



Alaska-Canada Rail Link Economic Benefits

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EXECUTIVE SUMMARY

Construction of the 1,740 km Alaska-Canada Rail Link (ACRL) between Fort Nelson, BC and Delta Junction, Alaska to join the North American rail system to the Alaska Railroad will result in tremendous economic benefits for Canada and the US. The ACRL will provide valuable additional east-west rail capacity and tidewater access to the Pacific, hugely benefitting not only the Yukon and Eastern Alaska regions, into which it will introduce rail transport for the first time, but throughout both countries. The economic benefits of ACRL construction are consistent with Canadian government's desire to promote Northern development and comparable in significance to those of Canadian Pacific Railway in the 1880's and the St. Lawrence Seaway in the 1950's.

Benefits of ACRL Construction

Construction of the ACRL alone will bring unprecedented economic stimulus to the region in terms of job creation, wages and income tax revenue over multiple years. Table 7-1 below summarizes the benefits from ACRL construction for the Yukon, BC and Canada as a whole. However, these estimates are conservative as they exclude benefits associated with pre-construction activities, railway operation post-construction, sales taxes and corporate taxes as well as all such benefits that will accrue to Alaska and the US.¹

Table 7-1: Summary of Benefits to Yukon, BC and Canada

	Yukon	BC	Canada
Direct, Indirect & Induced Employment (FTE's)	44,000-53,000	29,000-34,000	97,600-116,900
Wages & Salaries (Billion)	\$2.3-\$2.8	\$2.0-\$2.4	\$5.9-\$7.1
Income Tax Revenues (Million)	\$216-\$261	\$166-\$202	\$1,200-\$1,500

The sheer size of project's labour requirements and anticipated duration of construction supports the attraction of not only temporary workers but also the opportunity to draw workers willing to relocate and take up permanent residency with their families, if complementary policies, such as housing construction, and incentives are put in place.

¹ Estimates of job, wage and tax benefits for Alaska and the US have not been calculated as comparable economic multipliers for this purpose were unavailable.

Benefits to Mining

The mining industry, which is the main underpinning and catalyst of the Yukon's economy and a major contributor to Alaska's economy, will be a primary beneficiary of the ACRL's construction. The rail line will reduce the cost of mining exploration, development, operation, imports and exports, fundamentally changing mining cost structures that will result in economic viability of deposits at lower mineral price levels. In so doing, it will both encourage new mining investment and development and extend the economic life of existing and new mines in the region. It will also have the added benefit of reducing the Canadian government's remediation cost for the Faro mine. The Yukon and Eastern Alaska in turn will enjoy higher royalty income, taxes as well as population and employment growth.

Increasing mining activity in this minerally rich region, ranked #1 and #2 in potential in the world,² is providential given the expected exponential growth in demand for metals and minerals in the development of low-carbon energy technologies.³ This upsurge in mining activity will also inevitably result in the discovery and extraction of critical and strategic minerals with important manufacturing, technological and military uses, for which there are no viable substitutes, that are often a by-product of primary mineral production. Developing and securing a reliable supply of these critical and strategic minerals addresses the US Presidential Executive Order signed in 2017 with the specific purpose of increasing discovery, access, extraction and production of these key resources.⁴

Benefits to Communities and Residents

By opening access and providing lower transport cost to/from the Yukon, Northeast BC and Alaska for both import and export of goods and supplies, the ACRL will have a dramatic positive economic impact on resource industries within these regions, including mining, forestry and oil and gas, that will inevitably result in job creation. This, in turn, will open employment opportunities and assist in lowering unemployment and retaining existing residents, particularly in First Nations' communities and among youth.

The addition of high paying jobs in resources industries will serve to improve the income and economic well-being of residents and communities, including First Nations, through wage spending. It will also likely attract new or returning permanent and temporary residents, expanding the population base and stimulating the need for new housing, construction employment and demand for goods and services. Higher demand for goods and services by both industry and residents will open entrepreneurial opportunities for existing and new residents, especially First Nations and in small communities, given resource industries' practice of proactive local procurement.

² Fraser Institute, *Annual Survey of Mining Companies*, 2015.

³ World Bank, *The Growing Role of Minerals and Metals for a Low-carbon Future*, 2017.

⁴ US Energy and Environment, *Presidential Executive Order on Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals*, December 17, 2017.

Cost of living for Yukon and Alaska residents should also be reduced, assuming the lower cost of transport for goods and equipment is passed onto consumers. Savings will be most noticeable in industries like construction, which are dependent on large volumes of heavy materials and equipment. The ACRL may also add transport options for workers travelling to/from mine sites and communities or existing airports in the region if regular passenger service was implemented.

Benefits to Other Regions and Industries

While the Yukon, Northeast BC and Alaska will be the primary beneficiaries of the ACRL, other regions in Canada and the US Midwest and Eastern States will also gain new opportunities and benefit from this new rail connection to Pacific tidewater.

The Ports of Anchorage and Port MacKenzie will offer the most cost-effective export location for mineral ores and forest products from the Yukon and Eastern Alaska as a result of the ACRL. Since these exports represent new tonnage, this will not negatively impact other West Coast ports. In addition, the two to three-day sailing time advantage to Asia from these two ports over other Northwest Coast ports combined with the lower cost of direct rail transport to Central Canada and the US will make them attractive for container freight. This will add capacity and promote greater competition for this traffic as well as contribute back-haul freight demand for the ACRL.

By stimulating mining, the ACRL will also increase demand for fuel and LNG, broadening the market for these products from Northeast BC and Alberta. If shipment of LNG by rail receives regulatory approval, it could also offer a pipeline alternative to transport LNG both for consumption in the Yukon and Alaska as well as for export to Asia. In addition, the ACRL would reduce the cost for an Alberta rail extension that would enable transport of crude oil to tidewater for export to Asia.

Development of Alaska's North Slope will also benefit from the ACRL providing a lower cost for shipment of equipment, machinery, construction materials and supplies required for both construction of a rail extension to this region and oil and gas production facilities. Similarly, the ACRL would lower the cost of imports and exports, thus improving the economic viability of developing the Crest iron ore deposit in the northeast Yukon. It would also encourage the construction of rail rather than road access between the Crest site and ACRL, which would reduce environmental impact of the mine's development on its surrounding area.

The economic stimulus and lower transport cost created by the ACRL to the Yukon and Alaska will create new demand and open markets for manufacturers and suppliers in both Canada and the Midwest and Eastern US. At the same time, Yukon and Alaska residents and industries will benefit from the lower cost for numerous goods delivered to the region. The ACRL would also encourage increased Alaskan seafood exports into both Canada and the Midwest and Eastern US.

Other Benefits

In addition to the many other benefits described in this report, the ACRL offers an opportunity to develop a new rail-tourism experience – a niche that has proven appeal in the fast-growing travel market. In so doing, it could also encourage additional overnight stays in the Yukon and incubate other attractions, highlighting the region’s gold rush history, First Nations’ culture and environmental features.

While the ACRL will stimulate economic, industrial and population growth, it has the added benefit of neutralizing the GHG impacts of this growth because rail generates lower GHG emissions for the transport of both inbound and outbound goods compared to currently used transport modes. The ACRL also offers the opportunity to minimize intrusion and disruption into previously undeveloped areas because of its reduced footprint and controlled access that deters public trespass and preserves the territorial sovereignty and environmental values of these virgin territories.

Construction of the ACRL would also contribute a valuable transportation contingency in the event of a natural disaster and bolster national security by providing an alternative supply route in the case that the Port of Anchorage, which is the primary entry point for most of the Alaska’s supplies, and other ports were unavailable.

1 | BACKGROUND - MORE THAN A CENTURY IN THE MAKING

Interest in connecting the North American rail system to the Alaska Railroad dates to the early 1900's. Constructing this link would introduce rail service to the Yukon, partly addressing the region's infrastructure deficit, which is an acknowledged impediment to mining exploration, development and production⁵, the principal drivers of the Territory's economy. This factor alone takes on new economic and strategic importance as North America has come to realize the exponential growth in demand for metals and minerals in the development of low-carbon energy technologies. Added to this is the absence of domestic supply and supply chain assurance for critical and strategic minerals and rare earths required for 21st century technologies and production, prompting the adoption of a US Presidential Executive Order in 2017 to increase discovery, access, development and production of these key resources.⁶

Construction of the proposed link also directly responds to Canada's *Northern Corridor Initiative*,⁷ toward which the Canadian federal government has pledged \$400 million for Northern transportation infrastructure. The Government has also recognized the inadequacy of Canada's east-west infrastructure and resulting access limitations to tidewater for export of goods to international markets and its impediment to economic growth, particularly in the North. The proposed rail link would transform the region's economy as it would create a third trans-Canada rail line to Pacific tidewater and a shorter and less costly means of freight transport from Central Canada and the Midwest and Eastern US for construction materials, consumer goods and equipment to both the Yukon and Alaska; and conversely, a shorter potential route for containers from Asia via Alaska to Central Canada and the Midwest and Eastern US.

Over the years, the project has been raised numerous times only to be deferred for a variety of reasons. Within the last decade, two major feasibility studies of the Alaska-Canada Rail Link (ACRL) were completed. The first, *Rail to Resources to Ports (2007)*⁸, addressed multiple route alternatives and feeder lines and, while identifying a primary route and feeder line for analytical purposes, did not result in a definitive route recommendation. It also concluded that a significant shortfall would result between capital and operating costs and expected revenues predominantly generated by mine projects being actively explored for development at that time.

⁵ Association of Consulting Engineers (Canada), Mining Association of Canada, NWT & Nunavut Chambers of Mines, Prospectors & Developers Association of Canada, and Yukon Chamber of Mines, *Levelling the Playing Field: Supporting Mineral Exploration and Mining in Remote and Northern Canada*, 2015.

⁶ US Energy and Environment, *Presidential Executive Order on Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals*, December 17, 2017.

⁷ Standing Senate Committee on Trade and Commerce, *National Corridor: Enhancing and Facilitating Commerce and Internal Trade*, June 2017.

⁸ ALCAN Rail Link, *Rail to Resources to Ports: The Alaska Canada Rail Link Project, Preliminary Feasibility Study*, 2007.

However, significant changes have occurred since 2007. More than ten years of active mineral exploration have revealed major new finds and expanded reserves, including the Casino, Selwyn, Wellgreen, Mactung and other deposits. An initial review shows that expected shippable tonnage is six-times that predicted in 2007. In addition, commodity prices are significantly higher. For example, the price per pound of copper was \$4.22 (CAD)⁹ in June 2018 compared with the 2007 predicted price range of \$0.45 to \$1.00 per pound.

Figure 1-1: 2007 and 2015 Study Route Alternatives



The second study, the *Alberta to Alaska Railway Pre-Feasibility Study (2015)*¹⁰, examined two route options between the North American rail system at Fort Nelson, BC and the Alaska Railroad with an extension to Fort McMurray, Alberta and included infrastructure required for bitumen and petroleum handling. This study focused primarily on transportation of bitumen and petroleum products for export from Alberta. However, it also expanded consideration of mineral export potential by adding a probability

⁹ \$3.22 USD.

¹⁰ Van Horne Institute, *Alberta to Alaska Railway: Pre-Feasibility Study*, 2015

analysis of 30-year exports based on known mineral occurrences rather than the more limited sample of mine projects being actively explored for development contained in the 2007 study.

This 2015 study concluded that a reasonable rate of return on investment after operating costs could be achieved based on 1.0 to 1.5 million barrels per day of bitumen/petroleum exports at rail shipping costs comparable to 2015 rail rates to BC coast ports and would be supplemented by another \$10 to \$11 billion in net present value pre-tax cash flow over 30 years from mineral exports.

This Project – Focus on Benefits

The current project updates and builds on both the 2007 and 2015 studies. It adopts the 2015 study's preferred route between Fort Nelson, BC and Delta Junction, Alaska, the present designated terminus of the Alaska Railroad, as well as rail construction and operation costs developed by this study but updated to 2017 dollars. It assumes that extension of the railway to Alberta and bitumen and petroleum handling facilities as well as mine accesses to the mainline, if approved, would be justified and funded separately. This route is 805 km (500 miles) shorter than those examined in 2007 and 2015. (See Figure 1-1 above.)

The study addresses benefits to industries and residents resulting from freight and commodity flow and transport opportunities. It updates the estimates of mineral exports from the mine projects currently being explored for development and from the 30-year probabilistic forecast. It also includes imports of both mining and consumer commodities, construction materials and equipment to the region. As part of this work, the project engaged mining as well as cargo logistic stakeholders to gain better insight on timing and cost implications to them and seek their support.

The project also identifies other potential social benefits resulting from the rail line, including its role in lowering the cost of living, reducing environmental impacts, increasing employment opportunities and tax revenues, strengthening local communities and improving emergency contingency and national security, and addresses potential impacts to competing facilities and transport services.

2 | BENEFITS FROM ACRL CONSTRUCTION

The ACRL spans approximately 1,740 km from Fort Nelson to Delta Junction, Alaska, of which 1,400 km are within Canada and the remaining 340 km in Alaska. The cost to build the whole line is estimated to be \$14 to \$15 billion dollars (CAD)¹¹, of which \$11 to \$13 billion would be required for the section within Canada. Construction of the line will generate economic benefits in terms of jobs, wages and salaries and, in turn, income tax revenues derived from wages and salaries.

An estimate of these economic benefits has been calculated using the most recent economic multipliers for transportation engineering construction developed by Statistics Canada¹² for the Yukon, BC and Canada from their 2014 Input-Output Model (I-O). Unfortunately, the I-O model does not include values for railroad construction in the Yukon as no railway has been constructed there since the late 1800's. However, in provinces that do have this data, the multipliers for railroad construction are higher than transportation construction. Therefore, these estimates may be conservative.

In addition, the I-O model is based on survey data, which can vary from year to year, and represents an average of output impacts in various industries as defined by the North American Industry Classification System (NAICS).¹³ The input values used were 2017 NPV dollars deflated to 2014 based on the Bank of Canada's inflation calculator.¹⁴

The benefits estimated include:

- direct, indirect and induced employment resulting from the construction,
- wages and salaries associated with construction; and,
- income taxes stemming from wages and salaries paid.

Unfortunately, similar economic multipliers are not available for Alaska and therefore, economic benefits to Alaska and the US resulting from construction of the 340 km of the railway in Eastern Alaska have not been calculated.

The calculation also excludes economic benefits associated with any pre-construction studies and design, including surveys and mapping, a full feasibility study, preliminary design, financial studies, funding submissions, environmental studies and preparation of formal Canadian Environmental Assessment and US Environmental Impact Statement submissions and other pre-construction activities. In addition,

¹¹ This cost estimate is based on per km costs (Class D estimate) derived from the 2015 *Alberta to Alaska Railway Pre-feasibility Study* excluding rolling stock, facilities and land cost discount and inflated to \$2017 per the Bank of Canada.

¹² Statistics Canada, *Provincial Input-Output Multipliers*, 2014.

¹³ For additional details, please refer to Statistics Canada, *User's Guide to the Canadian Input-Output Model*, 2013.

¹⁴ Bank of Canada; <http://www.bankofcanada.ca/rates/related/inflation-calculator/>

economic benefits from ACRL operations have not been estimated as service requirements, schedule and operator(s) are unknown and therefore cannot be costed or attributed by jurisdiction.

Job Creation

Construction of the ACRL will generate direct employment as well as indirect employment with suppliers and services to construction companies undertaking the work. In addition, these workers and, possibly their families, through their wages and salaries will create demand for goods and services that will result in jobs or induced employment in various goods and service industries.

Yukon Employment Benefits

In the Yukon, approximately 31,000 to 37,000 direct person-years of employment or full-time equivalent jobs (FTE's)¹⁵ are expected to result over a five to seven-year construction period.¹⁶ Indirect employment with suppliers and construction service providers is expected to add another 8,000 to 10,000 jobs (FTE's). The wages and salaries of these workers are also expected to generate another 5,000 to 6,000 jobs (FTE's) in goods and service industries catering to these workers and their families.

In total, ACRL construction is anticipated to generate 44,000 to 53,000 person-years of employment or FTE's in the Yukon. This would mean creation of 6,300 to 10,600 jobs (FTE's) on average each year over the five to seven-year construction period. The number of people benefitting from these jobs, however, will be greater as actual employment will include both full and part-time positions and job requirements will vary over the course of the construction project.

By comparison, the entire labour force of the Yukon in 2017 numbered 21,825 people of which 96.4% were employed,¹⁷ with 2,100 Yukon residents engaged in construction. Based on these facts, ACRL construction will require and attract workers to the region, including those with family and roots in the region but who may have moved away. While some of these workers may be temporary, some are very likely to choose to become permanent Yukon residents and bring along their families given the length of the construction project and additional construction job prospects from mining development that the railway is expected to stimulate.

BC Employment Benefits

In BC, ACRL construction is expected to create 12,000 to 14,000 direct jobs (FTE's) over an approximately three to four-year construction period. Another 10,000 to 12,000 indirect jobs are also anticipated to be created as well as 7,000 to 8,000 jobs in induced employment from the expenditure of worker's wages

¹⁵ All figures are rounded.

¹⁶ Construction of 160 km per year is assumed based on recent international average rates of rail construction.

¹⁷ Yukon Bureau of Statistics, *Yukon Employment Annual Review 2017*, June 1, 2018.

and salaries. On average, this represents the creation of 7,250 to 11,300 new jobs per year over the construction period.

Northeast BC with a labour force of 41,000 people and a construction industry work force of 6,300 in 2017 is significantly larger than that in the Yukon. Unemployment in 2017 averaged 5.9%, which again is higher than in the Yukon. Nevertheless, job creation by the ACRL is equally likely to require and draw additional workers to the region over the construction period at least.

Employment Benefits in the Rest of Canada

Direct, indirect and induced employment will also result from ACRL construction in other parts of Canada. This would include such activities as engineering design, equipment and supply manufacture (e.g., rails and other components) and material production (e.g., cement). It is estimated that 11,000 to 14,000 direct and indirect jobs (FTE’s) will be created in other provinces by the ACRL construction in Yukon. Construction in BC is also expected to generate 4,000 to 5,000 direct and indirect jobs in other parts of Canada. In the case of the Yukon, many of these jobs are likely to be in BC as it is the largest provincial trade partner with the Yukon.¹⁸

Induced jobs will also result from the expenditure of wages and salaries by workers in these other jurisdictions. Extra-provincial induced employment stemming from the ACRL construction in the Yukon is forecast to be 6,500 to 7,900 jobs, again largely in BC. Induced employment generated by construction in BC totals 2,800 to 3,500 jobs.

In total, Canada will benefit from the creation of 97,300 to 117,400 person-years or employment or FTE’s over the ACRL’s construction period. This would mean an average of approximately 13,900 to 16,800 jobs if the construction period was seven years.

Table 2-1: Direct, Indirect & Induced Employment (FTEs) from Construction

	Yukon	BC	Other Provinces	Canada in Total
Direct & Indirect	39,000-47,000	22,000-26,000	15,000-19,000	76,000-92,000
Induced	5,000-6,000	7,000-8,000	9,300-11,400	21,300-25,400
Total	44,000-53,000	29,000-34,000	24,300-30,400	97,300-117,400

Wages and Salaries

Wages and salaries from direct and indirect employment in the Yukon are expected to total \$2.1 to \$2.6 billion¹⁹ over the ACRL construction period. Induced employment is anticipated to generate another \$190

¹⁸ Statistics Canada, *Inter-provincial Trade Flows*, CANSIM 386-003 and 386-005.

¹⁹ Converted to \$2017.

to \$230 million, bringing the total in wage and salary benefits to \$2.3 to \$2.8 billion in the Yukon during construction.

In BC, \$1.7 to \$2.0 billion in wages and salaries are expected from direct and indirect employment from construction of the ACRL in that province. Another \$330 to \$400 million is also forecast to be added from induced employment. Thus, the total amount of wages and salaries resulting from ACRL construction in BC is predicted to be \$2.0 to 2.4 billion.

Direct and indirect wages and salaries resulting from ACRL construction in the Yukon and BC are expected to total \$1.1 to \$1.3 billion in other provinces over the construction period. Induced wages and salaries generated by expenditures of direct and indirect incomes are expected to add another \$400 to \$500 million. As stated previously, much of the out-of-province wages and salaries stimulated by Yukon construction are expected to benefit BC.

In total, workers in Canada will earn an estimated \$5.8 to \$7.0 billion in wages and salaries because of ACRL construction.

Tax Revenues

Canadian federal and provincial income tax rates are graduated by income level. 2018 tax rates are identified in Table 2-2 below.

Table 2-2: Federal and Provincial 2018 Personal Tax Rates

Federal		Yukon		BC	
Tax Bracket	Tax Rate	Tax Bracket	Tax Rate	Tax Bracket	Tax Rate
Up to \$46,605	15%		6.4%	Up to \$39,676	5.6%
Up to \$92,208	20.5%		9%	Up to \$79,353	7.7%
Up to \$144,489	26%		10.9%	Up to \$91,107	10.5%
Up to \$205,842	29%	Up to \$500,000	12.8%	Up to \$110,630	12.29%
\$205,843+	33%	\$500,000+	15%	Up to \$150,000	14.7%
				\$150,000+	16.8%

Source: Canada Revenue Agency, 2018. <http://www.cra-arc.gc.ca/tax/individuals/faq/taxrates>

To estimate income tax revenues derived from wages and salaries, income earned was distributed between tax brackets. To calculate income taxes paid to the Yukon and BC, it was assumed that most workers (80%) would fall into the second tax bracket for incomes up to \$92,208 and \$79,353 respectively. This assumption was based on the average 2017 annual income of \$62,600 in Yukon for construction

workers²⁰ and \$59,600 to \$68,100 for construction and professional and technical workers (including engineers) in BC,²¹ which represent most of the jobs created by the project.

For wages generated in the Yukon, ten percent were assumed to fall into the third tax bracket for incomes up to \$144,489 and five percent into the fourth bracket for incomes over \$144,489 but lower than \$500,000 to account for managers, supervisors and other higher income earners. The remaining five percent of Yukon earnings were assumed to fall into the lowest tax bracket to account for part-time and lower income earners.

For wages generated in BC, five percent were assumed to fall in each of the third, fourth and fifth tax brackets to reflect managers, supervisors and other higher incomes earners as well as the lowest tax bracket to address part-time and lower income workers.

To calculate Federal taxes paid, it was again assumed that most workers (80 percent) would fall into the second tax bracket for incomes up to \$92,208. This is consistent with the average incomes of most workers as described above. Ten percent of earned income was estimated to fall into the next higher tax bracket for incomes up to \$144,489 and four percent in the fourth tax bracket for incomes up to \$205,842 and one percent in the fifth or top bracket for those earning above \$205,842. Five percent was also assumed to fall in the lowest tax bracket for incomes under \$45,605 to account for part-time and lower income earners.

Provincial personal income taxes generated in other provinces were not calculated, as there is no way to determine in which province earnings would apply given that construction contracts have not yet been awarded. In addition, as the precise breakdown of part-time and full-time workers as well as information on personal deductions or other income that factor into tax calculation are unavailable, hence the estimate of personal income taxes generated is an approximation.

Tax revenues calculated exclude estimates of Canadian federal and provincial sales for material, equipment and supplies procured as well as any potential corporate tax revenues for contractor services as the source of these materials and contractors cannot be determined at this time. As a result, tax benefits resulting from the project are likely to be higher than those calculated. This is consistent with the conservative approach taken in this analysis, which has specifically avoided quantification of benefits if accuracy or confidence were in doubt.

Income Tax Revenues

Income tax revenue resulting from wages and salaries associated with ACRL construction are expected to yield \$216 to \$261 million to the Yukon. Wages and salaries paid for construction work in BC are

²⁰ Survey data for average wages for professionals in the Yukon was not available.

²¹ Statistics Canada, *Annual Weekly Earnings by Industry: Table 14-10-0204-01*, July 27, 2018.

anticipated to generate \$166 to \$202 million. These forecasts exclude income taxes that may result from employment earnings in the neighbouring jurisdiction, which are considered extra-provincial by the I-O multipliers. As has been previously stated, BC is likely to be a primary beneficiary of construction in the Yukon given its proximity and standing as the Yukon’s largest trading partner. At the Canadian federal level, ACRL construction is expected to generate \$1.2 to \$1.5 billion in income tax revenues.

These financial contributions to provincial and federal treasuries could go a long way to offset any potential government grants or financial commitments to the project.

Conclusions

Construction of the ACRL would bring unprecedented economic stimulus to the Yukon and Northeast BC in terms of job creation, wages and salaries and income tax revenue to both jurisdictions over multiple years. Table 2-3 below summarizes these benefits to both jurisdictions and Canada as a whole.

Table 2-3: Summary of Benefits to Yukon, BC and Canada

	Yukon	BC	Canada
Direct, Indirect & Induced Employment (FTE’s)	44,000-53,000	29,000-34,000	97,600-116,900
Wages & Salaries (Billion)	\$2.3-\$2.8	\$2.0-\$2.4	\$5.9-\$7.1
Income Tax Revenues (Million)	\$216-\$261	\$166-\$202	\$1,200-\$1,500

While the above are estimates, the benefits calculated are likely conservative because of the many items excluded in the analysis, including pre-construction activities, railway operation post-construction, sales tax benefits and corporate tax payments.

The sheer size of the project’s labour requirements and anticipated duration of construction supports the attraction of not only temporary workers but also the opportunity to draw workers willing to relocate and take up permanent residency with their families, if complementary policies, such as housing construction, and incentives were put in place. As such, the construction of the railway would not only be a game changer for the mining industry but also for Northern economic development.

3 | BENEFITS TO MINING

Mining exploration, development and production are the main underpinnings and catalysts of the Yukon economy, and thus the industry's trends are inexorably linked to upswings and downturns in the Territory's economy. Over the past decade, mining has generated 17% of the Territory's GDP; 12% in 2017, its lowest contribution in ten years reflecting low global commodity prices, which have resulted in mine closures.²² Mineral exports represented 98.6% of the Territory's total exports in 2016, valued at \$218 million.²³

The value of mineral production in 2017 was \$301 million,²⁴ down 23% compared to 2016 and lower than the ten-year average of \$341 million. But true to form, mineral prices rebounded in 2017, resulting in a more than doubling of exploration and mine development expenditures in the Yukon compared to 2016 and the highest since 2011.²⁵

Mineral exploration in the Yukon in recent years has focused primarily on gold deposits largely reflecting the low commodity prices for other minerals. In 2017, gold comprised 82% of all exploration projects in the Territory. Nevertheless, over the past two years, exploration was also carried out on 14 copper deposit prospects (seven that combined gold, gold and silver and/or molybdenum and tungsten), nine lead/zinc, nine silver and five nickel/platinum deposit prospects.²⁶

Expenditures on exploration and mine complex development totaled over \$216 million and are forecast to exceed \$500 million in 2018²⁷ as the outlook for mineral prices improves. Approximately 800 direct and 1,800 indirect and induced jobs in the Yukon in 2017 are estimated to have been supported by the mining sector.²⁸ This represented 8.5% of the Territory's total 2017 employment.²⁹

Although less significant to the Alaskan economy due to the state's broader diversification, the mining sector, nevertheless, makes a sizable contribution to local and state governments and Alaska Native Corporations, contributing \$445.5 million (USD) in 2017.³⁰ The mining sector also spent almost \$420.3 million (USD) on exploration and development, generated a gross income of \$2.7 billion (USD), outlaid \$604 million (USD) in direct and indirect wages and supported over 10,100 direct, indirect and induced jobs,

²² Yukon Finance, *Fiscal and Economic Outlook*, March 2018.

²³ Natural Resources Canada & Statistics Canada, *Mineral Trade Information Bulletin 2016*, August 2017.

²⁴ Natural Resources Canada, *Annual Statistics of Mineral Production*, March 2018.

²⁵ CBC News, *Bonanza for Yukon Mineral Exploration as Expenditures Double*, August 2, 2017.

²⁶ Yukon Energy, Mines & Resources, *Yukon Exploration and Geology 2017*, 2018.

²⁷ Natural Resources Canada, *Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development*, 2018.

²⁸ *Ibid.*, estimate derived from application of Statistics Canada Economic 2014 Input-Output Multipliers.

²⁹ Yukon Finance, *Yukon Statistical Review 2017*, 2018.

³⁰ State of Alaska, Department of Natural Resources, *Alaska's Mineral Industry, 2017 - Special Report*, 2018.

representing about 3% of total state employment.³¹

More importantly in both jurisdictions, mining employment typically provides higher paying jobs than most other industries and job opportunities in remote and rural areas where unemployment is often high. This is especially significant for First Nations' communities in these areas both in terms of direct and indirect jobs and business opportunities created to service the industry.

The Yukon and Alaska's mineral potential was ranked #1 and #2 in the world in 2015³² based on its geologic attractiveness and known mineral deposits. This includes more than half of the minerals classified as critical and strategic by the US Geological Survey, which consist of mineral commodities that have important manufacturing, technological and military uses and no viable substitutes for everything from smartphones to weaponry, yet these essential minerals face potential disruption in supply.³³ A 2014 report by the US Geological Survey³⁴ reported that despite having significant deposits of these minerals, the US currently relies on imports for 90% of them from China. As a result, a US Presidential Executive Order was issued in 2017³⁵ to increase discovery, access to, development and production of these key resources.

Despite the mineral richness of the Yukon and Alaska, high transportation and energy costs have resulted in only the highest grade and tonnage occurrences, which are in the upper 90th percentiles of their type in the world and close to infrastructure, being economically viable and some only marginally so. For example, Alaska's Red Dog Mine, the world's largest source of zinc and a significant source of lead, is viable only because it is 84 km from the Chukchi Sea, where concentrates are exported. Had the mine been located 300 km from tidewater, it would not have been developed.

In 2015, a consortium of industry associations released a report outlining the impediments to exploration and mining in remote and Northern regions.³⁶ The study revealed that exploration was six times more costly, mine development was 16% to two and a half times more costly depending on the type of mine, and operations or production costs are 30% to 60% higher depending on the commodity. The chief contributors to these higher costs are logistics and transport due largely to the lack of existing infrastructure and the need for mines to both build and maintain much of this as part of their operations, including roads, camps and/or

³¹ Ibid., and National Mining Association, *US Mining by State*, 2017.

³² Fraser Institute, *Annual Survey of Mining Companies*, 2015.

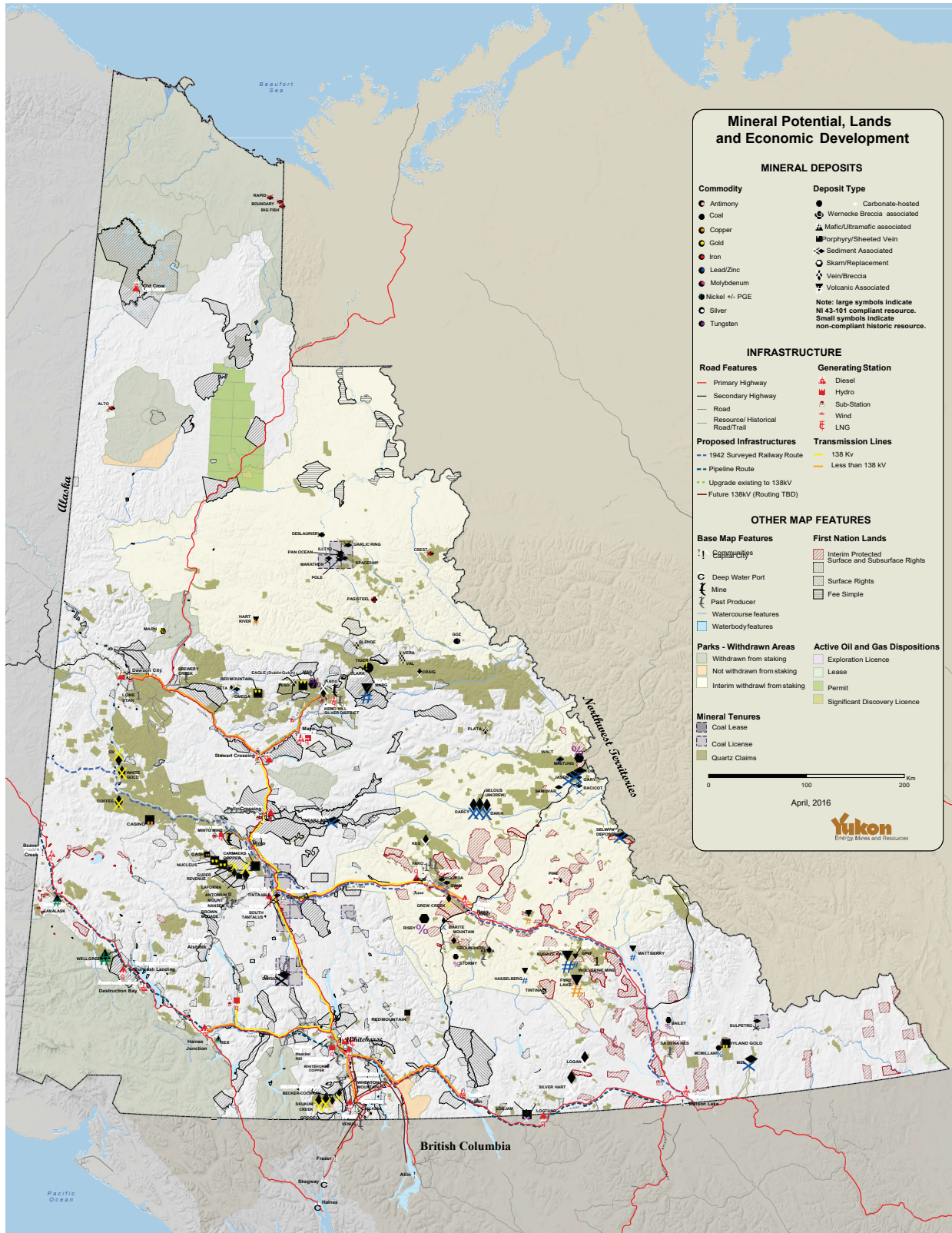
³³ Andrew Mayeda, *US to ensure rare-earth supply amid trade war with China*, American Journal of Trade, June 2, 2019; Stewart Patterson, *Rare Earths: The threat of embargo and clash of systems*, Hinrich Foundation, June 18, 2019; and The Economist, *Rare Earths: Give China leverage in trade war at a cost*, June 15, 2019.

³⁴ US Geological Survey, *Critical Mineral Resources of the US – Economic and Environmental Geology and Future Supply Prospects*, 2017.

³⁵ US Energy and Environment, *Presidential Executive Order on Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals*, December 20, 2017.

³⁶ Association of Consulting Engineers (Canada), Mining Association of Canada, NWT & Nunavut Chambers of Mines, Prospectors & Developers Association of Canada, and Yukon Chamber of Mines, *Levelling the Playing Field: Supporting Mineral Exploration and Mining in Remote and Northern Canada*, 2015.

Figure 3-1: Mines and Mineral Potential in Yukon



air facilities. It also reflects the absence of more cost competitive rail service. The current rail freight tariff is approximately \$0.10 (CAD)³⁷ per tonne km compared to \$0.33 for trucking^{38 39} in the vicinity of the ACRL corridor and higher in more challenging areas over rough terrain like the mostly gravel Dalton Highway, which provides access to Alaska's north slope.

Mining is also typified by short, sharp peaks of activity followed by long, deep troughs linked to world commodity price fluctuations. The impact of this pattern of extreme price and activity fluctuation is intensified in the Yukon as well as Alaska, where mine projects carry higher costs due to their remote, Northern location, effectively shortening the window of opportunity for economically viable production. The only means to mitigate this susceptibility and improve viability is cost reduction.

Cost Savings and Incentives for Mining Exploration

A 2015 study of actual exploration project costs by mining companies confirmed that these costs are directly linked to distance from infrastructure.⁴⁰ Costs for sites within 50 km of an all-weather road were 41% less than those within 51 to 500 km.

Although the ACRL route is near the Alaska Highway between Tok and Delta Junction, the Robert Campbell Highway between Watson Lake and Carmacks and the Liard Highway for a very short section north of Fort Nelson, it also passes through about 750 km of terrain without road access, which represents more than 40% of the rail corridor. In addition, the Robert Campbell Highway is mostly a gravel road, noted to be narrow and hazardous at times and subject to closure in inclement weather.

While identifying specific sites, timing, expected expenditures and cost savings for exploration would be speculative at best, it is reasonable to conclude that introduction of the ACRL into the corridor would lower exploration costs by at least 41% in those areas more than 50 km from an existing all-weather road, which represents an estimated 12 million hectares. It would also improve access and reliability and lower transport costs for equipment, materials and fuel by at least 30% compared to truck transport as well as provide a possible means of personnel transport to areas in the remaining sections of the corridor now served by lower quality existing roads.

The lack of infrastructure, including an economic means of exporting mineral product from the region served by the ACRL corridor, has resulted in this area being underexplored. Furthermore, the incentive to move from exploration to production is limited without an economic means of transporting mineral products for export. However, with lower cost and improved and more reliable access, exploration in the corridor would become more attractive. More exploration will result in more finds and certainly better

³⁷ Source: Alaska Railroad tariffs converted to CAD at the 2017 rate of \$1.2986 for \$1:00 USD.

³⁸ McDowell Group, *Southcentral Alaska Port Freight and Fuel Analysis, 2016 Update*, 2017. Cost converted to CAD at 2017 exchange rate of \$1.2986 for \$1.00 USD.

³⁹ Note: US information is cited here due to the absence of rail data pertaining to the Yukon.

⁴⁰ Op. cit., *Levelling the Playing Field*.

assessment of the tonnage and grade of resource deposits. This, in turn, would improve the incentive to move forward with mine development.

Cost Savings for Mine Development

Mine development in both the Yukon and Eastern Alaska also involves significant additional expenditures due to their remote and northern location and absence of infrastructure. Incremental capital cost for mine development in these regions was calculated to be double for a gold mine, two and a half times for base metal mines and 15% to 20% higher for a diamond mine.⁴¹ These added costs include provision of power plants, worker accommodation and other related facilities, access roads and, in some cases, air strips to allow fly-in, fly-out commuting by workers and contractors. It can also necessitate additional storage facilities to offset either the inability to export product or receive fuel, spare parts or equipment, when required, due to access unreliability. Higher transportation and logistics costs were found to be the main driver of these incremental capital costs, accounting for over a third to almost half of these costs, followed by power and fuel costs.

Table 3-1: Incremental Capital Cost for Remote and Northern Mines

% incremental cost	Gold	Zinc-Copper	Diamond
Power Plant	6.1%	X	4.9%
Accommodation	14.9%	6.0%	2.1%
Plane Transport	8.1%	2.0%	X
Permanent Road	7.1%	18.0%	X
Winter Road	X	X	1.2%
Transport ¹	X	X	2.6%
Concentrate & Other Storage	X	7.0%	X
Other Infrastructure ²	0.9%	5.0%	3.2%
Sub-Total Infrastructure	37.1%	38.0%	14.0%
Transportation	9.0%	2.0%	X
Contingencies	X	8.0%	X
Other/Not Specified	5.1%	13.0%	X
Total	51.2%	61.0%	14.0%
Northern Factor³	2.05	2.56	1.16

Source: Association of Consulting Engineers (Canada), Mining Association of Canada, NWT & Nunavut Chambers of Mines, Prospectors & Developers Association of Canada, and Yukon Chamber of Mines, *Levelling the Playing Field: Supporting Mineral Exploration and Mining in Remote and Northern Canada*, 2015.

1. For the diamond mine, this reflects transportation and storage plus freight estimate (excess trucking costs during construction).
2. For the gold mine, this includes a swage system and communications. For the zinc-copper mine, this equals additional indirect costs. For the diamond mine, this equals crushing infrastructure and other infrastructure (airport, boilers, water treatment, sewage system).
3. The northern factor is the ration of the capital costs of the remote and northern mine to the capital costs of an equivalent southern mine. It is equal to 100 divided by 100 minus the incremental percentage cost due to its northern/remote location. In the gold mine case, for example, the northern factor of 2.05 is equal to $100/(100-51.2)$.

⁴¹ Ibid.

The ACRL would provide significant savings for the transport of construction equipment, materials and fuel compared to trucking for all but transport between the railway mainline and mine site. This, in turn, would reduce the price of mine construction. In addition, the ACRL could also potentially reduce or shorten access roads that mining companies must construct and maintain.

For example, the current capital cost for constructing and maintaining a two-lane gravel access road is approximately \$1.4 million per km and \$25,200 per km per year respectively. If an access road was shortened by 50 km, this would result in a capital cost saving of \$70 million and an annual maintenance saving of \$1.26 million or \$37.8 million in current dollars over 30 years.

The availability of regular and reliable rail service also opens the possibility of workers being able to commute to mine sites from existing communities rather than require costly camp installations. It might also remove the need for air facilities at a mine, if the rail service enabled access to existing airports at communities served by the railway.

A further consideration is that the rail line has a smaller footprint than access roads and, because access is controlled, it avoids unauthorized entry and reduces environmental impacts to undeveloped areas. These advantages could factor positively in the environmental and social license approval processes for new mines that could translate into time savings and lower costs to achieve these approvals.

Cost Savings for Mine Operations

As stated earlier, operating costs for remote and northern mines have been found to be 30% to 60% higher than mines in more accessible regions. As in mine development, higher transportation and logistics costs are the main drivers of these incremental operating costs, followed by power and fuel costs. As illustrated below, transportation and logistics are the largest contributors to incremental operating costs for remote and Northern mines. The largest demand for transportation is for the export of metallic mineral concentrates or ore products followed by import of equipment, materials and supplies and transport of personnel to and from the mine site.

Table 3-2: Incremental Operating Cost for Remote and Northern Mines

% Incremental costs	Gold	Zinc-Copper	Diamond
Logistics & Transport ¹	13.8%	10..1	13.4%
Power/Fuel	8.8%	X	7.9%
Additional Wage Bill	2.9%	X	6.1%
General & Administration	3.6%	6.4%	X
Maintenance/Mining Operations	3.4%	6.4%	X
Other/Unspecified ²	4.6%	X	4.0%
Total Incremental Cost	37.1%	16.9%	31.4%
Northern Factor	1.59	1.30[#]	1.46

Source: Association of Consulting Engineers (Canada), Mining Association of Canada, NWT & Nunavut Chambers of Mines, Prospectors & Developers Association of Canada, and Yukon Chamber of Mines, *Levelling the Playing Field: Supporting Mineral Exploration and Mining in Remote and Northern Canada*, 2015.

1. For the zinc-copper mine, this includes flight operations, road maintenance, shipping and trucking. For the diamond mine, this includes personnel transport and logistics and transportation.
2. For the gold mine, this includes environmental, procurement, and IT expenses. For the diamond mine, this includes subsistence supplies, municipal services and Aboriginal community relations.
3. The estimates for eh zinc-copper mine is based upon a feasibility study, whereas data from the diamond and gold mines are based on actual expenditures.

Potential Mineral Export Freight on ACRL

Two approaches were used to estimate the potential mineral export freight from mines in the ACRL corridor as follows:

Priority Deposits or “Bottom Up” Approach⁴² – This approach was based on selecting a priority list of proposed mine projects in the corridor from the Yukon and BC mineral inventories. The selection criteria used was that they be near development with bulk shippable commodities (i.e., not precious metal mines) that had more than 40 million tonnes of mineral reserve. The resulting priority list consisted of 13 deposits in the Yukon. These sites are the most advanced in their development and were considered the most likely to come into operation early in the life cycle of the railway (i.e., 30 years). To put this limited selection in context, 136 metallic mineral deposits were subject to exploration in the Yukon in 2017, of which 112 were gold properties and 37 were other hard mineral deposits.⁴³

The likelihood for development of the 13 priority projects was then assessed based on 2017 mineral commodity price forecasts for three scenarios (i.e., optimistic, median and pessimistic) and current estimates of mine operating costs⁴⁴ derived either from published feasibility studies or mining engineering cost guidelines⁴⁵. The three metal price forecast scenarios were based on a simple regression analysis of

⁴² Ibx Valley Environmental Consulting & Morrison Hershfield, Alaska-Canada Railway Feasibility Study Phase 2: Data Development for Mineral Resources, 2017 Update.

⁴³ Yukon Energy, Mines & Resources, *Yukon Exploration and Geology 2017*, 2018.

⁴⁴ These include mining, milling and general and administration costs but exclude export transportation, smelting or recovery of capital costs.

⁴⁵ The mining industry engineering rule-of-thumb used was net ore value > 2 x mine operating cost to cover transportation, recuperation of capital and profits.

historic data projected over 30 years, with one standard deviation above and below determining the optimistic and pessimistic scenarios.

Based on the above, an estimate of annual shippable mineral commodities under various metal price scenarios was developed. However, this estimate should be considered short-term and conservative because transport costs to market were excluded as were potential capital and operating cost savings resulting from ACRL development, which would improve the economic viability of these projects at lower commodity price levels. Also, the assessment only includes mineral deposits that are well-advanced, with known quantities of minerals and with long-term economic viability. It excludes:

- potential bulk shippable commodities from Alaska;
- smaller, marginal deposits that may come into production during high metal price cycles but may be short lived, even though collectively, they could provide a significant source of freight over time to the railway;
- less developed deposits as well as new and unknown deposits that may be found over the life cycle of the railway;
- potential freight from very large mineral occurrences outside the corridor that could support the development cost of longer supply infrastructure, such as the Crest Iron Ore deposit in the Central Yukon for which the estimated output is 12 billion tonnes⁴⁶; and,
- coal exports given low current and projected price.

Long Term Probabilistic or “Top Down” Approach⁴⁷ – The second approach broadened the mineral export potential analysis by examining the probability of development of the over 1,700 known metallic mineral deposits plus larger potential for industrial and coal deposits in the Yukon and Northern BC within 80 km (50 miles) on either side of the ACRL route.⁴⁸ It should be noted that another 590 known deposits are located on the US section of the rail link corridor but were not included in the analysis to maintain comparability with the priority deposit approach.

The probabilistic model was based on past surveys of major mineral exploration firms by various Canadian federal and provincial agencies collecting and disseminating mineral industry data. The model was run with tonnage and grade curves for the known metallic mineral occurrences in the corridors at the 10th, 50th, and 90th percentiles of the worldwide occurrences.⁴⁹ The model considered metal prices, assumed

⁴⁶ Operating at 100 million tonnes per year, Crest could provide this rail freight load for 120 years.

⁴⁷ Dr. Paul Metz, University of Alaska Fairbanks, *Mineral Freight Forecasts for the Alberta to Alaska Rail Link Project*, June 2014.

⁴⁸ These deposits are principally located between the US-Canada border and Watson Lake.

⁴⁹ D.P. Cox and D.A. Singer, *Mineral Deposit Models: U.S. Geol. Survey Bull. #1693*, 1986.

mining and mineral processing methods and estimated quantitative deposits associated with grade and tonnage⁵⁰, to determine an estimate of in-place gross metal value and tonnage of mineral concentrates and potential metallic mineral freight volumes that could be carried by the ACRL. Only metallic mineral occurrences with validated mineral deposits were included in the analysis. As a result, the estimate, although presenting a longer-term perspective, is also conservative as it does not include:

- potential bulk shippable commodities from Alaska;
- mineral prospects that are in the early stage of exploration and evaluation;
- potential for additional mineral development resulting from new exploration activities that are likely to occur after the rail line is operational;
- potential freight from very large mineral occurrences outside the corridor that could support the development cost of longer supply infrastructure, such as the Crest Iron Ore deposit in the Central Yukon for which the estimated output is 12 billion tonnes⁵¹; and,
- the shipment of low-grade bog iron deposits from northwestern Alberta.

Estimates of Annual Potential Mineral Freight Volumes

The assessment of the 13 priority deposits (Approach 1) resulted in a short-term estimate of potential average annual mineral exports ranging from a low of 1.6 million tonnes to a high of 3.0 million tonnes from the Yukon only. The gross value of these mineral exports based on 2017 average commodity prices conservatively ranges from \$9 billion to \$16.5 billion per year. Potential average annual net revenue to the ACRL for transporting these minerals for export is estimated to be approximately \$43 million to \$81 million⁵² per year depending on the tonnage achieved.

The probabilistic model (Approach 2), on the other hand, predicts that, if the railway was present, all metallic mines at the upper 90th percentile in tonnage and grade in the rail corridor would be developed over the next 30 years. The estimated in-place gross metal value of these mines is \$373 to \$732 billion,⁵³ which is equivalent to one to two large copper porphyry mines. The expected outbound freight from these mines is 269 million tonnes⁵⁴ of metallic mineral concentrate over 30 years or an average of 9 million tonnes per

⁵⁰ Dr. Paul Metz, and Colin Dixon, *Mineral, coal, and aggregate resource appraisal of Alaska Mental Health Trust Lands: Metz, DeLong, and Associates, Fairbanks, Alaska, 153 p., Appendices; prepared for the Alaska Supreme Court in Weiss vs State of Alaska, 1988; and, Cox, D.P., and Singer, D.A., Mineral Deposit Models: U.S. Geol. Survey Bull. #1693, 1986.*

⁵¹ Operating at 100 million tonnes per year, Crest could provide this rail freight load for 120 years.

⁵² Estimate reflects Railway Association of Canada's reported 2017 average freight revenue of \$0.0315 per tonne kilometer times 817.5 kilometers, which represents half the distance

⁵³ \$336 - \$659 billion 2014 USD converted to CAD at the 2017 rate of \$1.2986 per \$1.00 USD.

⁵⁴ 296 million US short tons.

year. The potential average annual revenue or net cash flow to the ACRL would be \$247 million from Canadian mineral exports alone.

By lowering transportation cost for mineral concentrate exports as well as mine transportation capital and maintenance costs and imports of energy and other materials that are inputs to mine production, the railway is also expected to increase the economic viability of metallic mineral deposits in the 50th to 90th percentile range in terms of tonnage and grade. While these mines will be smaller, they are also likely to be more numerous and possibly closer to existing remote communities, where unemployment is high and cash income and expenditures are scarce. In addition, marginal production in less valuable sections of existing and expected metallic mines in the upper 90th percentile in future could become more profitable to develop thus extending mine life. This in turn would generate additional mineral freight traffic and revenue for the railway.

Potential Industrial Mineral and Coal Export Freight on ACRL

Globally, metallic minerals only constitute 25% of total mineral resource value produced annually. Industrial minerals (non-metallic minerals) and coal account for 75% (petroleum and natural gas excluded). The latter are generally low unit value commodities that must be transported on rail or on water.

Experience shows that as mines and communities develop along the rail corridor, demand for energy and industrial minerals locally will increase. Based on the gross metal value of metallic minerals, non-metallic minerals and coal generally results in four times the tonnage of metallic mineral tonnages. Applying this precedent to the probabilistic model's estimate, the estimated freight tonnage of industrial minerals and coal exports is 1.1 billion tonnes over 30 years or 36 million tonnes annually. If realized, this could result in \$988 million in annual revenue for the ACRL from Canada alone.

As previously cited, the priority deposits assessment (Approach 1) purposely excluded coal due to its low current and projected prices as well as industrial minerals in its analysis.

Potential Fuel and Other Supply Material Freight Imports on ACRL

Mines also require a large quantities inbound freight of fuel and other materials used in construction, mining, mineral processing, tailings disposal and personal support. A survey of Alaskan metallic mineral mines revealed that they annually require between 36,000 and 55,000 tonnes of inbound freight (excluding fuel).⁵⁵ However, the Donlin Gold project, which is a large-scale surface mine, is projected to require 95,250 tonnes of general cargo per year to sustain operations and approximately 450,000 to 550,000 tonnes of material

⁵⁵ McDowell Group, *Port McKenzie Rail Freight Market Analysis*, January 2017.

and equipment during mine development.⁵⁶

Based on the priority deposits assessment (Approach 1) and the 2017 average volumes cited above, this would represent another 252,000 to 715,000 tonnes of material per year to the Yukon during their operation. The potential revenue contribution that the inbound freight would add to the ACRL would range from \$6.9 million per year to \$19.6 million per year (excluding fuel) from metallic mineral mines. As one of the priority deposit mines (the Casino mine) is more comparable to the Donlin project, this estimate is likely low.

Fuel transport is another major factor for many mines and would result in additional rail tonnage and revenues. For example, the proposed Casino mine 200 km northwest of Carmacks estimates annual imports of 33.0 million litres of liquid natural gas (LNG) and 26.0 million litres of diesel fuel during construction and 360.0 million of LNG and 32.0 million litres of diesel fuel during operations.⁵⁷ Casino also estimates importing over 6,000 tonnes of equipment during construction and another 11,000 tonnes over the first seven years of operation. Imports of materials and general cargo would be over and above these figures.

As the probabilistic approach (Approach 2) estimates the volume of tonnage and not the number of mining operations, the estimating method used for Approach 1 cannot be applied. Assuming a correlation exists between the volume of inbound freight required to generate outbound freight, the estimate of inbound freight derived in Approach 1 suggests that inbound freight is 16% to 24% of outbound tonnage.

Based on the probabilistic assessment (Approach 2) and the above percentages, metallic mineral mines could generate 1.4 million to 2.2 million tonnes of inbound freight per year, annually generating conservatively between \$39.5 million to \$59.3 million in net revenue for the ACRL. Adding the potential for industrial minerals and coal mine import requirements could increase this volume by 5.8 to 8.6 million tonnes per year contributing another \$159 million to \$236 million in net revenue to the ACRL.

However, the above estimates of inbound freight only reflect materials and supplies once the projected mines are in operation. It excludes fuel as well as imported equipment, construction materials and supplies that would be required during exploration and construction of mines within the corridor that would also benefit from lower cost rail transport.

Other Mining Related Benefits from the ACRL

Construction of the ACRL also offers a means to reduce the cost of remediation of the Faro lead-zinc mine. Once the world's largest lead-zinc mine, it has been inactive since 1982, a victim of falling world prices for lead-zinc and the high cost of transportation for the mine's exports and imports. When closed, the mine left

⁵⁶ Ibid.

⁵⁷ Casino Copper and Gold, *Proposal for Executive Committee Review: Pursuant to Yukon Environmental and Socio-Economic Assessment Act*, January 3, 2014.

a legacy of 70 million tonnes of tailings and 320 million tonnes of waste rock, which require disposal. Responsibility for clean-up fell to the Yukon and Government of Canada upon bankruptcy of the mine's owners in 1998 and is estimated will cost over \$1 billion dollars. Maintaining the mine for safety reasons also costs the federal government approximately \$40 million annually.

The presence of the ACRL would both facilitate and offer a cheaper means of delivering equipment and supplies for this clean-up and remediation of waste rock and other materials. It could also make development and extraction of residual resource at Faro economically viable, which in turn could help offset the costs of both interim maintenance and remediation.

A further benefit of the ACRL is enabling the extraction of strategic and critical minerals and rare earths, on which advanced technology and manufacturing depend. It will also very likely assist in discovery of yet unknown deposits of these elements given the geological providence of the region and large areas that have been inaccessible for economic exploration. This is important because the US, once self-reliant in rare earth metal production, now sources 90% of its requirements from China, which dominates this global market.⁵⁸ This raises both economic and national security concerns about adequate, stable and reliable supply of these important elements particularly in light of the current US/China trade dispute. It is therefore not surprising that the US federal government responding to the US Presidential Executive Order 13817 have embarked on developing a strategy to address the critical and strategic mineral supply problem⁵⁹.

For Canada, extraction and processing of rare earth minerals offers a tremendous opportunity as it not only has some of the world's largest rare earth deposits but also expertise in processing them. The Canadian government is also in the process of developing a national minerals and metals plan⁶⁰, which includes addressing the infrastructure gap which hampers mining in remote areas, including the Yukon. The known presence of at least half of the 35 critical minerals designated by the US Geological Survey in the ACRL rail corridor means that the ACRL supports the Canadian federal policy objective regarding mineral development and will also make a crucial contribution to the US's policy objectives set out in the Presidential Executive order referenced above.

Conclusions

The ACRL represents a game changing infrastructure investment for mining in the Yukon, Northern BC and Eastern Alaska. The rail line would reduce costs in exploration, development, operations and exports thus stimulating new mining investment and development. It would also both improve and extend the economic viability of existing and new mines in the region. The Yukon, Northern BC and Eastern Interior Alaska would all enjoy economic spin off benefits from these investments and heightened mining activity in terms of

⁵⁸ The Canadian Business Journal, *Canada's Rare Earth Deposits Can Offer A Substantial Competitive Advantage*, April 2012.

⁵⁹ Lesley, Shane, *Critical Minerals Order*, North of 60° Mining News, January 26, 2018.

⁶⁰ Natural Resources Canada, *The Canadian Minerals and Metals Plan*, Mines Canada, website, 2018.

higher royalty income, taxes as well as population and employment growth to be discussed later in this report.

This activity would generate significant tonnage of minerals for export as well as imports of fuel, materials and supplies and equipment over all three phases of mining activity. Net revenue generated for the ACRL from estimated metallic mineral exports alone from the Yukon could conservatively amount to \$43 million to \$247 million per year, which would represent a net present value of between \$700 million to \$3.8 billion over 30 years.⁶¹ Industrial minerals and coal exports⁶² could add \$988 million per year in net revenue, which would amount to \$15.2 billion over 30 years.

Table 3-3: Estimated Range of NPV of ACRL Operations Net Revenues Over 30 Years (\$Billion)

	Approach 1 – Short Term Perspective	Approach 2 – Long Term Perspective
Yukon Mine Operation – Exports		
Metallic Minerals	\$0.7 - \$1.2	\$3.8
Industrial Minerals & Coal	N/A	\$15.2
Yukon Mine Operation – Imports ^a		
Metallic Minerals	\$0.1 - \$0.3	\$0.6-\$0.9
Industrial Minerals & Coal	N/A	\$2.4-\$3.6
TOTAL	\$0.8-\$1.5	\$22.0-\$23.5

a. Excludes fuel imports

Imports of materials and supplies (excluding fuel) for mineral mines mine operations are estimated to add \$6.9 million to \$59.3 million per year to ACRL revenues, which would have a net present value of \$600 million to \$900 million over 30 years. Industrial minerals and coal could add another \$160 million to \$235 million in import annual revenues, which would have a net present value over 30 years of \$2.4 billion to \$3.6 billion.

Based on the above, estimated net revenue derived from Yukon mining operation exports and imports, which excludes fuel, exploration and mine development freight, over 30 years are more than enough to cover the capital cost of the ACRL construction.

The ACRL represents the embodiment of the Canadian government’s *Northern Corridor Initiative* aimed at stimulating economic development in the North by redressing its infrastructure deficit and lack of tidewater access. The proposed railway could also reduce the Canadian government’s cost of remediation for the Faro Mine by making importation of equipment and materials and remediation of waste rock more economical. As well, it could possibly enable additional extraction of resources from the now defunct mine, which would help defray the current mine maintenance costs and offset some of the remediation costs. In addition, by improving the economic viability and increasing mining activity in this region richly endowed with critical and strategic earth minerals, the ACRL would inevitably result in the extraction of more of these resources, which is a policy priority for the US and would be of major benefit to Canada.

⁶¹ Interest of 5% assumed.

⁶² This exclude the remote but very large Crest deposit. See Section 5 of this report.

4 | BENEFITS TO COMMUNITIES AND RESIDENTS

In 2017, the Yukon had a population of 38,630 people, an increase of 2% from 2016, continuing a pattern of slow growth that has spanned 13 consecutive years.⁶³ More than three-quarters of all residents (78%) live in Whitehorse. Dawson City and Watson Lake accommodate another 2,220 (5.7%) and 1,441 (3.7%) residents respectively with the remaining population spread across 14 other communities with populations of less than 1,000 people and rural areas. The Territory's labour force numbered 21,825 in 2017 of which 96.4% were employed and 3.6% were unemployed. This low rate of unemployment is effectively considered to reflect full employment, as those without jobs are deemed either to be in the process of changing jobs or having skills that mismatch the job market necessitating a shift in employment.

The service sector provides the vast majority (17,800 or 86.4%) of jobs in the Yukon, with public administration followed by health and social assistance being the largest employers (7,100 jobs in 2017). The goods producing sector, which is predominated by construction and mining, supported the remaining 13.6% or 2,800 jobs in the Territory but contributed a disproportionately larger share to the Territory's GDP (23.3% in 2017).

Northeast BC had a population of 69,452 people in 2017,⁶⁴ up slightly from 2016 (0.2%) after two years of no growth or population loss, reflecting the region's resource industry reliance and an outflow of workers seeking job opportunities elsewhere. The southern portion of this region (Peace River Regional District) houses 92.4% of its population and contains its largest communities, Fort St John, the centre of shale oil and gas production, and Dawson Creek with 20,363 and 11,840 residents respectively.⁶⁵ The northern portion (Northern Rockies Regional Municipality), in which the ACRL would be located, had a 2017 population of 5,282 people of which approximately 3,340 (63.2%) resided in Fort Nelson.

Northeast BC's labour force shrank by 2,300 workers to 41,000 in 2017⁶⁶ in response to job losses but unemployment also went down slightly (3.8 percentage points to 5.9%) due to both a smaller labour force and a reduction in the work force participation rate. Like the Yukon, the service sector commands the largest share of the job market with 26,000 jobs (67.5%) in 2017;⁶⁷ the largest employers being trade and health and social assistance (9,500 jobs). Goods producing industries made up the remaining 32.5% or

⁶³ Yukon Bureau of Statistics, *Population Report Fourth Quarter 2017*, April 2018.

⁶⁴ Statistics Canada, *Estimates of Population by Economic Region, Sex and Age Group for July 1, Based on the Standard Geographical Classification 2011*, Annual, CANSIM Table 051-0059.

⁶⁵ BC Statistics, *BC Development Region and Municipal Population Estimates*, January 2018.

⁶⁶ Statistics Canada, *Labour Force Survey estimates (LFS), by provinces, territories and economic regions based on 2011 Census boundaries*, Annual, CANSIM Table 282-0123.

⁶⁷ Statistics Canada, *Labour Force Survey Estimates (LFS), Employment by Economic Region based on 2011 Census Boundaries and North American Industry Classification System (NAICS)*, Annual, CANSIM Table 282-0125. Last modified: 2018-01-05.

12,500 jobs of which half (6,300 jobs) were in construction and another 27.2% in forestry, mining, oil and gas.

However, considerable disparity exists between the north and south portions of Northeast BC. The Northern Rockies Regional Municipality has seen steady population decline over the last decade with the population of Fort Nelson falling from 4,514 in 2006 to 3,340 in 2017.⁶⁸ Employment opportunities are also fewer. In addition, greater distance to markets and the type of shale formations in the northern section have made gas extraction less competitive than in the southern portion of the region and have resulted in drastic employment decreases in recent years. Thus, unemployment in the Northern Rockies Regional District and Fort Nelson are higher than in the southern Peace River section (13.7% in 2016 versus 9.7% in the region as a whole).

Eastern Interior Alaska, for this study, has been deemed to include Southeast Fairbanks Census Area, which encompasses the 160-kilometre (100 mile) wide ACRL corridor, and Fairbanks North Star Borough, which is directly connected to it. In 2017, the population of the Southeast Fairbanks Census Area was 6,973 and that of Fairbanks North Star 97,738.⁶⁹ In total, the region's population of 104,711 is only slightly less than the combined populations of Yukon and Northeast BC but more than double that of the Yukon and Rockies Mountain Regional District. The City of Fairbanks, with a population of 35,535, is the largest community within this region. The population of Eastern Interior Alaska has declined slightly over the last five years (-3%).

The labour force in the Southeast Fairbanks Census Area and Fairbanks North Star Borough respectively averaged 2,969 and 46,708 in 2017.⁷⁰ The annual average unemployment rate in each of these areas was 10.4% and 6.3%. As in the two other jurisdictions, service producing industries provide the bulk of employment (88.6%).⁷¹ One-third of all service sector jobs are with the federal, state and local government, making public administration the largest employer. Trade and health and social assistance follow collectively making up another third of all service sector jobs. The goods producing sector comprises the remaining 11.4% of all jobs. Construction and mining, quarrying, oil and gas extraction make up over two-thirds of goods sector employment.

⁶⁸ Northern Rockies Children and Family Action Committee, *Fort Nelson State of the Community Report: A Discussion on Socio-economic Conditions and Resources in 2017*.

⁶⁹ State of Alaska, *2017 Population Estimates by Borough, Census Area and Economic Development*, Department of Labor and Workforce Development, Research and Analysis Section, 2018.

⁷⁰ State of Alaska, *2017 Not Seasonally Adjusted Labor Force Data*, Department of Labor and Workforce Development, Research and Analysis Section, June 2018.

⁷¹ State of Alaska, Department of Labor and Workforce Development, Research and Analysis Section, *2017 Labour Statistics*, 2018. Note: For comparability with Canadian reporting, government employment was added to service industry employment even though the State of Alaska reports this separately.

Employment Opportunities and Population Growth

The socio-economic profile of the three regions in the ACRL corridor reveals their dependence on resource extraction and the associated vulnerability of much of this area to employment and population loss. The introduction of the ACRL would fundamentally change access to and from these areas as well as stimulate their economies. By opening new markets for resource products and lowering the cost of production, exports and imports for resource industries, including mining as well as oil and gas and forestry, new job creation will inevitably follow absorbing excessive unemployment and attracting both returning and new residents to these areas.

Potential Employment Growth in Mining

New employment in mining will result from expanded exploration as well as the construction and operation of new mines in the Yukon and Eastern Interior Alaska. Over the past decade, exploration and deposit appraisal expenditures for base and precious metals in the Yukon alone have averaged \$153 million per year,⁷² fluctuating from a low of \$90.4 million in 2016 to a high of \$306.6 million in 2010. Exploration activity and expenditures typically increase and diminish with world commodity prices. Lower prices compounded by the higher cost of exploration due to the remoteness and inaccessibility of much of the terrain⁷³ make it more difficult for mining companies to raise capital to finance exploration. This is particularly true for junior companies, which undertake much of the Yukon's exploration work.

By improving access and lowering the cost of exploration, the ACRL will both open new areas for exploration and reduce capital requirements, thus stimulating more activity and investment. Unfortunately, it is not possible to estimate the precise timing nor stimulus that would result. However, if average annual expenditures were to double (\$307 million) replicating the 10-year high, the effect would be to annually add 500 new direct jobs (FTE's) in Yukon mining, representing a 63% increase in this sector. In total, approximately 900 new direct, indirect and induced jobs would be created in the Yukon and another 500 jobs elsewhere in Canada.⁷⁴

Employment resulting from new mine development and operation are equally difficult to predict and quantify. However, six proposed mine projects out of approximately 100 potential projects in the Yukon have been drawn on to illustrate a portion of the potential effect of stimulating this construction and operation. The projects selected have completed preliminary economic assessment, including capital and operating cost estimates and, in some cases, include projected employment numbers, but have yet to be constructed largely because of financial concerns. Given the advanced stage of these proposals, it is

⁷² Natural Resources Canada, *Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures*, July 2018.

⁷³ Refer to Section 2 of this report.

⁷⁴ Estimate is based on Statistics Canada, *Provincial Input-Output Multipliers*, 2014.

reasonable to conclude they would be the first to seek to benefit from implementation of the ACRL and resulting cost savings and move forward.

Each project has been estimated separately and, while every attempt was made in this review to make the cost projections comparable, the level of detail in cost breakdown was not necessarily consistent. For example, some may indicate that pre-construction activities, such as design and engineering or feasibility studies were excluded, others do not. Also, estimates include different percentages for contingency due to different levels of certainty and none include cost escalation or other factors that may influence costs both positively and negatively. In addition, the cost estimates do not reflect the existence of the ACRL and cost savings it would create. As a result, the following assessment should be considered indicative rather than predictive.

The total estimated capital expenditures for construction of these six projects is approximately \$7.1 billion (\$2017). Construction of each is anticipated to take from two to four years. In total, construction of these projects would generate over 12,125 direct and 33,600 direct, indirect and induced person-years of employment in the Yukon, with an additional 25,400 direct, indirect and induced person-years of employment in the rest of Canada.⁷⁵

Assuming no overlap in mine construction would mean the annual creation of approximately 725 person-years of direct employment in construction and 1,275 person-years of indirect and induced service sector employment over 18 years in the Yukon. Staffing requirements for mine construction alone would increase the number of existing jobs in the Yukon’s construction sector by 35% based on this assumption, while the overall job market would increase by 7%.

At the opposite extreme, if all six mines were constructed simultaneously, 4,040 person-years of direct employment in construction would be created over two to four years plus another 7,165 person-years of indirect and induced employment in supply and service industries in the Yukon. If this were the case, the increase in construction employment would almost triple and service sector employment would increase by 40% over this period.

Table 4-1: Indication of Construction Annual Employment (Person-Years) based on Six Mines

Annual Employment (numbers are rounded)	Yukon		Elsewhere in Canada	TOTAL
	Direct Person-Years	Indirect & Induced Person-Years	Direct, Indirect & Induced Person-Years	Direct, Indirect & Induced Person- Years
Simultaneous construction - 3 Yrs	4,040	7,165	8,170	19,400
No overlap - 18 Yrs ^a	725	1,275	1,400	3,400

a. Assumes average three years duration and no overlap in construction of six mines.

⁷⁵ Ibid. Note: all numbers are rounded.

Realistically, neither extreme is likely to occur. Rather the number of jobs created will vary by project and there may be overlaps as well as gaps between project construction. For this discussion, 2,020 person-years of direct construction sector employment has been assumed annually over approximately six years plus another 3,580 service sector jobs over this period. This would represent a 96% increase in construction sector jobs and a 20% increase in service sector employment over the six-year period.

Total annual operating expenditures for the six mines are estimated to range from \$79 million to \$465 million (\$2017) over ten to twenty-five years depending on the mine. If, or more likely when, all six mines operate simultaneously, this would result in total annual operating expenditures of \$1.3 billion (\$2017) over ten years and then lesser amounts as some mines reach their operating life limit.

Mine operations would annually add 2,000 person-years of direct employment in mining and 1,540 indirect and induced person-years of employment in service and supply industries in the Yukon over this decade. Mining sector jobs would increase by two and a half times their current level and jobs in service and supply industries would grow by 8.4%. The six mine operating expenditures would also support another 3,300 direct, indirect and induced person-years of employment annually in the rest of Canada over a decade. Most importantly, because of proactive local and First Nations hiring and contracting practices by mining companies, mining jobs created would open opportunities to small community and First Nations residents.

Table 4-2: Indication of Annual Operation Employment (Person-Years) based on Six Mines

Annual Employment (numbers are rounded)	Yukon		Elsewhere in Canada	TOTAL
	Direct Person- Years Employment/ Yr	Indirect & Induced Employment /Yr	Direct, Indirect & Induced Employment/Yr	Direct, Indirect & Induced Employment/Yr
Simultaneous Operation	2,000	1,540	3,300	6,880

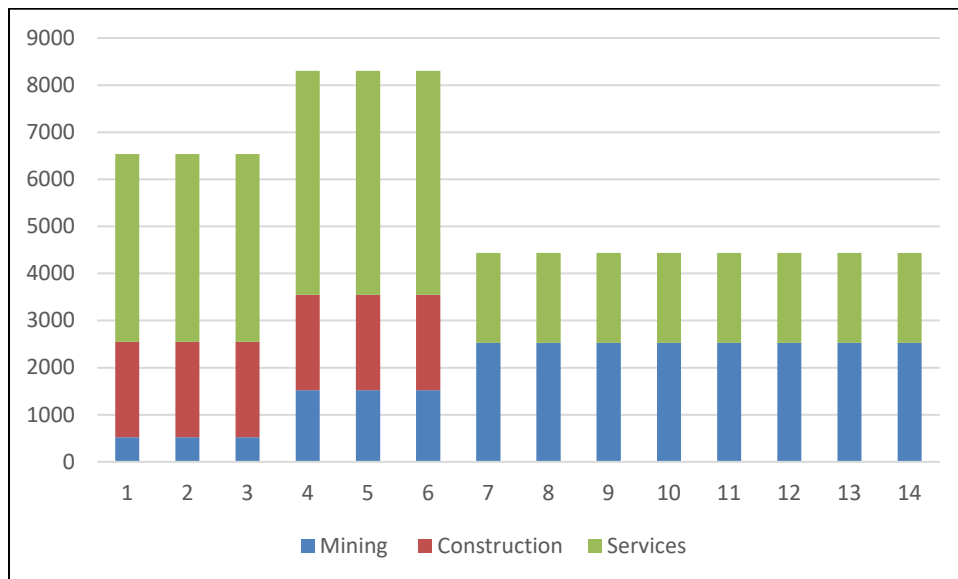
In addition to operating expenditures, the six mines collectively project spending another \$2.7 billion (\$2017) over their operating life for equipment replacements, infrastructure upgrades and, in some cases, mine expansion that will also generate construction, contracting, supplier and service employment. These expenditures will support 4,500 direct person-years of employment and 12,500 person-years of direct, indirect and induced employment in the Yukon alone over ten to twenty-five years. In addition, another 9,500 person-years of employment will be created elsewhere in Canada.

Table 4-3: Indication of Total Employment (Person-Years) from Sustaining Capital Expenditures based on Six Mines

	Yukon		Elsewhere in Canada	TOTAL
Employment (numbers are rounded)	Direct Person-Years Employment	Indirect & Induced Employment	Direct, Indirect & Induced Employment	Direct, Indirect & Induced Employment
	4,500	8,000	9,500	22,000

Based on the above, Figure 4-1 illustrates potential employment growth resulting from expanded mining exploration and new mine construction and operation by industrial sector in the Yukon over 14 years.⁷⁶ Further employment will result from sustaining capital expenditures as indicated above in Table 4-3 but has not been included in the Figure 4-1 below. As stated earlier in this section, the employment estimates depicted are illustrative only to provide a sense of the magnitude the ACRL’s potential impact on the Yukon and Canadian economies. Actual job growth resulting from the ACRL’s existence will fluctuate depending on when various mines are constructed and come into operation. As noted earlier, this illustration also only covers six of the approximately 100 known potential mine proposals and excludes mines that are currently on care and maintenance awaiting improved economic conditions (e.g., Minto and Wolverine mines).

Figure 4-1: Indication of Total Yukon Employment (Person-Years) by Industry Sector based on Six Mines



⁷⁶ 14 years was selected as two of the six mines have reported this as the limit of their expected production. However, if these mines opened in year 7, job levels indicated would extend at least to year 17.

Potential Employment Growth in Forestry

The Yukon has an annual allowable cut (AAC) of 342,000 cubic metres (m³) of trees,⁷⁷ However, only 15,745 m³ were harvested in 2017⁷⁸ and harvesting has been in decline since 2013. The forest industry in the Yukon is small as much of the Territory's land is above the tree line.⁷⁹ There are 70 commercial forestry operators in the Yukon, most of whom harvest fuelwood for domestic heating.⁸⁰ In addition, there are two operating mills that produce rough lumber for the local market. The Yukon government supports forest industry expansion to diversify the economy, but the industry faces significant challenges.

A 2005 report⁸¹ for the Watson Lake Chamber of Commerce on the opportunities and challenges to develop forest industry products concluded that amongst its difficulties was the insufficient size of the local market to support large commercial producers. This combined with the distance to other markets and the absence of rail transport for the export of products places the Yukon at a competitive disadvantage and limits its market to local demand.

The Fort Nelson Timber Supply Area in Northeast BC has 1.6 million m³ of undercut timber reserve plus an AAC of 1,625,000 m³ per year.⁸² Harvesting has declined from 750,042 m³ in 2007 to 151 m³ in 2017. This decline reflects the withdrawal of the major forestry licensee and operator, Canfor, from the region, which closed two mills in Fort Nelson in 2008 due to poor market and prices. However, efforts have recently been initiated by the Northern Rockies Regional District in partnership with the Fort Nelson First Nation to revitalize the industry.⁸³

Eastern Interior Alaska encompasses the Tanana State Forest and Valley, a major timber supply region. Within the Tanana Valley, the Delta and Tok Forest Management Areas, which include the ACRL corridor, respectively contain 18.1 and 8.6 billion net m³ of timber. The AAC for each of these areas is 87,636 m³ and 205,730 m³.⁸⁴ It is estimated that approximately 44,500 tonnes of logs and 399,200 tonnes of wood chips could be produced annually from these areas.⁸⁵ There are four timber processing facilities in the

⁷⁷ Yukon Energy, Mines and Resources, *Annual Allowable Cut/ Annual Limit*, website, last updated January 30, 2011.

⁷⁸ Yukon Finance, *Yukon Statistics Review 2017*, July 2018.

⁷⁹ Government of Canada, *Sectoral Profile: Forestry and Logging – Western Canada and the Territories – 2015-2017*.

⁸⁰ Yukon Government, *Yukon Water – Industry and Natural Resource Sectors*, February 2016.

⁸¹ Price Waterhouse Copper, *Economic Assessment of Forest Industry in Southwest Yukon*, August 2005.

⁸² BC Forests, Lands and Natural Resources, *Fort Nelson Timber Supply Area: Timber Supply Analysis Discussion Paper*, July 11, 2018.

⁸³ Northern Rockies Regional District, *Support a Locally Operated Forest Industry*, website, 2018.

⁸⁴ Marcille, Berg, Morgan and Christensen, *Alaska's Forest Products Industry and Timber Harvest, Part 1: Timber Harvest, Products and Flows*, University of Montana, 2017.

⁸⁵ McDowell Group, *Port MacKenzie Rail Freight Potential Analysis*, 2017.

Southeast Fairbanks Census area,⁸⁶ including two sawmills, a fuel pellet manufacturer and log home manufacturer.

Timber harvesting in Alaska has been in decline since 1990. Between 2005 and 2015, harvest levels dropped from 49.7 m³ to 25.3 m³ per year.⁸⁷ Log exports have been the main driver of harvesting activity, representing 75% of the total timber harvest in 2015.⁸⁸ However, truck transport of logs and wood chips as opposed to rail is only economic within 160 km of a port⁸⁹ and the distance from Tok to the Alaska Railroad terminus at Delta Junction exceeds this distance.

The ACRL will address the competitive disadvantage of all three jurisdictions' wood processors by opening new markets and lowering the cost of export for their products. However, timber supply will continue to be challenging given the harvesting terrain and its lack of access. Nevertheless, the ACRL should encourage wood processors to explore these new markets and either increase or shift their businesses to more profitable product lines, which would result in job creation.

Potential Employment Growth in Oil & Gas

Both the Yukon and Northeast BC have significant oil and gas potential. In 2016, the Yukon had on shore conventional known gas reserves of approximately 15 trillion cubic feet (tcf) and oil reserves of 663 million barrels (mbls), of which five tcf of gas and 17.6 mbls are within the ACRL corridor.⁹⁰ Much of these known reserves (4.5 tcf of gas and 0.1 mbls of oil) are in the Liard Basin, which extends from Northeast BC into the Yukon and Northwest Territories. In addition, the Yukon had another 8 tcf of unconventional gas (i.e., shale extracted), all within the Liard Basin, which the ACRL traverses.

However, oil and gas activity in the Yukon is presently restricted to exploration work with 15 active permits in place all in the Eagle Plain Basin in the northern part of the Territory. The Yukon's sole oil processing plant, the Kotaneelee in the Liard Basin north of Fort Nelson, ceased operation in 2012 and, upon insolvency of its owner, has since been acquired by the Yukon government.⁹¹ The Yukon currently imports 63.5% of its energy requirements⁹² and is focused on development of renewable energy sources.⁹³

Oil and gas activity in Northeast BC are more extensive. The region contains 3,337 tcf of gas reserves, of which 1,363 tcf of gas are in the Liard, Horn and Cordova Basins north of Fort Nelson.⁹⁴ However, due to

⁸⁶ Marcille, Berg, Morgan and Christensen, *Alaska's Forest Products Industry and Timber Harvest, Part 2: Industry Sectors, Capacity and Outputs*, University of Montana, 2017.

⁸⁷ Doug Hanson, *Timber Inventory of State Forest Lands in Tanana Valley*, 2013.

⁸⁸ Marcille, Berg, Morgan and Christensen, Op. cit.

⁸⁹ McDowell Group, *Port MacKenzie Rail Freight*, Op Cit.

⁹⁰ Yukon Department of Energy, Mines and Resources, *Oil and Gas Annual Report*, 2016.

⁹¹ Lori Garrison, *Ownership of one Kotaneelee well falls to YG after ELFO goes bust*, Yukon News, April 19, 2017.

⁹² Statistics Canada, Cat. No. 57-003-X and Yukon Energy, Mines and Resources, *Yukon's Energy Context*, 2017.

⁹³ Vector Research, *Yukon Energy State of Play*, February 8, 2018.

⁹⁴ BC Oil and Gas Commission, *2016 Oil and Gas Reserves and Production Report*, 2017.

the low price of gas, development activity has slowed. No new wells were drilled in the Cordova Basin in 2016 and production from the Horn Basin decreased as operators shut in wells that were no longer economic to produce.⁹⁵ Five new wells were drilled in the Liard Basin in 2016, but activity is limited due to high cost. The latter is due to both the geological formations in these basins compounded by their location, which is remote, uninhabited and lacking in either road or pipeline infrastructure.

The ACRL will improve access to both the Horn and Liard Basins and both streamline and reduce the transport cost of equipment and fracking materials required for drilling, such as sand, chemicals and piping, that are shipped from Central Canada and the US. More importantly, it would create increased demand and open access to new markets for liquid natural gas (LNG) processed in Northeast BC for mines and energy generation in the Yukon and Eastern Alaska. These improvements could tip the scale reinvigorating gas development and creating job growth in the Northern Rockies Regional District.

At present, there is no oil and gas extraction in the Southeast Fairbanks Census Area. However, Fairbanks is a major activity centre for the industry, which includes the Petro-Star refinery, Trans-Alaska Pipeline operations as well as numerous oil support service industries. It is also home to many North Slope workers. The industry in the Fairbanks North Star Borough employed 2,960 workers in 2016 and provided \$208 million in wages (USD 2016).

Potential Population Growth

Population growth in the Yukon has and is projected to continue to be modest at around 1.5% per year.⁹⁶ In contrast, population growth in both the Northern Rockies Regional District⁹⁷ and Southeast Fairbanks Census Area⁹⁸ have been negative in recent years. These declines have been linked to job losses and economic stagnation. The presence of the ACRL, however, would change this outlook by stimulating job creation in mining, forest product manufacturing and oil and gas production.

While increasing long term, permanent employment in both the forest industry and oil and gas sector is important and will help diversify the local economies in these regions, the numbers of positions created are likely, based on the prior analysis, to be relatively small due to other constraints on these industries. The larger impact will be felt in the mining and construction sectors, particularly in the Yukon. Based on the assumptions and illustration of potential job creation earlier in this section, the ACRL would annually stimulate 6,500 person-years of total employment related to mining activity over three years, then grow to 8,300 before reducing to 4,440 after mine construction ends in year 6 (See Figure 4-1).

Although all mines promote local hiring and provide training to facilitate this, finding adequate numbers of

⁹⁵ Ibid.

⁹⁶ Yukon Bureau of Statistics, December 2017.

⁹⁷ BC Statistics, *BC Development Region and Municipal Population Estimates*, January 2018.

⁹⁸ State of Alaska, Department of Labor and Workforce Development, Research and Analysis Section, *2017 Population Estimates by Borough, Census Area and Economic Development*, 2018.

skilled workers locally remains a problem. Nevertheless, proactive hiring and training programs to encourage local employment, especially amongst First Nations, have had positive results in increasing employee hires and retaining residents in nearby communities.⁹⁹ Monitoring of the Minto Mine has confirmed that both employment and the higher wages earned provided by mining have had positive effects for the economic well-being of Selkirk First Nation and nearby Pelly Crossing residents.

Most mines in the Yukon anticipate the need to attract mine workers from other regions. In 2014, the Minto mine reported that 35% of its workforce were Yukon residents and 65% were non-local.¹⁰⁰ Although some workers relocate to the Yukon with their families, others stay temporarily typically to complete shorter-term assignments and some fly-in and fly-out on a regular basis. As daily commuting to mine sites is rarely possible, mines construct camps, airstrips and/or provide transport from local airports or nearby communities and arrange rotational (e.g., two-week on, two-week off) shifts. Both the expense to the mines and the toll this takes on mine workers and their families are well documented.¹⁰¹

It is reasonable to assume that long term work opportunities and/or the prospect of on-going employment demand in workers' fields of expertise constitute a motivational factor in the decision of those who relocate. For example, the Casino mine, which is expected to involve four years of construction followed by 22 years of operation, has predicted the relocation of 248 workers (645 family members) to the Yukon starting during construction and increasing gradually thereafter.¹⁰² This number represents 25% to 41% of the mine's expected construction workforce of 980 at its peak and its 600 to 700 operations' workforce.

Using Casino's estimate of workers and their families moving to the Yukon and based on the calculation of employment generated by the six mines, , up to 1,035 mine workers (2,700 family members) would relocate to the Yukon over 14 years. Although anticipated construction work on the six mines was assumed to extend over six years, this would likely follow or possibly slightly overlap with the ACRL construction (discussed in Section 2 of this report), which will generate significant employment over at least five to seven years. As a result, construction workers on ACRL would likely decide to relocate with their families during ACRL construction and then stay on to work on mine development. If so and using the same percentage as before, 825 construction workers (2,150 family members) would become Yukon residents over five to eight years.

Like the construction sector, service industries will benefit from significant job creation because of ACRL construction. Consequently, both the attraction of new entrepreneurs to establish businesses and workers in service industries are likely to have already occurred prior to the expected requirements from new mining related activities. Unlike mining and construction sector jobs associated with mine development, most

⁹⁹ Selkirk First Nation, Government of Yukon and Minto Explorations Ltd., *Socio-Economic Monitoring Program: Minto Mine*, Annual Report 2014.

¹⁰⁰ Ibid.

¹⁰¹ Sandi Coleman, *Fly-in work and family stress: Researchers explore the pitfalls for remote workers*, CBC News, October 22, 2017.

¹⁰² Casino Mine Corporation, *Economic Impacts of the Casino Mine Project*, 2013; and Yukon Environmental and Socio-Economic Assessment Bureau (YESAB) *Project Proposal Submission*, January 2014.

service sector jobs would be situated away from mine sites in populated centres, especially Whitehorse, which already is the primary location for these activities. As such, a higher percentage of service workers may be attracted to relocate permanently to the Yukon.

Increased mining and related construction activity based on the six-mine illustration would generate 4,000 person-years of service and supply industry employment, growing to 4,760 before decreasing to 1,950 after mine construction has ended. Applying the Casino percentage to the peak employment figure suggests relocation of 1,950 workers or 5,064 family members, which seems reasonable given the post-construction base figure of support for 1,910 workers.

Figure 4-2: Illustration of Population Growth Resulting from Mining Activity Stimulation by ACRL

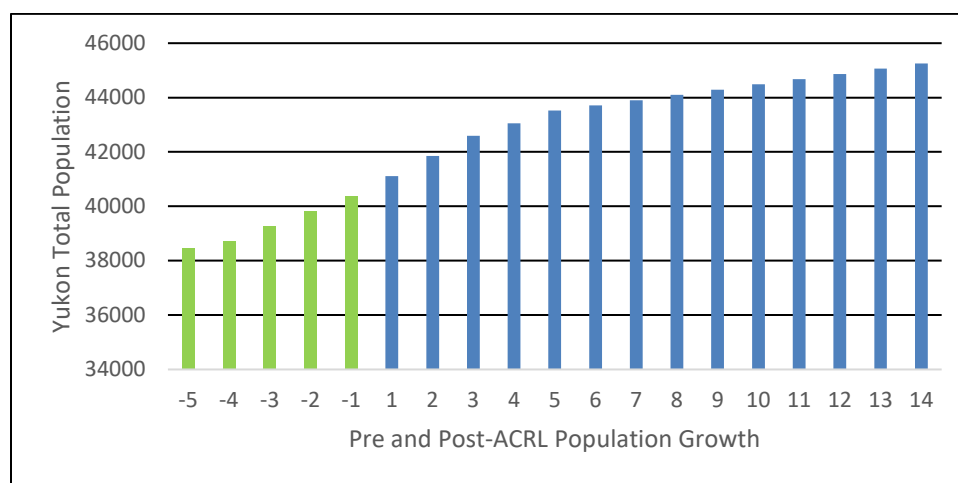


Figure 4-2 above illustrates the Yukon’s potential population growth based on the previous illustration and assumptions in this section. The illustrated annual population increase initially is 0.7% in year -4 (during ACRL construction) peaking in year 3 post ACRL construction at 1.9% before tapering off to 0.5% per annum in year 6 and beyond. This rate of growth is consistent with the currently forecast of an average 1.5% per annum by Yukon Statistics and therefore seems manageable. If, however, the illustrated population growth is incremental to that forecast, overall growth would be 2.0% to 3.9% depending on the year. Given that, except for 2011, the Yukon’s annual population increase exceeded 2.0% between 2008 and 2012¹⁰³ when mining activity was more active, even this higher growth rate again seems manageable.

However, this remains an illustration and actual population growth may manifest differently. For instance, the Casino estimate of worker relocation was derived on a stand-alone basis. If more projects proceed, thus creating a critical mass of employment making relocation more attractive for mine and construction workers, the percentage of workers choosing to relocate could increase. Also, additional workers who

¹⁰³ Yukon Finance, *Yukon Economic Outlook*, April 2017.

choose to only temporarily relocate will also have to be considered. Regardless, the stimulus from the ACRL to mining will undoubtedly result in population growth.

Community Development Benefits

As indicated in the socio-economic profile of the three regions, large areas of the ACRL corridor are unpopulated or sparsely populated, containing a handful of small communities of 1,000 residents or less. The exceptions are Whitehorse with just over 30,000 residents and Fort Nelson with 5,300.¹⁰⁴ The small communities in the corridor generally have lower labour force participation rates and higher unemployment than larger centres, like Whitehorse or, in the case of Fort Nelson, nearby Fort St John. The same is true for Tok, Alaska compared to Fairbanks.

Implementing the ACRL will provide residents in each of these regions, including small communities and First Nations residents, with both training and job opportunities stimulated in mining, forestry and oil and gas as previously discussed as well as in the construction and operation of the ACRL (See Section 2). But the number of direct jobs pales in comparison to employment and business opportunities that these industries and the ACRL will generate from expenditures for goods and services as well as both resident worker and transitory worker spending of wages and salaries.

While larger centres, like Whitehorse, have the advantage of having an established base of contractors and suppliers, opportunities nevertheless will exist for businesses and entrepreneurs in smaller communities and rural areas, where a large percentage of the First Nations' population reside, especially if procurement by resource companies and the ACRL are designed to encourage this. Provision of goods and services together with employee spending in small communities will not only improve these local economies and strengthen their tax base but encourage higher labour force participation, lower unemployment and the retention of young people because there are more job opportunities.

Population growth as well as the influx of temporary workers, who may require accommodation for a time or when they have time off away from mining or construction camps, will increase demand for housing. If ignored, this could result in higher housing costs, lower vacancy rates, high turnover and housing shortages that could affect affordability for current residents. Due to the wider range of services and facilities, larger centres, especially Whitehorse, will attract the bulk of this demand but spill-over effects will occur into smaller communities as well.

While the development sector will respond to this increased demand in due course, local and regional/territorial governments have a role to play in encouraging developers by enacting proactive policies, programs and incentives, including land use zoning, servicing, etc., and engaging the ACRL and

¹⁰⁴ Fairbanks with a population of 35,355, while the largest community in the three regions, is outside ACRL corridor and already served by the Alaska Railway but will be connected to the ACRL and benefit to a lesser extent than these other areas.

large project proponents to assist to ensure that negative impacts are avoided and resulting development is in keeping with and enhances existing communities.

Cost Savings on Supplies and Materials

All three regions depend heavily on imported goods and supplies, as their local manufacturing and agricultural sectors are small. As a result, virtually all produce, and consumer goods and supplies must be imported. The Yukon and Alaska must rely on trucking, barge/trucking or barge/rail/trucking for its supply chain that results in significantly higher costs for goods and supplies. Northeast BC has both direct rail and highway access to the rest of Canada and North America. As a result, that region will not benefit as much from the ACRL for shipping of supplies and materials, apart from having greater access to Alaskan produce like fish, which is the State’s principal export to the Yukon.

Approximately 98% of the Yukon’s food supply¹⁰⁵ and 95% of Alaska’s¹⁰⁶ are imported. This reliance also extends to fuel, consumer goods, equipment and vehicles and construction materials. In 2014, almost 600,000 tonnes of imported goods entered the Yukon,¹⁰⁷ of this total 147,000 tonnes were in transit to Alaska¹⁰⁸ of which 13,825 tonnes were transferred to the Alaska Railroad¹⁰⁹ at Fairbanks for distribution. In 2015/16, approximately 10.8 million tonnes of goods were imported into Alaska, of which 63.6% (6.9 tonnes) was fuel.¹¹⁰ By comparison, Yukon fuel imports for local consumption represented 42.0% of imports. The much larger population and industrial size of Alaska plus the presence of US military facilities explains this disparity.

Table 4-4: 2014 Freight Tonnage Imports to and via Yukon by Entry Location

Tonnes	Fuel	Community Resupply	Development	Total
Inside Passage (Skagway & Haines)	82,722	25,673	23,892	131,787
Interior Gateway (Beaver Creek)	15,411	833	858	17,102
Alaska Hwy (Watson Lake)	84,933	139,230	62,322	286,485
Sub-Total to Yukon	183,066	165,736	86,572	435,734
<i>Community Bulk Fuel</i>	<i>151,365</i>			
<i>Mining Bulk Fuel</i>	<i>31,700</i>			
Through Freight to Alaska	11,343	78,032	57,227	146,602

Source: Prolog Canada Inc. Canada Inc, *Economic Profile of the Alaska Highway*, 2016.

¹⁰⁵ Kwantlen Polytechnic University, *Yukon Food Design and Planning Project: Report on Agri-Food Industry Engagement*, January 2015.

¹⁰⁶ Lisa Phu, *Alaska only grows 4 percent of its food. Can we do better?* Juneau Empire, 2016.

¹⁰⁷ This excludes air freight.

¹⁰⁸ Prolog Canada Inc., *Economic Profile of the Alaska Highway*, 2016.

¹⁰⁹ McDowell Group, *Southcentral Alaska Port Freight and Fuel Analysis, 2016 Update*, 2017.

¹¹⁰ Ibid.

In 2014, the Yukon received approximately 66% of its consumer freight imports via the Alaska Highway at Watson Lake, 30% via the Inside Passage ports of Skagway and Haines and the remaining 4% through the Interior border crossing at Beaver Creek.¹¹¹ Community resupply, which includes agricultural products, general merchandise, household goods, livestock, cars and mobile homes, etc., accounted for over a third (38%) of the total volume in import goods. Development freight, including construction materials, iron, pipe and steel and equipment and machinery, for industry and residential and non-residential construction comprised 20%. Community bulk fuel for heating and transportation represented 35% and bulk fuel for mines another 7%.

Alaska received almost 3.0 million tonnes of imported non-petroleum goods and supplies in 2016.¹¹² The Port of Anchorage (POA), which is the principal point of entry for freight, received 50% of all inbound waterborne non-petroleum freight (see Figure 4-3 below) of which 15% was shipped by rail or truck to Fairbanks and the Interior of the State. The Port of Whittier was the second largest recipient of non-petroleum freight with about 450,000 tonnes (15%) and the remaining south-central ports received 150,000 (5%). Skagway and Haines, the two ports constituting the Inside Passage gateways to the Yukon, received approximately 45,000 tonnes¹¹³ of non-fuel freight respectively in 2016, most of which was destined for local business and resident use. Trucking accounted for another 114,000 to 136,000 tonnes and air transport 91,000 to 114,000 tonnes of goods and supplies consumed in Alaska.

In 2016, Alaska consumed 5.8 million tonnes of petroleum products, of which 46% was jet fuel.¹¹⁴ The POA received 1.8 million tonnes of petroleum products or 32% of total consumption. In-state refineries fill 70% to 80% of local consumption¹¹⁵, with a relatively small amount of petroleum product being imported from Canada. In 2015, 8,275 tonnes of Liquid Petroleum Gas (LPG) was shipped to Whittier via the CN Aquatrain.¹¹⁶ In 2014, 71,000 tonnes of gas, 106,000 tonnes of distillate fuel oil, 4,000 tonnes of LNG and 2,000 tonnes of kerosene were barged to communities in southeast Alaska (e.g., Skagway, Ketchikan and Juneau) from the Port of Vancouver¹¹⁷ as well as a 11,343 tonnes of fuel via the Alaska Highway.¹¹⁸

¹¹¹ Prolog Canada Inc., Op Cit.

¹¹² McDowell Group, *Southcentral Alaska Port Freight*, Op Cit.

¹¹³ Moffatt & Nicol, *Economic Analysis of Port of Skagway*, July 2017; Northern Economics, *Alaska Regional Ports: Planning for Alaska's Regional Ports Final Report*, January 2011.

¹¹⁴ US Energy Information System Website, *Table CT3. Total End Use Energy Consumption 1960-2016*, June 2017.

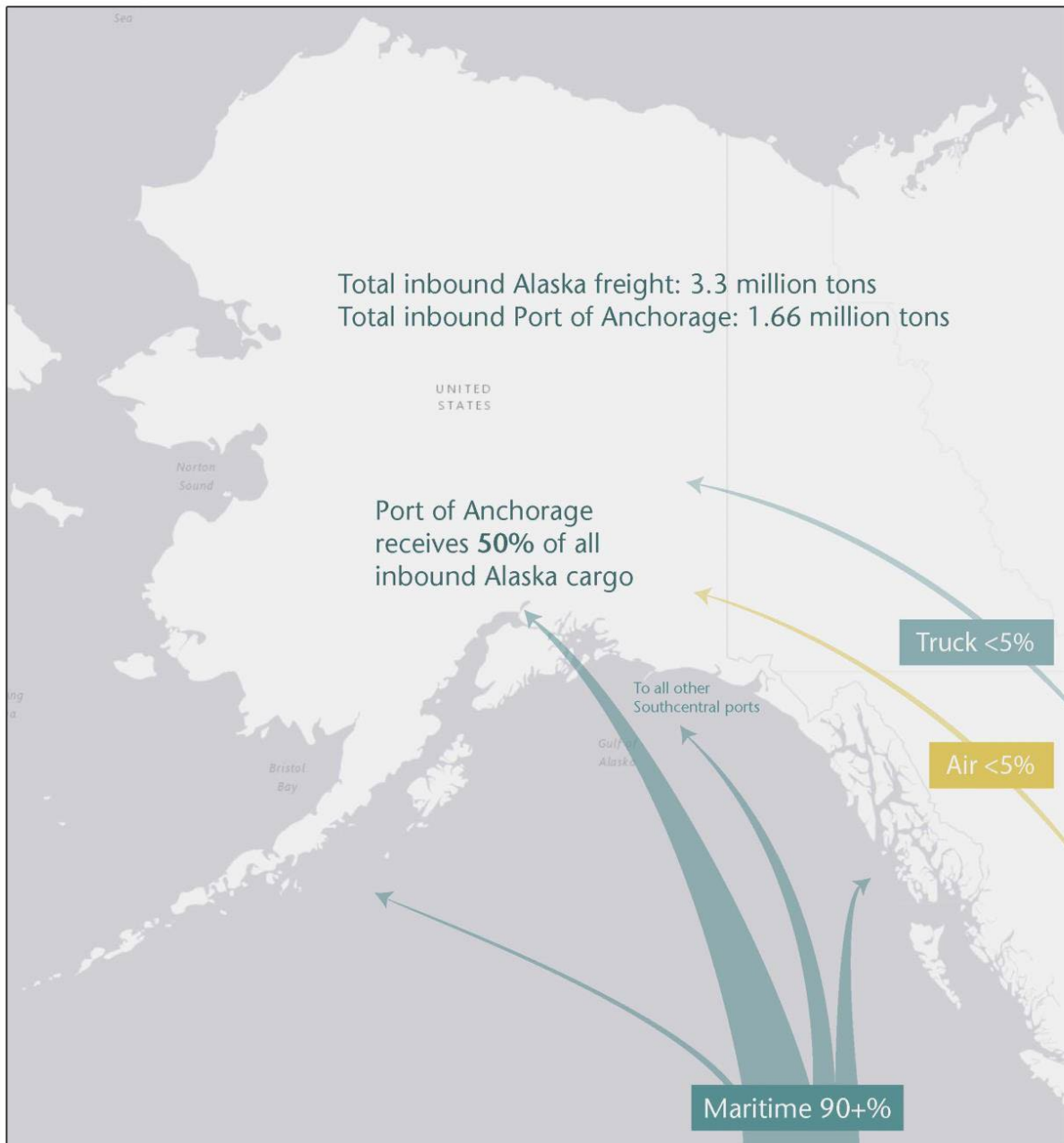
¹¹⁵ Alaska Department of Natural Resources, *The State of Alaska's Refining Industry*, 2015.

¹¹⁶ Transport Canada, *Community and industry resupply of oil on North Coast of British Columbia (as per CN Marine Services)*, Modified October 6, 2017.

¹¹⁷ CPCS Transom Ltd., *Community and Industry Resupply of Oil on the North Coast of BC: Analysis of US Corp of Engineers Waterborne Commerce of United States*, Transport Canada, 2016.

¹¹⁸ Prolog Canada Inc., Op Cit.

Figure 4-3: 2016 Inbound Non-Petroleum Freight by Transport Mode^a



Source: McDowell Group, *Southcentral Alaska Port Freight and Fuel Analysis, 2016 Update*, 2017; Note: tons are converted to tonnes in text.

The Yukon's and Alaska's reliance on imported goods and supplies and the transport costs involved translates into a higher cost of living in both regions. The Yukon's cost of living is estimated to be 16.7% higher than the Canadian average.¹¹⁹ The cost of living in Whitehorse in October 2017 was lower than in

¹¹⁹ Economic Research Institute, *website*, 2018.

other communities in the Territory where it ranged from 13.8% higher in Carmacks to 118.7% in Old Crow.¹²⁰ Alaska’s cost of living is the fifth highest in the US after Hawaii, the District of Columbia, California and New York.¹²¹ It ranks highest in health costs and second highest after Hawaii in food, utilities and transportation.

Choice of transport mode for freight generally hinges on a trade-off between cost and delivery time, which in turn involves considerations such as cargo weight and dimension, shipping schedule, shipper capacity restrictions, trans-shipment needs, weather concerns/risk, type of commodity, etc. Transport cost generally varies by distance. In general, trucking has a lower cost over short distances, whereas rail or marine transport are more economic over longer distances. In North America, the breakeven cost between truck and rail is 800 to 1,200 km, whereas marine transport becomes cheaper at approximately 2,400 km.¹²² Table 4-5 below illustrates the cost trade-off between transport modes in Alaska.

Table 4-5: Comparison of Time and Cost per Tonne & Km by Transport Mode

	Number of Days	Cost per Tonne	Cost per Tonne-Km ¹²³
Air	1 - 2.5	\$1,200-\$2,880	\$0.52-\$1.25
Truck	2.5 – 4.5	\$600-\$1,200	\$0.17-\$0.33
Deepwater Vessel	4.5 – 6.75	\$420-\$600	\$0.16-\$0.22
Barge	6.75 - 8	\$300-420	\$0.11-\$0.16

Source: McDowell Group, *Southcentral Alaska Port Freight and Fuel Analysis, 2016 Update*, 2017.

Based on cost alone, rail at \$0.10 per tonne km¹²⁴ presents a competitive and attractive alternative to other transport modes that could result in significant cost savings for shippers and consumers in both the Yukon and Alaska. However, other considerations must be factored in, particularly time sensitivity in delivery, which frequently relates to commodity type. Rail is acknowledged as the most economic carrier of bulk, time insensitive products.

The Alaska Railroad typifies this generalization. In 2015, the Alaska Railroad carried approximately 2.1 million tonnes of gravel, sand and stone, 0.8 million in coal, 0.4 million petroleum products, 0.1 million in intermodal traffic and chemicals respectively, 0.1 million in iron and steel and 0.4 million in other commodities, including military shipments.¹²⁵ Rail in the US carries only 16% of food products and 10% of beverages. Delivery time is especially important for fresh food produce, which require specific handling and shipping conditions and is time sensitive. Maximum shelf life for fresh produce ranges from:

¹²⁰ Yukon Statistics, *Yukon Statistical Review*, 2017.

¹²¹ Councils of Community Economic Research, *website*. Q1 2018.

¹²² Dr. Jean-Paul Rodrigue, *The Geography of Transport Systems*, 2017.

¹²³ Deepwater vessel and barge travel distance from Seattle to Anchorage is 1,695 nautical miles, truck travel distance is 2,260.4 miles and air distance is 1,438 miles.

¹²⁴ Conversion of Alaska Railway Rate of \$0.11 per ton mile to Canadian per tonne km.

¹²⁵ HDR Inc., & CD Smith, *Alaska State Rail Plan - Final*, November 2016.

- 6 days or less for berries, lettuce, herbs, etc.,
- 14 days or less for celery, French beans, citrus, etc.,
- 28 days or less for potatoes, root vegetables, etc., and,
- 28 days + for frozen meat.¹²⁶

To illustrate why trucks carry more of this produce than rail, the current time by rail from field to distribution centre between California/Mexico, which is the source of 73% of this produce, to the Northeast US is 4.8 to 7.7 days compared to 3.1 to 5.6 days by truck.

Clearly, the ACRL will not capture all current imports to the Yukon and Eastern Alaska but because of its lower transportation cost, there will be a diversion of some current import tonnage from existing modes. The most likely inbound freight to be attracted to the ACRL will be heavy, time insensitive goods such as construction materials, iron, pipe and steel and equipment and machinery for industry and residential and non-residential construction, chemicals and oil and gas products as well as consumer goods such as cars, mobile homes, livestock as well as non-perishable groceries.

However, as the ACRL is expected to stimulate new economic activity as well as industry and population growth, this should not mean a loss of business and revenue in the other transport modes. To the contrary, its stimulus will mean an increase in overall demand for transportation, including higher demand for more profitable short distance transport by truck to feed the ACRL as well as waterborne transport of commodities in higher demand from regions, like the Pacific Northwest or California with which the ACRL cannot compete.

Transportation cost on average is estimated to account for 10% of total product cost.¹²⁷ In the broadest of terms, transport costs comprise a combination of terminal and line haul costs. Terminal costs occur at both origin and destination for loading and unloading that are inevitable and intermediate points where these costs may be avoidable. Terminal costs involve many components, including labour and equipment handling and storage charges, docking or gate fees, pilotage and traffic control charges, etc. Line haul costs typically reflect both the weight and distance of freight cartage and consist of labour, equipment, overhead and fuel costs. They are also commonly multi-modal involving trucking for one or more segments of the line haul and one or more other line haul carriers (i.e., air, rail, deep sea vessels or barges).

The ACRL would offer a cheaper alternative in the line haul segment of freight transport for goods imported to both the Yukon and Alaska. For example, shipping a half-ton pick-up truck or single-wide mobile home to Whitehorse entirely by rail rather than by rail to Edmonton or Prince George and then transshipping it by truck to Whitehorse would save approximately \$1,050 per pick-up truck or \$2,725 per mobile home before taxes solely for line haul transport plus additional savings related to loading and unloading in Edmonton or Prince George. Table 4-6 below illustrates per tonne savings of shipments

¹²⁶ US Department of Transportation, *Higher Speed Freight Truck Market Analysis*, July 2013.

¹²⁷ Dr. Jean-Paul Rodrigue, *Transport Systems*, Op. Cit.

between Central Canada and the US and Whitehorse and Fairbanks.

Table 4-6: Comparison of Cost per Tonne to Whitehorse/Fairbanks by Point of Origin

	Rail & Truck	Rail & Barge	Rail, Barge & Truck	Rail Only with ACRL	Saving per tonne
Central Canada via Edmonton - Whitehorse	\$823.40			\$567.05	\$255.35
Central Canada via Prince George – Whitehorse	\$804.12			\$566.28	\$237.84
Chicago – Fairbanks via Seattle/Anchorage using Alaska Rail		\$810.69			
Chicago – Fairbanks via Seattle/Anchorage using truck			\$895.86		
Chicago – Fairbanks via Prince George/Whitehorse rail only				\$465.60	\$345.09 - \$430.26

- a. Calculations are based on the average cost per tonne/km estimated in Table 3-5.
- b. Rail cost was not adjusted for the Chicago-Seattle/ Edmonton segments, which may be lower than In the North. These were assumed to be comparable to each other and not affect the overall comparison. However, actual total cost and savings may be less.

While the estimated savings on an individual purchase of a pick-up truck or mobile home may seem small relative to their total cost, the real benefit of the ACRL’s transport cost reduction is the cumulative effect it will have on all goods and services that can be passed onto consumers. This is particularly true in sectors reliant on large volumes of heavy materials and equipment, which, as a result, represent a high percentage of the selling price of the end product or service. These cost savings will also open both the Yukon and Alaska to new products from new markets that may not have been previously competitive. When spread over all consumer goods and services, all these factors should reduce cost of living for residents in the Yukon and Eastern Alaska in particular.

Transportation Benefits

Construction and operation of the ACRL will add significantly to the transportation infrastructure of the Yukon, Northeast BC and Eastern Alaska as well as to Canada and the US. It will add another trans-continental railway link between the Atlantic and Pacific through its connection to the Alaska Railroad, which serves the Port of Anchorage and, in future, Port Mackenzie. It will also expand access to the region for export and import of goods at lower cost to and from other parts of Canada and the US as well as overseas. These latter benefits will be discussed in more detail in Section 5.

In addition to goods transport, the ACRL could also provide a possible means of transporting workers to and from mine and other resource extraction sites from nearby communities or airports. While the potential to serve daily commuting to/from work sites is likely to be limited, it could increase access and frequency of opportunities to go to nearby communities if a regular passenger rail service were

implemented. If this were the case, rail service would provide a more reliable and safer means of transport for workers, particularly in inclement weather, but also when they are fatigued when commuting after work.

In some cases, the ACRL would offer a more direct and shorter route to and from resource extraction sites. Shortening or eliminating the need for mine site access roads and on-site air strips would reduce costs and could also deter or prevent workers from bringing their own vehicles to mine sites, which has been cited as problematic at times.¹²⁸

Although the ACRL will reduce heavy truck traffic on some roads and highways, resulting in less need and cost for maintenance and rehabilitation of these facilities, its economic and population stimulus will also generate increased transport demand for feeder traffic between communities, mines and the ACRL as previously stated. Thus, any cost savings resulting from the diversion of heavy freight traffic to the ACRL is likely to be partly offset by increased feeder and other generated traffic. Put another way, higher economic activity and highway and road traffic will be supported at no extra cost overall.

Conclusions

Both communities and residents in the Yukon, Northeast BC and Eastern Alaska will derive significant benefits from the construction and operation of the ACRL. Opening access and providing lower transport cost to/from these regions for both import and export of goods and supplies will have a dramatic positive economic impact.

Reducing the cost and increasing both sources and markets for goods and supplies will benefit and stimulate resource industries, including mining, forestry and oil and gas, that will inevitably result in job creation. This, in turn, will open employment opportunities and assist in lowering unemployment and in the retention of existing residents, particularly amongst First Nations residents and youth, in these three resource dependent areas.

The addition of higher paying jobs in resources industries will also serve to improve the income and economic well-being of residents and communities, including First Nations, through wage spending. It will also likely attract new or returning permanent and temporary residents expanding the population base and stimulating the need for new housing, construction employment and demand for goods and services. Higher demand for goods and services by both industry and residents will open entrepreneurial opportunities for existing and new residents, especially First Nations and in small communities, particularly if resource industries continue their practice of proactive local procurement.

Cost of living for residents should also be reduced, assuming the lower cost of transport for goods and equipment is passed onto consumers. Savings especially should occur in industries like construction, which are dependent on large volumes of heavy materials and equipment. The ACRL may also add

¹²⁸ Chris Jones, *Mobile Miners: Work, Home and Hazards in Yukon Mining*, Lakehead University, 2013.

transport options for workers travelling to/from mine sites or elsewhere outside the region if regular passenger service was implemented.

5 | BENEFITS TO OTHER REGIONS AND INDUSTRIES

To this point, the report has focused on the ACRL corridor, which is roughly defined as 160 km (100 mile) wide centered on the notional alignment of the railway. However, by filling the gap between the North American rail grid and the Alaska Railroad, the ACRL's benefits will extend well beyond this limited corridor. The ACRL will establish a continuous railway link between the Yukon and Alaska and the rest of Canada and the lower 48 States for the first time. It will also provide direct rail access from these regions to two additional Pacific tidewater ports, namely Anchorage and Port Mackenzie, which are respectively two to three days shorter sailing time to/from Asia than other northwest ports.¹²⁹

It will also reduce the cost for, encourage and facilitate rail extensions to join the ACRL from resource deposits that can support the cost of connecting infrastructure, although not necessarily the entire cost to access tidewater. These potential extensions include a proposed 700 km extension east to the Alberta oil sands region and a 400 km extension north to the Crest Iron deposit in the Yukon. The ACRL's connection to the North American rail grid will also improve the viability of the proposed Alaska North Slope rail extension because construction and operation costs for equipment and materials to this region will be reduced.

Port MacKenzie and the Port of Anchorage

Mineral ore and concentrate exports from the Yukon and Eastern Alaska currently rely on truck transport from mines to the nearest all-weather road and then to a tidewater port. Skagway, Alaska is the closest tidewater port to the Yukon but unfortunately it has very limited upland area for storage and handling of these commodities as it is constrained by the town and Skagway River and its environmentally sensitive estuary. It also faces considerable competition for dock and land storage space from the lucrative cruise industry. Although served by the White Pass and Yukon Railway, this single gauge rail line is not suitable for major ore transfers and therefore these are carried by truck, which must traverse the very steep 22.5 km section between the Canadian Border and Skagway.

Haines, Alaska is the second closest tidewater port to the Yukon, located about 26 km to the southwest of Skagway. This port has greater upland port potential but is also only served by trucks at present and again has steep and challenging terrain to cross the 71.9 km between the port and the Yukon border. The Haines Borough and State of Alaska examined construction of a 336 km rail link¹³⁰ between the port and Carmacks to connect with the then assumed closest junction point with the ACRL. The estimated capital cost of this

¹²⁹ Calculation based on nautical miles between Shanghai and Anchorage/Port MacKenzie assuming average speed of 16 knots per hour.

¹³⁰ Prolog Canada Inc, *Haines Access Report*, April 2014.

rail link was \$4.0 billion (2017 USD).¹³¹

The ACRL will provide new tidewater access opportunities to both Port MacKenzie and Anchorage via the existing Alaska Railroad. The ports are roughly the same nautical distance to/from Asia. However, Port MacKenzie is 24 km closer to the Interior and is less constrained in both transportation access and upland storage and handling potential than Anchorage, with docks designed to efficiently export natural resources.¹³² Given that transportation differences are relatively small between the two ports, it would make sense and allow both ports to specialize their freight handling to take advantage of their respective assets.

Despite the greater distance to these ports from the Yukon compared to Skagway and Haines, the lower cost of rail transport compared to trucking and the reduction in deep sea shipping costs would make use of the ACRL for exports to Asia via these ports the cheaper option.¹³³ As cited previously (Section 4 – *Forestry Employment Opportunities*), the ACRL would now also make forest product exports from the Yukon, Northeast BC and Eastern Interior Alaska to Asia economic, further adding to both rail and port freight tonnage volumes.

The ACRL will also reduce the cost and time for imported goods from Asia to the Yukon and Alaska as well as the rest of Canada and the US Midwest and Eastern states. Anchorage is the main port of entry for containers and other goods barged or shipped to Alaska from the lower 48 States or Canada with 50% to 55% of all freight remaining in the Anchorage region for local consumption.¹³⁴ Approximately 20% of the Port's arriving freight is then distributed to the Matanuska-Susitna Borough and another 15% to Fairbanks and the Interior. Freight that is destined to Anchorage will likely continue to transit the Port of Anchorage as will mixed shipments that include significant volumes of freight for Anchorage. However, bulk freight and freight predominantly destined for the Matanuska-Susitna Borough and Alaska Interior could opt to use Port MacKenzie.

Port MacKenzie and Anchorage could both benefit from additional container and other freight imports from Asia being diverted from other Northwest ports because of their two to three-day shorter sailing time advantage. Also, depending on the deep-sea vessel cost, the rail cost to Central Canada could be \$30 to \$174 per tonne cheaper than from Prince Rupert or Vancouver and \$200 to \$330 per tonne cheaper to Chicago than from Seattle.¹³⁵ Rivalry between ports for container traffic is highly competitive and other factors

¹³¹ \$3.9 billion in 2014 inflated by 2.13%

¹³² Matanuska-Susitna Borough website, *Port Mackenzie*, February 2019.

¹³³ The saving in deep sea vessel transport costs were calculated using McDowell Group, *Southcentral Alaska Port Freight and Fuel Analysis, 2016 Update, 2017* and nautical mileage between Port MacKenzie, Skagway and Haines and Shanghai.

¹³⁴ McDowell Group, *Southcentral Alaska Port*, Op. Cit.

¹³⁵ The saving in deep sea vessel transport costs were calculated using McDowell Group, *Southcentral Alaska Port Freight and Fuel Analysis, 2016 Update, 2017* and nautical mileage between Shanghai and the ports.

including loading and operational efficiency at the ports, are factors in determining which port to use.

Northeast BC and Alberta Oil and Gas Industries

Fuel is a major import for the Yukon, as the Territory currently has no oil or gas production nor refineries, despite having 900 million barrels of crude oil and eight trillion cubic feet of gas reserves.¹³⁶ In 2017, 76.4 million litres of gasoline and 54.9 million litres of diesel fuel were used by motor vehicles alone in the Yukon.¹³⁷ Transportation use represents 82% of total refined petroleum product consumption in the Territory, with industrial use, principally in mining, making up 12%, commercial use another 5% and public administration and residential use the remaining one percent.¹³⁸

Virtually all refined petroleum products consumed in the Yukon are trucked from Edmonton, Alberta or Prince George, BC, with occasional small volumes imported from Alaska. Consumption of LNG in the Yukon, at present, is negligible, consisting principally of Yukon Energy's use for backup energy generation at their thermal plants. LNG is sourced from Fortis' Tillbury Island refinery in Vancouver, a 2,394 km one-way trip.¹³⁹

Demand for fuel by the mining sector is significant and will grow with construction/operation of the ACRL. Diesel fuel is needed for road and non-road vehicles. Either diesel or LNG is also needed for power generation by those mines unable to access the electric grid. As an example, the Casino mine anticipates annual imports of 33.0 million litres of LNG and 26.0 million litres of diesel fuel during construction and 360.0 million litres of LNG and 32.0 million litres of diesel fuel during operations.¹⁴⁰ The Casino mine anticipates shipping both LNG and diesel fuel by truck, which will involve two deliveries each per day during construction (eight truck trips daily) and 11 and four deliveries respectively per day during operations (30 truck trips daily). Casino expects to source its LNG requirements from Northeast BC, which will involve a 2,660 km return trip.

Northeast BC and Alberta are Canada's two largest producers of oil and gas but are constrained by a lack of both pipeline and overseas export terminal infrastructure. Western Canadian natural gas sales to the US, its sole export market, have declined by 18% over the past decade,¹⁴¹ and, despite projections of strong growth in Asian demand for LNG, prices are so low that gas production and exploration are being cutback.¹⁴² Oil production faces similar constraints. While pipelines are the cheapest means of transporting oil and gas, construction approvals have been fraught with environmental and First Nation opposition, political

¹³⁶ National Energy Board of Canada (NEB), *Provincial and Territorial Energy Profiles - Yukon*, January 22, 2019.

¹³⁷ Statistics Canada, *Annual Sales of Fuel for Road Motor Vehicles*, CANSIM 405-0002, February 5, 2019.

¹³⁸ Statistics Canada, *Report on Energy Supply and Demand in Canada, Table 1-14: Primary and Secondary Energy Units – Yukon*, April 4, 2018.

¹³⁹ Ibid.

¹⁴⁰ Casino Copper and Gold, *Proposal for Executive Committee Review: Pursuant to Yukon Environmental and Socio-Economic Assessment Act*, January 3, 2014.

¹⁴¹ Canadian Association of Petroleum Producers, *Canada's Natural Gas*, July 2018.

¹⁴² Dan Healing, *LNG Partner Petronas cuts Natural Gas Output due to Plunging Prices*, The Canadian Press, December 23, 2018.

controversy and delays.

Both fuels, including diesel and aviation fuel and propane, and crude oil can and are being transported by rail in Canada. In 2015, approximately 8% of fuel in BC was transported by rail.¹⁴³ Crude oil shipments by rail in Canada increased by 50% to 48 million barrels in 2017 compared to 2016 and are estimated to have increased by 65% in 2018.¹⁴⁴ Although LNG has been successfully transported by rail without incident in Japan since 2000, this has yet to receive regulatory approval in North America apart from a two-year pilot study in 2015 by the Alaska Railroad.¹⁴⁵

The ACRL's realization offers several significant potential benefits to the Northeast BC and Alberta oil and gas industries. First, by lowering the cost and stimulating the mining industry in the Yukon and Eastern Alaska, it will create a sizable new domestic market for both fuel and LNG. Second, it offers an alternative means of transporting fuel to the Yukon at potentially lower cost than trucking it entirely from either Prince George or Edmonton. Third, it could offer a cost-effective alternative to trucking LNG from Northeast BC, if rail transport of LNG is approved. At the same time, the additional volume of fuel and LNG generated by the ACRL will result in additional inter-modal demand for trucking in the Yukon to mines and other final locations of consumption, thus offsetting potential diversion of tonnage from long distance trucking.

Alberta to Alaska Link

In addition to the above, the ACRL could offer an alternative means of transporting crude oil to tidewater if either a pipeline or rail connection from Alberta was constructed to intercept the ACRL. The former has never been explored as all efforts regarding pipeline construction have focused on reaching tidewater on the BC coast at Prince Rupert, Kitimat (e.g., Enbridge Gateway project) or Vancouver (Kinder Morgan project). However, the feasibility of an Alberta to Alaska rail link connecting the oil sands region of Alberta to tidewater in Alaska has been the subject of study for several years.

The *Alberta Alaska Rail Link* pre-feasibility study in 2015 concluded that this rail link could transport 1.0 to 1.5 million barrels of petroleum product per day (mbpd).¹⁴⁶ The estimated cost for the 2,440 km rail line, including oil handling facilities, rolling stock as well as costs associated with possible port terminal upgrades or construction and either a pipeline and/rail connection to access the Port of Valdez, ranged from \$30 to \$36 billion (\$2017).¹⁴⁷ Actual cost would depend on the volume of petroleum products shipped, tidewater access option selected and the project's final cost and schedule. Annual operating costs were estimated to

¹⁴³ Canadian Association of Petroleum Producers *Rail Transport Is Becoming Increasingly Important as One of the Ways Oil Products Get to Market*, 2015.

¹⁴⁴ National Energy Board of Canada, *Canadian Crude Oil Exports by Rail – Monthly Data*, January 1, 2019.

¹⁴⁵ Jeff Stagl, *Free to Move LNG: Alaska Railroad gains FRA Blessing to Transport Liquefied Natural Gas to Interior Region*, Progressive Railroading, October 2015.

¹⁴⁶ Van Horne Institute, *Alberta to Alaska Railway – Pre-Feasibility Study*, 2015.

¹⁴⁷ 2013 CAD inflated using Bank of Canada inflation rate to 2017.

range from \$2.0 billion to \$3.7 billion (\$2017).¹⁴⁰

Based on the above and assuming petroleum revenues only, the 2015 study estimated that the transport charge necessary to fully cover all capital and operating costs over 25 to 29 years and provide a reasonable rate of return on debt and equity would be \$16.46 to \$22.82 per barrel for 1.0 mbpd and \$13.28 to \$19.20 per barrel for 1.5 mbpd. These projected charges are in line with the cost per barrel (\$10.32 to \$19.88) reported by the Canadian Association of Petroleum Producers for rail transport to BC's west coast.¹⁴⁸

Construction of the ACRL could roughly halve the estimated capital cost of an Alberta rail link by eliminating the need to construct 1,729 km of mainline track. The Alberta rail extension would still need to construct a rail connection between Fort Nelson and its end point in Northern Alberta as well as finance rolling stock, oil handling and other operation facilities, possible tidewater port connections and track upgrades, such as passing tracks, required by its operation.

Alaska's North Slope Oil Production

The ACRL could benefit oil production in Alaska's North Slope in two important ways. First, it could reduce the estimated \$9.5 billion (2017 CAD)¹⁴⁹ construction cost for the Alaska Railroad North Slope Extension and oil production infrastructure by lowering the cost of equipment and materials shipped from Canada and the lower 48 States. Second, it could lower the cost of equipment, materials and supplies required during production.

Shale oil production on Alaska's North Slope will require significant quantities of freight annually, including over 4,500 to 5,400 tonnes of fracking sand and equal aggregate tonnage of drilling steel, drilling fluids, cement, diesel fuel and equipment per well.¹⁵⁰ In total, it is estimated that oil production on the North Slope alone would require 2.2 million tonnes per year of inbound freight. This estimate is considered conservative as it does not include freight required to support conventional oil production nor the potential export of LNG. By comparison, rail freight carried to serve Russia's Yamal Peninsula oil and gas production, which is expected to produce 11.2 million tonnes of LNG over seven months each year, is estimated to be 24 million tonnes.¹⁵¹

The ACRL would enable inbound freight that is produced in Canada or the lower 48 States to be shipped entirely by rail to the North Slope. This would result in substantial cost savings. For example, \$425 would

¹⁴⁸ Canadian Association of Petroleum Producers, *Transporting Crude Oil by Rail in Canada*, 2014; \$9.83 - \$18.93 in 2014 adjusted to 2017 using Bank of Canada Inflation rate.

¹⁴⁹ \$7 billion 2013 USD per Alaska Department of Transportation and Public Facilities, *Alaska State Rail Plan*, November 2016; adjusted for inflation to \$2017 and converted to CAD.

¹⁵⁰ Dr. Paul Metz, University of Alaska Fairbanks, *Economic Impact of a North Slope Rail Extension on Future Northern Energy and Mineral Development*, Presentation, August 2013.

¹⁵¹ A. Bambulyak, B. Franzen and R. Rauio, *Oil Transport from the Russian part of the Barents Region – Status Report*, October 2015.

be saved for every tonne of freight shipped from Chicago exclusively by rail directly to the North Slope via Fairbanks rather than by rail and barge via Anchorage. If only half the inbound freight to the North Slope was routed through Chicago, this would amount to an annual saving of \$0.5 billion.

Crest Region Resources

The Crest iron ore deposit in the Peel River Watershed of Northeast Yukon is the largest of its kind in North America with a preliminary estimate of 12 billion tonnes of iron ore potential.¹⁵² In addition, it is located adjacent the Bonnet Plume Basin, which has been identified as source of coal and 25 million m³ of natural gas.¹⁵³

The Peel River Watershed, however, is uninhabited and one of the least explored regions of the Yukon. As such, access for exploration and mine or other resource development has been subject to environmental and First Nations' opposition, advocating protection for most of the region, which remains unresolved.¹⁵⁴ Realization of the ACRL potentially could assist in a resolution of this current impasse as rail access to the region would greatly limit access, its footprint and unauthorized intrusion into the area and, at the same time, provide a cost effective solution to the resource development.

The Crest deposit is situated approximately 240 km northeast of Mayo Landing and 400 km away from Carmacks. Accessing the Crest deposit would require either building a new 193 km mine access road to reach the nearest all-weather road at Elsa, which is 274 km northeast of Carmacks, or an approximately 370 km new railway spur line. Neither of these access options have been studied and costed but a rough estimate of their cost would be \$270 million for a two-lane gravel access road and \$4.8 billion for the rail line.¹⁵⁵

While the rail access option's capital cost is significantly higher, the transport cost savings (\$70 per tonne) compared to trucking ore from the Crest to the ACRL would more than offset this cost differential. In fact, it would only require transport of 65,700 tonnes of ore to break even. The size of the ore deposit and its production duration suggests that this investment would be economically supportable, particularly if it eased environmental approval for the project.

In addition, using rail to transport iron ore from Carmacks to Port MacKenzie would save \$75 per tonne compared to trucking ore from Crest to Haines, Alaska, the nearest port capable of handling Crest's

¹⁵² Gartner Lee, *Strategic Overview of Possible Mineral Development Scenarios – Peel River Watershed Planning Region*, 2006.

¹⁵³ P.K. Hannigan, *Petroleum Resource Assessment of the Bonnet Plume Basin, Yukon*, November 2000.

¹⁵⁴ CBC News, *Supreme Court rules in favour of First Nations in Peel watershed dispute*, December 1, 2017.

¹⁵⁵ Assumes current cost of approximately \$1.4 per km for construction of a gravel access road and \$12 million per km for rail construction which is the lower end estimate calculated for the ACRL as 70% if the access line would parallel existing highway making access easier than for most of the ACRL.

volume of ore exports. It would also obviate the need for an estimated \$1.8 billion¹⁵⁶ in capital expenditures for port development requirements.¹⁵⁷

The reciprocal benefit for the ACRL would be a potential revenue stream of almost \$500 billion over the life of the mine, assuming 12 billion tonnes of ore was transported to Port MacKenzie. In fact, it would only take 3% of the iron ore to be transported to cover the ACRL's entire capital cost. In addition, the ACRL would benefit from revenues and the Crest mine from transport cost savings for shipments of equipment, materials and supplies both during mine development and operation transported from the rest of Canada and the US Midwest and Eastern states.

Fisheries

Seafood is the second-largest source of export cargo from Alaska after oil and gas.¹⁵⁸ On average, Alaska harvests 2.3 to 2.7 million tonnes of seafood and processes 1.1 to 1.2 million tonnes of frozen, canned, dried or other seafood products¹⁵⁹ each year.¹⁶⁰ In 2017, the State exported 1.1 million tonnes of seafood valued at \$3.45 billion (USD), of which approximately one-third went to China.¹⁶¹ Exports to Canada comprised about 5% of this total. Alaska also ships about 0.5 million tonnes of seafood south to the Lower 48 States each year.

Shipping fresh and live seafood by air is an economically important component of Alaska's seafood exports, as it has a higher value, but it is small compared to marine transport, which carries most seafood exports. As seafood originates primarily from the southern coastal areas of the State, marine shipping will retain its dominance in the export of these products. However, the ACRL could facilitate increased exports of processed seafood to the Canadian market as well as to the Midwest and Eastern US because of its lower transport costs. In so doing, it would add a welcome source of back haul freight to the ACRL.

Goods Manufacturing and Construction Suppliers

The new connectivity provided by the ACRL to the Yukon and Alaska will benefit manufacturing and construction material and equipment suppliers/exporters in the Canada as well as the Midwest and Eastern US. As previously discussed, a large proportion of inbound freight for mining, oil and gas production, construction projects and domestic consumption originates from these regions. This includes the supply of vehicles, equipment, machinery and parts, chemicals, pre-fabricated buildings and construction materials, such as piping, lumber, cement, etc.

¹⁵⁶ Hatch, *Chevron Canada Resources – Snake River Iron Ore*, July 2006.

¹⁵⁷ Note: The Hatch report indicated that port development requirements were unnecessary at Port MacKenzie.

¹⁵⁸ Anonymous, *Freight Transport in Alaska: The Haul of the Wild*, Inbound Logistics, April 17, 2015.

¹⁵⁹ Includes surimi, meal and oil, etc.

¹⁶⁰ McDowell Group, *Economic Value of Alaska's Seafood Industry*, September 2017.

¹⁶¹ Alaska Seafood Marketing Institute, *2017 Annual Report*, 2018.

The ACRL's stimulus of new metallic mines alone is estimated to generate demand for up to 2.2 million tonnes of equipment, machinery and supplies annually to support mine operations (see Section 3). This does not include equipment, goods and supplies required during construction and development of new mines. As the exact number, scale and timing of development of these mines is unclear, freight requirements for equipment, goods and supplies are equally difficult to estimate and will vary by the type of mine (e.g., open pit, underground or a combination). For example, the Donlin mine in Alaska, which is a large scale open-pit gold mine, estimates needing 450,000 to 550,000 tonnes of equipment and materials (excluding fuel) for its development.¹⁶² The demands from the North Slope oil and gas industries and Crest iron ore mine will also be substantial.

Although less substantial in volume than these industrial uses, expected population growth will also add further demand for vehicles, pre-fabricated buildings, building materials and consumer products. Also, because the ACRL will make transport cheaper from eastern manufacturers and suppliers, it will likely open the Yukon and Eastern Alaska regions to new potential providers and more competition for these goods, which will benefit consumers and providers alike.

Conclusions

While the Yukon and Alaska will be the primary beneficiaries of the ACRL, other regions in Canada and the US Midwest and Eastern States will also gain new opportunities and benefit from this new railway connection to these markets and Pacific tidewater.

Both the Ports of Anchorage and Port MacKenzie will offer the most cost-effective export location for mineral ores and forest products from the Yukon and Eastern Alaska, as a result of the ACRL. Since these exports represent new tonnage, this will not negatively impact other West Coast ports. In addition, the closer sailing time to Asia combined with the lower cost of rail transport to Central Canada and the US will make them attractive for container freight adding capacity and promoting greater competition for this traffic as well as contributing back haul freight demand for the ACRL.

By stimulating mining, the ACRL will also increase demand for fuel and LNG broadening the market for these products from Northeast BC and Alberta. If shipment of LNG by rail receives regulatory approval, it could also offer a pipeline alternative to transport LNG both for consumption in the Yukon and Alaska as well as for export to Asia. In addition, the ACRL would reduce the cost for an Alberta rail extension that would enable transport of crude oil to tidewater for export to Asia.

Development of Alaska's North Slope will also benefit from the ACRL providing a lower cost for shipment of equipment, machinery, construction materials and supplies required for both construction of a rail extension to this region and oil and gas production. Similarly, the ACRL could lower the cost of imports

¹⁶² McDowell Group, *Port McKenzie Rail*, Op. Cit.

and exports and thus improve the economic viability of developing the Crest iron ore deposit. At the same time, it would encourage the construction of rail access to the site, which would reduce environmental impact associated with this development.

The economic stimulus created by the ACRL and lower transport cost it will afford to the Yukon and Alaska will create new demand and open markets for manufacturers and suppliers in both Canada and the Midwest and Eastern US. At the same time, Yukon and Alaska residents and industries will benefit from the lower cost for numerous goods delivered to the region. The ACRL could also encourage increased Alaskan seafood exports into both Canada and the Midwest and Eastern US.

6 | OTHER BENEFITS

While the direct economic stimulus and benefits of the ACRL for goods industries are significant and wide spread, the rail line will also create new potential opportunities for tourism and the service sector. In addition, it will have both environmental and social benefits for the Yukon and Alaska as well as Canada and the US.

Potential for Tourism

In 2017, the Yukon recorded 436,879 border crossings, of which 70% were Americans, 19% were Canadians, including Yukon residents, and 11% were from overseas.¹⁶³ Excluding Canadians, 54% of entrants were day-trippers and 46% stayed in the Yukon for one night or more. Overnight visitations were estimated to be 334,000. Tourism spending was \$418 million and supported 3,500 jobs.

From October 2016 to September 2017, Alaska welcomed 2.2 million visitors, of which 49% travelled by cruise ship, 47% entered and exited the state by air and the remaining 4% by highway.¹⁶⁴ Visitor spending was estimated to be \$2.2 billion (USD) with approximately 18% (\$392 million USD) occurring in the Interior region, in which the ACRL would be located. Tourism is estimated to support 43,300 jobs throughout the State, of which 8,500 are in the Interior region.

Globally, railway tourism is an increasingly popular form of travel. It is already an important contributor to the Alaska Railroad's (ARR) total revenue, estimated to be \$35.4 million (USD) or 33% of \$107.8 million in operating revenue excluding grants in 2017.¹⁶⁵ The ARR carried 506,000 passengers that year,¹⁶⁶ of which approximately 90% were visitors.¹⁶⁷ In addition, the ARR operates contracted train service using cruise company-owned cars, which carried another 227,000 passengers in 2016.¹⁶⁸ The train service with the greatest number of cruise passengers is the *Denali Star*, which operates between Anchorage and Denali National Park and from Denali to Fairbanks.

There is also the White Pass and Yukon Railway (WPYR) built in the late 1800's as a result of the Klondike Gold Rush, which was recently bought by the Carnival Cruise Lines. The WPYR operates a seasonal tourist excursion service from Skagway to Carcross and back for cruise ship passengers. It is the most popular cruise ship shore excursion, which drew over 423,000 passengers in 2017 and generated \$56 million in revenues.¹⁶⁹ The current WPYR operation uses 109 km of its 178 km original line whose terminus was

¹⁶³ Tourism Yukon, *2017 Year-End Report*.

¹⁶⁴ McDowell Group, *The Economic Impacts of Alaska's Visitor Industry, 2017*, November 2018.

¹⁶⁵ Ibid.

¹⁶⁶ E. Brehmer, *Alaska Railroad returned to profitability in 2017*, Anchorage Daily News, April 10, 2018.

¹⁶⁷ McDowell, *Op.cit.*

¹⁶⁸ HDR Inc., & CD Smith, *Alaska State Rail Plan*, *Op.Cit.*

¹⁶⁹ K. Halliday, *Big Cruise doubles down on Skagway cruise market*, Yukon News, July 21, 2018.

Whitehorse.

The ACRL could serve to extend the *Denali Star* beyond Fairbanks into the Yukon or serve as a stand-alone *Klondike Explorer* rail trip to Fairbanks. It could even stimulate a circle trip opportunity from Skagway on the WPYR either by rehabilitating the original WPYK rail line between Carcross and Whitehorse or by offering a tour bus link to Whitehorse and the ACRL. If the ACRL, in any of these configurations, were used as a tourism opportunity, it would naturally foster development of other excursion and educational activities focused on the gold rush history of the region, First Nations' culture and arts and the region's environmental attributes. It could also encourage additional overnight stays, particularly if a one-night stopover in Whitehorse were built into the visitor program to take advantage of the new excursion opportunities.

Environmental Benefits

Rail is the most energy efficient mode for freight transport. Typically, it is 2.5 times more efficient than trucks, using approximately 4 litres¹⁷⁰ of fuel to move a tonne of freight 753 km,¹⁷¹ whereas trucks using the same amount of fuel can only travel 241 km.¹⁷² As a result, transporting 100 tonnes of freight by rail over 100 km releases 0.15 tonnes of carbon dioxide (CO₂) or greenhouse gas emissions (GHG) compared to 0.67 tonnes of GHG if carried by trucks.¹⁷³ Furthermore, railways are actively working on lowering their GHG emissions through the adoption of new technologies and retrofits as well as operational practices, including switching to lower emission fuels and reducing idling.

Construction of the ACRL will result in a higher level of economic activity, while minimizing GHG emissions related to these activities, thus maintaining air quality. It also offers a smaller footprint and means of controlled access into previously undeveloped areas, which will result in less disruption and unauthorized intrusion into these areas, helping to preserve territorial rights and environmental values.

Emergency Contingency and National Security Benefits

Both the Yukon and Alaska are highly dependent on imported goods and supplies. Alaska relies heavily on marine transport to receive approximately 90% of these products.¹⁷⁴ The Port of Anchorage is the primary entry point, handling approximately 1.5 million tonnes of non-petroleum and 1.6 million tonnes of petroleum freight in 2017¹⁷⁵ or roughly 74% of all waterborne inbound freight, 80% of cement used for concrete in the State¹⁷⁶ and 90% of refined petroleum products sold in the Railbelt and beyond, which

¹⁷⁰ 1 US gallon conversion.

¹⁷¹ Alaska Railroad website, *Just the Facts: Railroad At a Glance*, May 15, 2016.

¹⁷² HDR Inc., and CD Smith, *Alaska State Rail Plan*, Op. Cit.

¹⁷³ Railway Association of Canada website, *Rail Freight Greenhouse Gas Calculator*.

¹⁷⁴ McDowell, *Southcentral Alaska Ports*, Op.Cit.

¹⁷⁵ Port of Anchorage website, *Cargo Distribution*.

¹⁷⁶ Ibid.

encompasses 87% of the State's population.¹⁷⁷

Alaska's supply chain is challenged by extreme weather and rugged inland terrain, where only 31% of Alaska's roads are paved.¹⁷⁸ Driver issues are also challenging as recruitment can be difficult given the State's relatively small population and regulated hours of service restrictions where a 500-mile stretch of highway may be uninhabited or lack amenities to serve driver rest periods.¹⁷⁹

Recognizing these challenges and the tenuous supply issues in Alaska, barge carriers have adopted two propellers systems to avoid sailing delays for repairs. Grocery suppliers have contracted trucks using two-driver crews and air deliveries of produce to supplement the main weekly barge supply.¹⁸⁰ However, these back-up arrangements come at a cost and are relatively minor compared to the main flow of goods by marine transport.

The State's vulnerability to disruption in food and other essential supplies was evident when the 1964 earthquake destroyed coastal ports for several months. However, at that time, the State was less dependent on outside supply of food¹⁸¹ and just-in-time delivery of parts and other necessities, such as re-agents for power plants, that are no longer stockpiled. Mechanical problems in January 2016 that prevented one barge trip delivering food to Anchorage resulting in empty shelves in grocery stores, illustrated this dependence.¹⁸²

If ports are unavailable for any reason, the current alternative is to transport goods and supplies by truck or air, which are both more costly and difficult due to the capacity that would be required. Assuming a maximum load of 19 tonnes per truck,¹⁸³ approximately 13,600 truck trips per month or over 3,000 per week would be needed to replace the barge freight tonnage transiting the Port of Anchorage.

The Port of Anchorage is also extremely important from a strategic and military perspective. It is one of 17 designated "US Commercial Strategic Seaports" by the Department of Defense.¹⁸⁴ It is directly connected by a secure road to the Joint Base Elmendorf-Richardson as well as by rail to four of Alaska's five military installations. It plays a vital role in troop deployment and handles 100% of jet fuel and two-thirds of all fuel used by the military as well as consumer, business and military cargo. From a Canadian perspective, the Alaskan military installations are also critically important both as training grounds that are used for joint military exercises and the defense of Arctic sovereignty, which is increasingly being

¹⁷⁷ Municipality of Anchorage, *Port of Anchorage – 2018 Approved Utility/Enterprise Activities Budget*, 2018.

¹⁷⁸ Anonymous, *Alaska: Logistics at a Global Crossroad*, Inbound Logistics, April 2013.

¹⁷⁹ Ibid.

¹⁸⁰ A. Zak, *How one cargo ship delay sends ripples through Alaska's food supply chain*, Anchorage Daily News, February 10, 2018.

¹⁸¹ In 1955, Alaska produced 55% of the food it consumed. Source: Craig Medred, *Why does Alaska produce so much less than 50 years ago?* Anchorage Daily News, September 27, 2016.

¹⁸² T. Ellis, *Closure of Interior's only dairy shows vulnerability of Alaska's food security*, FUAC org, May 16, 2016.

¹⁸³ Approximately 42,000 lbs.

¹⁸⁴ Port of Anchorage website, *Cargo Distribution – Military Support*, 2018.

challenged by both Russia and China.¹⁸⁵

For these reasons, the Port is modernizing several docks to withstand a catastrophic seismic event with minimum damage to ensure receipt of essential supplies should this occur. While positive, these measures may not cover all circumstances. Both in the case of emergencies and national security, the best contingency for Alaska's dependence on the Port of Anchorage is having viable alternatives. The Alaska Highway is the sole major highway access to Alaska from Canada and the Lower 48 States. The Highway is a two-lane undivided paved road that spans 2,232 km from Dawson Creek, BC to Delta Junction, Alaska, which is the currently designated terminus of the Alaska Railroad. Here, the Highway also joins the Richardson Highway (Interstate A2), which serves Fairbanks and then connects with the Glenn Highway (Interstate A1) that leads to Anchorage.

Construction of the ACRL would significantly bolster the region's resilience in event of natural disasters as well as national security. The rail link would provide a means of hauling heavy equipment and machinery necessary in such emergencies as well as construction materials and other bulk goods. It could either complement or offset the need for using the Alaska Highway.

Conclusions

In addition to the many other benefits already described in this report, the ACRL offers an opportunity to develop a new rail-tourism experience, which has proven appeal in this fast-growing travel market. In so doing, it could also encourage additional overnight stays in the Yukon and incubate other attractions highlighting the region's gold rush history, First Nations' culture and environmental features.

The ACRL has the added benefit of stimulating economic and industrial activity as well as population growth but, at the same time, neutralizing the GHG impacts of this increased activity because of its ability to lower GHG emissions for the transport of both inbound and outbound goods compared to currently used transport modes. The ACRL also offers the opportunity to minimize intrusion and disruption into previously undeveloped areas because of its reduced footprint and controlled access that deters public trespass and preserves the territorial sovereignty and environmental values of these virgin territories.

Construction of the ACRL would also contribute a valuable contingency measure in the event of a natural disaster and bolster national security by providing an alternative supply route in the case that the Port of Anchorage, which is the primary entry point for the vast majority of all the State's supplies, and other ports were unavailable.

¹⁸⁵ K. Rempfer, *Northern Border, along Arctic, not Southern is what worries NORAD leaders*, Military Times On-Line, February 27, 2019.

7 | CONCLUSIONS

The ACRL is the missing link in the North American rail grid. Its construction will provide valuable additional east-west rail capacity and tidewater access to the Pacific for both Canada and the US, hugely benefitting not only the Yukon and Eastern Alaska regions, into which it will introduce rail transport for the first time, but throughout both countries. The economic benefits of its construction are consistent with the Canadian government's desire to promote Northern development and comparable in significance as those of Canadian Pacific Railway in the 1880's and the St. Lawrence Seaway in the 1950's.

The enormous job and wage creation and tax revenue benefits from construction alone will create an unprecedented stimulus of Northern development. More importantly, the on-going presence of the ACRL will transform the economies of the Yukon, Northeast BC and Eastern Alaska, fundamentally changing and improving the cost structure and economic viability of its mining, forestry and oil and gas industries, fueling employment and population growth and lowering cost of living. At the same time, opening access and expanding this internal market within North America, while increasing access and shortening transport time for exports to/from Asia, will have far reaching national economic benefits in both Canada and the US.

Existence of the ACRL will also reduce the cost and improve the economic viability of Alaska North Slope development, an Alberta rail extension and potential development of the Crest iron ore deposit in the northeast Yukon. In addition, it constitutes a valuable transportation and supply line contingency should the Port of Anchorage and other Alaskan ports be unavailable for any reason.

As the ACRL will generate new economic, industrial and population growth, it should result in higher overall transport demand and rationalization between modes - not a loss of business and revenue in the other transport modes or from existing West Coast ports. Also, because rail generates lower GHG emissions than currently used transport modes, the impact of newly generated growth should be neutralized. In addition, the ACRL offers a reduced footprint and controlled access minimizing intrusion and disruption to previously undeveloped areas.

Investment in the ACRL now is extremely timely as its ability to stimulate mining exploration, development and production in this minerally rich region, directly responds to the expected exponential growth in demand for metals, critical and strategic minerals and rare earths in development of low-carbon technologies as well as other high-tech manufacturing and military uses, which are currently lacking in North America and have no viable substitute.

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ABOUT THE PROJECT TEAM

Shirocca Consulting Ltd.

Shirocca Consulting is an independent consulting practice established by its principal Teresa Watts in 1998. The firm offers strategic advice and consulting services in project development, management, planning and economic assessment and evaluation in the fields of transportation, land development and resource management. Since its inception, the firm has completed a variety of railway projects in Canada and the US, including the Alaska-Canada Rail Link Phase 1, Calgary-Edmonton High Speed Rail and Alaska to Alberta Rail Feasibility Study in association with the Van Horne Institute as well as other projects such as the revitalization of Vancouver Island's Southern Railway and Whistler Passenger Rail projects and various commuter and urban rail projects. In recent years, the firm's activities have increasingly focused on project management and providing strategic advice and review of major projects for senior management, boards and oversight agencies, such as the Auditor General of British Columbia, to ensure both value for money and appropriate risk management.

Peter Wallis Consulting Ltd.

Peter Wallis Consulting is an independent consulting practice established in 2017 specializing in advice on transportation policy and economic development in the fields of transportation, supply chain and logistics. Peter Wallis is the immediate past President and CEO of the Van Horne Institute and recently retired from the role of Vice-Chair of the Canadian Air Transport Security Authority. A seasoned career executive, he has successfully combined leadership roles in government, volunteer organizations, public and private companies and not-for-profit organizations, which have included a range of responsibilities from volunteer, Vice-chair, Chairman and President and CEO. Over the course of his career, he has held senior positions at Canadian Airlines and in Ottawa as Legal Counsel for the Canadian Transport Commission and Executive Assistant to two federal Ministers of Transport. Mr. Wallis is a member of the Law Society of Upper Canada. He is also past President of the Calgary Chamber of Commerce, past Vice-Chairperson of the Calgary Homeless Foundation, past member of the Board of Directors of the Fort McMurray Airport Authority and has served as Chairperson and a member of the Board of Directors of the Calgary Airport Authority. He is the Honorary Consul for Mongolia in Alberta.

University of Alaska (Fairbanks)

The University of Alaska Fairbanks (UAF) is a Land, Sea and Space Grant university and international centre for research, education and the that arts, emphasizing the circumpolar North and its diverse peoples. UAF integrates teaching, research and public service as it educates students for active citizenship and prepares them for lifelong learning and careers. The University's core themes are: to create, and disseminate new knowledge, insight, technology, artistic and scholarly works; to prepare

Alaska's career, technical and professional workforce; to connect Alaska native, rural and urban communities by sharing knowledge and ways of knowing; and, to engage Alaskans through outreach for continuing education and community and economic development. The UAF has partnered with the Van Horne Institute on several projects with cross-border interests over many years.

Van Horne Institute

The Van Horne Institute was incorporated federally in 1991 as a not-for-profit organization and is affiliated with the University of Calgary, University of Alberta, SAIT Polytechnic and Athabasca University. The Institute is recognized in Canada and internationally as a leading institute of public policy, education and research in transportation, supply chain and logistics, and regulated industries. The Institute was established to assist industry, governments and the public in addressing transportation and logistics issues relevant to the well-being and growth of industry and commerce. Efficient and low-cost transportation and logistics services are essential to both industry and the public in our geographically large country, so the evolution of sound industrial strategy, public policy and progressive legislation and regulations are increasing in importance as business moves further towards globalization. Industry needs to be innovative to compete. The Institute contributes to this competitive challenge through its education and public policy research activities. The Institute has partnered with University of Alaska Fairbanks in research on several major transportation and logistics projects over many years.