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The Slave Geologic Province

Transportation and Economic Development: Summary Report

November 2001

WHAT'S INSIDE

The purpose of this study is to assess the impact of investment in transportation infrastructure in the Slave Geologic Province.

The study is divided into four phases: Scenario Development; Benefit-Cost Analysis; Economic Impact Analysis; and Taxation Revenue and Fiscal Impact Analysis.

Each phase considers separate aspects of the potential aspects of three proposed development scenarios and a base case scenario.

This report summarises the methodology and results of the four individual studies.

The Conference Board of Canada

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The Conference Board of Canada is an independent, not-for-profit research organization with affiliates in the United States and Europe. Our mission is to help our members anticipate and respond to the increasingly changing global economy. We do this through the development and exchange of knowledge about organizational strategies and practices, emerging economic and social trends and key public policy issues. Since 1954, the Board has been committed to researching innovative practices, designing new strategies and providing our members with the most up-to-date information, analysis and expertise to help them excel in Canada and around the world.

ABOUT THE ECONOMIC SERVICES GROUP

The Economic Services Group is a research division at The Conference Board of Canada. The Group's purpose is to address the specific information requirements of the Conference Board's Associates by conducting financed research. Services include customized economic forecasting at the municipal, provincial, and national levels; economic impact analysis; custom-tailored econometric models; consumer and business attitudes surveys; and analysis of the economic implications of changes in public policy.

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Executive Summary

- This study examines the economic and other impacts of potential investments in transportation infrastructure in the Slave Geologic Province over a 20-year period. The study was developed by the Conference Board of Canada and the Government of the Northwest Territories and comprises four separate phases.
- Given the highly uncertain nature of possible economic developments in the Slave Geologic Province, a base case and three development scenarios were designed to embrace a broad range of potential future outcomes. The economic and other impacts of investments in transportation infrastructure were examined in the context of these scenarios.
- The first phase of this study describes how the base case and scenarios were developed. With the exception of the base case, each scenario involves investment in a transportation corridor through the Slave Geological Province, construction of a deepwater port on the Arctic coast and development of various mineral deposits (see Exhibit 1).
- Mineral development ranges from the inclusion of five diamond mines and a gold mine, in the base case, to seven diamond mines, a gold mine and three new base-metal mines in Scenario 3, the scenario with the highest and most rapid degree of investment in transportation infrastructure.
- The second phase of the study compares the incremental discounted economic costs and benefits of the three development scenarios with those of the base case. This phase also analyses the unquantified impacts of each scenario.
- This benefit-cost analysis shows that, for each of the development scenarios, the costs outweigh the benefits. Nonetheless, the magnitudes of these losses are not unduly large. However, these results should be further considered in the context of unquantified environmental costs and economic multiplier benefits.
- The third phase of the study examines the broader economic impacts, in terms of Gross Domestic Product (GDP) and employment, generated across Canada as a result of the investments in transportation infrastructure and mineral developments.
- The study indicates that the proposed investments in transportation infrastructure and mines represent a significant increase in the level of economic activity in the Northwest Territories and Nunavut. The rest of Canada would also benefit from these investments, in particular Alberta, Ontario and British Columbia.
- The fourth phase of the study quantifies the taxation revenue increases generated for federal, provincial/territorial and municipal governments as a result of the economic impacts described in the third phase. It also analyses the implications of these additional revenues for the level of fiscal transfers between the federal government and the Government of the Northwest Territories.
- The analysis shows that the development scenarios would generate sizeable extra taxation revenues in the Northwest Territories and Nunavut. Existing fiscal agreements, however, mean that 80 per cent of these revenues go to the federal

government. Governments in other parts of Canada also benefit from higher taxation revenues.

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Exhibit 1

Source: Northwest Territories Department of Transportation

Glossary of Terms

All-Weather Road	A road constructed with a loose or stabilized gravel surface open to two-way traffic year-round.
Benefit-Cost Ratio	A measure of economic worth composed of the present value of benefits of a project in the numerator and the present value of costs of the project in the denominator.
Constant Dollars	Dollar values that are adjusted for inflation (i.e., the effects of inflation have been netted out).
Direct Economic Impacts	The economic impacts associated with the direct expenditures or output of a project.
Discount Rate	The interest rate to be used in present value calculations.
Gross Domestic Product (GDP)	A measure of the total value of goods and services produced by the economy over a specified time period (usually one year).
Indirect Economic Impacts	The economic impact associated with expenditures made by firms and government agencies that produce goods and services that are consumed by a project.
Induced Economic Impacts	The economic impacts associated with the spending of labour income from both the direct and indirect economic expenditures on a project.
Multiplier	The ratio of the total economic impacts associated with a project to the initial expenditures on the project.
Internal Rate of Return (IRR)	A measure of economic worth which defines the discount rate which is required so that the Net Present Value of a project is exactly equal to zero.
Net Present Value (NPV)	A measure of economic worth which is defined as the present value of a project's benefits less the present value of a project's costs.
Winter Road	A road constructed annually on ice over water bodies and/or compacted snow over frozen terrain. Commonly open to traffic from early January until late March.

1 Introduction

Over the past 10 years, the Conference Board has undertaken a number of studies on transportation-related issues in the Northwest Territories. These studies examined various aspects of the transportation infrastructure and economic development in the Slave Geologic Province. A number of options have been examined to date as part of the government's overall transportation strategy. One option being assessed is a transportation corridor through the Slave Geologic Province and a port situated on the Arctic coast in the Nunavut Territory.

As well as lowering operating costs and improving safety, making improvements to existing transportation infrastructure or the construction of new transportation infrastructure may also stimulate economic development. The Northwest Territories has rich sources of both non-renewable and renewable resources but, in many cases, lacks the transportation infrastructure necessary to make these resources viable, a problem exacerbated by great distances and lack of proximity to major markets. However, the development of new or improving existing transportation infrastructure can also have significant social and environmental impacts. Thus, it is important to critically examine all of the impacts of proposed investments in transportation infrastructure before proceeding.

The current study is an assessment of transportation and economic development in the Slave Geologic Province. The study comprises four phases as follows:

1. Scenario Development;
2. Benefit Cost Analysis;
3. Economic Impact Analysis; and
4. Taxation Revenue and Fiscal Impact Analysis.

This report summarises the methodology and results of each of the four individual reports. The first phase describes the exercise used to produce a base case and three development scenarios. The second phase describes the economic costs and benefits of the three development scenarios together with an analysis of the unquantified impacts. The third phase describes, in terms of GDP and employment, the broader economic impacts of the development scenarios not only in the Northwest Territories and Nunavut but also the rest of Canada. The fourth phase examines the taxation revenue implications of these broader economic impacts together with an assessment of the fiscal implications for the level of transfers between the federal government and the Government of the Northwest Territories.

Several departments of the Government of the Northwest Territories conducted analyses and contributed data and other information to this study. They include the Department of Transportation, the Department of Resources, Wildlife and Economic Development and the Bureau of Statistics. The Conference Board assisted in the development of the scenarios, completed the economic and other analyses and compiled the various reports.

2 Scenario Development

2.1 Approach and Methodology

2.1.1 Overview

In the initial phase of this study the Government of the Northwest Territories developed, with the assistance of The Conference Board of Canada, several distinct development scenarios for the Slave Geologic Province for the 20-year period of 2001-2020. While the scenarios were developed to embrace a wide range of possible outcomes, the uncertainty associated with this forecasting exercise is acknowledged and it should be noted that the scenarios do not seek to forecast actual future events.

Underlying each scenario is an assumed level of investment in transportation infrastructure composed of possible investments in new roads and a deepwater port on the Arctic coast. These investments are assumed to spur mining and other developments as well as having other economic and non-economic impacts. These impacts of the investments in transportation and mine development were examined in the subsequent phases of the study.

2.1.2 Methodology

The first step taken in producing the development scenarios was to define a range of possible transportation infrastructure investments. These alternatives range from no new investment in transportation to a permanent, gravel-surfaced, all-weather road over the entire route from Yellowknife to a proposed new port on the Arctic coast. At present, there is a winter road from Yellowknife to the Lupin gold mine which is used to re-supply existing mines and in exploration and sampling work. The construction of a deepwater port on the Arctic Coast is common to all scenarios except the base case. The port would be used to re-supply mines such as the Izok Lake base-metal mine and the Lupin gold mine. The port would also be used to ship base-metal concentrate from the Izok Lake and other base-metal mines to markets in Europe and the Pacific Rim. In addition, the port facility may be used to supply nearby coastal communities.

The next step was to determine what level of mineral and other economic activity would be generated by these investments in transportation infrastructure. These potential activities comprised the economic development components of the base case and other scenarios.

In general new transportation infrastructure was assumed to have three main potential impacts on mining: it would increase the probability of making new mine discoveries; make some known deposits economic to mine; and extend the operational life of existing mines. The Conference Board tested the assumption that the introduction of a new transportation corridor would increase the probability of making new mine discoveries by analysing the impact that new transportation corridors have had historically on mine discoveries in other similar jurisdictions. Although the results indicated a positive relationship, caution was used in transferring these results to the Slave Geological Province given differences in geology and changes in technology and

the nature of modern-day prospecting. Mine production models, prepared by the Northwest Territories Department of Resources, Wildlife and Economic Development, were also used to investigate details of potential cost savings that might result from the opening up of a transportation corridor. These savings may make known mineral deposits profitable to develop these sites through lowering construction and operation costs and, in the case of base metal mines, reducing the costs of shipping out base-metal concentrate to markets. The scarcity of data on the extent to which the construction of transportation corridors has on extending the lives of existing mines means that this factor was discounted in the scenario development exercise.

Transportation infrastructure developments were also considered to have potential impacts beyond the mining sector. These included the development of tourism and other renewable resources, such as hydro-electric power generation. Local people may also require training to work in mining and related industries and increased resources may be required to develop municipal infrastructure for workers and their families coming from outside the Territories. The investments in transportation and mineral development may also have considerable environment and social/cultural impacts. Due to data constraints, however, the only resource that was quantified for this study was tourism expenditures.

2.2 Scenario Descriptions

2.2.1 Base Case

The base case was developed to represent a “status quo’ scenario in which there is no new investment in transportation infrastructure. Indeed, the only expenditures on the transportation corridor are those on operating and maintaining the existing winter road between Yellowknife and Lupin. Nonetheless, the base case does assume that some mineral development goes ahead using the existing infrastructure. It assumes that production at the existing Ekati mine continues until the end of 2016, and the Diavik mine, currently under construction, is developed. With various mineral exploration reports indicating that there are several other promising diamond-bearing kimberlite pipes in the Slave Geological Province, the base case also assumes that three further diamond mines will be developed during the forecast period. These include the deposits at Snap Lake and Jericho. In addition, production is set to continue at the Lupin gold mine.

2.2.2 Scenario 1

In this scenario an all-weather road is built between Contwoyto Lake and the Arctic coast with a deepwater seaport at its terminus. The construction of the transportation corridor, which takes place over 2003-06, is assumed to be a prerequisite for the development of the base metal deposits at Izok Lake and Hackett River. In addition, the opening of the transportation corridor is assumed to act as a spur to the development of an additional base metal mine.

Once this transportation corridor is complete, the all-weather road is extended to the Lac de Gras region. This will enable the diamond mines in the region, such as Ekati

and Diavik, to take advantage of costs savings from all-weather road access to the north. Otherwise, the construction and production scenarios for the Ekati, Diavik, Snap Lake, Jericho, Lupin and new diamond mine are the same as those in the base case.

2.2.3 Scenario 2

Scenario 2 builds on the previous scenario by gradually extending the all-weather road from the Arctic coast past Contwoyto Lake and Lac de Gras all the way to Yellowknife. The southern segment of the road between Lac de Gras and Yellowknife is built between 2007 and 2012, replacing the existing winter road. The construction and production scenarios for those mines included in Scenario 1 carry over to Scenario 2. The extension of the transportation corridor will, however, lead to some reductions in the mines' operating costs. This increased access to the region, brought about by the completion of the transportation corridor between Contwoyto Lake and Yellowknife, is assumed to lead to the discovery and development of a new diamond deposit.

2.2.4 Scenario 3

Scenario 3 represents a rapid development scenario in which the transportation corridor in Scenario 2 is built as soon and as quickly as possible. As a result, the entire transportation corridor is open at the start of 2007. This results in earlier access to the region and is assumed to lead to the discovery and development of a new diamond deposit. The faster completion of the transportation corridor also speeds up the development plans for the other new diamond and base-metal mines included in Scenario 2.

The timing of the construction and production scenarios for the Ekati, Diavik, Snap Lake, Jericho and Lupin mines remain unchanged from the base case and the previous two scenarios. However, the accelerated construction of the transportation corridor does bring these mines all-weather road access to Yellowknife and the coast faster and, consequently, delivers costs savings earlier.

Exhibit 2 summarises the components that define the base case and other scenarios.

Exhibit 2

Development Scenarios

	Transportation Infrastructure	Diamond Mines	Gold Mines	Base-metal Mines	Tourism
Base Case	Winter Road (Yellowknife to Lupin)	Ekati	Lupin		
		Diavik			
		Snap Lake			
		Jericho			
		One new mine			
Scenario 1	Winter Road (Yellowknife to Lupin)	Ekati	Lupin	Izok Lake	
	All-Weather Road (Contwoyto Lake to Arctic Coast)	Diavik		Hackett River	
	All-Weather Road (Extension from the North to Ekati/Diavik)	Snap Lake		One new mine	
		Jericho			
	Deepwater Port on Coast	One new mine			
Scenario 2	Winter Road (Yellowknife to Lupin)	Ekati	Lupin	Izok Lake	Increased expenditures
		Diavik		Hackett River	
	All-Weather Road (Yellowknife to Arctic Coast)	Snap Lake		One new mine	
		Jericho			
	Deepwater Port on Coast	Two new mines			
Scenario 3	Winter Road (Yellowknife to Lupin)	Ekati	Lupin	Izok Lake	Increased expenditures
		Diavik		Hackett River	
	All-Weather Road (Yellowknife to Arctic Coast)	Snap Lake		One new mine	
		Jericho			
	Deepwater Port on Coast	Three new mines			

Source: Scenario Development Report, Current Study

3 Benefit-Cost Analysis

3.1 Approach and Methodology

3.1.1 Overview

Having developed the scenarios, the second phase of the study set out to quantify the relative economic benefits and costs of the development scenarios compared with those of the base case. This study differs from most other benefit-cost analyses of improvements in transportation infrastructure conducted in Canada in one important way. Rather than solely examining the effects of replacing or improving existing facilities, this study also looks at the effects of the introduction of new transportation infrastructure. This has important implications for the types of benefits that are quantified in the analysis, the principal one being the development of natural resources that were previously considered uneconomic to develop or whose development will be hastened as a result of the investment.

3.1.2 Methodology

The benefits and costs that are considered in the analysis of each scenario are measured from society's perspective, i.e. the study did not explicitly consider who would receive the benefits or incur the costs. Comparison of the benefits and costs requires that they must be expressed in common units. In line with usual practice, this analysis estimated the economic value of the benefits and costs of each scenario in terms of constant dollars discounted over time, with the main criterion used to compare scenarios being Net Present Value, or NPV. A positive NPV indicates that a scenario is justified on economic terms. Similarly, the scenario with the highest NPV is usually the preferred option. Other indicators, the Benefit-Cost Ratio (BCR) and the Internal Rate of Return (IRR), are also presented for completeness.

As not all costs and benefits can be quantified in this manner, the results of the analysis are examined in light of the probable impact of the unquantified benefits and costs. For this study the quantified costs comprise those of the transportation corridor, the deepwater port and developing mineral resources, while the unquantified costs included environmental costs, training costs, the costs of providing additional municipal infrastructure and potential social and cultural costs.

The value of minerals extracted from the new mining activity form the largest category of benefits quantified in this study. Other benefits include user benefits for the new transportation infrastructure - reduced operating expenses and safety - and lower re-supply costs for some coastal communities. Tourism expenditures that result from improved transportation infrastructure have also been quantified. Following the recommended practice of the Treasury Board for benefit-cost analyses, economic "multipliers" were not quantified as benefits in the study.

The results of the benefit-cost analysis also took into account the possibility that certain key variables may take on a range of values around the estimates used for the baseline forecast. Here the prices of gold and base metals, the discount rate, the quantity of

diamond output, labour costs, capital costs and transportation construction costs were subjected to Monte Carlo risk analysis, both individually, and jointly to assess the robustness of the results.

3.2 Benefit-Cost Results

Table 1 summarises the results for the benefit-cost exercise. It shows that Scenario 1 (the highest ranked scenario) has the highest NPV at -$57 million, followed by Scenarios 2 and 3, respectively. These results indicate that the discounted costs of the projects in the three scenarios exceed the benefits, although the reverse is true for the undiscounted benefits and costs. Most of the costs are incurred in the early years of the project as "up-front" investments in infrastructure. By contrast, most of the benefits are only felt when the new mines not included in the base case start production in the later years of the project. As a result, these benefits are subject to relatively greater discount factors and so their sum falls below that of the total discounted costs. The IRR and BCR confirm these results. Nonetheless, the three indicators suggest that the relative size of the loss to society is not unduly large.

Table 1

Summary of Benefit-Cost Results

Benefit-Cost Criteria	Scenario 1	Scenario 2	Scenario 3
Net Present Value ($ millions)	-56.8	-200.3	-364.3
Internal Rate of Return (per cent)	8.7	5.3	0.0
Benefit-Cost Ratio	0.97	0.92	0.90
Undiscounted Benefits ($ millions)	6277.0	7236.4	9730.1
Undiscounted Costs ($ millions)	5414.4	6694.4	9041.0
Discounted Benefits ($ millions)	2118.1	2304.5	3235.1
Discounted Costs ($ millions)	2175.0	2504.7	3599.4

Source: Current study

The unquantified environmental costs will clearly reinforce these quantified results. The environmental impacts of the road and mine construction will occur relatively early in each of the scenarios. This means that with discounting, these unquantified costs will have a greater effect on the results than if the costs were incurred later. Other costs are assumed to be relatively small. The effects of the unquantified benefits - the economic multiplier impacts - were more readily assessable since the scenario definitions between the second and third phases of the study are nearly identical. Adding these multiplier benefits (even with discounting) to the existing benefit stream would make the scenarios more attractive.

In order to properly assess the scenarios, decision makers must decide if the balance between the discounted environment costs and the discounted multiplier benefits is sufficient to make the scenarios economic (i.e., result in a NPV of greater than zero).

Analysis of uncertainty confirmed the basic findings of the benefit-cost exercise. Table 2 summarises the results from the Monte Carlo risk analysis when all the key variables were allowed to vary simultaneously. The mean NPV values are reasonably close to those of the basic benefit-costs analysis and the ranking of the scenarios remains unchanged. It is worth noting that there is only a relatively low probability of the NPV turning out to be greater than zero.

Table 2

Summary of All-Variable Risk Analysis Results

Risk Analysis Criteria	Scenario 1	Scenario 2	Scenario 3
Mean NPV ($2000 millions)	-48.8	-195.9	-369.5
Standard Deviation of NPV ($2000 millions)	106.7	138.3	414.0
Probability NPV Greater Than Zero	30.5%	8.4%	18.4%

Source: Current study

The risk analysis also indicated that the findings were relatively sensitive to changes in the price of gold and base metals and the output from diamond mines. The results are much less sensitive to changes in labour costs and transportation infrastructure construction costs.

4 Economic Impact Analysis

4.1 Approach and Methodology

4.1.1 Overview

Like the benefit-cost analysis, the third phase of the study also examined the economic impacts of the base case and development scenarios. However, economic impact studies differ from benefit-cost analyses in that they consider the broader impacts on the economy as a whole of investment projects rather than just the direct costs and benefits. This analysis quantifies the economic impacts across Canada which result from the investments in transportation infrastructure and mineral developments in the base case and development scenarios. The impacts are measured in terms of the additional GDP and employment generated.

In general, the economic impacts of a project can be divided into direct, indirect and induced effects. The direct effects are captured by those industries whose outputs (either goods or services) are purchased directly by the project being assessed. For example, the construction of a new all-weather road requires gravel as one of its inputs. In order to produce the gravel, however, the gravel industry requires various inputs that are either produced by the industry itself or purchased from other industries. The economic activity created as a result of creating or purchasing these inputs to the individual projects is known as the indirect effects. In addition, the income earned by employees of the firms directly and indirectly involved in the project will generate additional economic activity as it is spent on goods and services. This economic activity is termed the induced effects.

The sum of the direct, indirect and induced impacts provides an estimate of the total economic impacts. In general, the impacts of the investment will not be confined to the geographic area where the development occurs. Depending on the nature of the project, products and services will be "imported" from other regions and from other countries. This characteristic of economic impact models is particularly important for the current study since the Northwest Territories imports a large amount of goods and services from other regions of Canada.

4.1.2 Methodology

The first stage in estimating the economic impacts of the scenarios included in this study was to estimate the total expenditures and value of output for the various scenario components. These estimates were then used to produce estimates of the direct and indirect impacts using the Bureau of Statistics' input-output models for the Northwest Territories and Nunavut and Statistics Canada's Inter-Provincial Input-Output Model for the rest of Canada. The final step was to determine the induced effects for each scenario. The Bureau of Statistics Input-Output models are "closed" models which trace the spending of labour income derived from the direct and indirect impacts within the Northwest Territories and Nunavut. Statistics Canada's model is an "open" model and does not trace these spending effects. Therefore, the Northwest Territories Bureau

of Statistics determined the induced effects for the ten provinces and the Yukon using an approach consistent with that of its own closed models.

The GDP impacts are measured in constant 2000 dollars and the employment impacts in person-year equivalents.

4.2 Economic Impact Results

The total GDP impact over the 20-year forecast period in the Northwest Territories and Nunavut ranges from $24.5 billion in the base case to $32.5 billion in Scenario 3, while the total employment impact ranges from 79 to 127 thousand person-years. The greater part of the additional impacts in Scenario 1 are felt in Nunavut as most of the incremental activities in that scenario focus on the development of base metal deposits in the Nunavut sector of the Slave Geological Province. In Scenarios 2 and 3, by contrast, there are only relatively small additional benefits to Nunavut while the Northwest Territories experience significantly increased levels of economic activity. This is because most of the incremental investment activities in these scenarios are concentrated in the south-western part of the Slave Geological Province.

In general, the results of the employment impact analysis broadly follow those of the GDP impact analysis, the main difference lying in that the employment impacts are much more broadly spread across Canada than are the GDP impacts. Only about 45 per cent of the employment impacts in the three development scenarios occur in the Northwest Territories and Nunavut compared with just over three quarters of the GDP impacts.

In relative terms, the economic impacts associated with the base case and development scenarios represent a significant increase in the current level of economic activity in the Northwest Territories and Nunavut. On an average annual basis, these impacts correspond to rises of between 55 and 63 per cent in 1999 levels of GDP in the Northwest Territories. In terms of employment, these impacts would lead to rises in average 1999 levels of between 18 and 23 per cent. In Nunavut, the impact of the three development scenarios would correspond to rises of about a third in 1999 levels of GDP and about a fifth in 1999 levels of employment.

The economic activity generated by the investments in the Northwest Territories and Nunavut also has a positive effect across Canada. This is because many of the goods and services consumed in the two territories are produced in other parts of the country. Table 3 shows the provincial/territorial distribution of GDP and employment impacts for each scenario. Alberta, Ontario, British Columbia and Québec, in particular, benefit from significant GDP and employment impacts. On average, these four provinces account for just over a fifth of national GDP impacts and about a half of national employment impacts.

Overall, each dollar of GDP generated in the Northwest Territories and Nunavut in the base case generates another 24 cents of activity in the rest of Canada. This figures rises to between 29 and 31 cents for the three development scenarios. Similarly, each 100 person-years of employment generated in the Northwest Territories and Nunavut in the base case generates another 109 person-years of additional employment in the rest

Table 3

Total Economic Impacts: by Province (20-year time profile)

Total Gross Domestic Product Impacts (millions of 2000 dollars)

	NFLD.	P.E.I.	N.S.	N.B.	QUE.	ONT.	MAN.	SASK.	ALTA.	B.C.	YUK.	Rest of Canada	N.U.N.	N.W.T.	Canada
Base Case															
Total GDP Impact	17	1	39	29	499	1,602	106	191	2,229	1,024	58	**5,795**	599	23,933	**30,327**
Share of National Total (per cent)	0.1	0.0	0.1	0.1	1.6	5.3	0.4	0.6	7.4	3.4	0.2	**19.1**	2.0	78.9	**100.0**
Scenario 1															
Total GDP Impact	21	2	47	37	674	2,374	148	343	3,112	1,516	83	**8,358**	4,924	23,986	**37,268**
Share of National Total (per cent)	0.1	0.0	0.1	0.1	1.8	6.4	0.4	0.9	8.4	4.1	0.2	**22.4**	13.2	64.4	**100.0**
Scenario 2															
Total GDP Impact	23	2	51	42	741	2,605	162	363	3,353	1,632	91	**9,067**	4,925	25,726	**39,717**
Share of National Total (per cent)	0.1	0.0	0.1	0.1	1.9	6.6	0.4	0.9	8.4	4.1	0.2	**22.8**	12.4	64.8	**100.0**
Scenario 3															
Total GDP Impact	26	2	56	48	824	2,868	179	389	3,653	1,781	101	**9,927**	5,095	27,395	**42,417**
Share of National Total (per cent)	0.1	0.0	0.1	0.1	1.9	6.8	0.4	0.9	8.6	4.2	0.2	**23.4**	12.0	64.6	**100.0**

Total Employment Impacts (person-year equivalents)

	NFLD.	P.E.I.	N.S.	N.B.	QUE.	ONT.	MAN.	SASK.	ALTA.	B.C.	YUK.	Rest of Canada	N.U.N.	N.W.T.	Canada
Base Case															
Total GDP Impact	390	29	689	524	8,159	23,652	1,913	2,933	28,176	19,102	1,001	**86,567**	5,814	73,287	**165,669**
Share of National Total (per cent)	0.2	0.0	0.4	0.3	4.9	14.3	1.2	1.8	17.0	11.5	0.6	**52.3**	3.5	44.2	**100.0**
Scenario 1															
Total GDP Impact	498	42	854	668	11,462	36,054	2,742	5,326	41,315	28,699	1,483	**129,142**	34,899	73,059	**237,101**
Share of National Total (per cent)	0.2	0.0	0.4	0.3	4.8	15.2	1.2	2.2	17.4	12.1	0.6	**54.5**	14.7	30.8	**100.0**
Scenario 2															
Total GDP Impact	544	46	939	751	12,597	39,498	3,015	5,627	44,615	30,971	1,616	**140,219**	34,885	81,154	**256,258**
Share of National Total (per cent)	0.2	0.0	0.4	0.3	4.9	15.4	1.2	2.2	17.4	12.1	0.6	**54.7**	13.6	31.7	**100.0**
Scenario 3															
Total GDP Impact	611	51	1,027	864	13,982	43,491	3,334	6,033	48,780	33,909	1,801	**153,883**	35,770	90,769	**280,422**
Share of National Total (per cent)	0.2	0.0	0.4	0.3	5.0	15.5	1.2	2.2	17.4	12.1	0.6	**54.9**	12.8	32.4	**100.0**

Source: Current study

of Canada. This figures rises to between 120 and 122 person-years for the three development scenarios.

5 Taxation Revenue Analysis

5.1 Approach and Methodology

5.1.1 Overview

The increase in economic activity associated with the investments made in transportation and mining infrastructure in the base case and development scenarios will also lead to higher taxation revenues for federal, provincial/territorial and municipal governments. The income streams generated through these new forms of economic activity are liable to various forms of direct taxation and firms and persons also pay indirect taxes as they spend their incomes on goods and services. These benefits extend to governments beyond the Northwest Territories and Nunavut in the same way that the economic impacts were felt across Canada.

The final phase of the study examines the taxation revenues resulting from the economic impacts derived in the previous phase. This report also quantifies fiscal implications for the Northwest Territories and Nunavut as a result of the arrangements between the federal and territorial governments. The Territories receive an annual transfer from the federal government designed to raise the territorial governments' revenues to a level necessary to cover their designated spending requirements. However, this grant is reduced when the Territories own revenue-raising ability increases. Thus, any initial revenue increases accruing to the Government of the Northwest Territories through the economic activity generated by the development projects will be reduced by corresponding grant reductions from the federal government. This reduction amounts to some 80 per cent of any revenue increases.

5.1.2 Methodology

The Northwest Territories Bureau of Statistics provided the income data from the economic impact analysis which were then used by the Conference Board to determine the taxation revenue implications for the ten provinces. Revenues were calculated for each of seven broad taxation categories and for each scenario. In order to estimate the taxation revenues some simplifying assumptions were made. Foremost among these was that the current taxation regime does not change over the forecast period. Thus, year 2000 tax rates and fiscal regimes were employed.

The Northwest Territories Department of Transportation conducted the taxation revenue analysis for the Northwest Territories and Nunavut. It also provided the data on the fiscal implications of the taxation revenue analysis for transfers between the federal government and the governments of the Northwest Territories and Nunavut. Because estimates of corporate income tax revenues and Canada/Québec Pension Plan (CPP/QPP) contributions were unavailable and because of other differences in coverage, the analyses for the Territories and the ten provinces are presented separately.

5.2 Taxation Revenue and Fiscal Impact Results

5.2.1 Overview

Although the two sets of results are presented separately, the broad patterns of the two sets of results are similar with the scale of impacts least in the base case and greatest in Scenario 3. The federal government also benefits the most in each case, although to a much greater extent in the Territories as additional revenues for the territorial governments are clawed back

5.2.2 Taxation Revenue Impacts in Northwest Territories and Nunavut

Table 4 shows that the total additional taxation revenue generated through personal income taxes and indirect taxes for the Government of the Northwest Territories ranges from $516 million in the base case to $703 million in Scenario 3. Revenues for the government of Nunavut in the three development scenarios range between $181 million and $192 million, compared with just $17 million in the base case. The federal government also benefits from higher personal direct taxation and indirect tax revenues. These range from $1.3 billion in the base case to $2.1 billion in Scenario 3.

These figures, however, represent only gross receipts and do not take into account the

Table 4

Summary Taxation Revenue Impact Results For the Northwest Territories and Nunavut (20-year profile, millions of 2000 dollars)

	Northwest Territories	Nunavut	Federal Government	Total
Base Case				
Taxation Revenue	516.1	16.7	1,303.0	1,835.7
Grant Adjustment	-412.4	-13.3	425.7	0.0
Net Revenue	**103.7**	**3.3**	**1,728.7**	**1,835.7**
Scenario 1				
Taxation Revenue	534.4	182.6	1,701.5	2,418.5
Grant Adjustment	-427.0	-145.9	572.9	0.0
Net Revenue	**107.4**	**36.7**	**2,274.3**	**2,418.5**
Scenario 2				
Taxation Revenue	598.3	181.3	1,838.2	2,617.8
Grant Adjustment	-478.0	-144.9	622.9	0.0
Net Revenue	**120.3**	**36.5**	**2,461.1**	**2,617.8**
Scenario 3				
Taxation Revenue	703.4	192.9	2,098.1	2,994.4
Grant Adjustment	-562.0	-154.1	716.1	0.0
Net Revenue	**141.4**	**38.8**	**2,814.2**	**2,994.4**

Source: Current study

reductions in the federal government's grant to the territorial governments as a result of their improved revenue raising capacities. When this 80 per cent claw-back is taken into account, federal net receipts rise to between $1.7 billion and $2.8 billion, or about 94 per cent of all revenue impacts.

By the same token, territorial net receipts fall to between $104 million and $141 million for the Northwest Territories and to between $3 million and $39 million for Nunavut over the entire forecast period. On an annual basis, these figures translate to between $5.2 million and $7.1 million for the Northwest Territories and $1.8 million to $1.9 million for Nunavut (in the three development scenarios). While these figures represent an increase of only about 2 to 3 per cent of 2000-01 own-source revenues it should be noted that this analysis did not include an estimate of additional corporate income tax revenues. Given the scale of the mining operations involved in the development scenarios, these are likely to be relatively large and would provide a substantial boost to the revenue impacts included in the analysis.

5.2.3 Taxation Revenue Impacts in the Ten Provinces

The analysis also shows that the investment projects in the base case and development scenarios generate additional taxation revenue for governments in parts of Canada outside the Northwest Territories and Nunavut. Table 5 shows that the scale of these revenue impacts ranges from $2.6 billion in the base case to $4.2 billion in Scenario 3. The amount of total revenue impacts increases by a relatively sharp 40 per cent in Scenario 1 given the increased level of mining operations and their impacts on the economy. The level of overall taxation revenue impacts then increases by 8 per cent in Scenario 2 and by a further 9 per cent in Scenario 3.

Nearly half of the positive impacts are enjoyed by the federal government, with the provincial and local governments taking another 44 per cent. The remaining impacts take the form of increased contributions to the CPP and QPP schemes. Some 47 per cent of the revenue impacts take the form of higher direct taxes on persons, and a further 10 per cent in direct taxes on corporations. Indirect taxes account for about 36 per cent of total revenue impacts. However, this breakdown differs between the various levels of government. A much greater share (57 per cent) of provincial and local governments revenue impacts come in the form of indirect taxes. This stems largely from the reliance of local governments on indirect forms of taxation. By contrast, only 22 per cent of federal revenue impacts come from indirect tax revenues.

In terms of the geographical distribution of the impacts, about half of the overall revenue impacts occur in the western provinces of Alberta and British Columbia. A further 43 per cent of the total impacts are felt in Ontario and Québec, with the remainder concentrated in Saskatchewan and Manitoba. Impacts in the Atlantic provinces are relatively minor.

Table 5

Summary Taxation Revenue Results For the Ten Provinces (20-year profile, millions of 2000 dollars)

	NFLD.	P.E.I.	N.S.	N.B.	QUE.	ONT.	MAN.	SASK.	ALTA.	B.C.	**Ten Provinces**
Base Case											
Total Gross Federal Taxes	4	0	9	7	107	391	23	35	426	245	**1,247**
Total Gross Provincial and Local Taxes	4	0	8	7	155	367	27	42	305	222	**1,136**
Total Gross CPP/QPP Contributions	1	0	2	1	19	53	4	5	53	36	**175**
Total Gross Taxation Revenue	**9**	**1**	**18**	**16**	**280**	**811**	**54**	**82**	**784**	**503**	**2,558**
Share of National Total (per cent)	**0.3**	**0.0**	**0.7**	**0.6**	**11.0**	**31.7**	**2.1**	**3.2**	**30.6**	**19.7**	**100.0**
Scenario 1											
Total Gross Federal Taxes	5	0	10	9	139	559	31	61	586	350	**1,752**
Total Gross Provincial and Local Taxes	5	0	10	8	203	523	36	73	418	318	**1,594**
Total Gross CPP/QPP Contributions	1	0	2	2	24	76	5	9	73	52	**245**
Total Gross Taxation Revenue	**11**	**1**	**22**	**19**	**367**	**1,158**	**73**	**144**	**1,077**	**721**	**3,591**
Share of National Total (per cent)	**0.3**	**0.0**	**0.6**	**0.5**	**10.2**	**32.3**	**2.0**	**4.0**	**30.0**	**20.1**	**100.0**
Scenario 2											
Total Gross Federal Taxes	5	0	11	10	152	606	34	64	627	375	**1,884**
Total Gross Provincial and Local Taxes	5	0	10	9	221	568	39	77	448	340	**1,718**
Total Gross CPP/QPP Contributions	1	0	2	2	26	82	6	10	78	56	**264**
Total Gross Taxation Revenue	**11**	**1**	**24**	**21**	**399**	**1,256**	**79**	**151**	**1,153**	**771**	**3,865**
Share of National Total (per cent)	**0.3**	**0.0**	**0.6**	**0.5**	**10.3**	**32.5**	**2.0**	**3.9**	**29.8**	**19.9**	**100.0**
Scenario 3											
Total Gross Federal Taxes	6	1	12	11	167	662	37	69	680	407	**2,052**
Total Gross Provincial and Local Taxes	6	0	11	10	243	621	43	83	486	370	**1,873**
Total Gross CPP/QPP Contributions	1	0	2	2	29	90	6	11	85	61	**287**
Total Gross Taxation Revenue	**12**	**1**	**26**	**23**	**439**	**1,373**	**87**	**162**	**1,251**	**837**	**4,212**
Share of National Total (per cent)	**0.3**	**0.0**	**0.6**	**0.6**	**10.4**	**32.6**	**2.1**	**3.8**	**29.7**	**19.9**	**100.0**

Source: Current study