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Technical Memorandum – Kudz Ze Kayah Project Socio-economic Effects

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PREPARED FOR:

Yukon Environmental and Socio-economic Assessment Board

Table of Contents

1	<i>Human Health and Safety</i>	4
1.1	Scope of work	4
1.2	Documentation reviewed.....	4
1.3	Comments on respiratory health	5
1.4	Comments on food security/contamination	6
2	<i>Housing</i>	7
2.1	Scope of work	7
2.2	Documentation reviewed.....	8
2.3	Analysis of the proponent’s predictions of effects to housing	8
2.4	Potential effects to housing availability, quality, occupancy, and affordability	9
2.5	Potential shortages in permanent, rental, interim housing, and land availability markets	10
2.6	The Indian Act and land administration in Ross River and Watson Lake	10
3	<i>Unscheduled Closure</i>	11
3.1	Scope of work	11
3.2	Documentation reviewed.....	11
3.3	Socio-economic effects of unscheduled mine closures on individuals and communities	12
3.4	Possible implementation measures to eliminate, reduce or control potential effects	13

SUMMARY

YESAB commissioned EEM to provide consulting expertise relating to the assessment of effects for the Kudz Ze Kayah Project. To this end, EEM has conducted a thorough review of selected documentation provided by YESAB relating to the following subjects:

- human health and safety
- housing; and
- unscheduled closure.

This memorandum summarizes EEM's assessment of the proponent's effects prediction for these subjects. Since the scope of work for each subject varied somewhat according to YESAB's specific requirements, EEM has divided the memorandum into three parts. For each part, EEM defines the scope of work, the documentation reviewed, and summarizes its finding and recommendations relating to the subject matter.

1 HUMAN HEALTH AND SAFETY

1.1 SCOPE OF WORK

EEM was provided with the following scope of work for Human Health and Safety:

Respiratory Health (Air Quality)

- Validating, qualifying or countering the proponent's effects prediction.
- Description of potential effects to Respiratory Health, both for off-duty workers and individuals (land users) in the project vicinity, including a description of exposure levels associated with potential health effects.
- Identify possible measures that should be implemented to eliminate, reduce or control critical potential effects.

Food Security/Contamination

- Validating, qualifying or countering the proponent's effects prediction.
- Description of potential effects to human health as it relates to contamination of country food and water sources, by direct and indirect pathways, including a description of exposure levels associated with potential health effects.
- Identify possible measures that should be implemented to eliminate, reduce or control critical potential effects.

1.2 DOCUMENTATION REVIEWED

The original documentation submitted to YESAB did not include a Human Health Risk Assessment. In response to comments provided by Health Canada, a Preliminary Quantitative Risk Assessment was carried out. The assessment was essentially qualitative in nature with a few calculations related to soil and water exposure.

To fulfill its mandate associated with the scope of work for Human Health and Safety, EEM reviewed the following documentation:

- Air Quality Assessment Section 6 of Project Proposal for Kudz Ze Kayah Project – March 2017
- Appendix R2-N Revised Preliminary Quantitative Risk Assessment – November 2017
- Response to YESAB Executive Committee Adequacy Review of Kudz Ze Kayah Project Proposal – July 2017
- Health Canada Review of Response to YESAB Executive Committee Adequacy Review of Kudz Ze Kayah Project – July 2017
- Health Canada Review of Preliminary Quantitative Risk Assessment – December 2017
- Health Canada Review of Kudz Ze Kayah Project – March 2018
- Health Canada Review of the Environmental Impact Statement for the Kudz Ze Kayah Project – April 2018
- Health Canada Review of Response to Human Health Information Requests for the Kudz Ze Kayah Project – July 2018

The time allocated for the review did not allow for the verification of any of the calculations in the reports or a detailed review of other sections of the submission, which included methodology for the modelling of Air Quality and Surface Water Quality to verify the air concentrations and water quality concentrations discussed in the Preliminary Quantitative Risk Assessment Appendix (PQRA). Therefore the review has assumed that:

- The dust, and gaseous pollutant (CO, NO₂, SO₂) concentrations used in the HHRA are appropriate; and
- The surface water concentrations used in the HHRA are appropriate.

1.3 COMMENTS ON RESPIRATORY HEALTH

The comments provided in this Section are based on a review of the Air Quality Assessment, IR4 Response and information discussed in the PQRA.

1. In qualitative discussion of health effects for gaseous pollutants a comparison of the predicted concentrations to the Yukon Ambient Air Quality Objectives were used. It is noted that a number of the AAQOs are not health-based. For example, the AAQOs for NO₂ are not health based. The World Health Organization (2005) have a short-term guideline (1-hr) of 200 µg/m³ based on bronchial responsiveness in asthmatics. They also have an annual guideline of 40 µg/m³ based on respiratory symptoms. In addition, the new federal air quality guidelines for NO₂ that are due to take effect in 2020 are based on health effects and are in line with the WHO (2005) guidelines. Revised air quality modelling data at 2 km from the mine infrastructure and 500 m from the Tote Road indicate that the 1-hr predicted NO₂ concentrations at these two locations are above the new federal quality guidelines for all phases of the Project. Figure 6-7 of the Air Quality Section also indicates that concentrations at the camp and off-site areas will have predicted 1-hr concentrations in the 100 µg/m³ to 150 µg/m³.

Since health-based values were not used to evaluate the potential for respiratory effects in the PQRA, the potential health effects from exposure to NO₂ have not been adequately addressed at off-site locations. As the predicted concentrations exceed health-based values, this could result in potential respiratory effects in people who have asthma or other respiratory diseases who may be present in off-site areas.

The proponent has provided a list of mitigation measures to reduce concentrations such as avoiding engine idling, ensuring vehicles are maintained properly, use of pollution control devices at processing facilities, etc. These are all appropriate mitigation measures which the proponent should include in an adaptive management plan based on an air monitoring program to reduce the potential for off-site impacts. Monitoring locations should be based on the location of project activities, the wind direction, and the location of topographic features that could affect the dispersion of emissions. The proponent should consider continuous monitoring for NO₂ during all phases of the project including construction, operation and decommissioning to ensure that the potential risks to short-term NO₂ exposure are minimized. The results of the monitoring program should be compared to the new federal air quality guidelines for NO₂, which is 114 µg/m³ on a 1-hr basis. An exceedance of this level for more than 2 hours in a day should result in implementation of the mitigation measures, work process modifications, and possibly a temporary work stoppage until the concentrations drop below the guideline. The proponent may want to consider using low NO₂ emission equipment at the site as an additional mitigation measure.

2. Similarly, health-based guidelines have not been used for SO₂. The U.S. EPA (2008) has developed a 1-hour Ambient Air Quality Standard of 196 µg/m³ based on respiratory symptoms, decreases in lung function, and airway inflammation. Several studies by Wong et al. (2002), Pope et al. (2002) and Burnett et al. (2004) indicate that there is no threshold for health effects for 24-hour exposure to SO₂ concentrations in the range of 5 to 40 µg/m³. The WHO has therefore set the 24-hour guideline at 20 µg/m³. These values are lower than the values used in the HHRA. A review of the predicted concentrations of SO₂ associated with the Kudz Ze Kayah project found that the concentrations are below these health-based values.

Health-based values should have been used to evaluate the potential for respiratory health effects from SO₂; however, the predicted SO₂ concentrations are low.

Therefore, there is little potential for adverse respiratory effects from exposure to SO₂ and no mitigation is necessary.

3. For fine particulate matter (PM_{2.5}), there are epidemiological studies to suggest that there are respiratory mortality risks associated with exposure to PM_{2.5}. The California Environmental Protection Agency Air Resources Board (CARB 2008) suggested that there is a 24-hour threshold level of PM_{2.5} exposure in the range of 5 to 7 µg/m³. Figure 6.4 of the Air Quality report indicates that concentrations of PM_{2.5} in the order of 10 to 20 µg/m³ will be found at the camp and off-site areas. It is also noted that the U.S. EPA and the Canadian government do not have health-based values for PM₁₀ due to a lack of evidence linking long-term exposure to health effects.

Health-based values were not used to evaluate the potential for respiratory health effects from PM_{2.5}, which results in uncertainty. As discussed above, the predicted 24-hour PM_{2.5} concentrations suggest that the some of the potential impacts occur off-site. Given the fact that the health effects literature indicates that PM_{2.5} causes asthma, respiratory inflammation, jeopardizes lung functions, and even promotes cancers, the potential for adverse effects from PM_{2.5} exposure needs to be mitigated. In the Air Quality assessment (Section 6), the proponent indicates that mitigation measures such as covering of the ore stockpile, progressive reclamation of disturbed areas, watering of road and exposed surfaces, minimizing of land clearing activities, and low speed limits for mobile equipment will be used to reduce dust exposure. These are all appropriate mitigation measures that should be implemented within an adaptive management plan. The adaptive management plan should be based on a continuous monitoring program for PM_{2.5} during all phases of the project, including construction, operation, and decommissioning to ensure that the potential risks off-site associated with PM_{2.5} exposure are minimized. The results of the monitoring program should be compared to the health-based value of 5 µg/m³. An exceedance of this level on a 24-hr basis should result in implementation of the mitigation measures discussed above to reduce dust levels.

4. Volatile Organic Compound (VOC) and Polycyclic Aromatic Hydrocarbon (PAH) concentrations as a result of diesel operations and other activities were not predicted for the Project. This is a gap in the assessment of respiratory effects associated with Air Quality.

The mitigation measures discussed for reduction in NO₂ concentrations should be adequate to address this deficiency.

1.4 COMMENTS ON FOOD SECURITY/CONTAMINATION

The comments provided in this Section are based on a review of the PQRA. It is assumed that the predicted concentrations in soil arising from dust are appropriate. This evaluation looked at the baseline and post-closure exposures from dust deposition on soil, surface water, and berries for a one-week camping scenario. The PQRA assumed that the soil and berry concentrations would not be changed from baseline in the post-closure scenario and the only change that would occur was in the surface water.

1. In Section 3.3.2 of the PQRA report it was stated that a one week per year exposure scenario was assumed. No justification is provided for the assumption. Given that the project is within two traplines and is within an outfitting concession, this exposure scenario may underestimate the potential risks to people using the site in the post-closure scenario. In Table 4 of the PQRA, the proponent has shown that there are potential risks from arsenic and lead, and these risks may be underestimated.

In order to mitigate this inadequacy, the proponent should implement risk management measures such as soil cover on disturbed areas to eliminate the soil pathway.

2. In Section 3.3.2 of the PQRA, soil ingestion rates from Health Canada were used; however, the camping scenario being evaluated is not the typical residential scenario used by Health Canada. The scenario being evaluated is a traditional land-use and camp setting, in which people would spend the majority of their days outdoors, including preparing food and eating their meals, and perhaps sleeping in a floor-less tent or shelter. Significantly greater opportunity and likelihood exists for transferring soil and dust to hands and food in this context. The proponent has shown that there are potential risks associated with arsenic exposure from soil ingestion by a toddler, and therefore these risks may have been underestimated. The proponent indicates that risks are low. The proponent has also indicated that mitigation measures such as soil cover would be needed in the operating areas of the site in the post closure scenario.

As indicated above, the proponent has indicated that mitigation measures such as soil cover would be needed in the operating areas of the site in the post closure scenario. This is an appropriate mitigation measure as it will eliminate the soil pathway. They also indicate that soil monitoring will be undertaken. The soil monitoring should take place in areas where people may be present to determine whether the concentrations have increased over baseline. If there is more than a 15 - 20% increase over baseline, then a risk assessment should be carried out using soil ingestion rates that are typical of a camping scenario to determine if there are potential risks that may require additional mitigation. Soil monitoring will provide further reassurance that individuals using the area in the future will not experience significant adverse effects.

3. The PQRA report did not evaluate the consumption of fish or wild game in the camping scenario. It was indicated that the intake from fish was “considered to be low and unlikely to contribute to substantial amounts of intake.” Similarly, for wild game it was indicated that soil and vegetation concentrations were not expected to change and therefore “changes in tissue concentrations are expected to be small.” This represents an uncertainty in the PQRA.

There is uncertainty in these qualitative statements, and in order to provide reassurance that the activities of the project will not affect fish and wild game a round of monitoring post-closure should be considered by the proponent to ensure that the concentrations in these food items are not increasing from project activities. If concentrations are unchanged, then the results of the PQRA will be validated, no risks exist, and no additional monitoring would be necessary. If concentrations are increasing, it may be prudent to conduct a risk assessment to determine whether there are risks associated with consumption of fish and wild game. Currently there is a fish monitoring program for small resident fish (sculpin). These fish are not consumed by humans but could be used as a surrogate for the concentrations in larger fish that are consumed by humans.

2 HOUSING

2.1 SCOPE OF WORK

EEM was provided with the following scope of work for Housing:

- Validating, qualifying or countering the proponent’s effects predictions to housing in the various project affected communities in Yukon.
- Identify and describe potential effects to Yukon communities’ housing availability, quality, occupancy, affordability.
- Examine and discuss the potential for shortages in the permanent, semi-permanent (rental), interim-housing (hotels/motels/bnb), and land availability (lots) markets.
- In considering the above, discuss any implications of the Indian Act in relation to land administration in Ross River and Watson Lake.

2.2 DOCUMENTATION REVIEWED

To fulfill its mandate associated with the scope of work for Housing, EEM reviewed the following documentation:

- Project Proposal – Chapter 4 – Project Description
- Project Proposal – Chapter 15 – Socio-Economic Effects Assessment
- Project Proposal – Chapter 18 – Conceptual Management Plans
- Project Proposal – Appendix G-1 – Socio-Economic Baseline Report
- BMR IR Response #1 – July 2017
 - Chapters 15 and 17
- BMR IR Response #2 – November 2017
 - Chapters 15 and 17
- BMR IR Response #3 – June 2018
 - Chapters 15 and 17
- BMR IR Response #4 – November 2017
 - Chapters 15 and 17
- Yukon Government’s comments on the Project Proposal and associated Information Request Responses
- Liard First Nation’s comments on the Project Proposal and associated Information Request Responses

2.3 ANALYSIS OF THE PROPONENT’S PREDICTIONS OF EFFECTS TO HOUSING

The proponent’s proposal and responses to YESAB information requests indicate that project-induced effects to housing will vary by community. In the Local Study Area, the proponent predicts a net benefit to the communities of Watson Lake and Faro. No effects on housing are predicted in Ross River, where there is an acute housing shortage and the community’s chief indicated in 2017 that homelessness was becoming an issue (CBC, 2017).¹

The proponent acknowledges that Whitehorse is the most likely place to relocate for workers moving to Yukon with families, but its predictions of negligible project-related effects to housing in Whitehorse appear to underestimate the potential severity of shortages that may be induced in rental housing markets by project influx. Even when considered in isolation, the project may result in significant adverse effects on availability of rental housing. However, these project-related effects are likely to occur in parallel with population growth due to other drivers and industries. Other mining projects may come on-line during the same period. It is not safe to assume that “the planets will align” (BMR IR Response #3, p. 324) with respect to the availability of specialized labor in Yukon during the construction of multiple mining projects.

The proponent notes that it believes that it can hire up to 70-80% of its construction labor force in Yukon (BMR IR Response #3, p. 63), which would reduce the effects of project-induced migration. This seems extremely optimistic. While there is a high degree of uncertainty about how many employees and their families will migrate to Yukon due to project-related work, the mitigation measures that the proponent has proposed do not appear sufficient at this time to reduce the likely severity of the project’s effects to rental housing availability and affordability in Whitehorse during the construction phase of the project.

¹ CBC News, December 12, 2017. Accessed at: <https://www.cbc.ca/news/canada/north/ross-river-housing-duplex-project-ayo-smart-homes-1.4443896>

2.4 POTENTIAL EFFECTS TO HOUSING AVAILABILITY, QUALITY, OCCUPANCY, AND AFFORDABILITY

Availability

The project is likely to have a moderate adverse effect on the availability of rental housing in Whitehorse in the short (1-2 years) and medium term (3-5 years) during the construction and initial operational phases of the project. The effects of the project on rental housing are likely to be most severe during the construction phase of the project. There is likely to be a moderate adverse effect on permanent housing in Whitehorse during the operational phase.

In Watson Lake, the proponent notes that there is likely to be a net positive effect on the rental housing market from the project and through project-induced indirect employment associated with the logistical hub of the trucking company that it plans to contract to ship concentrate. Similarly, in Faro the company has provided a proposal to the town for the purchase of 16 housing units for relocation of staff, and it anticipates that the project will have a net positive effect on the housing market. No effects are predicted for Ross River, where a acute housing shortage currently exists.

Quality

The quality of housing stock varies by community. In Faro, the proponent has proposed to renovate 16 units for relocation of staff, so there will likely be a net positive effect on the quality of housing stock. In Watson Lake and Whitehorse, higher demand during the construction phase of the project may incentivize investments in improvements and repairs to existing rental units. Permanent population influx associated with the operational phase of the project may result in improvements to existing permanent housing stock in both Watson Lake and Whitehorse.

Occupancy

Occupancy rates, which are already high in Whitehorse, are likely to increase as a result of the project. While this assessment considers the project in isolation, the cumulative effects of multiple mining projects coming on-line during the same time period, coupled with population growth due to other drivers, may lead to potential shortages in the permanent and rental markets, as noted in section 2.5 of the memorandum below.

The *October 2018 Rent Survey* produced by the Yukon Bureau of Statistics indicates that there is a vacancy rate of 18.4% in Watson Lake; while high, this only represents 15 vacant rental units out of a total of 82 units.² Project-induced demand will likely increase occupation rates in Watson Lake to near full capacity. In Faro the community has indicated that an influx of project-related housing demand would be beneficial to the town. There appears to be ample housing in Faro at the current time.

Affordability

The construction phase of the project is likely to put significant pressure on rental housing prices Whitehorse. Increased demand and lack of available rental housing supply will act as drivers of higher rental costs. During the operational phase of the project there will likely be higher demand for permanent housing Whitehorse as well. An increase in rental housing costs is likely to put financial pressure on existing renters and will likely lead to increased demand for Yukon Housing Corporation rental housing allowances and YHC social housing units in Whitehorse. Additional crowding in existing rentals and an increase in homelessness in Whitehorse are also possible.

² Yukon Bureau of Statistics, 2018. Accessed at http://www.eco.gov.yk.ca/stats/pdf/rent_Oct18_R.pdf

2.5 POTENTIAL SHORTAGES IN PERMANENT, RENTAL, INTERIM HOUSING, AND LAND AVAILABILITY MARKETS

Given the estimated size of the mine workforce, the predicted 10-year life of mine, existing rental capacity in Watson Lake, and the proponent's plan to relocate some of its new employees in Faro, the project is not likely to cause significant adverse effects to housing markets.

Nonetheless, in the absence of additional mitigation measures to reduce project-induced effects to housing markets, a shortage of rental housing may occur in Whitehorse during the construction phase of the project. This shortage of rental housing may extend into the operational phase of the project and is likely to be accompanied at that time by additional pressure on the permanent housing market. The extent to which a shortage of permanent housing may take place during the mine's operational phase will depend on a number of variables, notably the number of new residential construction starts in Whitehorse during the mine's construction phase and the effects of other mining projects on housing markets during the same period.

The interim housing market (hotels, motels, bed and breakfasts, etc.) is unlikely to experience significant project-induced effects. While logistical bottlenecks may present occasional challenges (i.e. flights grounded due to bad weather during the spring and fall could result in temporary spikes in demand for hotel accommodation of fly-in, fly-out workers in Whitehorse), such events would be infrequent and would not have significant effects.

In Whitehorse, the availability of land for residential development is likely to increase following the amendment of Yukon's Land Titles Act, which allows the territory's First Nations to list settlement lands for lease on the territory's land registry.

2.6 THE INDIAN ACT AND LAND ADMINISTRATION IN ROSS RIVER AND WATSON LAKE

With the dissolution of Indigenous and Northern Affairs Canada (INAC) in 2017, there are now two federal departments with differentiated responsibilities for the management of indigenous affairs in Canada. Indigenous Services Canada (ISC) has responsibility for the Crown's programs and social services in indigenous communities, while Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) is responsible for the administration of Crown policy, the negotiation of agreements and treaties, and the management of the Crown's relationship with Aboriginal peoples.

The *Indian Act* gives the Crown authority to make certain land management decisions regarding leases, licenses, and permits on reserve lands, as well as additions of lands to reserves. With respect to land administration and housing specifically, Indigenous Services Canada has a mandate to provide funding for safe and affordable on-reserve housing. First Nations communities can then use the funds provided by ISC for construction, improvements, and management of their own housing stock.

Liard First Nation and the Ross River Dena Council are both affected by funding that they receive from ISC. Ross River faces a critical housing shortage, and at least half of its houses are contaminated with toxic levels of mould, radon, petroleum, and sewage (CBC, 2016).³ In 2017 a builder hired to build three new duplexes in the community with money

³ CBC News, October 28, 2016. Accessed at: <https://www.cbc.ca/news/canada/north/ross-river-housing-contamination-crisis-1.3826828>

provided by the federal government skipped town without finishing the work it was contracted to do (CBC, 2017).⁴ The housing shortage in Ross River remains acute.

Separately, Liard First Nation's Housing Department provides rental housing on six small lots in the Watson Lake area, including Upper Liard, Albert Creek, Moon Lake, and 2.5 Mile.⁵ LFN has a two-year funding agreement with the federal government through ISC and significant repairs are underway to its existing housing stock.⁶

3 UNSCHEDULED CLOSURE

3.1 SCOPE OF WORK

EEM was provided with the following scope of work for Unscheduled Closure:

- Using examples from northern Canadian communities, preferably the Yukon, identify and characterize the socio-economic effects of unscheduled mine closures on both individuals and the communities. The focus should be on matters such as:
 - direct and indirect effects to the individual and community resilience,
 - loss of procurement business
 - service and economy fluctuations
- Identify possible measures that should be implemented to eliminate, reduce or control potential effects.

3.2 DOCUMENTATION REVIEWED

To fulfill its mandate associated with the scope of work for Unscheduled Closure, EEM reviewed the following documentation:

- Project Proposal – Chapter 4 – Project Description
- Project Proposal – Chapter 15 – Socio-Economic Effects Assessment
- Project Proposal – Chapter 18 – Conceptual Management Plans
- Project Proposal – Appendix F-3 – Kaska Ethnographic Overview of the KZK Project
- Project Proposal – Appendix G-1 – Socio-Economic Baseline Report
- Project Proposal – Appendix H-1 – Conceptual Reclamation and Closure Plan
- BMR IR Response #1 – July 2017
 - Chapters 15 and 17
- BMR IR Response #2 – November 2017
 - Chapters 15 and 17
- Yukon Government's comments on the Project Proposal and associated Information Request Responses
- Liard First Nation's comments on the Project Proposal and associated Information Request Responses

⁴ CBC News, December 12, 2017. Accessed at: <https://www.cbc.ca/news/canada/north/ross-river-housing-duplex-project-ayo-smart-homes-1.4443896>

⁵ Liard First Nation Programs and Services. Accessed at: <https://www.liardfirstnation.ca/department/housing-gu%CC%84ko%CC%A8%CC%84%CC%81a%CC%84-gu%CC%84tie-gu%CC%84%CC%81le%CC%84%CC%81i%CC%84-dege-ke%CC%84%CC%81ngi%CC%84%CC%81hde%CC%81l-they-are-working-so-our-homes>

⁶ CBC News, March 14, 2018. Accessed at: <https://www.cbc.ca/news/canada/north/liard-first-nation-out-of-third-party-management-1.4574995>

3.3 SOCIO-ECONOMIC EFFECTS OF UNSCHEDULED MINE CLOSURES ON INDIVIDUALS AND COMMUNITIES

Given the recent history of Yukon Zinc Corporation’s Wolverine Mine, which closed prematurely due to a drop in the price of zinc on international commodity markets, the effects of unscheduled closure are particularly relevant to the the Kudz Ze Kayah project effects assessment. As a zinc project located close to the Wolverine Mine, Kudz Ze Kayah is likely to employ approximately 300 people annually during operations, during which time it is hoping to hire 70-80% of its workforce (210-240 people) from local communities (Response #3 to YESAB IR, p. 63). This is an aggressive hiring goal; however, if this goal is met the local economic impact of employment and procurement from Kudz Ze Kayah would be greater than the economic impact of the Wolverine Mine, which during its 3-year operational life from 2012-2014 hired an average of 138 Yukoners per year.

Socio-economic data relating to local employment and procurement at the Wolverine Mine has been well documented as part of a requirement by the Government of Yukon during the 2006 Environmental Assessment screening for the project. **Table 1** displays the aggregated local employment and procurement data for the Wolverine Mine.

Wolverine Mine							
Year	Employment		Value of goods and services procured from and payments made to				
	Yukoners	Non-Yukoners	Ross River	Watson Lake	Rest of Yukon	Kaska Joint Venture Businesses	Total
2007	39	5	\$ 151,587	\$ 67,385	\$ 3,325,108	N/A	\$ 3,544,080
2008	75	37	\$ 1,304,510	\$ 84,171	\$ 3,371,769	N/A	\$ 4,760,450
2009	272	401	\$ 354,318	\$ 529,601	\$ 13,118,972	N/A	\$ 14,002,891
2010	240	460	\$ 65,000	\$ 157,400	\$ 16,150,700	\$ 3,350,000	\$ 19,723,100
2011	116	303	\$ 85,200	\$ 341,600	\$ 20,690,000	\$ 1,310,000	\$ 22,426,800
2012	162	432	\$ 143,000	\$ 565,000	\$ 31,543,000	\$ 1,700,000	\$ 33,951,000
2013	145	366	\$ 264,000	\$ 1,240,000	\$ 31,700,000	\$ 1,100,000	\$ 34,304,000
2014	108	258	\$ 174,000	\$ 818,000	\$ 30,557,000	\$ 964,000	\$ 32,513,000
2015	4	5	\$ -	\$ 204,815	\$ 5,079,688	\$ -	\$ 5,284,503
2016	5	7	\$ -	\$ -	\$ 1,962,932	\$ -	\$ 1,962,932
2017	6	5	\$ -	\$ -	\$ 1,037,125	\$ -	\$ 1,037,125

Table 1: Wolverine Mine Employment and Procurement, 2007-2017⁷

The Wolverine Mine lost \$100 million per year for each of the three years that it was open before closing in 2015 and declaring bankruptcy. Even under ordinary circumstances when a closure is planned and the lifecycle of a mine is reaching its end, significant socio-economic effects are felt by individuals and communities who work for, supply, and provide services to the mine. These effects are compounded when an unscheduled closure takes place.

The proponent of the Kudz Ze Kayah project notes in its responses to YESAB that it is confident in the long-term profitability of the mine since its technical and economic assessment are conservative and have taken a range of commodity prices into account (Response #1 to YESAB IR, p. 283). However, no mining company ever opens a mine with the goal of losing money. A note of caution is due in evaluating such claims.

Direct and indirect effects to the individual and community resilience

Yukon has a long history of mining boom and bust cycles dating back to the 1896 Klondike Gold Rush, and mining plays an important role in the territory’s economy to this day. The resilience of individuals during the bust cycle depends, to a large degree, on the extent to which they are able to adapt to post-closure economic conditions. Studies (Avery et al., 1998; Robinson and Wilkinson, 1998) have documented high rates of depression and other psychological disorders following mine closure.

⁷ Wolverine Mine Annual Reports to Yukon Energy, Mines and Resources, 2007-2017. Accessed at: <http://www.emr.gov.yk.ca/mining/wolverine.html>

Typical strategies that individuals use to adapt to post-closure economic conditions include: 1.) transfer of existing skills to other employers or industries, 2.) acquisition of new skills to pursue other employment opportunities, 3.) diversification of household income sources, or 4.) relocation to a more favorable working environment.

Community resilience varies on a case by case basis. Communities that are small and lack diversified economies are particularly vulnerable to the impacts of unplanned closure. For those communities where mining is the principal industry and there is a heavy reliance on mining for jobs, the economic impacts of closure can be particularly severe. A spike in unemployment from mine closure is typically accompanied by reduced spending at local businesses and outmigration of population. These drivers have a negative multiplier effect in the community's economy, and the erosion of the community's tax base due to population loss often leads to cuts in spending on services and infrastructure.

Loss of procurement business

Local businesses that provide goods and services to a mine are among the first affected by unplanned closure. The magnitude of the impact of closure on local suppliers depends on the extent to which they are reliant on the mine for revenues. Suppliers with diversified, non-mining sources of revenue are better able to industry downturns associated with low commodity prices.

The unplanned closure of the Wolverine Mine led to the loss of 104 direct jobs in Yukon and \$1.75 million in year-over-year losses to Ross River, Watson Lake, and Kaska Joint Venture businesses. There was an additional \$25.5 million decline in the value of goods and services procured from and payments made to the rest of Yukon (Yukon Energy, Mines, and Resources, 2019).

Providers of goods and services to a mine are often left with unanticipated liabilities when an unplanned closure takes place. Capital expenditures on goods and equipment purchased to supply the mine may lead to high levels of debt. Lower revenues often lead to default on loans or closure of the business. With a reduction in cash flow for payroll, suppliers frequently have to lay employees off.

Service and economy fluctuations

Unscheduled mine closures can lead to population loss in local communities, eroding the local tax base and the amount of money spent locally by former residents on goods and services. Municipal budgets are often constrained by the decline in tax revenues, and investments in community infrastructure such as roads, schools, and waterworks may be curtailed.

The magnitude of the impact of unplanned closure for economies of local communities will vary depending on the number of people directly or indirectly employed by a mine and the amount of mine-related spending in the community. For those communities that are heavily dependent on mining the effects may be severe.

3.4 POSSIBLE IMPLEMENTATION MEASURES TO ELIMINATE, REDUCE OR CONTROL POTENTIAL EFFECTS

It is important to consider the effects of unplanned closure within the context of the full mining lifecycle. Many of the economic benefits that accompany mine development are counterbalanced by the impacts of the mine's eventual closure, whether planned or unplanned. Whether there is a net benefit to local communities will depend on how successfully a proponent is able to implement measures to maximize local employment, training, and procurement and manage the negative socio-economic aspects of mining in a manner that is acceptable to project stakeholders.

The proponent's Socio-economic Effects Management Plan does not contain any mention of closure, either planned or unplanned (Conceptual Management Plans, p. 78-82). Similarly, the proponent's Conceptual Reclamation and Closure Plan does not include any discussion of the economic impacts of closure or how to mitigate them. These omissions prompted several rounds of information requests from the YESAB Executive Committee. In its responses to these requests, the proponent provided a detailed response about steps it would take to reduce potential socio-economic effects in an orderly, planned closure scenario (Response #3 to YESAB IR, p. 57-60). However, no measures to eliminate, reduce, or control potential effects of unplanned closure have been forthcoming.

Annual socio-economic monitoring reports throughout the life of the mine should be considered from construction to post-closure as a condition of project approval. These reports should provide data relating to:

- Employment from members of Kaska First Nations, communities in the LAA, and Yukon as a whole;
- Contracts awarded for goods and services to Kaska First Nations businesses, businesses in the LAA, and Yukon as a whole;
- Training and capacity building initiatives; and
- Community investments and contributions by the project.

The reports should also describe:

- Adaptive management measures that the proponent has identified to eliminate, reduce, or control the project's socio-economic effects; and
- An annual update on the anticipated effects of mine closure.