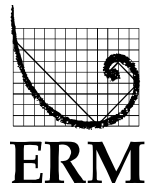


BRUCEJACK GOLD MINE PROJECT
Application for an Environmental Assessment Certificate /
Environmental Impact Statement

Appendix 19-B

BC Input-Output Model Report: Brucejack Mine



BC Input-Output Model Report: Brucejack Mine

BACKGROUND

This report summarizes the results of an input-output analysis that assesses the economic impact of the construction and operation of the Brucejack mine, a proposed gold mine in the Kitimat-Stikine region of the province.

The British Columbia Input-Output Model (BCIOM) was used to generate the estimates. A description of the BCIOM, and the assumptions underlying input-output analysis, is included in the Appendix.

ABOUT INPUT-OUTPUT ANALYSES

Input-output analyses highlight the relationships among producers and consumers (businesses as well as individuals) of goods and services. An input-output analysis is based on first identifying a basket of goods and services used by a specific project¹ and then tracing through all of the steps involved in producing those goods and services to identify the total extent to which the British Columbia economy will be affected by project expenditures.

THREE TYPES OF IMPACTS

Three different types of impacts are reported in a typical input-output analysis:

The **direct impact** measures the impact on BC industries supplying goods and services directly used by the project.

The **indirect impact** measures the impact on BC industries that are further back in the supply chain. The indirect impact is cumulative, and includes transactions going all the way back to the beginning of the supply chain.

The **induced impact** measures the effect that spending by workers (those employed by the project, or by direct and indirect supplier industries) has on the economy.

HOW ARE ECONOMIC IMPACTS MEASURED?

Output, GDP, employment and tax revenues are the key measures used to assess the economic impacts 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 is simply a measure of the total value of production 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, it can be measured as the total dollar amount of all spending on **goods and services produced in BC**. It should be noted that purchases of goods and services produced outside the province do not directly affect BC businesses, so these expenditures are explicitly excluded from the analysis. This is usually the main reason why the direct impact on BC industries is less than initial project expenditures.

Gross Domestic Product (GDP) is a measure of the value added (the unduplicated total value of goods and services) to the BC 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) from current productive activities as well as profits and other income earned by corporations. Only activities that occur within the province are included in GDP.

¹ Or, in the case of an industry analysis, the total value of production by one or more industries.

BCIOM Report—Brucejack Mine continued...

Employment estimates generated by the model are derived from estimated wage costs using information on average annual wages in an industry. They are not full-time equivalent (FTE) measures. Instead, they reflect the wages paid and hours spent on the job by a typical worker in an industry. For an industry where most employees work full time, the numbers will be very similar to FTE counts. However, in an industry where part-time work is more common, the job counts will be quite different from FTEs.

Government tax revenue estimates generated by the model include income taxes as well as commodity taxes. *Provincial and federal tax revenues* include federal and provincial personal and corporation income taxes. Also included are PST, GST and other *commodity* taxes such as gas taxes, liquor and lottery taxes and profits, air transportation taxes, duties and excise taxes. Property tax revenues are not included in the estimates. *Municipal tax revenues* are primarily related to accommodation taxes.

A more detailed explanation of input-output modelling in general and the BCIOM in particular is included in the Appendix.

OUTPUT OR GDP: WHICH MEASURE SHOULD BE USED TO EVALUATE ECONOMIC IMPACTS ASSOCIATED WITH A PROJECT?

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

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

If one is only looking at direct effects, output is a meaningful measure since it shows the total dollar value of industry production. However, there is a danger of double-counting when activities in industries further up the supply chain are also included. Output measures may overstate the indirect economic impact associated with a particular project

since the activities of every industry that has contributed in some way to the creation of a final product are counted each time a good or service changes hands.

For example, when a construction company builds a house, the selling price of the house includes:

- 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.

An **output-based impact measure** would include the entire selling price of the house (including all these imbedded costs) in the direct output of the construction industry. The value of architectural services included in the cost of the house would also be counted as an indirect output impact on the architectural services industry. The value of the lumber used would be counted as an indirect output impact on the wood industry, and going further back in the supply chain, the value of the logs used by the sawmill would be counted in the indirect output impact on the logging industry. 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 impact, and twice in the indirect output impacts on the sawmill and logging industries. In other words, the indirect output impact could be quite high simply because goods (or services) used in production have changed hands many times.

Indirect output impacts provide useful information about the total amount of money that has changed hands as goods and services are transformed into final products. GDP is a better measure of the economic impact since the value of the work done by each industry is attributed only to the producing industry, and is counted only once.

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

BCIOM Report—Brucejack Mine continued...

the construction example, the direct GDP impact would only include the value of the work done by the construction firm. The indirect impact on the sawmill industry would only include the value of the work done to transform the logs into lumber, and the indirect impact on the logging industry would be a measure of the value of the work done by the loggers. There is no double counting in GDP measures.

It should be noted that 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 impacts 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 impact associated with a specific project.

SUMMARY OF RESULTS, BRUCEJACK MINE

SOURCES OF DATA

The data inputs used for this study were provided to BC Stats by Rescan Environmental Services Limited, and were based on information supplied by Pretium, the company developing the proposed mine. Expenditure data were coded to BCIOM categories by BC Stats, using information from the model to allocate aggregated expenditures to the categories used in the BCIOM.

It was assumed that no PST or GST was included in the model inputs provided by the client. However, other taxes embedded in the cost of inputs (e.g., excise taxes on fuel) were estimated by the model based on the expenditure data.

KEY ASSUMPTIONS

The wage component of the labour cost estimate is assumed to include pre-tax wages, salaries and supplementary income (e.g., the employer's share of contributions to EI or CPP). The model's estimates of income tax revenues are calculated by estimating income taxes associated with a given wage. 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, other payroll deductions, and savings).

It is assumed that a social safety net is in place, and that workers hired to work on the project previously had some income from EI or other safety net programs (note: the social safety net assumption only affects the estimate of worker spending, which is the induced effect associated with the project).

Employment estimates generated by the model are based on the wage bill and average earnings in each affected industry. They should not be confused with FTE counts. The model estimates represent average jobs in an industry. 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.

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

SUMMARY OF RESULTS: MINE CONSTRUCTION

The total cost of developing the mine is expected to be \$599 million over a three-year-long construction period. Of this total, \$134 million is expected to be spent on wages paid to workers directly employed on the construction project, with the remainder used to purchase materials, equipment, and contracted services (e.g., engineering services) from various supplier industries.

The expenditure categories provided by the client included all types of expenditures: wages, materials, equipment and purchased services. It was necessary to extract the wage component of these expenditures from this spending. The wage bill for each component was estimated based on the assumption that wages account for the same share of total spending in each category.

The construction of the mine is expected to generate \$412 million of activity in supplier industries, including those directly providing goods and services used in construction (\$279 million), as well as those further back in the supply chain (\$133 million). Another \$115 million of activity is expected to be generated in industries benefitting from spending by workers.

The GDP associated with the construction of the project is estimated at \$134 million, which is equal to the wage bill. No information on an estimated operating surplus was provided by the client, and as a result, the actual GDP associated with the direct project expenditures is likely understated.

BCIOM Report—Brucejack Mine continued...

The reported GDP in supplier industries is not understated. It is estimated by the model, and includes all components of GDP (wages, salaries, operating surplus, and mixed income, together with taxes on production net of subsidies).

Supplier industry activities are expected to contribute another \$189 million to the province's GDP, including \$129 million in industries providing goods and services directly used by the project.

The direct employment estimate of 870 was provided by the client, and is based on the client's assumptions about wage rates and labour requirements for construction of the mine.

The wages used in the model do not explicitly take into account special circumstances which may drive wages higher in some areas of the province where the supply of labour may be limited, or where there is a risk premium associated with doing the work.

The supplier industry employment estimated by the model assumes that, for a given wage bill, average wages paid are significantly lower than the \$154,000 annual wage used by the client. Thus, the model's employment estimates, which are derived from estimated wage bills, are commensurately higher.

This difference in assumed average wages partly explains why the supplier industry employment associated with the project is much higher than direct employment on the construction site. It also reflects the relative importance of some types of supplier industries (e.g., engineering), which typically account for a significant share of the total costs associated with

construction projects. Employment in supplier industries is estimated at 2,232, including 1,510 workers in direct supplier industries.

Professional, scientific and technical services (455), accommodation and food services (307), manufacturing (253) and wholesale trade (152) are expected to be the key employer industries. It is expected that some construction activities would be sub-contracted, so another 134 jobs are expected to be supported in direct supplier industries.

Direct tax revenue impacts associated with project are estimated at \$27 million. This is primarily personal income taxes paid on workers wages. It should be noted that the model estimates of personal income taxes are usually conservative. The equation used in the model was developed using data on taxes paid on income from all sources, not just employment, so the effective tax rate is likely lower than it would be if only employment income had been used.

In the supplier industries, tax revenues are estimated at \$28 million, with another \$9 million generated in industries that benefit from worker spending.

The model was used to estimate the regional supplier industry impact. Based on this, it is estimated that direct supplier industries in the Kitimat-Stikine region will employ an average of 190 people per year during construction of the mine, with another 20 people working in industries further back in the supply chain.

Tables summarizing the model inputs and results follow below.

BCIOM Report—Brucejack Mine continued...

Total Capital Expenditures, Brucejack Mine		
	Estimated Cost, Including Labour (\$M)	Estimated Cost, Excluding Labour (\$M)
Mine Site	32.7	25.4
Mine Underground	174.5	135.5
Mine Site Process	80.1	62.2
Mine Site Utilities	23.7	18.4
Mine Site Facilities	43.7	33.9
Mine Site Tailings (Brucejack Lake)	3.5	2.7
Mine Site Temporary Facilities	10.2	7.9
Mine Site (Surface) Mobile Equipment	14.3	11.1
Off Site Infrastructure	69.1	53.6
Indirects	125.0	97.1
Owners costs	22.3	17.3
Cost of Labour	<i>included above</i>	134.0
Total Capital Expenditures	599.1	599.1
<i>Of which:</i>		
Cost of Labour	134.0	
Contingency (not included)	64.4	64.4

BCIOM Report—Brucejack Mine continued...

Brucejack Mine, Construction Phase Mine Construction

Total impact, including construction, supplier industry & induced effects					
	Direct	Other suppliers	Total Indirect*	Induced**	Total impact
Total expenditures, construction (\$M)	599				
Supplier industry & induced impacts (\$M)	279	133	412	115	527
GDP at basic prices (\$M)					395
Construction***	134				134
Supplier industry & induced impacts	129	60	189	72	261
Employment (#)****					3,912
Construction (Estimated by Client)	870				870
Supplier industry & induced impacts	1,510	722	2,232	809	3,042
Household income (\$M)					308
Construction	134				134
Supplier industry & induced impacts	92	41	133	41	174
Average annual wage (\$ per employee)					
Construction (Estimated by Client)	154,028				
Supplier industry & induced impacts	60,920	56,275	59,420	50,675	57,090
Tax revenue (\$M)					64
Construction	27				27
Supplier industry & induced impacts	19	9	28	9	38

* 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 2011. Includes total employment over the life of the project

BCIOM Report—Brucejack Mine continued...

Allocation of Project Expenditures Mine Construction	
Total construction expenditures (\$M)	599.1
<i>minus leakages:</i>	
<i>imports from other countries</i>	90.3
<i>imports from other provinces</i>	90.9
<i>other leakages (e.g. withdrawals from inventory)</i>	4.1
<i>Equals:</i>	
Expenditures on goods & services (including labour and profits) produced in BC (\$M)	413.8
<i>Of which:</i>	
<i>Wages, benefits, unincorporated business income and operating surplus (\$M)</i>	134.0
<i>Taxes on products net of subsidies (\$M)</i>	0.7
<i>Taxes on factors of production net of subsidies (\$M)</i>	0.0
Direct BC supply (\$M)	279
<i>(the change in BC supplier industry output associated with construction)</i>	
Project employment during mine construction (#)	870
Household income included in mine construction (\$M)	134.0
Tax revenue derived from direct project expenditures Mine Construction	
	Federal Provincial Local Total
Total, all sources	18.002 8.674 0.000 26.676
Taxes on products (\$M)*	0.239 0.456 0.000 0.694
Taxes on factors of production (\$M)	0.000 0.000 0.000 0.000
Personal income taxes (\$M)	17.763 8.218 25.981
Corporate income taxes (\$M)	0.000 0.000 0.000
<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.

Indirect & Induced Impacts resulting from construction expenditures					
	Direct suppliers	Other suppliers	Total indirect impact (all suppliers)	Induced Impact**	Total indirect & induced impacts
Output (\$M)	279	133	412	115	527
GDP at basic prices* (\$M)	129	60	189	72	261
Employment (#)*	1,510	722	2,232	809	3,042
Household income (\$M)	92	41	133	41	174
Total tax revenue (\$M)	19.021	9.192	28.213	9.428	37.640
Federal (\$M)	10.364	4.532	14.896	3.031	17.927
<i>Personal income tax</i>	7.782	3.211	10.993	2.287	13.280
<i>Corporation income tax</i>	2.767	1.311	4.079	1.233	5.311
<i>Net taxes on products</i>	-0.186	0.009	-0.176	-0.488	-0.665
Provincial (\$M)	7.394	3.413	10.808	3.611	14.419
<i>Personal income tax</i>	2.962	1.221	4.183	0.878	5.061
<i>Corporation income tax</i>	1.249	0.590	1.839	0.550	2.390
<i>Net taxes on products</i>	3.183	1.602	4.785	2.183	6.968
Local (\$M)	1.263	1.246	2.509	2.785	5.295

* Includes wages, benefits, unincorporated business 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

SUMMARY OF RESULTS: MINE CONSTRUCTION

The mine is expected to remain in operation for 22 years. The figures reported in the tables are based on total estimated costs over the life of the mine.

Total spending on operating costs, sustaining capital, and closure and environmental bonding is expected to be \$4.2 billion (\$192 million per year). This includes \$2.8 billion spent on goods and services used by the mine, and another estimated \$1.5 billion in wages and benefits paid to workers.

Direct supplier industry impacts associated with the operation of the mine are estimated at \$1.250 billion (or \$57 million per year), with another \$591 million (\$27 million annually) generated in industries further back in the supply chain.

It was assumed that the G&A/Surface Services Expenditure would include overhead items such as taxes on factors of production, and this is included in the project's direct GDP estimate of \$1.6 billion over the mine's operating life, which is slightly higher than the wage bill (\$1.5 billion). However, as was the case for the construction phase, the project direct GDP does not include any operating surplus that may result from mine operations. Thus, the GDP and corporate income taxes directly generated by the mine are likely understated.

Another \$588 million in GDP is expected to be generated in direct supplier industries, while industries

further back in the supply chain are expected to add \$277 million to the province's GDP over the life of the mine. The induced impact on GDP, which is the result of worker spending, is estimated at \$496 million.

Total employment at the mine is estimated at 12,353 (562 workers per year). Another 7,669 people (349 per year) are expected to be employed in direct supplier industries, while employment in industries further back in the supply chain is estimated at 3,332 (151 annually). Worker spending is expected to support another 5,602 jobs (an average of 255 per year).

Among direct supplier industries, key employers include accommodation and food services (2,049 jobs over the life of the project), transportation and warehousing (1,875 jobs), wholesale trade (919) and manufacturing (554).

Commodity and income tax revenues w are estimated at \$527 million while the mine is in operating, including \$320 million directly generated by the mine, \$141 million in supplier industries, and \$65 million resulting from spending by workers.

On an annual basis, supplier industries in the Kitimat-Stikine region are expected to provide employment for about 60 people, with another 20 jobs supported in industries that benefit from worker spending.

Tables summarizing the model inputs and results follow below.

Total Operating Costs, including Off-Site, Sustaining and Closure Costs, in \$M, over the life of the mine			
Expenditure Category	Total spending	Materials & Services	Labour
Mining expenditure	1,718	712	1,006
Processing expenditure	1,264	1,067	197
G&A/ Surface Services Expenditure	885	620	266
Total - Mining, Processing, G&A and Surface Services	3,868	2,399	1,469
Sustaining Capital	329	329	
Closure/Environmental Bonding	26	26	
Total spending	4,222	2,753	1,469

BCIOM Report—Brucejack Mine continued...

Brucejack Mine Operating costs (over life of mine)

Total impact, including operating costs, supplier industry & induced effects					
	Direct	Other suppliers	Total Indirect*	Induced**	Total impact
Total expenditures, operating costs (\$M)	4,222				
Supplier industry & induced impacts (\$M)	1,250	591	1,841	794	2,636
GDP at basic prices (\$M)					2,914
Operating costs***	1,554				1,554
Supplier industry & induced impacts	588	277	864	496	1,360
Employment (#)****					28,956
Operating costs (Estimated by Client)	12,353				12,353
Supplier industry & induced impacts	7,669	3,332	11,001	5,602	16,603
Household income (\$M)					2,331
Operating costs	1,475				1,475
Supplier industry & induced impacts	393	179	572	284	856
Average annual wage (\$ per employee)					
Operating costs (Estimated by Client)	119,436				
Supplier industry & induced impacts	51,275	53,710	52,015	50,675	51,560
Tax revenue (\$M)					527
Operating costs	320				320
Supplier industry & induced impacts	96	45	141	65	207

* 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 2011. Includes total employment over the life of the project

BCIOM Report—Brucejack Mine continued...

Allocation of Project Expenditures	
Operating costs (over life of mine)	
Total operating costs expenditures (\$M)	4,222.0
<i>minus leakages:</i>	
<i>imports from other countries</i>	837.1
<i>imports from other provinces</i>	560.6
<i>other leakages (e.g. withdrawals from inventory)</i>	7.5
<i>Equals:</i>	
Expenditures on goods & services (including labour and profits) produced in BC (\$M)	2,816.7
<i>Of which:</i>	
<i>Wages, benefits, unincorporated business income and operating surplus (\$M)</i>	1,475.4
<i>Taxes on products net of subsidies (\$M)</i>	12.5
<i>Taxes on factors of production net of subsidies (\$M)</i>	78.5
Direct BC supply (\$M)	1,250
<i>(the change in BC supplier industry output associated with operating costs)</i>	
Project employment during operating costs (over life of mine) (#)	12,353
Household income included in operating costs (over life of mine) (\$M)	1,475.4
Tax revenue derived from direct project expenditures	
Operating costs (over life of mine)	
	Federal Provincial Local Total
Total, all sources	170.786 98.206 51.204 320.196
Taxes on products (\$M)*	7.683 4.794 0.000 12.477
Taxes on factors of production (\$M)	0.566 26.685 51.204 78.456
Personal income taxes (\$M)	162.537 66.726 229.263
Corporate income taxes (\$M)	0.000 0.000 0.000
<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.

Indirect & Induced Impacts resulting from operating costs expenditures					
	Direct	Other	Total		Total
	suppliers	suppliers	indirect	Induced	indirect &
			impact (all	Impact**	induced
			suppliers)		impacts
Output (\$M)	1,250	591	1,841	794	2,636
GDP at basic prices* (\$M)	588	277	864	496	1,360
Employment (#)*	7,669	3,332	11,001	5,602	16,603
Household income (\$M)	393	179	572	284	856
Total tax revenue (\$M)	96.217	45.261	141.478	65.242	206.720
Federal (\$M)	44.106	21.257	65.363	20.975	86.338
<i>Personal income tax</i>	28.199	13.752	41.952	15.824	57.776
<i>Corporation income tax</i>	15.775	6.987	22.762	8.529	31.292
<i>Net taxes on products</i>	0.131	0.518	0.649	-3.378	-2.729
Provincial (\$M)	39.992	17.721	57.713	24.991	82.704
<i>Personal income tax</i>	10.718	5.239	15.956	6.076	22.033
<i>Corporation income tax</i>	7.031	3.218	10.248	3.809	14.057
<i>Net taxes on products</i>	22.243	9.265	31.508	15.106	46.614
Local (\$M)	12.120	6.283	18.402	19.276	37.678

* Includes wages, benefits, unincorporated business 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

INTERPRETING THE BCIOM RESULTS

BCIOM model results are summarized in the tables attached to this report. This section defines some of the terms and concepts used in the report tables and explains how they are calculated.

Variables that are calculated directly from information supplied by clients

Total project expenditure is usually provided by the client, and includes all direct expenditures associated with the project.

There are no jobs, GDP or output associated with the production of goods and services that are imported into the province. Therefore an estimate of the value of imported goods and services is deducted from project direct spending to determine the value of **project expenditure in BC**.

Estimates of wages, salaries and other components of GDP provided by the client are reported in **project direct GDP at basic prices**.

About Project Direct GDP Estimates

It should be noted that 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 biggest component of GDP, but other variables which ought to be included in the estimate (such as investment income, operating surplus, or depreciation) 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.

Project direct employment is derived based on the project's wage bill and estimates of average annual wages in the industry.

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

Variables that are estimated using model information

Commodity taxes less subsidies is calculated using information on average sales and other tax rates associated with each good or service purchased by the project.

Project expenditure in BC is traced back to the producing industries in order to determine the **direct BC supply**. Because industries do not “produce” taxes, wages or other components of GDP, the direct BC supply only includes the value of goods and services produced by BC industries. Direct project spending on wages, salaries, operating surplus and taxes are excluded from this measure.

An estimate of **corporate and personal income taxes** associated with these project direct expenditures is calculated using information on average tax rates from the model.

BCIOM impact estimates

The model is shocked using the direct BC supply calculated from the information provided by the client. This is used to determine the total economic impact of the project on the BC economy, which is reported in terms of direct, indirect and induced impacts.

The **direct impact** measures the change in economic activity required to satisfy the initial change in demand. The **direct output impact** is equal to the direct BC supply—the change in the economic activity of the industries producing the goods and services purchased by the project.

The **direct GDP impact** is the GDP generated as a result of the activities of the industries that produce the goods and services used by the project.

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

The **direct tax revenue impact** includes personal, corporation, sales and other taxes generated as a result

BCIOM Report—Brucejack Mine continued...

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 averages.

Induced effects

The induced effect, which measures the impact associated with expenditures by workers, includes

purchases of a variety of goods and services, including housing.

More detailed information about the impacts is available in the report tables included in this document.

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)
- 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 which 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

From an IO perspective, 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.

The precision of the figures in the tables should not be taken as an indication of their accuracy. Economic modelling is an imprecise science and the estimates in this report are probably no better than +/- 10%.

THE BRITISH COLUMBIA INPUT-OUTPUT MODEL

The BCIOM can be viewed as a snapshot of the BC economy. It is derived from inter-provincial input-output tables developed by Statistics Canada and includes details on 727 commodities, 300 industries, 170 “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.

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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 2008. It is assumed that relationships between industries are relatively stable over time, so that the 2008 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.

The BCIOM does not distinguish between regional effects. It will not, for example, differentiate between the economic impact of a plant located in one region of the province and a similar plant elsewhere in BC.