
16.	Principal Operators	3,319	269
17.	Surveyors Assistant	2s0	
18.	Technicians	448	921
19.	Welders	2,159	2 1 1
20.	Welders Helpers	2,325	,-
21.	Other Occupations	1,929	710
	Totals	25,094	3,778

Source: Adapted from MPS Impact Study Volume 7, p. 2-26
See Appendix I for description of modifications

TABLE 3

TOTAL LABOUR DEMAND BY MAJOR OCCUPATIONS
THAT COULD BE FILLED BY NORTHERN RESIDENTS
(man - years)

Occupation	Period of Major Pipeline Construction Profile Year 1977-78	Build up to Capacity Throughput Period - Profile Year 1980	Capacity Operations Profile Year 1983
1. Administrative Trainee	81	6	
2. Carpenter	131	4 3	8
3. Carpenters Apprentice	5 3	33	
4. Cooks Helper	243	20	
5. Drivers (Trucks & Bus)	795	7	8
6. Electricians Apprentice	53	33	
7. Engineers (Prof.)	36	11	10
8. Foreman	204	19	10
9. Labour	1,883	192	28
10. Mechanics	151	8	15
11. Mechanics Helper	167		
12. Millwright	143	88	
13. Oilers	166		
14. Office Assistants	71	15	19
15. Plumbers Apprentice	53	32	
16. Principal Operators	1,037	52	16
17. Surveyors Assistant	7 0		
18. Technicians	83	50	54
19. Welders	711	7	12
20. Welders Helpers	775		
21. Other Occupations	469	130	42
Total Labour Required	7,375	746	222

Soul-cc: Adapted from MPS Impact Study, Volume 7, p. 2-26

See Appendix I for description of modifications

period (197s-79) may be viewed as being 3 times the level of the profile year demand. Table 1 shows that the bulk of the demand for labour during the construction period is estimated. to occur during the calendar years 1977 and 1978.

(b) Potential Supply of Labour

Table 4 shows the estimated potential, pipeline labour supply in the northern territories in 1970. The 20 occupation groups shown are those which it is felt likely that. northern residents could fill and do not form an exhaustive list of occupational categories required by a pipeline. The "other pipeline related" category consists of a number of other occupations which have been grouped together into one category as they were felt to be too small to be considered individually.

Tables 5, 6 and 7 show the potential labour supply projected to 1977, 1980, and 1983 which are the profile years for the construction period, build up to capacity period, and capacity throughput periods respectively (see appendix 2 for the methodology used in making these projections) . The reasons for the different format used in Tables 5, 6 and 7 as compared to the format of Table 4 is discussed in the following section.

TABLE 4

POTENTIAL PIPELINE LABOUR SUPPLY BY OCCUPATION
IN THE NORTHERN TERRITORIES 1970

		Pipeline Corridor				Rest of N.W.T.				Yukon			
		Male		Female		Male		Female		Male		Female	
		Indigene	Other	Indigene	Other	Indigene	Other	Indigene	Other	Indigene	Other	Indigene	Other
1.	Administrative Trainee	18	66	24	26	48.	333	32	41	6	324	2	68
2.	Carpenter	3	18			14	66			2	67		
3.	Carpenters Apprentice	34	16			88	39			1	46		
4.	Cooks Helper	4	14	21	4	15	35	30	17		42	14	21
5.	Drivers (Trucks & Bus)	20	38			57	114			12	126	2	
6.	Electricians Apprentice	1	14			7	82				76		
7.	Engineers (Prof.)		6			3	27		1	1	25,		
8.	Foreman	3	36	1		14	63		"3	5	84		4
9.	Labourer	255	60	3	1	598	170	210		90	190	12	4
10.	Mechanics	4	52			11	141				160		
11.	Mechanics Helpers	3	20	1		7	24				38		
12.	Millwright	2	8			7	63		-		59		
13.	Oilers										5		
14.	Office Assistants	3	34	20	93	15	154	25	351	1	152	8	278
15.	Plumbers Apprentice	2	4			4	11				13		
16.	Principal operators	3-?	42			90	145			18	152		
17.	Surveyors Assistants	2	34			4	71				88		-
18.	Technicians		4				11				13		
19.	Welders		10				27				29		
20.	Welders Helpers	20	4			50	24				21		
	Total above	411	480	70	124	1032	1600	297	413	136	1710	38	375
	Other Pipeline Related	23	45	28	91	26	140	84	324	11	160	15	275
	Total Pipeline Related	434	525	"98	215	1058	1740	381	737	147	1870	53	650

Source: See"Appendix 2

TABLE 5

POTENTIAL PIPELINE LABOUR SUPPLY
BY OCCUPATION IN THE NORTHERN TERRITORIES
1977

	PIPELINE CORRIDOR			YUKON AND REST OF N.W.T.		
	INDIGENE		OTHER	INDIGENE		OTHER
	Male	Female	Male & Female	Male	Female	Male & Female
Administrative Trainee	22	29	109″	68	44	876
Carpenter	4		22	21		152
Carpenters Apprentice	42		19	111		97
Cooks Helper	5	26	22	20	56	131
Driver	25		46	86	3	275
Electricians Apprentice	2		17	10		180
Engineer (Prof.)	1		7	5		61
Foreman	4	″2	44	24		177
Labourer	317	4	74	861	282	417
Mechanic	5		62	15		345
Mechanics Helper	4	1	24	11		71
Millwright	3		10	10		140
Oiler	1		1	2		7
Office Assistant	4	24	147	20	42	1069
Plumbers Apprentice	3		5	6		27
Principal Operator	46		50	136		340
Surveyor's Assistant	3		41	6		182
Technician	1		5	1		27
Welder	1		12	2		64
Welders Helper	25		5	64		51
Total	518	86	722	1479	427	4689
Other Related Trades	29	34	158	47	121	1029
Total Pipeline Related	547	120	880	1526	548	5718

Source : See Appendix 2.

TABLE 6

POTENTIAL PIPELINE LABOUR SUPPLY BY OCCUPATION IN THE NORTHERN TERRITORIES 1980

	PIPELINE CORRIDOR			YUKON AND REST OF N.W.T.		
	INDIGENE		OTHER	INDIGENE		OTHER
	Male	Female	Male & Female	Male	Female	Male & Female
Administrative Trainee	24	31	108	73	47	909
Carpenter	4		2 1	22		158
Carpenters Apprentice	45		19	121		101
Cooks Helper	5	28	21	42	60	137
Driver	27		45	83	3	285
Electricians Apprentice	2		16	12		188
Engineer (Prof.)	1		7	5		63
Foreman	4	2	42	26		183
Labourer	340	5	72	929	303	431
Mechanic	5		61	17		357
Mechanics Helper	4	1	23	14		74
Millwright	3		9	11		145
Oiler	1		1	4		8
Office Assistant	4	26	149	22	45	1109
Plumbers Apprentice	3		5	7		28
Principal Operator	49		49	147		353
Surveyor's Assistant	3	-	40	6		189
Technician	1	-	5	1		28
Welder	1		12	4		66
Welders Helper	27		5	70		54
Total	553	93	710	1616	458	4866
Other Related Trades	31	37	161	50	131	1060
Total Pipeline Related	584	130	871	1666	589	5926

Source: Appendix 2

TABLE 7

POTENTIAL PIPELINE LABOUR SUPPLY BY OCCUPATION IN THE NORTHERN TERRITORIES 1983

	PIPELINE CORRIDOR			YUKON AND REST OF N.W.T.		
	INDIGENE		OTHER	INDIGENE		OTHER
	Male	Female	Male & Female	Male	Female	Male & Female
Administrative Trainee	26	34	112	79	51	931
Carpenter	5		22	23		162
Carpenters Apprentice	5		20	13		103
Cooks Helper	6	30	23	10	65	140
Driver	29		46	101	3	292
Electricians Apprentice	3		17	13		192
Engineer (Prof.)	1	-	7	5		65
Foreman	5	3	44	28	1	188
Labourer	371	6	76	1004	328	444
Mechanic	6		63	19		366
Mechanics Helper	5	1	24	15		75
Millwright	4		10	12		148
Oiler	1		1	5		8
Office Assistant	5	29	154	26	49	1135
Plumbers Apprentice	4		5	9		29
Principal Operator	54		51	157		360
Surveyor's Assistant	3	-	41	8		193
Technician	1	-	5	2		29
Welder	2		12	6	-	68
Welders Helper	29		6	77		55
Total	610	103	739	1731	497	4983
Other Related Trades	33	40	165	54	142	1092
Total Pipeline Related	643	143	904	1785	639	6075

Source: Appendix 2

(c) Actual Supply of Labour

The next step in the analysis is to determine what proportion of the potential labour supply will leave their existing employment for work on the pipeline. The potential labour supply as discussed in the preceding sect-ion was broken down by sex, ethnic group, geographical location and occupation. As a unique participation rate (i.e. the per cent of the potential labour force which will actually work on the pipeline) for each of these categories is clearly impractical (a total of 252 participation rates would be required: 21 occupations x 2 sexes x 2 ethnic groups x 3 regions) some simplifying assumptions were required. The following assumptions were made:

1. The Yukon Territory and the rest of the NWT were treated as one region with the Pipeline corridor being the other region. It is realized that participation rates will vary across the Yukon and the non pipeline corridor section of the NWT, however, it was felt that the same average rate could safely be assumed to apply to these two regions.

2. Male and female others were assumed to have the same participation rates. This group is projected to have relatively low participation rates, as the bulk of other employment in the north tends to be white collar salary employment.

3. The same participation rate for a given individual was assumed to apply regardless of occupation. This assumption is not overly unrealistic as the resulting single participation rate across occupations is in fact an average and will tend to offset high and low variations about the mean.

4. 'The bulk of the pipeline employment will be primarily available to males. It has been assumed that preference will be given to Indigene males over other males. (see P. 26 1972 Pipeline Guidelines), and it is also assumed that preference will be given to individuals living close to the pipeline over those living farther away.

5. A number of factors will affect participation rates such as: the differential between pipeline and non pipeline earnings for a given occupation, the willingness of northern labour to work in "remote" construction 'camps, the prevailing employment situation in the northern territories, the effectiveness of northern manpower training programs, etC.

The participation rates indicated below are educated "guesstimates" based on a careful consideration of the above assumptions and comments. For the pipeline construction period, the estimated participation rates are:

	Indigene		Other
	Male	Female	Male & Female
Yukon and rest of NWT	.20	.05	.05
Pipeline Corridor	.50	.10	.15

It is assumed that participation rates for indigenous peoples will tend to increase over time as a result of increased familiarity and exposure to hourly wage type employment. The estimated participation rates for the build up to capacity period and the capacity operations phase are:

	Indigene		Other
	Male	Female	Male & Female
Yukon and rest of NWT	.25	.05	.05
Pipeline Corridor	.55	.15	.15

The results of applying these participation rates to the potential. supply of labour for the 3 profile years are shown in Tables 8, 9 and 10. In some cases (eg. the demand for laborers), the estimated actual supply using the participation rate methodology proved to be larger than the estimated demand as shown in Table 3. In these instances, the actual supply of labour was simply prorated on a proportional basis (eg. if male indigenes in the pipeline corridor accounted for 25 per cent of the estimated actual supply, then 25 per cent of the estimated demand was assumed to be filled by this group.)

(d) Increased Earnings due to Pipeline Employment

The final step in the labour income analysis is to estimate the additional income accruing to northern residents as a result of pipeline employment. Table 11 shows the estimated increase in annual earnings of northern residents through pipeline employment by occupation. Tables 12, 13 and 14 show the estimated additional income accruing to northern residents as a result of direct pipeline employment during the three profile years.

TABLE 8

ESTIMATED ACTUAL PIPELINE EMPLOYMENT
OF NORTHERN RESIDENTS BY OCCUPATION
1977

	PIPELINE CORRIDOR			YUKON AND REST OF N.W.T.		
	INDIGENE		OTHER	INDIGENE		OTHER
	Male	Female	Male & Female	Male	Female	Male & Female
Administrative Trainee	1	1	3	16	14	2	44
Carpenter	2			3	4		8
Carpenters Apprentice	21			3	22		5
Cooks Helper	3	3		3	4	3	7
Driver	12			7	17		14
Electricians Apprentice	1			3	2		9
Engineer (Prof.)				1	1		3
Foreman	2			7	5		9
Labourer	159			11	172	14	21
Mechanic	2			9	3		17
Mechanics Helper	2			4	2		4
Millwright	1			2	2		7
Oiler							
Office Assistant	2	2		14	4	2	47
Plumbers Apprentice	1			1	1		1
Principal Operator	23			7	27		17
Surveyor's Assistant	2			6	1		9
Technician				1			1
Welder				2			3
Welders Helper	12			1	13		3
Total	256	8		101	294	21	221
Other Related Trades	15	3		24	9	6	51
Total Pipeline Related	271	11		125	303	27	272

Source : Based on Table 5

TABLE 9

ESTIMATED ACTUAL PIPELINE EMPLOYMENT
OF NORTHERN RESIDENTS BY OCCUPATION
1980

	PIPELINE CORRIDOR			YUKON AND REST OF N.W.T.		
	INDIGENE		OTHER	INDIGENE		OTHER
	Male	Female	Male & Female	Male	Female	Male & Female
Administrative Trainee	3			3	-	
Carpenter	2		3	5		8
Carpenters Apprentice	12		1	17		3
cooks Helper	3	3	2	8	1	3
Driver	4			3		
Electricians Apprentice	1		2	3		9
Engineer (Prof.)		-<	1	1		3
Foreman	2		6	6		9
Labourer	77		4	95	6	8
Mechanic	1		2	1		4
Mechanics Helper						
Millwright	2		1	3		7
Oiler						
Office Assistant		1	3	1		10
Plumbers Apprentice	2		1	2		1
Principal Operator	15		4	20		10
Surveyor's Assistant						
Technician			1			1
Welder			2	1		3
Welders Helper						
Total	124	4	33	169	1	79
Other Related Trades	17	5	24	12	6	53
Total Pipeline Related	141	9	57	181	13	132

Source : Based on Table 6

TABLE 10

ESTIMATED ACTUAL PIPELINE EMPLOYMENT
OF NORTHERN RESIDENTS BY OCCUPATION 1983

	PIPELINE CORRIDOR			YUKON AND REST OF N.W.T.		
	INDIGENE		OTHER	INDIGENE		OTHER
	Male	Female	Male & Female	Male	Female	Male & Female
Administrative Trainee						
Carpenter	1		1	2		4
Carpenters Apprentice						
Cooks Helper						
Driver	2		1	3		2
Electrician Apprentice						
Engineer (Prof.)	1		1	1		3
Foreman	1		3	3		4
Labourer	12		1	13		2
Mechanic	1		4	2		7
Mechanics Helper		-				
Millwright						
Oiler						
Office Assistant	1	2	4	2	1	9
Plumbers Apprentice						
Principal Operator	5		1	6		4
Surveyor's Assistant						1
Technician	1		1			
Welder	1		2	1		3
Welders Helper						
Total	26	2	19	33	1	37
Other Related Trades	7	2	8	5	2	18
Total Pipeline Related	33	4	27	38	3	55

Source : Based on Table 7"

These Tables were derived by multiplying the estimated actual employment on a pipeline during these profile years as shown in Tables 8, 9 and 10 by the potential increase in earnings by occupation as shown in Table 11. In the case of professional engineers, technicians and welders, where the estimated earned income by indigenous peoples in these occupations was zero (due to zero employment in these occupations) , the incremental earnings accruing to indigenous peoples due to pipeline employment was computed on one-third of the estimated pipeline earnings rather than 100 per cent. While estimated pipeline earnings for surveyors' assistants are shown to be less than those in non pipeline areas (Table 11) a value of $0 as an income differential was used in the calculation of' incremental labour incomes in order to avoid obtaining a questionable negative income result.

(e) Summary

The detailed estimates of incremental labour income are gathered together in Table 15 which shows the total estimated incremental income accruing to northerners during the three phases of pipeline activity considered in this study . It must be noted that the results in Table 15 are gross results in that they have not been corrected for extra taxes paid by the wage earners. A net result

TABLE 11

ESTIMATED INCREASE IN ANNUAL EARNINGS OF NORTHERN RESIDENTS THROUGH PIPELINE EMPLOYMENT BY OCCUPATION (1973 DOLLARS)

Occupation Type	Estimate of Average Earned Income From All Work in 1973		Potential Earnings From Pipeline 1973 Values	Potential Increase In Earnings Through Pipeline Employment			
				Indigene		Other	
	Indigene	Other		$	% Increase	$	% Increase
Administrative Trainee	6,019	10,355	11,450	+ 5,431	990.2	+ 1,095	10.6
Carpenter	9,227	9,747	14,377	+ 5,150	55.8	+ 4,630	47.5
Carpenters Apprentice	3,931	6,737	11,823	+ 7,892	200.7	+ 5,086	7s.5
Cooks Helpers	2,385	5,095	7,483	+ 5,0S8	213.7	+ 2,388	46.9
Drivers (Truck & Bus) "	6,010	7,260	13,040	+ 7,030	117.0	+ 5,202	79.6
Electrician Apprentice	8,492	9,416	12,784	+ 4,293	50.6	+ 3,369	35.8
Engineers (Prof.)	-	7,813	27,792				
Foreman'	6,897	9,934	14,907	+ 8,010'	116.1	+ 4,972	50.1
Labour	3,069	5,644	8,406	+ 5,337	173.9	+ 2,762	48.9
Mechanics	4,044	8,323	-12,255	+ 8,211	203.6	+ 3,933	47.3
Mechanics Helpers	5,211	8,037	9,721	+ 4,510	86*6	+ 1,685	21.0
Millwright	4,205	9,133	13,649	+ 9,365	218.6	+ 4,516	49.5
Oilers			9,721				
Office Assistants	8,663	7,742	8,720	+ 57	0.7	+ 977	12.6
Plumbers Apprentice	1,684	7,334	12,413	+10,729	637.2	+ 5,079	69.3
Principal Operators	6,931	9,765	12,255	+ 5,323"	76.8	+ 2,490	25.5
Surveyors Asst.	9,032	10,304	8,406	626	- 6.9	- 1,898	-18.4
Technicians		10,712	10,712				
Welders		9,086	12,255			+ 3,169	34.9
Welders Helpers	4,465	7,151	9,603	+ 5,138	115.7	+ 2,453	34.3

Notes:

1. Adapted from Table 23, p. 106, Vol. 1, MPS Impact Study. Figures in the MPS Table 23 were given in terms of 1970 dollars. The above table inflates the MPS figures to 1973 dollars by using an annual inflation factor of 58 (compounded annually). It is realized that the earnings *for* the 20 classes of labour will probably increase at differing rates. However, it was felt that an avera e annual increase of 5% (approximately the annual rate of price inflation in the Canadian economy970-.731 was much less troublesome than the multiple assumptions required to project nominal prices advancing at a variety of hypothetical rates (i.e., a different rate for each of the 20 labour classes).

2. The HPS results in their Table 23 (see note 1 above) referred only to N.W.T. earnings with and without a pipeline. In this analysis it is assumed that average Yukon earnings for a given occupational class without's pipeline are the same as they are in the N.W.T.

TABLE 12

ESTIMATED INCREASE IN DIRECT LAB(XJR INCOME ACCRUING TO NORTHERN RES1OENTS
DUE TO PIPELINE EMPLOYMENT FOR THE YEAR 1977 (FIGURES SHOWN ARE IN $000 1973)

	PIPELINE CORRIDOR			YUKON AND REST OF N.W.T.		
	INDIGENE		OTHER	INDIGENE		OTHER
	Kale	Female	Male & Female	Male	Female	Male & Female
Administrative Trainee	59.7	16.3	17.5	76.0	10.9	48.2
Carpenter	10.3		13.9	20.6		37.0
Carpenters Apprentice	165.7		15.2	173.6		25.4
Cooks Helper	15.3	15.3	7.2	20.4	15.3	16.7
Driver	84.4		36.4	119.5		72.8
Electricians Apprentice	4.3	-	10.1	8.6		30.3
Engineer (Prof.)		-	9.3	9.3		27.8
Foreman	16.0	-	34.0	40.0		44.7
Labourer	848.6	-	30.4	918.0	74.6	58.0
Mechanic	16,4		35.4	24.6		66.9
Mechanics Helper	9.0	-	6.7	9.0	-	6.7
Millwright	9.4		9.0	18.7		31.6
Oiler	-	-				
Office Assistant	0.1	0.1	13.7	0.2	0.1	45.9
Plumbers Apprentice	10.7		5.1	10.7		5.1
Principal Operator	122.4	-	17.4	143.7		42.3
Surveyor's Assistant						
Technician	-		3.6			3.6
Welder		-	6.3			9.5
Welders Helper	61.7		2.5	66.8		7.4
Total	$1,434.0	31.7	261.6	1,659.7	100.9	548.5
Other Related Trades	$ 84.0	12.0	63.0	50.8	7.5	126.6
Total Pipeline Related	1,518.0	43.7	324.6	1,710.5	3.34.7	675.1

Source: Table 11 and Table 8

TABLE 13

ESTIMATED INCREASE IN DIRECT LABOUR INCOME ACCRUING TO NORTHERN RESIDENTS DUE TO PIPELINE EMPLOYMENT FOR THE YEAR 1980 (FIGURES SHOWN ARE IN $000 1973)

	PIPELINE CORRIDOR			YUKON AND REST OF N.W.T.		
	INDIGENE		OTHER	INDIGENE		OTHER
	Male	Female	Male & Female	Male	Female	Male & Female
Administrative Trainee	16.3			16.3		
Carpenter	10.3	-	13.9	25.7.		37.0
Carpenters Apprentice	94.7		5.1	134.2		15.2
Cooks Helper	15.3	15.3	4.8	40.8	5.1	7.2
Driver	28.1			21.3		
Electricians Apprentice	4.3		6.7	12.9		3.0
Engineer (Prof.)		-	9.3	9.3	-	27.8
Foreman	16.0	-	29.8	48.1		44.7
Labourer	410.9	-	11.0	507.0	32.0	22.1
Mechanic	B.2		7.9	8.2		15.7
Mechanics Helper		-				
Millwright	1 8 . 7	-	4.5	28.1		31.6
Oiler		-				
Office Assistant		-	2.9			9.8
Plumbers Apprentice	21.4	-	5.1	21.4		5.1
Principal Operator	79.8	-	10.0	106.5		24.9
Surveyor's Assistant		-				
Technician		-				
Welder		-	6.3	4.1		9.5
Welders Helper						
Total	S724.	15.3	"117.3	983.9	37.1	253.6
Other. Related Trades	99.2	19.1	85.3	69.9	31.8	170.1
Total Pipeline Related	823.2	34.4	202.6	1053.8	68.9	423.7

Source: Table 11 and Table 9

TABLE 14

ESTIMATED INCREASE IN DIRECT LABOUR INCOME ACCRUING TO NORTHERN RESIDENTS DUE TO PIPELINE EMPLOYMENT FOR THE YEAR 1983 (FIGURES SHOWN ARE IN $000 1973)

	PIPELINE CORRIDOR			YUKON AND REST OF N.W.T.		
	INDIGENE		OTHER	INDIGENE		OTHER
	Male	Female	Male & Female	Male	Female	Male & Female
Administrative Trainee						
Carpenter	5.1		4.6	10.2		18.4
Carpenters Apprentice						
Cooks Helper						
Driver	14.0		5.2	21.1		10.4
Electricians Apprentice						
Engineer (Prof.)	9.3		9.3	9.3		27.9
Foreman	8.0		14.9	24.0		19.9
Labourer	64.1		2.8	69.4		5.6
Mechanic	8.2		16.0	16.4		27.0
Mechanics Helper						
Millwright						
Oiler						
Office Assistant	0.1	0.1	3.6	0.1	0.1	6.3
Plumbers Apprentice						
Principal Operator	26.5		2.5	31.8		10.0
Surveyor's Assistant						
Technician	3.6					
Welder	4.1		6.3	4.1		9.6
Welders Helper						
Total	$ 143.0	0.1	65.2	186.4	0.1	135.9
Other Related Trades	$ 38.5	0.1	27.4	28.2	0.2	66.1
Total Pipeline Related	$ 181.5	0.2	92.6	214.6	0.3	202.0

Source: Table 11 and Table 10

TABLE 1[illegible]

ESTIMATED INCREASE IN LABOUR INCOME ACCRUING TO NORTHERN RESIDENTS DUE TO PIPELINE EMPLOYMENT BY PERIOD
(all figures in $000 1973)

	Construction Period (Jan 1975 - Apr. 1979)	Build up to Capacity Period (1979 - 1982)	Full Capacity Operation (1983 - 1999)
Pipeline Corridor			
Indigene – Male	4,554	3.292.8	3,085.5
Indigene – Female	131.1	137.6	3.4
Other – Male & Female	973.8	810.4	1,574.2
Yukon & Rest of N.W.T.			
Indigene - Male	5,131.5	4,215.2	3,648.2
Indigene - Female	404.1	275.6	.5.1
Other - Male & Female	2,025.3	1,694.8	343.4
Total	13,219.8	10.42[illegible].4	8.659.[illegible]
Maximum @ 120%	15.8[illegible]3.8	12,511.[illegible]	10.[illegible]91.8
Minimum @ 80%	10,575.8	8,341.1	6,927.8

Source: Tables 12, 13 and 14

after taxes, assuming an average marginal tax rate of 20% on additional earnings, could be approximated by using the minimum estimate of incremental income in table 15.[7] Using an estimate of $200 million in 1973 dollars as the value of total wages and salaries in the two northern territories for 1976-77, it is estimated from Table 15 that direct labour incomes in the northern territories should increase by more than 2% during the construction phase of a gas pipeline (using $4.4 million as an average annual incremental labour income effect over the peak 3-year period of construction.)

(f) Indirect Employment

A demand for indirect labour will be induced both in the public and private sectors as a result of the construction and operation of a gas pipeline. An estimate of the indirect labour generated in terms of man years is given in the following table (see appendix 1 for a discussion of methodology).

INDIRECT TERRITORIAL EMPLOYMENT
FROM PIPELINE CONSTRUCTION AND OPERATION
(man years)

	Pipelaying Period (19.75-79)	Compressor Construction (1979-82)	Full Capacity Operation (1983-99)
Total Indirect Labour	938	190	345
(a) Private Sector	408	80	138
(b) Government	530	110	207

[1]Derived from J. Palmer, Social Accounts for the North, Economic Staff Group, April 1973, p. 12)

The incremental income accruing to this indirect labour is estimated to be:

INCOME EFFECT OF INDIRECT NORTHERN PIPELINE EMPLOYMENT
(all figures $000 1973

Estimated Gross Incremental Income	Pipelaying period (1975-79)	Compressor Construction (1979-82)	Full Capacity Operation (1983-99)
Private Sector	2030	400	687
Government Sector	1596	330	623
Total Increase	3626	770	1310
Maximum @ 1.20%	4351	924	1572
Minimum @ 80%	2900	616	1048

Sources: See Appendix 1

An ever present danger with large one time construction projects is the threat of a "boom bust" cycle - a burst of short term economic activity with its accompanying high incomes and increased expectations followed by a sudden decline in economic activity and incomes and a substantial increase in unemployment. There are several factors which would appear to be safeguards against this occurring in the northern territories as a result of construction of a gas pipeline. Firstly, the disturbing effects on local communities (especially in the pipeline corridor) of

large influxes and outward movements of labour will be dampened as present plans call for most of the pipeline workers to reside in isolated self-contained construction camps along the pipeline right-of-way. Secondly, there appears to be a strong probability that the gas pipeline will be looped to expand its throughput capacity - if this occurs, there will be a more or less continuous construction program for several years. Thirdly, the present analysis only considers the gas pipeline in isolation. and does not consider the possibility of greatly increased exploration and development activity accompanying the construction of a gas pipeline or the construction of a major gas producing, collecting and purifying complex in the Mackenzie delta. The question of the impact of related petroleum developments and activities is discussed in Volume 2 of the MPS Impact Study and is not considered here.

If large fluctuations in employment such as those experienced recently by Alaska - where periods of high employment coincided with periods of high unemployment due largely to influxes of transient labour during periods of peak economic activity (see Alaska Pipeline Report, pp. 19-23) - are to be avoided, it would appear that some measures will have to be taken to discourage large influxes of transients to the northern territories

during the pipeline construction period. A possible solution would be to set up regional centers for hiring southern pipeline labour (to work in the northern territories) at, say, Vancouver, Calgary, Edmonton, and Winnipeg. Regional employment centers could be established in the northern territories as well but could be restricted in that only northerners would be allowed to apply at these centers.

III REVENUE FLOWS TO THE TERRITORIAL GOVERNMENTS

There are three areas in which the territorial governments could realize incremental revenues from pipeline activity, namely: property taxes on the pipeline and associated facilities, fuel taxes, and revenues from increased liquor sales. While some portion of these revenues will accrue during the operations stage, it was felt that the presentation would be improved if territorial government revenues during the construction and operations stages were discussed in one section rather than in separate sections, and this has been done here.

(a) Territorial Property Taxes

Both the Yukon and the Northwest Territories (NWT) will realize revenues from real property taxes on the pipeline itself, on the ancillary installations of the pipeline, and on any buildings or other real property the pipeline company may construct or acquire for its own use in the north. The final amount of property taxes collected will depend upon the assessment rates and the mill rates levied.

(i) Pipeline and Ancillary Installations

Current taxation ordinances for the two territories indicate initial assessment values of $103,200 per mile for 48" pipe in the N.W.T. and $141,290 per mile in the Yukon.[8] Using $940 million as the total value of the ancillary installations of the base case pipeline and

pro rating this on a mileage basis yields a value of $320.4 million for the N.W.T. portion and $57.3 million for the Yukon portion.[9] Using the 1967 Alberta Assessment Manual as a guide, these values are converted into initial assessments of $59.9 million for the N.W.T. and $10.7 million for the Yukon[10], both values subject to re-evaluation every six years.

Current basic rates are 15 mills in the N.W.T. and 26 mills for the Yukon although within the municipal tax areas (e.g. Whitehorse, Yellowknife), the effective mill rate is considerably higher to cover the cost of services provided. While the eventual mill rates applicable to a pipeline are unknown at present, there are indications that these will approach 0.03$/$ (30 mills) by 1978. Estimated tax flows to the two territories using current mill. rates as well as the expected higher future rates are shown in table 16. The present value calculations are:

TABLE 16

Territorial Taxes - Pipeline and Ancillary Installations

Yukon Territory

Period	Total Assessment[1] ($ millions)	Current Mill Rate	Annual[2] Revenues ($ millions)	Mill Rate	Annual Revenue ($ millic
1978-83	32.6	.026	0.85	.030	0.98
1984-89	23.8	.026	0.62	.030	0.71
1990-95	17.6	.026	0.46	.030	0.53
1996-99	12.7	.026	0.33	.030	0.38

Northwest Territories

Period	Total[1] Assessment ($ millions)	Current Mill Rate	Annual[2] Revenues ($ millions)	Mill Rate	Annual Revenue ($ millic
1978-83	152.8	.015	2.29	.030	4.58
1984-89	111.5	.015	1.67	.030	3.34
1990-95	82.5	.015	1.24	.030	2.48
1996-99	59.6	.015	0.89	.030	1.78

NOTES:

1. Total assessment for the Yukon computed at 155 miles of pipe at $141,290 per mile plus $10.7 million for the ancillary installations, and for the N.W.T. 900 miles of pipe at $103,200 per mile plus $59.9 million for the ancillary installations.

2. Assuming the pipe is to be allowed to depreciate over 20 years the Alberta Assessment Manual calls for assessments of 100%, "?3%, 54% and 39% of the initial assessed value to be levied for successive six year periods. The Assessment schedule for the ancillary installations depends on a large number of factors, and it is not possible to determine the assessment schedule without a detailed breakdown of the size and type composition of each installation. The approach taken here is to assign these facilities the same schedule as the pipe and lump these two components together as in the above table.

Present Value - Territorial Pipeline Taxes
($ millions 1973)

	6%	8%	10%
Yukon at 26 mills	5.9	4.7	3.8
N.W.T. at 15 mills	15.8	12.6	10.1
Yukon at 30 mills	6.8	5.4	4.3
N.W.T. at 30 mills	31.6	25.2	20.2

(ii) Pipeline Company Buildings

It is estimated that the pipeline company itself will require about $20.6 million of dwellings, office space, warehouses and other structures to directly service the needs of pipeline construction and operation in the northern territories.[11] Initial assessment values for buildings in the N.W.T. may be approximated by taking 35% of the construction cost, in this case $7.2 million. (direct pipeline company building requirements in the Yukon will be negligible, and assumed to be zero here). The eventual mill rates to be charged will be determined by the location of the buildings (e.g. inside or outside a given municipal tax area) as well as the cost of services provided. Based on existing mill rates in the N.W.T., a projection of an <u>average</u> mill rate of $0.050/$ by 1976 seems reasonable. The calculation of these taxes are

shown in table 17.

With respect to support facilities and infrastructure required for pipeline construction, such as warehouses, dwellings, sewer systems, etc., the 1972 Pipeline Guidelines (p. 30) state that the territorial governments shall receive Prior consideration concerning the disposal of all surplus facilities. It is not possible to confidently place a value on any future possible surplus facilities, as the final value will depend upon the extent to which the facilities have depreciated, how far they have to be moved, etc. If a major looping program was to follow the gas pipeline, it is possible that no surplus facilities would develop.

TABLE 17

N.W.T. Property Tax - Pipeline Buildings

Period	Assessed[1] Value ($ millions)	Mill Rate[2]	Annual Tax Revenues
19'76-81	"?.2	0.050	0.36
1982-87	6.4	0.050	0.32
1988-93	5.5	0.050	0.28
1.994-99	4.6 -	0.050	0.23

Notes

1. The Alberta Assessment Manual calls for a depreciation rate of 2% per year on a straight line basis for tax purposes, with the depreciation being computed on the basis of successive six year periods.

2. Some representative 1972 mill rates were: Inuvik 42 mills, Fort. Simpson 42.4 mills, and Norman Wells 46.5 mills.

Present Value - N.W.T Property Tax
($ millions 1973)

Discount Rate	Present Value
6%	3.3
8%	2.7
10%	2.2

(b) Territorial Fuel Taxes

It is estimated that the construction of the Yukon and Northwest Territories portion of the base case pipeline will require about 31 million gallons of fuel, one half of which will consist of diesel fuel, 20percentheating fuels, and the remainder aviation and automobile gasoline.[12] The two northern territories presently impose fuel taxes on the consumption of fuel as follows:

Fuel Taxes in Cents per Gallon

Fuel	N.W.T.	Yukon
Gasoline	4½	14
Diesel Fuel	15	14
Fuel Oil	3	14
Aviation Fuel	2½	2
Propane & Butane	2¼	14

Source; Territorial Fuei Tax Ordinances

Assuming that fuel will be consumed proportionally per mile of pipe construction indicates that roughly 85% of the 31 million gallons will be consumed in the N.W.T. and the other 15% in the Yukon. Using the current

territorial tax rates, and assuming that all fuel will be taxed at full rates, yields estimated tax revenues of $2,938,025 to the N.W. T. and $595,200 to the Yukon as shown in the following table:

	N. W. T.		YUKON	
Type of Fuel	Thousands of Gallons	Tax Revenues	Thousands of Gallons	Tax Revenues
Diesel	.L3,175-	$1,976,250	2,325	$325,500
Aviation Fuel	2,635	65,8 15	460	9,300
Gasoline	5,270	737,800	930	130,200
Heating Fuels	5,270	158,100	930	130,200
TOTALS	26,350	$2,938,025	4,650	$595,200

Assuming that these tax revenues accrue to the territorial governments evenly over the three year period 1976-1978 the present value calculations are: [13].

Present Value Fuel Taxes
(millions 1973 dollars)

	Discount Rate		
	6%	8%	10%
Yukon	0.458	0.421	0.388
N.W.T.	3.031	2.787	2.567

Direct fuel requirements for the operations stage of a pipeline (e.g. fuel for surveillance aeroplanes, etc.) are unknown at present, and therefore no estimate of fuel tax revenues has been made for this period.

(c) Increased Territorial Liquor Revenues

A possible source of increased revenues to the territorial governments would be revenues realized from additional sales of alcoholic beverages as a result of pipeline activity. The amount of additional revenue realized will be determined by such factors as:

- will the construction camps be wet, dry or "moist"? - the latter refers to putting a daily limit on. alcoholic consumption at the construction camps, and
- will the imported labour working on the pipeline visit communities in the northern territories on their days off and holidays? - this seems unlikely as a 7 day work-week will probably be standard during the construction period, and imported labour will likely be flown to destinations such as Edmonton for time off.

If the construction camps are dry, as is the case on Alaska's North Slope,[14] and imported labour is 'restrained from visiting small local communities in the northern territories, which appears likely to be the prevailing

government policy, then there will be little or no direct impact on territorial liquor profits from the construction stage of a gas pipeline. It is recognized that increased exploration and development for oil and gas and other types of activity in the north induced by a pipeline could have an impact on the territorial liquor revenues; however, as an estimation of induced activities is not a part of this study, these possible revenues have not been considered in the analysis.[15] In light of the preceding comments and given the federal and territorial governments desire to limit the social disturbance aspects of northern pipeline activity (as spelled out in the 1972 Pipeline Guidelines pp. 25-30), it is estimated that the impact on territorial liquor revenues from the construction and operation of a gas pipeline will be minimal and therefore no allowance has been made for these possible revenue flows here.

FOOTNOTES

1. Given the widespread implications of a future Mackenzie Valley gas pipeline on the entire Canadian economy, to do a satisfactory cost benefit analysis would be a major undertaking. An analysis which only considered benefits and costs from the point of view of the northern territories (it is sometimes difficult to accurately account for costs to the northern territories given the present reliance on federal operating grants to meet territorial expenditure deficits - i.e. a 'cost" to the territories may ultimately be a cost to Canada) would ignore benefits and costs to the rest of Canada. The basic problem with this approach is that a benefit (cost) to either or both of the northern territories from a gas pipeline may be offset or more than offset by a cost (benefit) to the rest of Canada, or vice versa. For example, a "benefit" to the northern territories such as increased labour incomes could be offset by large costs to the rest of the Canadian economy (eg. appreciation of the Canadian dollar and the resulting unfavorable impact on export and import - competing industries, higher gas prices paid by Canadian consumers due to the high cost of Arctic gas, etc.). Similarly, "benefits" to Canada (eg. royalty revenues from gas production) may be offset by considerable costs to the northern territories in the form of social problems, environmental damage, attenuation of native culture, etc.

   From whose point of view should we consider the benefits and costs? A partial list of the interested parties is: the gas producers, native peoples, environmentalists , Canadian "nationalists", the different domestic industrial, commercial and residential gas consumers, foreign gas consumers, the-pipeline company, and the federal, territorial, and provincial governments. If the total benefits and costs to Canada could be identified, then a political decision would be required in order to attach some weighting scheme (eg. a $1 benefit to a native northerner is equivalent to a $5 benefit to an Ontario resident, etc.) in order that some comprehensive ordering of objectives could be arrived at. Without this, one would always face the danger that any final pipeline

'scenario could prove objectionable to some "strong coalition of interest groups, each feeling slighted in its own area of concern.

Strictly speaking, benefit cost analysis would be inappropriate as an analytical tool for evaluating a pipeline because benefit-cost analysis implicity assumes the existence of alternate (similar) investments against which a pipeline could be evaluated. Also, benefit-cost analysis is only appropriate where the project in question is small enough relative to the overall economy that the project itself will have no significant effect on relative price levels, exchange rates, and other macroeconomic 'variables in the economy which is obviously not true for a Mackenzie gas pipeline. Otherwise, a general equilibrium type of analysis (eg. Candide Model) is more appropriate.

A good discussion of the issues and points of view to be considered in evaluating whether or not a gas pipeline would be beneficial to Canada is contained in: M. Moore, "Problems of Optimal Management of Arctic Oil and Gas", a paper presented to the Canadian Arctic Resources Committee seminar, Ottawa, March 22, 1973.

2. MPS Associates Ltd. "Regional Impact of a Northern Gas Pipeline", Volume 2, Chapter 1. It is realized that some of the assumptions of the base case analysis (eg. the routing to Emerson) may differ somewhat from recent announcements by the Canadian Gas Arctic Study Group. However, with respect to that portion of the proposed pipeline from the Alaska/Yukon border to the Alberta/N.W.T. border, the present base case may be viewed as being a good representation of the proposed route based on recent announcements by the gas consortium. The base case analysis in this paper draws on the base case presented in the MPS Impact Study which was completed in 1972 and based on information received from the various pipeline consortia in 1971. It must be noted that many aspects of the (proposed) gas pipeline are still being studied by the gas consortium, and the overall parameters are liable to be subject to many changes before a final pipeline scenario is determined. If, as seems unlikely, the eventual pipeline differs substantially from the base case pipeline as presented here, then the methodology in this paper can easily be adapted to the new pipeline scenario.

The base case analysis here is confined to an analysis of a gas pipeline and directly related facilities. Other developments such as the construction of a major gas producing, collecting and purifying complex in the Mackenzie delta are not considered.

Present indications are that a gas pipeline (once built) will be subject to continuous expansion and upgrading programs (see for example the Globe and Mail Feb. 20, 1973 P.B. 5) in order to accommodate increased throughput volumes. However, revenue streams as calculated in this paper are based on the assumption that the base case pipeline will not be expanded in future years. This alternative was chosen because there are too many uncertainties involved with the continual expansion case in order to derive a plausible "base case" for analysis. For example, whole the pipeline may be looped in order to increase throughput capacity, it is not possible to state with any degree of certainty what the timing and magnitude of the looping construction program would be.

3. A research organization formed and financed by several private companies to examine the social, economic and environmental costs of constructing and operating a large diameter gas pipeline down the Mackenzie Valley. Some of the 25 members are: Alberta Gas Trunk Lines Co. Ltd., C.N.R., Imperial Oil Ltd., Gulf Oil Ltd., Trans-Canada Pipelines Limited, Atlantic Richfield Company and the Standard Oil Company (Ohio).

4. Financial Post, February 3, 1973.

5. See speech by W. Wilder, Chairman of Canadian Arctic Gas Study Limited to the Ad Hoc Committee on U.S. Canada Energy Supply of the National Association Of Regulatory Utility Commissioners, Washington, D.C., February 27, 1973.

6. The demand analysis for labour in this paper is based on a definition of a man year as being equivalent to 1600 hours per year (see p. 2-27, Volume 7 MPS Impact Study) and this may be too high an estimate for direct pipeline construction labour (see table 1 first activity group). It appears likely that the pipeline construction itself will be done over a 4 month winter period. Using a 12 hour day and 7 day week and a standard working schedule of 4 weeks on and 2 weeks

off during construction, yields a work year of 1008 hours (84 hours/week x 12 weeks). This could be increased to the extent that northern labour was willing and/or able to work on southern sections of the line during the summer construction seasons. However, as both the eventual length of the "man year" during the pipeline construction period (and this is complicated by the fact that a man year is likely to differ across occupational groups) and the extent to which northern labour will take advantage of (temporary) employment opportunities south of 600 are unknown at present, the present man year definition of 1600 hours has been retained. The longer work period of 1600 hours per year as a definition of a man year seems reasonable for the other categories of labour.

7. The time distribution of the additional labour income is not important as the results are all in the form of constant (1973) dollars.

8. N.W.T. Amendment to Municipal Ordinance, June, 1972 schedule C, and Yukon Territory Taxation ordinance 1972 schedule III A. It must be noted that these ordinances could be changed in future years.

9. The total construction expenditure in 1973 dollars including interest and finance charges for the base case pipeline is estimated to be $4.7 billion. The pipeline itself is estimated to be 80% of-the 'total capital cost, and the ancillary installations 20%. Preceding information is based on discussions with officials of the National Energy Board.

10. Both the northern territories use the Government of the Province of Alberta Assessment Manual 1967 First Edition (and amendments thereto) for the valuation of improvements for taxation purposes. To arrive at the ancillary installation assessment, the first step is to convert to 1963 costs in Alberta by taking 40% of the total capital value. The next step is to subtract 30% (from the 40% figure) to allow for higher costs in the north. Finally, the initial assessment value is computed as 66 2/3% of the assessment corrected for higher northern costs.

11. MPS Associates Ltd., op. cit., Volume 7, p. 3-26. The MPS reference gives an estimate of $15.4 million in 1970 dollars and this has been converted to 1976. dollars by arbitrarily compounding by 5% per year.

12.- MPS Impact Study. Volume 7, p. 3-33

13. To avoid double taxation on fuel purchases (e.g. purchasing fuel in Alberta for consumption in the N.W.T., paying the provincial tax and then paying the N.W.T. fuel tax), agreements exist between the two northern territories and various provinces whereby the fuel purchaser pays both the provincial and territorial taxes, and then makes an application to the province concerned for a rebate of the provincial tax.

14. D.J. Chasan, The Alaskan Oil Boom, New York and London, Praeger, 1971, p. 30

15. Of course, any increased territorial revenues from liquor sales as a result of pipeline activity could possibly be offset by various undesirable social costs. For a discussion of the sociological implications of pipeline activities see MPS Impact Study, esp. volumes 4 and 6.

REFERENCES

Alaskan Pipeline Report, Tussing, A., Rogers, G., and Fischer V. A study prepared for the U.S. Department of the Interior by the Institute of Social Economic and Government Research, University of Alaska, 1971.

Chasan, D.J. The Alaskan Oil Boom. praeger, New York and London, 1971.

Expanded Guidelines for Northern Pipelines, Tabled in the House of Commons, June 28, 1972.

Manders, P. An Evaluation of Federal and Territorial Revenue Streams Accruing from a Mackenzie Valley Gas Pipeline. A paper prepared for the Quantitative Analysis Course, April, 1973.

Territorial Impact of Northern Pipelines, A seven volume study done for the Department of Indian Affairs and Northern Development by MPS Associates Ltd., Winnipeg, 1972.

Weinrich, J.E., Economic Impact of the Canadian Gas Industry Local, Provincial and Regional. A study done for the Calgary Chamber of Commerce, 1966.

APPENDICES

1. THE DEMAND FOR LABOUR ANALYSIS

2. LABOUR SUPPLY AND PROJECTIONS METHODOLOGY

APPENDIX 1

THE DEMAND FOR LABOUR ANALYSIS

APPENDIX 1

THE DEMAND FOR LABOUR ANALYSIS

The purpose of this appendix is to estimate the direct and indirect demand for labour created by the construction and operation of a major gas pipeline in and through the northern territories. The analysis considers the aggregate demand for labour under five broad types of activity as well as a more detailed occupational breakdown. Two distinct periods are considered: (1) 1975-82, the construction and build up to capacity throughput period, and (2) 1983-99, the first 17 years of the capacity operation of the pipeline.

Direct Demand for Labour

Table 1 shows the estimated (aggregate) direct labour requirements in terms of man years under five broad types of activity for a Mackenzie Valley gas pipeline from 1975-83. This table has been adapted from the MPS Impact Study although some changes have been made. Firstly, the demand for labour ascalculated in the MPS Impact Study is computed on a base case pipeline which does not include a branch line to the MacKenzie delta. However, the Canadian Gas Arctic Study Group Ltd. proposed gas pipeline includes a branch line to the delta (".... to make the transportation of northern gas economically viable . . ..we need the gas resources of both the North Slope of Alaska and the Mackenzie delta." speech by W. Wilder to N.W.T. Legislative Council, June 12, 1973), and

it seems certain that a major gas pipeline will include a branch line to tap the Mackenzie delta reserves. Therefore the MPS calculations of labour demand have been increased by approximately 13% to allow for inclusion of a branch line to the Mackenzie delta (the branch line is estimated to be 120 miles long, or roughly 13% of the 935 miles of trunk pipeline estimated to be laid in the two northern territories - see p. 2-13, volume 2 - MPS Impact Study).

A second change concerned the estimated demand for operation and maintenance labour (the fifth broad type of labour - see table 1). The analysis in the MPS Study shows the direct demand for operation and maintenance type labour as being 105 man years from 1979 to 1982 inclusive and then suddenly increasing to 197 man years in 1983 - the first year of the assumed capacity operation. In order to allow for a somewhat smoother growth in the demand for operation and maintenance labour to the year 1983, and this seems reasonable given the gradual increase in capacity assumed in the MPS study and the present analysis, this analysis (arbitrarily) assumes that. the demand for this type of labour will grow by 10% per annum from 1979 to 1982 inclusive. This resulted in an additional demand of 76 man years of labour being generated during the build up to capacity throughput period as follows:

TABLE 1

LABOUR REQUIREMENTS FOR A MACKENZIE VALLEY GAS PIPELINE
(MAN YEARS)

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Pipeline Construction		3,913	5,390	5,390	2,471				
Compressor Station and Facility Construction	-		380	760	1,156	641	446	446	
Operation of Construction Camps	26	526	764	808	477	92	67	67	
Off Site Transportation Plus Material Handling	300	426	467	374	59	59	59	54	
Operation and Maintenance	-	-			118	130	143	157	222
Total Direct Labour Required	326	4,865	7,001	7,332	4,281	922	715	724	222
Minimum Estimate @ 80%	261	3,892	5,601	5,866	3,425	738	521	493	178
Maximum Estimate @ 120%	391	5,838	8,401	8,798	5,137	1,106	859	877	266

Source: Adapted from table 9, p. 57, volume 1 of the MPS Study Regional Impact of a Northern Gas Pipeline, according to methodology in Appendix 1.

Year	MPS Figures (Man Years)	MPS Figures -Corrected for Branch Line to Mackenzie Delta	Column 3 Corrected to Allow for Average 10% Annual Growth	Column 4 - Column 3 (Man years)
1979	105	118	118	0
1980	105	118	130	12
1981	105	118	143	25
1982	105	118	157	39
Total				76

The corrected" results were incorporated into Table 1.

Table 2 illustrates the total demand by occupational breakdown for those skills that it is estimated could be filled by northern residents. Similarly to table 1, the MPS results have been upgraded to allow for the inclusion of a branch line to the Mackenzie delta in the base case analysis .

The analysis here uses the MPS study demand estimates as a starting point with certain adjustments as discussed previously. The total demand for direct pipeline labour was analyzed in the MPS Impact Study (Vol. 7 chapters 2-2 and 2-3, and Vol. 2, pp. 2-12 to 2-27 and pp. 3-30 to 3-37) in terms of 36 predominant occupations. An assessment was made of the 36 occupations separating (1) the proportion of each occupation which would have to be imported due to previous pipeline experience being required, and (2) the proportion

TABLE 2

POTENTIAL PIPELINE DEMAND FOR GENERAL SKILLS
THAT COULD BE FILLED BY NORTHERN LABOUR FORCE

	Occupation	Total Man Years Required Construction Period	Total Man Years Required operations period
1.	Administrative Trainee	267	
2.	Carpenter	565	1 3 4
3.	Carpenters Apprentice	291	
4.	Cooks Helper	808	
5.	Drivers (Trucks & Bus)	2,413	134
6.	Electricians Apprentice	291	
7.	Engineers (Prof.)	153	172,
8.	Foreman	689	172
9.	Labour	6,416	480
10.	Mechanics	4s5	249
11.	Mechanics Helper	501	
12.	Millwright	781	
13.	Oilers	497	
14.	Office Assistants	273	326
15.	Plumbers Apprentice	287	
16.	Principal Operators	3,319	269
17.	Surveyors Assistant	210	
18.	Technicians	448	921
19.	Welders	2,159	211
20.	Welders Helpers	2,325	
21.	Other Occupations "	1,929	710
	Totals	25,094	3,778

Source: Adapted from MPS Impact Study Volume 7, p. 2-26, as described in text

which could be hired from the Territories assuming adequate available supply. The 20 occupations as" shown in table 2 are estimated to be those occupations which for the most part require general skills and in which after relatively short job familiarization and training the average qualified worker could easily be employed in the construction or operation and maintenance of a gas pipeline.

The construction period as shown in table 2 is an overall construction period (1975-82) and encompasses the pipelaying construction period including installation of initial pumping capacity and the period required for further installation of compressor stations to bring the pipeline to the full capacity throughput level of operations (end of 1982). Table 2 shows that by far the greatest demand for labour will occur during the construction phase, with an estimated demand of roughly 25,000 man years being required over an 8 year construction period (1975-82), and less than 4,000 man years being required over a 17 year operations period.

Table 3 shows table 2 broken down in terms of "profile years", where a profile year shows the expected demand for a given occupational type during a typical or average year for a given period. Referring to table 3, it can be seen that there is expected to be a demand for 81 (6) administrative

TABLE 3

TOTAL LABOUR DEMAND BY MAJOR OCCUPATIONS
THAT COULD BE FILLED BY NORTHERN RESIDENTS

occupation	Period of Mayor Pipeline Construction Profile Year 1977-78	Build up to Capacity Throughput Period - Profile Year 1980	Capacity Operations Profile Year 1983
1. Administrative Trainee	81	6	
2. Carpenter	131,	43	8
3. Carpenters Apprentice	53	33	
4. Cooks Helper	243	20	
5. Drivers (Trucks & Bus)	795	7	8
6. Electricians Apprentice	53	33	
7. Engineers (Prof.)	36	11	10
8. Foreman	204	19	10
9. Labour	1,883	192	28
10. Mechanics	151	8	15
11. Mechanics Helper	167		
12. Millwright	143	88	
13. Oilers	166		
14. Office Assistants	71	15	19
15. Plumbers Apprentice	53	32	
16. Principal Operators	1,037	52	16
17. Surveyors Assistant	70		
18. Technicians	83	50	54
19. Welders	711	7	**12**
20. Welders Helpers	775		
21. Other Occupations	469	130	**42**
Total Labour Required	**7,375**	746	222

Source: Adapted from MPS Impact Study, Volume 7, p. 2-26, as described in text.

trainees per year on average during the 3 year (4 year) construction period (build up to capacity throughput period). The total estimated demand for administrative trainees during the overall construction period is therefore 267 (3 x 81 + 4 x 6) which checks with table 2. It must be noted that the construction period itself is not likely to be 3 years of evenly spaced effort, however, the total demand for labour during the construction period can be taken to be equal to 3 times the profile years demand. Table 1 shows that the bulk of the demand for labour during the construction period is estimated to occur during the calendar years 1977 and 1978.

The basic use of the profile year schema is as a check on how the expected demand for a given type of labour compares with the estimated actual supply or actual estimated employment on the pipeline which is presented on a yearly basis. Care had to be taken that the actual supply of labour (the actual estimated employment on the pipeline) as calculated using the participation rate methodology (see pp. 24-26 of text) did not exceed the estimated demand as shown in table 3, and the profile year format was used to check this. If the estimated actual supply did exceed the demand, than a pro rata adjustment was made as explained in the text.

For purposes of calculating net labour income generated due to pipeline employment, the time distribution of the demand for labour is not important. For example, it does not matter if the 243 administrative trainees required during the construction period are distributed 61 per year from 1975-78, or 33 for the first year and 70 each year for the last 3 years. The reason for this is that the incremental income calculations, which show the difference in income between pipeline and non-pipeline employment earnings, are computed in terms of constant 1973 dollars - hence there is no discounting problem. The additional 76 man years of labour generated by assuming an annual 10% growth in operation and maintenance labour referred to previously, were distributed across column 2 in table 3 on a proportional basis -- only 19 man years were distributed as the profile year results in column 3 of table 3 represent one quarter of the total demand during the build up to capacity period.

Indirect Demand for Labour

In addition to the direct demand for labour, a demand for indirect labour will be included both in the public and private sectors as a result of the construction and operation of a gas pipeline. The indirect demand for labour in the MPS study was estimated to be (volume 7 P" 3-9) :

INDIRECT TERRITORIAL
EMPLOYMENT FROM PIPELINE
CONSTRUCTION AND OPERATION

(Man-years)

	Pipelaying Period	Compressor Construction	Capacity Operation
	(1975-79)	(1980-83)	(1984-95)
Total Indirect Labour	1,150	260	300
(a) - Private	500	110	120
(b) - Government	650	150	180

The MPS analysis of indirect labour requirements - with several changes as noted following - was accepted as a starting point mainly due to a lack of time to develop an independent estimate. Part 3 of volume 2 and volume 4 of the MPS analysis contain an appraisal of the indirect employment in the Territory and particularly in the impact communities which would be required,

The MPS results of indirect employment in terms of man years indicated above were converted to the table following by comparing the MPS estimates of direct labour employment for each period with the present study's estimates. For example, the MPS study (vol. 7, p. 3-3) estimates total direct territorial employment labour during the construction period to be 3712 man years while the present analysis (table 8, p. 27 in text) estimates a total of 3027 man years.

'Therefore, the MPS results for the construction period were corrected by a factor of 0.8155 (3027 divided by 3712) .

INDIRECT TERRITORIAL EMPLOYMENT
FROM PIPELINE CONSTRUCTION AND OPERATION
(man years)

	Pipelaying Period (1975-79)	Compressor Construction (1979-82)	Full Capacity Operation (1983-99)
Total Indirect Labour	938	190	345
(a) Private Sector	408	80	138
(b) Government	530	110	207

The estimated income effect of indirect territorial employment (p. 3-10 volume 7) was corrected by the appropriate -factors to allow for the different direct employment estimates as indicated above, and then corrected by a factor of 1.1576 "to convert to 1973 dollars (5% per annum compounded annually 1970-73) .

Appendix 2

LABOUR SUPPLY AND PROJECTIONS

METHODOLOGY

APPENDIX 2

LABOUR SUPPLY AND PROJECTIONS
METHODOLOGY

Data used to estimate the future supply of labour from the northern territories available for pipeline construction and operation were obtained from three sources. The primary source was the study The Regional Impact of a Northern Gas Pipeline.[1/] Other sources were the D.I.A.N.D. Northern Manpower Survey Program[2/] and the 1971 Census of Canada.

The M.P.S. - D.I.A.N.D. Regional Impact Study concentrated essentially on pipeline activities within the N.W.T. Consequently, the labour supply projections pertaining to potential employment opportunities for northern residents contained within that study applied only to the N.W.T., and only minor consideration was given to the resident labour force of the Yukon as a potential source of pipeline workers. The source study also gave the N.W.T. resident potential labour supply only in terms of the male labour force, no analysis being made of the possible participation by members of the female labour force in pipeline construction and operation activities. For purposes of the present report, however, it

---

1/ Regional Impact of a Northern Gas Pipeline, Vol. 6, 7, Economic Staff Group, D.I.A.N.D., Ottawa and M.P.S. Ltd., Winnipeg, November 1972.

2/ The Mackenzie Manpower Survey, November, 1970; Yukon Indian Manpower Survey, November, 1971.

was regarded as important to consider both the Yukon. male resident labour force and the female labour force component of both territories as part of the total potential supply of pipeline labour.

The M.P.S. study dealt with potential resident labour supply from the N.W.T. in detail in terms of three profile years, 1977/78, 1981 and 1985. For the present study, however, the profile years established were 1977, 1980 and' 1983. These changes are due to slightly changed assumptions concerning the pipeline construction schedule, etc. To incorporate the added elements of the potential labour force supply and to calculate the potential resident labour supply on the basis of the three different profile years required the development of a methodology for augmen-ting the estimates presented in the M.P.S. study. The steps . taken were:

1. Establish the makeup of the N.W.T. female labour force, by Indigene and Other, for the base year 1970 and project for the selected profile years; then establish the potential female labour supply in terms of the selected pipeline-related occupations,

   i.e., those regarded as being the ones most likely to give northern. residents employment opportunities.

2. Establish the composition and size of the Yukon population and labour force for the base year 1970, by sex and ethnic origin (Indigene and Other) and project for the profile years.

3. Establish the occupational breakdown of the Yukon potential labour supply as per the selected pipeline-related occupations, and project these results for the-profile years mentioned above.

N.W.T. Potential Female Labour Supply

The methodology used for establishing the 1970 base population and labour force data in the M.P.S. - D.I.A.N.D. Regional Impact Study is set out in detail in that report.[1/] As the methods used for projection of the potential male labour supply were regarded as being reasonable, and as the 1970 base data for the female population and labour force were available from that study, for the purpose of the present report, it was necessary only to establish the occupational break-down for females by the pipeline-related occupations in the various regions of the N.W.T. for 1970, and project from t-here (see below).

Yukon Potential Labour Supply

The only relatively current sources of information on the population and labour force of the Yukon are the preliminary

---

1/ Volume 7, Appendix 1, Regional Impact of a Northern Gas Pipeline, D I A N D - M.P.S.

results of the 1971 Census of Canada and the D.I.A.N.D. Yukon Indian Manpower Survey. The available census information provided data on the total population, by sex, and on the total active working age population (15 to. 64 years of age) by sex. The Yukon Indian Manpower Survey provided information on the Indian and Métis population of the Yukon as of November, 1971. It is estimated that the latter survey covered approximately 85 per cent of the Yukon indigene population.

Two assumptions were made: (1) that the Yukon Indian Manpower Survey covered 85 per cent of the Yukon native resident population; (2) that the composition of the Yukon "other'" (non-native) population was similar to that of the Other population group resident in the Mackenzie District of the N.W.T. The latter assumption was made with respect to the proportion of the total population formed by the labour force; the relative proportions of males and females; and the percentage of the labour force formed by each pipeline-specific occupation.

The Yukon native resident population figures. were increased by roughly 18 per cent to include the entire population. Subtracting that total figure from the total Yukon population as shown by the preliminary 1971 census information gave the total population figures for the two groups for 1971. The numbers of native residents in the

specific pipeline-related occupations as of 1970 were obtained directly from the Yukon Indian Manpower Survey. The numbers of Others in the specific occupations as of 1970 were derived by determining what proportion of the labour force the numbers in each occupation formed, for males and females, in the Mackenzie District, and than applying these percentages to the labour force of the Yukon Other population group as established for 1970.

Projections - Potential Pipeline Labour Supply

The methods of projection used for the N.W.T. population and labour force in the D.I.A.N.D. - M.P.S. regional impact study are detailed in Volume 7, Appendix 1. Summarizing briefly, the method was one of establishing first the total population; then the adult population (14 years and over); the active working age population (15-64 years); and finally the labour force (a portion of the active working age population). Various rates were developed for projecting different segments of the population, according to whether males or females, Indigenes or Others, and according to the region of the N.W.T., i.e., the pipeline corridor, the rest of the Mackenzie District, the rest of the N.W.T. Projections were developed on a year by year basis up to 1985 for the total N.W.T. population; on a year by year basis for the males for active working age population and labour force.

Projections for the occupations specific to pipeline work were made by establishing each occupation's percentage of the labour force, then applying the percentages to the labour force projections for the profile years used in the M.P.S. study.

For the present study, the female components of the various parts of the N.W.T. population, i.e., active working age and labour force populations, were first established and projected for each N.W.T. region according to methods used in the M.P.S. study. Data on the numbers of females having pipeline-specific occupations were obtained for Indigenes from the manpower survey; for Others in the Mackenzie District from the Mackenzie manpower survey; for others in the rest of the N.W.T. percentages established for the Mackenzie were taken on the estimated female labour force of the remainder of the N.W.T. For the Yukon Other population group (once the basic population components were worked out) projections were made on the basis of factors used to project the Other population of the Mackenzie District. Occupations were arrived at by applying the percentages obtained in the Mackenzie District Other population. For the Yukon native population, the necessary base data were available from the Yukon Indian Manpower Survey; projections were made according to factors used in the M.P.S. study for the native population of the Mackenzie pipeline corridor.

In electing to use profile years differing from those used in the N.W.T. regional impact study by M.P.S. - D.I.A.N.D., it was decided to use a somewhat different method of projecting the potential supply of labour in terms of persons having pipeline-specific occupations. For both Indigenes and Others in the Yukon and Northwest Territories, the potential pipeline labour supply by occupation for the profile years 1977, 1980 and 1983 (Tables 5, 6, 7, text pp. 20-22) was arrived at by first establishing the straight rate of increase of the labour force by region from the base year 1970 to each profile year. The rate of increase of the labour force was then applied to the numbers shown in each occupation for the base year 1970 (Table 4, above p. 19) for each profile year. Thus, the assumption was made that the potential supply of persons in each occupation in any given profile year would increase at the same rate as the labour force.