



Southeast  
Regional College



Saskatchewan Energy  
Training Institute

A Division of Southeast Regional College

# Investing in Growth

## Bakken Formation Economic Impact Report



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## I. Executive Summary

The Bakken Formation located in the 600,000 square-kilometer Williston Basin, cuts across three U.S. states and two Canadian provinces and contains hundreds of billions of barrels of oil. Activity in the region is generating huge injections of jobs, capital and consumer spending into parts of the Prairies that were largely bypassed in previous energy booms.

Although a significant engine of growth, economic activity in the southeast region of the province has led to a chronic shortage of reasonably priced housing. This, in turn, has resulted in a number of employers facing unfilled positions because workers are unable to find affordable priced accommodations and post-secondary educational institutions are operating under capacity as students cannot find adequate student accommodations.

The Southeast Regional College (SERC) contracted McNair Business Development Inc. (McNair) to quantify the value of economic activity due to the Bakken Formation in the Province, the value of the southeast region to the province, and the cost of unfilled employment to the regional and provincial economies.

### A. Summary of Provincial Level Results

Over the course of 2008-2012, The Bakken Formation added the following to the Saskatchewan economy in millions of current dollars and jobs (all impacts are incremental over the base case or “No Bakken Formation” Scenario):

Provincial Impacts	2008	2009	2010	2011	2012
Employment (Positions)	7,687	6,543	7,551	8,136	8,622
Gross Domestic Product (\$M)	4,418.4	2,876.1	3,978.6	4,626.2	4,656.6
Labour Income (\$M)	416.9	383.9	446.3	484.1	525.3
Provincial Gov't Revenues (\$M)	894.2	714.2	755.0	861.8	763.7

### B. Summary of Regional Level Results

In 2008-2012, at the regional level, energy driven economic activity added the following to the economy of the region (approximated by the Sun Country Regional Health Authority) in millions of current dollars and jobs:

Regional Impacts	2008	2009	2010	2011	2012
Employment (Positions)	3,655	3,173	3,616	3,709	4,003
Gross Domestic Product (\$M)	4,055.7	2,574.3	3,630.5	4,232.0	4,176.5
Labour Income (\$M)	265.3	258.7	300.0	318.8	353.7
Provincial Gov't Revenues (\$M)	861.8	687.3	723.6	826.3	724.0

Note: Gross Domestic Product (GDP) is the measure of the sum of all goods and services produced within a geographic area and are the measurement of the “size” of an economy.

### C. Impacts on the Rest of the Province

A significant feature of the McNair regional economic impact model is the inclusion of estimated imports to the region from within the rest of the province. It follows that activity within the region will have impacts on other areas of the province, notably those with industries providing inputs to region businesses which cannot be sourced locally. As such, a further simulation was undertaken to estimate the impacts of the Bakken Formation on the rest of the province, outside of the southeast region:

Rest of Province Impacts	2008	2009	2010	2011	2012
Employment (Positions)	4,033	3,370	3,935	4,426	4,619
Gross Domestic Product (\$M)	362.7	301.8	348.1	394.2	480.1
Labour Income (\$M)	151.6	125.2	146.3	165.3	171.6
Provincial Gov't Revenues (\$M)	32.3	26.9	31.4	35.4	39.7

## D. Fiscal Impacts

The Bakken Formation generated a significant fiscal contribution to the provincial and federal treasuries. In 2012 alone, including oil royalties, the Bakken Formation generated the following fiscal impacts:

Government Fiscal Impacts 2012	Personal Income Tax (PIT)	Corporate Income Tax	Taxes Unincorporated Business Profits	Non-Renewable Resource Revenue	Sales & Excise Taxes	Total Revenue
Federal (\$M)	112.8	187.7	14.8	na	5.8	321.1
Provincial (\$M)	62.5	150.2	10.8	531.5	8.7	763.7
Total (\$M)	175.4	337.9	25.6	531.5	14.5	1,084.8

## E. Productivity Impacts

Unfilled positions, due to employees unable to find adequate housing, have a negative impact on productivity. Assuming that the 1,182 currently vacant positions in the Estevan area were filled, this would have the following impacts on the provincial and regional economies.

2013	Provincial Productivity Impacts	Regional Productivity Impacts
Employment (Positions)	2,308	1,626
Gross Domestic Product (\$M)	391.3	348.7
Labour Income (\$M)	109.8	91.9
Provincial Gov't Revenues (\$M)	29.0	24.6
Federal Gov't Revenues (\$M)	41.5	35.5

## F. Value of the Region to the Province

An additional simulation was run to estimate the value of the region to the province both with and without the economic activity associated with the current Bakken Formation boom. 2005 was chosen as the “pre-boom year”. There was still a modest amount of oil activity in the area but activity did not begin to surge until 2006, reaching a first peak in 2008. Please note this is the value of the region in its entirety, not just the impact of the Bakken formation.

Value to the Province of South East Saskatchewan with the Bakken Formation	
Gross Domestic Product (\$M)	6,310
Employment (Positions)	28,181
Provincial Gov't Revenues (\$M)	953
Value to the Province of South East Saskatchewan in 2005	
Gross Domestic Product (\$M)	3,553
Employment (Positions)	23,003
Provincial Gov't Revenues (\$M)	605

## G. Government Investment in Affordable Housing:

Further analysis of the government fiscal impact of unfilled positions, due to employees being unable to find adequate housing, was undertaken and compared to apartment construction costs. In this analysis, the payback period to government for funding affordable apartment construction varied from 4.3 to 11.4 years depending on revenue stream and construction type. It should be noted that this scenario explicitly assumes 100 percent government financing with no offsetting government benefits for sale or lease/rentals of the units. This is admittedly an extreme case and is used for illustrative purposes only as decision support for considering incentives for residential construction.

Construction Costs* (800 Square Foot Apartment)	Prov. Gov't Rev** per Unit	Fed. Gov't Rev** per Unit	Payback Period (yrs) Prov. Gov't	Payback Period (yrs) Fed. Gov't
Wood frame building, No Parking: \$188/sq.ft. \$150,000	\$24,544	\$35,071	6.1	4.3
Wood frame building, with Parking: \$265/sq.ft. \$212,000	\$24,544	\$35,071	8.6	6.0
Concrete Building, No Parking: \$273/sq.ft. \$218,000	\$24,544	\$35,071	8.9	6.2
Concrete Building, with Parking: \$351/sq.ft. \$281,000	\$24,544	\$35,071	11.4	8.0

\*Excluding Land

\*\* Includes Total (Direct, Indirect, Induced personal and business taxes) per vacant position

Additional scenarios were conducted with a mix of one, two, and three bedroom apartments and varying levels of public funding. Results indicated that the payback period was reduced with the addition of multi-bedroom apartments simply because there will be more occupants to fill previously unfilled positions. The same can be said for any reduction in the percentage of government funding for construction.

## H. Conclusion

The Bakken Formation is a key driver for the provincial and regional economies. In 2012, alone, Bakken accounted for 8,622 jobs (almost 2 percent of total provincial employment), \$4.6 billion in GDP (6.4 percent of total provincial GDP) and \$764 million in government revenues (almost 7 percent of total 2012-13 General Revenue Fund revenue).

Finally, for relatively modest and cost effective public sector investment in affordable housing in the Estevan area, continued growth in the region can be expected to be maintained over the productive life of the Bakken Formation.

## II. Introduction & Methodology

### A. Introduction

The Bakken Formation located in the 600,000 square-kilometer Williston Basin, cuts across three US states and two Canadian provinces and contains hundreds of billions of barrels of oil. Activity in the region is generating huge injections of jobs, capital and consumer spending into parts of the Prairies that were largely bypassed in previous energy booms.

In April 2008, a US Geological Survey report estimated the amount of recoverable oil using technology readily available at the end of 2007 within the Bakken Formation at 3.0 to 4.3 billion barrels (680,000,000 m<sup>3</sup>), with a mean of 3.65 billion. The state of North Dakota also released a report that month which estimated that there are 2.1 billion barrels (330,000,000 m<sup>3</sup>) of technically recoverable oil in the Bakken Formation. Various other estimates place the total reserves, recoverable and non-recoverable with today's technology, at up to 24 billion barrels. A recent estimate places the figure at 18 billion barrels. In April 2013, the US Geological Survey released a new figure for expected ultimate recovery of 7.4 billion barrels of oil.

While the economic activity in the region generates jobs, investment, tax, and royalty revenues for the province, the resulting in-migration to the region has elevated housing costs to critical levels. In addition, with the Estevan rental vacancy rate at zero, according to the June 2013 CMHC rental market report, accessibility to housing, of any form, is also an issue. One unfortunate side effect of elevated housing costs and lack of accessibility is unfilled employment in the region.

In addition, some leading employers have engaged in internal discussions around potentially centralizing positions and other services out of the province due to the difficulties in finding housing for new staff. While likely having a slightly positive impact on vacancy rates in the short term, the resulting impact on housing starts will have a negative impact on municipal government revenues. The outflow of high-paying jobs to other jurisdictions will also have a profoundly negative impact on the long-term health of the Saskatchewan economy.

Southeast Regional College (SERC) required a study to quantify the value of economic activity in the region, the value of the region to the province, and the cost of unfilled employment to the regional and provincial economies. This information is used, in turn, to develop part of a business case for both public and private sector funding of affordable student and employee housing.

### B. Methodology

The provincial economic impacts will be estimated using McNair's Saskatchewan Economic Impact Model. The model is based on Statistics Canada's 2009 Saskatchewan input-output table, the latest available. The model is comprehensive with 35 industries and 66 commodities. Please note that provincial model results were aggregated to 25 industries for this study to allow for industry to industry comparisons with regional results. A complete model description and definitions are available in Appendix A.

The Region will be defined as the Sun County Regional Health Authority (RHA) as the Saskatchewan portion of the Bakken Formation is almost entirely contained within. A separate economic impact model was developed to represent the economy of the RHA Region. This is based on a regional share of the 2009 provincial economy and is square in dimension with 25 industries. A detailed discussion on the development of sub-provincial input-output models is available in Appendix B.

Inputs into the model will be oil production, direct employment, and royalties derived from the region for the past 5 years. The 5 year period of 2008 to 2012 was chosen because not only because it is the latest 5 year time period but to also illustrate some of the volatility inherent in resource activity: an initial peak in 2008, downturn, and subsequent recovery.

Provincial and Regional impacts of the Bakken Formation 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

a new development. In this study, the labour income and employment coefficient in the model was adjusted to reflect actual employment and income paid to labour. A detailed account of the mixed endogenous–exogenous model methodology is available in Appendix C. This approach is appropriate when the input structure of the industry differs significantly from the input structure of the impacted industry. In the case of the Provincial and Regional Models, detailed input data for mining, oil and gas extraction was available. However, input data for the oil and gas extraction industry alone was not available. As such, Bakken oil and gas extraction gross output and employment were estimated. Employment was estimated using the volume split of Area IV (Estevan) to provincial oil volume multiplied by provincial oil and gas extraction employment, resulting in 1,627 positions during 2012.

Provincial compensation (From Cansim Table 383-0030 Labour statistics by business sector industry and by non-commercial activity consistent with the industry accounts, provinces and territories, annual) for oil and gas extraction was divided by employment by industry to derive compensation per employee. This was, in turn, multiplied by total estimated Bakken direct employment to yield the total oil and gas extraction direct wage cost in the region. Remaining inputs were based on the mining, oil, and gas industry input structure, after adjusting for industry default leakages from imports and inventory withdrawals.

Royalties from Area IV (Estevan) were derived using the lower of the regional volume and value of output splits times total provincial oil royalties. A detailed account of estimating regional output and royalties collected by the provincial government is available in Appendix D.

Unfilled positions were initially estimated by a review of vacancies available on the SaskJobs website for the Estevan area. This data was validated through consultations with local chambers of commerce and certain businesses.

The impact of unfilled employment was estimated by converting unfilled positions into economic output using industry averages of output per employee and “shocking” the model in terms of foregone output. Induced impacts of foregone output were also used to calculate lost consumer spending in the region and province.

An additional simulation was run to estimate the value of the region to the province both with and without the economic activity associated with the current Bakken Formation boom. To estimate the value to the province with the current boom, the latest available employment, GDP figures, and tax revenues were compiled for the region. To estimate the value of the region to the province pre- boom, the regional model was “shocked” by reducing oil and gas activity to 2005 levels and tabulating the resulting economic impacts and subtracting these from the latest available employment, GDP figures, and tax revenues. 2005 was chosen as the starting point. There was still a modest amount of oil activity in the area but activity did not begin to surge until 2006, reaching a first peak in 2008.



### III. Provincial Impacts

#### A. Direct, Indirect and Induced Impacts

Direct impacts typically represent total project expenditure, usually construction costs or, in this case, the value of operating output. Indirect impacts represent the secondary impact that includes inter- industry transactions and the purchases of inputs from supporting industries. Finally, induced impacts are additional impacts from changes in household spending as industries modify labour input requirements in response to altered levels of demand for output. All impacts are incremental over the base case or “No Bakken Formation” Scenario.

Direct, indirect, and induced provincial impacts are below.

Provincial Employment Impacts (Jobs)	2008	2009	2010	2011	2012
Direct	1,621	1,439	1,593	1,452	1,627
Indirect	3,187	2,417	2,837	3,315	3,319
Induced	2,878	2,687	3,121	3,369	3,676
Total	7,687	6,543	7,551	8,136	8,622

Provincial GDP Impacts (\$M)	2008	2009	2010	2011	2012
Direct	3,803.4	2,368.2	3,385.1	3,955.6	3,960.3
Indirect	377.6	286.3	336.0	392.7	393.1
Induced	237.4	221.6	257.5	277.9	303.2
Total	4,418.4	2,876.1	3,978.6	4,626.2	4,656.6

Provincial Labour Income Impacts (\$M)	2008	2009	2010	2011	2012
Direct	165.4	175.5	202.7	209.3	239.6
Indirect	150.2	113.9	133.7	156.2	156.4
Induced	101.3	94.6	109.8	118.6	129.4
Total	416.9	383.9	446.3	484.1	525.3

## B. Detailed Results by Industry

The following table provides total impacts (direct, indirect, and induced) by industry, of the Bakken Formation on the provincial economy in 2012. All of the direct activity occurs within the mining, oil, and gas extraction industry. Total direct employment is represented by the 1,627 positions in the oil and gas sector. Industries providing operating inputs to the oil sector, notably professional and technical services and finance, insurance, real estate, rental and leasing. Induced impacts, which represent the additional impacts of consumer spending of wages earned, is concentrated heavily within the retail trade and service industries.

Total Impacts (\$M) - Saskatchewan	Gross Output Impact	GDP at Basic Prices Impact	Employment Impact (Positions)	Labour Income Impact
Crop and Animal Production	17.4	7.4	71	0.5
Forestry and Logging	0.4	0.1	1	0.1
Fishing, Hunting and Trapping	0.1	0.1	0	0.0
Support Activities for Agriculture and Forestry	0.5	0.4	7	0.2
Mining, Oil and Gas Extraction	5,859.7	3,960.3	1,627	239.6
Utilities	98.8	62.7	136	14.1
Construction	82.6	32.6	309	17.9
Manufacturing	84.1	26.1	186	11.3
Wholesale Trade	58.2	37.5	310	16.8
Retail Trade	82.4	53.8	1,384	37.1
Transportation and Warehousing	60.5	32.0	294	13.9
Information and Cultural Industries	39.8	23.6	201	11.6
Finance, Insurance, Real Estate and Rental and Leasing	384.4	262.4	891	55.0
Professional, Scientific and Technical Services	64.4	44.0	555	25.2
Administrative and Support, Waste Management and Remediation	35.4	21.7	494	15.8
Educational Services	1.3	0.9	61	0.5
Health Care and Social Assistance	17.3	10.7	160	5.0
Arts, Entertainment and Recreation	11.3	5.4	158	3.6
Accommodation and Food Services	41.1	20.0	706	14.7
Other Services (Except Public Administration)	27.8	17.1	464	11.2
Operating, Office, Cafeteria and Laboratory Supplies	71.5	0.0	0	0.0
Travel, Entertainment, Advertising and Promotion	76.9	0.0	0	0.0
Transportation Margins	8.0	0.0	0	0.0
Non-Profit Institutions Serving Households	6.2	3.4	111	3.2
Government Sector	55.5	34.4	496	28.1
<b>Total</b>	<b>7,185.5</b>	<b>4,656.6</b>	<b>8,622</b>	<b>525.3</b>

## IV. Region Impacts

The identical procedure was repeated using the regional impact model to derive impacts at the regional level. With the calculation of imports to a sub-provincial region from within the rest of the province (intra-provincial imports), impacts at the regional level are, as expected, less than those occurring at the provincial level. All impacts are incremental over the base case or “No Bakken Formation” Scenario. Regional impacts are summarized below:

Regional Employment Impacts (Jobs)	2008	2009	2010	2011	2012
<b>Direct</b>	1,621	1,439	1,593	1,452	1,627
<b>Indirect</b>	1,191	903	1,060	1,239	1,241
<b>Induced</b>	842	831	963	1,019	1,135
<b>Total</b>	<b>3,655</b>	<b>3,173</b>	<b>3,616</b>	<b>3,709</b>	<b>4,003</b>

Regional GDP Impacts (\$M)	2008	2009	2010	2011	2012
<b>Direct</b>	3,788.1	2,352.6	3,371.5	3,939.7	3,872.6
<b>Indirect</b>	185.1	140.4	164.8	192.6	192.8
<b>Induced</b>	82.4	81.3	94.3	99.7	111.2
<b>Total</b>	<b>4,055.7</b>	<b>2,574.3</b>	<b>3,630.5</b>	<b>4,232.0</b>	<b>4,176.5</b>

Regional Labour Income Impacts (\$M)	2008	2009	2010	2011	2012
<b>Direct</b>	165.4	175.5	202.7	209.3	239.6
<b>Indirect</b>	67.0	50.8	59.7	69.7	69.8
<b>Induced</b>	32.8	32.4	37.6	39.7	44.3
<b>Total</b>	<b>265.3</b>	<b>258.7</b>	<b>300.0</b>	<b>318.8</b>	<b>353.7</b>

At the regional level, the industry breakdown of direct and indirect impacts exhibits much the same patterns of provincial impacts. However, induced impacts (concentrated in retail and service industries) tend to be relatively larger than indirect impacts. This suggests that the region has been less successful in utilizing local suppliers to the oil industry but more successful in retaining wages of employees to be spent in regional communities.

Total Impacts (\$M) - Saskatchewan	Gross Output Impact	GDP at Basic Prices Impact	Employment Impact (Positions)	Labour Income Impact
Crop and Animal Production	5.5	3.4	23	0.2
Forestry and Logging	0.0	0.0	0	0.0
Fishing, Hunting and Trapping	0.0	0.0	0	0.0
Support Activities for Agriculture and Forestry	0.1	0.1	2	0.1
Mining, Oil and Gas Extraction	5,859.7	3,872.6	1,627	239.6
Utilities	131.8	76.1	182	17.1
Construction	45.3	21.7	170	12.2
Manufacturing	26.3	10.2	58	4.4
Wholesale Trade	0.0	0.0	0	0.0
Retail Trade	25.9	19.1	435	13.2
Transportation and Warehousing	4.9	3.3	24	1.4
Information and Cultural Industries	0.0	0.0	0	0.0
Finance, Insurance, Real Estate and Rental and Leasing	150.8	111.9	350	24.7
Professional, Scientific and Technical Services	21.4	16.5	184	9.7
Administrative and Support, Waste Management and Remediation Services	13.5	9.4	188	7.0
Educational Services	0.0	0.0	0	0.0
Health Care and Social Assistance	0.0	0.0	0	0.0
Arts, Entertainment and Recreation	5.8	2.6	82	1.8
Accommodation and Food Services	17.6	10.5	303	7.8
Other Services (Except Public Administration)	11.0	7.7	184	5.1
Operating, Office, Cafeteria and Laboratory Supplies	33.9	0.0	0	0.0
Travel, Entertainment, Advertising and Promotion	44.9	0.0	0	0.0
Transportation Margins	0.0	0.0	0	0.0
Non-Profit Institutions Serving Households	0.0	0.0	0	0.0
Government Sector	21.6	11.5	193	9.4
<b>Total</b>	<b>6,420.0</b>	<b>4,176.5</b>	<b>4,003</b>	<b>353.7</b>

## V. Rest of Province Impacts

A significant feature of the McNair regional economic impact model is the inclusion of estimated imports to the region from the remainder of the province. It follows that activity within the region will have impacts on other areas of the province, notably those with industries providing inputs to region businesses which cannot be sourced locally. As such, a further simulation was undertaken to estimate the impacts of the Bakken Formation on the rest of the province, outside of the Southeast Region:

Rest of Province Employment Impacts	2008	2009	2010	2011	2012
<b>Direct</b>	0	0	0	0	0
<b>Indirect</b>	1,996	1,513	1,776	2,076	2,078
<b>Induced</b>	2,037	1,856	2,159	2,350	2,541
<b>Total</b>	<b>4,033</b>	<b>3,370</b>	<b>3,935</b>	<b>4,426</b>	<b>4,619</b>

Rest of Province GDP Impacts	2008	2009	2010	2011	2012
<b>Direct</b>	15.4	15.6	13.7	16.0	87.7
<b>Indirect</b>	192.4	145.9	171.2	200.1	200.3
<b>Induced</b>	155.0	140.3	163.2	178.1	192.0
<b>Total</b>	<b>362.7</b>	<b>301.8</b>	<b>348.1</b>	<b>394.2</b>	<b>480.1</b>

Provincial Labour Income Impacts (\$M)	2008	2009	2010	2011	2012
<b>Direct</b>	0.0	0.0	0.0	0.0	0.0
<b>Indirect</b>	83.2	63.1	74.0	86.5	86.6
<b>Induced</b>	68.4	62.1	72.3	78.8	85.0
<b>Total</b>	<b>151.6</b>	<b>125.2</b>	<b>146.3</b>	<b>165.3</b>	<b>171.6</b>

## VI. Fiscal Impacts

### A. Fiscal Module Description

An expansion in economic activity, especially when wages and salaries comprise a significant portion of incremental gross domestic product, is expected to generate incremental government revenues. The economic impact model's fiscal module is based on the latest federal, provincial, and municipal budgets and estimates government revenues, where all impacts are incremental over the base case or "No Bakken Formation" Scenario, as follows:

- Personal income tax is calculated by using the provincial and federal personal income tax rate that would apply to average industry annual income. This is applied to model-generated labour income.
- Corporation income tax is calculated by applying the provincial and federal corporate tax rates to incremental corporate profits before taxes calculated by the model.
- Unincorporated business income taxes are calculated by applying the small business tax rate to incremental unincorporated business profits calculated by the model.
- Sales tax calculation is based on the ratio of provincial and federal sales taxes collected to retail trade gross output applied to incremental retail trade output calculated by the model.
- Fuel and tobacco revenues are calculated as a fixed ratio (based on budget figures of tobacco and fuel tax revenues to total sales tax revenue) multiplied by estimated sales tax revenues.

Provincial government royalties from non-renewable resources were estimated separately. Estimates were not adjusted for any changes in equalization entitlements.

### B. Fiscal Impacts

At the provincial level, Bakken generated the following provincial fiscal impacts:

Government Fiscal Impacts 2012	Personal Income Tax (PIT)	Corporate Income Tax	Taxes Unincorporated Business Profits	Non-Renewable Resource Revenue	Sales & Excise Taxes	Total Revenue
Federal (\$M)	112.8	187.7	14.8	na	5.8	321.1
Provincial (\$M)	62.5	150.2	10.8	531.5	8.7	763.7
Total (\$M)	175.4	337.9	25.6	531.5	14.5	1,084.8

## VII. Productivity Impacts

The impact of unfilled employment was estimated by converting unfilled positions into economic output using industry averages of output per employee and “shocking” the model in terms of foregone output. Induced impacts of foregone output will also measure lost consumer spending in the region and province.

To estimate the actual number of job vacancies within the Estevan area, a combination of sources were used. The main source used was the SaskJobs website which indicated that 1,065 positions were vacant in the region as of August 13, 2013. This value represents many employers in the area, but is not all-encompassing. This value was then supplemented by the Estevan Chamber of Commerce’s Housing Shortage vs. Labour Recruitment and Retention report. This report indicated that the lack of available and affordable housing in the Estevan area has had a negative impact on labour recruitment and retention, resulting in a continuous stream of unfilled positions. A number of businesses in the Estevan area were consulted with to identify if they have faced these challenges, if they still advertise job openings, and how many positions they have been unable to fill. Cross referencing the estimated unfilled positions from this report with job postings on SaskJobs and the associated business’s website, an additional 117 job vacancies were identified. This produced a conservative estimate of approximately 1,182 job vacancies in the Estevan area. These job vacancies were then organized according to the firm specific industry in the Chamber of Commerce Study and the SaskJobs industry breakdown.

It should be noted that anecdotal evidence exists that there are a number of unfilled positions which are simply not advertised as employers have simply “given up” due to the insurmountable difficulties in finding available and affordable housing. It should also be noted that a certain number of unfilled positions are not necessarily due to a lack of housing and other factors apply. However, for the purpose of this analysis it is assumed that all 1,182 positions are unfilled due to the lack of affordable housing.

Unfilled positions, due to a lack of adequate housing, have a negative impact on productivity at the provincial and regional level. Assuming that the 1,182 currently vacant positions in the Estevan area were filled and converted to average output per employee, this would have the following direct, indirect, and induced impacts on the provincial and regional economies:

2013	Provincial Productivity Impacts	Regional Productivity Impacts
Employment (Positions)	2,308	1,626
Gross Domestic Product (\$M)	391.3	348.7
Labour Income (\$M)	109.8	91.9
Provincial Gov’t Revenues (\$M)	29.0	24.6
Federal Gov’t Revenues (\$M)	41.5	35.5

## VIII. Value of the Region to the Province

An additional simulation was run to estimate the value of the region to the province both with and without the economic activity associated with the current Bakken Formation boom.

To estimate the value to the province with the current boom, the latest available employment and GDP figures were used. Provincial tax revenues were estimated for the region by “re-shocking” the model with industry by industry gross output. This exercise would not include natural resource royalties. Consequently, the latest provincial Area IV oil royalties were added to estimated provincial revenues.

To estimate the value of the region to the province pre-boom, the regional model was “shocked” by reducing oil and gas activity to 2005 levels and tabulating the resulting economic impacts and subtracting these from the latest available employment, GDP figures, and tax revenues, including the latest provincial Area IV oil royalties. 2005 was chosen as the “pre-boom” year as there was still a modest amount of oil activity in the area but activity did not begin to surge until 2006, reaching a first peak in 2008.

Value to the Province of South East Saskatchewan with the Bakken Formation	
Gross Domestic Product (\$M)	6,310
Employment (Positions)	28,181
Provincial Gov't Revenues (\$M)	953
Value to the Province of South East Saskatchewan without the Bakken Formation	
Gross Domestic Product (\$M)	3,553
Employment (Positions)	23,003
Provincial Gov't Revenues (\$M)	605



## IX. Public Sector ROI

Key to any business case around the funding affordable housing in the Estevan area is the calculation of a public sector return on investment (ROI) or payback period. Scenario based payback periods were calculated for each level of government (federal and provincial) under varying levels of investment. Government returns were expressed as the capture of otherwise foregone public sector revenues.

In a recent McNair study for a Regina-region project, the following Condo/Apartment building costs were utilized:

- Wood frame buildings cost \$150 per square foot and underground parking cost \$125 per square foot, resulting in a blended rate for these two items of \$265 per square foot
- Concrete buildings were \$218 per square foot and underground parking cost \$125 per square foot, resulting in a blended rate for these two items of \$281 per square foot
- These were scaled up by 25 percent to reflect the construction price differences between Regina and Estevan

Apartment construction costs were converted to a small single occupancy apartment below. Total construction costs per unit were compared to foregone government revenues per unfilled positions (assuming unfilled positions were a direct result of affordable housing shortages alone) to calculate a government payback period per 800 square foot apartment built. It should be noted that this scenario explicitly assumes 100 percent government financing with no offsetting government benefits for sale or lease/rentals of the units. This is admittedly an extreme case and is used for illustrative purposes only as decision support for considering incentives for residential construction.

Construction Costs* (800 Square Foot Apartment)	Prov. Gov't Rev** per Unit	Fed. Gov't Rev** per Unit	Payback Period (yrs) Prov. Gov't	Payback Period (yrs) Fed. Gov't
Wood frame building, No Parking: \$188/sq.ft. \$150,000	\$24,544	\$35,071	6.1	4.3
Wood frame building, with Parking: \$265/sq.ft. \$212,000	\$24,544	\$35,071	8.6	6.0
Concrete Building, No Parking: \$273/sq.ft. \$218,000	\$24,544	\$35,071	8.9	6.2
Concrete Building, with Parking: \$351/sq.ft. \$281,000	\$24,544	\$35,071	11.4	8.0

\*Excluding Land

\*\* Includes Total (Direct, Indirect, Induced personal and business taxes) per vacant position

Two other scenarios were examined. In both of these government financing consisted of 50 percent of total cost. In the first scenario, a 150 unit building was constructed with 50 units each of one bedroom, two bedrooms, and 3 bedrooms. Average square footage per apartment was 1150. It was assumed that the number of occupants equals the number of bedrooms. The impact of household structure on employment was modeled by using the Estevan participation rate of 75.8 percent (2011 National Household Survey) times building occupants to calculate the number of building occupants employed. It should be noted that the 50 percent government contribution does not impact per unit construction costs, only the payback period. Finally, government revenues per unit are higher under the scenarios with multi bedroom apartments simply because there are more people working per unit. Scenario results are below:

Construction Costs* (1150 Square Foot Apartment)	Prov. Gov't Rev** per Unit	Fed. Gov't Rev** per Unit	Payback Period (yrs) Prov. Gov't	Payback Period (yrs) Fed. Gov't
Wood frame building, No Parking: \$188/sq.ft. \$215,625	\$37,209	\$53,167	2.9	2.0
Wood frame building, with Parking: \$265/sq.ft. \$304,750	\$37,209	\$53,167	4.1	2.9
Concrete Building, No Parking: \$273/sq.ft. \$313,375	\$37,209	\$53,167	4.2	2.9
Concrete Building, with Parking: \$351/sq.ft. \$403,938	\$37,209	\$53,167	5.4	3.8

\*Excluding Land

\*\* Includes Total (Direct, Indirect, Induced personal and business taxes) per vacant position

In the third scenario, a 200 unit apartment was constructed with a 50 percent government contribution and with 70, 80, and 50 one, two, and three bedroom units, respectively. Average square footage per apartment was 1115, one person per bedroom, and the Estevan participation rate was assumed to estimate employed occupants. Results are below:

Construction Costs* (1115 Square Foot Apartment)	Prov. Gov't Rev** per Unit	Fed. Gov't Rev** per Unit	Payback Period (yrs) Prov. Gov't	Payback Period (yrs) Fed. Gov't
Wood frame building, No Parking: \$188/sq.ft. \$209,063	\$35,349	\$50,509	3.0	2.1
Wood frame building, with Parking: \$265/sq.ft. \$295,475	\$35,349	\$50,509	4.2	2.9
Concrete Building, No Parking: \$273/sq.ft. \$303,838	\$35,349	\$50,509	4.3	3.0
Concrete Building, with Parking: \$351/sq.ft. \$391,644	\$35,349	\$50,509	5.5	3.9

\*Excluding Land

\*\* Includes Total (Direct, Indirect, Induced personal and business taxes) per vacant position

## Appendices

## Appendix A: Definitions & Model Description

**Final Demand:** sum of personal expenditure, government purchases of goods and services, business and government investment, and net exports.

**Gross Output:** total expenditures on local goods and services as well as payments to labour and business profits. Gross output includes double counting because it includes the value of inputs used in production rather than net value added alone.

**GDP at Factor Cost:** measure of net economic activity within a prescribed geographic area. It represents the payments made to final factors of production: labour, unincorporated business profits, and other operating surplus (corporate profits, interest income, inventory valuation adjustments, and capital consumption allowances). GDP at factor cost excludes the value of intermediate goods and services used in production.

**GDP at Basic Prices:** GDP at factor costs plus net indirect taxes (indirect taxes less subsidies) on factors of production.

**GDP at Market Prices:** GDP at factor cost plus indirect taxes less subsidies.

**Employment:** measured in positions.

**Direct Impact:** total project expenditure, usually construction or operating outlays.

**Indirect Impact:** the secondary impact that includes inter-industry transactions, purchases of inputs from supporting industries.

**Induced Impact:** the additional impact from changes in household spending as industries modify labour input requirements in response to altered levels of demand for output.

Industry outputs are calculated as  $(I - D(I - \mu - \alpha - \beta)B)^{-1}D((I - \mu - \alpha - \beta)e^* + (I - \mu - \beta)X_d + (I - \mu)X_r) = X$

Where:

$I$  = an identity matrix of industry by industry dimension

$D$  = a matrix of coefficients representing commodity output proportions

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

$\mu$  = a diagonal matrix whose elements represent the ratio of imports to use

$\alpha$  = a diagonal matrix whose elements represent the ratio of government production to use

$\beta$  = 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

$X_d$  = 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.

## Appendix B: Developing Community 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 2009 S-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:

$Z_{11}$
$Z_{12}$
$\cdot$
$\cdot$
$\cdot$
$Z_{125}$
$W_1$
$X_1$

$Z_{ij}$  = 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:

$$X_i^R = \text{Labour Force}_i^R / \text{Labour Force}_{Sk_i}^{Sk_i} \times X_{Sk_i}^{Sk_i}$$

Where:

$X_i^R$  = regional gross output for industry  $i$

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

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

$X_{Sk_i}^{Sk_i}$  = 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:

$$Z_{ij}^R = Z_{ij}^{Sk_i} / X_{Sk_i}^{Sk_i} \times X_i^R$$

Where:

$Z_{ij}^R$  = an element of the regional transactions matrix

$Z_{ij}^{Sk_i}$  = the corresponding element of the provincial transactions matrix

The same methodology is used for estimating the components of GDP

$$W_i^R = W_{Sk_i}^{Sk_i} / X_{Sk_i}^{Sk_i} \times X_i^R$$

Where:

$w^R$  = regional value added or gross domestic product component of industry i's output

$w^{Sk}$  = 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.

$$PE_i^R = PE_i^{Sk} / \text{Pop}^{Sk} \times \text{Pop}^R$$

Where:

$PE_i^R$  = Regional personal expenditure on industry i's output

$PE_i^{Sk}$  = Provincial personal expenditure on industry i's output

$\text{Pop}^{Sk}$  = Provincial population

$\text{Pop}^R$  = 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).

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

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

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

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

Where:

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

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

$\text{Xd}_i^R$  = Regional exports of industry i's output

$\text{Xd}_i^{Sk}$  = Provincial exports of industry i's output

$\text{M}_i^R$  = Regional imports of industry i's output

$\text{M}_i^{Sk}$  = Provincial imports of industry i's output

$\text{VPC}_i^R$  = Regional inventory changes of industry i's output

$\text{VPC}_i^{Sk}$  = Provincial inventory changes of industry i's output

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

$$\text{GCE}_i^R = \text{PAE}^R / \text{PAE}^{Sk} \times \text{GCE}_i^{Sk}$$

Where:

$\text{GCE}_i^R$  = Regional government current expenditures on industry i's output

$\text{PAE}^R$  = Regional public administration labour force

$\text{PAE}^{Sk}$  = Provincial public administration labour force

$\text{GCE}_i^{Sk}$  = Provincial government current expenditures on industry i's output

It is also necessary to adjust for leakages for intra-provincial imported factors of production. In Saskatchewan's case, 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)

There are only 2 Primary Wholesale-Retail communities in the province: Regina and Saskatoon. Moose Jaw, Prince Albert, Yorkton, Lloydminster, Battlefords, Swift Current, Weyburn, and Estevan are among the eight communities that presently classify as Secondary Wholesale-Retail. The communities classifying as PWR and SWR have been unchanged since 1961 to 1995.

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:

$$((m1-ms) \times (PE_i^{Sk} + GFCF_i^{Sk} + GCE_i^{Sk})) + ((m2-ms) \times PE_i^{Sk})$$

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.

## A. 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.

$\mu$  = a diagonal matrix whose elements represent the ratio of imports to use

$\alpha$  = a diagonal matrix whose elements represent the ratio of government production to use

$\beta$  = 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

$X_d$  = 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.

## Appendix C: 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  $X^M$

$$\begin{bmatrix} X_1 \\ X_2 \\ Y_3^L \end{bmatrix}$$

is calculated as follows:

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

Where  $M =$

$$\begin{bmatrix} (1-a_{11}^L) & -a_{12}^L & 0 \\ -a_{21}^L & (1-a_{22}^L) & 0 \\ -a_{31}^L & -a_{32}^L & -1 \end{bmatrix}$$

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

$Y^M =$

$$\begin{bmatrix} Y_1^L + a_{13}^L X_3 \\ Y_2^L + a_{23}^L X_3 \\ -(1-a_{33}^L)X_3 \end{bmatrix}$$

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

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

$\mu$  = a diagonal matrix whose elements represent the ratio of imports to use

$\alpha$  = a diagonal matrix whose elements represent the ratio of government production to use

$\beta$  = 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

$X_d$  = final demand category of domestic exports

$X_r$  = final demand category of re-exports



## Appendix D: Methodology for Approximating Estevan Crude Oil Royalties

Following the end of each fiscal year (March 31), the Government of Saskatchewan prepares the Public Accounts which contain the General Revenue Fund (GRF) Financial Statements. Within these financial statements, the value of provincial non-renewable resource revenue is published, including the provincial value of oil royalties paid to the government. The Government of Saskatchewan provincial values of non-renewable resource revenue received through oil royalties for the most recent five years are shown below:

Oil Royalties	2008-09	2009-10	2010-11	2011-12	2012-13
Provincial (\$)	1,616,071,000	1,294,670,000	1,274,053,000	1,528,808,000	1,283,877,000

Government oil royalty revenue is not further subcategorized by area, so determining the exact value of oil royalties paid from the Estevan area was not possible. Instead an approximate estimate was developed based on oil production in Area IV (Estevan) as a proportion of the provincial total.

The Government of Saskatchewan Ministry of Economy (previously the Ministry of Energy and Resources) publishes annual summaries of crude oil production volumes and gross values by area. Area IV (Estevan) and provincial production totals for the most recent five years are indicated below, as well as the proportion of Area IV (Estevan) production compared to the provincial total:

Oil Production by Volume	2008	2009	2010	2011	2012
Area IV (Estevan) (m <sup>3</sup> )	10,804,705.2	10,792,044.5	10,719,767.2	10,420,701.5	11,376,296.9
Prov. Total (m <sup>3</sup> )	25,590,750.5	24,634,078.7	24,526,766.0	25,089,562.0	27,482,118.9
Estevan Proportion of Total	0.42221	0.43809	0.43706	0.41534	0.41395

Oil Production by Value	2008	2009	2010	2011	2012
Area IV (Estevan) (\$)	5,627,708,874 <sup>1</sup>	4,267,183,269	5,008,748,776	5,852,891,835	5,859,720,435
Prov. Total (\$)	13,329,127,544	8,986,959,805	10,324,273,82	12,368,674,96	12,564,697,88
Estevan Proportion of Total	0.42221	0.47482	0.48514	0.47320	0.46636

The proportion of oil production in Area IV (Estevan) compared to the provincial total based on oil production by volume was then used to estimated values of oil royalties originating from the Estevan area. This proportion was chosen over the use of gross value production because it is a more conservative estimate. By applying this proportion to the associated provincial oil royalty values, an approximate estimate of Area IV (Estevan) annual oil royalties was determined.

Oil Royalties	2008-09	2009-10	2010-11	2011-12	2012-13
Estevan Proportion of Total Provincial Royalties (\$)	682,323,511	567,187,286	556,842,739	634,975,286	531,464,331

<sup>1</sup> 2008 value of production was unavailable for Area IV. The 2008 figure was estimated using the Area IV volume proportion of provincial production multiplied by the total provincial value of production.

