Yukon Mining Sector Profile

Component 1: Global Trends & Canadian Overview

1 Mining Sector: Global Trends & Canadian Overview

The health of Yukon's mining sector fundamentally relies on the demand for minerals and therefore their prices. The demand for most minerals is strongly linked to economic growth and prices are set in world markets. The ability of mining companies to successfully find, build and operate a mine, however, is also dependent on their ability to find financing, control costs and their ability to adapt to societal expectations.

In this component of the Yukon Mining Sector Profile we:

- Provide an overview of national and international economic growth projections;
- Lay out demand patterns and trends in prices for the minerals that Yukon produces or is likely to produce in the near future;
- Provide some short and medium term price forecasts for those minerals;
- Discuss the financing and cost issues facing the mining sector; and,
- Discuss mining and sustainability.

Note that this component is not intended to directly address how economic performance in other areas, future demand and supply, performance of prices and issues related to financing are likely to impact Yukon going forward. For an assessment of those likely impacts please see the risks and opportunities sections developed in the Yukon Mining Sector Overview component and in the Summary Report.

1.1 Economic Growth

Following the severe global downturn that began in 2008 recovery has been generally slow and economic growth highly uneven. Fears of a second global downturn have persisted as different countries and regions have struggled.

The International Monetary Fund is expecting overall economic growth to recover from its slower rates of growth in 2012 through 2013 and 2014 as shown in Table 1.

Table 1: Selected Economic Outlook Projections, International Monetary Fund

	2011	2012	2013	2014
World Output	4.0	3.2	3.3	4.0
Advanced Economies	1.6	1.2	1.2	2.2
United States	1.8	2.2	1.9	3.0
Euro Area	1.4	–0.6	–0.3	1.1
Japan	–0.6	2.0	1.6	1.4
Canada	2.6	1.8	1.5	2.4
Korea, Taiwan, Hong Kong, Singapore	3.3	1.8	2.5	3.4
Emerging Market and Developing Economies	6.4	5.1	5.3	5.7
China	9.3	7.8	8.0	8.2
India	7.7	4.0	5.7	6.2
Brazil	2.7	0.9	3.0	4.0
Mexico	3.9	3.9	3.4	3.4

Source: International Monetary Fund World Economic Outlook Update April 2013

In recent years, economic growth in emerging and developing economies such as China and India has been much more robust than in advanced economies. However, the IMF does not expect growth in these economies to return to the higher growth rates of 2010 and 2011 before 2015. The projection for gradually strengthening world output is dependent on an economic recovery taking firm hold in the Euro Area, a gradual re-balancing of China's economy toward more private consumption and the US avoiding short term fiscal cutbacks.

In Canada economic growth has been uneven since the economic downturn of 2008. According to Statistics Canada figures[1] the country's real GDP growth was 2.1% in 2007 before dropping to 1.1% in 2008 and then shrinking by 2.8% in 2009. Both 2010 and 2011 brought a recovery of 3.2% and 2.6% real growth respectively but 2012 saw it drop back to 1.8%.

1.2 Demand and Price Trends: Key Minerals

It is unarguable that mineral prices are highly cyclical, and swings in nominal prices can be large and abrupt. The economic literature, however, is not entirely clear on how the long-term real prices move, and why. In general it has been accepted over the past century that these price cycles have taken place against a backdrop of either stagnant or downward trending real prices for commodities in general, and minerals in particular, as large-scale extraction has become much more economically efficient. This argument for generally stagnant or declining real prices has been strongly challenged recently with new analysis such as that of David Jacks.[2] Jacks' work shows that gold and silver have been big gainers in real price terms between 1900 and 2011; zinc has been a big loser in real price over the same period, lead has shown effectively no trend at all since 1975 and copper was in real decline between 1900 and 1950 but has been on an overall upward trend between 1950 and 2011.

Since demand and prices for many minerals began to rise in the early 2000's there has been much talk in the mining and financial industries that the world has entered into a mineral super-cycle or even that we are now in a new and different era where minerals will continue to appreciate in price due to ever-increasing demand.[3] The only things we can be sure of over the long term are that:

- Long-run trends in prices and demand are not fixed; they shift in response to new technology, economic growth and other underlying determinants;
- Mineral prices over the long term will reflect the on-going tug of war between exploration, deposit depletion and technological change; and,
- There is no reason to expect that the current balance between exploration, deposit depletion and technological change will remain unchanged.[4]

1.2.1 Copper

Copper has been mined and used for thousands of years in different applications but world production has been climbing strongly since the 1920s and soaring since the 1990s. Table 2 shows recent trends in copper production and prices.

1 Statistics Canada. Canadian Economic Accounts. Available at: http://www.statcan.gc.ca/daily-quotidien/130301/t130301a005-eng.htm
2 Jacks, David. 2013.
3 Recent article titles include: "Mining Super-Cycle is the New Normal" "Commodity Super-Cycle will last at least another decade." Etc.
4 Drawn from Tilton, John 2003 and Cuddington, John. 2012

Table 2: World Copper Production and Price, 2006 through 2012

	2006	2007	2008	2009	2010	2011	2012
World mine production (thousands of tonnes)	14,984	15,482	15,531	15,898	16,020	16,023	15,180
World mine capacity (thousands of tonnes)	16,628	17,900	18,551	19,254	19,560	19,824	18,703
Mine capacity utilization	90.1%	86.5%	83.7%	82.6%	81.9%	80.8%	81.2%
Price (US$ per tonne)	$6,810	$7,119	$6,899	$5,201	$7,560	$8,772	$7,956
Price (US$ per pound)	$3.09	$3.23	$3.13	$2.36	$3.43	$3.98	$3.61

Source: International Copper Study Group[5]
Notes:
2011 data is preliminary
2012 data is preliminary from January through November but production was running 4% higher than 2011
Price is Comex average over applicable time period

World mine production continued to increase through the severe world economic downturn of 2008 and 2009. Copper's price did drop sharply in 2009 however, before recovering in 2010. It is interesting to note that world mine capacity has increased more quickly than production resulting in a decrease in mine capacity utilization from over 90% in 2006 to 81.2% in 2012.

Approximately 65% of all copper produced is used in electrical applications, wire, cable, electric motors etc. due to its very high electrical conductivity. Construction — mostly plumbing but also roofing and cladding — uses another 25% of copper production. The other major use for copper is in automotive parts, which accounts for a further 7% of copper production.[6]

The secondary production of copper (recycling) can and does meet a significant amount of demand for the metal. The United States Geological Survey reports that secondary production of copper in the US accounted for approximately 33% of US consumption in 2012.[7]

With these uses it is clear that demand for copper, and therefore its price, is tightly linked to economic growth and development. Growth in China is particularly crucial as that country is responsible for approximately 40% of world demand in 2012.[8]

1.2.2 Zinc

Zinc has only been recognized and used as a stand alone metal in the last few centuries but has, as an essential component of brass (an alloy of copper and zinc), been used for thousands of years. Currently 50% of world zinc production is use in galvanizing steel — from nails to roofing to chain link fencing — to make it corrosion resistant. Approximately 17% of production is used in die casting a very wide array of mostly consumer goods and another 17% is still used to produce brass and bronze alloys.[9] Table 3 shows recent trends in zinc production and price.

5 Available at: http://www.icsg.org/index.php/component/jdownloads/finish/165/871
6 Copper Development Association. Available at: http://www.copperinfo.co.uk/applications.shtml
7 USGS Mineral Commodities Summary 2013. p.48. Available at: http://minerals.usgs.gov/minerals/pubs/commodity
8 International Copper Study Group. Available at: http://www.icsg.org/index.php/component/jdownloads/finish/113/1126
9 International Zinc Association. Available at: http://www.zinc.org/basics/zinc_uses

Table 3: World Zinc Production and Price, 2007 through 2012

	2007	2008	2009	2010	2011	2012
World mine production (thousands tonnes zinc)	11,201	11,882	11,608	12,486	12,948	13,604
Price (US$ per tonne)	$3,284	$3,240	$1,873	$1,653	$2,160	$2,182
Price (US$ per pound)	$1.49	$1.47	$0.85	$0.75	$0.98	$0.99

Source: International Lead and Zinc Study Group for production[10] and World Bank[11] for price

Zinc production has risen by 21% from 2007 through 2012 while its price has dropped by 34% over the same period. As with copper, the uses of zinc are tightly tied to construction and manufacturing and so demand is highly dependent on economic growth and development. Unfortunately, the International Lead and Zinc Study Group — unlike the International Copper Study Group — does not track world mine capacity and capacity utilization.

The secondary production of zinc (recycling) can and does meet a significant amount of demand for the metal. The United States Geological Survey reports that secondary production of zinc in the US accounted for approximately 57% of US consumption in 2012.[12]

1.2.3 Lead

Lead resources are widespread and relatively easy to mine and use. Lead has therefore been commonly used for a wide variety of purposes for thousands of years. Rome was by far the biggest producer and user of lead in pre-industrial times, using it especially for plumbing.

Currently the overwhelming majority of lead (77%) is used in the production of batteries. About 8% of lead is used in paint pigments while the remainder is used for a wide variety of uses from cable sheathing to ammunition.[13] Table 4 shows recent trends in lead production and price.

Table 4: World Lead Production and Price, 2007 through 2012

	2007	2008	2009	2010	2011	2012
World mine production (thousands tonnes lead)	3,657	3,805	3,833	4,327	4,645	5,178
Price (US$ per tonne)	$2,579	$2,094	$1,719	$2,160	$2,402	$2,050
Price (US$ per pound)	$1.17	$0.95	$0.78	$0.98	$1.09	$0.93

Source: International Lead and Zinc Study Group for production[14] and World Bank[15] for price

World lead mine production jumped by 42% between 2007 and 2012 while its price fell by 21% over the same period. Unfortunately, the International Lead and Zinc Study Group — unlike the International Copper Study Group — does not track world mine capacity and capacity utilization.

Lead is relatively easy to recover and re-use from its primary use in lead-acid batteries. Therefore secondary production through recycling can meet a significant amount of demand for refined

10 Available at: http://www.ilzsg.org/static/statistics.aspx?from=2
11 Available at: http://databank.worldbank.org/data/
12 USGS Mineral Commodities Summary 2013. p.188. Available at: http://minerals.usgs.gov/minerals/pubs/commodity
13 International Lead and Zinc Study Group. Available at: http://www.ilzsg.org
14 Available at: http://www.ilzsg.org/static/statistics.aspx?from=2
15 Available at: http://databank.worldbank.org/data/

lead. The United States Geological Survey for example, reports that secondary production of lead in the US accounted for approximately 80% of US consumption of lead in 2012.[16]

1.2.4 Gold

Gold is a highly valued precious metal that has been used for decorative purposes and as a store of value for millennia. According to the World Gold Council,[17] a total of 171,300 tonnes of gold has been mined since people first began to value the metal. Over 90% of that total has been mined since 1850.

For 2008 through 2012, 49% of gold produced was for jewellery, 28% was turned into bars and coins, 11% was for industrial and technology uses, 9% was used to back direct investment via Exchange Traded Funds and similar financial instruments, and 4% went to central bank direct net purchases. India is the largest consumer of gold in the world, accounting for approximately 23% of total consumption in 2012.[18] Table 5 shows recent trends in gold production, demand and price.

Table 5: Gold Production, Demand and Price, 2006 through 2012

	2006	2007	2008	2009	2010	2011	2012
World mine production (tonnes)	2,370	2,360	2,290	2,450	2,560	2,660	2,700
World demand (tonnes)	3,077	3,104	3,720	3,593	4,147	4,582	4,405
Price (US$ per oz)	$604	$697	$872	$973	$1,225	$1,569	$1,670

Sources: United States Geological Survey[19] for production, World Gold Council[20] for demand, and World Bank for price.[21]
Note: The difference between mine production and demand is accounted for through recycled gold.

Because almost all of the demand for gold is connected to the idea of it as a store of value (much of the gold jewellery produced is seen in the same light as gold bullion or coins) its price has very little to do with economic or industrial growth and development. Indeed, economic hard times can drive the price higher as appears to have happened since the global economic downturn of 2008.

1.2.5 Silver

Like gold, silver is a precious metal that has been used for decorative purposes and as a store of value for millennia. Industrial applications for silver include its use in window coatings, mirrors, in specialized electronics due to its very high conductivity and in small high value batteries. Over the past 15 years the use of silver in photo developing has declined precipitously as digital cameras have taken over the photography market.

In 2011 according to the Silver Institute industrial applications accounted for 47% of silver demand, jewellery 15%, coins 11%, and photography 6.5% (compared to 31% of demand in

16 USGS Mineral Commodities Summary 2013. p.90. Available at: http://minerals.usgs.gov/minerals/pubs/commodity
17 http://www.gold.org
18 World Gold Council. Available at: http://www.gold.org
19 Available at: http://www.usgs.gov/
20 Available at: http://www.gold.org
21 Available at: http://databank.worldbank.org/data

1998) and silverware 4.5% of total demand.[22] Table 6 shows recent trends in silver production, demand and price.

Table 6: Silver Production, Demand and Price, 2006 through 2012

	2006	2007	2008	2009	2010	2011	2012
World mine production (millions ounces silver)	641.1	665.9	683.6	716.1	751.4	761.6	746.5
World demand (millions ounces silver)	925.6	911.4	915.0	931.7	1,074.7	1,040.6	-
Price (US$ per oz)	$11.56	$13.39	$15.00	$14.64	$20.15	$35.22	$31.14

Sources: The Silver Institute for mine production and demand statistics[23] and the World Bank[24] for price.
Notes: Difference between mine production and demand is accounted for through recycled silver. 2012 mine production is an estimate.

1.2.6 Tungsten

Tungsten is a relatively rare and very hard metal that is found only in chemical compounds mostly in wolframite and scheelite ores. Most tungsten production is used to make cemented carbide (also called hardmetal) that in turn is used to make super hard materials including cutting and shaping tools of all kinds. Cemented carbide accounts for approximately 60% of all tungsten consumption according to the International Tungsten Industry Association[25] and steels and alloys make up most of the rest of consumption. Like many other metals, recycling or secondary production makes a significant contribution to meeting demand. In 2010 about 25% of demand was met through secondary production. Table 7 shows recent trends in tungsten production and price.

Table 7: Tungsten Production and Price, 2006 through 2012

	2006	2007	2008	2009	2010	2011	2012
World mine production (tonnes of tungsten content)	73,300	54,500	55,900	61,300	68,800	73,100	73,000
Price (US$ per MTU WO_3)	$260	$250	$250	$210	$250	$425	$375

Sources: United States Geological Survey[26] for production and International Tungsten Industry Association[27] for price.
Notes: Price is based on a Metric Ton Unit (MTU) which contains 10 kg of WO_3 (7.93 kg of tungsten). Price is the European free market APT.

Tungsten is an unusual commodity with world supply being utterly dominated by Chinese production (approximately 85% in 2010 and 2011). China is also the world's leading tungsten consumer. In its 2013 Mineral Commodities Summary, the US Geological Survey writes:

> "China's Government has regulated its tungsten industry by limiting the number of exploration, mining, and export licenses; limiting or forbidding foreign investment; imposing

22 Silver Institute. Available at: http://www.silverinstitute.org/site/supply-demand/
23 Available at: http://www.silverinstitute.org/site/supply-demand/
24 Available at: http://databank.worldbank.org/data
25 http://www.itia.info/
26 Available at: http://www.usgs.gov/
27 http://www.itia.info/tungsten-prices.html

> constraints on mining and processing; establishing quotas on production and exports; adjusting export quotas to favour value-added downstream materials and products; and imposing export taxes on tungsten materials."[28]

The pricing of tungsten is also highly unusual. Unlike other commodities there are a number of prices and they can vary widely. For example in 2011 the APT Europe price was $425/MTU, the FeW Rotterdam price was $385/MTU, the APT (USA) price was $365/MTU and the Wolframite price was $150/MTU.

1.2.7 Molybdenum

Molybdenum is primarily used as an alloy in steel making and its versatility in that application, along with its availability, has led to the development of new uses for the metal. Molybdenum can be the primary product at a mine but it is more commonly recovered as a by-product at copper mines. World mine production is shown in Table 8.

Table 8: Molybdenum Production, 2006 through 2012

	2006	2007	2008	2009	2010	2011	2012
World mine production (tonnes of molybdenum content)	184,000	205,000	212,000	221,000	242,000	264,000	250,000

Source: United States Geological Survey

In 2012 China was the source of 42% of primary molybdenum production with the United States producing 23%. Canada produced 4% of the world's molybdenum in 2012.[29]

Molybdenum is priced in US dollars per pound or per tonne of molybdenum oxide. The price of the metal has been extraordinarily volatile over the past decade, rising 15-fold from a price of under $3.00 per pound in 2000 to over $45.00 per pound in 2005. In 2006 and 2007 the price varied between $25.00 and $35.00 per pound but plunged to under $10.00 per pound by late 2008. Since then it has recovered somewhat. The 2011 average London Metal Exchange price for molybdenum was $15.59 per pound, and the 2012 average price fell to $12.84 per pound.[30]

1.2.8 Demand and Price Forecasts: Short and Medium Term

Demand and price forecasts, even over the short and medium term, are fraught with uncertainty. In the sections below we largely present forecasts from the World Bank with some comparison and discussion from other sources.

1.2.8.1 Copper Forecasts

According to the International Copper Study Group (ICSG) world demand for refined copper is expected to exceed production of refined copper by about 400,000 tonnes in 2012 as supply will continue to lag behind the growth in demand. This would be the third consecutive year of production deficit. In 2013, however, increased output from new and existing mines could reverse the 3-year trend, and refined copper production could exceed demand by an amount approximately equal to the 2012 shortfall. The ICSG hedges these forecasts with caveats ranging from a world economic slowdown to potential production shortfalls from labour unrest. The

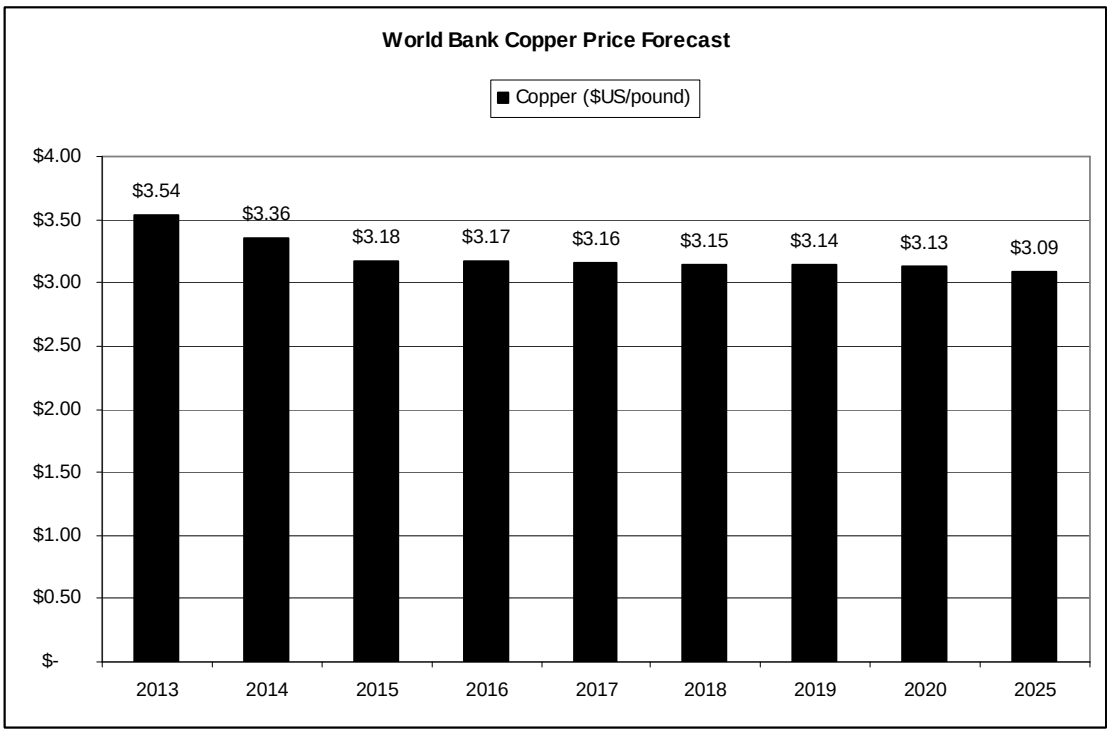
28 USGS Mineral Commodities Summary 2013. p.177. Available at: http://minerals.usgs.gov/minerals/pubs/commodity/tungsten/mcs-2013-tungs.pdf
29 USGS Mineral Commodities Summary 2013. p.107
30 London Metal Exchange. Available at: http://www.lme.com/

largest caveat however, is that the ICSG uses an apparent copper usage calculation for China (the world's largest consumer of copper) based only on reported data. In China, changes in unreported stocks can be significant.[31]

BMO Capital Markets forecast that the average 2013 price for copper will be US$3.50 per pound and the average price will rise slightly to US$3.60 per pound in 2014.[32] BMO anticipates that demand for copper will be supported by strengthening economies in North America and emerging economies. However, rising supply from new mines, including the mega Oyu Tolgoi project in Mongolia and increasing production in Chile, coupled with near record high inventories of copper (650,000 tonnes) being held at major exchanges will balance that demand.[33]

The BMO forecasts for 2013 and 2014 are higher than the short-term World Bank forecasts as shown in Figure 1. The World Bank is forecasting a gradual decline in the nominal price of copper out to 2025 with demand rising at 2.5% per annum but overall high prices bringing on enough supply over the longer term (along with substitution away from the metal and increased recycling) to reduce nominal prices over the next 12 years.

Figure 1: World Bank Copper Price Forecast, in Nominal Dollars, 2013 through 2025



Source: World Bank, Development Prospects Group[34]

31 International Copper Study Group. Available at: http://www.icsg.org/index.php/component/jdownloads/finish/113/1126
32 BMO Capital Markets Economic Research. Available at: http://www.bmonesbittburns.com/economics/goods/current/Default.asp?article=2
33 BMO Capital Markets Economic Research. Available at: http://www.bmonesbittburns.com/economics/goods/201302/goods.pdf
34 Available at: http://www.worldbank.org/prospects/commodities

1.2.8.2 Zinc Forecasts

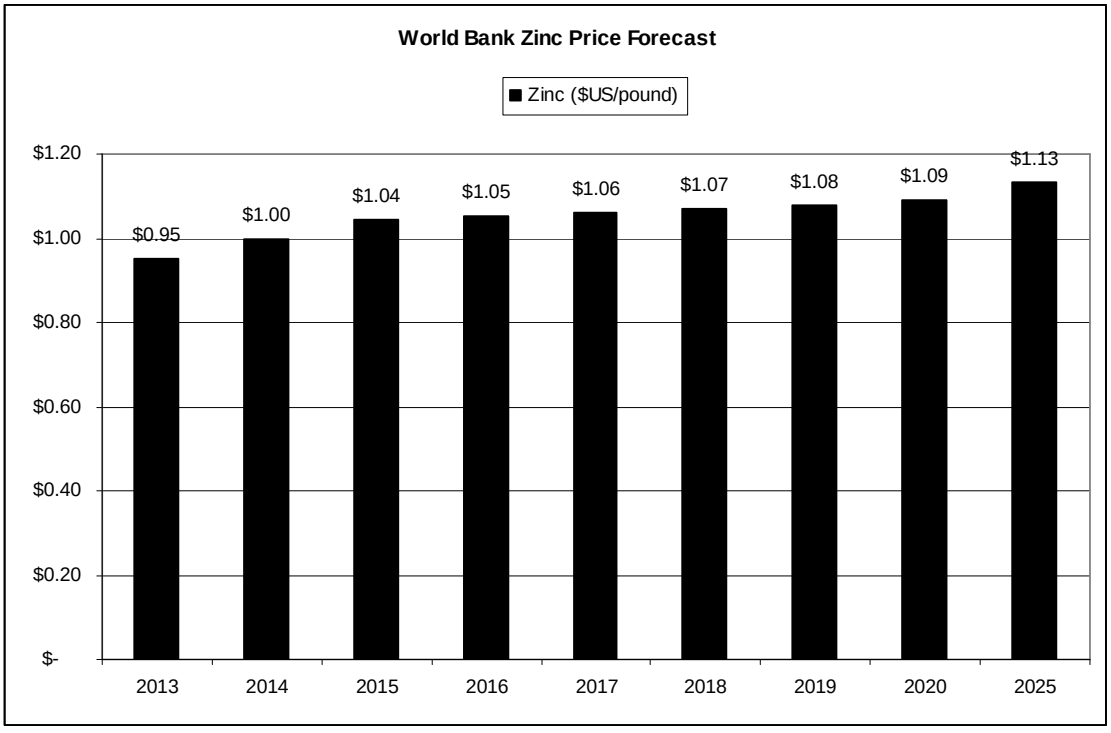
BMO Capital Markets forecast that the average 2013 price for zinc will be US$0.91 per pound and the average price will rise to US$0.99 per pound in 2014. The World Bank is also forecasting a rise in the price of zinc both in the short and medium terms as shown in Figure 2.

The International Lead and Zinc Study Group offer the following forecast for zinc mine supply:

> "Global zinc mine supply is forecast to increase 5% to 13.60 million tonnes in 2012; due largely to increases in China, where output is forecast to rise by 13.7%. In 2013, global production is anticipated to grow 2.7% to 13.96 million tonnes, with additional output from Australia, Burkina Faso, Kazakhstan, Mexico, Portugal and the United States."[35]

The Study Group also reports that — based on forecasts supplied by the Group's member countries — the global supply of refined zinc exceeded demand by 153,000 tonnes in 2012 and that gap will grow to 293,000 tonnes in 2013. This would indicate a likely fall in price rather than the rise forecast by BMO and the World Bank.

Figure 2: World Bank Zinc Price Forecast, in Nominal Dollars, 2013 through 2025



Source: World Bank, Development Prospects Group[36]

35 International Lead and Zinc Study Group. Available at: http://www.ilzsg.org/generic/pages/list.aspx?table=document&ff_aa_document_type=N&from=2
36 Available at: http://www.worldbank.org/prospects/commodities

1.2.8.3 Lead Forecasts

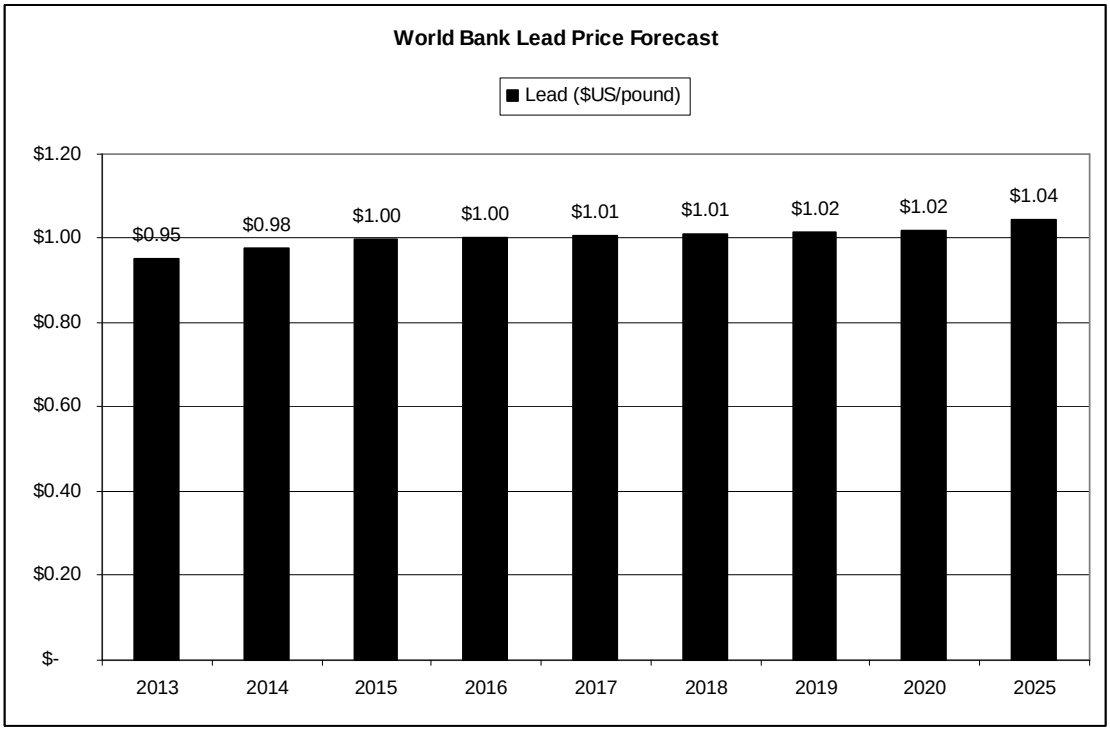
Lead is not a metal that many forecasters regularly look at. The International Lead and Zinc Study Group, however, offer the following:

> "Global **lead mine production** is forecast to increase by 10.9% in 2012 to 5.21 million tonnes and 2.8% in 2013 to 5.36 million tonnes due to increased production in China. Output in the rest of the world will be relatively stable as increases in Mexico, Peru and Russia are offset by a reduction in Canada."[37]

So although demand and consumption of lead increased by 3% in 2012 the Group also anticipates that refined lead production will exceed consumption by approximately 180,000 tonnes in 2013. 2012 also saw a build up of lead stocks being held at the London Metal Exchange and producer warehouses. All of the above indicates that the price of lead is likely to decline over the next year and more.

However, in contrast, the World Bank is expecting the price of lead to rise in both the short and medium terms as is shown in Figure 3.

Figure 3: World Bank Lead Price Forecast, in Nominal Dollars, 2013 through 2025



Source: World Bank, Development Prospects Group[38]

37 International Lead and Zinc Study Group. Available at: http://www.ilzsg.org/generic/pages/list.aspx?table=document&ff_aa_document_type=N&from=2
38 Available at: http://www.worldbank.org/prospects/commodities

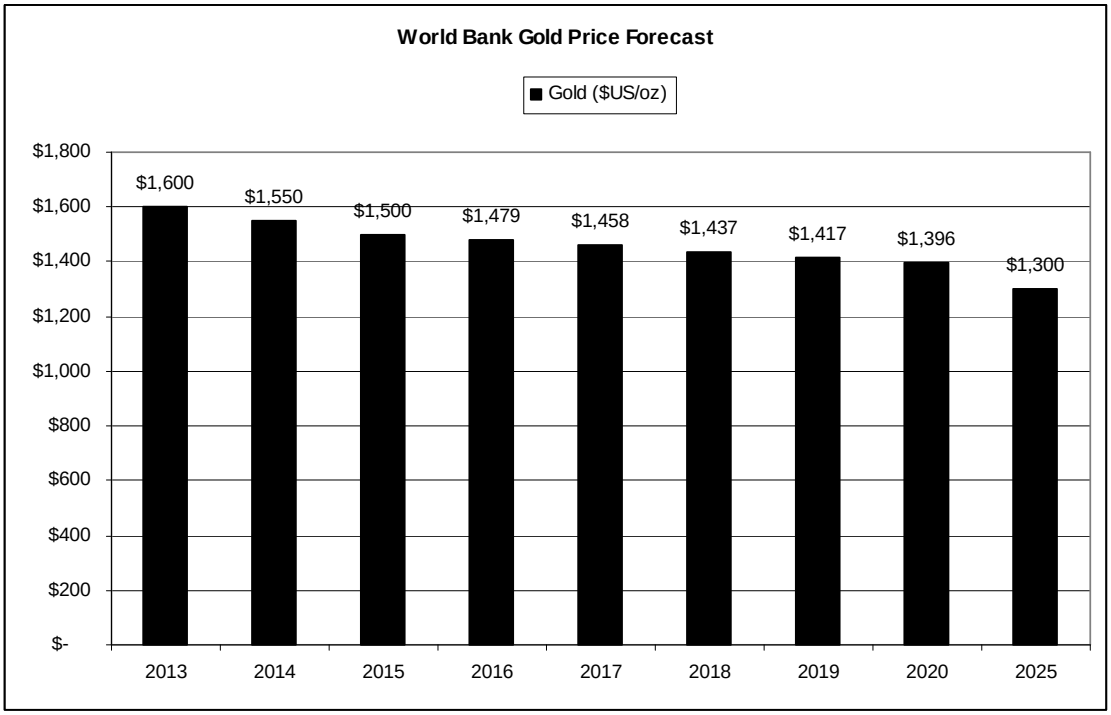
1.2.8.4 Gold Forecasts

The World Bank is expecting a steady and significant overall drop (19%) in the price of gold out to 2025 as is shown in Figure 4. The forecast is based on expected increases in supply as mines are brought on to take advantage of current prices, the expectation that China will increase its production of the metal, and that the perceived need for a safe haven investment will decline.

The abrupt collapse in the price of gold in mid-April 2013 (gold futures for June 2013 delivery closed at US$1,361 per ounce on April 15, 2013)[39] may be temporary. It may also indicate that the World Bank's forecast for a gradual decline in price is too optimistic. If that is the case then many gold producers will be quickly faced with the need to re-examine high cost operations and attempt to curtail costs:

> "RBC estimates the average all-in costs for North American gold producers at about $1,200 an ounce. "We would expect all the gold producers in our coverage universe to cut all discretionary expenses, cut capital spending sharply, defer new capital development programs and in some cases cut dividends" at that level."[40]

Figure 4: World Bank Gold Price Forecast, in Nominal Dollars, 2013 through 2025



Source: World Bank, Development Prospects Group[41]

39 http://www.businessweek.com/articles/2013-04-15/the-price-of-gold-is-crashing-dot-heres-why#r=rss
40 Hill, Liezel and Eric Lam. Bloomberg. "Gold Miners Approaching $1,300 Pain Threshold". Available at: http://www.bloomberg.com/news/2013-04-16/gold-miners-approaching-1-300-pain-threshold.html
41 Available at: http://www.worldbank.org/prospects/commodities

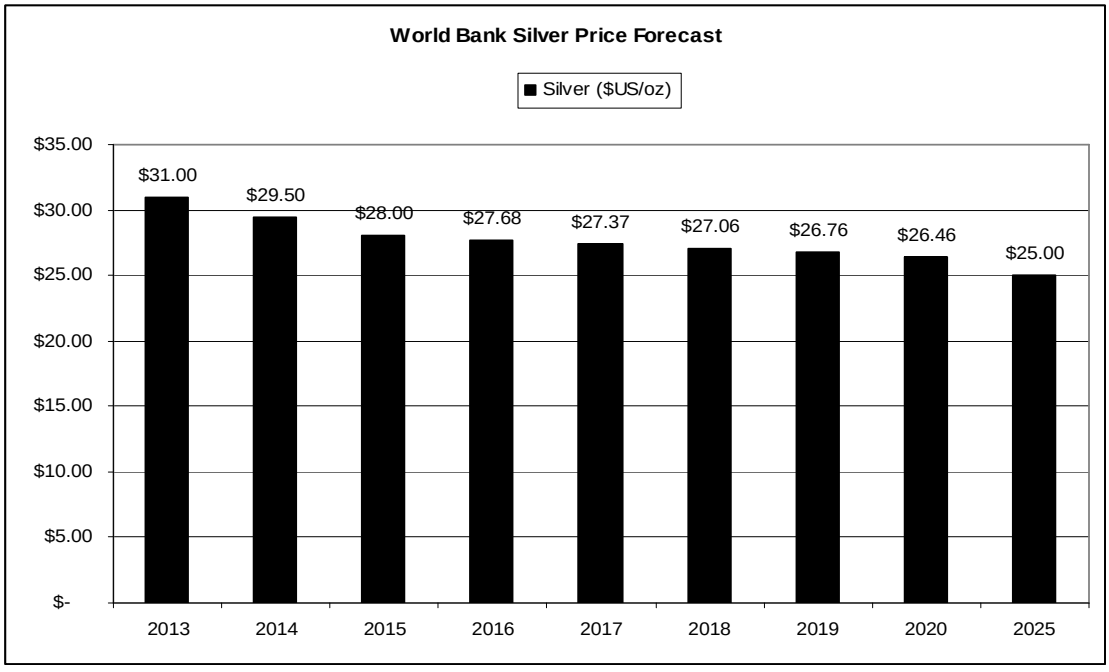
BMO Capital Markets, like other forecasters, has quickly changed its outlook for gold following its abrupt price decline in April 2013. In early April BMO forecast that the average 2013 price for gold would be US$1,681 per ounce and that the average price would fall to US$1,634 per ounce in 2014. As of May 22, 2013, however, BMO forecasts a gold price of US$1,460 per ounce for 2013 (13.5% lower than it forecast less than two months before) and US$1,390 per ounce in 2014 (14.9% lower). According to reports[42] Goldman Sachs is cutting their price forecasts on the assumption that the economic recovery from the 2008 global downturn will continue to strengthen and interest rates will rise, resulting in lower demand for gold as a safe haven investment. Their long-term forecast for gold (US$1,200 per ounce) is based on the same reasoning.

The World Gold Council is expecting demand for gold in India, the world's largest market, to decline somewhat in 2013 due to both ongoing high prices and a recent rise in the tariff on gold imports. The Council is expecting demand in China to remain stable while overall demand for gold in the industrial and electronics sectors to continue to decline marginally.[43]

1.2.8.5 Silver Forecasts

The World Bank is expecting the price of silver to follow a similar trajectory to that of gold over the next 12 years, with nominal prices dropping by about 20% over the period. The forecast is based on reasoning similar to that of gold, with new production coming on stream in response to high prices and a decline in the amount of safe-haven investment.

Figure 5: World Bank Silver Price Forecast, in Nominal Dollars, 2013 through 2025



Source: World Bank, Development Prospects Group[44]

42 Proactive Investors. Available at: http://www.proactiveinvestors.com/companies/news/40797/goldman-cuts-gold-price-forecasts-as-metal-extends-decline-miners-weigh-40797.html
43 World Gold Council. Available at: http://www.gold.org
44 Available at: http://www.worldbank.org/prospects/commodities

In early April 2013, BMO Capital Markets forecast that the average 2013 price for silver would be US$31.79 per ounce and that the average price would fall to US$29.68 per ounce in 2014, very similar to the World Bank's short term forecasts. As of May 22, 2013, however, BMO has substantially down shifted its forecast to US$25.47 per ounce for 2013 and US$23.88 per ounce in 2014.

The Silver Institute is forecasting a rebound in demand for industrial silver in 2013, enough to recoup the demand decline in the sector in 2011 and 2012, and that industrial demand for silver will reach record highs in 2014.[45] Demand for silver as an investment, however, can expect to follow gold as economic conditions improve and interest rates rise. This decline in investment demand also underpins BMO's forecast for a decline in price in 2014.

1.2.8.6 Tungsten Forecasts

Forecasting what the demand and price for tungsten will be is a matter of forecasting what the government of China will do and tungsten is not a metal that many forecasters look at.

One forecast, from Amadee and Company Inc., provides the following insight:

> "Chinese primary tungsten production will be curbed to half its historical growth rate going forward. Further, very few tungsten mines outside of China are expected to be in production, or close to beginning production, during the next few years."[46]

Therefore Amadee and Company expect supply of primary tungsten to be curtailed and therefore its price to rise over the next few years.

The USGS forecast is that China will continue to make efforts to control production from unofficial mines, continue to use quotas to control mine production, and continue to limit or prevent the export of upstream tungsten products in order to meet increasing domestic demand.

In contrast with Amadee and Company, the USGS expects that:

> "In the next few years, mine production from outside China is expected to increase. Numerous companies worked towards developing tungsten deposits or restarting tungsten production from inactive mines in Asia, Australia, Europe, and North America. Scrap was an important source of raw material for the tungsten industry. In 2011 and 2012, U.S. net import reliance for tungsten was lower than that of prior years owing to an increase in scrap consumption (secondary production)."[47]

With the anticipated increase in both primary and secondary supply outside of China the price of tungsten will likely drop somewhat.

1.2.8.7 Molybdenum Forecasts

Like tungsten, forecasting the demand and price for molybdenum is largely a matter of forecasting how much production in China will be pushed and how much of the metal the Chinese government will stockpile. China's mine production of molybdenum has increased from

45 Silver Institute. Available at: http://www.silverinstitute.org/site/wp-content/uploads/2012/11/OutlookSilverDemand.pdf
46 http://www.giiresearch.com/report/ambe252362-tungsten-markets-competitors-opportunities.html
47 USGS Mineral Commodities Summary 2013. p.177. Available at: http://minerals.usgs.gov/minerals/pubs/commodity/tungsten/mcs-2013-tungs.pdf

44,000 tonnes in 2006 to 105,000 tonnes in 2012 according to the USGS.[48] And the country has gone from a major exporter to a net importer of molybdenum.

RBC Capital Markets forecast trends for molybdenum in early 2012:

> "We estimate demand grew by 6.2% in 2011, and we forecast growth of 8.4% in 2012 and 8.8% in 2013, before settling back to trend growth of a little over 5.0% in 2014 and 2015.
>
> "We forecast a dramatic acceleration in mine production growth throughout our forecast period, as new projects, both primary and secondary, come on stream. After rebounding strongly in 2010, we estimate that global mine production declined by 3.0% in 2011. We forecast growth of 5.0% in 2012, 3.4% in 2013, 8.6% in 2014 and 8.9% in 2015.
>
> "We estimate that the market was in surplus for the fourth year in a row in 2011. However, we expect the market to move into deficit in the second half of 2012 and become very tight in 2013 and 2014. Our analysis continues to suggest that projects delayed in the 2008/2009 downturn will not allow supply to keep up with the growth in demand in the medium term.
>
> "We forecast deficits of 2 Mlb in 2012, 34 Mlb in 2013, and 15 Mlb in 2014. Assuming that current production plans are met, we expect the market to face a large and growing surplus beginning in 2015 and beyond.
>
> "We remain quite positive on the prospects for significant molybdenum price increases over the next two to three years… We forecast an average price of $17.50/lb in 2012, rising to $25.00/lb in 2013 and $20.00/lb in 2014, before falling back to $15.00/lb in 2015 in the face of our forecast growing surplus. Our long-term price forecast remains $11.00/lb in 2011 US$ terms."[49]

The RBC price forecasts have not held up especially well thus far, with the actual average 2012 price of US$12.84 per pound being well below the forecast price of $17.50 per pound.

1.3 Financing and Costs

The global mining industry has experienced a boom period where the seemingly insatiable demand for many metals has driven prices ever higher. Along with those high prices came ever escalating costs as the demand for equipment, skills and labour outstripped the supply within the industry. The industry and financial press has been and continues to be full of accounts of how project costs have soared far beyond initial estimates resulting in delays, cancellations, and stock price collapses. A handful of headlines, all from February 2013, from the Northern Miner[50] provide an illustration:

- Banro shares plummet as CEO exits, costs rise at Namoya
- Capital costs overruns Part III: Where are the owners in all this?
- San Gold sinks on higher costs, lower guidance
- Iamgold shares fall 15% on higher costs

48 USGS Mineral Commodities Summary 2007 and 2013
49 RBC Capital Markets. Quoted in: International Mining. Available at: http://www.im-mining.com/2012/01/27/nickel-copper-molybdenum-and-zinc-demand-all-trending-up/
50 Available at: www.northernminer.com

1.3.1 Costs

Brebner and Fu, writing for Commodities Now[51] estimate that cost inflation in the mining and metals industry world-wide in 2011 was between 10% and 15% while the annual average was between 5% and 7% over the past decade. The effect is:

> "As miners push to grow production, supply chain cost pressures are beginning to escalate. Cost inflation has reached unprecedented levels with record high and rising industry cost components now beginning to threaten the medium-term supply outlook."[52]

For the Yukon's mining sector, the following are important in driving costs:

- The rise of the Canadian dollar against its US counterpart. Apart from a dip in 2008 and 2009, the Canadian dollar has been steadily appreciating against its US counterpart and has now been oscillating around par in 2011 and 2012. Companies operating in Canada pay most of their costs in Canadian dollars and currency appreciation adds to those costs relative to operating in other jurisdictions.
- The rise in the price of diesel fuel. According to the Yukon Bureau of Statistics, the retail price of diesel fuel has risen by 84%, from $0.735 per litre to $1.351 per litre, in Whitehorse between 2002 and 2011.[53] Mining operations have faced a similar percentage rise in the wholesale cost of fuel. This increase is especially significant for those operations that rely, or plan to rely on diesel generated electricity for their operations.
- The rise in industry labour costs. Statistics Canada reports that the mining and oil & gas industries in Canada saw their hourly labour costs rise by 20% between 2008 and 2012. This is nearly double the 10.5% increase across all industries.[54]

1.3.2 Financing

Since the global economic downturn of 2008 the industry has faced an increasing challenge in finding the financing required to build mines. This has been especially true for the junior sector where companies can very rarely finance further mine development from the cash flow of existing operations as many of the larger firms can. Most investors' appetite for risk — and junior mining companies are renowned as a high risk investment — diminished or vanished altogether as share prices tumbled.

The Toronto stock exchanges (TSX and TSX Venture) were responsible for 90% of equity financing transactions in the global mining sector in 2011, raising a total of $10.9 billion that year. But in 2012 that number dropped substantially, especially for junior mining companies who raised only $2.3 billion in the first 10 months of 2012, the lowest level in many years.[55]

For companies that have a project in the development stage but no cash flow from existing operations, financing can be especially difficult:

51 Brebner, Daniel and Xiao Fu. July 2012. "Industrial Metals, Cost Inflation Deconstructed." Available at: http://www.commodities-now.com/reports/metals-and-mining/11883-industrial-metals-cost-inflation-deconstructed.html
52 Ibid.
53 Yukon Bureau of Statistics Annual Reports. Available at: http://www.eco.gov.yk.ca/stats/annualreview.html
54 Statistics Canada. CANSIM Table 281-0030
55 Global Mining Finance. Available at: http://www.globalminingfinance.com/documents/GMF_2013/GMF-2013-NorthAmerica.pdf

> "Many development stage companies have lost 50% of their market caps over the last year and are on the ropes… These companies have enough in the treasury to keep the lights on, but outside of that, they are facing major challenges developing their properties because their capital expenditures significantly exceed their market caps and they are unable to raise capital in these markets."[56]

One result of the industry's equity financing issues is the increasing efforts to finance mine development through debt financing and more innovative metal streaming arrangements where the development capital is secured against the stream of future production. Even when successful however, these debt financing arrangements do not come cheaply. Global Mining Finance discusses a number of mid-tier producers who received debt financing in 2012 including HudBay Minerals (raised $500 million at 9.5%), Allied Nevada Gold (raised $400 million at 8.75%) and Thompson Creek Metals (raised $350 million at 9.75%).[57]

Using debt financing to build mines brings an extra degree of risk to the project. Re-payment schedules must be met and creditors are not usually a forgiving group. Construction delays, production problems or declines in prices that might be difficult for a project that has been equity financed may prove fatal to a debt financed project. Anvil Range, the last operator of the Faro mine, used debt to finance its re-start but was abruptly out of business one year after production resumed.

1.4 Mining and Sustainability

The concept of long-term sustainability has become increasingly important, both explicitly and implicitly, to our thinking about resources and resource extraction. Robinson et al. define sustainability as, "...the persistence over an apparently indefinite future of certain necessary and desired characteristics of the socio-political system and its natural environment."[58]

For a mining project to meet the values of sustainability, the overall contribution of the project must be positive to both human and ecosystem well-being over the long term (if it's good for one and not the other, the fundamental values of sustainability are not met).[59] To make this work, the following all have to be addressed: (1) benefits to all parties; (2) costs and risks borne by all parties; and (3) responsibilities and accountabilities of all parties. This last point is critical; many mines will involve multiple industry players over time engaged with a host community over generations rather than just years. Changing governments, legislation, regulatory regimes and societal expectations are also inevitable over a multi-generational period. Costs, benefits, risks and responsibilities must be clearly identified, assigned and there must be processes in place to monitor and adjust over the long term.

Currently in most jurisdictions projects are licensed on the basis that negative environmental (and sometimes social) effects are identified and mitigated. Economic effects are usually considered as 100% positive although this is not always the case. In general it is much easier to identify measure and monitor environmental effects although long term planning and monitoring for even these has often been less than stellar. The long term planning for, and monitoring of, social and economic effects has usually been woefully inadequate or entirely non-existent in many jurisdictions.

56 Ibid.
57 Ibid.
58 Robinson, J.G. et al. 1990. Defining a Sustainable Society: Values, Principles, and Definitions. pp.26-36.
59 Hodge, R. Anthony, 2011. Mining and Sustainability. Chapter 16.2 in Darling, Peter (ed.), 2011. SME Mining Engineering Handbook, Third Edition. Society for Mining, Metallurgy, and Exploration Inc.

The mining industry as a whole has become increasingly committed to working with regulators and society to have their projects meet more of the values of sustainability. In part this is a response to generally more demanding regulatory regimes and it is also simply good business practice; it is much more cost effective to avoid problems and possibly lengthy delays by building relationships, dealing proactively with potential problems and going beyond the legal minimums. Voluntary, extra-regulatory sustainability frameworks and standards have proliferated in most extractive sectors, and mining is no exception. The Mining Association of Canada, for example has developed the "Towards Sustainable Mining" program, which is a comprehensive system of environmental and social policy and performance standards that all its members are required to adopt and be audited against.[60] Internationally, the International Council on Mining and Metals (ICMM), a group of most of the largest mining companies in the world requires each member to follow the ICMM's sustainable development framework.[61] For the exploration sector, extensive guidelines on best practices (Environmental Excellence in Exploration) have been adopted by the Prospectors and Developers Association of Canada as a resource for companies seeking to go beyond baseline regulatory requirements.[62]

As with other sectors such as forestry and agriculture, there are also a number of recently developed market related initiatives that are seeking to differentiate and reward companies who are willing to adhere to higher standards. Organizations such as the Responsible Jewellery Council, the Alliance for Responsible Mining, Fairtrade Labelling Organization, and the Initiative for Responsible Mining Assurance are in various stages of establishing independent third party certification systems whose goals are to promote responsible and ethical approaches to human rights, the environment and social effects in a transparent and accountable manner throughout the industry from mine to retail. These, along with other similar frameworks, are contributing to a growing body of knowledge, experience and incentives related to the practical experience of integrating advanced social and environmental practices into the mining sector.

In the Yukon context, the mostly much smaller junior mining companies operating here have become increasingly aware of the need to work very closely with local communities and First Nations. The advent of the Yukon Environmental and Socio-economic Assessment Act (YESAA) in 2005 has brought in broader regulatory requirements but most companies know that simply following the legal minimums will not win them the "social license to operate" without which they will not have a successful project.

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Yukon Mining Sector Profile

Component 2: Yukon Mining Sector Overview

1 Yukon Mining Sector Overview

It is often said that those who are unaware of history are doomed to repeat it. When looking at where things are today — or attempting to forecast future trends — it is important to have a reasonable overview of the pattern of past events.

In this component of Yukon Mining Sector Profile we:

- Provide a thumbnail sketch of Yukon's mining history, including some of the history of mining and Yukon First Nations;
- Provide an overview of the last 10 years in Yukon mining; and,
- Provide an analysis of the key opportunities and risks associated with currently operating Yukon mines and potential mines.

We had originally planned to present a number of scenarios for the industry in Yukon over the short and medium term as called for in the request for proposals, but after discussion with Yukon Economic Development staff it was agreed that an analysis of the key opportunities and risks associated with currently operating Yukon mines and potential mines would be a more valuable approach.

1.1 Yukon Mining History: A Thumbnail Sketch

Yukon First Nation people had been finding, using and trading copper where it appears in relatively pure form as a natural mineral such as in the White River area long before European people arrived in the territory. But it was the arrival of increasing numbers of prospectors and miners, many of whom had long experience in looking for gold and other minerals from California through to northern British Columbia, that made mining central to Yukon's recent history.

1.1.1 Placer

Placer gold — relatively pure gold mostly found in the gravels of rivers and streams that can be mined by hand methods — is what brought the first miners to Yukon. Gold and other minerals are rarely found by accident, they tend to be found because people are looking for them in places they have reason to believe they may be found. Placer gold had been found in large quantities in California in the 1840s and in central British Columbia in the 1860s. Independent miners were travelling throughout western North America prospecting rivers and streams. By the late 1860s the most determined were as far north as Cassiar, BC where they found payable quantities of gold. It was obvious to these men that gold might also be found further north yet.

Stories had been circulating among the fur traders in Yukon and Alaska since the 1850s about indications of gold in the region. By the early 1870s miners were looking for gold along the Yukon River. Among the best known, Jack McQuesten, Arthur Harper and Alfred Mayo, arrived in 1872. They, along with others, found indications of gold in many creeks and rivers but none that would pay a man more than a few dollars a day to mine. By 1878 the first miners had found their way over the Chilkoot Pass and by 1882 approximately 50 miners were over-wintering in Yukon. The finds of payable levels of gold in the Stewart River in 1884 brought more interest and more miners with about 200 over-wintering in 1885 and about one thousand by 1894.[1] Coates and Morrison write:

1 Coates, Ken S. and William R. Morrison. 1988. Land of the Midnight Sun pp. 47-51

> "A majority of these men were veteran miners — men who had gone to earlier rushes in California, Nevada, Colorado, or British Columbia. They were not greenhorns or idealists, and they did not take foolish chances if they could avoid doing so… These were not the wild-eyed, almost crazed gold seekers of the later Klondike rush, but pragmatic men, weighing their chances, looking out for opportunities, and working patiently while awaiting the arrival of the big strike."[2]

That big strike arrived in August of 1896 when Skookum Jim, Dawson Charlie and George and Kate Carmack discovered coarse gold and nuggets in Rabbit Creek (later named Bonanza Creek) a tributary of the Klondike River. Given the number of miners looking for gold, and finding it in payable quantities, the discovery of the Klondike appears to have been inevitable. But the timing of the big find during a general economic depression turned it into the last and largest of the gold rushes. When some miners arrived back in Seattle and San Francisco carrying sacks and suitcases of gold in July of 1897 they ignited a world-wide frenzy. Within months thousands of gold seekers, most without any experience and only the foggiest of notions where they were going and how they would find gold when they got there were on their way to Yukon. An estimated 100,000 people set out for the Klondike in 1897 and 1898 but only 30,000 to 40,000 managed to reach their destination.

The great attraction of placer mining was that it could be done by pick shovel and sluice box and the Klondike gold field had some very rich ground. Some of the claims along Bonanza and Eldorado Creeks quickly yielded hundreds of thousands of dollars in gold. In the second shaft he dug in the famous "Lowe's Fraction," a pie-shaped piece of ground only 86 feet wide at it base, Dick Lowe found $46,000 worth of gold (over 2,000 ounces) in eight hours. Lowe eventually took out more than half a million dollars worth from the fraction and it was rumoured that at least that much again was stolen from it.[3] But getting the gold was not usually quick or easy, nor was it guaranteed. Digging shafts through permafrost to bedrock during the winter and stockpiling the dirt and gravel from the horizontal drifts on the surface was backbreaking and filthy work and the miner could not be sure of how much he would get until he could wash out the pay dirt the next spring.

The frenzy of the gold rush could not possibly last and it didn't. Most of those who managed to reach the Klondike did not remain long; disappointment, the lack of prospects and a follow-up rush to Nome, Alaska that began in 1899 quickly began to bring the population of Yukon down from its estimated peak of 40,000 in the summer of 1898. The Census of 1901 put the population of Yukon at 27,000 of whom nearly 10,000 lived in Dawson City. Declining gold production and the discovery of gold in the Tanana River in Alaska in 1903 created the new boom town of Fairbanks and accelerated Dawson's population and economic decline. By 1911 the population of Dawson City had fallen to under 3,000 and by 1921 it had fewer than 1,000 residents.[4]

The Klondike gold fields were very quickly turned into large industrial operations in the early years of the twentieth century as gold production dropped from over 1 million ounces in 1900 to 420,000 ounces in 1905. Consolidation of individual mining claims and large scale hydraulic mining, which uses high pressure water hoses to wash down entire hillsides of gravel and dirt, began almost immediately following the rush. The first dredge began operations in the Klondike in 1900 and large scale operations were enabled by a new legal system known as the concession

2 Ibid. p.51

3 Coates and Morrison. p.84

4 Ibid. p.147

which allowed a single operator to buy existing and lapsed claims, control water and timber rights and manage entire sections of the gold fields. Large scale dredging continued for decades in the Klondike but high costs, the fixed price of gold and declining production eventually led to the last dredge being shut down in 1966.[5]

The Klondike was not the only placer gold field found in Yukon. Placer gold was also found in the Mayo region, the Kluane region of the south-west Yukon and along the Teslin River. But none of these finds came near matching the Klondike for size and richness of ground. Overall Yukon placer gold production continued to fall over the decades until by the early 1970s fewer than 5,000 crude ounces were being produced annually. With the breaking of the fixed price link between the US dollar and gold (US$35 per ounce) in 1971, the price of gold began to rise and the production of Yukon placer gold followed. In 1989 Yukon's placer gold production reached a modern-day high of 165,571 crude ounces.[6]

1.1.2 Hardrock

Hardrock mineral deposits began to be found by prospectors beginning with the Klondike gold rush, but remoteness and high costs limited hardrock mining in Yukon for many years. Yukon hardrock mines or districts with the most extensive history and production are: the Keno silver district, the Faro mine, the Whitehorse Copper belt and Clinton Creek.

1.1.2.1 Keno and Elsa

In 1903, Jake Davidson staked the first quartz claim in the Mayo district when he found a silver-rich galena specimen on the trail to Duncan Creek. He left Yukon shortly after but some samples he took were assayed at 300 ounces of silver per ton. Despite the exceptionally high grade, gold was what held interest and it was not until 1913 that others re-staked the site, calling it Silver King and began to high-grade the vein using hand mining methods. A total of 59 tons of ore were shipped out the next year and smelter returns were $269 per ton. This generated considerable interest and high-grade mining in the vicinity over the next several years proved limited (never exceeding 1,400 tons of ore) but largely profitable.[7]

The 1919 discovery and staking of further silver-rich galena deposits on what is now known as Keno Hill and their acquisition by the well-capitalized Yukon Gold Company in 1920 led to the steady mining of silver in the district. The area was remote and transportation costs in particular were extraordinarily high. In the first few years of operation, the operator Keno Hill Limited (KHL) used a cut-off grade of 200 ounces of silver per ton or ore, anything of lower grade could not turn a profit. Given that it cost $30 per ton to haul the ore from Keno to Mayo by horse drawn sleigh and a further $30 per ton to ship it from Mayo to San Francisco with silver selling for 65 cents per ounce the high grade nature of the mining is not surprising.[8]

While KHL closed down its operations in 1924 other corporate owners continued to build infrastructure, including a 125 ton per day mill and concentrator in 1925 at Wernecke Camp, a small community that included a recreation hall, bowling alley, library, and laundry service. Further discoveries in the district, including a vein on the Lucky Strike claim near Elsa that assayed at 3,000 ounces of silver per ton, allowed mining to continue and expand. The

5 Ibid. pp.152 to160

6 LeBarge, William. Yukon Geological Survey. 2010. Presentation on Yukon Placer Mining Industry. Available at: http://www.slideshare.net/wlebarge/yukon-placer-mining-industry-overview-2010

7 Mayo Historical Society. 1990. Gold and Galena. pp. 59-62.

8 Ibid. pp. 69-74

community of Elsa complete with mill and other mining infrastructure, a store and poolroom and a school was founded in 1935 at the site of Elsa Camp. But the outbreak of WWII and the decision by the US stopping the purchase of foreign silver resulted in the closure of all hardrock mining operations in the region in 1942.[9]

Production began again at Keno and Elsa in 1947 under the auspices of United Keno Hill Mines (UKHM) and its financial success, along with the completion of a road from Mayo to Whitehorse, triggered a silver boom in the district in the 1950s. UKHM remained the only significant company still operating in the district by 1958 and it grew to be Canada's second largest silver producer before it closed down operations permanently in 1989. Between 1913 and 1989 the total production from all hardrock mines in the area is estimated at over 213 million ounces of silver, over 710 million pounds of lead and over 436 million pounds of zinc.[10]

1.1.2.2 Faro

Al Kulan was the first to prospect the Anvil region of Yukon in the summer of 1953. Kulan was drawn to the area by members of the Ross River Dena First Nation who told him of a rusty creek bank. Kulan staked the lead-zinc outcropping he observed, later to become known as the Vangorda ore body, and he raised sufficient funds over the next 3 years to continue prospecting the area. He staked the main Faro ore body in 1956.

Lack of funds and low metal prices soon stopped exploration in the area however, and the claims were allowed to lapse. By the mid 1960s, rising metal prices had led to renewed interest in the Anvil region. A number of companies, including Dynasty Explorations, formed specifically to follow up on Kulan's earlier work began exploring the area. By the summer of 1965, intensive exploration was underway, and Dynasty formed a partnership with an American mining company, Cyprus Mines. The two formed Anvil Mining Corporation, later known as Cyprus Anvil. That exploration season made it clear that the makings of a mine were present.[11]

Feasibility studies began in 1966, and from the beginning it was clear that the mining company expected substantial government assistance to bring the mine into production. The final decision to go into production was made in August of 1967 when financing was arranged, sales contracts signed, and the government's role defined with the signing of the Anvil Agreement. The government agreed to provide transportation and energy infrastructure for the project as well as assistance in the construction of the town site of Faro. In total, government assistance came to approximately $28 million out of a total capital cost of about $114 million, or about one quarter of the project. The company agreed: to open the mine and construct the town, to examine the feasibility of building a smelter to process the lead-zinc concentrates produced at the mill, and to make every effort to employ local residents, particularly First Nations residents. Smelter feasibility studies were completed but the smelter was never built, and the company failed miserably in its efforts to employ First Nations people.[12]

In 1968, the Robert Campbell Highway running west from the Faro/Ross River area to Carmacks on the Klondike Highway was completed. The new road would allow the ore concentrates to be hauled by truck as far as Whitehorse. From Whitehorse, a railway ran to tidewater at Skagway, Alaska. Construction of the town site began in the fall of 1968. In June of 1969, the first 50

9 Mayo Historical Society. 1990. Gold and Galena. pp. 74-85

10 Ibid. pp. 85-89

11 MacPherson, Janet. 1978. "The Cyprus Anvil Mine" p.117.

12 MacPherson. 1978. p.127.

houses were near completion when, on Friday the 13th, a forest fire roared through the area, destroying 48 of them. It was an inauspicious start, but the decision to rebuild on the same site was made immediately. Three months later, the first families moved into the new town of Faro. Waste rock stripping at the Faro No.1 ore body and the construction of the mill that would process the raw ore into concentrates for shipping also proceeded through 1969. The mine shipped its first load of concentrates on December 8, 1969.[13]

Cyprus Anvil became a subsidiary of Dome Petroleum through a corporate takeover of its former parent company, Hudson's Bay Oil and Gas, in 1981. Dome had neither the expertise nor the interest to run the mine, metal prices dropped, and Cyprus Anvil began losing money and building up debt. A temporary shutdown was announced in June of 1982, and Dome put the operation up for sale. A waste-rock stripping program costing $50 million began in June of 1983 (touted as a program funded equally by the government and the company, nearly $20 million of the company's half share came via an interest free loan from the federal government).[14] The goal of the program was to prepare the mine for reopening by exposing the ore. It would also make the mine more attractive to potential buyers by reducing start up costs, and provide employment for approximately 250 of the original 750 employees.[15] The stripping program continued until October of 1984 when the company locked out its remaining workers.

The population of Faro, which had reached a peak of approximately 2,300 in early 1982, had now dwindled to fewer than 800, and more than 80% of the local businesses had closed. The final blow came in May of 1985 when the company announced that it was going to mothball the mine. With the announcement of permanent closure came severance pay for the locked-out workers, and by July 1985, Faro was a virtual ghost town. A stubborn few residents of Faro hung on, believing that, contrary to all the evidence, Faro had a future. These few (totalling fewer than 100)[16] were proven correct.

In the summer of 1985, Clifford Frame, an independent mining executive approached Dome with a proposal to buy the mine. Frame's company, Curragh Resources Inc., Dome, and both the federal and Yukon governments then entered into negotiations culminating in Curragh's taking over of the mine, mill and housing in Faro in November of 1985. The purchase price of the operation was effectively zero. (Dome had paid $340 million in cash for the mine in 1981).[17] The new owner began to work on the mine's reopening, and by the spring of 1986 the mill and mine were back in production.

Curragh carried on mining the Faro ore body and then moved on to the Vangorda deposit in 1990 when the Faro pit was exhausted. Everything appeared to be running smoothly and the mine was profitable. By 1992 however, the company was mired in difficulties. A horrendous explosion at its Westray coal mine in Nova Scotia and its heavy debt load (caused by its bid to expand through corporate acquisitions) drove the company to bankruptcy. In April of 1993 the Faro mine was shut down for the second time. This time there was no major stripping program to allow some

13 MacPherson. 1978. p.122.

14 Lourie, Bruce. 1987. Mineral Resource Decision Making. p.44.

15 Cyprus Anvil Mining Corporation. 1984. Socio-Economic Impact Assessment. pp.1-5.

16 McLachlan, Jim. June 1997. Personal communication.

17 Financial Post. October 12, 1985.

people to continue working, and again the town's population dropped precipitously (though it never fell below approximately 400).[18]

The mine had been profitable, however, and there was still ore in the ground. A new company, Anvil Range Mining Corporation, bought the property in 1994 — with no direct government assistance — and after a $75 million stripping program and work at the mill, production began again in August of 1995. Work resumed at the Vangorda deposit and the company began to mine the Grum deposit. Full commercial production was achieved by November 1995.[19] Again, the community got back on its feet, and many hoped for stability as the new company had little debt and owned no other properties. In November of 1996, however, Anvil Range suddenly announced that there would be a temporary closure of the mine by the end of the year. The mill would continue to operate until March 1997 using stockpiles of ore. Lower metal prices and a higher Canadian dollar were given as the reasons for the shutdown. The shutdown occurred as announced, but the company appears to have had problems greater than metal prices and exchange rates. Anvil Range declared bankruptcy in April 1998, leaving the property in the hands of a receiver.[20]

Since its opening in 1969, the mine at Faro has played a very large role in Yukon's economy. In the mid 1970s, the mine's average net addition to Yukon's GDP was 20%.[21] In the year following the shutdown in 1982, Yukon's GDP fell by 17%, and after the 1993 shutdown the GDP fell by 18%.[22] In each case, the GDP continued to drift downward in the second year of the shutdown. Of course there were other factors at play in the economy following each shutdown, but it would be safe to assume that the mine had generally accounted for between 15 and 20% of Yukon's GDP. It appears to be declining in its relative importance, however, as the decline in GDP in 1997 was 7.9% with a further drop of 4.0% in 1998.[23]

Since its inception, the Faro mine has been the single largest private employer in Yukon. Between 1974 and 1980, the mine directly employed, on average, 15% of Yukon's workforce. At its peak in 1981, the mine accounted, directly and indirectly, for 20.1% of total wages and salaries paid in Yukon.[24] In that year Cyprus Anvil was paying its employees an average of $40,000 per annum.[25] In 1989, under Curragh's tenure, the mine accounted for 11.3% of total employment in the territory.[26] Like its share of GDP, the Faro mine's share of employment appears to have continued to decline in its third incarnation. Under Anvil Range the mine was estimated to account for a 5% direct share of employment. [27]

The importance of this single mine to Yukon's economy has reinforced the general attitude of governments and the public in Yukon that mining continues to be the prime means of economic

18 McLachlan, Jim. June 1997.

19 Anvil Range Mining Corporation. May 1997. 1996 Annual Report. p.14

20 Anvil Range Mining Corporation. April 1998. Press release.

21 Canada. July 1982. Preliminary Assessment of Cyprus Anvil Mining Corporation and its Impact on Yukon. p.10.

22 Yukon. April 1997. Yukon Short-term Economic Outlook 1997. p.3.

23 Yukon. February 1999. Yukon Short-term Economic Outlook. p.8.

24 Gunter, Peter E. and S. Green. March 1982. The Impact of Cyprus Anvil on Yukon. p.24.

25 Ibid. p.14.

26 Stanley, William E. and Eric C. Vance. May 1990. Curragh's Socio-Economic Contribution to Yukon. p.17.

27 Yukon. February 1999. Yukon Short-term Economic Outlook 1999. p.3.

development in the territory. Indeed in 1982, during Faro's first shutdown, the Government of Yukon stated:

> "Yukon's economy is on the verge of total collapse. It is an economic region threatened with extinction. The Government of Yukon wishes all parties to clearly understand the magnitude of the problem. Yukon cannot, on its own, recover from the collapse because it has neither the financial capability nor the complete legislative jurisdiction."[28]

Although stated rather dramatically, the Faro shutdown, coupled with the closure of two smaller hard rock mines in the same year, did result in genuine fears of complete economic collapse.

Even in nominal dollar (i.e. not adjusted for inflation) terms, the gross value of production of the Faro mine under Cyprus Anvil from 1971 through 1981 (not including production from 1970 and the first half of 1982) comes in at an impressive $1.44 billion.[29] After Curragh restarted operations in 1986, the gross value of production numbers were also impressive. In late 1992 Curragh reported:

> "The sale of concentrate for the Faro Mine since commercial production was restarted in 1986 totals 1.8 billion dollars. Deducting smelter charges and cost of delivery to smelters from Skagway, this activity brought just over 1 billion dollars into the Canadian economy in the same interval."[30]

In its third incarnation under Anvil Range Mining Corporation, the Faro mine was only in production for approximately 14 months and produced approximately $214 million in gross revenue for the company in that period.[31]

1.1.2.3 Whitehorse Copper

During the course of the Klondike rush, experienced miners found a number of hardrock copper deposits in the hills to the west of Whitehorse. Some of these deposits were both large and rich, but generally low prices and high transportation costs led to only sporadic production for a decade or so. Production began to increase after 1910, rising from 286,000 pounds that year to a peak of 2.8 million pounds in 1916.[32] Costs, however, remained high and all copper production ceased by 1920. The Whitehorse Copper belt remained dormant until the construction of a 1,800 tonne per day mill in 1966 and both open pit and underground mining supplied the mill with ore from 1967 to 1982. Total production over this period is estimated at 123,000 tonnes of copper, 90 tonnes of silver and 7 tonnes of gold.[33]

There are currently plans by Eagle Industrial Minerals Corporation moving through the regulatory process to reprocess the tailings at Whitehorse Copper in order to recover magnetite. Yukon Department of Energy Mines and Resources describes the project as:

> "Eagle Industrial Minerals Corporation are proposing to process 12,000 tonnes per day, for 6 to 7 months during the snow free season, producing 250 to 350 thousand tonnes per

28 Yukon. September 1982. Yukon Economy: Strategy for Recovery. p.21.

29 Gunter and Green. 1982. pp.4-5

30 Curragh Inc. November 1992. p.1.

31 Anvil Range Mining Corporation. 1996 Annual Report. p.20

32 Coates and Morrison. p.163

33 Yukon Geological Survey. Available at: http://www.geology.gov.yk.ca/pdf/whitehorse_copper_belt.pdf

year of magnetite over a duration of 6 to 7 years and employing up to 20 people seasonally. The project will also involve reclamation of the site for possible future industrial development."[34]

1.1.2.4 Clinton Creek

The Clinton Creek asbestos mine operated near the confluence of the Forty Mile and Yukon Rivers from October of 1967 through to August 1978 producing approximately 940,000 tonnes of cement grade asbestos fibre. The mine was operated by the Cassiar Asbestos Company (which also operated the Cassiar asbestos mine in northern BC) and the workforce lived in the company town of Clinton Creek which had a maximum population of about 500. The mine employed an average of 290 people. When the mine closed, the company also closed the town site and most of the houses and other buildings were removed to other locations. The site is now the responsibility of Yukon government's Department of Energy Mines and Resources.[35]

1.1.2.5 Other Hardrock Mines

Yukon has seen a number of other operating hardrock mines and small high grade operations or bulk sampling efforts.

The Mount Skukum mine, located 40 km west of Carcross, was an underground mine that produced 77,796 ounces of gold between 1986 and 1988.[36]

The Ketza River gold mine, located 51 km south of Ross River, produced approximately 100,000 ounces of gold from its largely underground workings from 1988 through 1990. The operation focussed on oxide ores and ceased operations when oxide reserves were depleted.[37]

Sa Dena Hes is a lead-zinc mine located 45 km north of Watson Lake. It was operated for 14 months between August 1991 and November 1992 by Curragh Resources producing 374,400 tonnes of zinc and 290,200 tonnes of lead. When Curragh went bankrupt, the Sa Dena Hes property was put into the hands of a receiver in September 1993. A group of companies led by Cominco and Teck (now merged as Teck) bought the property and announced in 1997 that the mine would reopen in 1998. That reopening was cancelled.[38]

The Mount Nansen gold mine, located 60km west of Carmacks, operated intermittently between early 1997 and early 1999. Mining was both open pit and underground and the operation employed approximately 65 people. In 1998 total production was 15,190 ounces of gold and 38,849 ounces of silver.[39]

The Brewery Creek mine was the first cyanide heap leach mine in Yukon, producing approximately 267,000 ounces of gold between 1997 and 2001. It is located 57 km west of Dawson City and the site was entirely reclaimed by the end of 2007.[40]

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34 Yukon Energy Mines and Resources. http://www.emr.gov.yk.ca/mining/whse_copper_tailings.html

35 Yukon Energy Mines and Resources. http://www.emr.gov.yk.ca/aam/clinton_creek.html

36 Yukon Geological Survey. 2008 Mineral Property Update.

37 Ibid.

38 Ibid.

39 Ibid.

40 Ibid.

1.1.3 Mining and Yukon First Nations

Long before the arrival of Europeans, Yukon First Nations had been living as hunter gatherers on their traditional territory in the central Yukon for thousands of years.

Although it is still common to think of hunter gatherers as scratching out a subsistence existence on the edge of starvation, this was generally not true. First Nation people could face hard times and even starve if their environment turned against them but an economic surplus was the norm in pre-contact Yukon societies. These surpluses resulted in a flourishing trade network. Catherine McClellan writes:

> "Long before the arrival of white men, the Coast Indians were bringing candlefish (or oolichan) grease, dried seaweed, dried clams, clamshells, plant medicines, cedar boxes and seashells into the southern Yukon. Seashells were said to be like jewels to Yukon Indians, and in return for these shells they offered copper, furs, tanned hides, and the lichen dyes and mountain goat hair used in making Chilkat blankets."[41]

Long accustomed to trade, and with adaptability as one of their defining characteristics,[42] the North's original peoples were well positioned to adapt to the first major shift in Yukon's economy, the introduction of the European fur trade.

The Hudson Bay Company began to move into Yukon in the 1840s with the construction of trading posts at Frances Lake in 1842, on the Bell River in 1846, and at Fort Yukon and Fort Selkirk on Yukon River in 1847 and 1848. Although the trading posts were new to the interior First Nations of Yukon the trading process and European trade goods were not — the latter had been reaching them for decades via middle-men. Ken Coates writes:

> "...they [Yukon First Nations] took from the trade only what they wanted; the trade was a supplement to their way of life and did not control it. Conversely, the natives exerted considerable influence over the pace and direction of the trade."[43]

First Nations were creating a mixed or dual economy in which people continued their subsistence way of life while trapping to satisfy new needs. Although this dual economy of subsistence and furs continued successfully in Yukon for nearly a century, the volatile nature of the fur market with its changing fashions and fluctuating demands probably made its eventual demise inevitable.

With the arrival of mining in Yukon that mixed economy suffered a number of blows and the Tr'ondëk Hwëch'in of the Dawson area in particular suffered the catastrophic loss of much of their hunting and fishing grounds along with the accelerated introduction of infectious diseases during and after the gold rush.

But the introduction of a wage-based industrial economy that demanded far different skills and attitudes also had far-reaching effects. Coates and Morrison write:

> "Probably the worst result of the mining activity was that the major economic activity in the region ceased to be fur trading. This had an effect which did not occur to observers at the time: it tended to make Yukon Indians powerless outsiders in the economic life in their own

41 McClellan, Catherine. 1987. Part of the Land, Part of the Water. p.235.

42 Cruikshank, Julie. 1975. Their Own Yukon. p.1.

43 Coates, Ken S. and William R. Morrison. 1988. Land of the Midnight Sun p.29.

> country… [In the fur trade] the Indians were able to shape the nature and flow of the trade to a degree which is only now being recognized. But on the mining frontier the Indians played no role outside of a bit of casual day-labour and some supplying of some food… As the mining frontier developed in the late 1880s, the pressing need for day-labour meant that some Indians did find jobs, yet employers hired them only reluctantly and they were paid less than whites. At one point white workers formed a "combination" to exclude native workers from the gold fields. When Indians did work they could earn as much as $8 a day, much more than they could trapping fur, though less than a white man was paid for doing the same work. But they had to live close to the mining region to get those jobs."[44]

Following the gold rush, most Yukon First Nation people went back as best they could, to the dual economy of subsistence supplemented by trapping and occasional other wage employment. By the 1950s and 1960s, another aspect of mining came to the fore in Yukon, extensive quartz exploration. The staking and exploration rush that occurred around the discovery of the Faro project serve as an illustration. For First Nation people the early phases of mineral exploration — prospecting, staking and line cutting — share some features with the fur trade. Both allowed First Nation people to work in the wage economy in a field where their existing skills and abilities were valued without totally disrupting traditional pursuits and seasonal rounds. Bob Sharp writes:

> "Three to five different exploration companies operated out of Ross River during the summers of 1965 to 1969… Indians were often hired as prospectors, assistant prospectors or line cutters. Exploration companies said that they preferred to hire Indian men because they were "bush wise"; they were less likely to get "bushed" or lost or to split a shin with an axe than were people from the outside. The relationships between the exploration crews and the Indians were usually relaxed and cordial. Indian men were recognized for their abilities and strengths in the bush rather than for their behaviour in the bar."[45]

Even as the Faro mine was being built and went into operation, First Nation men continued to prefer the work of prospecting. Sharp writes:

> "Assistant prospecting was the preferred job. After a couple of seasons working for companies that paid a bonus for the discovery of a showing, these men began to feel that they too should be working for prospector's wages. They were often finding more showings than the prospectors they were assisting. In order to become prospectors they had to pass a prospecting test administered in Whitehorse. The fact that a test had to be written and that it had to be done in Whitehorse deterred men from becoming prospectors… [A prospector's training program] was set up [in Ross River] in 1970… Approximately 25 men took the course and all that wrote the prospector's exam passed with honours."[46]

As noted previously, the exploration and prospecting work used the existing skills and abilities of First Nation men while allowing enough flexibility for them to continue with most traditional pursuits and modified seasonal rounds. It is ironic, however, that the men who passed their prospector's exam in 1970 did so just as the exploration boom ended.

As the Faro mine and the town of Faro itself moved into the development and construction phase from late 1966 to 1969 along with the associated infrastructure projects such as the construction of the highway from Carmacks to Ross River, a very large number of people were hired.

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44 Ibid. pp. 52-54.

45 Sharp, Bob. 1977. Changes in Ross River During the Anvil Mine Development. p.61

46 Ibid. p.62

However, Sharp writes that through the entire construction phase of the Anvil mine and the town of Faro from 1966 to the end of 1969 only a total 15 First Nation men from Ross River were employed intermittently.[47] The total construction work force averaged about 500 men in total through that period.

When the construction phase ended and the mine went into production even fewer of the Ross River Dena worked there. Sharp writes:

> "During 1970 and 1971, about five different Indian men from Ross River worked with Anvil. Three of these men worked for only a short period of time. They all indicated that they did not like the work at the mine. Most jobs were dusty and depressing. All of the men were unskilled and were given tasks which did not require skills or skill training…All of these men returned to Ross River after leaving their jobs. Other men in the town, hearing them speak of their difficulties with this work, did not seek out employment with the mine."[48]

Dead-end jobs, the need to be away from families and the implicit requirement to largely abandon the seasonal round and traditional activates, coupled with deep and pervasive discrimination and racism made working at the operating mine a highly unattractive option.

1.2 Yukon Mining: The Last 10 Years

Yukon's mining industry entered into a prolonged slump following the closure of the Faro lead-zinc mine in January of 1998. By 2002 there were no operating hard-rock mines in Yukon, mineral exploration spending had declined steeply, and even placer gold production had fallen to a 23-year low. The total value of mineral production in the territory fell from $225 million in 1997 to $82 million in 2003.

1.2.1 Placer

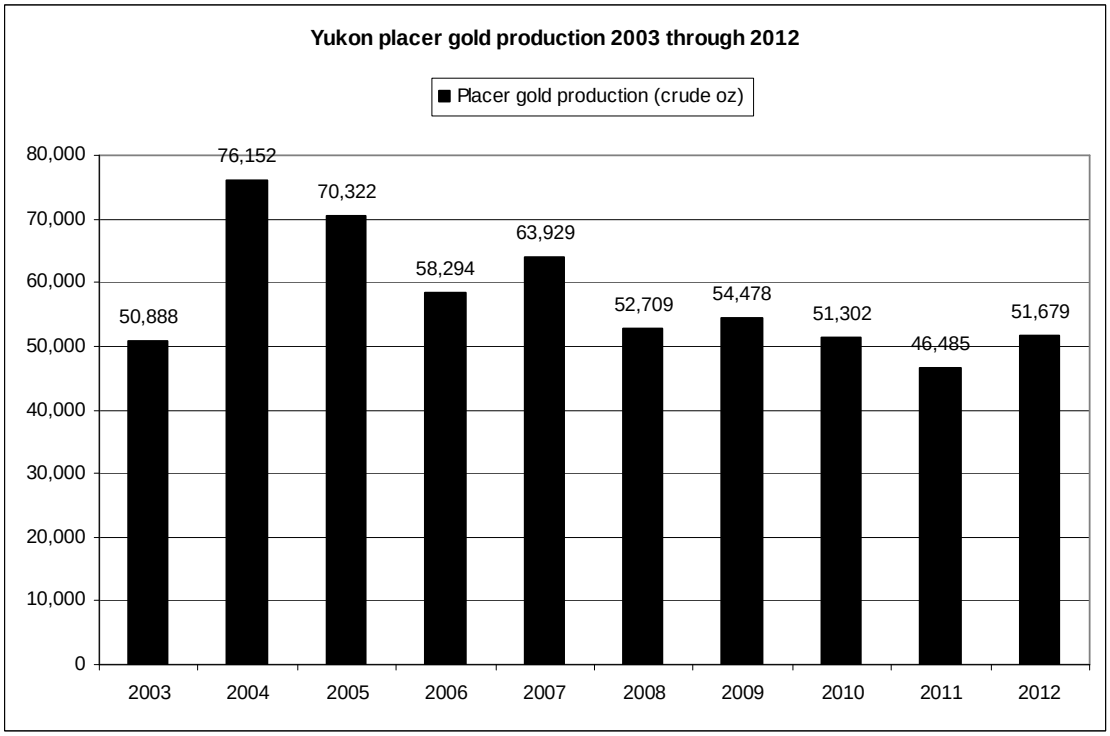
Despite its overwhelming historical importance to Yukon's economy — it is estimated that Yukon has produced over 518 tonnes of placer gold valued at over $12 billion at current prices[49] — placer mining has continued to shrink as a source of economic activity over the past decade. Since peaking at 165,571 crude ounces in 1989, placer gold production has been declining on a steady trend. The more recent part of that trend can be seen in Figure 1. In 2012 production was only 31% of 1989 production.

47 Ibid. p.53

48 Ibid. p.77

49 LeBarge, William. Yukon Geological Survey.

Figure 1: Yukon Placer Gold Production in Crude Ounces, 2003 through 2012



Source: Yukon Energy Mines and Resources

The drop in production is not a result of fewer placer claims in good standing. The number of Yukon placer claims in good standing has not varied significantly since the late 1980s; it has been in the 15,000 to 19,000 range each year. Most of these claims are not actively mined. Yukon's Energy Mines and Resources statistics show that the number of active placer operations has varied from 107 to 163 between 2003 and 2009 and 135 active operations in 2012.

Although 2012 production recovered somewhat from the low in 2011 the trend continues to be downward. This continued decline is of particular concern to the placer mining industry given that the price of gold has increased greatly over much of the period, rising from US$279 an ounce in 2000 to US$1,670 an ounce in 2012.

It appears that placer gold is simply getting more difficult to find as reserves decline in the traditional placer mining areas. Unless new geological theories emerge enabling the industry to find new sources of placer gold in other areas, production is unlikely to increase significantly.

1.2.2 Hardrock

With the closure of the Brewery Creek mine in 2001, Yukon entered a six year period where it had no operating hardrock mines. Yukon now has three operating mines: the Minto copper gold mine that achieved commercial production in the fall of 2007, Alexco's Bellekeno silver mine that achieved full production in the fall of 2010, and Yukon Zinc's Wolverine lead zinc mine that announced it had reached commercial production in the first quarter of 2012. In addition, the Cantung tungsten mine, which is located just over the border in the NWT, but is accessed and supplied from Yukon, has been in operation since resuming production in October 2010.

1.2.2.1 Exploration and Development

Yukon has been enjoying several years of robust mineral exploration spending, including a record of $332 million in 2011, as is shown in Figure 2. The 2012 figure of $227 million is preliminary and Yukon Economic Development is suggesting that Natural Resources Canada's preliminary estimate for 2012 is likely too high and that the actual figure will be approximately $150 million.

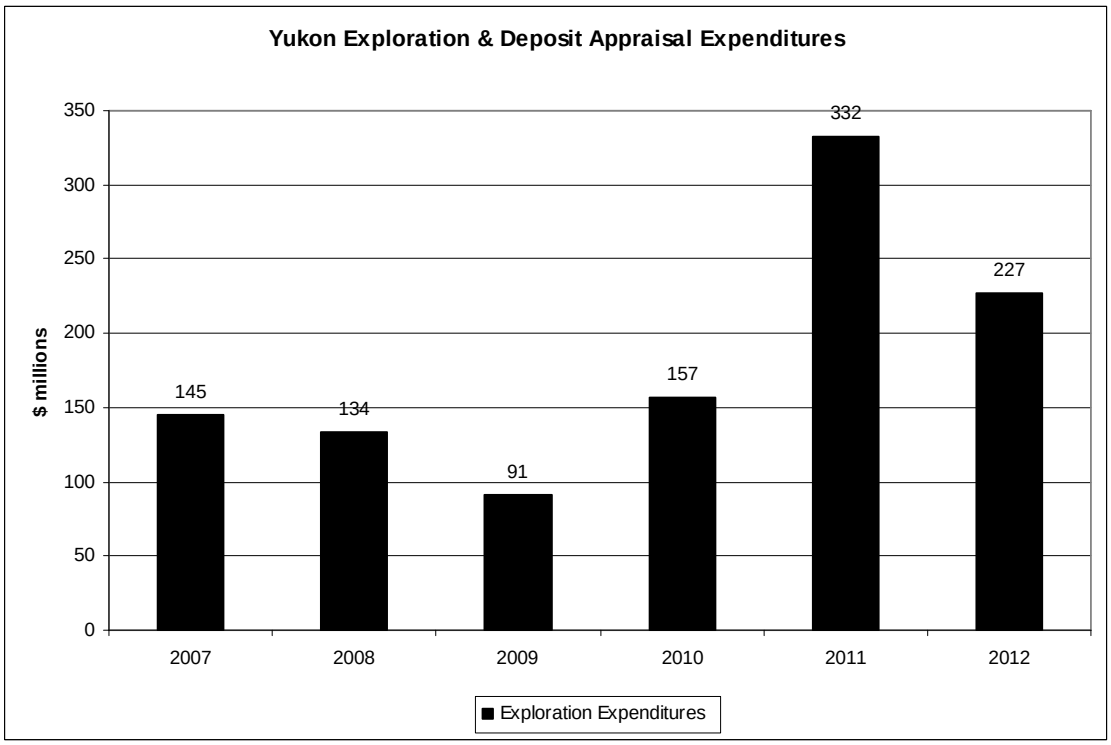
Quartz claim staking in Yukon declined sharply in 2012 to 11,733 new claims compared to the record 114,587 claims staked in 2011. However, the number of claims in good standing remains at an all time high of 254,896 in 2012 (this compares to the normal level of approximately 50,000 in good standing from 1982 through 2006). This indicates that companies have not yet begun to consolidate their holdings to any significant degree. However, some consolidation and reduction in the number of claims in good standing is expected in 2013.[50]

Yukon exploration boom has been largely driven by the search for gold. The major mineral exploration targets, by share of expenditures, in 2012 were:

- Gold at 69%;
- Lead and zinc at 11%;
- Silver at 9%;
- Nickel and platinum group metals at 7%; and,
- Copper at 4%.[51]

50 Yukon Geological Survey. Yukon Hardrock Mining, Development and Exploration Overview 2012. Available at: http://www.geology.gov.yk.ca/pdf/yeg_overview_2012_web.pdf
51 Ibid.

Figure 2: Yukon Exploration & Deposit Appraisal Expenditures, 2007 through 2012, Millions of Dollars



Source: Natural Resources Canada. Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.[52]
Note: Includes on-mine-site and off-mine-site activities; field work, overhead costs, engineering, economic and pre- or production feasibility studies, environment, and land access costs. Exploration and deposit appraisal activities include only the search for and appraisal of deposits and do not include work for extensions of known reserves.
The 2012 number is preliminary.

1.2.2.2 Minto

Much of the development and permitting for the Minto mine had been completed between 1996 and 2000, including a Type A water licence in 1998 and a production licence in 1999. The sites for the camp and mill were prepared, road work completed and mill equipment was purchased before the mine owner suspended work on the project. The Minto property was acquired by Sherwood Copper (now Capstone Mining) in 2005 and construction and development work to open the mine began again in 2006. Commercial production at the open pit copper gold mine was reached in October 2007 with a forecast mine life of 5 years.[53]

A total of nine further ore deposits have been found and delineated since production began, allowing production to be increased from an initial 1,600 tonnes per day first to 2,400 tonnes per day in early 2008 and then to a design of 3,200 tonnes per day capacity in early 2009. Current mill through put is 3,850 tonnes per day. With underground working now being developed, the mine is now expected to operate with current reserves until 2022. Capstone Mining is projecting

52 Available at: http://www.nrcan.gc.ca/minerals-metals/statistics/4350

53 Yukon Geological Survey. 2008 Mineral Property Update and Capstone Mining March 13,2013 Corporate Presentation. Available at: http://capstonemining.com/i/pdf/presentation.pdf

its cash costs at Minto to be in the range of $2.30 to $2.40 per payable pound of copper produced.[54]

In 2012 Minto mined 942,739 tonnes of ore and processed 1,341,584 tonnes through the mill (including stockpiled ore) at an average grade of 1.34% copper. Total mineral production was 35.9 million pounds of copper, 183,500 ounces of silver and 18,600 ounces of gold.[55] In 2013 Capstone expects to increase mill production slightly to 1.4 million tonnes at an overall higher grade resulting in the expected production of 41.0 million pounds of copper, 18,300 ounces of gold and 200,000 ounces of silver.[56]

The Minto mine is located on Category A settlement land that the Selkirk First Nation has both surface and sub-surface rights to under its final agreement. Therefore the royalties from the mine flow to the SFN (Yukon government collects the royalties on behalf of the first nation). Between 2007, when the mine opened, and the end of 2011 the royalties from the Minto mine, at $12.6 million total, is a significant source for revenue for the Selkirk First Nation.[57]

1.2.2.3 Keno Silver District

In early 2006, following extensive negotiations between the company and the federal and Yukon governments, Alexco Resources Inc. purchased the Keno property — an abandoned site that was the responsibility of the federal government until devolution in 2003 — through its subsidiary Elsa Reclamation & Development Company (ERDC). The agreement with ERDC is an innovative attempt to reduce the overall costs to government for the abandoned site while also allowing further production and the benefits that brings. The company is being paid to continue care and maintenance on the property while it both designs a final closure and reclamation plan and looks to develop or re-develop ore bodies on the site.

Following the acquisition of the property Alexco began exploration work on the old Bellekeno mine, one of the last to be in operation under United Keno Hill. The company completed the construction of the new mine and mill in the fall of 2010 at a total capital cost of $61 million. In January 2011, Alexco announced that it had achieved full commercial production at the mill.

Total tonnes of ore milled increased from 81,064 tonnes in 2011 to 94,810 tonnes in 2012. Production of silver increased from 2.02 million ounces in 2011 to 2.15 million ounces in 2012. Zinc production fell from 7.2 million pounds in 2011 to 5.7 million pounds in 2012 while lead production increased from 16.4 million pounds in 2001 to 18.2 million pounds in 2012. Alexco is projecting 2013 production at:

- 2.0 million ounces silver;
- 9.0 million pounds of zinc; and,
- 17.0 million pounds of lead.[58]

The company reports its cash costs are $10.17 per payable ounce of silver in 2011 and $12.18 per payable ounce over the first three quarters of 2012.

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54 Capstone Mining March 13, 2013 Corporate Presentation. Available at: http://capstonemining.com/i/pdf/presentation.pdf

55 Capstone Mining. January 10, 2013 News Release. Available at: http://capstonemining.com/s/NewsReleases

56 Capstone Mining. December 19, 2012 News Release. Available at: http://capstonemining.com/s/NewsReleases

57 Yukon Government News Release #12-185. Available at:: http://www.gov.yk.ca/news/12-185.html

58 Alexco Resources. Available at: http://www.alexcoresource.com

For 2011, its first full year of production at the Bellekeno mine, Alexco Resources paid $351,525 in royalties to the Yukon government.[59]

In January 2013 Alexco Resources received amendments to its quartz mining licence to allow it to bring the Lucky Queen and Onek deposits into production. With the amended licence comes an increase in the security deposit required to a total of $4.2 million.[60]

Given the district wide nature of Alexco's operation there is no straightforward life of mine calculation. However, given the reported indicated resources for each of the three permitted deposits[61] and an average milling rate of 90,000 tonnes per year, we can calculate the following:

- Bellekeno has approximately 2.5 years of production remaining;
- Lucky Queen can feed the mill for approximately 1.5 years; and,
- Onek can feed the mill for 6.5 years.

This takes the current overall project out to 2023. However, there are obviously variables that could extend that period including:

- The inferred resources in each of those deposits are mined;
- The planned mining of the Elsa tailings begins; and,
- The next set of known deposits including Flame, Moth, Silver King and Bermingham are mined.

On the other hand there are factors that could shorten the overall project life including:

- An increase in mill capacity and mining rate; and,
- Some of the indicated resources are found to be not economically viable.

1.2.2.4 Wolverine

The site of the Wolverine mine was first staked in 1973 and the Wolverine deposit was discovered in 1995. Through a series of corporate changes Expatriate Resources became the majority owner of the property in 1999. In late 2004 Expatriate changed its name to Yukon Zinc and submitted its plan for a 1,250 tonne per day underground mine to Yukon government. In 2005 the company completed preparation of the main portal, submitted an environmental assessment under the Canadian Environmental Assessment Act (CEAA) and entered into a socio-economic participation agreement with the Ross River Dena Council. In late 2006 Yukon Zinc received a quartz mining licence and a water licence followed in October of 2007.[62]

In July 2008 two-state owned Chinese companies, Jinduicheng Molybdenum Group Co. Ltd. (JDC) and Northwest Nonferrous International Investment Company Ltd., acquired all of the public shares of Yukon Zinc Corporation. Currently Yukon Zinc is private and no longer publicly listed, with JDC as the majority shareholder. Mine and mill construction proceeded in 2009 and 2010, the mill was commissioned in late 2010 and production began in 2011. The company announced that it had achieved commercial production (defined as 60% of production capacity or 1,020 tonnes per day) in the first quarter of 2012. Yukon Zinc was planning to achieve full

59 Yukon Government News Release #12-185. Available at:: http://www.gov.yk.ca/news/12-185.html

60 Yukon Government News Release #13-015. Available at:: http://www.gov.yk.ca/news/13-015.html

61 Alexco Resources. March 2013 Corporate presentation. Available at: http://www.alexcoresource.com/i/pdf/ppt/Alexco-Resource-Corp-2013-03-03-PDAC.pdf

62 Yukon Geological Survey. 2008 Mineral Property Update

production of 1,700 tonnes per day by the end of 2012. In July 2012 there were 363 people employed at the Wolverine mine. The mine life is given as 9.5 years, suggesting that the mine will be closed by 2022.[63]

1.2.2.5 Cantung

The Cantung underground tungsten mine is owned by North American Tungsten and located just over the border in the NWT 300 km north of Watson Lake but is accessed and supplied through Yukon. The mine operated, with some interruptions, from 1962 to 1986. North American Tungsten purchased the mine, and the Mactung property located on Yukon side of the border 250 km north east of Ross River, in 1997. Rising tungsten prices allowed the company to reopen Cantung in December 2001. In 2003 the company ran into financial difficulty, sought court protection from its creditors and closed the mine in December 2003. With its financial problems worked out, North American Tungsten opened the mine again two years later with production starting in September 2005. It was not smooth sailing, however, as production was suspended in October 2009 due to a collapse in the price of tungsten and it was not resumed again until October 2010.[64]

In the two years from resumption of operations in October 2010 and September 2012, Cantung milled 728,000 short tons of ore, an average of 364,000 short tons per year. Going forward, the company is forecasting the production of 383,000 short tons per year with the end of the mine life in March of 2015 based on current reserves. However, the mine has a pattern of finding new underground reserves and is also currently studying the feasibility of processing the historical tailings at the site.[65]

The mine normally employs approximately 200 people, with no more than 140 on site at any given time. Turnover is reported to be high.[66] In its earlier operation prior to the 2009 shutdown, North American Tungsten reported that 28% of its employees were Yukon residents and that 6% were Kaska from the Watson Lake area.

1.2.2.6 Yukon Hardrock Production

With the three mines coming on line and increasing production since late 2007, the total value of Yukon's mineral production has increased more than 10-fold between 2006 and 2012 as is shown in Figure 3. With planned production increases in 2013 at Minto and Wolverine, the value of production is likely to rise again in 2013.

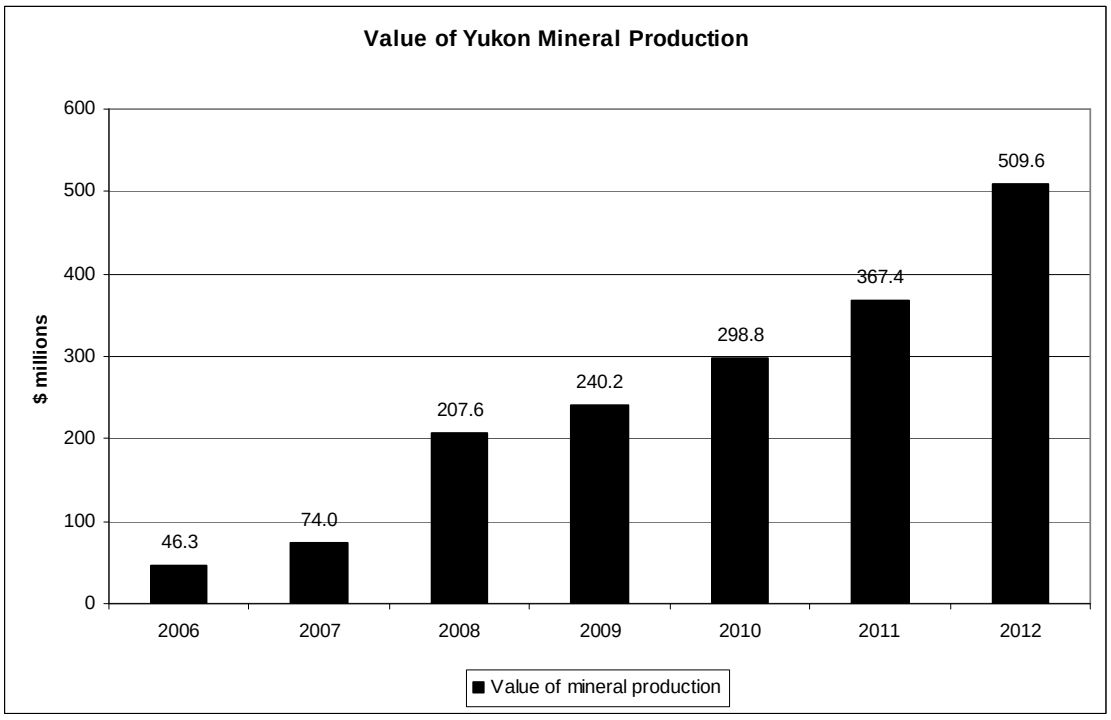
63 Yukon Zinc newsletter. Available at: http://www.yukonzinc.com/documents/Yukon_Zinc_Newsletter_August27_2012_000.pdf

64 North American Tungsten. http://www.northamericantungsten.com/s/Cantung.asp

65 Ibid.

66 Yukon News. March 8, 2013. "Inside Cantung, the mine that keeps on giving." Available at: http://www.yukon-news.com/business/32620/

Figure 3: Value of Yukon Mineral Production, 2006 through 2012, Millions of Dollars



Source: Natural Resources Canada. Mineral Production of Canada Annual Statistics[67]

1.2.3 Abandoned Mines

In April of 2003, as part of the Devolution Transfer Agreement, Yukon government took over responsibility for environmental issues and problems associated with lands previously managed by the federal government. The transfer included a number of mining properties that had unfunded environmental liabilities and had been abandoned by their corporate owners. The federal government agreed to provide funding to plan for and institute permanent closure of these properties: United Keno Hill, Faro, Clinton Creek and Mount Nansen. Going forward however, Yukon government will be financially responsible for any newly abandoned mines.

From the broad Canadian perspective the environmental clean up of the abandoned mining sites in Yukon is a financial and social cost; the moneys spent could have been more productively been used elsewhere. However, from a more parochial Yukon perspective, the federal government spending that pays for the planning, management; monitoring and on-the-ground work brings employment and other economic benefits to Yukon.

1.2.3.1 United Keno Hill Mines

United Keno Hill Mines ceased production in January of 1989 and could not find sufficient capital to reopen. In 1999 the courts ordered that the property and mine assets be sold. In 2001 the property was purchased for $2.9 million but the new owner quickly ran into financial difficulties and the property was taken over by a court-appointed receiver.

[67] Available at: http://www.nrcan.gc.ca/minerals-metals/statistics/4348

In early 2006, following extensive negotiations between the company and the federal and Yukon governments, Alexco Resources Inc. purchased the Keno property through its subsidiary Elsa Reclamation & Development Company (ERDC). Key points in the agreement include:

- ERDC is indemnified against all historical environmental liability on the property;
- The company conducts environmental care and maintenance on the property on an annual fixed price basis paid for by the federal government;
- The company is responsible for developing a final closure and reclamation plan, for fees of 65% of agreed commercial contractor rates paid for by the federal government;
- Upon acceptance and approval the closure and reclamation plan will be implemented by ERDC at full contractor rates (early estimates at more than $50 million);
- The company has full access to the property for exploration and future development;
- ERDC is responsible for new environmental liabilities created by its exploration, development and production; and,
- ERDC must also pay a 1.5% net smelter return royalty from any production on the property to a maximum of $4 million (royalty commences once earnings exceed exploration costs plus development and construction capital costs).[68]

The agreement with ERDC is an innovative attempt to reduce the overall costs to government for the abandoned site while also allowing further production and the benefits that brings. The overall success of the agreement will only be able to be judged in the longer term, but Alexco, ERDC's parent company, has had a profitable mine in full production for more than two years at Bellekeno and is working toward reopening other historical mines on the property (see Section 1.2.2.3 above).

1.2.3.2 Faro

In April of 1998, Anvil Range Mining declared bankruptcy and the Faro mine site was placed in the care of a receiver under the authority of the federal government. The receiver was responsible for the care and maintenance of the site, including water monitoring and treatment and the inspection and maintenance of structures.

In January of 2003, the federal and territorial governments acknowledged that the Faro mine would not reopen and the responsibility for the final remediation and closure of the large (25 square km) site would remain with government. The mine site has three major areas of concern within it: the Faro pit with its surrounding waste rock piles, the Rose Creek tailings, and the Vangorda Plateau. The Faro pit is over 1.5km long and nearly 1.0km wide and reaches a maximum depth of 335m. The waste rock piles that surround it contain more than 260 million tonnes of material and block the original course of Faro Creek which now follows a diversion channel around the pit and waste rock. More than 55,000 tonnes of tailings from the mill are held by a series of dams in an unlined containment area covering approximately 4km2 in the Rose Creek Valley. The Vangorda Plateau consists of the Vangorda and Grum pits with their associated waste rock (totalling over 126 million tonnes) with Vangorda Creek flowing through a diversion culvert around the Vangorda pit.[69]

In general terms there are four major issues that the final closure and reclamation of the Faro mine must deal with:

- The contamination of water by acid mine drainage;
- The long-term stability of the containment dams and diversion channels on the site;

68 Alexco financial reports. Available at:: http://www.alexcoresource.com/s/annual_reports.asp

69 Faro Mine Remediation Project. Available at: http://www.faromine.ca/mine/general.html

- The creation and wind borne distribution of dust from the tailings; and,
- The need to minimize both human and animal contact with waste materials.[70]

From 2003 through 2009 the two governments, in partnership with the Ross River Dena and the Selkirk First Nation, commissioned over 100 technical studies and assessments with the goal of coming to consensus on the preferred option for closure and reclamation. That consensus was reached in February 2009. The Faro Mine Closure Office writes:

> "The recommended closure plan involves a stabilize-in-place approach. Just like it sounds, this approach will include upgrading dams to ensure tailings stay in place during natural events such as earthquakes and floods. In addition, all waste rock will be re-sloped to improve long-term stability and engineered soil covers will be installed over all tailings and waste rock. The plan also provides for state-of-the-art collection and treatment systems for contaminated water."[71]

In March 2009 the Yukon government formally took over managing the Faro mine complex from the receiver Deloitte and Touche. A three year care and maintenance contract valued at $21.6 million was awarded to Denison Environmental Services at the same time. In the spring of 2012 the care and maintenance contract was awarded to Tlicho Engineering and Environmental Services Ltd. Much of the care and maintenance work is focussed on the monitoring, collection and treatment of contaminated water on the site. In addition to care and maintenance work, in the summer of 2010 the Yukon government let a contract for $11.5 million to have some of the most highly reactive waste rock covered with liners to contain acid mine drainage.[72]

The Faro Mine Remediation Project is currently developing a five year plan for the next phase of the project. The plan will include:

- Ongoing care and maintenance activities to ensure human health and safety and protection of the environment;
- Typical activities associated with Phase 2b of the project (i.e., engineering design, schedule and cost planning, and procurement of goods and services);
- Preparation for submission of the Project Proposal to Yukon environmental and socio-economic assessment process; and,
- Identification, planning, design, and execution of early remediation components for which the identified risks have exceeded acceptable tolerance levels.[73]

Once the final detailed engineering design plan is complete and has met all regulatory approvals, the major construction phase is expected to take 15 years to complete. This will be followed by a 20 to 25 year phase where all of the site structures, ground covers and water treatment systems are tested, monitored and improved as required. A certain level of active management, and especially water monitoring and treatment, is expected to be required for a very long period following the construction and testing phases. Currently there is no expectation that the Faro site can be a walk-away closure. The current estimate for the total cost of remediation and closure of the site is $700 million.

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70 Faro Mine Remediation Project. Available at: http://www.faromine.ca/project/challenges.html

71 Faro Mine Remediation Project. Available at: http://www.faromine.ca/news/2009/02/recommended_closure_plan_for_t.html

72 Yukon Government News Release #10-097. Available at: http://www.gov.yk.ca/news/2010/10-097.html

73 Faro Mine Remediation Project. November 27, 2012. Available at: http://www.faromine.ca/news/2012/11/fmrp_planning_process.html

1.2.3.3 Clinton Creek

Clinton Creek is an example of how poor engineering and mining practices combined with inadequate government oversight over a long time period combine to produce seemingly intractable environmental problems. In 1974 while the mine was still operating, the waste rock pile slid down into the valley, blocking Clinton Creek and creating Hudgeon Lake. That same year the tailings slid down into Wolverine Creek, restricting its water flow. When mining ended in 1978, the company removed most of the buildings and equipment from the site and built a rock channel and weirs to direct the flow of Wolverine Creek over the tailings that ended up in the valley. In the early 1980s Cassiar Asbestos constructed weirs and installed culverts at the outlet of Hudgeon Lake and reinforced the channel of Clinton Creek. The channel reinforcement quickly failed causing further erosion and was reconstructed. By 1985 the tailings had moved to partially block Wolverine Creek again. In the late 1980s some further clean up and remediation was done and in 1992 the federal government recommended that the environmental security deposit be returned to the new owners of the site, a move that freed the owner from further environmental liability. In 1997 a flood destroyed the weirs and channel reinforcement of Clinton Creek and the federal government undertook work to stabilize the channel in 2002.[74]

With the devolution transfer agreement, the Yukon government took over management of the site in 2003 with funding from the federal government. The past 10 years have seen a further clean up of physical hazards on the site and further reinforcement and repair of the gabions previously installed to stabilize the creek and reduce erosion. The waste rock pile is continuing to move, a sign that a permanent solution to the site's environmental issues is not likely to be found soon. The technical studies needed to produce long-term management and final closure plan options are ongoing.[75]

1.2.3.4 Mount Nansen

The Mount Nansen mine, operated by BYG Resources, was in production between early 1997 and early 1999. The operation was plagued with geological and technical problems and higher than average rainfall created water imbalances on the site leading to water discharge issues and legal problems. In May 1999 BYG went into receivership and was convicted of violating the terms of its water licence. In July of 1999 the receiver abandoned the property, departing overnight, and the federal government took over its environmental management.[76] The Assessment and Abandoned Mines Branch of Yukon government writes:

> "When the site was abandoned, the tailings pond contained high levels of cyanide and metals and was in danger of spilling over the dam into the Dome Creek–Victoria Creek–Nisling River system. The dam holding back the tailings and contaminated water leaked and was unstable. This posed a threat to the downstream environment including vegetation, wildlife and fish. The original 1940s and 1960s buildings, including the mill and the physical hazards such as pits, trenches and underground workings (called adits) posed safety hazards and needed to be addressed."[77]

74 Yukon Energy Mines and Resources. Clinton Creek Fact Sheet. Available at: http://www.emr.gov.yk.ca/aam/cc_timeline.html

75 Yukon Energy Mines and Resources. http://www.emr.gov.yk.ca/aam/reclaiming_abandoned_mines.html

76 Yukon Geological Survey. Mineral Property Update

77 Yukon Energy Mines and Resources. Mount Nansen Fact Sheet. Available at: http://www.emr.gov.yk.ca/aam/mn_fastfacts.html

With the devolution transfer agreement, Yukon government took over management of the site in 2003 with funding from the federal government. The past 10 years have seen reduction of water levels behind the tailings dam, improvements in water quality, a clean up of hazardous materials and adit remediation being carried out. Site security, monitoring and technical studies have been ongoing as Yukon, federal and Little Salmon Carmacks First Nation work on a final closure and remediation plan.[78]

1.2.4 First Nations

The relationship between First Nations and mining has undergone a radical transformation in Yukon over the past several decades, and especially in the last 10 years.

For First Nation individuals seeking employment, the mining industry has become much more welcoming overall than it was decades ago. All over Canada the industry has been recruiting First Nation employees as general labour shortages make First Nation communities, with their generally higher levels of unemployment and under-employment, an attractive pool of untapped labour (see Labour Market Discussion component). In addition, mining companies have the added incentive in that hiring more First Nation employees — and especially the citizens of the First Nation traditional territory on which the mine is situated — helps to improve the overall relationship between the mine and the local communities. Finally, as the amount of time spent on traditional activities and the seasonal round by First Nation people has generally declined, there is both more opportunity and greater incentive for individuals to take on full time work.

A recent Yukon example of the changes from the experience of the Ross River Dena in the early years of the Faro mine operation (see Section 1.1.3 above) and the present is at the Minto mine. Capstone Mining reports that in 2012, of 316 employees at the Minto mine, 51% are Yukoners, and 26% are First Nations.[79] Over 20 of the 82 First Nation employees are Selkirk First Nation citizens. This is a substantial improvement from mid-2011 when only 24 out of approximately 300 workers (8%) were reported to be aboriginal.[80]

With the signing of the Umbrella Final Agreement in 1993, followed by 11 of Yukon's 14 First Nations signing individual final land claim and self-government agreements there has been a fundamental shift in the relationship between mining companies and First Nation governments. Beyond the requirements stipulated under Yukon Environmental and Socio-economic Assessment Act, mining companies operating in Yukon are very aware that they now need to build long-term relationships with First Nations, treat First Nation governments with the level of respect due to them, and negotiate comprehensive impact benefit agreements.

Land claims agreements have also opened the door to First Nations being able to collect resource royalties from mining projects. The Minto mine is located on Category A settlement land that the Selkirk First Nation has both surface and sub-surface rights to under its final agreement. Therefore, the royalties from the mine flow to the SFN (Yukon government collects the royalties on behalf of the first nation). Between 2007, when the mine opened and the end of 2011 the royalties from the Minto mine, at $12.6 million total, is a significant source for revenue for the Selkirk First Nation.[81]

78 Yukon Energy Mines and Resources. Mount Nansen Fact Sheet. Available at: http://www.emr.gov.yk.ca/aam/mn_fastfacts.html

79 Capstone Mining Corporation. http://capstonemining.com/s/Responsibility.asp?ReportID=553151

80 Yukon News. February 15, 2012. Available at: http://yukon-news.com/business/27132/

81 Yukon Government News Release #12-185. Available at:: http://www.gov.yk.ca/news/12-185.html

Indications are emerging that Yukon First Nations may expect to share in the revenues from a mine even if it is not located on Category A settlement land. As an example, Victoria Gold signed a comprehensive cooperation benefits agreement with the Nacho Nyak Dun First Nation for the planned Eagle project north of Mayo in October 2011. Although all the details of the agreement have not been made public, there is a provision that the company provide financial support and profit sharing opportunities that may result from a successful project.[82]

As noted above, not all Yukon first nations have signed land claim agreements. Of particular note in the mining context are the two Kaska nations: the Ross River Dena Council and the Liard First Nation. However, the Kaska have also required that they be accorded due respect as governments, have negotiated benefit agreements with mining companies, and have vigorously defended their aboriginal rights and title in the courts.

1.3 Opportunities and Risks

As noted in the introduction to this component, we are had originally intended to provide a set of scenarios for the industry in Yukon over the short and medium term as called for in the request for proposals. Although governments and others have a obvious interest in knowing what lies ahead, forecasting what Yukon's mining sector will look like over the next decade is obviously an uncertain proposition. But it was not the inherent uncertainty of forecasting that led to the decision to not offer scenarios. Instead:

- Yukon government currently contracts the Center for Spatial Economics[83] to provide forecasting services and the Center can provide various scenarios based on changes to the mining sector;
- Specific forecasts rely entirely on the set of assumptions on which they are based but often tend to be viewed as more accurate or robust than they actually are; and,
- In discussions with Yukon Economic Development staff it was decided that our approach should focus more on pointing to the specific opportunities and risks faced by different mining projects in Yukon.

In Section 1.3.2 below therefore, we provide an analysis of the key opportunities and risks associated with currently operating Yukon mines and potential mines along with the placer and exploration sectors and current abandoned mines.

1.3.1 Assumptions

When discussing opportunities and risks — even when not offering specific forecasts or future scenarios — it is important to be explicit about the critical assumptions that underpin the discussion. We offer the following.

1.3.1.1 Mineral Prices

We assume that the prices of key minerals will generally reflect the World Bank forecasts outlined in the Global Trends and Canadian Overview component. Specifically:

- Gold will decline in price from US$1,600 to US$1,300 per ounce between 2013 and 2025;
- Silver will decline from US$31.00 to US$25.00 per ounce between 2013 and 2025;

82 Victoria Gold press release. October 14, 2011. Available at: http://www.vitgoldcorp.com/s/news_releases.asp?ReportID=533736

83 http://www.c4se.com/

- Copper will decline from US$3.54 per pound in 2013 to US$3.09 per pound in 2025;
- Lead and zinc rise in price between 2013 and 2025, lead from US$0.95 to US$1.04 and zinc from US$0.95 to US$1.13; and,
- Although the World Bank offers no forecast, the price of tungsten seems likely to decline to its 2006/2007 price of US$250 per MTU.

1.3.1.2 Financing & Costs

The substantial financing difficulties now faced by the mining industry — and particularly by development stage companies who have what appears to be a viable mine but not the capital to finance its development — add a substantial level of risk to plans to open new mines in Yukon. Equity financing has largely dried up for many junior mining companies and for most development stage companies. Even debt financing deals for mid-tier producers to expand operations or build new projects carry interest rates in the 9-10% range. There is no indication that this will change in the short to medium term.

Cost escalation is an ongoing risk faced by both operating mines and the construction of new projects. The costs of fuel and labour loom the largest. For the purposes of the discussion on opportunities and risks, we are assuming that the recent general downturn in the industry will mean that severe cost escalation will no longer be the norm. However, even a lower level of cost escalation will still pose risks for Yukon mining sector.

The ability to attract and retain employees for Yukon's mining sector is a key consideration for Yukon, and with an aging mining labour force across the country, this may become a bigger problem going forward. Ramifications could include higher labour costs, delays in project development or issues securing and maintaining the operational workforce.

1.3.1.3 Political, Regulatory and Legal Issues

Although Yukon's overall regulatory regime is a relatively clear and known quantity, projects still face regulatory and legal issues and risks. Examples include disagreements between proponents and regulators over the level of assessment required and projects being caught up in legal disputes between different levels of government.

There is also both risk and opportunity associated with changes in the governing party going forward, as parties can view the mining sector and further mining sector development differently depending on the values and platform of their party.

1.3.2 Project Opportunities and Risks

In the tables below we present a summary of the opportunities and risks for Yukon's mining sector over the short and medium terms. Underlying assumptions are detailed in Sections 1.3.1.1 through 1.3.1.3 above.

Table 1: Exploration: Opportunities and Risks

OPPORTUNITIES	RISKS
Yukon will continue to offer attractive geological targets for mineral exploration. The recently-discovered Carlin-type geology in the Rackla Belt north-east of Keno and the White Gold finds in the western Yukon provide evidence that Yukon has not been fully explored and much potential remains.	Exploration spending in Yukon has largely (69% of expenditures in 2012) been driven by the search for gold. A declining gold price (US$1,600 to US$1,300 per ounce or 19% between 2013 and 2025) will likely result in a significant decline in exploration spending. This will be reinforced by the expected decline in the prices of copper and silver (-13% and -19% respectively).
Yukon offers minimal geo-political risks compared with many jurisdictions and has a largely stable regulatory regime.	Following the global economic downturn of 2008 the junior sector has faced an increasing challenge in raising the equity required to fund exploration despite high mineral prices. Until investors regain their appetite for risk junior companies, which drive the bulk of exploration in Yukon, these companies will lack the money to explore.
The rise in the prices of lead and zinc that is expected by the World Bank (+9% and +19% respectively) will likely drive more exploration focussed on these metals. Lead and zinc were the targets of 11% of Yukon exploration expenditures in 2012.	The exploration sector is now facing some legal uncertainty around claim staking as the Kaska First Nations and Yukon government fight a legal battle over the requirement to consult prior to claims being staked.
	Exploration in the Peel region also faces ongoing uncertainty as a protracted public conflict over the Peel land use plan continues.

Table 2: Placer Mining: Opportunities and Risks

OPPORTUNITIES	RISKS
Placer mining has a long history in Yukon, uses well-known approaches and technology and has relatively low costs and barriers to entry compared with other forms of mining. These features work to ensure that placer mining will continue to be significant part of the mining sector.	Placer production has been in steady overall decline since its modern day peak in 1989 despite the six-fold rise in price between 2000 and 2012. It appears that placer gold is simply getting more difficult to find as reserves decline in the traditional placer mining areas. Unless new geological theories emerge enabling the industry to find new sources of placer gold in other areas, production is unlikely to increase significantly.
The regulatory regime for placer mining is well established and well understood.	The expected 19% decline in the price of gold over the next 12 years will act to reduce the level of effort in the placer industry.

Table 3: Hardrock Mining: Opportunities and Risks

OPPORTUNITIES	RISKS
Mineral Prices	
The rise in the prices of lead and zinc that is expected by the World Bank (+9% and +19% respectively) from 2013 through 2025, will improve financial returns of existing mines and make new lead-zinc mines more likely.	A declining gold price (US$1,600 to US$1,300 per ounce or 19% between 2013 and 2025 forecast by the World Bank) will increase price risks for operating gold mines and make the opening of new projects less likely.
	The World Bank forecast 13% decline in copper price from US$3.54 per pound in 2013 to US$3.09 per pound in 2025 will increase price risks for operating copper mines and make the opening of new projects less likely.
	The World Bank forecasts that silver will decline from US$31.00 to US$25.00 per ounce between 2013 and 2025, increasing the price risks for operating silver mines and make the opening of new projects less likely.
	The price of tungsten is largely dependent on decisions made by the Chinese government as China is both the largest producer and largest consumer of the metal. The price of the metal has been highly volatile in the recent past.
Financing & Costs	
China and particularly Chinese state-owned enterprises continues to be potential source of financing for the Yukon's mining sector.	Equity financing has largely dried up for many junior mining companies and for most development stage companies.
The recent general downturn in the industry will mean that severe cost escalation will likely no longer be the norm.	Debt financing has also become much more challenging. Even debt financing deals for mid-tier producers to expand operations or build new projects carry interest rates in the 9-10% range. The larger the capital cost the greater the risk that financing will simply not be available.
	Cost escalation is an ongoing risk faced by both operating mines and the construction of new projects. The costs of fuel and labour loom the largest.
Infrastructure	
Mineral projects located close to the Yukon's power grid have the opportunity to reduce their power cost risks by connecting to the grid.	Projects requiring the construction or substantial upgrade of roads and bridges face greater risks.
Technical	
Open pit mines generally face lower cost risks than underground operations.	Project-specific geo-chemistry and other issues can increase risks due to higher costs or lower recovery rates.

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Yukon Mining Sector Profile

Component 3: Mining Sector Performance Measurements

1 Mining Sector Performance Measurements

The purpose of this project component is to help identify Yukon-relevant mining sector performance measurements and their related data sets. This component includes:

- A literature review of relevant work in the field of mining performance measurements, including NRCan's *Mining Sector Performance Report* that is currently being updated; and,
- A discussion of the data and approaches needed to support mining sector performance measurements in the Yukon.

1.1 Literature Review

1.1.1 Mining Sector Performance Report

In September 2010 Natural Resources Canada released the *Mining Sector Performance Report 1998 to 2008.*[1] The report was built around a number of indicators grouped under economic performance, environmental performance and social performance as shown in Table 1.

The objective of the report was "…to provide an evidence-based analysis of the Canadian mining sector's economic, environmental and social performance over the past decade."[2]

The report states:

> "The indicators presented in this report reflect this disparity in the availability of evidence. They were selected on the basis of (i) international mining performance reporting practice (Annex), (ii) the input of an external advisory committee composed of individuals from academia, industry, Aboriginal and non-governmental organizations, and (iii) the availability of data. Where available, quantitative performance improvements were reported. Where no empirical evidence was found, key initiatives or events were used to illustrate activity and case studies were also used to round out the story."[3]

This reflects precisely the experience of those tasked with producing meaningful socio-economic indicators for socio-economic effects assessments under YESAA (see Component 6 of this profile). The mining industry affects many aspects of the social, environmental and economic fabric. Much of what is valued by individuals, communities and society is not readily measured and, at least implicitly, that which cannot be measured quantitatively generally gets less weight in the decision making process. There is limited credible data to measure the social dimensions of mining, which undermines efforts to choose relevant indicators.

To be useful, indicators must be linked to the desired outcomes. The purpose behind selecting and tracking indicators is to measure progress toward explicit goals not to simply create a snapshot view of current activities or to repackage data.

[1] Federal, Provincial and Territorial Social Licence Task Group. September 2010. Mining Sector Performance Report: 1998 to 2008. Available at: http://www.nrcan.gc.ca/minerals-metals/publications-reports/3016
[2] Ibid. p.1
[3] Mining Sector Performance Report: 1998 to 2008. p.5

Table 1: Mining Sector Performance Report: Indicators

ECONOMIC PERFORMANCE
Indicator 1: Production
Indicator 2: Exploration expenditures
Indicator 3: Employment
Indicator 4: Exports
Indicator 5: Research and development
Indicator 6: Government revenues and expenditures
ENVIRONMENTAL PERFORMANCE
Indicator 1: Water quality and acid rock drainage
Indicator 2: Tailings management
Indicator 3: Energy consumption and efficiency
Indicator 4: Greenhouse gas emissions
Indicator 5: Air emissions
Indicator 6: Land-use planning
Indicator 7: Orphaned and abandoned mines
Indicator 8: Environmental expenditures
SOCIAL PERFORMANCE
Indicator 1: Duty to consult and accommodate Aboriginal groups
Indicator 2: Outreach and engagement
Indicator 3: Aboriginal benefits
Indicator 4: Training and skills
Indicator 5: Gender equality
Indicator 6: Worker health and safety
Indicator 7: Mine closure
Indicator 8: Strikes and lockouts

The Mining Sector Performance Report is to be updated every three years and the next is therefore due to be completed in 2013. Feedback to the 2010 report suggested that:

- The indicators need to be anchored in a more robust conceptual framework on the sustainable development of mineral resources;
- Indicators, and especially economic and social indicators, should be improved; and,
- The provinces and territories need to be better represented in the updated report. [4]

A revised indicator framework for the 2013 Performance Report has been approved and new indicators will be included.

For economic performance, Natural Resources Canada identifies the key desired outcome as:

> "Maintain and enhance the financial health of the sector, ensuring its ability to sustain itself over time, so that the industry can make an economic contribution to the local, regional, national and global economy."[5]

[4] Natural Resources Canada. January 11, 2013. 2013 Mining Sector Performance Report: Background and Project Update Presentation. Available at: : http://www.nrcan.gc.ca/minerals-metals/publications-reports/3016

The original economic performance indicators and the proposed additions for 2013 are summarized in Table 2.

Table 2: Economic Performance Indicators

2010 Report	Proposed for 2013 Report
▪ Exploration, Development and Assessment Expenditures ▪ Value of Canadian Production ▪ Contribution to Canadian GDP ▪ Mine closures ▪ Exports Indicator #4 in 2010 ▪ Age composition of the Canadian minerals and metals industry ▪ Research and Development ▪ Canadian Reserves of Selected Metals	▪ Infrastructure Expenditures by companies and governments ▪ Public Geoscience Expenditures ▪ Skills Training - Expenditures by industry, jurisdiction, organized labour ▪ Regulatory Efficiency - Length of time a project takes to move through environmental assessment and permitting processes ▪ Land-Claim Settlements ▪ Advanced Exploration Projects

For environmental performance, Natural Resources Canada identifies the key desired outcomes as:

> "Responsible mining exploration, development, operations and public policies will be predicated on maintaining a healthy environment and, on closure, returning mine sites and affected areas to viable self-sustaining, ecosystems (Adapted from the Whitehorse Mining Initiative)"
>
> "Protected area networks are essential contributors to environmental health, biological diversity, and ecological processes, as well as being a fundamental part of the sustainable balance of society, economy, and environment (Whitehorse Mining Initiative)"
>
> "Institutional governance frameworks are in place or will be built that can provide certainty and confidence that the capacity of government, companies, communities and residents exists to address environmental impacts (Mining Minerals and Sustainable Development)"[6]

The original environmental performance indicators and the proposed additions for 2013 are summarized in Table 3.

[5] Natural Resources Canada. January 11, 2013. 2013 Mining Sector Performance Report: Background and Project Update Presentation. Available at: : http://www.nrcan.gc.ca/minerals-metals/publications-reports/3016
[6] Ibid.

Table 3: Environmental Performance Indicators

2010 Report	Proposed for 2013 Report
▪ Water Quality (Compliance with Metal Mining Effluent Regulations will be primary data source) ▪ Tailings Management (narrative) ▪ Energy Consumption and Efficiency ▪ GHG and Air Emissions (NOx, SOx, PM) ▪ Environmental Expenditures ▪ Orphaned and Abandoned Mines (Government and industry expenditures on contaminated sites and reclamation and decommissioning)	▪ Regulatory Oversight ▪ Land-use planning ▪ Absolute energy usage and Energy Sources ▪ Orphaned and Abandoned Mines ▪ # of high-risk sites in each jurisdiction (to show decreasing numbers over time) ▪ Reductions in Crown liability arising from Crown expenditures

For social performance, Natural Resources Canada identifies the key desired outcomes as:

> "The development of Canada's mineral resources will result in a fair distribution of the costs and benefits of development for the current generation, including the communities directly affected by exploration and mining activities (Adapted from Whitehorse Mining Initiative and Mining Minerals and Sustainable Development)"
>
> "The depletion of Canada's natural capital will not deprive future generations, through the reinvestment of the wealth generated from mining into other forms of capital (Adapted from Mining Minerals and Sustainable Development)"
>
> "Aboriginal peoples are entitled to opportunities to participate fully in mineral development at all stages of mining and associated industries and at all employment levels (Whitehorse Mining Initiative)"[7]

The original environmental performance indicators and the proposed additions for 2013 are summarized in Table 4.

[7] Natural Resources Canada. January 11, 2013. 2013 Mining Sector Performance Report: Background and Project Update Presentation. Available at: : http://www.nrcan.gc.ca/minerals-metals/publications-reports/3016

Table 4: Social Performance Indicators

2010 Report	Proposed for 2013 Report
▪ Employment ▪ Aboriginal employment, by occupation classification ▪ Gender Equality ▪ Worker Health and Safety ▪ Strikes and Lockouts ▪ Number of agreements between companies and Aboriginal communities	▪ Spending on Aboriginal skills training by business and government ▪ Revenue flows to Aboriginal/non-Aboriginal communities from companies and/or jurisdictions ▪ Company spending on local procurement / Aboriginal procurement ▪ Government funding of groups to participate in environmental assessment ▪ Duty to Consult

1.1.2 Sustainability, Indicators and Reporting

Useful insights into best practice on corporate sustainability reporting measurements and reporting are contained in the Canadian Corporate Sustainability Reporting Best Practices 2008.[8]

A good overview of some key reporting parameters that have been the subject of considerable stakeholder review can be found in the work of the Global Reporting Initiative.[9]

Alan Young, who is one of the team members preparing this material, offers the following key concepts and approaches from his experience as part of the External Advisory Committee for the 2010 *Mining Sector Performance Report* and his involvement in the current updating of the mining sector performance measurements used:

1. Process is as important as product, if you want the set of measurements to be credible, meaningful and effective in driving behaviour and policy.
2. Starting with clear definition of purpose and audience is critical – who are the key users and what will they be using the indicators for? What end is the government seeking by investing in performance measurements?
3. Engaging selected experts/users in definition/finalization of key parameters improves strategic focus, and efficiency in data gathering
4. Stability of the framework and data sources over time is important for trend analysis. While adjustments can be made, focus on finding core indicators that can be traced over time
5. If you use aggregate numbers to build indicators, be transparent about the formula for aggregation
6. Be aware that industry and civil society are heavily saturated with performance reporting requests and reports. In this context it is critical to look for a limited number of targeted indicators in each subject area that zero in on the core issue of concern or that define desired social, economic or environmental conditions. “Shotgun” targeting of performance data will lose data sources and users quickly.

[8] http://www.stratos-sts.com/wp-content/uploads/2013/04/2008_04_CSR-Best-Practices.pdf
[9] https://www.globalreporting.org/resourcelibrary/MMSS-Complete.pdf)

1.2 Yukon Mining Sector Performance Measurements

What would a made-in-Yukon mining sector performance report look like? It could mirror the national report very closely given the structure of the 2010 report and the additions and changes expected in the 2013 update as summarized in Table 1 through Table 4.

Although it will be best to wait for the 2013 update before finalizing the structure of a Yukon mining sector performance report, a proposed outline for economic performance is presented in Table 5**Error! Reference source not found.**.

Table 5: Proposed Yukon Mining Sector Economic Performance Measurements

INDICATOR	SUB-INDICATORS	SOURCE
1. Production	Volume of production by mine	Yukon Energy Mines & Resources
	Value of production by mine	Yukon Energy Mines & Resources
	Volume of placer production	Yukon Energy Mines & Resources
	Value of placer production	Yukon Energy Mines & Resources
	Contribution to GDP	Yukon Bureau of Statistics
1.a) Mine construction	Expenditures on mine construction	Mining company reports
2. Exploration	Exploration & deposit appraisal expenditures	Natural Resources Canada
	Ratio of advanced projects to early stage projects	Yukon Energy Mines & Resources
2.a) Reclamation	Government expenditures on reclamation	Yukon Assessment and Abandoned Mines Branch
3. Employment	Total employment:	
	Exploration	Annual survey
	Mine construction	Make reporting part of Quartz mining license
	Placer mining	Estimate from Yukon EMR
	Hardrock mining	Make reporting part of Quartz mining license
	Reclamation	Yukon Abandoned Mines Branch
	Proportion of Yukon residents employed at each stage	Part of exploration survey and reporting requirement of Quartz mining license
4. Local procurement	Spending by industry on Yukon goods and services	Annual survey of exploration companies and make reporting part of Quartz mining license
	Economic impact of Yukon expenditures	Use Statistics Canada's Inter-provincial input-output model to calculate

5. Research and human resource development	Public Geoscience expenditures	Yukon Geoscience
	Skills training by industry, government, NGO and unions	Annual scan of programs, uptake, and completion rates.
6. Government revenues	Royalties (Yukon)	Yukon Finance
	Income tax	Yukon Finance
	Corporate tax	Yukon Finance
7. Regulatory process	Average length by stage	Yukon Environmental and Socio-economic Assessment Board Yukon Water Board

A proposed outline for Yukon environmental performance measures is presented in Table 6.

Table 6: Proposed Yukon Mining Sector Environmental Performance Measurements

INDICATOR	SUB-INDICATORS	SOURCE
1. Water quality and acid rock drainage		Existing quartz mining license reports
2. Tailings management		Existing quartz mining license reports
3. Energy consumption and efficiency	Fuel type and volume consumed	Would need to be made a reporting requirement on quartz mining license
	Total energy consumption by unit of production	Would need to be made a reporting requirement on quartz mining license
4. Greenhouse gas emissions		Calculate from reported fuel consumption using Canada Department of Environment conversion factors
5. Air emissions		Calculate from reported fuel consumption
6. Land-use planning	Number of complete land use plans under UFA	Yukon Energy Mines & Resources
	Number of plans in process	Yukon Energy Mines & Resources
7. Orphaned and	Number and current status	Yukon Assessment and Abandoned

abandoned mines		Mines Branch
8. Environmental risks	Estimated remaining cost of reclamation of orphaned and abandoned mines	Yukon Assessment and Abandoned Mines Branch
	Total bonding in place for existing mines	Yukon Energy Mines and Resources

A proposed outline for Yukon social performance measures is presented in Table 7.

Table 7: Proposed Yukon Mining Sector Social Performance Measurements

INDICATOR	SUB-INDICATORS	SOURCE
1. Aboriginal benefits	First Nation royalties	Yukon Finance
	First Nation employment	Make reporting part of Quartz mining license
	Procurement with First Nation businesses	Make reporting part of Quartz mining license
	Socio-economic participation agreements	Yukon First Nations
2. Community engagement	Community events & sponsorships	Mining companies
2.a) Community and individual health	Individual health	Selected Health Survey statistics from Statistics Canada
	Alcohol and drug abuse	Alcohol sales data (Source: Yukon Liquor Corporation) Reported drug incidents and criminal code traffic incidents data (Source: Yukon Bureau of Statistics)
	Crime rates	Community crime rates: broad all, violent, property (Source: Yukon Bureau of Statistics)
3. Gender equality	Ratio of women employed	Make reporting part of Quartz mining license
4. Worker health and safety	Workplace accident rates	Yukon Workers' Compensation Health and Safety Board
5. Mine closures, strikes and lockouts		Yukon Energy Mines & Resources

Taken together, the Yukon mining sector performance measures as outlined are well suited to create a Yukon-wide socio-economic effects assessment of the mining industry. Using this approach will satisfy the need for such an assessment as called for under Component 6 of this profile.

Yukon Mining Sector Profile

Component 4: Analysis of Mining Supply Chain

1 Analysis of Mining Supply Chain

Our initial intent for this component was to provide:

- A literature review of similar studies from other jurisdictions to help identify the various aspects of the mining supply chain across the full mining life cycle;
- A scan of the existing supply chain in Yukon, including rural community businesses, Yukon First Nation owned businesses and joint ventures; and,
- Discussions with selected representatives of the business community that make up part of the existing supply chain in order to confirm what is currently present and where gaps and opportunities may exist across the full mining life cycle.

We have retained the literature review portion, including the only known effort to provide a systematic analysis of Yukon's mineral supply chain in Section 1.1 below.

However, because of the difficulties faced in a previous effort to effectively survey the industry to measure the extent and nature of the supply chain, in Section 1.2 below we have tried to take a different approach to creating an overview of Yukon's existing supply chain. The input-output (I-O) data published by Statistics Canada provides the amount of each commodity purchased by the mining industry. The latest 2009 iteration of the input-output model considerably changed the methodology along with the rest of the System of National Accounts.[1] In the past, I-O data was provided at four levels, (S, M, L & W) with the W level being the most detailed and the L, M and S levels having greater degrees of aggregation. Since the 2012 revision (2009 data), there are only two levels of aggregation: detailed and summary. Detailed information is only available at the Canadian level, but summary information is published for Yukon. The detailed data provides information on different sectors of the mining industry while the summary information lumps the entire oil & gas and mining industry together. The final demand data allows inferring how much of the inputs of each commodity are imported.

Finally, in Section 1.3 we provide suggestions for how the Yukon government can most effectively build on the current understanding of the supply chain and to provide support for businesses wishing to become a part of that chain.

1.1 Literature Review

A supply chain is simply the necessary flow of products and services to the end user. In the mining context this is often thought of as suppliers to an operating mine but the industry wide supply chain is much more complex; ranging from contractors providing staking services to exploration companies to wholesale fuel distributors bringing in the fuel for actual operations. Along the way is a complex web of consultants, service providers, wholesalers and retailers.

In the resource industries there has been a general shift away from bringing and keeping activities in-house (vertical integration) within a company and toward out-sourcing all manner of services and activities to separate, specialized firms. For large resource companies the advantage of owning and/or directly managing different aspects of their supply chain is a greater degree of control, a reduction of risk that critical goods or services are not available when needed and the potential to improve profitability. The motivation to outsource more and more of the supply chain — and even formerly core aspects of the business like the actual mining — is:

- The reduction in overhead costs;

[1] For the start of the description of the 2012 major revision to the System of National Accounts see: http://www.statcan.gc.ca/nea-cen/hr2012-rh2012/start-debut-eng.htm

- The advantages of having smaller, more specialized firms doing what they specialize in; and,
- The competition among suppliers reducing overall costs and therefore improving profitability.

While both sides of the supply chain — the suppliers and the buyers — see themselves as benefiting from the trend toward greater reliance on a deeper and more complex supply chain, who benefits most? Brian Dumsday[2] argues that, although all firms involved can benefit, those that benefit most are:

- Suppliers of goods who can carry large inventories;
- Suppliers who themselves have relationships with large numbers of suppliers or sub-contractors;
- Suppliers of complex products; and,
- Buyers with large purchasing budgets.

1.1.1 Saskatchewan

Saskatchewan has a strong focus on productivity and supply chain development in the Ministry of the Economy. The province hosts an annual mining supply chain forum and tradeshow, with its fifth annual held in April 2013.[3] The provincial government has also developed two related guides for businesses and communities:

- *How to Successfully Access the Mining Supply Chain*[4]; and,
- *Potash Mining Supply Chain Requirement Guide*[5].

The *How to Successfully Access the Mining Supply Chain* guide was largely based on an online survey of key players in the mining and mining service sectors, including large consulting firms, of the Saskatchewan economy with follow-up interviews also conducted. The guide appears to be aimed at firms that have little background in the industry. Its overall advice to new entrants is very broad and somewhat rote:

"To be successful in the Mining Industry, as a new manufacturer, you need to:

- Do your homework
  - Fully understand your customers business (See Section – Mining Overview)
  - Know who your customers are, and what they are doing (See Section – Your Customer)
  - Learn the process they use for Procurement (See Section – Supply Chain)
  - Discover where opportunities exist (See Section – Services and Equipment)
- Invest in the opportunity
  - Develop your company image (See section – Marketing your company)
  - Develop your core competencies (See Section – Assessing needs)
- Think long term
  - Be realistic and focus on sustainability (See Section – Strategies)
- Make your mark
  - Follow the steps to becoming a new supplier (See Section - Becoming a New Supplier)
  - Strive for Excellence (See section – How to maintain your position)

[2] BW Dumsday and Associates. November 2012. Alberta Supply Chain Overview.
[3] http://www.enterprisesaskatchewan.ca/MiningSupplyChainForum
[4] Saskatchewan Ministry of the Economy. "How to Successfully Access the Mining Supply Chain." Available at: http://www.enterprisesaskatchewan.ca/AccessTheSupplyChain
[5] http://www.enterprisesaskatchewan.ca/PotashRequirementGuide

- Search for Continuous Improvement opportunities (See Section – Quality Management)"[6]

There is also somewhat more specific advice from the survey. For example:

> "Mining Companies control the type of contracts they wish to use and are now expanding into using more flexible incentive type contracts. Consultants have less flexibility as they are governed by the Mining Companies, and they are shown as more conservative in their contract choices."[7]

Perhaps even more useful is the inclusion of relatively detailed tables containing e.g., representative lists of equipment required for new mining projects, including an estimated value for each piece of equipment.

The *Potash Mining Supply Chain Requirement Guide*, prepared by Hatch, appears to be a more specific and useful guide for firms that are looking to become part of the supply chain for new potash mines in Saskatchewan and for government in its efforts to support industry growth. The guide presents the order-of-magnitude costs associated with the main expenditures over the lifecycle of a typical green field potash facility. The life cycle has five stages:

- Exploration and Resource Evaluation.
- Regulatory Licences, Permits and Approvals.
- Engineering and Construction.
- Operations and Maintenance.
- Closure, Reclamation and Monitoring.[8]

The steps required to go through each of the five stages is presented and a cost estimate for each step is included. Some of the cost estimates (getting the required permits and approvals for example) are based on the experience of recent projects in the province. Other cost estimates that are less dependent on project specifics are of a more generic nature. The stages are broken down in varying levels of detail with goods and services in the lifecycle supply chain grouped into categories. Some specialty suppliers are referenced separately.

1.1.2 British Columbia

In British Columbia there appears to be not nearly the same level of focus on supply chain development as in Saskatchewan. There is a Mining Suppliers Association of BC[9] (affiliated with the Mining Association of BC) but a scan of the organization's website indicates that it has a thin calendar of events and its news releases lean heavily to somewhat generic letters of support for various aspects of federal budgets and letters of congratulations.

The provincial government does have a specific program aimed at helping to finance local vendors in the mining (and oil & gas) supply chains in then northern part of the province:

> "The Northern Industry Expansion program supports supply chain financing with a 25% loan guarantee. The guarantee is delivered in partnership with the National Bank of Canada, which makes it easier for small and medium sized companies to take on major contracts and expand their businesses to create more jobs. Supply chain financing

[6] Saskatchewan Ministry of the Economy. "How to Successfully Access the Mining Supply Chain." P.8
[7] Ibid. p.68
[8] *Potash Mining Supply Chain Requirement Guide. P.1*
[9] http://miningsuppliersbc.ca/

> includes both financing of purchase orders (accounts payables) and of invoices to customers (accounts receivables) to retain more working capital in the company. Eligible companies may obtain the financing needed to purchase materials that require an outlay of more cash than a company might have on hand after it has signed a contract. In the case of receivables financing, National Bank provides cash up front to a company that is secured by an invoice to an end customer."[10]

The supply chain financing program has $15 million in funding.

1.1.3 Yukon

The only known effort to provide a systematic analysis of Yukon's mineral supply chain was commissioned by Yukon Economic Development in 2009.[11] Yukon *Mineral Sector Supply Chain Gap Analysis* was based on a primary research effort that involved surveying four projects:

- The Minto mine (only operating Yukon mine at the time);
- The Cantung mine (as a proxy for a Yukon mine of similar size and type);
- The Wolverine project (then under construction); and,
- The Carmacks Copper project (then in the permitting process).

In addition, 18 companies conducting exploration drilling on their properties were surveyed but only four responded.

In general, the authors of the analysis warn that the very small sample size on the producer side, coupled with the low response rate on the exploration side limits their observations to a high level analysis only and that the results cannot be reasonably extended to other Yukon mine operations. With those caveats however, the analysis offers the following on the mining production side:

- Mining companies are beginning to make public and firm commitments on the use of local suppliers to support mining during both pre-production and production;
- Spending on administrative costs and technical services tends to occur outside Yukon;
- Spending on mining, milling and transport show mixed results with no particular pattern; and,
- Price and value appear to be the driving factors in establishing supplier relationships.

And on the mineral exploration side:

- The largest components of mineral exploration spending are: drilling, labour, transportation, camp operations, and assays & analysis;
- Mineral exploration is a largely local endeavour. Most supply chain items are purchased in Yukon from Yukon suppliers;
- As with operating mines, most administrative spending occurs outside Yukon; and,
- Most of the spending on technical services is outside of Yukon.

1.2 Existing Yukon Mining Supply Chain

Yukon *Mining and Exploration Directory*,[12] compiled annually by Yukon Chamber of Mines, is the best inventory available of the firms and other organizations that make up Yukon's mining industry. However, it is not a truly comprehensive census; listings are voluntary and are driven by the firms and organizations themselves.

[10] http://www.northerndevelopment.bc.ca/funding-programs/business-development/northern-industry-expansion-supply-chain-financing/
[11] Vector Research. June 2009. *Yukon Mineral Sector Supply Chain Gap Analysis*.
[12] Yukon Chamber of Mines. Available at: http://www.yukonminers.ca/MiningDirectory.aspx

Another, though very spotty, source of information on the firms that make up Yukon's potential mining supply chain are the submissions by mining proponents to the Executive Committee of Yukon Environmental and Socio-economic Assessment Board. Usually included in the socio-economic baseline is a list of local (community and First Nation) firms and joint ventures that may benefit from the project.

1.2.1 Input-Output Data

Input-output data provides information on the purchases of different industries, including mining. As of 2012, Statistics Canada publishes input-output data at two levels of aggregation: summary and detailed. The detailed data is only available for Canada as a whole but separates out the different sectors of the "Mining, quarrying, and oil and gas extraction industry". Territorial data is only available for the entire "Mining, quarrying, and oil and gas extraction industry", but import data is also published.

1.2.1.1 Detailed Level Purchasing Data for Canada

At the detailed level, information is available on input of different sectors of the mining industry including:

1. Coal mining
2. Iron ore mining
3. Gold and silver ore mining
4. Copper, nickel, lead and zinc ore mining
5. Other metal ore mining
6. Stone mining and quarrying
7. Sand, gravel, clay, and ceramic and refractory minerals mining and quarrying
8. Diamond mining
9. Other non-metallic mineral mining and quarrying (except diamond and potash)
10. Potash mining
11. Support activities for mining

Of specific interest to Yukon are the *Gold and silver ore mining*, *Copper, nickel, lead and zinc ore mining*, and *Other metal ore mining* as well as *Support activities for mining*. Table 1 outlines the percentage distribution of the main purchases of the relevant sectors of the Canadian mining industry while the detailed information is provided in the appendix to this section. The table is in order of importance of each commodity for metal mining.

For the metal mining industry, the important inputs are: energy; support services; holding company services (presumably royalties paid to other companies); advertising, promotion, meals and entertainment (probably mostly meals and catering for workers). For the support activity industry, the architectural, engineering and related services cluster (which includes geological and mining engineering) is by far the most important input. Fuels and machinery leasing are also very important.

Table 1: Per Cent Distribution of Purchases for Selected Metal Mining Industries and Support Activities for Mining, Canada, 2009.

	Cu, Ni, Pb, Zn, Au, Ag & other metal (W) mining	Support activities for mining
Good or Service	**% of purchases of goods and services**	
Support services for mining and quarrying (except exploration)	9.3%	0.0%
Holding company services and other financial investment and related activities	8.8%	0.2%
Advertising, promotion, meals and entertainment	8.7%	1.0%
Fossil fuels	7.3%	9.3%
Electricity	6.9%	0.4%
Office supplies	6.5%	0.2%
Architectural, engineering and related services	2.6%	44.8%
Travel, meetings and conventions	2.6%	2.1%
Holding company services (imputed)	2.2%	0.3%
Wholesale margins	1.9%	3.7%
Commercial and industrial machinery and equipment renting and leasing services	1.4%	8.6%
Portion of Gross Output	**% of gross output**	
Indirect Taxes less subsidies	2.0%	0.1%
Value added	63.3%	49.6%
Purchases of goods and services	34.7%	50.2%

Source: Calculated from: Statistics Canada. Table 381-0022 - Input-output tables, inputs and outputs, detailed level, basic prices, annual (dollars), CANSIM (database). (Accessed: 2013-04-05)

1.2.1.2 Summary level purchasing data for Yukon

For Yukon input-output data is only available at the "summary level", which means that only total data for the overall *Mining, quarrying, and oil and gas extraction* industry is published. According to input-output data, total gross output of the mining, quarrying, and oil and gas extraction industry totals $440.2 million in 2009. Note that this is gross output and includes value added of $300.0 million (including $54.0 million in wages salaries and supplementary labour income) as well as indirect taxes net of subsidies of $1.7 million.

Table 2 presents the purchases of goods and services by the *Mining, quarrying, and oil and gas extraction* industry in 2009 and compares it to the total final demand for those commodities in Yukon economy. Note that negative numbers in the final demand column indicates net imports of those commodities. It would also have been instructive to compare these numbers with the actual import data, but the expenditure categories did not match sufficiently to draw any conclusions.

The most purchased service is professional services, not surprising given the amount of exploration work done in that year. The second most important purchase is refined petroleum products, followed by advertising and travel, and what are know as "fictive commodities". These so-called "fictive commodities" are not really fictional: it is just that they cannot be ascribed to a specific industry although they are a category in firms' income tax returns.

Table 2: Inputs into Mining, Quarrying, and Oil & Gas Extraction and Total Final Demand, Millions of Dollars, Yukon, 2009

	Mining, quarrying, and oil and gas extraction	Total, final demand: final expenditure on gross domestic product (GDP)
Professional services (except software and research and development)	35.4	-119.4
Refined petroleum products (except petrochemicals)	15.5	-84.3
Advertising and travel	14.4	
Repair and maintenance, Operating supplies, Office supplies	12.6	
Real estate, rental and leasing and rights to non-financial intangible assets	9.4	55.2
Other finance and insurance	9.1	-3.7
Computer and electronic products	8.0	-15.1
Primary metallic products	6.6	-11.8
Wholesale margins and commissions	6.6	-11.1
Industrial machinery	3.9	-21
Transportation margins	2.9	-14.6
Mineral fuels	2.8	2.1
Depository credit intermediation	2.8	5.8
Chemical products	2.0	-16.8
Non-metallic mineral products	1.7	-14.8
Administrative and support, head office, waste management and remediation services	1.1	-18.8
Transportation and related services	1.0	28.8
Other services	0.8	10.4
Utilities	0.5	20.3
Information and cultural services (Telecommunications)	0.4	-5.7
Fabricated metallic products	0.3	-35.8
Electrical equipment, appliances and components	0.3	-11.8
Mineral support services	0.2	156
Non-metallic minerals	0.1	-8.6
Sales of other government services	0.1	2
Total purchases	$138.5	
Value added	300.0	
Taxes and subsidies	1.7	
Total commodities	$440.2	$2,158.0

Source: Calculated from: Statistics Canada. CANSIM Table 381-0029 - *Provincial input-output tables, final demand, summary level, basic prices, annual (dollars)* and CANSIM Table 381-0028 - *Provincial input-output tables, inputs and outputs, summary level, basic prices, annual (dollars).*

1.3 Moving Forward

To date, the examination of the mining industry' supply chain has been faced with a lack of information. Input-output data and income tax data collected to derive that model, however, could be used to get a better picture of the industry's inputs and where they come from. Special runs on the model could be requested. These special runs could include more detail on purchase and the source of those purchases. This analysis could then be tested through a survey of selected firms in the industry.

To support Yukon firms that wish to enter into the supply chain, or improve their position within it, Yukon government may consider providing a guide modeled on the Saskatchewan *Potash Mining Supply Chain Requirement Guide*. The guide would present the order-of-magnitude costs associated with the main expenditures over the lifecycle of a typical mine from exploration through closure and reclamation. The steps required to go through each of the five stages would be presented and a cost estimate for each step included. Some of the cost estimates (getting the required permits and approvals for example) could be based on the experience of recent projects in Yukon. Other cost estimates that are less dependent on project specifics could be of a more generic nature with major differences between mines (open pit versus underground for example) presented. The stages should be broken down in detail with goods and services in the lifecycle supply chain grouped into categories. Specialty suppliers would be referenced separately.

1.4 Bibliography

BW Dumsday and Associates. November 2012. “Alberta Supply Chain Overview.”

Saskatchewan Ministry of the Economy.
http://www.enterprisesaskatchewan.ca/MiningSupplyChainForum

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1.5 Appendix: Input-Output Data

Table 3 Inputs into selected metal mining industries, detailed level, basic prices, Canada 2009, millions of dollars

Commodity	Cu, Ni, Pb, &Zn ore mining	Au & Ag ore mining	Other metal ore mining (W?)	Total Cu, Ni, Pb, Zn, Au, Ag & other metal ore mining
Total commodities	$5,863.0	$3,891.0	$1,701.0	$11,455.0
Other operating surplus	$2,379.0	$1,389.0	$901.0	$4,669.0
Wages and salaries	$951.0	$986.0	$151.0	$2,088.0
Supplementary labour income	$264.0	$138.0	$39.0	$441.0
Mixed income		$3.0		$3.0
Value added	$3,594.0	$2,513.0	$1,091.0	$7,198.0
Subsidies on production	-$2.0			-$2.0
Subsidies on products	-$1.0	-$14.0	-$2.0	-$17.0
Taxes on production	$108.0	$22.0	$2.0	$132.0
Taxes on products	$64.0	$34.0	$16.0	$114.0
Taxes minus subsidies	$169.0	$42.0	$16.0	$227.0
Discrepancy	$49.0	$2.0	$24.0	$75.0
Purchases of goods and services	$2,051.0	$1,331.0	$570.0	$3,952.0
Support services for mining and quarrying (except exploration)	$111.0	$152.0	$104.0	$367.0
Holding company services and other financial investment and related activities	$239.0	$76.0	$32.0	$347.0
Advertising, promotion, meals and entertainment	$184.0	$125.0	$33.0	$342.0
Electricity	$120.0	$126.0	$25.0	$271.0
Office supplies	$146.0	$87.0	$24.0	$257.0
Diesel fuel	$141.0	$45.0	$20.0	$206.0
Management, scientific and technical consulting services	$107.0	$26.0	$22.0	$155.0
Other basic inorganic chemicals	$41.0	$43.0	$54.0	$138.0
Ferrous metal castings	$60.0	$51.0	$7.0	$118.0
Architectural, engineering and related services	$73.0	$19.0	$12.0	$104.0
Travel, meetings and conventions	$42.0	$32.0	$30.0	$104.0
Holding company services (imputed)	$62.0	$11.0	$13.0	$86.0
Wholesale margins	$38.0	$28.0	$11.0	$77.0
Office administrative services	$52.0	$18.0	$6.0	$76.0
Repair construction services		$70.0		$70.0

Repair and maintenance	$33.0	$32.0	$3.0	$68.0
Logging, mining and construction machinery and equipment	$21.0	$38.0	$8.0	$67.0
Petrochemicals	$17.0	$16.0	$24.0	$57.0
Natural gas liquids and related products	$14.0	$14.0	$29.0	$57.0
Commercial and industrial machinery and equipment renting and leasing services	$31.0	$22.0	$1.0	$54.0
Other loan intermediation services indirectly measured (FISIM)	$31.0	$9.0	$7.0	$47.0
Transportation margins	$23.0	$13.0	$10.0	$46.0
Custom work, other manufacturing production services		$41.0		$41.0
Rights to non-financial intangible assets	$8.0	$32.0		$40.0
Freight transportation arrangement and customs brokering services	$30.0	$5.0	$4.0	$39.0
Computer systems design and related services (except software development)	$25.0	$12.0	$1.0	$38.0
Motor vehicle metal stamping	$19.0	$14.0	$3.0	$36.0
Facilities and other support services	$27.0	$6.0	$2.0	$35.0
Deposit intermediation services indirectly measured (FISIM)	$23.0	$7.0	$5.0	$35.0
Automotive insurance services	$19.0	$9.0	$5.0	$33.0
Rail freight transportation services	$27.0		$6.0	$33.0
Lubricants and other petroleum and coal products	$15.0	$8.0	$3.0	$26.0
Employment services	$15.0	$3.0	$1.0	$19.0
Other professional, scientific and technical services	$11.0	$6.0	$1.0	$18.0
Specialized freight truck transportation services	$12.0	$1.0	$5.0	$18.0
Stone	$17.0		$1.0	$18.0
Business support services	$12.0	$4.0	$1.0	$17.0
Liability and other property and casualty insurance services	$12.0	$3.0	$2.0	$17.0
General freight truck transportation services	$11.0	$1.0	$5.0	$17.0
Lime and gypsum products	$11.0	$4.0	$2.0	$17.0
Security brokerage and securities dealing services	$4.0	$10.0	$2.0	$16.0
Investigation and security services	$7.0	$5.0	$3.0	$15.0
Wholesale trade commissions	$9.0	$4.0	$2.0	$15.0

Rental of non-residential real estate	$12.0	$2.0		$14.0
Coating, engraving, heat treating and similar metal processing services		$14.0		$14.0
Uncut diamonds	$13.0		$1.0	$14.0
Sand, gravel, clay, and refractory minerals	$13.0		$1.0	$14.0
Motor vehicle rental and leasing services	$6.0	$3.0	$3.0	$12.0
Air specialty services	$10.0		$2.0	$12.0
Investment banking services	$6.0	$5.0		$11.0
Data processing, hosting, and related services	$4.0	$4.0	$3.0	$11.0
Legal services	$3.0	$7.0		$10.0
Springs and wire products	$5.0	$4.0	$1.0	$10.0
Non-metallic minerals (except diamonds)	$10.0			$10.0
Other membership services	$3.0	$4.0	$2.0	$9.0
Accident and sickness insurance services	$5.0	$2.0	$2.0	$9.0
Banking and other depository credit intermediation services - explicit charges	$2.0	$6.0	$1.0	$9.0
Postal, courier, parcels and messenger delivery services	$3.0	$5.0	$1.0	$9.0
Gasoline	$6.0	$2.0	$1.0	$9.0
Non-depository credit intermediation services - explicit charges (fees)	$2.0	$5.0	$1.0	$8.0
Operating supplies	$5.0	$3.0		$8.0
Sales of other government services		$4.0	$3.0	$7.0
Specialized design services	$5.0	$1.0	$1.0	$7.0
Property insurance services	$3.0	$2.0	$1.0	$6.0
Water delivered by water works and irrigation systems		$6.0		$6.0
Accounting and related services	$2.0	$3.0		$5.0
Refined non-ferrous metals and non-ferrous metal alloys (except aluminum and precious metals)	$3.0	$2.0		$5.0
Wireless telephone services	$2.0	$1.0	$1.0	$4.0
Wired telephone services	$2.0	$1.0	$1.0	$4.0
Warehousing and storage services (except grain storage)		$1.0	$3.0	$4.0
Transportation of crude oil and other commodities by pipeline	$1.0	$1.0	$2.0	$4.0
Hardware	$2.0	$1.0	$1.0	$4.0
Industrial gases	$1.0	$1.0	$2.0	$4.0
Heavy fuel oils	$2.0	$2.0		$4.0
Natural gas	$2.0	$2.0		$4.0

Portfolio management services	$2.0	$1.0		$3.0
Road transportation support services	$1.0		$2.0	$3.0
Air freight transportation services		$3.0		$3.0
Threaded metal fasteners and other turned metal products	$1.0	$1.0	$1.0	$3.0
Forged and stamped metal products	$1.0		$2.0	$3.0
Other crop products	$3.0			$3.0
Light fuel oils	$1.0	$1.0	$1.0	$3.0
Laundry and dry-cleaning services	$2.0			$2.0
Transportation of natural gas by pipeline	$1.0	$1.0		$2.0
Natural gas distribution	$1.0	$1.0		$2.0
Clay products and refractories	$2.0			$2.0
Other basic organic chemicals	$1.0		$1.0	$2.0
Medical and diagnostic laboratory services	$1.0			$1.0
Office machinery and equipment rental and leasing services (except computer equipment)		$1.0		$1.0
Computer equipment rental and leasing services	$1.0			$1.0

Source: Statistics Canada. Table 381-0022 - Input-output tables, inputs and outputs, detailed level, basic prices, annual (dollars), CANSIM (database). (Accessed: 2013-04-05)

Table 4: Inputs into Support activities for mining industry, detailed level, basic prices, Canada 2009, millions of dollars

Commodity	Support activities for mining	
Total commodities	$4,360.0	
Taxes on products	$52.0	
Subsidies on products	-$40.0	
Subsidies on production	-$6.0	
Taxes and subsidies		$6.0
Wages and salaries	$1,091.0	
Supplementary labour income	$107.0	
Mixed income	$25.0	
Other operating surplus	$938.0	
Value added		$2,161.0
Purchases of goods and services		$2,190.0
Natural gas	$1.0	
Natural gas liquids and related products	$10.0	
Electricity	$8.0	
Gasoline	$9.0	
Diesel fuel	$128.0	

Jet fuel	$32.0	
Heavy fuel oils	$23.0	
Repair and maintenance	$16.0	
Operating supplies	$1.0	
Office supplies	$5.0	
Advertising, promotion, meals and entertainment	$21.0	
Travel, meetings and conventions	$46.0	
Transportation margins	$17.0	
Holding company services (imputed)	$7.0	
Lubricants and other petroleum and coal products	$9.0	
Chemical products not elsewhere classified	$2.0	
Cement	$3.0	
Non-metallic mineral products, not elsewhere classified	$3.0	
Iron and steel basic shapes and ferro-alloy products	$124.0	
Iron and steel pipes and tubes (except castings)	$17.0	
Ferrous metal castings	$2.0	
Fabricated steel plates and other fabricated structural metal	$1.0	
Other engine and power transmission equipment	$2.0	
Pumps and compressors	$1.0	
Other miscellaneous general-purpose machinery	$13.0	
Measuring, medical and controlling devices	$263.0	
Electric motors and generators	$2.0	
Repair construction services	$9.0	
Wholesale margins	$81.0	
Wholesale trade commissions	$49.0	
General freight truck transportation services	$2.0	
Specialized freight truck transportation services	$19.0	
Transportation of crude oil and other commodities by pipeline	$1.0	
Wired telephone services	$1.0	
Wireless telephone services	$5.0	
Banking and other depository credit intermediation services - explicit charges	$1.0	
Non-depository credit intermediation services - explicit charges (fees)	$1.0	
Investment banking services	$3.0	
Security brokerage and securities dealing services	$1.0	
Holding company services and other financial investment and related activities	$5.0	
Accident and sickness insurance services	$5.0	
Automotive insurance services	$7.0	
Property insurance services	$1.0	
Liability and other property and casualty insurance services	$6.0	
Deposit intermediation services indirectly measured (FISIM)	$5.0	
Other loan intermediation services indirectly measured	$9.0	

(FISIM)		
Commercial and industrial machinery and equipment renting and leasing services	$188.0	
Legal services	$3.0	
Accounting and related services	$2.0	
Architectural, engineering and related services	$982.0	
Management, scientific and technical consulting services	$1.0	
Other professional, scientific and technical services	$8.0	
Office administrative services	$12.0	
Employment services	$1.0	
Business support services	$2.0	
Services to buildings and dwellings	$1.0	
Facilities and other support services	$2.0	
Other repair and maintenance services	$1.0	
Other membership services	$1.0	
Sales of other government services	$9.0	

Source: Statistics Canada. Table 381-0022 - Input-output tables, inputs and outputs, detailed level, basic prices, annual (dollars), CANSIM (database). (Accessed: 2013-04-05)

Yukon Mining Sector Profile

Component 5: Labour Market Discussion

1 Labour Market Discussion

In this component of the Yukon Mining Sector Profile we:

- Identify employment opportunities by occupation using the available forecasts;
- Identify the effects of mining development on local labour markets;
- Identity the effects of an insufficient local labour supply; and,
- Identify current training programs and training needs.

1.1 Employment Opportunities

The only detailed Yukon employment by occupation data for the mining industry comes from the 2006 Census. However, that census data is for residents of Yukon, not employees of the mining industry who work in Yukon. Note that the Census does not distinguish between the different phases of the mining cycle from exploration through closure and reclamation. It uses the North American Industry Classification System (NAICS) which only considers mining and support activities for mining and oil and gas as industries. Also, a significant part of mine construction is normally done by the construction industry rather than the mining industry.

Even gross mining industry employment data from Statistics Canada's Survey of Employment Earnings and Hours (SEPH) is not available for Yukon. At best, there is data for goods producing industries which include—in addition to Mining, quarrying, and oil and gas extraction—Agriculture, Forestry, Construction, Utilities, and Manufacturing. Industry level data is only available for the Construction industry, and not for all years at that.

However, as part of the System of National Accounts, Statistics Canada publishes a number of labour statistics for a wide array of industries.[1] The labour market data includes a number of variables including total jobs, hours worked and compensation. Unfortunately, most of the data for sub-sectors of the Mining, quarrying, and oil and gas extraction industry is suppressed for confidentiality reasons, but data for the whole industry is available and presented in Table 1.

Table 1: Labour statistics for the Mining, Quarrying, and Oil & Gas Extraction Industry, Yukon, 2002 through 2011

	Total number of jobs	Total compensation per job (dollars)	Total compensation per hour worked (dollars)	Total compensation for all jobs (dollars x 1,000)	Hours worked for all jobs (x 1,000)	Annual average number of hours worked for all jobs (hours)
2002	300	$39,073	$17.31	$11,722	677	2257
2003	295	$45,441	$19.89	$13,405	674	2285
2004	360	$46,394	$19.22	$16,702	869	2414
2005	450	$45,782	$19.38	$20,602	1063	2362
2006	620	$49,027	$21.42	$30,397	1419	2289

[1] Statistics Canada. CANSIM Table 383-0010 - Labour statistics by business sector industry and non-commercial activity, consistent with the System of National Accounts, by North American Industry Classification System (NAICS), annual.

2007	825	$64,144	$28.64	$52,919	1848	2240
2008	1005	$63,776	$28.82	$64,095	2224	2213
2009	805	$71,306	$36.40	$57,401	1577	1959
2010	1295	$46,529	$22.88	$60,255	2634	2034
2011	1440	$47,312	$21.51	$68,129	3168	2200

Source: Statistics Canada. CANSIM Table 383-0010 - Labour statistics by business sector industry and non-commercial activity, consistent with the System of National Accounts, by North American Industry Classification System (NAICS), annual

The Yukon Labour Force survey occasionally provides estimates of employment in the Forestry, Fishing, Mining, and Oil & Gas Sectors. For the 10 months for which data was published in 2012, employment in those industries averages 700, ranging from 500 in February to a peak of 900 in July and August.

Section 1.7 shows the occupations that comprise 0.05% or more of the Canadian mining and support activities for mining and oil and gas according to the 2006 Census. In addition to the labour force number for Yukon, the percentage distribution is presented for Canada, Northern regions of Canada, and Yukon.

Three occupational forecasts have been done for Yukon: Yukon Occupational Modeling system (YOMS), Yukon Work Futures and a recent forecast done by Derome & Associates and the Mining Industry Human Resource Council (MIHR 2012). Only the last has been published, the other two were obtained from unpublished data from Luigi Zanasi Economist and Yukon's Department of Economic Development. In addition, the Conference Board of Canada also published gross employment forecasts for the mining industry. The key data and findings from each are presented below.

1.1.1 Yukon Occupational Modelling System

YOMS is an economic forecasting model that allows varying a number of factors and produces, among others, forecasts of employment by industry. The YOMS model was developed by the Centre for Spatial Economics for Yukon's Department of Economic Development. The model is designed specifically to incorporate information on major projects including total investment expenditures and their allocation over time. To include the projects, assumptions must be set for investment, capital stock, and employment. The model produces forecasts of employment for each industry.

The model allows assuming what proportion of new jobs will be filled within Yukon. Other forecasts assume that half of the new jobs in mining would be filled by non-residents. The following table presents the base employment forecasts (i.e. the total labour demand) and GDP forecasts for the mining industry generated by the YOMS model. This is total employment assuming that all workers will be Yukon residents. The YOMS model projects mining industry employment demand to increase from about 1,000 in 2013 to 1,500 in 2016 and roughly stabilize between 1,400 and 1,500 until 2020.

Table 2: YOMS Mining Employment and GDP Forecasts, 2005 through 2020

	EMPLOYMENT	*GDP (VALUE ADDED, MILLIONS OF $)*				
		Mining & Oil & Gas Extraction	*Oil & Gas Mining*	*Metal Ores*	*Non-Metallic Minerals*	*Other Mining*
2005	400	$41.0	$9.0	$17.0	$2.0	$14.0
2006	500	$44.0	$7.0	$16.0	$1.0	$21.0
2007	600	$60.0	$5.0	$21.0	$2.0	$34.0
2008	400	$116.0	$4.0	$44.0	$1.0	$68.0
2009	300	$157.0	$3.0	$58.0	$1.0	$96.0
2010	400	$148.0	$3.0	$52.0	$1.0	$93.0
2011	500	$161.0	$3.0	$59.0	$2.0	$97.0
2012	900	$215.0	$3.0	$108.0	$1.0	$102.0
2013	1000	$223.0	$3.0	$114.0	$2.0	$105.0
2014	1200	$223.0	$3.0	$115.0	$2.0	$103.0
2015	1400	$232.0	$3.0	$119.0	$1.0	$109.0
2016	1500	$286.0	$3.0	$162.0	$1.0	$119.0
2017	1500	$305.0	$3.0	$180.0	$1.0	$120.0
2018	1400	$295.0	$3.0	$175.0	$1.0	$116.0
2019	1400	$283.0	$3.0	$170.0	$1.0	$109.0
2020	1400	$254.0	$3.0	$147.0	$1.0	$103.0

The YOMS model also produces forecasts of income by fairly broad occupational groups based on industries' share of each occupation. The broad occupation groups are National Occupational Classification System (NOCS) two and three digit level occupational groupings. However, although they are calculated, it does not produce occupational forecasts for individual industries.

1.1.2 Yukon Work Futures Forecast

We have obtained the detailed information from Yukon Work Futures forecast as one of our team members (Luigi Zanasi) was responsible for producing those forecasts. The forecasts were done for 100 “important” occupations across the economy. Preparation of the forecast made use of Yukon Occupational Modeling System (YOMS) developed for Yukon Department of Economic Development and special runs on the 2006 Census. The occupational forecasts involved using the results of the YOMS for employment by broad industry group and demand by broad occupational categories. However, the two and three digit occupational categories used by YOMS were too coarse as four digit level classes were required for the Work Futures project. The YOMS output was used to derive total employment by industry as well as employment for major occupational groups while an employment share approach based on detailed Census data was used to derive detailed occupational forecasts. The employment share approach used detailed occupation by broad industry group data from the 2006 Census.

The forecasts for the mining industry (including support activities) were as shown in Table 3. The total employment for 2015 and 2020 is 1,400, the same as the YOMS forecast and the occupational distribution is not expected to change.

Table 3: Yukon Work Futures Forecast: Mining Industry and Support Activities, 2006, 2011, 2015 and 2020

	2006	*2011*	*2015*	*2020*
Total result	715	500	1400	1400
Other	155	108	304	304
Heavy equipment operators (except crane)	110	77	215	215
Primary production managers	70	49	137	137
Underground production and development miners	70	49	137	137
Truck drivers	40	28	78	78
Heavy-duty equipment mechanics	30	21	59	59
Secretaries (except medical and legal) and clerical occupations (except mail and message distribution occupations)	30	21	59	59
Chefs & cooks & bakers	25	17	49	49
Chemical technologists and technicians	20	14	39	39
Geological and mineral technologists and technicians	20	14	39	39
Geologists, geochemists and geophysicists	20	14	39	39
Labourers except mine labourers	20	14	39	39
Mine labourers	20	14	39	39
Welders and related machine operators	20	14	39	39
Carpenters	15	10	29	29
Administrative officers & other administrative services managers	10	7	20	20
Food counter attendants, kitchen helpers and related occupations	10	7	20	20
Janitors, caretakers and building superintendents & light duty cleaners	10	7	20	20
Restaurant and food service managers	10	7	20	20

1.1.3 Conference Board Territorial Outlook

The Conference Board of Canada has recently developed an econometric Territorial forecasting model (TFM) which produces a 15-year economic forecast. The two most recent *Territorial Outlooks* provide forecasts of employment in the mining industry. The *Summer 2012 Territorial Outlook* has a graph showing mining employment increasing by about 600 jobs from 2011 through 2016. The latest *Winter 2013 Territorial Outlook* states that the mining industry will have 2,400 workers at its peak, with 1,400 of them being Yukon residents.

1.1.4 Mining Industry Human Resource Council

Derome and Associates and the MIHR developed employment forecasts for Yukon in December 2012. The MIHR's forecast total employment using a model that correlates mineral prices and productivity changes to employment. The model uses the World Bank Mineral Price Index forecast and the Iron Ore Price Index. It seems that the composite metals index is used rather than individual commodity indices other than the Iron Ore Price Index. There scenarios are developed, the baseline, the contractionary, which assumes that the Mineral Price Index will be one standard

deviation below the forecast and the expansionary scenario where the Minerals Price Index will be one standard deviation above the forecast.

The MIHR defines the mining industry as including:

- NAICS 2121: Coal mining.
- NAICS 2122 Metal ore mining
- NAICS 2131 Support activities for mining and oil and gas extraction.
- NAICS 3311: Iron and Steel Mills and Ferro-Alloy Manufacturing
- NAICS 3313: Alumina and Aluminum Production and Processing.
- NAICS 3314: Non-Ferrous Metal (except Aluminum) Production and Processing.
- NAICS 2123 Non-metallic mineral mining and quarrying
- NAICS 5413: Architectural, engineering and related services.

The calculations for each occupation starts with the forecast change in employment, adds in new entrants, and then subtracts people who leave the industry, both retirees and other workers who need to be replaced. The MIHR forecast considers 66 NOCS occupations key to the mining industry.

While the main MIHR model provides regional forecasts including a single one for the three territories, a separate run on the model was done for Yukon. The initial existing supply came from a survey of employers and from 2006 data by occupation. Based on that survey, employment in 2012 was estimated at 960 people in mining and 1,700 in exploration for a total of close to 2,700 workers working in the mining industry in Yukon. An estimated 45% (or about 1,200) of these workers were Yukon residents. (MIHR & Derome, 2012, p.31) No details are available on how the survey was conducted and what the universe and sampling was. Following requests for further information, representatives of MIHR indicated that the model and research methodology are proprietary and details beyond those included in the report are not available.

The main forecast is as follows. Based on 2,765 people working in 2012, Yukon industry will need to hire a total of between 1,360 and 4,260 new workers by 2023.Total employment in 2023 will be between 2,435and 4,535 workers, with a baseline scenario of 3,535, representing an increase.

Table 4: MIHR Forecast Hiring Requirements

	Hiring requirements			*Net change in employment*
	2015	*2018*	*2023*	*2013-2023*
Contractionary	450	920	1,360	-240
Baseline	820	1,830	2,900	850
Expansionary	1,000	2,650	4,260	1860

Hiring requirements by occupation forecasts are developed for 66 NOCS occupations. Occupations forecast to have high demand include:

- Machine operators, mineral and metal processing;
- Heavy equipment operators (except crane);
- Underground mine service and support workers;

- Underground production and development miners; and,
- Production workers in mineral and metal processing.

Other occupations are of high concern despite not requiring a large absolute number of hires:

- Geoscientists and technologists and technicians;
- Laboratory technologists and technicians; and,
- Mining engineers and engineering technicians

1.1.5 Analysis of Mining Sector Employment Opportunities

There are serious discrepancies in the estimates of mining employment in Yukon. For 2012, they range from 500-900 from the labour force survey to 2,675 (of whom 1,200 are Yukon residents) in the MIHR work. The YOMS model presents an employment level of 900 for 2012.

Forecasts of employment vary equally, ranging from 1400-1500 jobs to 2020 for the YOMS forecast, a peak employment of 2,400 mentioned by the Conference Board, and a baseline forecast of 3,525 workers by the MIHR.

It is difficult to decide between the different forecasts. Other than the YOMS forecast, the assumptions on which the forecasts are based and the specifics of the models used are not readily available.

Table 5 compares the hiring requirements and total employment forecasts of the main occupations identified by MIHR and Work Futures. There are considerable similarities in the ranking of occupations, but the numbers differ. For the MIHR, the figure is the cumulative number of hires required over the next 10 years, while the Work Futures number is the forecast employment in each occupation. The main differences is that Work Futures did not identify machine operators and underground service workers as important in Yukon, while MIHR did not include truck drivers in their list of critical occupations. Supervisors and managers are treated differently, with managers being important in the Work Futures forecast while the MIHR focuses on "supervisors", but this is probably more of a semantic difference than a real one; both refer to supervisory/management positions.

Table 5: Comparison of MIHR and Work Futures Forecasts

	MIHR Cumulative Hiring requirements 2023	*Work Futures rank*	*Work Futures employment 2020*
Machine operators, mineral and metal processing	375		
Heavy equipment operators (except crane)	370	1	215
Underground mine service and support workers	265		
Underground production and development miners	205	3	137
Labourers in mineral and metals processing	140	12	

Supervisors, mineral and metal processing	140		
Millwrights	120		
Chemical technologists and technicians	100	8	39
Geologists, geochemists and geophysicists	100	10	39
Industrial electricians	100		
Supervisors, mining and quarrying	95		
Secretaries (except medical and legal) and clerical occupations (except mail and message distribution occupations)	90	6	59
Heavy-duty equipment mechanics	85	5	59
Chefs & cooks & bakers	55	7	49
Geological and mineral technologists and technicians	40	9	39
Primary production managers	10	2	137
Truck drivers		4	78

1.2 Local Labour Markets: The effects of mining development

Mining can have many positive benefits for an economy such as more jobs (including skilled and professional jobs), higher wages and the ability of workers to buy more goods and services. The ancillary benefits for retail businesses, service business and the construction industry are very tangible. Royalties offer both public governments and First Nation governments more revenue to be put back into community infrastructure, health and education services or to lower taxes.

However, mining can also have negative effects on a community. As the Conference Board of Canada noted in a recent report of January 2013, these can include:

- Increased pressure on existing infrastructure including roads and the power grid;
- Increased pressure on government to provide more infrastructure either from the mining companies themselves or from the public as the population grows;
- A low level of financial literacy is a challenge in many Northern communities. Some workers have had little access to a salary in the past, and so tend to spend all of their earnings without considering that their job may not be a long-term certainty;
- An influx of workers can worsen existing housing shortages; inflate house prices and rents, and lower vacancy rates;
- There are also potential adverse effects for family cohesion. The shift work and rotation schedule leaves mainly women home alone to care for children and can put a strain on families. The strain at home can lead to conflicts, family violence, the neglect of children, and family break-ups. Increased violence against women and drug and alcohol abuse may also result;

- A community's social cohesion can also be negatively affected, as many workers and their families may no longer want to or be able to participate in traditional activities or volunteer in the community. Further tensions can exist between those earning high wages who can afford to purchase home goods, new vehicles, and those who cannot;
- The mining economy can adversely affect the traditional aboriginal economy of a community thereby causing more social disruption; and,
- Companies that rely on fly in/fly out workers run the risk of angering local community businesses as they believe that they are not sharing in the economic benefits of the mine as much as they should.[2]

1.3 Effects of Insufficient Labour Supply

Chronic lack of the labour required for mining will result in delays or cancellations in the development of new projects thereby adversely affecting a local economy. Negative effects of project delays and cancellations can include loss of jobs, loss of business for suppliers and loss of government revenues.

Insufficient labour supply usually leads to higher wages for existing workers, greater incentives such as bonuses and merit pay thereby driving up operating costs. Longer- term employees may feel that new incentives are unfair and demand equal treatment creating strain on labour relations and additional costs to equalize incentives across the workforce. Problems are exacerbated by the loss of operational knowledge, due to high turnover as employees respond to demand by moving to better paying or otherwise more desirable jobs. High turnover at all levels of the industry leads to a loss of productivity.

MRC-Business Consulting Service's research has revealed the following critical risks for the mining industry:

- Increased competition for labour;
- Expansion of skills shortage;
- Increased competition for entry level talent; and,
- An increasing mismatch between the available labour pool and the competencies and characteristics required.

In British Columbia, industry created the Mineral Exploration and Mining Industry Labour Shortage Task Force in 2008. The purpose of the Task Force is to co-ordinate, develop and implement workforce measures to ensure the mining industry in British Columbia has the human resources needed to support the growth and sustainability of the sector. The task force is funded through the Canada-B.C. Labour Market Agreement.[3]

While there have been a variety of training programs and efforts, to date Yukon has had no coordinated effort at filling the labour needs of the mining industry in the territory.

1.4 Existing Labour Pools

The Conference Board of Canada estimates that over the next 10 years, there will be a million jobs unfilled across Canada. This shortage will hurt Canada's potential to innovate and compete into the future. Throughout Canada, the current number of graduates from mining-specific post-

[2] Conference Board of Canada. January 2013. The Future of Mining in Canada's North," pp. 52-54. See also Larry Schlesinger, "Fly-in-fly-out workers preventing overbuilding of houses and infrastructure in mining towns: RBA research paper," Melbourne Property Observer, September 20, 2012
[3] See http://www2.news.gov.bc.ca/news_releases_2009-2013/2011JTI0134-00154**5**

secondary programs is insufficient to meet the sector's needs — forecast to exceed 100,000 people over the coming decade.[4]

The fastest growing labour pools in Canada are older workers, aboriginal people, youth, persons with disabilities, immigrants and women. However, aboriginal people and youth are not enough to fill the current and potential jobs in Yukon or across the country.

> "Across the West, for example, provinces are encouraging young people to learn the skills demanded by the labour market. But even if everyone who wanted to work was working, there would still be jobs available. Al Wahlstrom, an engineer with Suncor Energy Services, says it would help to get aboriginal people and other disadvantaged groups more involved in the work force, but that would eliminate just a portion of the labour gap"[5]

But provinces such as Alberta need much more than just trades people. It faces shortages in almost every sector and nursing and trucking are two sectors that stand out. Some of these shortages were caused by immigration itself. Alberta, for example, sent a delegation to Europe to recruit Mandarin, French and Spanish teachers for the burgeoning language programs in its schools.[6] Similarly, Yukon has experienced a growing need for teachers of English as a Second Language in the public school system as it has had to incorporate the children of foreign workers, such as Filipinos. With labour in short supply, mining companies in Yukon are starting to eye the potential of recruiting local immigrants who have received their Permanent Residency. The firms at which these immigrants currently work see this as affecting local retail and other businesses negatively.[7] However, labour mobility within the economy is a given and increasing the skills of existing workers is a net positive.

Yukon Government could have helped to solve the lack of labour with its Temporary Foreign Worker Initiative but suspended the initiative after Tumbler Ridge, an incident in which unions complained that HD Mining had brought in 200 Chinese workers when Canadian workers were available.[8] In the end, Yukon Government has not come to grips with the fact that the mining industry and Canada as a whole need immigrants. It is behind in this regard and has been for sometime.[9]

At 14.4 per cent, the representation of women in mining and exploration is the lowest among primary industry categories in Canada. Steady improvements over the last decade have closed the gap, but this percentage remains well below the overall labour force average of 47.4 per cent.[10] However, as important women may seem as an underutilized labour pool, many women remain largely uninterested in mining and exploration as career choices. There are well documented barriers to women entering these occupations, such as employer attitudes and workplace culture which means that women will remain underrepresented in mining and exploration for some time. Nevertheless in Yukon, Women in Trades and Technology is an NGO that works to promote skilled trades to women, even those in Grade 8, with its annual Girls Exploring Trades Fair, and works to pull down barriers, real or perceived, and to encourage employers to hire women into the skilled trades.[11] In a very unusual effort to recruit more women into the industry, the

[4] Financial Post. March 4, 2013
[5] Globe and Mail. May 4, 2012
[6] Ibid.
[7] Rick Karp, President of Whitehorse Chamber of Commerce, March 2013 personal communication.
[8] Globe and Mail, February 6, 2013.
[9] Brent Slobodin, Former Assistant Deputy Minister of Advanced Education. March 2013 personal communication.
[10] Women in Mining Canada, "Ramp-Up: A Study on the Status of Women in Canada's Mining and Exploration Sector, February 2010, page 4.
[11] See http://www.yukonwitt.org

Queensland government in Australia has offered women up to $20,000 if they pursue an education and career in mining.[12]

Data from the Mining Industry Human Resources Council indicate that 40% of the industry is at least 50 years old, with one-third eligible to retire by 2015.[13] The loss of knowledge and experience will hurt the mining industry as it moves forward but it must look to other labour pools to fill vacancies and plan for the future. Older workers not currently in the mining industry will not likely be attracted to it, given their age and the perceived hardness of jobs in mining. Most of the government sponsored programs designed to assist older workers are based on workers who have been displaced from economic sectors such as mining, forestry and fishing and need to transition to new careers. In Yukon, the Targeted Initiative for Older Workers has been in operation at Yukon College since 2007.[14]

The Mining Industry Human Resources Council (MIHR) has noted that Yukon mining employs a large proportion of Aboriginal people:

> "According to Statistics Canada's 2006 census, the Canadian mining industry already outperforms the rest of the economy with Aboriginal peoples making up nearly 7 per cent of the sector's labour force. According to MIHR's survey of Yukon exploration and extraction employers and producers, currently Aboriginal peoples compose more than one-fifth of the mining labour force in the territory. However, the vast majority of this employment (nearly 60 per cent) is concentrated in support services and labourer occupations."[15]

MIHR noted, however, that less than 40 per cent of the Aboriginal workforce had completed high school and less than 1 per cent had completed post-secondary education or training as their highest level of education attainment:

"There is an opportunity for Yukon mining employers and government to partner to identify and address the education gaps and move the Aboriginal workforce into roles that require a post-secondary education."[16]

While aboriginal people are entering the mining economy at a greater rate, staying power remains an ongoing issue. For example, Mining Watch Canada noted the problem at the Ekati diamond mine, located in the Northwest Territories, 300 km Northeast of Yellowknife. This land is the territory of the Lutsel K'e Dene First Nation. Employment at the site fluctuated over its short life. In 1997, 22 people from Lutsel K'e were reported as employed in the mining sector, while six months later only three people were still working there.[17]

Anecdotally, local mining companies have indicated that commitment to the job is often an issue with First Nation workers. In a 2012 report, the Conference Board of Canada noted that Canadian businesses reported that absenteeism was the top issue they faced with Aboriginal workers. A key reason for absenteeism with Aboriginal workers is due to a desire by Aboriginal workers to participate in traditional or seasonal activities, such as hunting and fishing. For example, Aboriginal employees may work at a job until hunting season and then leave their job to hunt. As

[12] See http://iminco.net/mining-jobs-for-women-qld-govet-scholarship-scheme/
[13] Financial Post, March 4, 2013
[14] See http://www.yukoncollege.yk.ca/programs/view/targeted_initiative_for_older_workers
[15] (MiHR, "Yukon Hiring Requirements and Available Forecasts: Mineral Exploration, Mining, and Support Services," December 2012, p. 19)
[16] Ibid.
[17] Christine Cleghorn, "Aboriginal Peoples and Mining in Canada: Six Case Studies," Mining Watch Canada, August 1999.

an underutilized labour pool, Aboriginal people offer great potential but all evidence indicates that training and support will be constant challenges.[18]

Youth remain another untapped source of employees for the mining sector. The mining industry has a severe public perception problem, which must effectively be dealt with to make a career in mining an attractive option for new entrants:

> "The misconception of the industry is that being in mining, translates to working in a mine. Being in a dark, murky and at times, perilous environment— is not ideal for many youth with a bright future ahead of them. Though true for a large segment of the labour force, it must be conveyed to youth that the mining industry encompasses many occupations. Career options include mine engineer, mining geologist, data mining consultant, quantity surveyor, health & safety consultant, and machine operator. The industry must execute effective awareness campaigns by marketing mining as a desirable career path for the youth."[19]

Mining and exploration can be lucrative but today's youth are looking for a more varied life experience and benefits that go beyond salary. Awareness should begin as early as junior high as it would allow youth to choose better their programming in high school, apprenticeship and, ultimately, in post-secondary education.

Yukon currently has no formal strategy for engaging youth with mining and exploration. YWITT and Skills Canada are useful in promoting awareness of apprenticeship and the skilled trades but there is no focused approach to making youth aware of mining and exploration.

1.5 Training Programs and Training Needs

As reported in the Calgary Herald on March 19, 2013, Prime Minister Stephen Harper has announced that he has heard repeatedly from business leaders who say their inability to find skilled workers is impeding growth. Solving that problem now takes centre stage for his government. As a result, it was announced in the latest federal budget that skills training for seniors, immigrants, the disabled and aboriginals will receive particular attention. Better job training, the Prime Minister noted, could help ease economic hardship on aboriginal reserves, while also providing northern resource firms with a better-trained and readily available pool of workers.

There are many examples of training and skills development that are used to prepare Canada's existing labour pools with the skills and training necessary to fill the many and diverse jobs that the country has to offer.

On March 1, 2013, CanNor announced it will invest $390,951 to support three projects that will help Yukoners benefit from increased resource development activity. The three projects include marketing activities to promote increased investment into Yukon's mining sector, the development and delivery of community mine training awareness workshops and support for the development of a Socio-Economic Partnership Agreement between the Tr'ondëk Hwëch'in First Nation and Kaminak Gold Corporation.

Existing training programs provided by industry, Yukon College and Yukon Mine Training Association are outlined and discussed in the following sections.

[18] Conference Board of Canada, "Understanding the Values, Challenges, and Opportunities of Engaging Metis, Inuit and First Nation Workers, 2012, pp. 23-24
[19] African Mining Brief, June-July 2011

1.5.1 Mining Industry

The mining industry uses a number of training approaches.

Job shadowing is growing as a training tool in the mining economy. Job shadowing is an informal practice but is recognized as having significant potential in helping young people know what opportunities are there for them and to raise overall awareness about these opportunities.

Mentoring is also recognized in mining as a valuable training method. MIHR, for example, supports a virtual mentor program. The Virtual MineMentor Program provides students from post-secondary mining programs with positive, virtual mentoring relationships with exceptional workers from the industry. Students will engage in a virtual relationship with a positive role model to have ready access to advice and guidance that will support them in developing employment opportunities in the Canadian mining sector.[20]

With competition for labour increasing, mining companies know that they have to adapt their recruitment and retention policies to be able to attract Aboriginal people. A resource for this purpose is *Mastering Aboriginal Inclusion in Mining*. This tool, a product of Mining Industry Human Resources Council and the Aboriginal Human Resources Council, includes fives modules:

- The Business Case for Aboriginal Inclusion;
- History's Pendulum from Exclusion to Inclusion;
- Communicating Across Cultures;
- Recruitment, Retention and Advancement; and,
- Partnerships and Alliances[21]

Diavik Diamond in the NWT adopted an Aboriginal Employment Strategy in 2004 that focused on pre-employment initiatives, recruiting, employee retention, and employee development initiatives. Diavik established a Workplace Learning Centre at the mine site to coordinate the development of training and apprenticeship programs. By 2005, Diavik and its contractors employed 17 apprentices, all northerners and mostly Aboriginal, in trades such as electrician, millwright, instrumentation technician, welding, heavy-duty mechanics, and automotive mechanics. Diavik also wanted to increase the number of aboriginal people in supervisory and management positions. To that end, it created the Aboriginal Leadership Development Program, which matched participants with a manager who acted as a mentor.[22]

Diavik offers a good demonstration that training can be very successful when mining companies are involved and offer to share resources. In Yukon, for example, Capstone has partnered with Yukon College, Alexco Resource Corp., Yukon Zinc Corp. and the Yukon government on a training program designed to get more Yukon people employed in mines. The Introduction to Mining Operations program is a 44-day course that offers students an orientation to both surface and underground mining, essential safety certifications and the opportunity to complete a two-week shift at one of Yukon's producing mines. Four students have just finished their placement at the Minto mine.[23]

[20] See http://minementor.acareerinmining.ca/en/
[21] See Aboriginal Human Resources Council: www.aboriginalhr.ca
[22] See www.diavik.ca
[23] Yukon News, March 20, 2013

1.5.2 Yukon College

Yukon College offers a variety of mining-relevant or mining-specific training programs including:

- Introduction to Mining Operations, a 44 day program that includes:
  - Introduction to Mining Cycle
  - Orientation to Mine Equipment
  - Preparation for Mining Employment, including a complete two-week shift in a working Yukon mine
- Millwright Pre-Apprentice. 17 week vocational certificate.
- Exploration Field Assistant
- Mineral Resources. One year certificate and two year technologist diploma.[24]

The first phase of the feasibility study to establish the Centre for Northern Innovation in Mining (CNIM) is complete and demonstrates a significant need for Yukon-based mine training, education and research. Phase Two will research and provide recommended models of governance, funding avenues, program delivery and research opportunities for CNIM. The CNIM Feasibility Study is due to be completed in June 2013.

1.5.3 Yukon Mine Training Association

Yukon Mine Training Association (YMTA) describes itself as:

> "…a link between Yukon First Nations and Yukon's mining and resource-related industries. We believe that our local workforce is the future of Yukon's growing resource industries. Our central goal is the training and development of a skilled workforce made up of First Nations and Yukoners to meet the current and future needs of the mining and resource sectors."[25]

YMTA writes that their commitment is:

- To make First Nations and Yukoners aware of the value and variety of opportunity attached to working in the mining industry and resource-related sectors;
- to coordinate, with partners, the delivery and development of effective, immediate training programs that meet the needs of industry and result in real jobs;
- To ensure Yukoners, especially First Nations, receive the appropriate training for jobs as they become available; and
- To establish, along with labour and industry partners, occupational standards for resource-related jobs that are key to Yukon industry.[26]

Courses available from the Association include:

- Workplace Hazardous Material Information System (WHMIS);
- Transportation of Dangerous Goods (TDG);
- Confined Spaces Awareness;
- Fork Lift Safety;
- Lock Out/Tag Out;
- H2S Awareness;
- Fall Arrest Awareness;

[24] See www.yukoncollege.ca/programs
[25] Yukon Mine Training Association. See: http://www.yukonminetraining.com
[26] Ibid

- Indoor Cranes;
- Outdoor Cranes;
- Machine Guards;
- Hazard Recognition;
- Incident investigation;
- NORM Awareness;
- Benzene Awareness;
- Aerial Lifts;
- Personal Protective Equipment;
- Fire Extinguisher Training;
- Blood borne Pathogens;
- Workplace Violence – Employees;
- Workplace Violence – Managers; and,
- First Line Supervisor Training. The program contains an on-line e-learning training course with six modules.

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1.7 Appendix: 2006 Census Data by Occupation

The following occupations are those that comprise 0.05% or more of the Canadian mining and support activities for mining and oil and gas according to the 2006 Census. The percentage distribution is presented for Canada, Northern regions of Canada, and Yukon, in addition to the labour force numbers for Yukon.

	212 MINING (EXCEPT OIL AND GAS)				213 SUPPORT ACTIVITIES FOR MINING AND OIL AND GAS EXTRACTION		
Occupation	Canada	Yukon	Northern Regions	Yukon	Canada	Yukon	Yukon
I131 Underground production and development miners	11.888%	13.846%	15.084%	45	2.053%	7.143%	20
H611 Heavy equipment operators (except crane)	10.929%	16.923%	9.736%	55	3.516%	14.286%	40
I121 Supervisors, mining and quarrying	6.572%	4.615%	7.386%	15	0.000%	0.000%	0
H412 Heavy-duty equipment mechanics	5.407%	3.077%	5.683%	10	1.183%	5.357%	15
H711 Truck drivers	4.770%	3.077%	4.604%	10	5.487%	5.357%	15
H411 Construction millwrights and industrial mechanics (except textile)	3.927%	0.000%	4.532%	0	2.256%	0.000%	0
I214 Mine labourers	3.034%	6.154%	3.333%	20	0.357%	3.571%	10
H212 Industrial electricians	2.654%	0.000%	3.213%	0	0.845%	0.000%	0
A381 Primary production managers (except agriculture)	2.406%	15.385%	2.158%	50	4.246%	5.357%	15
H812 Material handlers	2.307%	0.000%	1.103%	0	0.531%	0.000%	0
H326 Welders and related machine operators	2.191%	3.077%	2.638%	10	2.444%	0.000%	0
I141 Underground mine service and support workers	2.141%	3.077%	3.022%	10	0.720%	3.571%	10

C112 Geological and mineral technologists and technicians	2.034%	3.077%	2.782%	10	1.319%	3.571%	10
C043 Mining engineers	1.860%	0.000%	1.655%	0	0.251%	3.571%	10
J121 Machine operators, mineral and metal processing	1.662%	0.000%	1.703%	0	0.058%	0.000%	0
C013 Geologists, geochemists and geophysicists	1.455%	0.000%	1.391%	0	1.729%	7.143%	20
H821 Construction trades helpers and labourers	1.447%	0.000%	0.743%	0	1.198%	3.571%	10
J111 Central control and process operators, mineral and metal processing	1.091%	0.000%	1.559%	0	0.029%	0.000%	0
B011 Financial auditors and accountants	1.058%	0.000%	0.312%	0	1.106%	0.000%	0
G933 Janitors, caretakers and building superintendents	1.042%	0.000%	1.343%	0	0.811%	0.000%	0
B511 General office clerks	0.992%	0.000%	0.839%	0	1.454%	0.000%	0
A016 Senior managers - Goods production, utilities, transportation and construction	0.967%	3.077%	0.288%	10	1.550%	3.571%	10
B211 Secretaries (except legal and medical)	0.719%	4.615%	0.432%	15	1.898%	0.000%	0
J311 Labourers in mineral and metal processing	0.719%	0.000%	0.552%	0	0.014%	0.000%	0
C111 Chemical technologists and technicians	0.686%	3.077%	0.887%	10	0.285%	0.000%	0
B531 Accounting and related clerks	0.661%	0.000%	0.480%	0	1.208%	0.000%	0
H622 Drillers and blasters - Surface mining, quarrying and construction	0.653%	0.000%	0.624%	0	0.469%	3.571%	10
B311 Administrative officers	0.521%	0.000%	0.360%	0	1.401%	0.000%	0
C143 Industrial instrument technicians and mechanics	0.504%	3.077%	0.408%	10	0.498%	0.000%	0
C071 Information systems analysts and consultants	0.496%	0.000%	0.312%	0	0.367%	0.000%	0
B315 Purchasing agents and officers	0.455%	0.000%	0.791%	0	0.517%	0.000%	0
A111 Financial	0.446%	0.000%	0.168%	0	0.377%	0.000%	0

managers							
A112 Human resources managers	0.446%	0.000%	0.456%	0	0.353%	0.000%	0
B021 Specialists in human resources	0.446%	0.000%	0.528%	0	0.203%	0.000%	0
G631 Security guards and related occupations	0.446%	0.000%	0.671%	0	0.063%	0.000%	0
B575 Dispatchers and radio operators	0.430%	0.000%	0.072%	0	0.512%	0.000%	0
E121 College and other vocational instructors	0.430%	0.000%	0.480%	0	0.261%	0.000%	0
J125 Inspectors and testers, mineral and metal processing	0.413%	0.000%	0.576%	0	0.053%	0.000%	0
C163 Inspectors in public and environmental health and occupational health and safety	0.397%	0.000%	0.528%	0	0.705%	0.000%	0
J124 Concrete, clay and stone forming operators	0.397%	0.000%	0.048%	0	0.000%	0.000%	0
B571 Shippers and receivers	0.389%	0.000%	0.432%	0	0.454%	0.000%	0
A131 Sales, marketing and advertising managers	0.380%	0.000%	0.048%	0	0.647%	0.000%	0
H016 Contractors and supervisors, mechanic trades	0.380%	0.000%	0.312%	0	0.290%	0.000%	0
A391 Manufacturing managers	0.372%	0.000%	0.216%	0	0.357%	0.000%	0
H421 Automotive service technicians, truck and bus mechanics and mechanical repairers	0.372%	0.000%	0.216%	0	0.343%	0.000%	0
G931 Light duty cleaners	0.372%	0.000%	0.647%	0	0.203%	0.000%	0
H621 Crane operators	0.355%	0.000%	0.144%	0	0.396%	0.000%	0
C141 Electrical and electronics engineering technologists and technicians	0.355%	0.000%	0.647%	0	0.357%	0.000%	0
B572 Storekeepers and parts clerks	0.347%	0.000%	0.480%	0	0.261%	0.000%	0
B541 Administrative clerks	0.331%	0.000%	0.336%	0	0.401%	0.000%	0
I212 Landscaping and grounds maintenance labourers	0.331%	0.000%	0.048%	0	0.130%	0.000%	0
H311 Machinists and machining and tooling inspectors	0.322%	0.000%	0.432%	0	0.584%	0.000%	0

H121 Carpenters	0.306%	0.000%	0.432%	0	0.242%	5.357%	15
H221 Stationary engineers and auxiliary equipment operators	0.306%	0.000%	0.312%	0	0.174%	0.000%	0
B574 Purchasing and inventory clerks	0.289%	0.000%	0.216%	0	0.275%	0.000%	0
A141 Facility operation and maintenance managers	0.289%	0.000%	0.216%	0	0.222%	0.000%	0
C054 Land surveyors	0.289%	0.000%	0.600%	0	0.164%	0.000%	0
I021 General farm workers	0.281%	0.000%	0.168%	0	0.048%	0.000%	0
C015 Other professional occupations in physical sciences	0.273%	0.000%	0.216%	0	0.014%	0.000%	0
C032 Mechanical engineers	0.256%	0.000%	0.120%	0	0.386%	0.000%	0
B532 Payroll clerks	0.248%	0.000%	0.216%	0	0.333%	0.000%	0
B553 Customer service, information and related clerks	0.248%	0.000%	0.048%	0	0.299%	0.000%	0
B312 Executive assistants	0.231%	0.000%	0.048%	0	0.184%	0.000%	0
C181 Computer network technicians	0.223%	0.000%	0.168%	0	0.169%	0.000%	0
B514 Receptionists and switchboard operators	0.215%	0.000%	0.096%	0	0.367%	0.000%	0
C132 Mechanical engineering technologists and technicians	0.215%	0.000%	0.192%	0	0.198%	0.000%	0
C153 Drafting technologists and technicians	0.215%	0.000%	0.168%	0	0.174%	0.000%	0
B573 Production clerks	0.215%	0.000%	0.216%	0	0.159%	0.000%	0
G211 Retail salespersons and sales clerks	0.207%	0.000%	0.048%	0	0.889%	0.000%	0
J319 Other labourers in processing, manufacturing and utilities	0.207%	0.000%	0.000%	0	0.053%	0.000%	0
G412 Cooks	0.198%	4.615%	0.456%	15	0.213%	3.571%	10
F024 Professional occupations in public relations and communications	0.198%	0.000%	0.072%	0	0.087%	0.000%	0
A371 Construction managers	0.190%	0.000%	0.072%	0	0.251%	0.000%	0
C012 Chemists	0.190%	0.000%	0.216%	0	0.068%	0.000%	0

E031 Natural and applied science policy researchers, consultants and program officers	0.174%	0.000%	0.120%	0	0.068%	0.000%	0
B111 Bookkeepers	0.165%	0.000%	0.168%	0	1.121%	0.000%	0
C074 Computer programmers and interactive media developers	0.165%	0.000%	0.000%	0	0.232%	0.000%	0
C041 Industrial and manufacturing engineers	0.165%	0.000%	0.072%	0	0.188%	0.000%	0
J011 Supervisors, mineral and metal processing	0.165%	0.000%	0.120%	0	0.068%	0.000%	0
H112 Steamfitters, pipefitters and sprinkler system installers	0.157%	0.000%	0.096%	0	1.662%	0.000%	0
H017 Contractors and supervisors, heavy construction equipment crews	0.157%	0.000%	0.072%	0	0.464%	0.000%	0
A121 Engineering managers	0.157%	0.000%	0.192%	0	0.174%	0.000%	0
B415 Supervisors, recording, distributing and scheduling occupations	0.157%	0.000%	0.120%	0	0.164%	0.000%	0
A113 Purchasing managers	0.157%	0.000%	0.216%	0	0.087%	0.000%	0
C033 Electrical and electronics engineers	0.149%	0.000%	0.144%	0	0.203%	0.000%	0
H714 Delivery and courier service drivers	0.149%	0.000%	0.120%	0	0.198%	0.000%	0
D234 Ambulance attendants and other paramedical occupations	0.141%	0.000%	0.072%	0	0.116%	0.000%	0
B522 Data entry clerks	0.132%	0.000%	0.072%	0	0.367%	0.000%	0
G932 Specialized cleaners	0.132%	0.000%	0.240%	0	0.246%	3.571%	10
H822 Other trades helpers and labourers	0.132%	0.000%	0.144%	0	0.222%	0.000%	0
E033 Business development officers and marketing researchers and consultants	0.132%	0.000%	0.000%	0	0.135%	0.000%	0
H012 Contractors and supervisors, electrical trades and telecommunications occupations	0.132%	0.000%	0.240%	0	0.068%	0.000%	0

G121 Technical sales specialists, wholesale trade	0.124%	0.000%	0.048%	0	0.343%	0.000%	0
B022 Professional occupations in business services to management	0.116%	0.000%	0.120%	0	0.203%	0.000%	0
C182 User support technicians	0.116%	0.000%	0.048%	0	0.145%	0.000%	0
C034 Chemical engineers	0.116%	0.000%	0.000%	0	0.126%	0.000%	0
A122 Computer and information systems managers	0.116%	0.000%	0.000%	0	0.121%	0.000%	0
B012 Financial and investment analysts	0.116%	0.000%	0.048%	0	0.072%	0.000%	0
H533 Automotive mechanical installers and servicers	0.116%	0.000%	0.096%	0	0.053%	0.000%	0
C042 Metallurgical and materials engineers	0.116%	0.000%	0.168%	0	0.029%	0.000%	0
E012 Lawyers and Quebec notaries	0.116%	0.000%	0.000%	0	0.010%	0.000%	0
H131 Bricklayers	0.116%	0.000%	0.120%	0	0.000%	0.000%	0
H721 Railway and yard locomotive engineers	0.116%	0.000%	0.288%	0	0.000%	0.000%	0
A114 Other administrative services managers	0.107%	0.000%	0.168%	0	0.203%	0.000%	0
C133 Industrial engineering and manufacturing technologists and technicians	0.107%	0.000%	0.096%	0	0.106%	0.000%	0
B313 Personnel and recruitment officers	0.107%	0.000%	0.096%	0	0.058%	0.000%	0
H111 Plumbers	0.107%	0.000%	0.120%	0	0.053%	0.000%	0
J112 Petroleum, gas and chemical process operators	0.099%	0.000%	0.072%	0	1.493%	0.000%	0
B412 Supervisors, finance and insurance clerks	0.099%	0.000%	0.048%	0	0.101%	0.000%	0
E211 Paralegal and related occupations	0.099%	0.000%	0.000%	0	0.039%	0.000%	0
H433 Electrical mechanics	0.099%	0.000%	0.192%	0	0.039%	0.000%	0
J134 Water and waste plant operators	0.099%	0.000%	0.144%	0	0.010%	3.571%	10
C125 Landscape and horticultural technicians and specialists	0.099%	0.000%	0.000%	0	0.000%	0.000%	0

H722 Railway conductors and brakemen/women	0.091%	0.000%	0.240%	0	0.000%	0.000%	0
C031 Civil engineers	0.083%	0.000%	0.096%	0	0.130%	3.571%	10
D112 Registered nurses	0.083%	0.000%	0.192%	0	0.010%	0.000%	0
G111 Sales representatives, wholesale trade (non-technical)	0.074%	0.000%	0.000%	0	0.150%	0.000%	0
H416 Machine fitters	0.074%	0.000%	0.072%	0	0.077%	0.000%	0
B411 Supervisors, general office and administrative support clerks	0.074%	0.000%	0.048%	0	0.072%	0.000%	0
B542 Personnel clerks	0.074%	0.000%	0.144%	0	0.034%	0.000%	0
G625 Other protective service occupations	0.074%	0.000%	0.048%	0	0.014%	0.000%	0
J193 Woodworking machine operators	0.074%	0.000%	0.000%	0	0.014%	0.000%	0
H222 Power systems and power station operators	0.074%	0.000%	0.072%	0	0.010%	0.000%	0
A123 Architecture and science managers	0.066%	0.000%	0.072%	0	0.063%	0.000%	0
H323 Structural metal and platework fabricators and fitters	0.066%	0.000%	0.000%	0	0.063%	0.000%	0
C044 Geological engineers	0.066%	0.000%	0.048%	0	0.053%	0.000%	0
C047 Computer engineers (except software engineers)	0.066%	0.000%	0.048%	0	0.039%	0.000%	0
H214 Electrical power line and cable workers	0.066%	0.000%	0.096%	0	0.010%	0.000%	0
H414 Railway carmen/women	0.066%	0.000%	0.168%	0	0.010%	0.000%	0
I215 Oil and gas drilling, servicing and related labourers	0.058%	0.000%	0.048%	0	9.578%	3.571%	10
I132 Oil and gas well drillers, servicers, testers and related workers	0.058%	0.000%	0.000%	0	8.868%	5.357%	15
J012 Supervisors, petroleum, gas and chemical processing and utilities	0.058%	3.077%	0.048%	10	0.420%	0.000%	0
C164 Construction inspectors	0.058%	0.000%	0.000%	0	0.188%	0.000%	0
G961 Food counter attendants, kitchen helpers and related	0.058%	3.077%	0.168%	10	0.048%	0.000%	0

occupations							
J313 Labourers in chemical products processing and utilities	0.058%	0.000%	0.096%	0	0.039%	0.000%	0
H811 Longshore workers	0.058%	0.000%	0.144%	0	0.000%	0.000%	0
J122 Foundry workers	0.058%	0.000%	0.072%	0	0.000%	0.000%	0
J227 Plating, metal spraying and related operators	0.058%	0.000%	0.120%	0	0.000%	0.000%	0
I122 Supervisors, oil and gas drilling and service	0.050%	0.000%	0.000%	0	5.294%	0.000%	0
A211 Retail trade managers	0.050%	0.000%	0.000%	0	0.164%	0.000%	0
A373 Transportation managers	0.050%	0.000%	0.048%	0	0.111%	0.000%	0
J317 Labourers in food, beverage and tobacco processing	0.050%	0.000%	0.000%	0	0.010%	0.000%	0
C161 Non-destructive testers and inspectors	0.041%	0.000%	0.072%	0	0.367%	0.000%	0
J226 Painters and coaters, industrial	0.041%	0.000%	0.048%	0	0.043%	0.000%	0
C155 Mapping and related technologists and technicians	0.041%	0.000%	0.048%	0	0.039%	0.000%	0
C011 Physicists and astronomers	0.041%	0.000%	0.072%	0	0.000%	0.000%	0
H732 Railway track maintenance workers	0.041%	0.000%	0.096%	0	0.000%	0.000%	0
H324 Ironworkers	0.033%	0.000%	0.048%	0	0.309%	0.000%	0
I161 Chain saw and skidder operators	0.033%	0.000%	0.048%	0	0.130%	3.571%	10
B513 Records management and filing clerks	0.033%	0.000%	0.000%	0	0.097%	0.000%	0
H022 Supervisors, motor transport and other ground transit operators	0.033%	0.000%	0.072%	0	0.082%	0.000%	0
J312 Labourers in metal fabrication	0.033%	0.000%	0.096%	0	0.063%	0.000%	0
C154 Land survey technologists and technicians	0.033%	0.000%	0.048%	0	0.058%	0.000%	0
A302 Banking, credit and other investment managers	0.033%	0.000%	0.000%	0	0.034%	0.000%	0
C121 Biological technologists and technicians	0.033%	0.000%	0.000%	0	0.024%	0.000%	0

H734 Engine room crew, water transport	0.033%	0.000%	0.000%	0	0.024%	0.000%	0
H216 Telecommunications installation and repair workers	0.033%	0.000%	0.120%	0	0.010%	0.000%	0
C053 Urban and land use planners	0.033%	0.000%	0.048%	0	0.000%	0.000%	0
D212 Medical laboratory technicians	0.033%	0.000%	0.048%	0	0.000%	0.000%	0
H014 Contractors and supervisors, metal forming, shaping and erecting trades	0.025%	0.000%	0.000%	0	0.140%	0.000%	0
G612 Firefighters	0.025%	0.000%	0.048%	0	0.121%	0.000%	0
C142 Electronic service technicians (household and business equipment)	0.025%	0.000%	0.000%	0	0.092%	0.000%	0
H733 Deck crew, water transport	0.025%	0.000%	0.048%	0	0.063%	0.000%	0
I011 Farmers and farm managers	0.025%	0.000%	0.000%	0	0.058%	0.000%	0
H144 Painters and decorators	0.025%	0.000%	0.000%	0	0.043%	0.000%	0
H712 Bus drivers and subway and other transit operators	0.025%	0.000%	0.048%	0	0.039%	0.000%	0
B554 Survey interviewers and statistical clerks	0.025%	0.000%	0.048%	0	0.034%	0.000%	0
B576 Transportation route and crew schedulers	0.025%	0.000%	0.048%	0	0.034%	0.000%	0
B014 Other financial officers	0.025%	0.000%	0.000%	0	0.029%	0.000%	0
G411 Chefs	0.025%	0.000%	0.048%	0	0.019%	0.000%	0
C175 Railway traffic controllers and marine traffic regulators	0.025%	0.000%	0.072%	0	0.010%	0.000%	0
H435 Other small engine and equipment mechanics	0.025%	0.000%	0.048%	0	0.010%	0.000%	0
H832 Railway and motor transport labourers	0.025%	0.000%	0.048%	0	0.010%	0.000%	0
G016 Other service supervisors	0.025%	0.000%	0.072%	0	0.000%	0.000%	0
G721 Tour and travel guides	0.025%	0.000%	0.048%	0	0.000%	0.000%	0
I142 Oil and gas well drilling workers and services operators	0.017%	0.000%	0.048%	0	6.477%	0.000%	0
H143 Insulators	0.017%	0.000%	0.000%	0	0.522%	0.000%	0
H322 Boilermakers	0.017%	0.000%	0.000%	0	0.130%	0.000%	0

C073 Software engineers and designers	0.017%	0.000%	0.000%	0	0.126%	0.000%	0
H713 Taxi and limousine drivers and chauffeurs	0.017%	0.000%	0.000%	0	0.077%	0.000%	0
H211 Electricians (except industrial and power system)	0.017%	0.000%	0.000%	0	0.068%	0.000%	0
J191 Machining tool operators	0.017%	0.000%	0.000%	0	0.068%	0.000%	0
C171 Air pilots, flight engineers and flying instructors	0.017%	0.000%	0.048%	0	0.063%	0.000%	0
C072 Database analysts and data administrators	0.017%	0.000%	0.000%	0	0.053%	0.000%	0
H431 Oil and solid fuel heating mechanics	0.017%	0.000%	0.000%	0	0.053%	0.000%	0
H113 Gas fitters	0.017%	0.000%	0.000%	0	0.048%	0.000%	0
H321 Sheet metal workers	0.017%	0.000%	0.000%	0	0.048%	0.000%	0
C173 Deck officers, water transport	0.017%	0.000%	0.048%	0	0.043%	0.000%	0
H132 Concrete finishers	0.017%	0.000%	0.000%	0	0.039%	0.000%	0
J196 Other metal products machine operators	0.017%	0.000%	0.048%	0	0.014%	0.000%	0
H523 Other trades and related occupations	0.017%	0.000%	0.048%	0	0.010%	0.000%	0
J216 Mechanical assemblers and inspectors	0.017%	0.000%	0.048%	0	0.010%	0.000%	0
G513 Food and beverage servers	0.017%	0.000%	0.048%	0	0.000%	0.000%	0
H215 Telecommunications line and cable workers	0.017%	0.000%	0.048%	0	0.000%	0.000%	0
H512 Tailors, dressmakers, furriers and milliners	0.017%	0.000%	0.048%	0	0.000%	0.000%	0
H535 Other repairers and servicers	0.017%	0.000%	0.048%	0	0.000%	0.000%	0
C045 Petroleum engineers	0.000%	0.000%	0.000%	0	1.531%	0.000%	0
H532 Waterworks and gas maintenance workers	0.000%	0.000%	0.000%	0	0.285%	0.000%	0
H013 Contractors and supervisors, pipefitting trades	0.000%	0.000%	0.000%	0	0.261%	0.000%	0
H011 Supervisors, machinists and related occupations	0.000%	0.000%	0.048%	0	0.159%	0.000%	0

H019 Contractors and supervisors, other construction trades, installers, repairers and servicers	0.000%	0.000%	0.000%	0	0.121%	0.000%	0
H312 Tool and die makers	0.000%	0.000%	0.000%	0	0.097%	0.000%	0
H623 Water well drillers	0.000%	0.000%	0.000%	0	0.087%	0.000%	0
C162 Engineering inspectors and regulatory officers	0.000%	0.000%	0.000%	0	0.068%	0.000%	0
G731 Operators and attendants in amusement, recreation and sport	0.000%	0.000%	0.000%	0	0.068%	0.000%	0
I162 Silviculture and forestry workers	0.000%	3.077%	0.000%	10	0.019%	0.000%	0
F154 Program leaders and instructors in recreation, sport and fitness	0.000%	0.000%	0.048%	0	0.010%	0.000%	0
All occupations	100.000%	100.000%	99.976%	325	99.995%	101.786%	285

Yukon Mining Sector Profile

Component 6: Requirements for Economic Impact Analysis

1 Requirements for Economic Impact Analysis

This project component is designed to lay the groundwork for an economic impact analysis of Yukon's mining sector, not to conduct the analysis itself. Laying that groundwork will include:

- A literature review of economic impact assessment models designed for the mining sector in other jurisdictions;
- Examining the project-level economic effects assessments that are part of the project proposals submitted to YESAB for Executive Committee level screening to determine what is the current standard here in the Yukon;
- Identifying any gaps in the economic impact assessments as they are currently carried out;
- Identifying the data needed to carry out an effective economic impact analysis of the sector;
- Identifying gaps in that needed data: and,
- Developing a framework for evaluating the likely economic impacts of mining projects in the Yukon, including the likely impacts on local communities and First Nations.

1.1 Literature Review

We reviewed available economic impact assessments done in other Canadian jurisdictions. The following are offered as covering a variety of approaches:

- A 2011 analysis of the economic impact of the mining industry in BC authored by Price Waterhouse Coopers for the Mining Association of British Columbia[1];
- A 2013 analysis of the economic impact of coal mining in BC authored by Price Waterhouse Coopers for the Coal Association of Canada[2];
- A 2007 analysis of the economic impact of a hypothetical "representative" mine in Ontario prepared by Dungan and Murphy for the Ontario Mining Association[3];
- A 2012 analysis of the overall economic impact of mining in Ontario prepared by Dungan and Murphy for the Ontario Mining Association[4]; and,
- A forward-looking analysis of the economic impact of iron ore mining in Labrador prepared by Wade Locke for the Government of Newfoundland and Labrador.[5]

Each of the five analyses is reviewed in Sections 1.1.1 through 1.1.5 below.

1.1.1 Economic Impact Analysis: Mining Association of British Columbia

This 2011 analysis is a standard approach to economic impacts only largely based on Statistics Canada's Inter-provincial Input Output model. However, the authors have also used a model provided by the BC Stats to measure induced impacts (the effects of the re-spending of labour

[1] Price Waterhouse Coopers. October 2011. *Economic Impact Analysis: Mining Association of British Columbia.* Available at: www.pwc.com/ca/mining
[2] Price Waterhouse Coopers. February 15, 2013. *Economic impact analysis of the coal mining industry in British Columbia, 2011*. Prepared for the Coal Association of Canada. Available at: www.pwc.com/ca/mining
[3] Dungan, Peter and Steve Murphy. December 2007. *Ontario Mining: A Partner in Prosperity Building. The Economic Impacts of a 'Representative Mine' in Ontario.* Available at: http://www.oma.on.ca/en/ontariomining/resources/RepMineFinalReportDec07.pdf
[4] Dungan, Peter and Steve Murphy. December 2012. *Mining: Dynamic and Dependable for Ontario's Future*. Available at: http://www.oma.on.ca/en/ontariomining/resources/UofTMiningReport2012Final.pdf
[5] Locke, Wade and Strategic Concepts Inc. September 24, 2012. Economic Impact Analysis of Iron Ore Mining Industry in Labrador 2011-31. Available at: http://www.powerinourhands.ca/pdf/Economic_Analysis.pdf

income of those employed, directly and indirectly, by the industry) along with the direct and indirect impacts measured by the Statistics Canada model. The analysis examines the impact of the industry on economic output, provincial Gross Domestic Product, employment and tax revenues (federal, provincial and municipal).

The authors list only the general sources of the data that was fed into the economic models. These sources include aggregated data from a 2010 survey of firms in the industry carried out by Price Waterhouse Coopers, industry statistics from Statistics Canada, publications from the BC Ministry of Energy, Mines and Petroleum Resources, and reports and publications from the Mining Association of BC. From the report, it appears that the aggregated data from the 2010 survey is the primary source of data with other sources used only to supplement it. The 2010 survey included 42 mining companies and was augmented by data on mineral exploration published by the Ministry of Energy, Mines and Petroleum Resources.

The authors broke down reported industry spending into the following six categories and provided a separate impact analysis for each of the six:

1. Operating expenditures;
2. Capital expenditures;
3. Outward transportation costs;
4. Exploration and development expenditures;
5. Expenditures of environmental control and public interest; and,
6. Other expenditures;

The strengths of the approach used include:

- A straightforward focus on a handful of simple economic indicators;
- The use of the rigorous Statistics Canada I-O model to measure direct and indirect impacts;
- The inclusion of induced impacts only through a model provided by BC Stats; and,
- The separate analysis of very different aspects of the mining cycle from exploration through reclamation.

The weaknesses of the approach used include:

- The very narrow focus on a handful of simple economic indicators with no acknowledgement of the broader social and economic context in which the industry operates;
- No acknowledgement that the industry may have negative impacts as well as positive ones;
- Specifics on methodology and approach are scarce;
- The seemingly strong reliance on the authors' own industry survey (which did not appear to include a good sample of junior mining companies) as the primary data source; and,
- Only general sources of data are referenced leaving the reader with little or no information about the data being fed into the economic models.

In the Yukon context, there is no rigorous economic model of the territory's economy that includes induced impacts so that part of the approach used by Price Waterhouse in BC could not be replicated here. The tiny number of operating mines also means largely relying on the aggregation of annual industry surveys does not appear to be a viable Yukon approach.

1.1.2 Economic Impact Analysis of the Coal Mining Industry in British Columbia, 2011

This 2013 analysis is an example of a standard economic impact analysis applied to the mining of a single commodity. The overall approach used is very similar to that used in the broader analysis of the BC mining industry as a whole (see Section 1.1.1 above) which is not surprising as they are both authored by Price Waterhouse Coopers. However, there are several differences between the two including:

- The impact analysis for the coal industry uses only Statistics Canada's I-O model and therefore reports only direct and indirect economic impacts, not induced impacts. This is likely due to the origin of the BC report as a sub-report of a larger national report where no rigorous economic model provides estimates of induced impacts;
- The Price Waterhouse Coopers survey which provides the majority of the expenditure data was responded to by all of the operating coal mining companies in British Columbia, indicating that the survey results were likely robust; and,
- The coal analysis disaggregated industry expenditures into only two categories, capital expenditures and operating expenditures.

Otherwise, the strengths and weaknesses of the coal analysis are very similar to the broader impact analysis as outlined in Section 1.1.1 above.

1.1.3 Economic Impacts of a "Representative Mine" in Ontario

This 2007 economic impact analysis — by Peter Dungan and Steve Murphy of the University of Toronto's Institute for Policy Analysis — creates a hypothetical representative mine and analyses its economic and social impacts. The impetus behind this approach is that it is always individual projects and not the industry as a whole that are the objects of policy decisions.

The study considers a representative mine in Ontario to:

- Be a nickel and copper producer located in an already serviced area such as Sudbury;
- Cost $450 million to build over three years with 80% construction costs and 20% equipment;
- Produce $270 million worth of product annually for 20-30 years;
- Employ 480 full time workers with an average wage of $85,000 and total labour compensation of $145,000 each annually ($69.5 million annually);
- Purchase $119.5 million of inputs annually during operations;
- Have a capital consumption allowance of $40.5 million annually; and,
- Have a gross profit of $40.5 million annually.

The analysis focuses on the anticipated annual economic impacts during the construction and operation phases. It relies, at least in part, on Statistics Canada's Inter-provincial Input Output model to estimate direct, indirect and induced impacts on GDP, employment, and total labour compensation. (Note that Statistics Canada no longer provides multipliers for induced impacts). The direct, indirect and induced impact of the representative mine on government revenues is presented in considerable detail for federal, provincial and municipal governments, including separate estimates for employer CPP and EI contributions, Workers Compensation, employer health taxes etc. The authors also attempt to estimate the total local or regional impacts of the representative mine.

The authors also discuss but do not attempt to quantify other economic and social impacts of the hypothetical mine including:

- The economic activity associated with maintaining the local community that the mine makes possible, including municipal, health and education services;
- The special efforts to contribute to the well-being and development of Aboriginal communities;
- The ongoing economic effects of generous pension plans; and,
- A brief mention of the impact of other phases of the mining life cycle, exploration and reclamation.

The strengths of this approach include:

- The use of the rigorous Statistics Canada I-O model;
- The level of detail in the estimate of impacts on government revenues; and,
- The acknowledgement of some of the wider social and economic context in which mines operate.

The weaknesses of this approach include:

- The hypothetical nature of the mine gives the entire analysis a feeling of unreality even if the mine is representative;
- There is no acknowledgement that the industry may have negative impacts as well as positive ones;
- Specifics on methodology and approach are scarce, for example, the authors do not specify how they came to their estimates of local versus provincial impacts;
- The exploration and reclamation phases of the mining life-cycle are acknowledged but no effort is made to measure their impacts; and,
- Although it may be applicable in the long-developed mining areas of northern Ontario, the expectation that mine employees live in communities near the mine, and indeed that the mine sustains the community, is not applicable across most of Canada.

1.1.4 Mining: Dynamic and Dependable for Ontario's Future

This 2012 report by the same authors of the impact analysis of a representative Ontario mine reviewed above, is a far more wide ranging examination of many different aspects of the mining industry in Ontario. The report does include a province-wide economic impact analysis of the mining industry in using Statistics Canada's I-O model, and includes induced impact multipliers from special runs on the model. However, it also includes:

- Employment and wage comparisons with other industries;
- Discussion and analysis of exploration and development, both generally in the province and for specific regions;
- An analysis of international trade and Ontario's mining industry;
- Innovation in the mining industry;
- A discussion of mine safety;
- A discussion of mining and sustainability; and,
- An effort to analyze the regional distribution of economic impacts.

In general, this report goes further than any of those we have reviewed in its explicit and implicit acknowledgement of the wider social and economic context in which the mining industry operates. However, it too appears to avoid acknowledging that mining can have negative as well as positive social and economic impacts.

1.1.5 Economic Impact Analysis of Iron Ore Mining Industry in Labrador 2011-31

This study uses a scenario-based approach in order to estimate the future economic impacts of iron ore mining in Labrador using a purpose built input-output model of the provincial economy that includes direct, indirect and induced multipliers. The authors describe the model as:

> "The model used to measure economic impacts, developed specifically for Newfoundland and Labrador-based resource projects, and has been applied to the majority of large mining and oil and gas projects proposed or occurring within the province. The economic model is based on the principal of tracking expenditures through the economy and applying coefficients to determine direct, indirect and induced impacts on employment, incomes, gross domestic product, taxation and equalization… The working basis underlying this model is that the economic impacts that flow throughout the provincial and national economies emanate from the project expenditures associated with mining operations. In addition, the sale of final iron ore mining outputs also generates economic impacts. Furthermore, all of these impacts are magnified as incomes earned by labour and businesses associated with the mining activities are re-spent throughout the economy."[6]

The model considers impacts on the provincial economy, the provincial government, provincial labour force and provincial businesses. Four production scenarios are constructed using existing operations as the base case and various combinations of possible mine expansions and new openings. Each production scenario is in turn analyzed using three different pricing scenarios. The primary source of data for input into the model is the estimated capital and operating expenditures of existing and proposed mining operations supplied by the provincial Department of Natural Resources supplemented by publicly available corporate reports on their operations.

The analysis focuses on the industry impacts on GDP, employment, incomes and government revenues. It provides a sensitivity analysis for its results. In addition, the authors have included the highly unusual and perhaps unique step of converting the economic impact estimates to an equivalent value in terms of electricity prices. This is intended to facilitate a comparison of the total benefits received from the construction and operations of the iron ore projects with the alternative of simply exporting the hydro power needed by the mining projects at some net back price.

The strengths of this approach include:

- A straightforward focus on a handful of simple economic indicators;
- The use of sensitivity analysis on the results; and,
- The considerable effort to facilitate the comparison of impacts with a simple alternative use of Labrador's available hydro power.

The weaknesses of this approach include:

- The complete reliance on a purpose built input-output model that may lack economic rigor;
- There is no acknowledgement of the wider social and economic context in which mines operate;
- There is no acknowledgement that the industry may have negative impacts as well as positive ones; and,

[6] Locke. 2012. p.4

- Only the impacts of mine construction and operation are considered, with no examination of the exploration and closure phases of the mining cycle.

1.2 Yukon Socio-Economic Effects Assessments

The advent of the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) in 2005 has changed the nature and scope of socio-economic impact assessments of projects in the Yukon. These are now required to be much more comprehensive and detailed than what was done under previous legislation. A number of proposed mining projects have now been subject to Executive Committee level screening under the act. The projects and their submission dates include:

- Carmacks Copper (February 2007);
- Mactung Mine (December 2008);
- Eagle Gold (July 2011); and,
- Ketza River Mine (September 2011).

The projects are at different stages of the assessment and licensing process.

Carmacks Copper received a recommendation to proceed from the Yukon Environmental and Socio-economic Assessment Board (YESAB) in July 2008 subject to extensive conditions largely focused on the planned use of sulfuric acid heap leaching to extract copper from the ore. The Yukon government issued a quartz mining license but the Water Board refused to issue the water license required for the mine to operate amidst much public concern and legal intervention by the Little Salmon Carmacks First Nation. In April of 2012, Copper North, the project's owner announced that it had brought forward design changes to the heap leach facility and that YESAB will be determining the scope for re-assessing the project.[7]

A recommendation has not yet been issued on the Mactung project. In February 2013 North American Tungsten withdrew its proposal to construct a new access road on the Yukon side of the border from the North Canol Road to the mine site.[8] Instead it will be applying to the NWT to upgrade and use the old existing access road on the NWT side of the border. It is unclear what effect this decision will have on the timing of the project.

For the Eagle Gold project, the board recommended the project proceed with conditions on February 20, 2013. Project construction is now awaiting a quartz mining license and a water license.

The Ketza River project proposal is undergoing adequacy review by YESAB.

1.2.1 Approach

Two of this profile's authors, Malcolm Taggart and Luigi Zanasi, have been involved in preparing the socio-economic effects assessments for all four of the mining projects submitted to YESAB for Executive Committee level screening thus far. They have been entirely responsible for the socio-economic submissions for the Mactung and Ketza projects, were both involved in preparing the socio-economic baseline for the Eagle Gold project and Malcolm Taggart (with Paul Kischuck) was responsible for responding to YESAB's request for the proponent to revisit most aspects of their original submission for the Carmacks Copper project.

[7] Copper North. News Release April 26, 2012. Available at: http://www.coppernorthmining.com
[8] Yukon Environmental and Socio-economic Assessment Board. http://www.yesab.tzo.com

The socio-economic effects portion of each of these project proposals has been accepted without the need for the proponent to submit more information. We therefore feel confident in offering the following as a summary of the current standard approach to socio-economic effects assessments in the Yukon.

In the Yukon Environmental and Socio-economic Assessment Board's (YESAB's) *Guide to Socio-economic Effects Assessments*, seven principles are laid out to provide broad and general direction on how a proponent is to conduct a socio-economic effects assessment:

- Achieve a broad understanding of the local and regional settings potentially affected by the proposed action;
- Focus assessment on key aspects of the human environment;
- Provide valid and relevant information for use in decision-making;
- Identify methods and assumptions and define significance;
- Ensure that effect equity issues are described and analyzed;
- Consider and recommend suitable mitigation and include in the assessment mechanisms to improve the likelihood of mitigation success; and,
- Determine the best development alternative(s) rather than merely serving as an arbiter between socio-economic benefit and social cost.[9]

YESAB suggests a six-step process for conducting socio-economic effects assessments:

- Determine scope of project;
- Determine scope of assessment;
- Compile the socio-economic baseline;
- Characterizing potential effects;
- Mitigation/enhancement; and,
- Significance determination.[10]

Both the Act and the YESAB's published guides emphasize the importance of engagement with the affected communities to establish and validate valued socio-economic components (VSECs), to characterize potential effects, to evaluate potential mitigation and enhancement strategies, and finally, to determine the significance of the potential effects on the VSECs. The last three tasks require an iterative process, which involves substantial contact and consultation with the affected communities, First Nations, and other identified interests.

1.2.1.1 Scope of Project

Determining the socio-economic scope of a project requires that the proponent:

- Identify and describe the principal project;
- Identify and describe any accessory project or projects;
- Summarize the broad project components and activities that will be included in the assessment; and,
- Describe and document the rationale used to determine the socio-economic scope of the project.[11]

[9] Yukon Environmental and Socio-economic Assessment Board. *Guide to Socio-economic Effects Assessments*. June 2006. pp. 20-23
[10] Ibid. p.25
[11] Adapted from: Yukon Environmental and Socio-economic Assessment Board. *Guide to Socio-economic Effects Assessments*. June 2006. p.26.

The proponent must summarize the broad project components that are included in the socio-economic effects assessment and describe and document the rationale used to determine the socio-economic scope of the project. Where applicable it is important to distinguish between the three broad phases of a mining project: construction, operation, and closure/reclamation.

1.2.1.2 Scope of Assessment

Determining the scope of the socio-economic effects assessment includes:

- Developing a basic understanding of the socio-economic setting;
- Identifying which communities, governments, organizations, and individuals have an interest in a proposed project;
- Identifying what those interested parties value in the socio-economic context (their valued socio-economic components or VSECs);
- Determining whether the project is likely to have a significant effect on those valued socio-economic components; and,
- Establishing the spatial and temporal boundaries for the assessment and documenting the rationale for choosing those boundaries.[12]

Although YESAB does not specify that the proponent must demonstrate a basic understanding of the project's socio-economic setting, but merely develop that understanding, good practice demands that the understanding be demonstrated.

Communities, governments, organizations, other groups and individuals have an interest in a proposed project when the project may have an effect — positive or negative — on a part of the social and economic system that they, or those they represent, value. It is important to note that although the project *may* have an effect on an interest; it will not necessarily do so.

Valued socio-economic components, or VSECs, are defined by the Yukon Environmental and Socio-economic Assessment Board as those parts of the socio-economic fabric that are valued because of their importance to the community, specifically because of their:

- Integral connection to, or reflection of, the socio-economic system;
- Commercial or economic value; and/or,
- Their role in maintaining quality of life in a community.[13]

Some VSECs are specific to a particular community or interest, but many overlap among communities and interests.

The VSECs for a project can be identified through a variety of means including:

- Community meetings and workshops;
- Existing community plans and strategies;
- Meetings between the proponent and First Nation and community representatives;
- Meetings between the proponent and government representatives;
- Responses by many interests (and especially government interests) to other similar projects submitted to the YESAB for Executive Committee level screening; and,
- The professional judgement of the authors of the project proposal.

[12] Adapted from: Yukon Environmental and Socio-economic Assessment Board. *Guide to Socio-economic Effects Assessments*. June 2006. p.29.

[13] Yukon Environmental and Socio-economic Assessment Board. *Guide to Socio-economic Effects Assessments*. June 2006. p.36.

Once the VSECs for a project are identified, a preliminary determination of potential effects is required. Coming to a preliminary determination for some of the VSECs common to all projects is straightforward, e.g. the opening of a mine will result in a clear and measurable increase in the Yukon's GDP and employment. For other VSECs, however, such a determination is not straightforward. For example, family stress was identified as a VSEC (part of the larger human health & well-being VSEC) for the Ketza River mine project during community consultations. A preliminary determination of potential effects is neither quick nor simple in this case.

Determining the spatial boundaries for the socio-economic assessment is normally straightforward. A Yukon mine is not likely to have significant effects on a national scale and therefore Canada-wide effects are not within the scope of assessment. Any mining project that requires Executive Committee level screening will have Yukon-wide effects. YESAB has established that effects on all Yukon First Nations (and therefore, by extension, their home communities) on who's traditional territory the project occurs is included within the scope of assessment. Finally, the social and economic effects of a mining project tend to be more concentrated in the communities nearest to the mine, and especially those relatively close by road and this community (or communities) are included within the scope of assessment.

The temporal boundaries of assessment scope normally run from the beginning of project construction through to the end of the planned monitoring period following final closure and reclamation.

1.2.1.3 Socio-economic Baseline

In an effects assessment, the baseline provides the necessary indicators for answering the question; what effects will the project have on the community or other interest? The baseline indicators are what anticipated changes are measured against. In YESAB's *Guide to Socio-economic Effects Assessments*, the following direction on selecting baseline indicators is given:

> The social and economic assessment indicators are derived from the VSECs and point to measurable change in human population, communities and social and economic relationships resulting from a proposed project. The delineation of socio-economic assessment indicators defines categories of social and economic change and selects the most suitable measures from which to describe current conditions and predict change. It achieves the goals of scoping by focusing on the most important categories of change and on useful and meaningful indicators.[14]

Thus, the socio-economic baseline data presented by a proponent should not be put together simply to provide a backdrop for the effects assessment or as a background primer for those not familiar with the affected communities. Rather, all of the data on the communities, and for the Yukon that make up the baseline should be selected to provide useful indicators for measuring the anticipated effects on each of the identified valued socio-economic components (VSECs) for the proposed development, operation and closure of the mine. The baseline indicators will also provide the means for longer term socio-economic effects monitoring as the project proceeds. It is also important to note that the anticipated effects of the project on the baseline indicators assist in devising effective mitigation and enhancement measures during the effects assessment itself.

However, there is not always a clear and direct indicator for each of the VSECs. Where this is the case, two approaches are possible. Either other indicators are selected that, singly or together, can provide indirect or proxy means of measurement or, no quantifiable indicator at all is provided

[14] YESAB. June 2006. *Guide to Socio-economic Effects Assessments*.p.49

where there is no value in doing so. In these cases the VSEC (it is often the case in the social sciences that the things we have no means of measuring are given insufficient weight in an assessment) is acknowledged and any indirect or anecdotal evidence for assumptions of how the project will affect it is described. Providing an indicator that has only a tenuous or tangential relationship to the VSEC at best will not assist in the assessment and may distract from what is actually valued. It is important to avoid including data simply because it is available.

1.2.1.4 Effects Assessment and Mitigation & Enhancement Measures

The effects assessment itself builds on the preliminary determination of effects as described above. The likely effects of the project on each of the VSECs (and any sub-components of those VSECs) are presented in detail. Included under each of the VSECs are the mitigation or enhancement measures planned by the proponent to maximize the social and economic benefit of the project and minimize social and economic costs. Where applicable it is important to distinguish between the three broad phases of a mining project: construction, operation, and closure/reclamation.

1.2.1.5 Significance Determination

The final step in the socio-economic effects assessment of a mining project is an analysis of the significance of the anticipated residual social and economic effects of the project once the proposed mitigation and enhancement measures have been applied. A discussion of the possible cumulative effects of the project in addition to other known activities and projects in the region should also be included.

1.2.2 Weaknesses

With the advent of the Yukon Environmental and Socio-economic Assessment Act (YESAA) in 2005 there were high hopes in the Yukon that the general lack of long term planning and monitoring of the social and economic effects of mining projects would now change. The Act, which was a requirement of Chapter 12 of the Umbrella Final Agreement to settle the modern land and treaty claims of Yukon First Nations, elevates social and economic effects onto an equal footing with environmental effects. Under YESAA, as is noted above, proponents are required to go multiple times to the affected communities and First Nations, present their plans and then record and respond to every concern raised. The mitigation and enhancement measures proposed cannot be weasel-worded (for example YESAB has not accepted efforts at wording things like "The company may attempt to..." and required it to be "The company will....").[15]

The primary weakness of the means of socio-economic effects assessment in the Yukon is the lack of any clear reporting or accountability system. When a proponent commits to ensuring water quality standards are met those commitments become conditions of the water licence and will be monitored closely by government agencies who have enforcement authority, including the ability to close the project down. But what about the effects and commitments on the social and economic side ranging from training programs to business opportunities to addiction programs for employees? The commitments are clear but to date in the Yukon none of them have been made conditions of a licence and they are therefore not monitored or enforced. The only mechanism available to ensure the socio-economic commitments are met is public opinion. The only exception (and it has not yet been tested in the Yukon) is when an affected First Nation has a socio-economic participation agreement (SEPA) with the proponent. In theory, a SEPA is a contract and can be enforced through the courts. However, all SEPA's to date in the Yukon are confidential and so how this could work is unclear. The lack of monitoring and enforcement of

[15] Personal experience with the process.

socio-economic effects, along with commitments to mitigation and enhancement measures, is the single biggest weakness of the Yukon effects assessment system.

A further weakness in the system are the data gaps that can lead to the downplaying of issues that are very important to communities and First Nations that will feel most of the effects of mining development. It is a truism that we value what we measure and, by implication, what is not measured is not valued. But considerable first-hand experience in the communities shows that the issues people raise and what they clearly value in relation to a proposed mining project often do have indicators that are available to the proponent. Examples include: reducing alcohol and drug abuse, family stress, reducing discrimination and racism, and encouraging volunteerism.

1.3 Framework for Evaluation of Socio-Economic Effects

We are suggesting that the best framework for the evaluation of Yukon-wide socio-economic effects is to follow the Yukon mining sector performance measures as outlined in Component 3 of this sector profile. If the intent is to determine the overall socio-economic effect of the industry on the Yukon there is no need to produce an analysis separate from the performance measures approach.

One lesson from the review of approaches used elsewhere to calculate economic impacts is that it is critical to provide details on the methodology used and to properly reference data sources. The following example is one not to be followed:

> "Using information available from public reports from the Ontario Mining Association, various federal and provincial government departments and special calculations performed by Statistics Canada in its Input-Output Division, it is possible to obtain reliable calculations of the direct, indirect, and induced impacts of a representative mine in Ontario. To maintain reliability, cautious assumptions have been used where necessary in determining elements such as tax take at the various levels, or production and re-spending by consumers. In all cases, an attempt has been made to make the estimates presented in this report as reliable and conservative as possible."[16]

This does not give the reader enough information to determine the validity of the analysis.

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Yukon Mining Sector Profile: Supporting Material

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Yukon Mining Sector Profile

Summary Report

Mining Sector Profile: Summary Report

This profile is the outcome of the *Mining Sector Profile: Development of supporting material* RFP released by Yukon Economic Development. The RFP contains a broad range of project components, all with a strong economic focus, designed to provide a foundation of informative and current supporting material for Yukon government departments and others interested in the impacts, and especially the economic impacts of mineral development in Yukon.

This project is intended to lay a foundation of supporting material for Yukon government departments and others interested in the impacts, and especially economic impacts, of mining development. Some of its components are designed to provide a specific foundation for future projects, e.g., the requirements for economic impact analysis. The very strong emphasis throughout the RFP is on the economy, economic indicators, and economic impacts. While maintaining the focus on the economy, we have attempted to also consistently acknowledge the broader context in which the mining sector operates. Our society, and the mining industry with it, has been increasingly concerned with ensuring that mining projects do less damage to the environment, provide greater economic benefit to local communities and indigenous people, cause less social disruption, and generally meet more of the criteria of economic, social, and environmental sustainability.

Historically in the Yukon, as in many other jurisdictions, local communities and indigenous people often bear a disproportionate share of negative social and environmental impacts of mining projects while not always reaping available positive economic benefits. Throughout this project therefore, we worked to ensure that the research and analysis did not overlook the rural Yukon and Yukon First Nations. Further, although placer mining is not mentioned in the RFP, it is still of importance in the Yukon and that part of the industry is included here.

We have also attempted to give explicit thought and analysis to the full life cycle of mining in this project. Operating mines are just a sliver of that cycle. In summary, we have attempted to blend a rigorous approach to the economic issues with a consistent and explicit acknowledgement of the broader context and issues arising from the development of the Yukon's mining sector.

Looking Forward: Global Trends & Yukon Context

Component 1 of the Yukon Mining Sector Profile examines the global trends affecting the Yukon's mining sector and much of Component 2 is dedicated to the history of the mining industry in the Yukon. However, in this summary report we are choosing to focus on what those trends and history can tell us as we look forward.

The health of the Yukon's mining sector fundamentally relies on the demand for minerals and therefore their prices. The demand for most minerals is strongly linked to economic growth and prices are set in world markets. However, the ability of mining companies to successfully find, build and operate a mine is also dependent on their ability to find financing, control costs and the ability to adapt to societal expectations.

An analysis of the key opportunities and risks associated with currently operating Yukon mines and potential mines along with the placer and exploration sectors and current abandoned mines is laid out below. When discussing opportunities and risks — even when not offering specific forecasts or future scenarios — it is important to be explicit about the critical assumptions that underpin the discussion. We offer the following.

Mineral Prices

We assume that the prices of key minerals will generally reflect the World Bank forecasts outlined in the Global Trends and Canadian Overview component. Specifically:

- Gold will decline in price from US$1,600 to US$1,300 per ounce between 2013 and 2025;
- Silver will decline from US$31.00 to US$25.00 per ounce between 2013 and 2025;
- Copper will decline from US$3.54 per pound in 2013 to US$3.09 per pound in 2025;
- Lead and zinc rise in price between 2013 and 2025, lead from US$0.95 to US$1.04 and zinc from US$0.95 to US$1.13; and,
- Although the World Bank offers no forecast, the price of tungsten seems likely to decline to its 2006/2007 price of US$250 per MTU.

Financing & Costs

The substantial financing difficulties now faced by the mining industry — and particularly by development stage companies who have what appears to be a viable mine but not the capital to finance its development — add a substantial level of risk to plans to open new mines in Yukon. Equity financing has largely dried up for many junior mining companies and for most development stage companies. Even debt financing deals for mid-tier producers to expand operations or build new projects carry interest rates in the 9-10% range. There is no indication that this will change in the short to medium term.

Cost escalation is an ongoing risk faced by both operating mines and the construction of new projects. The costs of fuel and labour loom the largest. For the purposes of the discussion on opportunities and risks, we are assuming that the recent general downturn in the industry will mean that severe cost escalation will no longer be the norm. However, even a lower level of cost escalation will still pose risks for the Yukon's mining sector.

The ability to attract and retain employees for Yukon's mining sector is a key consideration for Yukon, and with an aging mining labour force across the country, this may become a bigger problem going forward. Ramifications could include higher labour costs, delays in project development or issues securing and maintaining the operational workforce.

Political, Regulatory and Legal Issues

Although Yukon's overall regulatory regime is a relatively clear and known quantity, projects still face regulatory and legal issues and risks. Examples include disagreements between proponents and regulators over the level of assessment required and projects being caught up in legal disputes between different levels of government.

There is also both risk and opportunity associated with changes in the governing party going forward, as parties can view the mining sector and further mining sector development differently depending on the values and platform of their party.

In the tables below we present a summary of the opportunities and risks for Yukon's mining sector over the short and medium terms.

Table 1: Exploration: Opportunities and Risks

OPPORTUNITIES	RISKS
Yukon will continue to offer attractive geological targets for mineral exploration. The recently-discovered Carlin-type geology in the Rackla Belt north-east of Keno and the White Gold finds in the western Yukon provide evidence that Yukon has not been fully explored and much potential remains.	Exploration spending in Yukon has largely (69% of expenditures in 2012) been driven by the search for gold. A declining gold price (US$1,600 to US$1,300 per ounce or 19% between 2013 and 2025) will likely result in a significant decline in exploration spending. This will be reinforced by the expected decline in the prices of copper and silver (-13% and -19% respectively).
Yukon offers minimal geo-political risks compared with many jurisdictions and has a largely stable regulatory regime.	Following the global economic downturn of 2008 the junior sector has faced an increasing challenge in raising the equity required to fund exploration despite high mineral prices. Until investors regain their appetite for risk junior companies, which drive the bulk of exploration in Yukon, these companies will lack the money to explore.
The rise in the prices of lead and zinc that is expected by the World Bank (+9% and +19% respectively) will likely drive more exploration focussed on these metals. Lead and zinc were the targets of 11% of Yukon exploration expenditures in 2012.	The exploration sector is now facing some legal uncertainty around claim staking as the Kaska First Nations and Yukon government fight a legal battle over the requirement to consult prior to claims being staked.
	Exploration in the Peel region also faces ongoing uncertainty as a protracted public conflict over the Peel land use plan continues.

Table 2: Placer Mining: Opportunities and Risks

OPPORTUNITIES	RISKS
Placer mining has a long history in Yukon, uses well-known approaches and technology and has relatively low costs and barriers to entry compared with other forms of mining. These features work to ensure that placer mining will continue to be significant part of the mining sector.	Placer production has been in steady overall decline since its modern day peak in 1989 despite the six-fold rise in price between 2000 and 2012. It appears that placer gold is simply getting more difficult to find as reserves decline in the traditional placer mining areas. Unless new geological theories emerge, enabling the industry to find new sources of placer gold in other areas, production is unlikely to increase significantly.
The regulatory regime for placer mining is well established and well understood.	The expected 19% decline in the price of gold over the next 12 years will act to reduce the level of effort in the placer industry.

Table 3: Hardrock Mining: Opportunities and Risks

OPPORTUNITIES	RISKS
Mineral Prices	
The rise in the prices of lead and zinc that is expected by the World Bank (+9% and +19% respectively) from 2013 through 2025, will improve financial returns of existing mines and make new lead-zinc mines more likely.	A declining gold price (US$1,600 to US$1,300 per ounce or 19% between 2013 and 2025 forecast by the World Bank) will increase price risks for operating gold mines and make the opening of new projects less likely.
	The World Bank forecast 13% decline in copper price from US$3.54 per pound in 2013 to US$3.09 per pound in 2025 will increase price risks for operating copper mines and make the opening of new projects less likely.
	The World Bank forecasts that silver will decline from US$31.00 to US$25.00 per ounce between 2013 and 2025, increasing the price risks for operating silver mines and make the opening of new projects less likely.
	The price of tungsten is largely dependent on decisions made by the Chinese government as China is both the largest producer and largest consumer of the metal. The price of the metal has been highly volatile in the recent past.
Financing & Costs	
China and particularly Chinese state-owned enterprises continues to be potential source of financing for the Yukon's mining sector.	Equity financing has largely dried up for many junior mining companies and for most development stage companies.
The recent general downturn in the industry will mean that severe cost escalation will likely no longer be the norm.	Debt financing has also become much more challenging. Even debt financing deals for mid-tier producers to expand operations or build new projects carry interest rates in the 9-10% range. The larger the capital cost the greater the risk that financing will simply not be available.
	Cost escalation is an ongoing risk faced by both operating mines and the construction of new projects. The costs of fuel and labour loom the largest.
Infrastructure	
Mineral projects located close to the Yukon's power grid have the opportunity to reduce their power cost risks by connecting to the grid.	Projects requiring the construction or substantial upgrade of roads and bridges face greater risks.
Technical	
Open pit mines generally face lower cost risks than underground operations.	Project-specific geo-chemistry and other issues can increase risks due to higher costs or lower recovery rates.

Mining Sector Performance Measurements & Requirements for Economic Impact Analysis

In Component 3 of the Yukon Mining Sector Profile we were tasked with helping to identify Yukon-relevant mining sector performance measurements and their related data sets based on Natural Resources Canada's *Mining Sector Performance Report 1998 to 2008.* The objective of the report was "…to provide an evidence-based analysis of the Canadian mining sector's economic, environmental and social performance over the past decade." The report was built around a number of indicators grouped under economic performance, environmental performance and social performance.

In Component 6 of the Yukon Mining Sector Profile we were tasked with developing a framework for evaluating the likely economic impacts of mining projects in the Yukon, including the likely impacts on local communities and First Nations.

From our research and analysis we are suggesting that both objectives can be met through structuring a Yukon-wide analysis of the socio-economic impacts of the mining industry based on the upcoming 2013 updating of Natural Resources Canada's *Mining Sector Performance Report* using its revised indicators with some additions to make it more relevant to the Yukon.

Analysis of Mining Supply Chain

A supply chain is simply the necessary flow of products and services to the end user. In the mining context this is often thought of as suppliers to an operating mine but the industry wide supply chain is much more complex; ranging from contractors providing staking services to exploration companies to wholesale fuel distributors bringing in the fuel for actual operations. Along the way is a complex web of consultants, service providers, wholesalers and retailers.

The original intent of Component 4 of the Yukon Mining Sector Profile was to conduct a scan of the existing supply chain in Yukon, including rural community businesses, Yukon First Nation owned businesses and joint ventures and to identify gaps and opportunities that may exist across the full mining life cycle. However, because of the difficulties faced in a previous effort to effectively survey the industry to measure the extent and nature of the supply chain, we took a different approach, using input-output (I-O) data published by Statistics Canada. I-O data provides the amount of each commodity purchased by the mining industry.

In the Yukon the most purchased service is professional services, not surprising given the amount of exploration work done. The second most important purchase is refined petroleum products, followed by advertising and travel, and what are know as "fictive commodities". These so-called "fictive commodities" are not really fictional; it is just that they cannot be ascribed to a specific industry although they are a category in firms' income tax returns.

To date, the examination of the mining industry' supply chain has been faced with lack of information. However, input-output data and income tax data collected to derive that model could be used to get a better picture of the industry's inputs and where they come from. Special runs on the model could be requested. These special runs could include more detail on purchase and the source of those purchases. This analysis could then be tested through a survey of selected firms in the industry.

To support Yukon firms that wish to enter into the supply chain, or improve their position within it, Yukon government may consider providing a guide modeled on the Saskatchewan *Potash Mining Supply Chain Requirement Guide*. The guide would present the order-of-magnitude costs

associated with the main expenditures over the lifecycle of a typical mine from exploration through closure and reclamation. The steps required to go through each of the five stages would be presented and a cost estimate for each step included. Some of the cost estimates (getting the required permits and approvals for example) could be based on the experience of recent projects in Yukon. Other cost estimates that are less dependent on project specifics could be of a more generic nature with major differences between mines (open pit versus underground for example) presented. The stages should be broken down in detail with goods and services in the lifecycle supply chain grouped into categories. Specialty suppliers would be referenced separately.

Labour Market Discussion

In Component 5 of the Yukon Mining Sector Profile the major goal was to identify employment opportunities by occupation using the available forecasts.

The only detailed Yukon employment by occupation data for the mining industry comes from the 2006 Census. However, that census data is for residents of the Yukon, not employees of the mining industry who work in the Yukon. Note that the Census does not distinguish between the different phases of the mining cycle from exploration through closure and reclamation. It uses the North American Industry Classification System (NAICS) which only considers mining and support activities for mining and oil and gas as industries. Also, a significant part of mine construction is normally done by the construction industry rather than the mining industry.

Three occupational forecasts have been done for the Yukon: the Yukon Occupational Modeling system (YOMS), the Yukon Work Futures and a recent forecast done by Derome & Associates and the Mining Industry Human Resource Council (MIHR 2012). Only the last has been published, the other two were obtained from unpublished data from Luigi Zanasi Economist and the Yukon Department of Economic Development. In addition, the Conference Board of Canada also published gross employment forecasts for the mining industry.

There are serious discrepancies in the estimates of mining employment in the Yukon. For 2012, they range from 500-900 from the labour force survey to 2,675 (of whom 1,200 are Yukon residents) in the MIHRC work. The YOMS model presents an employment level of 900 for 2012.

Forecasts of employment vary equally, ranging from 1400-1500 jobs by 2020 for the YOMS forecast, a peak employment of 2,400 mentioned by the Conference Board, and a baseline forecast of 3,525 workers by the MIHRC.

It is difficult to decide between the different forecasts. Other than the YOMS forecast, the assumptions on which the forecasts are based and the specifics of the models used are not readily available.