

APPENDIX 19-A

BC Input-Output Model Report: Red Mountain

BC Input-Output Model Report: Red Mountain Underground Gold Project Construction and Operation

PREPARED FOR HATFIELD CONSULTING
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Background

This report summarizes the results of an input-output analysis of the economic effects of the construction and operation of the Red Mountain Underground Gold Project (the Project), a proposed gold and silver mine located in northwest British Columbia (BC). Both mining and processing of the ore will occur at the mine site.

The British Columbia Input-Output Model (BCIOM) was used to generate the estimates. The following section provides an overview of input-output analysis and explains some of the key concepts used in the BCIOM. A more detailed explanation of input-output modelling in general and the BCIOM in particular, including the assumptions underlying input-output analysis, is included in the Appendix.

About the BCIOM

The BCIOM can be used to determine the extent to which expenditures made by industries, consumers, or businesses (i.e., project-specific expenditures) affect overall economic activity in the province. This is done by tracing through the steps involved in producing goods and services that are purchased in the province. Data on the production, consumption and origin of goods and services comes from input-output (also called supply-use) tables for British Columbia, which have been compiled by Statistics Canada.

Whether the input data represents consumer or producer spending, the results are reported in terms of the impact on British Columbia industries.

Three Types of Effects

Three different types of impacts are calculated in an input-output analysis:

- The **direct effect** measures the effect on BC industries supplying goods and services directly used by the project. For example, direct effects for a typical construction project would include effects in industries supplying goods and services such as cement, lumber, or engineering.
- The **indirect (supplier industry) effect** measures the effect on BC industries that are further back in the supply chain. The indirect effect is cumulative and includes transactions going all the way back to the beginning of the supply chain. Indirect effects for a typical construction project would include effects in industries supplying a wide range of goods and services, such as janitorial services, accounting, transportation, logging, and mining.

- The **induced effect** measures the effect that spending by workers (those employed by the Project or by direct and indirect supplier industries) has on the economy. Induced impacts for a typical construction project would include effects in industries that sell goods and services to consumers (e.g., retailers, food services, accommodation, and so on).

Key Measures of Economic Effects

Output, gross domestic product, household income, employment, and tax revenues are the key measures used to assess the economic effects associated with a project. In order to properly interpret the results of a BCIOM analysis, some background information about what these measures represent and how they are calculated may be helpful. A brief explanation of terms and concepts follows.

Output

Output measures the total value of industry production in British Columbia that is associated with a project.

In an **industry-based analysis**, output is equal to the value of goods and services produced by the BC industry or industries that are affected by a specific project.

In an **expenditure-based analysis**, output is equal to total spending on goods and services produced in British Columbia.

Gross Domestic Product (GDP)

GDP is a measure of the value added (the unduplicated total value of goods and services) to the British Columbia economy by current productive activities attributable to the project. It includes household income (wages, salaries, and benefits, as well as income earned by proprietors of unincorporated businesses) as well as profits and other income earned by corporations. Only activities that occur within the province are included in GDP.

Output or GDP: which measure should be used to evaluate economic effects associated with a project?

Output and GDP are both valid economic measures. However, there are some important differences between them that should be kept in mind when analyzing or reporting on the results of an input-output analysis.

If one is only looking at direct effects, output is a meaningful measure since it shows the total dollar value of production associated with a particular project or industry. However, output data should not normally be used to describe the total effect of a project, since the value of goods or services used in production is counted each time a product changes hands.

For example, the selling price of newly-constructed housing includes the following imbedded costs:

- the cost of the land on which it is built;
- the cost of inputs (lumber, shingles, cement, carpets, paint, hardware, plumbing fixtures, architectural services, and so on) purchased and used by the builder; and
- the value of the work done by the construction company that built the house.

The direct output of the construction industry would be the value of the finished house (i.e., the cost of the inputs used to build the house plus the value of the work done by the construction company).

The indirect output effect would include:

- the value of the architectural services as an indirect effect on the engineering and architectural services industry;
- the value of the lumber as an indirect output effect on the wood industry;
- the value of the logs used by the sawmill as an indirect output effect on the logging industry; and
- similar effects associated with other materials and services used in construction.

In this example, the value of the logs used to produce the building materials is counted at least three times: once in the direct output effect and twice in the indirect output effects on the sawmill and logging industries. The value of goods or services used in production is counted in indirect output effects every time a product changes hands.

GDP is calculated by subtracting the cost of purchased goods, services, and energy from the total value of an industry's output. As a result, the value of the work done by a producing industry is only counted once.

In the construction example:

- the direct GDP effect would only include the value of the work done by the construction firm;
- the indirect GDP effect on the sawmill industry would only include the value of the work done to transform the logs into lumber; and
- the indirect GDP effect on the logging industry would be a measure of the value of the work done by the loggers.

Output measures correspond to total spending or production, but may overstate the economic effect of a project because the value of a good or service used in production is counted each time a product changes hands.

Relationship between GDP and Output

The relationship between GDP and output is a useful analytical measure since it shows the extent to which industries rely on labour and capital as opposed to material and service inputs in production. The analysis of economic effects relies on this relationship, since output is more easily and directly measured than GDP. In fact, the starting point for most input-output analyses is a measure of the direct output associated with a project. From this, known relationships between output and other indicators, such as GDP and employment, can be used to estimate the economic effects associated with a specific project.

Household income

Household income includes wages, salaries, and benefits (e.g., employer contributions to Employment Insurance (EI) and Canada Pension Plan (CPP)), as well as an estimate of mixed income received by self-employed workers or unincorporated businesses.

Employment

Two different employment estimates are presented in the report tables: employment (jobs) and full-time equivalent (FTE) measures.

The **employment** estimates reflect the wages paid and annual hours spent on the job by a typical worker in each industry. In an industry where most employees work full time, the numbers will be very similar to FTE counts. In an industry where part-time work is more common, the job counts will be quite different from FTEs.

The **full-time equivalent estimates** are calculated based on the assumption that a full-time employee works 35 hours a week, for 50 weeks of the year (a total of 1,750 hours a year). This assumption can be modified when the model is run. In an industry where workers typically spend more than 1,750 hours on the job annually, the FTE estimate will exceed the employment estimate. In an industry where workers typically spend less than 1,750 hours on the job, the FTE estimate will be less than the employment estimate.

In other words, there is no double counting in GDP measures. Indirect output effects provide useful information about the total amount of money that has changed hands as goods and services are transformed into final products.

However, GDP is a better measure of the total economic effect since the value of the work done by each industry is attributed only to the producing industry, and is counted only once.

Tax revenues

Government tax revenue estimates generated by the model include federal, provincial, and local income and commodity taxes. The revenue estimates are calculated based on tax rates in effect in 2015.

Provincial and federal tax revenues include federal and provincial personal and corporation income taxes. Also included are PST, GST, and other **commodity** taxes. These include taxes on products (e.g., gas taxes, environmental taxes, liquor and lottery taxes and profits, air transportation taxes, duties, and excise taxes) and taxes on factors of production (e.g., licences, permits, fees, and property taxes).

Municipal tax revenues include taxes on products (primarily accommodation taxes) and taxes on production (business taxes, developer's fees, licences, permits, fees, and property taxes).

Regional Effects

The BCIOM is a provincial model, based on the structure of the British Columbia economy in 2011. Impact estimates are calculated at the provincial level.

Regional effect estimates reported in the model outputs are derived from the provincial effects using information about the regional composition of the province's labour force in each industry. This information comes from two sources: the National Household Survey (NHS) and the Labour Force Survey (LFS). The NHS data are available for detailed geographies (development region, regional district, census subdivision, etc.) and industries. They show the composition and industrial structure of the province's work force in 2010. Information from the LFS is not as detailed (at either the industry or geography level), but is more current than the NHS information; the current version of the model uses LFS data for 2014.

When calculating regional effects, the NHS data for the selected region is extrapolated based on trends in the LFS data for the more aggregated region or industry. NHS-based estimates are then used to calculate the share of total British Columbia employment, by detailed industry, in the selected region. These shares are then applied to the detailed industry effects generated by the model to estimate the percentage of total activity in each affected industry that could potentially be allocated to the study region. The regional shares are applied to the detailed industry effect estimates.

Information on the regional labour force and employment is used to determine whether the local area could potentially supply the number of workers needed by each industry affected by the project. For some industries (e.g., resource industries, construction, accommodation, and food services), it is assumed that the pool of potentially available workers is not

restricted to those who were previously employed in these industries. For other industries, the region's share of total employment is based on the existing pool of workers in the affected industry.

It is assumed that for each industry, the ratio of output to employment is consistent across regions. This assumption would not be reasonable if the ratios were applied to aggregate industries (e.g., manufacturing) because the output to employment ratio varies considerably within manufacturing industries. However, the regional ratios are calculated at the most detailed level possible (e.g., sawmills and wood preservation) for each industry, so inter-regional differences due to economic structure are less likely to be an issue.

Source of Data

The results presented in this section are derived from information provided to BC Stats by Hatfield Consultants. The information included cost estimates for the Project Construction Phase, as well as operating costs during the period when the mine is in production.

Construction of the Project is expected to cost \$143.0 million and to occur over a 20-month period. Capital expenditure will include purchases of equipment for use at the mine, the development of underground and above-ground infrastructure, including the Access Road, Haul Road, Tailings Management Facility (TMF), Powerline, and buildings at the mine site, and mine closure costs.

Detailed cost estimates for equipment purchases and rebuilds were provided by the client together with information on spending on key components of the Project. This information was allocated to BCIOM categories by BC Stats. Where the data provided by the client was at an aggregate level, the estimates were allocated to BCIOM categories by applying expenditure patterns for related industries or final demand categories to the more aggregate information provided by the client. For example, “tailings management” construction was allocated to labour and materials such as pipes, valves, pumps, and other building construction materials based on model information.

Some cost components (e.g., Access Road construction, bulk earthworks development, and Powerline construction) were treated as sub-contracts in the modelling. This means that these expenditures were viewed as purchases of engineering, road, or electric power engineering construction. In this case, the jobs, GDP, and tax revenues associated with these expenditures are included in the supplier industry effects reported in the tables below. For the rest of the mine development costs, detailed estimates provided by the client were used to determine the allocation of expenditures, and the jobs and GDP associated with these components are reported as direct project effects.

Detailed estimates of operating costs, totalling \$196 million over the five-year lifespan of the Project, were also coded to BCIOM categories by BC Stats.

Construction, Red Mountain Underground Gold Project

Project Expenditures, Project Construction

It is estimated that \$30.4 million of the \$143.0 million spent over a 20-month-long construction period would be used to purchase goods and services imported from other countries, while \$18.5 million would be imported from other provinces. Another \$0.6 million would be supplied from inventories held by businesses.

TABLE 1: ALLOCATION OF PROJECT EXPENDITURES

Allocation of Project Expenditures Construction Project					
Total construction project expenditures (\$M)					143.0
<i>minus leakages:</i>					
<i>imports from other countries</i>					30.4
<i>imports from other provinces</i>					18.5
<i>other leakages (e.g. withdrawals from inventory)</i>					0.6
<i>Equals:</i>					
Purchases of goods & services (including labour and profits) produced in BC (\$M)					93.5
<i>Of which:</i>					
<i>Wages, benefits, mixed income and operating surplus (\$M)</i>					24.7
<i>Taxes on products net of subsidies (\$M)</i>					3.7
<i>Taxes on factors of production net of subsidies (\$M)</i>					0.0
Direct BC supply (\$M)					65.1
<i>(the change in BC supplier industry output associated with construction project)</i>					
Project employment, construction project (#)					295
Household income, construction project (\$M)					22.6
Tax revenue derived from direct project expenditures Construction Project					
	Federal	Provincial	Local	Total	
Total, all sources	3.5	5.0	0.0	8.5	
Taxes on products (\$M)*	0.0	3.7	0.0	3.7	
Taxes on factors of production (\$M)	0.0	0.0	0.0	0.0	
Personal income taxes (\$M)	3.3	1.2		4.5	
Corporate income taxes (\$M)	0.2	0.1		0.2	
<i>(income taxes paid on worker's wages and returns to capital reported in project expenditure)</i>					

*Small differences between this figure and the value for taxes on products net of subsidies reported in the allocation of project expenditure are due to rounding and/or the inclusion of net taxes paid on some goods purchased by subcontractors which are not reflected in the indirect & induced impacts given below.

Spending on goods and services produced in British Columbia is estimated at \$93.5 million. This amount includes \$24.7 million in wages, benefits and operating surplus, and \$3.7 million going to taxes net of subsidies on factors of production. Government revenues directly generated by project spending are estimated at \$8.5 million, including the \$3.7

million in commodity taxes net of subsidies, another \$4.5 million in federal and provincial income taxes and \$0.2 million in corporate income taxes.

The direct BC supply—the change in BC supplier industry output associated with the project—is estimated at \$65.1 million, including \$31.5 million in construction sub-contracts (roads, earthworks, and Powerline).

Summary of Results

The estimated expenditures of \$143 million would directly contribute \$24.7 million to the province's GDP, with an additional \$45.2 million of GDP generated by the activities of supplier industries (including \$12.2 million of GDP associated with the construction work treated as sub-contracts). Another \$11.3 million of GDP would be generated as a result of spending by workers.

The Project would directly support 295 jobs (model estimates, derived from the estimated wage bill) during the 20-month-long construction period, for an annual average of 178 jobs. Ninety-five of the 291 direct supplier industry jobs are expected to be in construction firms. Thus, the total number of construction jobs supported by the Project would be 390 (or an average of 235 per year).

Employment in other supplier industries is estimated at 364 (219 per year), with another 111 (67 per year) jobs supported in industries benefitting from spending by workers.

In addition to the \$8.5 million of tax revenues generated by direct product expenditures, another \$9.8 million in government revenues is expected to come from supplier industry activities, while spending by workers will contribute an additional \$2.0 million to government coffers. Total federal tax revenues (including supplier industry and induced effects) are estimated at \$6.5 million (primarily income taxes paid by workers), with provincial revenues of \$4.4 million and local government revenues estimated at \$0.8 million.

Table 2 summarizes the results of the BCIOM analysis while Table 3 shows, in more detail, the indirect and induced effects associated with the project.

TABLE 2: SUMMARY OF RESULTS

**Red Mountain Mine
Construction Project**

Total impact, including Construction Project, supplier industry & induced effects					
	Direct	Other suppliers	Total Indirect*	Induced**	Total impact
Total project expenditures, Construction Project (\$M)	143.0				
Supplier industry & induced impacts (\$M)	65.1	31.8	96.9	18.1	115.0
<i>Of which: construction sub-contracts</i>	31.5		31.5		
<i>other suppliers</i>	33.5	31.8	65.4		
GDP at basic prices (\$M)					81.2
Construction Project***	24.7				24.7
Supplier industry & induced impacts	30.2	15.0	45.2	11.3	56.5
<i>Of which: construction sub-contracts</i>	12.2		12.2		
<i>other suppliers</i>	18.0	15.0	33.0		
Employment (#)****					865
Construction Project (Model estimate)	295				295
Supplier industry & induced impacts	291	167	459	111	570
<i>Of which: construction sub-contracts</i>	95		95		
<i>other suppliers</i>	196	167	364		
Employment (FTES)					948
Construction Project (Model estimate)	358				358
Supplier industry & induced impacts	318	170	488	102	590
<i>Of which: construction sub-contracts</i>	111		111		
<i>other suppliers</i>	208	170	377		
Household income (\$M)					62.7
Construction Project	22.6				22.6
Supplier industry & induced impacts	21.5	10.4	31.9	8.2	40.1
Average annual household income (\$ per employee)					
Construction Project	76,626				
Supplier industry & induced impacts *****	73,880	62,100	69,580	46,617	70,330
Tax revenue (\$M)					20.3
Construction Project	8.5				8.5
Supplier industry & induced impacts	6.6	3.2	9.8	2.0	11.8

* The total indirect impact is the sum of the effect on direct suppliers and other supplier industries

** Assumes a social safety net is in place. Includes effects generated by project spending and activities of supplier industries

*** Project expenditure data provided by clients may not include all components of GDP (e.g., operating surplus)

**** Employment estimates are based on average annual wages in 2013. Includes total employment over the life of the project

***** Average household income (induced impact) is based on income excluding imputed rent estimate

TABLE 3: INDIRECT AND INDUCED EFFECTS

Indirect & Induced Impacts resulting from Construction Project expenditures					
	Direct suppliers	Other suppliers	Total indirect impact (all suppliers)	Induced Impact**	Total indirect & induced impacts
Output (\$M)	65.1	31.8	96.9	18.1	115.0
GDP at basic prices* (\$M)	30.2	15.0	45.2	11.3	56.5
Employment (#)*	291	167	459	111	570
FTEs (#)	318	170	488	102	590
Household income (\$M)	21.5	10.4	31.9	8.2	40.1
Total tax revenue (\$M)	6.6	3.2	9.8	2.0	11.8
Federal (\$M)	3.7	1.8	5.6	1.0	6.5
<i>Personal income tax</i>	3.1	1.5	4.6	0.8	5.3
<i>Corporation income tax</i>	0.6	0.3	0.9	0.2	1.1
<i>Net taxes on products</i>	0.1	0.1	0.1	0.0	0.2
Provincial (\$M)	2.6	1.2	3.8	0.6	4.4
<i>Personal income tax</i>	1.1	0.5	1.6	0.3	1.9
<i>Corporation income tax</i>	0.3	0.2	0.5	0.1	0.6
<i>Net taxes on products</i>	1.2	0.5	1.7	0.3	1.9
Local (\$M)	0.2	0.2	0.4	0.4	0.8

* Includes wages, benefits, mixed income, operating surplus and net taxes on factors of production

** Assumes a social safety net is in place. Includes effects generated by project spending and activities of supplier industries

Regional Effects

The Project is located in northwest British Columbia, and regional effect estimates are based on the expected effects in the Kitimat-Stikine Regional District (RDKS). It should be noted that the regional effects are presented on an annual basis. Figures comparable to the ones in Tables 1 to 3 can be derived by multiplying the effects by 1.66 (reflecting a 20-month-long construction period).

It is estimated that supplier industry impacts in the local area will be quite significant. On an annual basis, 103 (59%) of the jobs supported in direct supplier industries are expected to be in the local area. For industries further back in the supply chain, local effects are expected to account for less than one percent of total employment.

TABLE 4: REGIONAL EFFECTS

**Regional Impact Estimates based on Supplier Industry Output,
Census Employment Data, and Labour Force Statistics
(experimental data, annual averages)**

Estimated Impact, Supplier Industries in Kitimat-Stikine					
	Direct suppliers	Other suppliers	Total indirect impact (all suppliers)	Induced	Total indirect & induced
Total output (\$M)	27.2	0.2	27.4	0.1	27.5
Total GDP (\$M)	11.7	0.1	11.8	0.1	11.9
Total household income (\$M)	7.9	0.0	7.9	0.0	8.0
Total employment	103	1	104	0	104

Estimated Impact in Rest of BC					
	Direct suppliers	Other suppliers	Total indirect impact (all suppliers)	Induced	Total indirect & induced
Total output (\$M)	12.0	19.0	31.0	10.9	41.8
Total GDP (\$M)	6.5	8.9	15.4	6.8	22.1
Total household income (\$M)	5.1	6.2	11.3	4.9	16.2
Total employment	72	100	172	67	239

Operation, Red Mountain Underground Gold Project

Project Expenditures, Project Operation

The mine is expected to be in operation for six years, with operations including both extraction and processing of the ore. Total operating costs over the entire period (including some pre-production costs) are estimated at \$194.6 million. Of this total, it is expected that \$27.0 million will be used to purchase goods and services imported from other countries, while \$24.3 million will be spent on imports from the rest of Canada. Another \$0.8 million of goods used by the mine is expected to be supplied from inventories held by businesses.

TABLE 5: ALLOCATION OF PROJECT EXPENDITURES

Allocation of Project Expenditures					
Mine Operation					
Total mine operation expenditures (\$M)					194.6
<i>minus leakages:</i>					
<i>imports from other countries</i>					27.0
<i>imports from other provinces</i>					24.3
<i>other leakages (e.g. withdrawals from inventory)</i>					0.8
<i>Equals:</i>					
Purchases of goods & services (including labour and profits) produced in BC (\$M)					142.5
<i>Of which:</i>					
<i>Wages, benefits, mixed income and operating surplus (\$M)</i>					92.8
<i>Taxes on products net of subsidies (\$M)</i>					3.9
<i>Taxes on factors of production net of subsidies (\$M)</i>					0.0
Direct BC supply (\$M)					45.8
<i>(the change in BC supplier industry output associated with mine operation)</i>					
Project employment, mine operation (#)					1,162
Household income, mine operation (\$M)					92.8
Tax revenue derived from direct project expenditures					
Mine Operation					
	Federal	Provincial	Local	Total	
Total, all sources	13.1	8.0	0.0	21.1	
Taxes on products (\$M)*	0.5	3.4	0.0	3.9	
Taxes on factors of production (\$M)	0.0	0.0	0.0	0.0	
Personal income taxes (\$M)	12.6	4.5		17.1	
Corporate income taxes (\$M)	0.0	0.0		0.0	
<i>(income taxes paid on worker's wages and returns to capital reported in project expenditure)</i>					

*Small differences between this figure and the value for taxes on products net of subsidies reported in the allocation of project expenditure are due to rounding and/or the inclusion of net taxes paid on some goods purchased by subcontractors which are not reflected in the indirect & induced impacts given below.

Total purchases of goods and services produced in BC are estimated at \$142.5 million. A significant portion (\$92.8 million) of this total is expected to be labour costs. Another \$3.9 million is expected to be spent on taxes net of subsidies on production. The direct BC supply—the change in BC supplier industry output associated with mine operations—is estimated at \$45.8 million. This is the amount that was used to shock the model.

Summary of Results

Tax revenues directly derived from Project operations are estimated at \$21.1 million, including \$13.1 million in revenues to the federal government and \$8.0 million going to the provincial government. These revenues are primarily personal income taxes, reflecting the comparatively high wage bill for the mine operation.

The mine operation's direct GDP is estimated at \$92.8 million, which is equal to the wage bill provided by the client. Operating surplus estimates, which would also be included in the GDP figure, were not provided to BC Stats, so have not been included in the project's direct GDP.

Another \$22.4 million in GDP is expected to be generated in industries directly supplying goods and services used by the Project operation, with an additional \$10.4 million of GDP generated by the activities of industries further back in the supply chain. Spending by workers is expected to contribute \$22.4 million to the province's GDP during the life of the Project.

Employment at the Project is estimated at 1,162 jobs (an average of 194 per year, based on six years of operation). It should be noted that the employment figures are based on estimates provided by the client.

Another 198 jobs (an average of 33 per year) would be supported in supplier industries providing goods and services directly used by the Project, with 116 jobs (19 per year) supported in industries further back in the supply chain. The induced employment effect is estimated at 220 jobs (37 per year).

In addition to the \$21.1 million in federal, provincial, and local tax revenues directly generated by the Project, \$6.8 million in tax revenues is expected to come from supplier industry activities with an additional \$4.0 million in government revenues attributable to spending by workers.

TABLE 6: SUMMARY OF RESULTS

**Red Mountain Mine Operation (Over Lifetime of Mine), Revised
Mine Operation**

Total impact, including Mine Operation, supplier industry & induced effects					
	Direct	Other suppliers	Total Indirect*	Induced**	Total impact
Total project expenditures, Mine Operation (\$M)	194.6				
Supplier industry & induced impacts (\$M)	45.8	22.5	68.3	35.9	104.2
GDP at basic prices (\$M)					148.0
Mine Operation***	92.8				92.8
Supplier industry & induced impacts	22.4	10.4	32.8	22.4	55.3
Employment (#)****					1,696
Mine Operation(Client Estimate)	1,162				1,162
Supplier industry & induced impacts	198	116	313	220	534
Employment (FTES)					1,884
Mine Operation(Client Estimate)	1,361				1,361
Supplier industry & induced impacts	205	115	321	202	523
Household income (\$M)					129.6
Mine Operation	92.8				92.8
Supplier industry & induced impacts	13.8	6.8	20.6	16.2	36.8
Average annual household income (\$ per employee)					
Mine Operation	79,853				
Supplier industry & induced impacts *****	70,100	58,500	65,810	46,617	68,955
Tax revenue (\$M)					31.9
Mine Operation	21.1				21.1
Supplier industry & induced impacts	4.6	2.3	6.8	4.0	10.8

* The total indirect impact is the sum of the effect on direct suppliers and other supplier industries

** Assumes a social safety net is in place. Includes effects generated by project spending and activities of supplier industries

*** Project expenditure data provided by clients may not include all components of GDP (e.g., operating surplus)

**** Employment estimates are based on average annual wages in 2013. Includes total employment over the life of the project

***** Average household income (induced impact) is based on income excluding imputed rent estimate

Table 7 shows, in more detail, the indirect and induced effects associated with the direct BC supply.

TABLE 7: INDIRECT AND INDUCED EFFECTS

Indirect & Induced Impacts resulting from Mine Operation expenditures					
	Direct suppliers	Other suppliers	Total indirect impact (all suppliers)	Induced Impact**	Total indirect & induced impacts
Output (\$M)	45.8	22.5	68.3	35.9	104.2
GDP at basic prices* (\$M)	22.4	10.4	32.8	22.4	55.3
Employment (#)*	198	116	313	220	534
FTEs (#)	205	115	321	202	523
Household income (\$M)	14	7	21	16	37
Total tax revenue (\$M)	4.6	2.3	6.8	4.0	10.8
Federal (\$M)	2.6	1.2	3.8	1.9	5.7
<i>Personal income tax</i>	1.9	1.0	2.9	1.5	4.4
<i>Corporation income tax</i>	0.6	0.2	0.9	0.4	1.2
<i>Net taxes on products</i>	0.0	0.0	0.0	0.1	0.1
Provincial (\$M)	1.7	0.9	2.6	1.3	3.8
<i>Personal income tax</i>	0.7	0.3	1.0	0.5	1.6
<i>Corporation income tax</i>	0.4	0.1	0.5	0.2	0.7
<i>Net taxes on products</i>	0.7	0.4	1.1	0.5	1.6
Local (\$M)	0.3	0.2	0.5	0.8	1.2

* Includes wages, benefits, mixed income, operating surplus and net taxes on factors of production

Regional Effects

In addition to the direct effect of the Project's operation on the regional economy, about 40% of the jobs, GDP and employment in direct supplier industries are expected to be in the RDKS. On an annualized basis, it is estimated that 13 jobs would be supported in local industries directly supplying services used by the Project, with another 20 direct supplier industry jobs in other parts of the province. Further back in the supply chain, industry effects are expected to be largely outside the local area, as is the induced effect associated with spending by workers employed by the mine and its direct and indirect suppliers.

TABLE 8: REGIONAL EFFECTS

**Regional Impact Estimates based on Supplier Industry Output,
Census Employment Data, and Labour Force Statistics
(experimental data, annual averages)**

Estimated Impact, Supplier Industries in Kitimat-Stikine					
	Direct suppliers	Other suppliers	Total indirect impact (all suppliers)	Induced	Total indirect & induced
Total output (\$M)	3.1	0.0	3.1	0.0	3.2
Total GDP (\$M)	1.6	0.0	1.6	0.0	1.6
Total household income (\$M)	1.0	0.0	1.0	0.0	1.0
Total employment	13	0	13	0	14

Estimated Impact in Rest of BC					
	Direct suppliers	Other suppliers	Total indirect impact (all suppliers)	Induced	Total indirect & induced
Total output (\$M)	4.5	3.7	8.3	6.0	14.2
Total GDP (\$M)	2.2	1.7	3.9	3.7	7.6
Total household income (\$M)	1.4	1.1	2.5	2.7	5.2
Total employment	20	19	39	36	75

Interpreting the BCIOM Results

BCIOM model results are summarized in the tables included in this report. This section explains how some of the variables are calculated.

Variables that are Derived from Information Supplied by Clients

Allocation of Project Expenditures

The information summarized in Table 1 (allocation of expenditures) is calculated directly from data supplied by the client. Total Project expenditure is usually provided by the client and includes all direct expenditures associated with the Project. The expenditure data are first coded to BCIOM commodities (goods and services). Model information is then used to break down the expenditures (by commodity) into the following categories:

- Leakages: purchases of goods and services that have been imported into British Columbia from other provinces or countries (import leakages) or withdrawn from inventories held by businesses (inventory leakages);
- Taxes net of subsidies on products and factors of production (included in the purchase price of goods and services used by the Project);
- Wages paid to workers directly hired by the Project;
- Purchases of goods and services made in British Columbia (the direct B.C. supply); and
- Purchases of existing assets.

Leakages

Some types of expenditures do not generate any economic effects in the province. For example, the jobs, GDP, and tax revenues associated with the production of goods and services that have been imported into British Columbia are attributable to the province or country where those goods or services are produced. In the case of goods withdrawn from inventories held by businesses, the jobs, GDP, and tax revenues associated with their production would have been generated in the period in which those goods were produced. Estimated leakages (imports and inventory withdrawals) are generated from model information about BC production of each commodity and the value of imports of each commodity in the model year. These leakages are deducted from Project expenditure data when determining the direct BC supply.

Taxes Net of Subsidies on Products and Factors of Production

Taxes on products are a transfer from consumers (or businesses) to government, but there is no direct economic activity generated by these taxes. Similarly, subsidies represent a

transfer from government to business and do not directly generate economic effects. Taxes and subsidies on products and factors of production directly associated with Project expenditures were calculated using effective tax rates for each good or service used by the Project. This amount is included in the net tax revenue directly generated by the Project.

All of the tax revenue effects have been calculated based on the current tax structure, which assumes a PST of 7% is applied to items subject to the tax.

Wages Paid to Workers Directly Hired by the Project

Labour costs for the project are assumed to include pre-tax wages, salaries, and benefits (e.g., the employer's share of contributions to EI or CPP). Wages do not include embedded costs, such as transportation or accommodation costs for workers at remote job sites.

Wages paid to workers directly hired by the Project are used to estimate Project direct employment, federal, and provincial income tax revenues and induced expenditures directly generated by the Project. However, they are not part of the Direct BC Supply, a measure which only includes industry output (wages are not produced by industries, they are paid to individuals).

Income tax revenues are calculated by estimating income taxes associated with a given wage.

Similarly, if the input data supplied by the client includes an estimate of operating surplus, this amount is used to estimate federal and provincial corporate income tax revenues. However, it is not part of the Direct BC Supply since profits, like wages, are not produced by a particular industry. Instead, they are a payment for the use of capital in production.

Direct BC Supply

The Direct BC Supply is the change in output in all British Columbia industries directly supplying goods and services used by the Project. This value is calculated by deducting leakages, taxes, and wages paid to workers directly hired by the Project from the expenditure data. It is used to shock the model in order to determine supplier industry and induced effects.

Purchases of Existing Assets

The purchase cost of land, existing buildings, infrastructure, or transfers of other assets (such as financial assets) represents a transfer of ownership from one agent to another. There are no current jobs or GDP associated with the value of these transactions. The only current economic activity associated with the transfer relates to the value of the work done by real estate agents, lawyers, or others involved in expediting or recording the transfer that has occurred.

If they are included in the input data, expenditures related to purchases of existing assets are deducted from the input data before any of the coding is done.

Retail, Wholesale, and Transportation Margins

Costs embedded in the final selling price of each commodity (e.g., transportation, wholesaling, and retailing services) are identified and allocated to the appropriate industry using information in the model.

Project Direct GDP Estimates

Project direct GDP figures are derived from information provided by clients. These figures are usually project-specific, but they are not always based on complete information. For example, it is often possible to get good data on wages and salaries associated with a project or activity. Labour costs are the largest component of GDP, but other variables that ought to be included in the estimate (such as operating surplus) are not always known. When the GDP figures generated by the BCIOM are based on partial information, they may understate the project's direct contribution to GDP.

The reported project direct GDP is based on input data provided by clients. Corporation profits (normally included in GDP) and associated corporate income tax revenues are only included in the reported direct expenditures if this information has been supplied by clients, or if the input data used was based on model averages.

Project Direct Employment and Household Income

Project direct employment is derived based on the Project's wage bill and estimates of average annual wages in the affected industry. In some cases, the reported project direct employment estimates have been supplied by clients.

Employment estimates generated by the model are derived from estimated wage costs using data on average annual wages and hours worked in each industry in 2013 (the latest year for which this information was available when the model was last updated). In some industries, most workers are employed full time but in others (e.g., accommodation and food services) the typical work week is usually shorter.

The model output also includes full-time equivalent (FTE) estimates, calculated using the assumption that a full-time employee would work 1,750 hours per year (50 weeks, at 35 hours per week).

Household income is calculated based on Project direct wages, benefits, and mixed income.

BCIOM Effect Estimates

The model is shocked using the Direct BC Supply calculated from the information provided by the client. The total economic effect of the Project on the BC economy is reported in terms of direct, indirect, and induced effects. The results of the model shock are summarized in Tables 2 and 3.

Direct Supplier Industry Effects

The direct supplier industry effect measures the change in economic activity in British Columbia industries that is required to satisfy the initial change in demand.

The direct output impact is equal to the Direct BC Supply (i.e., the change in the economic activity of the industries producing the goods and services purchased by the Project).

The direct GDP effect is the GDP generated as a result of the activities of the industries that produce the goods and services directly used by the Project.

The direct employment effect shows total employment in these industries, and the direct household income effect is a measure of the wages, salaries, benefits, and other income earned by these workers.

The direct tax revenue effect includes personal, corporation, sales, and other taxes generated as a result of the activities of the industries that supply the goods and services used by the Project.

The allocation of tax revenues to federal, provincial, and local governments is based on model information.

Other Supplier Industry Effects

Other supplier industry effects measure the cumulative impact on BC industries that are further back in the supply chain. This includes industries producing goods and services used by direct suppliers.

Induced Effects

The induced effect, which measures the effect associated with expenditures by workers (those directly employed by the project as well as workers in supplier industries), includes purchases of a variety of goods and services, including housing.

For the calculation of induced effects, it is assumed that 80% of workers' earnings will be used to purchase goods and services in the province (the remaining 20% goes to taxes, payroll deductions, and savings).

BC STATS

It is assumed that a social safety net is in place, and that workers who are newly hired as a result of the Project previously had some income from EI or other safety net programs.

Appendix

Some Background on Input-Output Models and Analysis

Input-output analysis is based on statistical information about the flow of goods and services among various sectors of the economy. This information, presented in the form of tables, provides a comprehensive and detailed representation of the economy for a given year. An input-output model is essentially a database showing the relationship between commodity usage and industry output. It consists of three components:

- a table showing which commodities-both goods and services-are consumed by each industry in the process of production (the input matrix);
- a table showing which commodities are produced by each industry (the output matrix); and
- a table showing which commodities are available for consumption by final users (the final demand matrix).

These data are combined into a single model of the economy that can be solved to determine how much additional production is generated by a change in the demand for one or more commodities or by a change in the output of an industry. Changing the usage or production of a commodity or group of commodities is often referred to as shocking the model. The known relationship between goods and services in the economy is used to generate an estimate of the economic impact of such a change.

If a change in demand is met by increasing or decreasing imports from other jurisdictions, there is no net effect on domestic production. All of the benefits or costs associated with employment generation or loss, and other economic effects, will occur outside the region. Therefore, it is important to identify whether or not a change in the demand for a good or service is met inside or outside a region.

Assumptions and Caveats

Commodities made in BC have a much bigger impact than those imported into the province. The analysis presented here is based on using default import ratios for most commodities: i.e., assuming they are purchased locally, but allowing for the fact that they may have been manufactured elsewhere.

All tax data were generated using the model structure, and are based on averages for an industry or commodity.

Economic modelling is an imprecise science, and the precision of the figures in the tables should not be taken as an indication of their accuracy.

The British Columbia Input-Output Model

The BCIOM is based on 2011 data. It is derived from inter-provincial input-output tables developed by Statistics Canada and includes details on 481 commodities, 235 industries, 280 "final demand" categories, and a set of computer algorithms to do the calculations required for the solution of the model. It can be used to predict how an increase or a decrease in demand for the products of one industry will have an impact on other industries and therefore on the entire economy.

Limitations and Caveats Associated with Input-Output Analysis

Input-output analysis is based on various assumptions about the economy and the inter-relationships between industries. These assumptions are listed below:

Input-output models are linear. They assume that a given change in the demand for a commodity or for the outputs of a given industry will translate into a proportional change in production.

Input-output models do not take into account the amount of time required for changes to happen. Economic adjustments resulting from a change in demand are assumed to happen immediately.

It is assumed that there are no capacity constraints and that an increase in the demand for labour will result in an increase in employment (rather than simply re-deploying workers).

It is assumed that consumers spend an average of 80% of their personal income on goods and services. The remaining 20% of personal income is consumed by taxes, or goes into savings.

The BCIOM is based on a "snapshot" of the BC economy in 2011. It is assumed that relationships between industries are relatively stable over time, so that the 2011 structure of the economy continues to be applicable today. However, it should be noted that employment estimates have been adjusted to reflect wage levels for the year of the expenditures in each case.

BC STATS

BC Stats is the provincial government's leader in statistical and economic research, information and analysis essential for evidence-based decision-making. BC Stats, the central statistics agency of government, is excited to be taking a lead role in the strategic understanding of data sources and analysis across government. The goal is to increase overall business intelligence—information decision makers can use. As part of this goal, BC Stats is also developing an organizational performance measurement program. For more information, please contact Elizabeth Vickery.



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