REPORT ON

PRELIMINARY ECONOMIC AND FINANCIAL IMPACT ANALYSIS OF A PROPOSED NUCLEAR POWER GENERATION FACILITY IN THE PEACE COUNTRY OF NORTHERN ALBERTA

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EXECUTIVE SUMMARY

The objective of this study was to provide a high level preliminary assessment of the economic and fiscal impacts on the Province of Alberta and on the Peace Country of the proposed Bruce Power Alberta New Build Project (the Project).

The economic assessment predicts the changes in economic activity (additional spending and jobs) that could be created by the proposed Project during the site preparation and construction phase, and the economic impact that the annual ongoing operations could have. The site preparation and construction phase is expected to last for ten years. The impact in this report represents an annual average for this period. The impact for ongoing operations, which would follow construction, is also represented annually for what is expected to be a sixty year period.

The financial impact analysis estimates the net impact that the proposed Project could have on property tax revenues for both municipal and cost sharing program (such as education) purposes in the Peace Country municipalities once the Project is fully operational.

This study is the first step in the development of more detailed socio-economic studies to be prepared later on as part of the environmental assessment (EA) and regulatory approval process that is being conducted for the Project. The study also provides a preliminary order-of-magnitude overview analysis for use in communications about the proposed Project. This study will be followed by more detailed assessment of the social, economic and environmental impacts of the Project that will be conducted as part of the EA.

Regional Study Area (RSA) Baseline Conditions

The sub-provincial economic region of Athabasca-Grande Prairie-Peace River was chosen for the purpose of the regional economic analysis. This region includes Alberta Census Divisions 13, 17, 18 and 19, and comprises much of north central/northwest Alberta. The Peace Country is included within this economic region.

The regional economy is relatively small in size, not as diversified as the provincial economy, and weighted to the primary and resource development sectors. Secondary and tertiary activities

appear to be closely tied to the primary sector. For many of the other industry sectors it may be assumed that the region is heavily reliant on importing goods and services.

Economic Impact Estimates

The predicted total[1] economic impact results for the Province of Alberta for the construction (including site preparation) and operations phases of the Project are shown below.

Predicted Provincial Economic Impacts of the Proposed Project

Activity	GDP	Labour Income	Employment
	Millions of Dollars		Person-Years
construction (over 10 years)	12,647.8	5,542.3	83,752.9
operations (single year)	1,110.8	523.1	8,527.2

During the 10-year site preparation and construction period, the Project would be expected to contribute $12 Billion of Gross Domestic Product (GDP) or $5.5 Billion of labour income to the Province of Alberta. During each year of the approximately 60 year operation life span of the facility, the Project can be expected to result in about $1 Billion in GDP or $520 Million in labour income to the Province. Province-wide, the Project would generate an expected total of about 83,000 direct, indirect and induced employment positions (as person-years) over the 10-year construction period. During a typical operational year, the Project would generate an expected 8,500 direct, indirect and induced employment opportunities in the Province.

The regional analysis estimated the total economic impacts of the Project on the economic region, as shown below.

Predicted Regional Economic Impacts of the Proposed Project

Activity	GDP	Labour Income	Employment
	Millions of Dollars		Person-Years
construction (over 10 years)	7,305.2	1,973.6	31,384.3
operations (single year)	319.4	278.3	2,707.4

[1] 'Total' economic impacts include direct, indirect and induced impacts, as defined in the body of the report.

During site preparation and construction, the Project would contribute about $7.3 Billion to the GDP or about $1.9 Billion labour income to the region. During operations in a typical year, the Project would contribute about $320 Million in GDP or $280 Million in labour income to the region. The Project would result in a total of about 31,000 direct, indirect and induced employment opportunities in the region over the 10-year construction period. The peak labour force on the site would reach approximately 5,000 during year six of construction. Over the longer term, operations will result in about 2,700 direct, indirect and induced jobs in the region, with an anticipated permanent workforce at the site of about 1,900 full time positions.

This analysis indicates that the Project is expected to have a significant stimulative impact on the region, as employment opportunities are created and commodities and services are purchased by Bruce Power Alberta.

Many of the jobs created during construction and operations will require skilled personnel and hence offer above average income opportunities for workers. A larger and more diverse economy should result in greater regional self-sufficiency, increased stability, and greater community diversity. Expanded regional activity can also benefit local residents – as economies grow and diversify both public and private sector services also tend to grow and diversify. However, increased activity levels could put some upward pressure on wages and prices, and cause some other disruptions in local markets.

Predicted Fiscal Effects

The multiplied government revenue impacts of the Project on the federal, provincial and local governments in Alberta are derived from the Tax Module appended to the Alberta Input-Output Model, and are shown below.

Predicted Fiscal Impacts of the Proposed Project

Level of Government	Construction Phase (Over 10 Years)		Operations Phase (Over 60 Years)	
	Average Annual	Cumulative (2007 Dollars)	Average Annual	Cumulative (2017 Dollars)
	Millions of Dollars			
federal	222	2,219	81	4,846
provincial	160	1,599	86	5,145
local	27	269	18	1,056
Total	**409**	**4,087**	**184**	**11,047**

The incremental government revenues would expand the tax base available for use in providing additional goods and services to Alberta residents. During construction, the Project would result in approximately $222 Million, $160 Million and $27 Million per year in revenue to federal, provincial and local governments, respectively. During a typical operational year, the Project would be expected to contribute an annual average of $81 Million, $86 Million and $18 Million revenue to federal, provincial and local governments.

On the expenditure side, the Project itself is unlikely to have a large direct impact on the Municipal Districts' capital and operating costs. The site will be self-contained in the provision of utility services needed by the Project and access will be via provincial highways and air.

There may be some in-migration to the region as a result of the Project's direct, indirect and induced effects with consequent impacts on expenditures by local governments. Workers relocating to the region would pay property taxes (and user fees associated with utility services) to the municipality in which they reside, and municipalities would be required to provide municipal services to the new residents.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

The objective of this report is to provide the results of a high level analysis of the economic and fiscal effects on the Province of Alberta and on the Peace Country of the proposed Bruce Power Alberta New Build Project (the Project). Bruce Power Alberta proposes to construct up to four nuclear reactors and associated facilities in the province, with operations beginning as early as 2017.

Bruce Power Alberta's proposed Project is in its earliest stage of development. There are many consultations and studies that need to be done before potentially affected communities; local, provincial and federal governments; and Bruce Power Alberta have the information needed to make decisions about the value of moving forward to construct and operate the Project. Nevertheless, because of the Project's large size and long life, it can be expected that it has the potential to bring substantial economic benefits to the regional economy and communities of northwestern Alberta.

In order to provide a preliminary estimate of these potential benefits, Bruce Power Alberta has commissioned this economic analysis, as one part of an ongoing information disclosure and consultation program with potentially affected communities that would continue throughout the development of the Project. The potential for benefit will be weighed by governments and communities against the potential for any negative environmental and social effects that are of concern to potentially affected communities and regulatory agencies.

This economic analysis is preliminary, and relies on input-output and tax models used by the Alberta Government to examine the economic returns (such as increases in gross domestic product, jobs, labour income and tax revenues) of projects. Such models are very useful as they quantify the effects of a given project on provincial and regional economies. The results include not just the direct effects of a project, but also indirect and induced (ripple) effects.

The models are recognized to have limitations. For example, the models do not do the following:

- capture changes over time – for example nuclear power would be new to Alberta and there is currently little capacity to meet some of more specific labour force and

supply requirements of the industry; however, given the long life of the Project, Alberta's (and the region's) capacity would increase, and consequently so would the economic benefits;

- capture environmental and social effects that are not easily expressed in economic terms – these can be both positive and negative (quality of life may improve for some and not improve for others, depending on personal choices and values); and
- necessarily well address the ability of an economy to respond to increases in economic activity in the short term – a large project can represent a large shock to particularly smaller economies such as that of the region, which in turn can strain limited human resources, cause changes in prices, and make economic impacts difficult to predict.

In addition, the Project is in the earliest stages of development, and assumptions – based on costs, technologies and labour force requirements of projects elsewhere – have been made to develop the input data to run the models.

Irrespective of the above, as the economic analysis demonstrates, the potential for economic benefit is very large relative to the size of the region's economy and workforce. Refinements to the economic results will be made as more information becomes available; however, it is clear that the challenge in developing the Project will be to maximize the participation of workers and businesses in communities in closest proximity to the Project such that benefits are retained locally. Bruce Power Alberta would expect to work closely with communities towards meeting this challenge – implementing training, and preferential hiring and contracting programs to enhance the capacity of people and businesses to participate in the economic opportunities that would be created by the Project.

The potential for economic benefit is only one of many considerations that need to be addressed should the Project advance. The environmental assessment (EA) process – with its technical studies, information disclosure, consultation and interventions by government and representatives of civil society interests – is the primary mechanism to address concerns outside the scope of this preliminary economic analysis.

This report was prepared by Golder Associates Ltd. (Golder) and SJ Research Services. SJ Research Services conducted the economic and fiscal impacts study, while Golder provided editorial input and contributed contextual information to the report.

The focus of the analysis was:

- to provide a broad baseline description of the current economic environment in the economic region that includes the Peace Country; and
- to provide an estimation of the expected economic (income and jobs) and fiscal (or tax) impacts of the site preparation and construction and operation phases of the proposed Project.

The analysis was done prior to any detailed engineering and design activities being conducted for a site-specific nuclear generation facility in Alberta. Thus, data for a "reference project" were used, taken from other studies of nuclear generation facilities in North America. This study will support the development of more detailed socio-economic studies to be prepared later on as part of the EA and regulatory approval process. Additionally, the study provides a preliminary order of magnitude overview analysis for use in communications about the proposed Project. A conservative approach is adopted so as not to overstate the potential economic benefits to the Peace Country.

The Project scope was defined to terminate at the high voltage interconnection between the generation facilities and the provincial electricity transmission grid. As a result, downstream impacts on the electricity transmission system and electricity consumers are excluded from the analysis. It was also assumed that the Project would not impact other producers of electricity in Alberta.

1.1 Information Sources and Models Used for the Study

A number of data and information sources were used for this study including:

- data from Bruce Power;
- recent studies by Dr. Harry Kitchen of potential nuclear power generation facilities at Nanticoke and Kincardine in Ontario;

- reports by the Canadian Energy Research Institute (CERI) prepared for the Canadian Nuclear Association;
- socio-economic impact assessments of other large industrial projects proposed for Alberta; and
- reports relating to the estimation of sub-provincial economic impacts.

To estimate the potential fiscal impacts of a nuclear power plant on the Province of Alberta, Alberta Finance was contracted to conduct simulations using the Alberta Input-Output Model. SJ Research Services' Alberta Economic Impact Model was used to generate provincial level economic impacts. As well, a sub-provincial economic impact model of the regional study area was constructed incorporating additional intra-provincial leakages.

The baseline economic conditions in the province and the Peace Country are primarily based on data from Statistics Canada (Census 2006 and CANSIM database) and several Alberta Government Ministries (Employment and Immigration, Municipal Affairs, and Finance and Enterprise). For the purposes of this study, the Peace Country or Regional Study Area (RSA) is defined as the Athabasca-Grande Prairie-Peace River Economic Region (comprised of Census Divisions 13, 17, 18 & 19).

1.2 Report Outline

The report outline is as follows:

Section 2 gives a brief description of the Project including estimated expenditures and direct employment, for the site preparation and construction phase, and for the on-going operations phase.

Section 3 defines the Regional Study Area (RSA) under consideration, and summarizes baseline economic conditions in this provincial sub-region and for the Province of Alberta as a whole.

Section 4 describes the economic model that is used to derive the provincial impact estimates and the procedure employed to estimate the economic impacts on the RSA.

Section 5 outlines the economic impact estimates, distinguishing between the province and the RSA, and between the construction and operation phases of the Project. The economic indicators considered are gross output, gross domestic product (or value-added), household income and employment.

Section 6 outlines the Project's fiscal effects on Alberta and the RSA. The provincial fiscal impacts as derived from Alberta Finance's Input-Output Model tax module are reported, followed by an overview of the current municipal fiscal situation in the region and the regional fiscal impact of the Project.

The Appendices at the end of the report contain a number of tables and charts that profile the current economic circumstances and supplement the summary information contained in Section 3 as well as a more detailed treatment of methodological issues.

2. PROJECT DESCRIPTION

The proposed Project involves the construction of up to four nuclear reactor units and associated facilities with operations beginning as early as 2017. Generation capacity will total 3,120 to 4,340 MWe, depending on the number of reactor units and the design chosen. Several reactor designs are being considered including Atomic Energy of Canada Limited, Areva and Westinghouse.

Bruce Power has not decided on a specific reactor design at this time and the economic analysis should be viewed as representing a generic or technology neutral project. The data used is considered to be reflective of the scale of generating capacity proposed for Alberta and the location of the reactors on a Greenfield site in northwest Alberta.

The current proposed site of the Project is adjacent to Lac Cardinal in the Municipal District of Northern Lights No. 22 (population 3,556). The closest communities are Berwyn (561) and Grimshaw (2,537) located about 15 km south and southeast of the site and Peace River (6,315) located about 30 km to the east. As part of the regulatory review process for the proposed Project, alternative sites within the Peace Country will likely also be considered; however, the results of this report will still be applicable as the analysis featured in this report is high-level and not tied to a specific location within the region.

Over the life-cycle of the proposed Project, activities would include planning and approvals, site preparation, construction, commissioning and plant start-up, operations and maintenance, and decommissioning. An approximate timeline is shown in Table 1.

Table 1 Proposed Project Timeline

Activity Phase	Time & Duration
planning & approvals	2007 to 2010 (38 months)
site preparation	2010 to 2012 (24 months)
construction	2012 to 2016 (54 months)
commissioning of first unit	2016
commissioning of subsequent units	9-month intervals
operations	2017 to 2076 (60 years)
decommissioning	2079 and beyond

This study focused on the site preparation and construction and operation phases of the proposed Project. Construction-related activities are anticipated to occur both on and off site. The modular nature of many components allows major components of the reactors to be fabricated off-site and transported to the site by road or rail. Also, much of the planning and approval activity will occur off-site. For the analysis, a site preparation and construction schedule of ten years and an operations schedule of 60 years was assumed. It was also assumed that 4,000 MWe (net) of electrical generating capacity will be added to the Alberta electric grid to supply electricity demand once the project is operational in 2017.

2.1 Capital Expenditures and Employment Predictions

Direct employment and expenditure data for the proposed Project were provided by Bruce Power and Golder, using information from similar projects elsewhere.

The Project's capital costs were estimated to total $12 billion, based on generation capacity and an assumed plant cost of $2,965/kW (2007 dollars). Construction costs were disbursed over a number of years, given the lengthy project schedule. The assumed annual expenditure profile for the site preparation and construction phase of the proposed Project (using project labour requirements) is presented in Table 2.

Table 2 Annual Expenditure Profile

Capital Expenditure Profile										
	Yr. 1	**Yr. 2**	**Yr. 3**	**Yr. 4**	**Yr. 5**	**Yr. 6**	**Yr. 7**	**Yr. 8**	**Yr. 9**	**Yr. 10**
capital (%)	0.6%	1.3%	6.3%	15.5%	21.0%	21.3%	17.8%	11.2%	3.8%	1.1%

Nuclear projects generally are characterized by long construction periods, long operating lives, high capital costs, high decommissioning costs, and low operating costs. They are thus operated as baseload units, providing a continuous and constant flow of electricity to the grid.

Based on data provided by Bruce Power, on-site preparation and construction employment was initially estimated to total 19,280 person-years. However, this figure corresponds more closely to adding additional capacity. It was therefore assumed that since the proposed Project, being a Greenfield operation, will require an additional 20% more labour in order to maintain the construction schedule, construction employment needs will be 23,148 person years. Table 3 summarizes the annual employment profile for the on-site preparation and construction

workforce, assuming plant construction over a ten year period. Peak employment is in year 6 and equals 4,920 persons.

Table 3 Annual Employment Profile for the Site Preparation and Construction Phase of the Proposed Project

Site Preparation & On-Site Construction Workforce										
	Yr. 1	**Yr. 2**	**Yr. 3**	**Yr. 4**	**Yr. 5**	**Yr. 6**	**Yr. 7**	**Yr. 8**	**Yr. 9**	**Yr. 10**
workforce	144	312	1464	3588	4860	4920	4128	2592	876	264

For the operations phase, about 1,940 permanent full-time equivalent (FTE) positions are projected by Bruce Power. The estimates assume that all of the nuclear reactor units are on-stream.

3. REGIONAL STUDY AREA (RSA) BASELINE CONDITIONS

The Project's current proposed location is within the Municipal District (MD) of Northern Lights No. 22. A Regional Study Area (RSA), that is defined much broader geographically than the MD itself, is desirable since it is anticipated that a large industrial project would have far reaching regional economic impacts. The sub-provincial economic region of Athabasca-Grande Prairie-Peace River was chosen for the purpose of the regional economic analysis. This region includes Alberta Census Divisions 13, 17, 18 and 19, and comprises much of north central/northwest Alberta. The Athabasca-Grande Prairie-Peace River Region was chosen as the unit of analysis for a number of reasons. The region is an established unit of analysis of the Government of Alberta. Although the region is very large geographically, it is comparatively small in terms of Alberta's population and economic activity. It is anticipated that a large industrial project would have far reaching regional economic impacts. Economic analysis at a sub-regional level would require Project decisions that cannot be made yet, for example on Project location, workforce and supply sources, and workforce management.

The proposed Project's regional economic effects will be felt primarily in the settled areas of this relatively large geographic region. These include: Clear Hills County, MD of Northern Lights No. 22, Northern Sunrise County, MD of Smoky River No. 130, Birch Hills County, MD of Fairview No. 136, MD of Peace River No. 135, and MD of Spirit River No. 133 and the following five towns located within this arbitrary 70 km trading area: Peace River (6,315 people); Manning (1,493); Grimshaw (2,537); Fairview (3,297); and, Falher (941). The village of Berwyn (561 people) is also located near the proposed Project site.

There are five First Nation or aboriginal communities (Duncan's First Nation, Woodland Cree First Nation, Lubicon Lake First Nation, Horse Lake First Nation and Peavine Métis) with seven reserves and settlements within 100 km of the proposed Project site. Finally, larger communities in the general area of the proposed Project (but beyond 70 km) include the City of Grande Prairie (50,227), and the towns of Spirit River (1,148), Sexsmith (2,255), High Prairie (2,836) and Valleyview (1,884).

The RSA, in very broad terms, may be described as consisting of agriculture (production of coarse grains and pasture land for cattle); mixed forests (coniferous and deciduous); manufacturing (e.g., wood processing); conventional oil and gas; in-situ bitumen recovery;

municipal, provincial and federal government administration; and trades and services. Much of the economic activity is centred in or around the larger communities in the Athabasca-Grande Prairie-Peace River Economic Region (23 towns and the City of Grande Prairie). Regional resources include clay, iron ore, lime, marl, oil and gas, bitumen, silica sand, sand and gravel, timber and water.

The economic base of the local aboriginal communities includes hunting and fishing, trapping, cattle and grain farming, and seasonal employment in local house construction, fire fighting, reforestation, and road and wellsite clearing and brushing. Economic data for the region, and for the Province of Alberta as a whole, are presented in the Appendices. The data includes population, labour force, and employment by industry. A brief summary of the characteristics of the RSA, as a percent share of Alberta, is provided in Table 4.

Table 4 Overview of the Regional Study Area (RSA)

Item	RSA as a Share of Alberta (%)
land area	42.2
population	7.3
household average income	77.8
population 25-64 with post-secondary education	5.4
experienced labour force	6.9
employment	6.9
construction employment	7.4
utilities employment	6.4

Generally, the data show that the RSA economy is relatively small in size, not as diversified as the provincial economy, and weighted to the primary and resource development sectors. Secondary and tertiary activities appear to be closely tied to the primary sector, and are directly affected by it and events that positively and negatively affect primary sector productivity and activity. Unemployment rates are slightly higher than for Alberta (and some of its other sub-regions). Historically, growth in the region has been relatively modest. The population in the RSA increased from 194,516 in 1986 to 246,311 in 2006, an average annual increase of 1.13% per year. By comparison, Alberta's population increased at a rate of 1.58% per annum during the same time frame.

4. ECONOMIC IMPACT – MODELS AND ASSUMPTIONS

The concept of economic impact analysis is relatively simple. When a dollar is spent in an economy, that dollar re-circulates within the economy, multiplying the effects of the original expenditure. Re-circulation is, however, not indefinite as certain expenditures are lost due to leakages. Leakages include imports, taxes and savings.

The objective of the economic analysis was to assess the economic impacts on the Province of Alberta and the Athabasca-Grande Prairie-Peace River Economic Region of the proposed Project. Direct impacts measure the initial expenditures made by the proposed Project usually after adjusting for leakages. Indirect impacts measure the secondary business transactions that result from the initial expenditures. Induced impacts are third round impacts from the spending of incremental labour income in the economy after removing a portion for taxes and savings. Results are typically expressed in terms of Gross Output, Gross Domestic Product (GDP), labour income (included in GDP), and employment (jobs).

It should be noted that Gross Output is equivalent to the total value of sales or shipments. Because it includes the value of final sales and intermediate goods and services, double-counting occurs, and thus is not as good a measure of economic activity as GDP. GDP is the sum of all value-added in various sectors of the economy within a prescribed geographic area. It equals the gross value of production of firms less the purchases of intermediate goods and services from other firms. GDP is the measure of the "size" of an economy.

An Input-Output Model which identifies all of the inter-industry production and trading linkages of an economy is a useful tool for estimating the total economic impact of the construction and operation of nuclear reactors.

Both site preparation and construction and operational impacts were calculated by creating a mixed endogenous–exogenous model. This approach allows modification of the input structure of the expanding industry to reflect the output and input structure of the Project This approach is appropriate when the input structure of the Project differs significantly from the input structure of the impacted industry. In the case of construction impacts, detailed inputs (from the CERI study referenced in the bibliography section) for employment and construction labour income were

available. As such, the construction industry inputs structure was exogenized and modified to reflect the addition of reactor construction. In the case of operational impacts, nuclear power generation is an entirely new input structure within the utility industry. In both cases (site preparation and construction and operation) inputs reflect only those that can be locally (within the province and within the RSA) sourced. In the case of highly specialized inputs (heavy water, radioactive concentrates), these were all imported. For other inputs, the IO model's default import leakages were used. A detailed account of the mixed endogenous–exogenous model methodology is available in Appendix B.

It should be noted that in the case of mixed I-O models, direct gross output impacts equal the initial project outlay and the GDP component is the value added portion of the proposed Project. Inter-industry inputs, however, are adjusted for leakages. This corresponds to the geographic definition of GDP as activity taking place within a prescribed geography. In other words, since construction takes place within Alberta and the RSA, gross output and GDP accrue within the same geography. As a result, indirect impacts (reflecting import leakages of inputs) are minimal and induced impacts (reflecting spending of wages earned within the geography) are larger in magnitude.

For the site preparation and construction phase of the proposed Project, the construction industry was shocked by a vector of expenditures by commodity, based on information about the distribution of inputs required for the construction of AECL CANDU reactors contained in a CERI report and estimated construction labour force and salaries.

For the operations phase of the proposed Project, the utility industry was shocked by a vector of expenditures by commodity, based on information about the distribution of commodity inputs required for nuclear electricity generation in Canada contained in the CERI report. Wages (average Bruce Power salaries), direct employment, and the ratio of labour income to gross output were employed to estimate the value of new utility industry gross output in 2017.

As noted, the import leakage coefficients implicit in the I-O Model were used except in the case of highly specialized inputs. Imports of goods and services during the site preparation and construction and operation phases of the proposed Project have no impact on the business sector of the domestic economy.

The proposed Project's fiscal effects on various levels of government in Alberta are estimated from a Tax Module added to the Alberta Input-Output Model by Alberta Treasury & Enterprise. The Tax Module estimates impacts on federal, provincial and local government revenues.

The RSA Economic Impact Model is based on a regional share of the latest Statistics Canada provincial input-output tables. Intra-provincial imports and exports are estimated based on the number and types of businesses within the region. Additional leakages from out-shopping and imports from other areas of the province generate region-specific impact multipliers based on the number of communities within the region corresponding to a Trade Centre Functional Classification system. In the case of Alberta, community population was used to derive a Trade Centre Functional Classification system, with Edmonton and Calgary at the top and other communities classified lower based on population relative to Calgary/Edmonton. A detailed discussion on the development of regional economic impact models is available in Appendix D.

Region-specific impact multipliers, in turn, provide more accurate results than when using provincial impact multipliers at the regional level. Given the relative paucity of services and businesses within the RSA, communities were determined to be lower within the community hierarchy and regional multipliers generated by the economic impact model were lower than provincial multipliers across all industries. This implicitly recognizes the lack of linkages between industries within the region and significant out-shopping.

It should also be noted that Employment by Industry within the Input Output Framework (used as baseline and impacted employment in the RSA Economic Impact Model) differs significantly from census employment. Notably, within the input-output framework, Government Sector employment includes both public sector health and education and is not limited to government administration alone. As a result, RSA employment within the model was adjusted to reflect this and to generate comparable results with the provincial model.

5. ECONOMIC IMPACT ESTIMATES

5.1 Provincial Economic Impacts

Economic impact analysis focuses on the magnitude of a project, and provides measures of the related changes in the economy's output and employment levels. The proposed construction of new reactors in Alberta will impact the economy through the hiring of construction workers, expenditures on engineering and design and project management, and the purchase of other services, materials and equipment from Alberta suppliers. Some components and services will be purchased from outside of Alberta; the larger these imports the smaller will be the domestic economic impact. Likewise, during the operation phase of the proposed Project, the Alberta economy will be impacted through the hiring of permanent staff and contract workers, and the purchase of materials and goods and services needed for operations. To the extent they are purchased in Alberta, economic activity in the Province will increase.

The I-O Model results for the Province of Alberta are summarized in this section, for both the site preparation and construction and operation phases of the proposed Project. The analysis excludes refurbishment investment and other sustaining capital expenditures during the life of the proposed Project. The economic indicators considered are gross output, GDP, labour income and employment. Tables 5, 6 and 7 present data on the cumulative construction impacts, the predicted construction impacts by year and the operational impacts for a single year of the proposed Project on the Province of Alberta. Detailed impacts by industry are available in Appendix C.

Table 5 Predicted Cumulative Provincial Construction Impacts

Construction Impact	Cumulative (over 10 years)
direct gross output ($M)	12,000.0
indirect gross output ($M)	1,212.4
induced gross output ($M)	10,583.7
total gross output ($M)	23,796.2
direct GDP ($M)	7,501.8
indirect GDP ($M)	453.0
induced GDP ($M)	4,693.0
total GDP ($M)	12,647.8
direct labour income	2,740.8
indirect labour income	220.8
induced labour income	2,580.7
total labour income ($M)	5,542.3
direct employment (positions)	23,148.0
indirect employment (positions)	4,347.3
induced employment (positions)	56,257.6
total employment (positions)	83,752.9

Table 6 Predicted Provincial Construction Impacts by Year

Total Impacts – Construction Alberta	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
direct gross output ($M)	74.7	161.7	758.9	1,860.0	2,519.4	2,550.5	2,140.0	1,343.7	454.1	136.9
indirect gross output ($M)	7.5	16.3	76.7	187.9	254.6	257.7	216.2	135.8	45.9	13.8
induced gross output ($M)	65.8	142.7	669.4	1,640.5	2,222.1	2,249.5	1,887.4	1,185.1	400.5	120.7
total gross output ($M)	**148.0**	**320.7**	**1,505.0**	**3,688.5**	**4,996.1**	**5,057.8**	**4,243.6**	**2,664.6**	**900.5**	**271.4**
direct GDP ($M)	46.7	101.1	474.5	1,162.8	1,575.0	1,594.5	1,337.8	840.0	283.9	85.6
indirect GDP ($M)	2.8	6.1	28.6	70.2	95.1	96.3	80.8	50.7	17.1	5.2
induced GDP ($M)	29.2	63.3	296.8	727.4	985.3	997.5	836.9	525.5	177.6	53.5
total GDP ($M)	**78.7**	**170.5**	**799.9**	**1,960.4**	**2,655.4**	**2,688.2**	**2,255.5**	**1,416.2**	**478.6**	**144.2**
direct Labour Income	17.0	36.9	173.3	424.8	575.4	582.5	488.8	306.9	103.7	31.3
indirect labour income	1.4	3.0	14.0	34.2	46.4	46.9	39.4	24.7	8.4	2.5
induced labour income	16.1	34.8	163.2	400.0	541.8	548.5	460.2	289.0	97.7	29.4
total labour income ($M)	**34.5**	**74.7**	**350.5**	**859.1**	**1,163.6**	**1,178.0**	**988.4**	**620.6**	**209.7**	**63.2**
direct employment (positions)	144.0	312.0	1,464.0	3,588.0	4,860.0	4,920.0	4,128.0	2,592.0	876.0	264.0
indirect employment (positions)	27.0	58.6	274.9	673.8	912.7	924.0	775.3	486.8	164.5	49.6
induced employment (positions)	350.0	758.3	3,558.0	8,720.1	11,811.5	11,957.3	10,032.5	6,299.5	2,129.0	641.6
total employment (positions)	**521.0**	**1,128.9**	**5,297.0**	**12,981.9**	**17,584.2**	**17,801.3**	**14,935.7**	**9,378.2**	**3,169.5**	**955.2**

Table 7 Predicted Provincial Operational Impacts for a Single Year (2017)

Impacts – Operational- Alberta	2017
direct gross output ($M)	994.4
indirect gross output ($M)	250.6
induced gross output ($M)	759.0
total gross output ($M)	**2,004.1**
direct GDP ($M)	579.1
indirect GDP ($M)	139.4
induced GDP ($M)	392.2
total GDP ($M)	**1,110.8**
direct labour income	218.3
indirect labour income	81.2
induced labour income	223.6
total labour income ($M)	**523.1**
direct employment (positions)	1,940.0
indirect employment (positions)	1,523.9
induced employment (positions)	5,063.2
total employment (positions)	**8,527.2**

The income and employment created by the proposed Project are important, as they have a stimulative impact on the Alberta economy and add to the economic well-being of Albertans.

Economic impacts are likely to be incremental. The proposed Project is relatively small in relation to the overall size of the Alberta economy, and the province has demonstrated historically an ability to accommodate fairly large cyclical swings in economic activity. Also, the proposed Project differs from much of the other new investment being proposed in Alberta. Prospective Alberta investment projects are heavily weighted towards oil sands projects (52 projects with a value of $163 billion).

The magnitude of the economic effects is likely to be small, in relation to the size of the overall Alberta economy, based on a comparison of the Project's effects to baseline economic conditions in the Province.

5.2 Regional Economic Impacts

The economic impacts on the RSA have been estimated for the site preparation and construction and the operation phases of the proposed Project. The impact measures that were considered

included gross output, GDP, labour income and employment. The estimates were derived using a RSA specific economic impact model, details of which can be found in Appendix D. Tables 8, 9 and 10 present data on the cumulative construction impacts, the predicted construction impacts by year and the operational impacts for a single year of the proposed Project on the RSA. Detailed impacts by industry are available in Appendix C.

Table 8 Predicted Cumulative Regional Construction Impacts

Impacts – Construction - RSA	Cumulative
direct gross output ($M)	12,000.0
indirect gross output ($M)	1,140.1
induced gross output ($M)	894.6
total gross output ($M)	**14,034.7**
direct GDP ($M)	6,424.7
indirect GDP ($M)	433.8
induced GDP ($M)	446.7
total GDP ($M)	**7,305.2**
direct labour income	1,546.1
indirect labour income	190.4
induced labour income	237.0
total labour income ($M)	**1,973.6**
direct employment (positions)	23,148.0
indirect employment (positions)	2,990.8
induced employment (positions)	5,245.5
total employment (positions)	**31,384.3**

Table 9 Predicted Regional Construction Impacts by Year

Total Impacts – Construction RSA	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
direct gross output ($M)	74.7	161.7	758.9	1,860.0	2,519.4	2,550.5	2,140.0	1,343.7	454.1	136.9
indirect gross output ($M)	7.1	15.4	72.1	176.7	239.4	242.3	203.3	127.7	43.1	13.0
induced gross output ($M)	5.6	12.1	56.6	138.7	187.8	190.1	159.5	100.2	33.9	10.2
total gross output ($M)	**87.3**	**189.**	**887.6**	**2,175.4**	**2,946.6**	**2,983.0**	**2,502.8**	**1,571.5**	**531.1**	**160.1**
direct GDP ($M)	40.0	86.6	406.3	995.9	1,348.9	1,365.5	1,145.7	719.4	243.1	73.3
indirect GDP ($M)	2.7	5.8	27.4	67.2	91.1	92.2	77.4	48.6	16.4	4.9
induced GDP ($M)	2.8	6.0	28.2	69.2	93.8	94.9	79.7	50.0	16.9	5.1
total GDP ($M)	**45.4**	**98.5**	**462.0**	**1,132.3**	**1,533.8**	**1,552.7**	**1,302.7**	**818.0**	**276.5**	**83.3**
direct labour income	9.6	20.8	97.8	239.7	324.6	328.6	275.7	173.1	58.5	17.6
indirect labour income	1.2	2.6	12.0	29.5	40.0	40.5	34.0	21.3	7.2	2.2
induced labour income	1.5	3.2	15.0	36.7	49.8	50.4	42.3	26.5	9.0	2.7
total labour income ($M)	**12.3**	**26.6**	**124.8**	**305.9**	**414.4**	**419.5**	**351.9**	**221.0**	**74.7**	**22.5**
direct employment (positions)	144.0	312.0	1,464.0	3,588.0	4,860.0	4,920.0	4,128.0	2,592.0	876.0	264.0
indirect employment (positions)	18.6	40.3	189.2	463.6	627.9	635.7	533.4	334.9	113.2	34.1
induced employment (positions)	32.6	70.7	331.8	813.1	1,101.3	1,114.9	935.4	587.4	198.5	59.8
total employment (positions)	**195.2**	**423.0**	**1,984.9**	**4,864.7**	**6,589.2**	**6,670.6**	**5,596.8**	**3,514.3**	**1,187.7**	**357.9**

Table 10 Predicted Regional Operational Impacts for a Single Year (2017)

Total Impacts – Operational- RSA	2017
direct gross output ($M)	994.4
indirect gross output ($M)	62.5
induced gross output ($M)	77.0
total gross output ($M)	1,133.9
direct GDP ($M)	249.3
indirect GDP ($M)	31.7
induced GDP ($M)	38.5
total GDP ($M)	319.4
direct labour income	237.3
indirect labour income	20.6
induced labour income	20.5
total labour income ($M)	278.3
direct employment (positions)	1,940.0
indirect employment (positions)	317.9
induced employment (positions)	449.5
total employment (positions)	2,707.4

The regional economic analysis shows that the proposed Project is expected to have a significant stimulative impact on the Peace Country, as employment opportunities are created and commodities and services are purchased by Bruce Power Alberta. Many of the jobs created during the site preparation and construction and operation phases will require skilled personnel and hence offer above average income opportunities for workers. Because the RSA is smaller and less diverse than the overall Alberta economy, the Project has significant spill-over effects on the rest of Alberta.

It is expected that in-migration will fill many of the more highly skilled direct positions. However, it should be noted that the 10 year construction period will allow for substantial training opportunities for local residents and a number of previous out-migrants from the region can be reasonably expected to return to the RSA.

If the regional unemployment rates remain high and if this holds true also for capacity utilization in local businesses, the economic effects might be interpreted as incremental to the RSA. Also, if inputs from Alberta relocate to the RSA to meet opportunities created by the proposed Project, effects are incremental to the region (and only distributive from an overall Alberta perspective).

A larger and more diverse economy should result in greater regional self-sufficiency, increased stability, and greater community diversity. The presence of the proposed Project would be expected to bring the RSA closer to a more self-sufficient regional economy.

Within the smaller regional economy, increased activity levels could put some upward pressure on wages and prices, but expenditures are not so large as to cause major disruptions of local markets. The impact would be to reduce regional unemployment, increase in-migration, and create opportunities for regional suppliers.

6. PREDICTED FISCAL EFFECTS ON ALBERTA AND THE REGIONAL STUDY AREA

6.1 Provincial Fiscal Impacts

Alberta Finance was sub-contracted to run equivalent I-O simulations of the proposed Project. The Alberta Finance model lacked the flexibility to generate specialized mixed IO model results. However, the model has the advantage of having a detailed fiscal impact module. In the case of operational impacts, the Finance model was shocked through increasing electricity generation final demand. In the case of site preparation and construction, a previous large scale industrial project was scaled up to reflect the magnitude of the proposed Project. Fiscal analysis results for the site preparation and construction and operation phases of the proposed Project are presented in Table 11. Table 12 presents a breakdown of the fiscal impacts by level of government by source.

Table 11 Predicted Provincial Fiscal Analysis Results

Level of Government	Construction Phase (Over 10 Years)		Operations Phase (Over 60 Years)	
	Average Annual	Cumulative (2007 Dollars)	Average Annual	Cumulative (2017 Dollars)
	$ Millions			
federal	222	2,219	81	4,846
provincial	160	1,599	86	5,145
local	27	269	18	1,056
total	**409**	**4,087**	**184**	**11,047**

Table 12 Predicted Incremental Local Government Revenues at the Provincial Level

Provincial Level Impacts				
Operations (60 year Cumulative in 2017 $M)	**Direct**	**Indirect**	**Induced**	**Total**
licenses, fees and permits, developers fees	24.2	6.2	7.5	37.9
real and personal property tax	557.3	143.9	172.7	873.9
business tax	52.5	13.6	16.3	82.3
developer's fees	28.5	7.4	8.8	44.7
other transfers to local Government from persons	6.3	6.9	3.9	17.0
total local Government revenues (operations)	**668.7**	**178.0**	**209.2**	**1,055.9**
construction (10 year cumulative in 2007 $M)				
licenses, fees and permits, developers fees	3.5	1.7	4.2	9.5
real and personal property tax	81.1	40.0	96.9	218.0
business tax	7.6	3.8	9.1	20.5
developer's fees	4.2	2.0	5.0	11.2
other transfers to local Government from persons	3.8	3.6	2.2	9.6
total local Government revenues (const.)	**100.2**	**51.2**	**117.3**	**268.7**

6.2 Municipal Fiscal Impacts

Property tax is a main source of revenue for financing municipal operations. Annually, municipalities establish assessment values for various classes of property within their boundaries, to which the applicable current municipal tax rates are applied. Municipalities also set tax rates to raise requisitions for cost sharing programs, the most notable being the Alberta School Foundation Fund.

Other sources of municipal revenues (apart from grants from senior levels of government) include business taxes, special taxes, local improvement taxes, taxes on well drilling equipment, taxes within a business revitalization zone, special franchise fees, and user fees for various services such as water, sewer, garbage collection, recreation facilities, etc. The MD of Northern Lights' primary source of assessment is the non-residential class or the industrial component of the property tax base.

6.3 Regional Fiscal Impacts

The proposed Project will add considerably to the Municipal District of Northern Lights No. 22 assessment base and municipal property tax revenue (Table 13).

In order to derive local government fiscal impacts within the RSA from the provincial level analysis a number of assumptions were made. First and foremost, the ratio of RSA to provincial GDP impact was used to allocate provincial level government fiscal impacts to the RSA level. Second, the direct operational property tax within the RSA is assumed to be the impact of the new facility on local property taxes within the MD where it is located. This figure is $160.2 million over the 60 year life span of the facility.

Table 13 Regional Level Local Government Fiscal Impacts

RSA Level Impacts (used RSA GDP Impacts to Prov GDP Impacts to Allocate)				
Operations (60 year Cumulative in 2017 $M)	**Direct**	**Indirect**	**Induced**	**Total**
licenses, fees and permits, developers fees	7.0	1.8	2.2	10.9
real and personal property tax	160.2	41.4	49.7	251.3
business tax	15.1	3.9	4.7	23.7
developer's fees	8.2	2.1	2.5	12.9
other transfers to local Government from persons	1.8	2.0	1.1	4.9
total local Government revenues (operations)	**192.3**	**51.2**	**60.2**	**303.6**
construction (10 year cumulative in 2007$M)				
licenses, fees and permits, developers fees	2.0	1.0	2.4	5.5
real and personal property tax	46.8	23.1	56.0	125.9
business tax	4.4	2.2	5.3	11.9
developer's fees	2.4	1.2	2.9	6.4
other transfers to local Government from persons	2.2	2.1	1.3	5.5
total local Government revenues (const.)	**57.9**	**29.6**	**67.8**	**155.2**

On the expenditure side, the proposed Project itself is unlikely to have a large direct impact on the MD's capital and operating costs. The site will be self-contained in the provision of utility services needed by the Project and access will be via provincial highways and air.

However, there may be some in-migration to the RSA as a result of the proposed Project's direct, indirect and induced effects with consequent impacts on expenditures by local governments. Most of the in-migration (at least for direct effects) would be expected to occur in proximity to the Project. Workers relocating to the region would pay property taxes (and user fees associated with utility services) to the municipality in which they reside, and municipalities would be required to provide municipal services to the new residents.

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Statistics Canada, Table 282-0055 – Labour force characteristics, population 15 years and older, by economic region, by Province (Manitoba, Saskatchewan, Alberta, British Columbia) and Catalogue No. 71-001-PIB.

Statistics Canada, Table 282-0054 – Labour force characteristics, unadjusted, by economic region (3-month moving average) (Alberta, British Columbia) and Catalogue No. 71-001-XIE.

Statistics Canada, Table 282-0060 – Labour force survey estimates (LFS), employment by economic region and North American Industry Classification System (NAICS), 3-month moving average, unadjusted for seasonality, monthly (persons), CANSIM (database).

Statistics Canada, Table 282-0061 – Labour force survey estimates (LFS), employment by economic region and North American Industry Classification System (NAICS), annual (persons), CANSIM (database).

APPENDIX A

ECONOMIC PROFILE OF ALBERTA & THE REGIONAL STUDY AREA

Table A-1 Economic Profile of Alberta & the Regional Study Area

Demographic & Economic Profile of RSA and Alberta, 2006 Census Data[a][c]		
	RSA[b]	**Province of Alberta**
Demographic		
population	239,288	3,290,350
population aged 15 & over[d](%)	76.8	80.8
urban population (%)	47.6	82.1
private dwellings[e]	85,746	1,256,192
household average income[f]($)	76,174	97,915
Educational Attainment		
population aged 25-64 with post-secondary education	59,055	1,092,340
population aged 25-64 without post-secondary education	64,690	713,300
total population aged 25-64	123,745	1,805,640
Labour Force Activity[g]		
total population aged 15 & over	181,670	2,625,145
in the labour force[h]	134,675	1,942,825
employed[i]	128,190	1,859,960
unemployed[j]	6,475	82,860
not in the labour force[k]	47,005	682,320
participation rate[l](%)	74.1	74.0
employment rate[m](%)	70.6	70.9
unemployment rate[n](%)	4.8	4.3
Employment by Occupation[o]		
total experienced labour force aged 15 & over[p]	133,670	1,928,635
A. management	11,235	187,240
B. business, finance & administration	18,540	340,430
C. natural & applied sciences & related	5,470	144,240
D. health	5,545	103,615
E. social science, education, government service & religion	7,575	136,610
F. art, culture, recreation & sport	1,565	45,160
G. sales & service	27,180	438,105
H. trades, transportation & equipment operators & related	31,995	350,360
I. unique to primary industry	18,680	117,500
J. unique to processing, manufacturing & utilities	5,885	65,370
Employment by Industry[q]		
total experienced labour force aged 15 & over[p]	133,670	1,928,635
A. agriculture, forestry, fishing & hunting	14,180	75,875
B. mining & oil & gas extraction	15,830	134,620
C. utilities	1,155	18,025
D. construction	12,560	169,420
E. manufacturing	8,205	138,365
F. wholesale trade	4,590	85,510
G. retail trade	13,675	206,655
H. transportation & warehousing	7,930	98,870
I. information & cultural	1,085	35,970
J. finance & insurance	2,315	59,560
K. real estate & rental & leasing	2,270	37,905
L. professional, scientific & technical services	4,960	145,475
M. management of companies & enterprises	65	2,585

Table A-1 Economic Profile of Alberta & the Regional Study Area (continued)

Demographic & Economic Profile of RSA and Alberta, 2006 Census Data[a][c]		
	RSA[b]	Province of Alberta
N. administration & support, waste management & remediation services	3,540	71,365
O. educational services	8,555	120,460
P. health care & social assistance	9,885	175,200
Q. arts, entertainment & recreation	1,315	36,280
R. accommodation & food services	8,065	127,630
S. public administration	5,785	89,800
T. other services	7,680	90,050

Notes:

(a) Totals- may not add due to rounding. Data for the RSA are compiled from Census Division data.

(b) Regional Study Area (RSA)- Athabasca-Grande Prairie-Peace River Economic Region, defined by Statistics Canada to include Alberta Census Divisions 13, 17, 18 & 19.

(c) Data coverage- The demographic data are based on 100% data from the 2006 Census by Statistics Canada. Household income, educational attainment, labour force activity, and employment data are based on 20% sample data from the 2006 Census by Statistics Canada. Note that data exclude Census data for one or more incompletely enumerated Indian reserves or Indian settlements.

(d) Population aged 15 & over- persons aged 15 and over in the week prior to Census Day; sometimes referred to as working age population.

(e) Private dwellings- A private dwelling is a separate set of living quarters which has a private entrance either directly from outside or from a common hall, lobby, vestibule or stairway leading to the outside, and in which a person or a group of persons live permanently. Private dwellings equates to private households which refers to a person or persons (other than foreign residents) who occupy the same dwelling and do not have a usual place of residence elsewhere in Canada. Household members temporarily absent on Census Day are considered as a part of their usual household.

(f) Household Income- is income of all members of that household in the year 2005. Income includes employment income, income from government sources and investments.

(g) Labour force activity- refers to the labour market activity of the population aged 15 and over in the week prior to Census Day. Respondents are classified as employed, unemployed or not in the labour force. The labour force includes the employed and unemployed.

(h) Labour force- persons either employed or unemployed during the week prior to Census Day.

(i) Employed- persons who, during the week prior to Census Day: a) did any work at all for pay or in self-employment or without pay in a family farm, business or professional practice; b) were absent from their job or business, with or without pay, for the entire week because of a vacation, an illness, a labour dispute at their place of work, or any other reasons.

(j) Unemployed- persons who, during the week prior to Census Day, were without paid work or without self-employment work and were available for work and either: a) had actively looked for paid work in the past four weeks; or b) were on temporary lay-off and expected to return to their job; or c) had definite arrangements to start a new job in four weeks or less.

(k) Not in the labour force- persons who, in the week prior to Census Day, were neither employed nor unemployed. It includes students, homemakers, retired workers, seasonal workers in an 'off' season who were not looking for work, and persons who could not work because of a long term illness or disability.

(l) Participation rate- is labour force as a percentage of the total population aged 15 and over.

(m) Employment rate- is employed persons as a percentage of the total population aged 15 and over.

(n) Unemployment rate- is unemployed persons as a percentage of the labour force.

(o) Employment by Occupation- the National Occupational Classification for Statistics 2006 is used. Occupation refers to the kind of work persons 15 years of age and over were doing during the survey reference week, as determined by the kind of work reported and the description of the most important duties of the job.

(p) Experienced labour force- is persons who were employed and persons who were unemployed who worked for pay or in self-employment since January 1, 2005.

(q) Employment by Industry- uses the North American Industry Classification System 2002.

Sources:

Statistics Canada. 2008. *Profile of Labour Market Activity, Industry, Occupation, Education, Language of Work, Place of Work and Mode of Transportation for Canada, Provinces, Territories, Census Divisions and Census Subdivisions, 2006 Census (table)*. 2006 Electronic Profiles. 2006 Census of Population.

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Table A-2 Labour Force Characteristics of Alberta's Economic Regions 2007 & 2008

Economic Region/ Time Period	Working-Age Population	Labour Force	Employed	Unemployed	Unemployment Rate	Participation Rate	Employment Rate
	Thousands				Percent		
Alberta (Annual 2007)	**2,740.7**	**2,030.5**	**1,959.0**	**71.5**	**3.5**	**74.1**	**71.5**
Lethbridge-Medicine Hat	206.7	139.4	133.8	5.6	4.0	67.4	64.7
Camrose-Drumheller	154.7	113.6	110.0	3.6	3.2	73.4	71.1
Calgary	995.1	760.4	736.2	24.3	3.2	76.4	74.0
Banff-Jasper-Rocky Mountain House	67.8	54.1	52.8	x	x	79.8	77.9
Red Deer	142.2	107.8	104.4	3.4	3.2	75.8	73.4
Edmonton	900.0	645.7	621.0	24.7	3.8	71.7	69.0
Athabasca-Grande Prairie-Peace River	**183.2**	**138.8**	**133.3**	**5.6**	**4.0**	**75.8**	**72.8**
Wood Buffalo-Cold Lake	91.0	70.7	68.0	2.7	3.8	77.7	74.7
Alberta							
March 2008	2,776.0	2,048.7	1,977.3	71.4	3.5	73.8	71.2
March 2007	2,709.4	1,984.1	1,913.3	70.8	3.6	73.2	70.6
Athabasca-Grande Prairie-Peace River							
March 2008	185.1	135.9	130.2	5.6	4.1	73.4	70.3
March 2007	181.4	135.7	130.8	4.9	3.6	74.8	72.1

Notes:

Data are from Labour Force Survey.

x- data suppressed due to confidentiality.

Sources:

Statistics Canada, *Table 282-0055 – Labour force characteristics, population 15 years and older, by economic region, by Province (Manitoba, Saskatchewan, Alberta, British Columbia)* and Catalogue No. 71-001-PIB.

Statistics Canada, Table 282-0054 – Labour force characteristics, unadjusted, by economic region (3-month moving average) (Alberta, British Columbia) and Catalogue No. 71-001-XIE.

Table A-3 Regional and Alberta Employment by Industry, Labour Force Survey Data

Industry	RSA		Alberta		
	May 2007	May 2006	March 2008	May 2007	March 2007
	Thousands (Unadjusted)				
all industries	**133.2**	**129.7**	**1,987.2**	**1,937.7**	**1,921.3**
goods-producing sector	**44.2**	**44.7**	**551.2**	**538.2**	**534.2**
agriculture	6.9	8.0	59.0	44.4	41.8
other primary	16.0	14.9	148.0	147.6	149.2
utilities	x	x	16.2	17.7	17.3
construction	11.0	12.2	196.8	183.2	181.4
manufacturing	9.7	9.0	131.2	145.4	144.6
services-producing sector	**89.0**	**84.9**	**1,436.4**	**1,399.5**	**1,387.1**
trade	23.1	22.9	314.1	287.1	282.0
transportation & warehousing	7.9	7.8	102.5	106.3	103.1
finance, insurance, real estate & leasing	4.6	6.4	116.9	95.8	94.9
professional, scientific & technical services	6.1	5.0	161.1	145.7	145.8
business, building & other support services	3.0	2.4	67.4	70.6	70.3
educational services	9.7	7.4	129.3	142.9	144.4
health care & social assistance	12.6	11.4	188.9	184.1	181.9
information, culture & recreation	2.7	2.9	69.7	75.0	73.1
accommodation & food services	7.7	8.4	107.3	117.6	120.3
other services	9.2	6.5	92.5	95.9	97.6
public administration	2.4	3.9	86.9	78.6	73.6

Notes:

x- data suppressed due to confidentiality.

Sources:

Alberta Employment and Immigration, *Alberta Labour Force Statistics March 2008*, March 2008. Data are from Statistics Canada.

Statistics Canada, Table 282-0060 – Labour force survey estimates (LFS), employment by economic region and North American Industry Classification System (NAICS), 3-month moving average, unadjusted for seasonality, monthly (persons), CANSIM (database).

Table A-4 Regional and Alberta Employment by Industry, 2000 to 2006

Industry	2000	2001	2002	2003	2004	2005	2006
	Thousands						
Province of Alberta							
total goods-producing sector	429.8	445.5	462.2	474.7	496.4	487.1	518.9
agriculture	70.8	60.0	61.4	66.8	66.2	56.2	52.3
other primary	82.8	101.4	95.8	101.3	111.7	127.0	139.3
utilities	11.9	13.9	17.4	13.9	13.6	13.2	17.1
construction	126.4	131.3	141.4	146.6	160.5	159.7	172.6
manufacturing	137.8	138.9	146.2	146.1	144.3	130.9	137.5
total services-producing sector	1,154.2	1,185.4	1,208.6	1,242.0	1,261.1	1,297.3	1,351.8
total employed, all industries	1,584.0	1,630.9	1,670.8	1,716.7	1,757.5	1,784.4	1,870.7
Athabasca-Grande Prairie- Peace River Economic Region							
total goods-producing sector	40.3	39.1	37.6	42.7	42.4	47.0	45.9
agriculture	11.2	7.7	9.0	10.3	6.7	9.0	7.7
other primary	10.1	11.1	10.2	14.2	15.1	17.3	16.0
utilities	x	x	x	x	x	x	x
construction	10.5	11.1	9.7	8.6	11.2	11.3	12.5
manufacturing	7.9	8.4	7.9	8.4	8.5	8.2	8.8
total services-producing sector	69.1	71.3	74.8	72.1	73.2	78.1	83.1
total employed, all industries	109.3	110.4	112.4	114.7	115.7	125.1	129.0

Notes:

x- data suppressed due to confidentiality.

Source:

Statistics Canada, Table 282-0061 – Labour force survey estimates (LFS), employment by economic region and North American Industry Classification System (NAICS), annual (persons), CANSIM (database).

APPENDIX B

MIXED ENDOGENOUS-EXOGENOUS INPUT-OUTPUT IMPACTS

In a 3 industry x 3 industry input-output model with industry 3 exogenized, endogenous industry output and final demand X^M

X1
X2
YL3

is calculated as follows:

$$X^M = M^{-1} Y^M$$

Where M=

(1-aL11)	–aL12	0
-aL21	(1-aL22)	0
-aL31	–aL32	-1

$$A^L = (D(I-\mu-\alpha-\beta)B)$$

Y^M=

YL1+aL13X3
YL2+aL23X3
-(1-aL33)X3

$Y^L = D((I-\mu-\alpha-\beta)e^*+(I-\mu-\beta)X_d+(I-\mu)X_r)$

Where:

I = an identity matrix of industry by industry dimension.

D = a matrix of coefficients representing commodity output proportions.

B = a matrix of coefficients representing commodity input proportions (technical coefficients) by industry.

μ = a diagonal matrix whose elements represent the ratio of imports to use.

α = a diagonal matrix whose elements represent the ratio of government production to use.

β = a diagonal matrix whose elements represent the ratio of inventory withdrawals to use.

e^* = final demand categories of consumption, government purchases of goods and services, business and government investment, and inventory additions.

Xd = final demand category of domestic exports.

X_r = final demand category of re-exports.

APPENDIX C

IMPACTS BY INDUSTRY

Table C-1 Construction Impacts in Alberta by Industry

Total Impacts ($M) Construction – Alberta – Cumulative -2007 to 2016	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	371.6	144.5	100.6	2366.4	55.0
forestry and logging	56.4	23.8	24.5	194.9	12.4
fishing, hunting and trapping	0.1	0.1	0.1	2.9	0.0
support activities for agriculture and forestry	9.9	4.9	5.1	124.9	4.4
mining and oil and gas extraction	951.7	667.9	676.4	1221.1	108.4
utilities	221.6	129.8	128.7	359.4	27.1
construction	12,000.0	7,501.8	7,695.7	23148.0	2,740.8
manufacturing	4,431.0	1,113.7	1,136.3	10,272.2	600.9
wholesale trade	310.7	182.9	188.6	2,326.1	119.3
retail trade	559.6	332.0	344.1	10,162.4	269.2
transportation and warehousing	532.5	293.3	311.1	3,441.3	190.2
information and cultural industries	377.0	250.1	256.0	1901.1	101.5
finance, insurance, real estate and rental and leasing	1,754.6	1,040.4	1,159.9	5,178.2	534.7
professional, scientific and technical services	368.6	216.3	219.7	3350.1	176.2
administrative and support, waste management and remediation services	234.1	143.4	147.2	3,297.8	112.5
educational services	18.6	13.8	14.1	498.0	13.2
health care and social assistance	111.9	84.7	86.4	1,568.0	66.4
arts, entertainment and recreation	69.0	31.0	32.4	1,301.7	24.9
accommodation and food services	291.0	136.8	145.5	4,742.0	102.3
other services (except public administration)	243.5	150.8	154.3	4550.3	116.7
operating, office, cafeteria and laboratory supplies	264.8	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	226.9	0.0	0.0	0.0	0.0
transportation margins	84.6	0.0	0.0	0.0	0.0
non-profit institutions serving households	128.4	83.3	84.8	2284.3	79.4
government sector	178.1	102.6	103.3	1461.7	86.8
total	**23,796.2**	**12,647.8**	**13,014.4**	**83,752.9**	**5,542.3**

Table C-1 Construction Impacts in Alberta by Industry (continued)

Direct Impacts ($m) Construction – Alberta – Cumulative -2007 to 2016	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	0.0	0.0	0.0	0.0	0.0
forestry and logging	0.0	0.0	0.0	0.0	0.0
fishing, hunting and trapping	0.0	0.0	0.0	0.0	0.0
support activities for agriculture and forestry	0.0	0.0	0.0	0.0	0.0
mining and oil and gas extraction	0.0	0.0	0.0	0.0	0.0
utilities	0.0	0.0	0.0	0.0	0.0
construction	12,000.0	7,501.8	7,695.7	23,148.0	2,740.8
manufacturing	0.0	0.0	0.0	0.0	0.0
wholesale trade	0.0	0.0	0.0	0.0	0.0
retail trade	0.0	0.0	0.0	0.0	0.0
transportation and warehousing	0.0	0.0	0.0	0.0	0.0
information and cultural industries	0.0	0.0	0.0	0.0	0.0
finance, insurance, real estate and rental and leasing	0.0	0.0	0.0	0.0	0.0
professional, scientific and technical services	0.0	0.0	0.0	0.0	0.0
administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.0
educational services	0.0	0.0	0.0	0.0	0.0
health care and social assistance	0.0	0.0	0.0	0.0	0.0
arts, entertainment and recreation	0.0	0.0	0.0	0.0	0.0
accommodation and food services	0.0	0.0	0.0	0.0	0.0
other services (except public administration)	0.0	0.0	0.0	0.0	0.0
operating, office, cafeteria and laboratory supplies	0.0	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	0.0	0.0	0.0	0.0	0.0
transportation margins	0.0	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.0	0.0	0.0	0.0	0.0
government sector	0.0	0.0	0.0	0.0	0.0
total	**12,000.0**	**7,501.8**	**7,695.7**	**23,148.0**	**2,740.8**

Table C-1 Construction Impacts in Alberta by Industry (continued)

Indirect Impacts ($M) Construction – Alberta – Cumulative -2007 to 2016	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	50.4	19.6	13.6	320.7	7.4
forestry and logging	8.3	3.5	3.6	28.6	1.8
fishing, hunting and trapping	0.0	0.0	0.0	0.0	0.0
support activities for agriculture and forestry	1.2	0.6	0.6	15.6	0.6
mining and oil and gas extraction	127.7	89.7	90.8	163.9	14.5
utilities	14.4	8.5	8.4	23.4	1.8
construction	0.0	0.0	0.0	0.0	0.0
manufacturing	695.9	174.9	178.5	1,613.3	94.4
wholesale trade	21.2	12.5	12.9	159.0	8.2
retail trade	5.3	3.1	3.3	96.3	2.5
transportation and warehousing	59.3	32.7	34.6	383.2	21.2
information and cultural industries	38.8	25.7	26.3	195.5	10.4
finance, insurance, real estate and rental and leasing	45.2	26.8	29.9	133.3	13.8
professional, scientific and technical services	35.8	21.0	21.4	325.8	17.1
administrative and support, waste management and remediation services	26.0	15.9	16.3	365.8	12.5
educational services	0.1	0.1	0.1	3.0	0.1
health care and social assistance	0.5	0.4	0.4	7.7	0.3
arts, entertainment and recreation	2.5	1.1	1.1	46.2	0.9
accommodation and food services	3.8	1.8	1.9	61.5	1.3
other services (except public administration)	18.7	11.6	11.9	350.1	9.0
operating, office, cafeteria and laboratory supplies	27.7	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	14.6	0.0	0.0	0.0	0.0
transportation margins	8.9	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.5	0.3	0.3	8.3	0.3
government sector	5.6	3.2	3.2	46.0	2.7
total	**1,212.4**	**453.0**	**459.1**	**4,347.3**	**220.8**

Table C-1 Construction Impacts in Alberta by Industry (continued)

Induced Impacts ($M) Construction – Alberta – Cumulative -2007 to 2016	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	321.3	124.9	87.0	2,045.7	47.5
forestry and logging	48.1	20.3	20.9	166.3	10.6
fishing, hunting and trapping	0.1	0.1	0.1	2.9	0.0
support activities for agriculture and forestry	8.6	4.2	4.4	109.3	3.9
mining and oil and gas extraction	824.0	578.3	585.6	1,057.2	93.8
utilities	207.1	121.3	120.3	336.0	25.3
construction	0.0	0.0	0.0	0.0	0.0
manufacturing	3,735.1	938.8	957.8	8,658.9	506.6
wholesale trade	289.5	170.4	175.7	2167.2	111.1
retail trade	554.3	328.9	340.9	10,066.1	266.7
transportation and warehousing	473.2	260.7	276.5	3,058.2	169.0
information and cultural industries	338.2	224.4	229.6	1,705.5	91.0
finance, insurance, real estate and rental and leasing	1,709.4	1,013.6	1,130.0	5044.9	520.9
professional, scientific and technical services	332.8	195.2	198.3	3,024.3	159.1
administrative and support, waste management and remediation services	208.2	127.5	130.8	2,932.0	100.0
educational services	18.5	13.7	14.0	495.0	13.1
health care and social assistance	111.3	84.3	86.0	1,560.4	66.1
arts, entertainment and recreation	66.5	29.9	31.2	1,255.5	24.0
accommodation and food services	287.2	135.0	143.6	4,680.4	101.0
other services (except public administration)	224.7	139.2	142.4	4,200.2	107.7
operating, office, cafeteria and laboratory supplies	237.1	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	212.3	0.0	0.0	0.0	0.0
transportation margins	75.7	0.0	0.0	0.0	0.0
non-profit institutions serving households	127.9	83.0	84.5	2,276.0	79.2
government sector	172.5	99.4	100.0	1,415.7	84.1
total	**10,583.7**	**4,693.0**	**4,859.6**	**56,257.6**	**2,580.7**

Table C-2 Operational Impacts in Alberta by Industry

Total Impacts ($M) Operational – Alberta - 2017	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	14.2	5.5	3.9	90.6	2.1
forestry and logging	1.8	0.8	0.8	6.3	0.4
fishing, hunting and trapping	0.0	0.0	0.0	0.3	0.0
support activities for agriculture and forestry	0.4	0.2	0.2	5.5	0.2
mining and oil and gas extraction	91.6	64.3	65.1	117.5	10.4
utilities	994.4	579.1	608.4	1,940.0	218.3
construction	12.7	4.4	4.5	57.4	3.7
manufacturing	125.8	31.6	32.3	291.6	17.1
wholesale trade	24.9	14.7	15.1	186.8	9.6
retail trade	54.3	32.2	33.4	985.9	26.1
transportation and warehousing	25.2	13.9	14.7	163.1	9.0
information and cultural industries	132.7	88.0	90.1	669.0	35.7
finance, insurance, real estate and rental and leasing	187.5	111.2	124.0	553.4	57.1
professional, scientific and technical services	117.2	68.8	69.8	1065.1	56.0
administrative and support, waste management and remediation services	60.9	37.3	38.3	857.7	29.3
educational services	1.9	1.4	1.4	50.4	1.3
health care and social assistance	11.3	8.5	8.7	158.2	6.7
arts, entertainment and recreation	6.9	3.1	3.2	130.4	2.5
accommodation and food services	28.3	13.3	14.2	461.1	10.0
other services (except public administration)	17.0	10.5	10.8	317.7	8.1
operating, office, cafeteria and laboratory supplies	28.4	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	25.0	0.0	0.0	0.0	0.0
transportation margins	4.9	0.0	0.0	0.0	0.0
non-profit institutions serving households	12.4	8.1	8.2	221.2	7.7
government sector	24.1	13.9	14.0	197.9	11.7
total	**2,004.1**	**1,110.8**	**1,161.1**	**8,527.2**	**523.1**

Table C-2 Operational Impacts in Alberta by Industry (continued)

Direct Impacts ($M) Operational – Alberta - 2017	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	0.0	0.0	0.0	0.0	0.0
forestry and logging	0.0	0.0	0.0	0.0	0.0
fishing, hunting and trapping	0.0	0.0	0.0	0.0	0.0
support activities for agriculture and forestry	0.0	0.0	0.0	0.0	0.0
mining and oil and gas extraction	0.0	0.0	0.0	0.0	0.0
utilities	994.4	579.1	608.4	1,940.0	218.3
construction	0.0	0.0	0.0	0.0	0.0
manufacturing	0.0	0.0	0.0	0.0	0.0
wholesale trade	0.0	0.0	0.0	0.0	0.0
retail trade	0.0	0.0	0.0	0.0	0.0
transportation and warehousing	0.0	0.0	0.0	0.0	0.0
information and cultural industries	0.0	0.0	0.0	0.0	0.0
finance, insurance, real estate and rental and leasing	0.0	0.0	0.0	0.0	0.0
professional, scientific and technical services	0.0	0.0	0.0	0.0	0.0
administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.0
educational services	0.0	0.0	0.0	0.0	0.0
health care and social assistance	0.0	0.0	0.0	0.0	0.0
arts, entertainment and recreation	0.0	0.0	0.0	0.0	0.0
accommodation and food services	0.0	0.0	0.0	0.0	0.0
other services (except public administration)	0.0	0.0	0.0	0.0	0.0
operating, office, cafeteria and laboratory supplies	0.0	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	0.0	0.0	0.0	0.0	0.0
transportation margins	0.0	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.0	0.0	0.0	0.0	0.0
government sector	0.0	0.0	0.0	0.0	0.0
total	**994.4**	**579.1**	**608.4**	**1,940.0**	**218.3**

Table C-2 Operational Impacts in Alberta by Industry (continued)

Indirect Impacts ($M) Operational – Alberta - 2017	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	1.2	0.5	0.3	7.5	0.2
forestry and logging	0.2	0.1	0.1	0.6	0.0
fishing, hunting and trapping	0.0	0.0	0.0	0.0	0.0
support activities for agriculture and forestry	0.0	0.0	0.0	0.5	0.0
mining and oil and gas extraction	5.2	3.7	3.7	6.7	0.6
utilities	0.0	0.0	0.0	0.0	0.0
construction	4.6	1.6	1.7	20.9	1.4
manufacturing	14.7	3.7	3.8	34.0	2.0
wholesale trade	2.7	1.6	1.7	20.4	1.0
retail trade	1.8	1.1	1.1	32.8	0.9
transportation and warehousing	3.2	1.8	1.9	20.7	1.1
information and cultural industries	85.7	56.9	58.2	432.2	23.1
finance, insurance, real estate and rental and leasing	28.0	16.6	18.5	82.5	8.5
professional, scientific and technical services	71.0	41.7	42.3	645.3	33.9
administrative and support, waste management and remediation services	3.7	2.3	2.3	52.5	1.8
educational services	0.1	0.1	0.1	2.6	0.1
health care and social assistance	0.7	0.6	0.6	10.3	0.4
arts, entertainment and recreation	0.9	0.4	0.4	16.9	0.3
accommodation and food services	1.3	0.6	0.7	21.3	0.5
other services (except public administration)	2.2	1.4	1.4	41.6	1.1
operating, office, cafeteria and laboratory supplies	8.2	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	5.8	0.0	0.0	0.0	0.0
transportation margins	0.5	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.2	0.2	0.2	4.1	0.1
government sector	8.6	4.9	5.0	70.4	4.2
total	**250.6**	**139.4**	**143.8**	**1,523.9**	**81.2**

Table C-2 Operational Impacts in Alberta by Industry (continued)

Induced Impacts ($M) Operational – Alberta - 2017	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	13.1	5.1	3.5	83.2	1.9
forestry and logging	1.7	0.7	0.7	5.7	0.4
fishing, hunting and trapping	0.0	0.0	0.0	0.3	0.0
support activities for agriculture and forestry	0.4	0.2	0.2	5.0	0.2
mining and oil and gas extraction	86.3	60.6	61.4	110.8	9.8
utilities	0.0	0.0	0.0	0.0	0.0
construction	8.1	2.8	2.9	36.5	2.4
manufacturing	111.1	27.9	28.5	257.6	15.1
wholesale trade	22.2	13.1	13.5	166.4	8.5
retail trade	52.5	31.1	32.3	953.1	25.2
transportation and warehousing	22.0	12.1	12.9	142.3	7.9
information and cultural industries	47.0	31.2	31.9	236.8	12.6
finance, insurance, real estate and rental and leasing	159.5	94.6	105.5	470.8	48.6
professional, scientific and technical services	46.2	27.1	27.5	419.9	22.1
administrative and support, waste management and remediation services	57.2	35.0	35.9	805.2	27.5
educational services	1.8	1.3	1.4	47.8	1.3
health care and social assistance	10.5	8.0	8.1	147.9	6.3
arts, entertainment and recreation	6.0	2.7	2.8	113.6	2.2
accommodation and food services	27.0	12.7	13.5	439.8	9.5
other services (except public administration)	14.8	9.1	9.4	276.1	7.1
operating, office, cafeteria and laboratory supplies	20.2	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	19.3	0.0	0.0	0.0	0.0
transportation margins	4.4	0.0	0.0	0.0	0.0
non-profit institutions serving households	12.2	7.9	8.1	217.1	7.6
government sector	15.5	8.9	9.0	127.4	7.6
total	**759.0**	**392.2**	**408.9**	**5,063.2**	**223.6**

Table C-3 Construction Impacts in Region by Industry

Total Impacts ($M) Construction – RSA – Cumulative -2007 to 2016	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	45.0	30.2	24.4	286.5	10.4
forestry and logging	164.2	30.6	31.6	568.0	15.0
fishing, hunting and trapping	11.0	3.1	3.3	214.2	2.5
support activities for agriculture and forestry	0.4	0.2	0.2	5.2	0.2
mining and oil and gas extraction	216.1	167.8	170.0	277.2	24.7
utilities	0.0	0.0	0.0	0.0	0.0
construction	12,000.0	6,424.7	6,549.4	23,148.0	1,546.1
manufacturing	780.3	262.0	267.7	1,808.9	133.8
wholesale trade	0.0	0.0	0.0	0.0	0.0
retail trade	88.6	58.7	61.1	1,608.6	46.5
transportation and warehousing	78.5	59.5	64.5	507.1	36.9
information and cultural industries	0.4	0.3	0.4	2.1	0.1
finance, insurance, real estate and rental and leasing	249.8	169.8	190.9	737.1	81.3
professional, scientific and technical services	26.8	18.2	18.6	243.3	14.5
administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.0
educational services	3.3	3.0	3.0	87.3	2.8
health care and social assistance	0.0	0.0	0.0	0.0	0.0
arts, entertainment and recreation	13.8	6.9	7.4	261.2	5.4
accommodation and food services	85.0	47.8	51.9	1384.5	34.7
other services (except public administration)	0.0	0.0	0.0	0.0	0.0
operating, office, cafeteria and laboratory supplies	114.1	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	109.0	0.0	0.0	0.0	0.0
transportation margins	18.6	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.0	0.0	0.0	0.2	0.0
government sector	29.8	22.3	22.5	244.9	18.5
total	**14,034.7**	**7,305.2**	**7,466.9**	**3,1384.3**	**1,973.6**

Table C-3 Construction Impacts in Region by Industry (continued)

Direct Impacts ($M) Construction – RSA – Cumulative -2007 to 2016	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	0.0	0.0	0.0	0.0	0.0
forestry and logging	0.0	0.0	0.0	0.0	0.0
fishing, hunting and trapping	0.0	0.0	0.0	0.0	0.0
support activities for agriculture and forestry	0.0	0.0	0.0	0.0	0.0
mining and oil and gas extraction	0.0	0.0	0.0	0.0	0.0
utilities	0.0	0.0	0.0	0.0	0.0
construction	12,000.0	6,424.7	6,549.4	23,148.0	1,546.1
manufacturing	0.0	0.0	0.0	0.0	0.0
wholesale trade	0.0	0.0	0.0	0.0	0.0
retail trade	0.0	0.0	0.0	0.0	0.0
transportation and warehousing	0.0	0.0	0.0	0.0	0.0
information and cultural industries	0.0	0.0	0.0	0.0	0.0
finance, insurance, real estate and rental and leasing	0.0	0.0	0.0	0.0	0.0
professional, scientific and technical services	0.0	0.0	0.0	0.0	0.0
administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.0
educational services	0.0	0.0	0.0	0.0	0.0
health care and social assistance	0.0	0.0	0.0	0.0	0.0
arts, entertainment and recreation	0.0	0.0	0.0	0.0	0.0
accommodation and food services	0.0	0.0	0.0	0.0	0.0
other services (except public administration)	0.0	0.0	0.0	0.0	0.0
operating, office, cafeteria and laboratory supplies	0.0	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	0.0	0.0	0.0	0.0	0.0
transportation margins	0.0	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.0	0.0	0.0	0.0	0.0
government sector	0.0	0.0	0.0	0.0	0.0
total	**12,000.0**	**6,424.7**	**6,549.4**	**2,148.0**	**1,546.1**

Table C-3 Construction Impacts in Region by Industry (continued)

Indirect Impacts ($M) Construction – RSA – Cumulative -2007 to 2016	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	19.6	13.2	10.6	124.9	4.6
forestry and logging	130.0	24.2	25.0	449.6	11.9
fishing, hunting and trapping	0.6	0.2	0.2	11.3	0.1
support activities for agriculture and forestry	0.1	0.0	0.0	0.8	0.0
mining and oil and gas extraction	135.2	105.0	106.3	173.4	15.4
utilities	0.0	0.0	0.0	0.0	0.0
construction	0.0	0.0	0.0	0.0	0.0
manufacturing	633.6	212.7	217.3	1,468.7	108.6
wholesale trade	0.0	0.0	0.0	0.0	0.0
retail trade	2.4	1.6	1.7	43.9	1.3
transportation and warehousing	58.7	44.6	48.3	379.6	27.7
information and cultural industries	0.3	0.3	0.3	1.6	0.1
finance, insurance, real estate and rental and leasing	21.8	14.8	16.6	64.2	7.1
professional, scientific and technical services	20.2	13.8	14.0	184.0	11.0
administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.0
educational services	0.0	0.0	0.0	0.9	0.0
health care and social assistance	0.0	0.0	0.0	0.0	0.0
arts, entertainment and recreation	0.6	0.3	0.3	11.2	0.2
accommodation and food services	4.1	2.3	2.5	66.9	1.7
other services (except public administration)	0.0	0.0	0.0	0.0	0.0
operating, office, cafeteria and laboratory supplies	68.6	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	35.4	0.0	0.0	0.0	0.0
transportation margins	7.8	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.0	0.0	0.0	0.0	0.0
government sector	1.2	0.9	0.9	9.8	0.7
total	**1,140.1**	**433.8**	**444.2**	**2,990.8**	**190.4**

Table C-3 Construction Impacts in Region by Industry (continued)

Induced Impacts ($M) Construction – RSA – Cumulative -2007 to 2016	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	25.4	17.0	13.7	161.6	5.9
forestry and logging	34.2	6.4	6.6	118.4	3.1
fishing, hunting and trapping	10.5	2.9	3.1	203.0	2.4
support activities for agriculture and forestry	0.3	0.2	0.2	4.4	0.2
mining and oil and gas extraction	80.9	62.8	63.6	103.8	9.2
utilities	0.0	0.0	0.0	0.0	0.0
construction	0.0	0.0	0.0	0.0	0.0
manufacturing	146.7	49.3	50.3	340.2	25.2
wholesale trade	0.0	0.0	0.0	0.0	0.0
retail trade	86.2	57.1	59.4	1,564.6	45.2
transportation and warehousing	19.7	15.0	16.2	127.5	9.3
information and cultural industries	0.1	0.1	0.1	0.5	0.0
finance, insurance, real estate and rental and leasing	228.0	155.0	174.3	672.9	74.3
professional, scientific and technical services	6.5	4.4	4.5	59.3	3.5
administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.0
educational services	3.2	2.9	3.0	86.5	2.8
health care and social assistance	0.0	0.0	0.0	0.0	0.0
arts, entertainment and recreation	13.3	6.6	7.1	250.0	5.2
accommodation and food services	80.9	45.5	49.4	1,317.5	33.0
other services (except public administration)	0.0	0.0	0.0	0.0	0.0
operating, office, cafeteria and laboratory supplies	45.6	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	73.7	0.0	0.0	0.0	0.0
transportation margins	10.8	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.0	0.0	0.0	0.2	0.0
government sector	28.6	21.4	21.6	235.1	17.8
total	**894.6**	**446.7**	**473.3**	**5,245.5**	**237.0**

Table C-4 Operational Impacts in Region by Industry

Total Impacts ($M) Operational – RSA-2017	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	2.6	1.7	1.4	16.3	0.6
forestry and logging	5.0	0.9	1.0	17.2	0.5
fishing, hunting and trapping	1.0	0.3	0.3	18.6	0.2
support activities for agriculture and forestry	0.0	0.0	0.0	0.4	0.0
mining and oil and gas extraction	10.9	8.5	8.6	14.0	1.2
utilities	994.4	249.3	248.7	1,940.0	237.3
construction	2.7	1.5	1.5	12.1	1.2
manufacturing	22.3	7.5	7.7	51.7	3.8
wholesale trade	0.0	0.0	0.0	0.0	0.0
retail trade	7.6	5.0	5.2	137.2	4.0
transportation and warehousing	1.7	1.3	1.4	11.1	0.8
information and cultural industries	0.2	0.2	0.2	1.0	0.1
finance, insurance, real estate and rental and leasing	26.6	18.1	20.3	78.4	8.7
professional, scientific and technical services	22.8	15.5	15.8	206.9	12.3
administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.0
educational services	0.3	0.3	0.3	7.6	0.2
health care and social assistance	0.0	0.0	0.0	0.0	0.0
arts, entertainment and recreation	1.2	0.6	0.6	22.5	0.5
accommodation and food services	7.4	4.2	4.5	120.8	3.0
other services (except public administration)	0.0	0.0	0.0	0.0	0.0
operating, office, cafeteria and laboratory supplies	8.9	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	10.9	0.0	0.0	0.0	0.0
transportation margins	1.2	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.0	0.0	0.0	0.0	0.0
government sector	6.3	4.7	4.7	51.5	3.9
total	**1,133.9**	**319.4**	**322.2**	**2,707.4**	**278.3**

Table C-4 Operational Impacts in Region by Industry (continued)

Direct Impacts ($M) Operational – RSA – 2017	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	0.0	0.0	0.0	0.0	0.0
forestry and logging	0.0	0.0	0.0	0.0	0.0
fishing, hunting and trapping	0.0	0.0	0.0	0.0	0.0
support activities for agriculture and forestry	0.0	0.0	0.0	0.0	0.0
mining and oil and gas extraction	0.0	0.0	0.0	0.0	0.0
utilities	994.4	249.3	248.7	1,940.0	237.3
construction	0.0	0.0	0.0	0.0	0.0
manufacturing	0.0	0.0	0.0	0.0	0.0
wholesale trade	0.0	0.0	0.0	0.0	0.0
retail trade	0.0	0.0	0.0	0.0	0.0
transportation and warehousing	0.0	0.0	0.0	0.0	0.0
information and cultural industries	0.0	0.0	0.0	0.0	0.0
finance, insurance, real estate and rental and leasing	0.0	0.0	0.0	0.0	0.0
professional, scientific and technical services	0.0	0.0	0.0	0.0	0.0
administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.0
educational services	0.0	0.0	0.0	0.0	0.0
health care and social assistance	0.0	0.0	0.0	0.0	0.0
arts, entertainment and recreation	0.0	0.0	0.0	0.0	0.0
accommodation and food services	0.0	0.0	0.0	0.0	0.0
other services (except public administration)	0.0	0.0	0.0	0.0	0.0
operating, office, cafeteria and laboratory supplies	0.0	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	0.0	0.0	0.0	0.0	0.0
transportation margins	0.0	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.0	0.0	0.0	0.0	0.0
government sector	0.0	0.0	0.0	0.0	0.0
total	**994.4**	**249.3**	**248.7**	**1,940.0**	**237.3**

Table C-4 Operational Impacts in Region by Industry (continued)

Indirect Impacts ($M) Operational – RSA - 2017	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	0.4	0.3	0.2	2.6	0.1
forestry and logging	2.1	0.4	0.4	7.1	0.2
fishing, hunting and trapping	0.1	0.0	0.0	1.3	0.0
support activities for agriculture and forestry	0.0	0.0	0.0	0.0	0.0
mining and oil and gas extraction	3.9	3.0	3.1	5.0	0.4
utilities	0.0	0.0	0.0	0.0	0.0
construction	2.0	1.1	1.2	9.2	0.9
manufacturing	9.8	3.3	3.4	22.7	1.7
wholesale trade	0.0	0.0	0.0	0.0	0.0
retail trade	0.2	0.1	0.2	4.0	0.1
transportation and warehousing	0.0	0.0	0.0	0.2	0.0
information and cultural industries	0.2	0.2	0.2	1.0	0.1
finance, insurance, real estate and rental and leasing	7.2	4.9	5.5	21.2	2.3
professional, scientific and technical services	22.2	15.1	15.4	201.9	12.0
administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.0
educational services	0.0	0.0	0.0	0.3	0.0
health care and social assistance	0.0	0.0	0.0	0.0	0.0
arts, entertainment and recreation	0.1	0.0	0.0	1.3	0.0
accommodation and food services	0.5	0.3	0.3	8.7	0.2
other services (except public administration)	0.0	0.0	0.0	0.0	0.0
operating, office, cafeteria and laboratory supplies	5.0	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	4.6	0.0	0.0	0.0	0.0
transportation margins	0.3	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.0	0.0	0.0	0.0	0.0
government sector	3.8	2.9	2.9	31.5	2.4
total	**62.5**	**31.7**	**32.7**	**317.9**	**20.6**

Table C-4 Operational Impacts in Region by Industry (continued)

Induced Impacts ($M) Operational – RSA - 2017	Gross Output Impact	GDP at Factor Cost Impact	GDP at Market Prices Impact	Employment Impact	Labour Income Impact
crop and animal production	2.2	1.5	1.2	13.8	0.5
forestry and logging	2.9	0.5	0.6	10.1	0.3
fishing, hunting and trapping	0.9	0.3	0.3	17.3	0.2
support activities for agriculture and forestry	0.0	0.0	0.0	0.4	0.0
mining and oil and gas extraction	7.0	5.4	5.5	9.0	0.8
utilities	0.0	0.0	0.0	0.0	0.0
construction	0.6	0.4	0.4	2.9	0.3
manufacturing	12.5	4.2	4.3	29.0	2.1
wholesale trade	0.0	0.0	0.0	0.0	0.0
retail trade	7.3	4.9	5.1	133.1	3.8
transportation and warehousing	1.7	1.3	1.4	10.8	0.8
information and cultural industries	0.0	0.0	0.0	0.0	0.0
finance, insurance, real estate and rental and leasing	19.4	13.2	14.8	57.2	6.3
professional, scientific and technical services	0.6	0.4	0.4	5.1	0.3
administrative and support, waste management and remediation services	0.0	0.0	0.0	0.0	0.0
educational services	0.3	0.2	0.3	7.4	0.2
health care and social assistance	0.0	0.0	0.0	0.0	0.0
arts, entertainment and recreation	1.1	0.6	0.6	21.3	0.4
accommodation and food services	6.9	3.9	4.2	112.1	2.8
other services (except public administration)	0.0	0.0	0.0	0.0	0.0
operating, office, cafeteria and laboratory supplies	3.9	0.0	0.0	0.0	0.0
travel, entertainment, advertising and promotion	6.3	0.0	0.0	0.0	0.0
transportation margins	0.9	0.0	0.0	0.0	0.0
non-profit institutions serving households	0.0	0.0	0.0	0.0	0.0
government sector	2.4	1.8	1.8	20.0	1.5
total	**77.0**	**38.5**	**40.7**	**449.5**	**20.5**

APPENDIX D
DEVELOPING COMMUNITY/REGIONAL LEVEL INPUT-OUTPUT MODELS

The latest available provincial input-output tables at the S-Level from Statistics Canada were used as the starting point. The table represents 25 industries and 18 components of final demand (based on the 2004S-level aggregation). The tables were converted into industry-by-industry space.

In a square input-output table, each industry in the table can be represented as a column. For example industry 1 can be represented as follows:

z_{11}
z_{12}
.
.
.
z_{125}
w_1
X_1

z_{ij} = purchases by industry i of products from industry j. The transactions matrix consists of z_{11} to z_{2525} comprise the transactions matrix of 625 (25 x 25) elements.

W_1 = value added or gross domestic product component of industry 1's output which includes wages, salaries, supplementary labour income, unincorporated business profits, incorporate income profits, other income, and depreciation.

X_1 = industry 1's total output, which equals W_1 plus the sum of z_{11} to z_{25}.

To create sub-provincial models, four challenges must be overcome:

1. Allocation of provincial gross output by community/region.
2. Estimation of technical coefficients by industry at a community/regional level.
3. Estimation of components of gross domestic product by industry at a community/regional level.
4. Allocation of provincial final demand output by community/region.

Census data on labour force by industry will be used to allocate gross output by industry for the region/community. Regional gross output for industry i is estimated:

$$X^{R}_{i} = \text{Labour Force}^{R}_{i}/\text{Labour Force}^{Sk}_{i} \times X^{Sk}_{i}$$

Where:

X^{R}_{i} = regional gross output for industry i.

$\text{Labour Force}^{R}_{i}$ = regional labour force for industry i.

$\text{Labour Force}^{Sk}_{i}$ = provincial labour force for industry i.

X^{Sk}_{i} = provincial gross output for industry i.

To estimate items in each regional transaction matrix (z_{ij}) it will be assumed in all cases that the provincial input structure will apply to regional industries. The components of the regional transaction matrix are estimated:

$$z^{R}_{ij} = z^{SK}_{ij}/X^{Sk}_{i} \times X^{R}_{i}$$

Where:

z^{R}_{ij} = an element of the regional transactions matrix.

z^{SK}_{ij} = the corresponding element of the provincial transactions matrix.

The same methodology is used for estimating the components of GDP.

$$W^{R}_{i} = W^{Sk}_{i}/X^{Sk}_{i} \times X^{R}_{i}$$

Where:

W^{R}_{i} = regional value added or gross domestic product component of industry i's output.

W^{Sk}_i = provincial value added or gross domestic product component of industry i's output

The components of final demand are estimated as follows. Personal expenditures are based on a per capita allocation of provincial spending.

$$PE^{R}_i = PE^{Sk}_i/Pop^{Sk} \times Pop^{R}$$

Where:

PE^{R}_i = Regional personal expenditure on industry i's output.

PE^{Sk}_i = Provincial personal expenditure on industry i's output.

Pop^{Sk} = Provincial population.

Pop^{R} = Regional population.

Gross capital formation (GFCF) or investment by industry is estimated applying the regional share industry output to total provincial gross capital formation for each industry. The same approach is used to estimate exports (Xd), imports (M), and inventory changes by industry (VPC)

$$GFCF^{R}_i = X^{R}_i/X^{Sk}_i \times GFCF^{Sk}_i$$

$$Xd^{R}_i = X^{R}_i/X^{Sk}_i \times Xd^{Sk}_i$$

$$M^{R}_i = X^{R}_i/X^{Sk}_i \times M^{Sk}_i$$

$$VPC^{R}_i = X^{R}_i/X^{Sk}_i \times VPC^{Sk}_i$$

Where:

$GFCF^{R}_i$ = Regional investment spending on industry i's output.

$GFCF^{Sk}_i$ = Provincial investment spending on industry i's output.

Xd^{R}_{i} = Regional exports of industry i's output.

Xd^{Sk}_{i} = Provincial exports of industry i's output.

M^{R}_{i} = Regional imports of industry i's output.

M^{Sk}_{i} = Provincial imports of industry i's output.

VPC^{R}_{i} = Regional inventory changes of industry i's output.

VPC^{Sk}_{i} = Provincial inventory changes of industry i's output.

Regional public administration employment is used to allocate provincial government current expenditures by region.

$$GCE^{R}_{i} = PAE^{R}/PAE^{Sk} \times GCE^{Sk}_{i}$$

Where:

GCE^{R}_{i} = Regional government current expenditures on industry i's output.

PAE^{R} = Regional public administration labour force.

PAE^{Sk} = Provincial public administration labour force.

GCE^{Sk}_{i} = Provincial government current expenditures on industry i's output.

It is also necessary to adjust for leakages for intra-provincial imported factors of production.

Dr. Jack Stabler's work on community level multipliers and hierarchical communities will be incorporated to estimate intra-provincial imports and exports.

In the Stabler methodology there are six levels of Trade Centre Functional Classification:

1. Primary Wholesale-Retail (PWR)
2. Secondary Wholesale-Retail (SWR)
3. Complete Shopping Centre (CSC)
4. Partial Shopping Centre (PSC)
5. Full Convenience Centre (FCC)
6. Minimum Convenience Centre (MCC)

Dr. Stabler has estimates of the marginal propensity for out-shopping in other communities (m2) and local expenditures on goods and services that have been imported by local firms for resale or as intermediates inputs used in production for local consumption (m1). Both of these have been estimated by functional level of community. The marginal propensity to import industry i's output (ms) is already available at the provincial level from the provincial input-output table.

Once m1 and m2 are estimated, intra-provincial imports can be estimated as:

m1 – ms = marginal propensity to import intra-provincial intermediate goods.

m2 – ms = marginal propensity to import intra-provincial consumer goods (out-shopping).

To add intra-provincial imports to the regional table the following is added to each industry's imports:

$$((m1\text{-}ms) \times (PE^{Sk}_i + GFCF^{Sk}_i + GCE^{Sk}_i)) + ((m2\text{-}ms) \times PE^{Sk}_i)$$

Intra-provincial exports are estimated by calculating the marginal propensity to import (both out-shopping and intermediate inputs) for the rest of the province based on the same methodology used to calculate community/regional intra-provincial imports. Intra-provincial exports will be added to the estimated community/regional exports.

After an initial community/regional table has been created there is a high probability that it will be unbalanced: row sums will not equal column sums. The community/regional table will be

rebalanced using the Haring-McMemanin method or RAS, by performing multiple iterations of row and column error pro-rations until the row and column errors converge to zero.

The estimation of intra-provincial imports into a region/community and incorporation of intra-provincial imports into the region/community model's leakages will constrain local multipliers to values not exceeding provincial level multipliers.

Developing Community/Regional Impact Models

Industry outputs in response to a shock in final demand are calculated as $(I-(I-\mu-\alpha-\beta)A)^{-1}((I-\mu-\alpha-\beta)e^*+(I-\mu-\beta)X_d+(I-\mu)X_r)=X$

Where:

I = an identity matrix of industry by industry dimension.

A = a matrix of technical coefficients representing inter-industry purchases (zij) divided by own industry gross output Xi.

μ = a diagonal matrix whose elements represent the ratio of imports to use.

α = a diagonal matrix whose elements represent the ratio of government production to use.

β = a diagonal matrix whose elements represent the ratio of inventory withdrawals to use.

e* = final demand categories of consumption, government purchases of goods and services, business and government investment, and inventory additions.

Xd = final demand category of domestic exports.

X_r = final demand category of re-exports.

Employment is calculated as a fixed number of positions per dollar of industry output.

GDP components are calculated based on a fixed ratio of W_i to industry output.