WHITEHORSE COPPER EXISTING ENVIRONMENTAL AND SOCIO-ECONOMIC CONDITIONS, POTENTIAL EFFECTS, AND PROPOSED MITIGATIONS

PREPARED FOR:

EAGLE INDUSTRIAL MINERALS

7 FIELDING CIRCLE

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1 SITE DESCRIPTION

1.1 LOCATION

The decommissioned Whitehorse Copper mine site is located within the City of Whitehorse, approximately 10 km south of the city centre. The site is 1.5 km from the Yukon River on the west side of the river valley, and lies at the foot of an east facing slope below the tree line. The site is accessible by road via the Alaska Highway and Mt. Sima Road.

The Project is within the Traditional Territories of two Yukon First Nations, the Kwanlin Dün First Nation (KDFN) and the Ta'an Kwäch'än Council (TKC). Both the KDFN and the TKC have negotiated land claims with the territorial and federal government. The KDFN Traditional Territory covers an area of 10,380 km^2, and overlaps with much of the TKC Traditional Territory, which covers an area of 12,079 km^2.

The mine site is located within the upper Yukon River watershed and the Southern Lakes Ecoregion. The ecoregion is characterized by large lakes, broad valleys and round summits with elevations ranging from 610 m to 2,380 m above sea level. The area is within the sporadic discontinuous permafrost zone (Yukon Ecoregions Working Group 2004); however, it is unlikely that permafrost underlies the mine site, as none was encountered during active underground mining. Relief on the property is approximately 335 m, with the highest point on the property at 1,220 m above sea level.

1.2 CLIMATE

The Whitehorse climate is best described as cool and dry, with low to moderate annual precipitation. Climate data for the area are available for six different Meteorological Service of Canada meteorological stations in Whitehorse (Table 1). Monthly climatic records for these stations are available from Environment Canada's National Climate Data and Information Archive (Environment Canada 2010). For the purposes of this baseline study, data from the 'Whitehorse A' meteorological station will be used to summarize data from 1970 to 2010.

1.2.1 AIR TEMPERATURE

For most areas in Yukon, December and January are typically the coldest months and July the warmest. Mean monthly temperatures in Whitehorse range from a low of -16.0°C in December to a high of 14.4°C in July, and mean monthly temperatures are above freezing for approximately seven months of the year, April to October (Table 2). Monthly extreme temperature data indicates the warmest and coldest temperatures recorded in Whitehorse at 34.1°C (May 1983) and -49.4°C (January 1975), respectively (Table 2).

1.2.2 PRECIPITATION

Whitehorse is located in the rain shadow of the St. Elias-Coast Mountain Range, and as such, receives relatively little precipitation, on average 299 mm annually (Environment Canada 2010). The wettest month is August with an average precipitation of 46.8 mm, while the driest month is April with an average precipitation of 6.6 mm (Table 2; Figure 1). The most extreme monthly precipitation amount recorded in Whitehorse since 1970 was 109.6 mm which occurred in July 1988. The greatest daily precipitation recorded was 44.9 mm in June 1984.

Precipitation can occur as snow in any month of the year, but accumulation of snow generally occurs from late September through early May (Table 2; Figure 2). The greatest monthly snowfall occurs in January with 29.2 cm on average. Over the year, an average of 158 cm of snow falls in the area.

1.2.3 WIND

In the Whitehorse area the most frequent wind directions are from the southeast and east. Average monthly wind speeds are relatively even throughout the year, ranging from 14.7 km/hr in October to 10.4 km/hr in July (Table 3). Average maximum gust speeds are highest from November through February with speeds over 30 km/hr. The most extreme wind speed recorded in Whitehorse from 1970 to 2010 was 243 km/hr in December 1992.

1.2.4 CLIMATE CHANGE

Average winter temperatures in Alaska and north-western Canada have increased by as much as 3–4°C between 1950 and 2000 (ACIA 2004). Climate change predictions for Yukon predict greater changes in winters than summers. Average temperature in winter is expected to continue to increase over the entire Yukon, while summer temperatures are expected to increase mostly in the south and central Yukon. More precipitation is anticipated to occur in the winter, and the effect will be greatest in the far north. The predictions also include more extreme winter and summer weather events, particularly heavy summer rainfalls and thunderstorms (ACIA 2004).

Table 1. Meteorological Service of Canada meteorological stations located within the city of Whitehorse, Yukon.

Station name	Station number	Location		Elevation (m)	Data years
		Latitude	Longitude		
Whitehorse	2101290	60°43'00.000" N	135°03'00.000" W	636.10	1904–1942
Whitehorse A	2101300	60°42'34.200" N	135°04'07.800" W	706.20	1942–2010
Whitehorse Auto	2101310	60°43'59.000" N	135°05'52.000" W	707.00	2009–2010
Whitehorse Riverdale	2101400	60°42'36.000" N	135°01'38.000" W	640.10	1959–2010
Whitehorse WSO	2101415	60°44'00.000" N	135°05'00.000" W	706.90	1996–1998

Table 2. Monthly temperature and precipitation values in Whitehorse, Yukon from 1970 to 2010. (Data Source: Environment Canada 2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Temperature (°C)	-15.8	-13.6	-7.7	1.2	7.7	12.3	14.4	12.8	7.4	0.5	-7.9	-16.0
Extreme Temp. High (°C)	10	11.5	11.7	21.8	34.1	33.2	33.2	31.6	25.0	19.3	11.7	10.6
Extreme Temp. Low (°C)	-49.4	-45.2	-40.6	-29.4	-12.9	-2.8	-0.5	-2.8	-19.4	-31.1	-41.0	-46.7
Mean Precipitation (mm)	22.7	19.7	17.3	6.6	11.6	35.0	37.6	46.8	34.6	29.6	20.0	18.1
Mean Snowfall (cm)	29.2	28.1	23.5	6.3	3.5	0.6	0.0	0.2	5.7	20.1	18.3	22.5
Extreme Precip. High (mm)	44.7	32.8	43.9	21.4	38.4	82.2	109.6	103.4	67.0	50.5	38.1	39.6
Extreme Precip. Low (mm)	1.6	0.0	0.4	0.0	0.8	6.0	5.6	9.9	6.6	5.7	2.0	3.0

Table 3. Monthly wind data for Whitehorse, Yukon from 1970 to 2010. (Data Source: Environment Canada 2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Average Wind Speed (km/hr)	12.9	13.5	12.7	12.7	12.6	11.5	10.4	11.1	13	14.7	14.1	13.9
Average Max Gust Speed (km/hr)	30.4	30.1	27.9	25.6	27.4	22.6	20.8	17.4	23.7	27.8	33.4	30.7
Max Gust Speed (km/hr)	89.0	89.0	91.0	80.0	74.0	80.0	91.0	80.0	94.0	230.0	85.0	243.0
Wind Direction	SE	SE	SE	SE	SE	SE	E	E	SE	SE	SE	SE

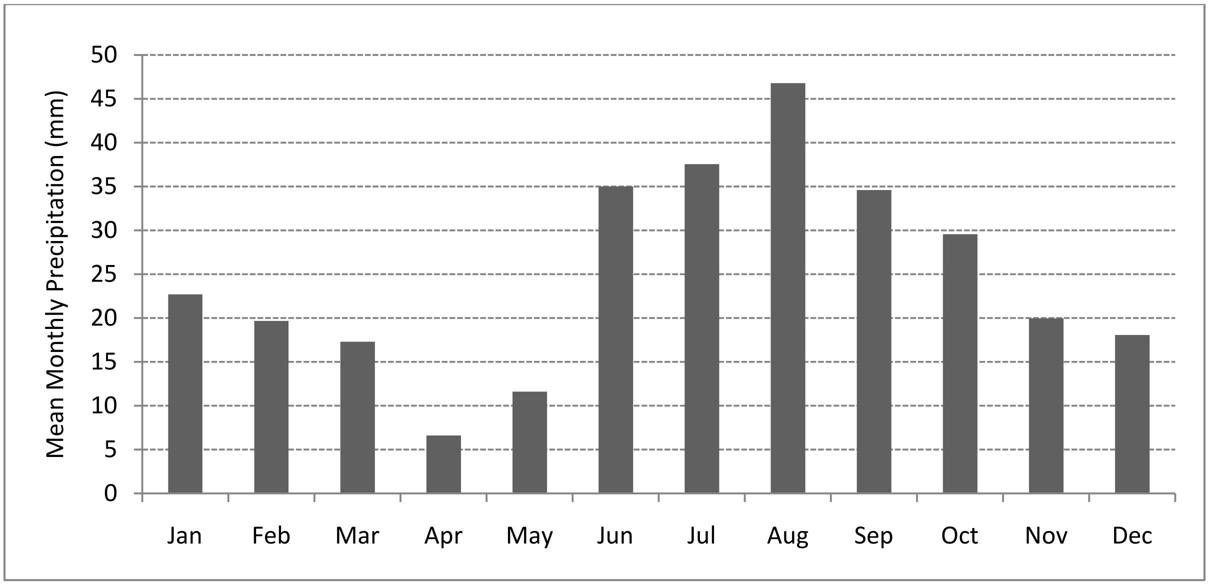

Figure 1. Mean monthly precipitation for Whitehorse, Yukon from 1970 to 2010.
(Data Source: Environment Canada 2010)

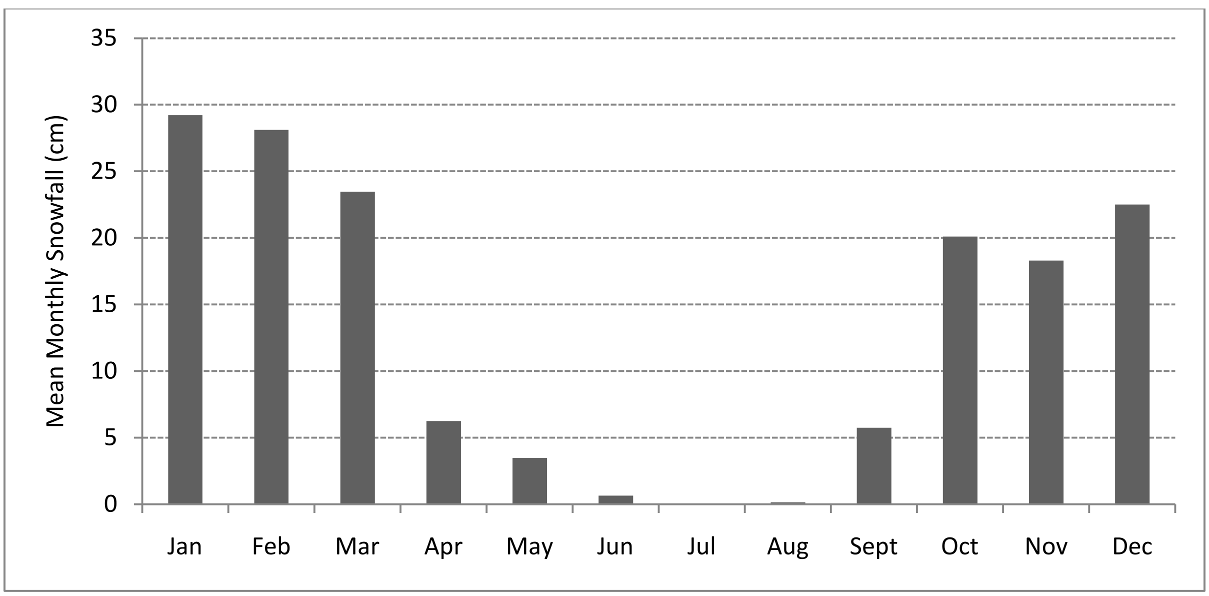

Figure 2. Mean monthly snowfall for Whitehorse, Yukon from 1970 to 2010.
(Data Source: Environment Canada 2010)

2 TERRESTRIAL ENVIRONMENT

The proposed Whitehorse Copper Project is located within the Southern Lakes Ecoregion (Yukon Ecoregions Working Group 2004). This ecoregion contains diverse mammals and ecosystems — most mammalian species present in Yukon occur in this area. Today most of Yukon's population lives within the Southern Lakes Ecoregion. The presence of humans in the region has resulted in decreased abundance of wildlife because of reduced availability of wildlife habitat and overharvest.

2.1 ECOLOGICAL DESCRIPTION

The project area, though small, contains diverse vegetation. The diversity is a consequence of the variable topography of the area, and the history of disturbance from mining activity and recreational activities. Furthermore, there are natural and man-made water bodies within and near the project area that add to the diversity of habitats. Riparian willow stands occur around moist areas. Older growth spruce dominated forest occurs on the east facing slopes near the project area. Dry pine forests are present around and throughout the project area that was undisturbed by previous mining activity. Disturbed areas contain early succession trees and shrubs. The tailings areas, where the project activities will occur, are best described as barren and devoid of most vegetation.

The Yukon Government identifies Wildlife Key Areas (WKA) for valued animal species across Yukon. The WKAs highlight important geographical locations that are used by wildlife for critical seasonal life functions. For example, WKAs identified for woodland caribou include winter range, fall rutting areas and migration corridors. No WKAs for any species were identified within the proposed project area. There are no known vegetation and/or animal species of conservation concern that occupy the project area (Mulder pers. comm. 2010).

2.2 WILDLIFE OCCURRENCE

Terrestrial Mammals

Terrestrial mammals most likely to use the proposed project area include a normal assortment of Yukon's wildlife species (Table 4). Most of these species are relatively common to the area and region. Wolves and grizzly bears likely occur infrequently on site as they exist at relatively low densities in the region. These two predatory species generally have trouble co-existing with humans. The site is within the range of three species that have been assessed and identified as *Special Concern* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC): woodland caribou, grizzly bear and wolverine (Table 4).

Woodland caribou occur in this area. The Yukon population of woodland caribou is known as the northern mountain woodland caribou population and is listed as a species of *Special Concern* under the federal *Species at Risk Act* (SARA). Currently, a species management plan is being developed as required by SARA, but the plan has not been finalized. The local caribou herds nearest to the proposed project are the Carcross and Laberge herds. Though the Environment Yukon's current caribou herd range maps do not include the proposed project location in any herd's range, the Southern Lakes regional biologist confirmed that caribou may occasionally pass through and potentially forage in the habitat around the proposed project in the winter (S. Taylor pers. comm. 2010).

Moose abundance in the Southern Lakes region has been declining during the previous several decades. Currently, the Southern Lakes Wildlife Coordinating Committee is preparing moose conservation and management recommendations in an attempt to restore moose populations. The decline is a result of the combination of habitat change, predation and overharvest. Reduced habitat availability is not the significant issue because moose thrive in disturbed habitats. Early succession forests provide abundant forage for moose. Predation in the area is a growing issue for the public. Predation in the region is probably near or at natural levels as predator control programs have not been conducted in the region since the 1980s. Harvest in the Southern Lakes Ecoregion has historically exceeded the annual allowable harvest rates identified by Yukon Government.

Amphibians

Wood frogs (*Rana sylvatica*) have been observed on site and they are very likely the only amphibian that occurs in the area. Wood frogs are ubiquitous in water bodies throughout most of Yukon. The project site is outside the range of all other amphibian species that have been observed in Yukon. The other species of amphibians that occupy wetlands in Yukon have only been observed along the British Columbia border and mostly in eastern Yukon.

Birds

A total of 195 bird species have been documented in the Whitehorse area (Sinclair et al. 2003), which is representative of the Southern Lakes Ecoregion. A number of these species are migrants that pass through the area, while a smaller proportion breeds in the area. Eight bird species of conservation concern, as determined by the Canadian Endangered Species Conservation Council (CESCC) or the Committee on Status of Endangered Wildlife in Canada (COSEWIC), likely nest in the surrounding project area (Table 5).

Table 4. Summary of mammal species that are likely to occur on the proposed project site, and their local and regional distribution.

(The conservation status as determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) for each species is included.)

Species	Project site occurrence	Local distribution	Yukon distribution	Conservation status
Moose (*Alces alces*)	Confirmed	Common	Widespread	Not a concern
Woodland caribou (*Rangifer tarandus caribou*) Northern mountain population	Unlikely	Common	Widespread	Special concern (COSEWIC)
Mule deer (*Odocoileus hemionus*)	Confirmed	Common	Southern Yukon	Not assessed
Black bear (*Ursus americanus*)	Confirmed	Common	Widespread	Not at Risk (COSEWIC)
Grizzly bear (*Ursus arctos*)	Likely	Common	Widespread	Special Concern (COSEWIC)
Wolf (*Canis lupus occidentalis*)	Likely	Common	Widespread	Not at Risk (COSEWIC)
Wolverine (*Gulo gulo*)	Unlikely	Uncommon	Widespread	Special Concern (COSEWIC)
Coyote (*Canis latrans*)	Confirmed	Common	Widespread	Not assessed
Red fox (*Vulpes vulpes*)	Likely	Common	Widespread	Not assessed
Lynx (*Lynx canadensis*)	Likely	Common	Widespread	Not at Risk (COSEWIC)
Marten (*Martes americana*)	Likely	Common	Widespread	Not assessed

Table 5. Summary of bird species that could occur on the proposed project site, and their local and regional distribution.

Species	Project Site Occurrence During Breeding	Local Distribution	Yukon Distribution	Conservation Status[a]
American Kestrel (*Falco sparverius*)	Likely	Uncommon	Widespread	May Be At Risk (CESCC 2006)
Lesser Yellowlegs (*Tringa flavipes*)	Likely	Common	Widespread	Sensitive (CESCC 2006)
Common Nighthawk (*Chordeiles minor*)	Likely	Uncommon	Southern Yukon	Threatened (COSEWIC)
Olive-sided Flycatcher (*Contopus cooperi*)	Likely	Uncommon	Widespread	Threatened (COSEWIC)
Mountain Chickadee (*Poecile gambeli*)	Unlikely	Rare	Southern Yukon	Sensitive (CESCC 2006)
Golden-crowned Kinglet (*Regulus satrapa*)	Unlikely	Rare	Southern Yukon	Sensitive (CESCC 2006)
Mountain Bluebird (*Sialia currucoides*)	Likely	Uncommon	Central and Southern Yukon	Sensitive (CESCC 2006)
Townsend`s Warbler (*Dendroica townsendi*)	Unlikely	Rare	Central and Southern Yukon	Sensitive (CESCC 2006)

Notes:

[a] The conservation status as determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Canadian Endangered Species Conservation Council (CESCC) for each species is included.

3 AQUATIC ENVIRONMENT

3.1 SURFACE WATER

3.1.1 SURFACE WATER FEATURES, STREAMS, WETLANDS

There are minimal surface water features present on and around the Whitehorse Copper site. No permanent watercourses flow through the Whitehorse Copper site or surrounding area. There are three water bodies currently located on and downgradient of the site (Gadsby 1991). The Little Chief open pit is a man-made construct from the days of active mining. With the end of active mining, water was no longer pumped out of the Little Chief open pit and associated underground workings, and the pit slowly filled with water. The water body present today acts as a surface representation of the elevation of the groundwater table based on groundwater mapping conducted in the area in 2002 (Gartner Lee 2002). The other two water bodies close to the site include Copper and Crater Lake. Both Copper and Crater lakes are 'closed' or 'seepage' lakes, with no surface water inflows or outflows. Rather, they are fed by surface runoff, precipitation and groundwater seepage.

There are wetland areas at the base of many of the onsite tailings dams. Wetlands were noted on the south-eastern edge of the Old Pond dam, and between the northeast corner of the Old Pond dam and the south end of the A Valley dam. In addition, there is a seep located at the northwest corner of the B Valley tailings area. This seep results in the near-saturation of the tailings in the B valley. During decommissioning of the mine site a spillway was created draining the B valley to the east; however, the elevation of the spillway is such that water remains stored in the tailings behind the dam. The water ponds on the surface of the tailings in this area appear to be a year-round feature at this time.

3.1.2 SURFACE WATER QUALITY

Surface water quality was sampled at a number of locations at the Whitehorse Copper site as part of the decommissioning program. Water samples were collected in summer 1991, spring and fall of 1992, and summer 1993 (Gadsby 1991). A number of these sampling sites were re-visited in the summer and fall of 2010 (Figure 3; Table 6). Changes to onsite conditions since decommissioning have led to perennial water bodies in 2010 which did not exist in 1993 including the pond in B Valley as well as the Little Chief open pit. Water quality data collected over the past 20 years at the Whitehorse Copper site allows comparisons to be drawn with respect to the changes in water quality over time. By sampling in both summer and fall, changes in water quality with the seasons can be investigated during the period of time when the proposed project would be active. All 2010 laboratory data is located in Appendix A.

Legend

- Water Sampling Location
- Monitoring Well Sampling Location
- Residential Well Sampling Location
- Major Groundwater Divide
- Major Surface Divide
- Legal Survey - Land Parcel
- Eagle Industrial Minerals - Lease

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Checked By:	G. Pelchat, J. Bachman
Date:	08 February 2011
Projection:	NAD 1983 - UTM Zone 8
EDI Project:	10-YC-0050

Digital Data Sources:

Major groundwater and surface divides were digitized by EDI using georeferenced hardcopy maps prepared by Gadsby Consultant Ltd. (1991) - boundaries are approximated.

Digital imagery of the Whitehorse region provided by Geomatics Yukon - Yukon Government; acquired Summer 2008. Land tenure data depicting lease lands downloaded via Geomatics Yukon spatial warehouse; online source (Feb. 8, 2011).

Data (sampling locations) were collected by EDI Environmental Dynamics Inc. (2010) was obtained using Garmin GPS technology.

This document is not an official land survey and the spatial data presented is subject to change without notice.

Original Map Scale 1:20,500
(printed on 11x17)

0 100 200 400 600 800 1,000
Metres

Figure 3.
Water quality sampling locations at the Whitehorse Copper site.

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Table 6. Whitehorse Copper Project water quality sampling sites and sampling dates.

Water Sampling Site	Sampling Schedule
Little Chief open pit	Spring and Fall 2010
Old Pond	Summer 1991, Spring 1992, Fall 1992, Fall 1993, and early Summer and Fall 2010
A Valley pond	1991, Spring, Fall 1992, 1993, 2010
Copper Lake	1991, Spring, Fall 1992, 1993, 2010
B Valley pond	1991, Spring, Fall 1992, 1993, 2010
Crater Lake	1991, Spring, Fall 1992, 1993, 2010
Wetland seepage areas	Spring and Fall 2010

The sampling parameters in the early 1990s included major ion chemistry, pH, specific conductivity, and total and dissolved metals. This sampling regime was mirrored in 2010 with the addition of nutrient parameters (nitrate, nitrite, and ammonia) which were not sampled during site decommissioning, but are useful in understanding the chemistry of the water on site.

Laboratory analysis of water quality has undergone significant improvements since analysis of samples collected in 1993. This has resulted in greater accuracy of results, as well as lower concentration detection limits. As such, the water quality data reviewed here from 1991–1993 will continue to be compared with Canadian Council of Resource and Environment Ministers (CCREM) guidelines for the protection of freshwater aquatic life and CCREM drinking water guidelines (CCREM 1987). Alternatively, data collected in 2010 was analyzed with current laboratory methods and detection limits, and is therefore compared with current Canadian Council Ministers of the Environment (CCME) protection of freshwater life guidelines (CCME 2007) and Health Canada drinking water guidelines (Health Canada 2008; Table 7).

Table 7. Current water quality guidelines applicable to data collected at the Whitehorse Copper site.

Sample Parameters	Units	CCME AL Guidelines [a]	Health Canada DW Guidelines [b]
pH	pH units	6.5 – 9.0	6.5 – 8.5 [AO]
Total Dissolved Solids (TDS)	mg/L	--	≤500 [AO]
Ammonia-N	mg/L	0.832[TP]	--
Nitrate-N	mg/L	2.9	10
Nitrite-N	mg/L	0.06	--
Aluminum	mg/L	0.1	0.1 [AO]
Antimony	mg/L	--	0.006
Arsenic	mg/L	0.005	0.010
Barium	mg/L	--	1
Boron	mg/L	--	5
Cadmium	mg/L	0.000017	0.005
Chloride	mg/L	--	≤250 [AO]
Chromium	mg/L	0.0089	0.05
Copper	mg/L	0.002 – 0.004[c]	≤1.0 [AO]
Fluoride	mg/L	--	1.5
Iron	mg/L	0.3	≤0.3 [AO]
Lead	mg/L	0.001 – 0.007[c]	0.01
Manganese	mg/L	--	≤0.05 [AO]
Mercury	mg/L	0.000026	0.001
Molybdenum	mg/L	0.073	--
Nickel	mg/L	0.025 – 0.15[c]	--
Selenium	mg/L	0.001	0.01
Silver	mg/L	0.0001	--
Sulphate	mg/L	--	≤500
Thallium	mg/L	0.0008	--
Uranium	mg/L	--	0.02
Zinc	mg/L	0.03	≤5.0 [AO]

Notes:
[a] CCME guidelines for the protection of freshwater aquatic life (AL) (CCME 2007)
[b] Health Canada Guidelines for Canadian Drinking Water Quality (Health Canada 2008)
[c] Hardness dependent guideline
[AO] Aesthetic objective
[TP] Temperature and pH dependent

Little Chief open pit

The mine pit lake was not sampled at the time of site decommissioning since it was dry in the early 1990s. Sampling in 2010 indicates that water in the pit lake is very hard, with a total hardness concentration of 541 mg/L $CaCO_3$ in the summer and 682 mg/L in the fall. Water was also alkaline, with a total alkalinity of greater than 100 mg/L and a pH slightly over 8 during both sampling visits. The water clarity was high, with a suspended sediment load of less than 4 mg/L (below laboratory detection), and a dissolved sediment load of between 700 – 800 mg/L (higher in the fall). Nutrient concentrations were very low, often below detection, in the water in the Little Chief open pit.

Some metals are present in the pit lake with total concentrations above the CCME freshwater aquatic life guidelines; these included cadmium, copper, lead, molybdenum, and selenium. Given the presence of high mineralization in this area, and its past suitability as a commercial mine site (high concentrations of copper ore), these concentrations are not unexpected and likely naturally occurring. The pit lake water is in constant contact with unprocessed ore in the pit walls, likely leading to higher metals concentrations. The dissolved concentrations of these metals are significantly lower, often undetectable (Appendix A), and therefore the bioavailable concentrations of these metals are below the CCME guidelines.

Old Pond Tailings

The Old Pond located on the top of the main tailings impoundment area was sampled in summer 1991, spring 1992, fall 1992, fall 1993, and early summer and fall 2010. Water in the Old Pond is both hard and alkaline due to high concentrations of calcium and magnesium. Total dissolved solids (TDS) were high in 1991 with a concentration > 1000 mg/L, however the TDS concentrations had decreased significantly by 1992 to a spring concentrations of 354 mg/L and a fall concentration of 528 mg/L. This decreasing trend continued into 1993, and 2010 sampling indicated a TDS concentration of 240 mg/L in the early summer, and 300 mg/L in the fall.

Sulphate concentrations were also high in 1991 (>700 mg/L), but showed a strong decreasing trend through the early 1990s, and concentrations continued to be low in 2010 (<200 mg/L).

Nutrient concentrations were very low in the water in the Old Pond, as investigated in 2010. Ammonia, nitrate, nitrite, nitrate + nitrite and total phosphorus concentrations were all below laboratory detection levels.

It is difficult to compare total metals concentrations between 1991 and 2010 due to the improvement in laboratory detection limits. To this end, 1991 results were compared with CCREM guidelines in place at the time and 2010 results were compared with current CCME guidelines for the protection of freshwater aquatic life. In 1991 the only metal present at concentrations exceeding existing guidelines was copper. In 2010, there were a select few metals with total concentrations above the CCME freshwater aquatic life guidelines, including aluminum, copper, iron, molybdenum and selenium. Dissolved, and therefore more bioavailable concentrations of aluminum, copper and iron were all significantly lower than total concentrations, indicating that the presence of these metals was associated with suspended particulate matter.

A Valley Tailings Pond

Water quality data for ponded water in A Valley are available only from 2010 as it appears ponded water was not present during surface water sampling in the early 1990s. The TDS concentration was lower than in the Old Pond, with a concentration of 180 mg/L in the summer and 140 mg/L in the fall. The suspended solids concentration was also low in both early summer and fall samples.

Sulphate concentrations in the A Valley were on average less than a quarter to a half of that found in other waterbodies on site, with concentrations of 59 mg/L in the summer and 53 mg/L in the fall.

Nutrient concentrations were very low in the water in the A Valley pond. Nitrate, nitrite and nitrate + nitrite concentrations were all below laboratory detection levels. Ammonia was present at concentrations below detection in the summer, but was 0.18 mg/L in the fall. Total phosphorus concentrations were also low, at 0.005 mg/L, with no seasonal variation.

There were a select few metals with total concentrations above the CCME freshwater aquatic life guidelines in 2010; these metals included aluminum, cadmium, copper and iron. Dissolved metals concentrations of all these four metals were significantly lower than the total concentration, indicating that the presence of metals is largely associated with suspended particulate matter.

Copper Lake

Copper Lake receives run-off from the A valley tailings area; as such the water quality is expected to reflect that of the ponded water in the A valley. This site was sampled in 1989, 1991, 1992, 1993 and 2010. Water in Copper Lake is very hard, with a hardness concentration of 556 mg/L. Currently conditions indicate it is also alkaline, with a total alkalinity of 270 mg/L and a pH of 8.3 (2010 data). Alkalinity has remained relatively constant over time, and shows no seasonal patterns. Total dissolved solids were historically, and continue to be quite high (> 600 mg/L), save for a lower concentration in the fall 2010 (270 mg/L). Total suspended solids concentrations were low in all sampling taken from this site.

Sulphate concentrations were low in the early 1990s; approximately 100 mg/L in all samples with no seasonal patterns. However, sulphate concentration was higher in 2010 (300 mg/L, no seasonal change).

Nutrient concentrations were very low in the water in the Copper Lake. Nitrate, nitrite and nitrate + nitrite concentrations were all below laboratory detection levels. Ammonia was present in concentrations below laboratory detection in the summer, but the concentration was higher in the fall (0.22 mg/L; still far below CCME guidelines). Total phosphorus concentrations were also low, at 0.008 mg/L during both 2010 sampling events.

No metals in Copper Lake exceeded CCREM guidelines in 1989–1993 or CCME freshwater aquatic life guidelines in 2010. The manganese concentration does exceed drinking water guidelines, and has since the sampling conducted in the early 1990s; however this water body is not used as a drinking water source.

B Valley Tailings Pond

Data from water ponded in the B valley is available from 1989, 1991, 1992, 1993 and 2010. The water ponded in the B Valley is alkaline, and seasonally, the total alkalinity decreases slightly in the spring, generally associated with spring melt dilution, and is higher in late summer and fall samples. The TDS concentration in the ponded water has remained relatively constant over time, with concentrations between 200 and 300 mg/L over the entire period of sampling. No seasonal trends were noted. The suspended sediment load was and continues to be very low, with concentrations below 10 mg/L.

Nutrient concentrations including ammonia, nitrate, nitrite and nitrate + nitrite were very low in the water in the B Valley pond. Total phosphorus concentrations were also low, at 0.005 mg/L.

Through the early 1990s the only metal present at concentrations exceeding existing CCREM protection of aquatic life guidelines was copper. There were a few metals with total concentrations above the CCME freshwater aquatic life guidelines in 2010; these metals included aluminum, copper, iron and selenium. Aluminum and iron were elevated in only one sample, and the dissolved metal, and therefore the bioavailable fraction, concentration for both metals was below detection, indicating that the metals were associated with particulate matter in the water column.

In addition to the pond immediately upstream of the B Valley dam, a small area of ponded water at the far (south) end of the B Valley was sampled in 2010. Water quality in the ponded water here had slightly different water quality from the main B Valley pond. The water here had a higher concentration of carbonates. Also the suspended solids concentration was higher, while the dissolved solids concentration was lower. Metals that exceeded the CCME aquatic life guideline included cadmium, copper, molybdenum and selenium. The higher concentration of these metals may be associated with the higher concentration of suspended solids in the water column.

Crater Lake

Crater Lake was sampled in 1991, 1992, 1993 and 2010. Despite being used during mine operation to collect and reclaim tailings pond water, water quality in Crater Lake was not overly compromised. Historically the water was highly alkaline, and had high concentrations of TDS (exceeding the CCREM drinking water guidelines). Sampling in 2010 indicated that neither alkalinity nor TDS have decreased over time. No seasonal trends were noted among the physical chemistry parameters indicating that dilution associated with spring melt has little effect on the water body.

Nutrient concentrations were very low in the water in the Copper Lake. Nitrate, nitrite and nitrate + nitrite concentrations were all below laboratory detection levels. Ammonia was present in concentrations below laboratory detection in the summer, but the concentration was higher in the fall (0.21 mg/L, still far below CCME guidelines). Total phosphorus concentrations were also low, at 0.006 mg/L.

In general concentrations of total metals were low in Crater Lake. Historically, only manganese exceeded the CCREM drinking water guidelines, while none exceeded the CCREM protection of freshwater life guidelines. In 2010 sampling only copper in the fall sample exceeded the CCME freshwater aquatic life guideline (dissolved copper concentration was significantly lower, below the guideline of 4 μg/L). Manganese concentrations continue to exceed the Health Canada Drinking water aesthetic objective.

Wetland/Dam Seepage Areas

On site investigations in summer 2010 indicated the presence of two previously un-sampled wetland/groundwater seep areas. One is located between the Old Pond and A Valley, and the second was identified as a small seepage area to the south-east of the Old Tailings Pond, outside of the perimeter berm. Water sample data from these sites is only available from summer and fall 2010.

Water in both seep areas was very hard, with concentrations of 599 and 564 mg/L, indicating high concentrations of calcium and magnesium. Water was also very alkaline with total alkalinity concentrations of 370 and 350 mg/L. The pH of both sites was also alkaline at 7.72 and 7.70. Total dissolved concentrations were very high at both sites (970 and 900 mg/L) and TSS concentrations were low (8 and 11 mg/L).

Nutrient concentrations were higher in water samples from these sites than from any other samples on site. This is likely due to the increased presence of aquatic vegetation surrounding the surface water. Ammonia concentrations ranged from 0.24 to 0.95 mg/L, both below the CCME guideline for the protection of freshwater aquatic life. Nitrate and nitrite concentrations were low at both sites, in some cases below detections, and total phosphorus concentrations ranged from 0.031 to 0.088 mg/L.

There were a select few metals with total concentrations above the CCME freshwater aquatic life guidelines; these included aluminum, arsenic, copper and iron. Neither of these sites is in contact with fish bearing water bodies.

3.1.2.1 SUMMARY OF WATER QUALITY AT WHITEHORSE COPPER SITE

- Water quality at all sites is very hard and highly alkaline.
- As was noted in the early 1990s, the TDS concentration in the water from water bodies around the Whitehorse Copper site is high, and generally exceeded both past and existing federal drinking water guidelines.
- Iron and manganese both historically and more recently exceeded drinking water aesthetic guidelines.

3.2 GROUNDWATER

3.2.1 GROUNDWATER DIRECTION AND ELEVATION

Groundwater movement and elevation in the project area was investigated in 2002 as part of the assessment of the then-proposed Whitehorse Copper residential subdivision (Gartner Lee Ltd. 2002). In general, groundwater flow through the area moves toward the east, to the Yukon River. Groundwater recharge occurs mainly in upland areas, and discharge occurs in low-lying wetlands and ultimately the Yukon River. Therefore, due to the elevation, the area immediately surrounding the Whitehorse Copper project area is largely considered an area of groundwater recharge (Gartner Lee Ltd. 2003). The substrate through which groundwater moves is composed of surficial deposits (glacial till, till veneers, glaciofluvial sand and gravel) are present as thin layers overlying bedrock, which is frequently found within 5 metres of surface (Gartner Lee Ltd. 2002).

3.2.2 GROUNDWATER QUALITY

Groundwater quality downstream of the Whitehorse Copper site was investigated during site decommissioning via sampling of nine private residential wells in the Canyon Crescent area of Whitehorse in 1991 (Gadsby 1991). Those data were compared with the CCREM drinking water quality guidelines that existed at the time of sampling (CCREM 1987).

As part of the current investigation into existing environmental conditions, these wells were again sampled in September 2010, together with two monitoring wells located upstream of the site (Table 8). Data collected in 2010 allows for the investigation of changes to groundwater quality that may have occurred in the years since decommissioning, as well as for upstream and downstream groundwater quality comparisons to be made. Data collected in 2010 were analyzed using more recent laboratory techniques, with lower laboratory detection limits than data analyzed in 1991. Therefore 2010 data is compared here with current Health Canada Drinking Water Guidelines (Health Canada 2008; Table 7).

The wells are divided into three main areas. Upstream of the project area are two monitoring wells (MW-N and MW-S) located south and east of the project area. Water quality data from these wells is valuable as it allows an upstream, or reference groundwater quality comparison. The area around Canyon Crescent, north of the project area includes three residential wells (91-1, 91-2 and 91-3). The final grouping of wells is located due east of the project area and includes four residential wells and two commercial wells (91-15, 91-16 (decommissioned), 91-17, 91-18, 91-19 and 91-20). However, one of the commercial wells, 91-16, is no longer in use, and could not be sampled in 2010.

The two monitoring wells upstream of the project area were sampled using bailers. A water level tape, Heron Instruments Dipper-T, was first used to determined the depth of the well and volume of water present. The wells were then bailed until three times the volume of the water was removed, or until the field water quality parameters (temperature, pH and specific conductivity), as measured with a YSI 556 sonde, had stabilized. Once these parameters have stabilized, it indicates that water in the well was reflective of groundwater flowing into the well, and not that which may have been stored in the well for an undetermined period of time. The stabilized field water quality parameters were recorded (Table 9), and the sample bottles were filled. At the residential and commercial wells, a water port not connected to a water softener unit was located, and water was allowed to flow openly until field water quality parameters had stabilized. Again, at this point the parameters were recorded and a water sample was collected. All collected water samples were shipped to Maxxam Analytics, Burnaby, BC, for analysis of dissolved metal concentrations, nutrient concentrations, and routine chemistry.

Upstream Monitoring Wells

The two wells located upstream of the project area were drilled to different depths, and as such reflect water quality of two different groundwater reservoirs, the shallow and deep groundwater tables in the area (Figure 3). The south well had a depth of approximately 20 metres below ground level, and the north well was drilled to a depth of approximately 6.5 metres. As expected, the water temperature in the deeper well was colder (3.66°C) when compared with the shallower well (5.18°C). Specific conductivity was also higher in the deeper well. This increase in conductivity is due to increased ion concentrations (Appendix B).

Nutrient concentrations were low in both wells, though nitrate concentrations were higher in the shallower well. The suspended sediment load was higher in the shallower well, while the dissolved solids load was higher in the deeper well.

Concentrations of dissolved metals in the monitoring wells were generally low, well below Canadian Drinking Water quality guidelines (Health Canada 2008). Exceptions to this were manganese and uranium concentrations in the deeper well, with concentrations of 125 μg/L and 85.7 μg/L, respectively (Appendix B). The presence of these metals in the deeper well and not in the shallower well is indicative that they are due to local mineralization and not surface contamination.

Canyon Crescent Area

Water quality from the residential wells of the Canyon Crescent area does not appear to have changed appreciably since previous testing in 1991 (Appendix B). The only exception is the sulphate concentration which has increased slightly (by approximately 10 – 15 mg/L) in all three wells. However, when compared with the Drinking Water guidelines, these concentrations remain very low (28 – 36 mg/L, compared with the Health Canada guideline of 500 mg/L). All metals concentrations in these wells met the CCREM drinking water guidelines in 1991 sampling, and again met the Health Canada guidelines in 2010 samples. Drinking water quality in the wells sampled here is of high quality, and does not appear to have degraded between sampling in 1991 and 2010.

Small Residential Area East of Whitehorse Copper Site

Groundwater quality among the four residences and the Pioneer RV Park to the east of the Whitehorse Copper site has not deteriorated since the last water quality sampling conducted in 1991. Unlike in the Canyon Crescent area, the sulphate concentrations in the wells sampled here have not changed appreciably since 1991 sampling (Appendix B). However, chloride concentrations are slightly higher than in 1991, though they remain below the Drinking Water Guideline. Suspended solids concentrations were generally undetectable or low. Total dissolved solids were slightly lower in 2010 than in 1991, with the exception of the Pioneer well, where concentrations were 437 mg/L in 1991 and 510 mg/L in 2010 (Appendix B). The concentration of 510 mg/L slightly exceeds the drinking water guideline of 500 mg/L.

Nutrient concentrations, present in the form of ammonia, nitrate or nitrite, in the water from all wells sampled were all consistently low.

Metals concentrations in the residential wells were all far below Drinking Water guidelines. Data from 2010 also fell below CCME protection of freshwater life guidelines. However, water from the Pioneer RV Park exceeded the drinking water guideline for barium by a small margin (112 μg/L, exceeding the guideline of 100 μg/L). However, it is unlikely that the barium concentration measured here is due to the upstream mine site, as this well is located downstream from the other wells sampled in the area, all of which had markedly lower barium concentrations , and are located between the mine site and the Pioneer well. It is more likely that barium in this concentration is due to the commercial uses of this site. Barium is used in the manufacturing of rubber tires, and released through weathering and wearing of these tires. As an RV Park the area surrounding this well sees high volumes of traffic.

Table 8. Groundwater wells sampled as part of Whitehorse Copper decommissioning and again in September 2010, well locations and sampling dates.

Well Identifier	Type of Well	Location (decimal degrees)	Dates Sampled
91-1, C. Boyd	Residential	60.659917, -135.041400	August 1991, September 2010
91-2, Lowry (formerly Richardson)	Residential	60.661864, -135.042572	August 1991, September 2010
91-3, McKinnon	Residential	60.662511, -135.040361	August 1991, September 2010
91-15, Pioneer RV Park	Residential	60.662511, -135.040361	August 1991, September 2010
91-16, Pioneer RV Park*	Residential	Unknown	August 1991
91-17, D. Boyd	Residential	60.647972, -135.022292	August 1991, September 2010
91-18, Lammers	Residential	60.648483, -135.023225	August 1991, September 2010
91-19, C. Boyd	Residential	60.647644, -135.019077	August 1991, September 2010
91-20, G. Boyd	Residential	60.647244, -135.019511	August 1991, September 2010
MW-N	Monitoring	60.633219, -135.055524	September 2010
MW-S	Monitoring	60.633164, -135.055508	September 2010

Notes:

* The Pioneer Park well is now decommissioned and sampling was not possible.

Table 9. Field water quality parameters of water in groundwater wells sampled September 2010.

Well Identifier	Temperature (°C)	Specific Conductivity (μS/cm)	pH
91-1, C. Boyd	3.07	480	6.52
91-2, Lowry (formerly Richardson)	4.90	439	6.46
91-3, McKinnon	9.25	468	6.48
91-15, Pioneer RV Park	6.38	842	7.02
91-17, D. Boyd	4.16	502	6.78
91-18, Lammers	3.99	552	6.84
91-19, C. Boyd	3.09	453	6.37
91-20, G. Boyd	3.39	452	6.24
MW-N	5.18	323	6.71
MW-S	3.66	492	6.94

3.3 FISH AND FISH HABITAT

The site decommissioning report indicated that there were no fisheries values present on site (Gadsby 1991). However, no additional information was provided concerning data or observations upon which this conclusion was based. While there are no watercourses on or near the site there are currently three waterbodies that may be of some concern (there were only two at the time of decommissioning, as the Little Chief open pit was dry at the time). There exists the possibility that local residents have since stocked the Copper (Photo 1), Crater (Photo 2) and/or Little Chief open pit (Photo 3) lakes as these sites remain accessible by both foot and motorized vehicle. As such, a fisheries investigation was conducted in August 2010 to determine fish presence/absence in waterbodies on and surrounding the site.

Field water quality parameters (temperature, dissolved oxygen, conductivity and pH) were collected in all sampled lakes using a YSI-556 sonde multi-meter (Table 11). Accurate location (GPS co-ordinates) and photo documentation data were also collected at all fish sampling sites.

Photo 1. View across Copper Lake, August 10, 2010.

Photo 2. Crater Lake, August 10, 2010.

Photo 3. Little Chief open pit, with view of gill net set along east wall, August 10, 2010.

Minnow traps and gill nets were set in Crater Lake, Copper Lake and the Little Chief open pit on August 10, 2010. Five minnow traps were set in Crater Lake and Copper Lake; two traps were set along an area of vegetated shoreline on the Little Chief open pit. Where possible, traps were spaced evenly around the shorelines of the lakes. Traps were baited with an artificial fish bait (Mike's® Orange-Garlic Glo-Mallows), were left to sample overnight and were removed the following morning (Table 12).

Gill nets were set perpendicular to the lake shorelines and left to fish for four hours. Crater Lake and Copper Lake were sampled using single-panel gill nets, while a multi-panel gill net was used to sample the larger Little Chief open pit (Table 13). Nets were set on the bottom of Crater and Copper lakes; however, the net in the deeper pit lake was floated on the surface to sample the lake depths thought most likely to be inhabited by fish.

No fish were captured using either the gill net or minnow trap sampling methods. In addition, a large number of aquatic invertebrates of very large size were observed in many of the sampling areas. Aquatic invertebrates of this size and number are generally only observed in areas with little or no fish presence, resulting in limited predation.

Past literature combined with evidence provided by the August 2010 fish sampling indicates that the claims made in the site decommissioning report (Gadsby 1991) were correct, and there are no fisheries values present on the Whitehorse Copper site. Therefore, there are no predicted impacts associated with fish and fish habitat on the Whitehorse Copper site.

Table 10.Locations at which each of the Whitehorse Copper fish sampling sites were visited.

Site	Zone	Easting	Northing
Copper Lake	8 V	496920	6724357
Crater Lake	8 V	498168	6722888
Little Chief open pit	8 V	496686	6722251

Table 11.Field water quality as measured at the time of fish sampling in the Whitehorse Copper fish sampling sites.

Parameter	Crater Lake	Copper Lake	Little Chief open pit
Water temperature (°C)	15.30	15.85	16.35
pH	7.16	7.90	8.26
Specific Conductivity (µS/cm)	1357	1330	1477
Dissolved oxygen (mg/L)	9.93	9.32	10.23

Table 12.Summary of minnow trapping effort at Whitehorse Copper fish sampling sites.

Parameter	Crater Lake	Copper Lake	Little Chief open pit
Total number of traps	5	5	2
Set time per trap (average hours)	23.48	22.85	21.48
Total sampling effort (total hours)	117.40	114.24	42.97

Table 13.Summary of gill net dimensions at Whitehorse Copper fish sampling sites.

Net Parameters	Crater Lake	Copper Lake	Little Chief open pit
Net mesh size	25.4 mm	50.8 mm	38.1/63.5/88.9 mm
Net height (metres)	1.8	2.1	1.8
Total net length (metres)	9.1 (1 panel)	17.1 (1 panel)	29.7 (3 x 9.9 m panels)
Set time (hours)	4.02	4.50	4.00
Total sampling effort (m^2/hour)	4.07	7.98	13.36

4 AIR QUALITY

Air quality is often considered in terms of the amount of gaseous pollutants and/or particulate matter in the air. Poor air quality can affect both human health and the environment. Causes of poor air quality may be attributed to human activities and/or natural processes. Yukon has one air quality monitoring station located in Whitehorse, which is part of the National Air Pollution Surveillance network (NAPS). Pollutants monitored at the station include carbon monoxide, nitrogen dioxide, ground level ozone and fine particulate matter.

An emission inventory for Whitehorse was developed by SENES Consulting Ltd. (2008) to acquire an understanding of air emission sources and their relative contributions to the environment. A summary of annual emissions of numerous air pollutants (in tonnes) from area, mobile and point sources in Whitehorse were compiled (Table 14). Most of the emissions are dominated by mobile sources (i.e., local traffic) and residential and commercial heating (fuel oil and wood). Mobile sources accounted for 71% of the nitrogen oxide (NO_x) emissions and 62% of the carbon monoxide (CO) emissions, while heating accounted for 92% of the sulphur oxide (SO_x) emissions and 84% of the fine particulate matter ($PM_{2.5}$) emissions.

Emission levels also vary throughout the year. For example, emissions from heating fuel and wood are greatest during the winter months and drastically decline through the summer. Conversely, emissions from highway traffic are greatest during the spring and summer, due to increased tourism, travel, and freight activity. Another factor that can influence air quality is the dispersion of emissions. Wind is the main dispersion factor, and in Whitehorse winds tend to come from the south, following the main orientation of the valley. Temperature inversions, which commonly occur in the winter, also have an effect as warmer air in the upper atmosphere traps the colder air and any pollutants in the valley.

Whitehorse emission levels for CO, NO_2, NO and $PM_{2.5}$ were well below ambient air quality objectives of Environment Canada (EC) and the World Health Organization (WHO) from 2000 to 2005 (Table 15). The only exceedence was for $PM_{2.5}$ concentrations that were three to four times the recommended WHO guideline in 2004 and 2005 due to forest fires.

No specific air quality data exists for the Project Area, but it can be inferred from the inventory data above and the existing land use around the area, that baseline emission sources are mainly from local traffic, heavy machinery, recreational equipment, and residential and commercial heating. There is also dust generated from traffic on the dirt portion of the Mt. Sima Road, as well as from activities at the gravel quarry. The tailings ponds are also a source of tailings dust that can be suspended and dispersed during wind storms (Gadsby 1991). These wind storms generally occur from June to August, but do not occur on a daily basis for extended periods of time. Dust, must be present in excessive quantities and inhaled for prolonged periods of time (several months) to cause physiological damage. People with already compromised respiratory systems (such as asthma, chronic pneumonia and cardiovascular problems) are more sensitive to dust and are more prone to adverse health effects.

Table 14.Annual emissions (tonnes) in Whitehorse from area, mobile and point sources.
(Data sourced from SENES 2008)

Emission sources		NO_X[a]	CO	VOC	SO_X	PM_{10}	$PM_{2.5}$	NH_3	CO_2	CH_4	N_2O
Area	Agricultural	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Heating	142.6	2,299.7	647.7	255.7	424.2	422.7	12.6	131,040.0	302.8	5.5
	Miscellaneous[b]	0.0	0.0	377.3	0.0	2.1	2.1	20.3	15,321.0	5,583.9	0.0
	Transportable dust	-	-	-	-	197.5	43.9	-	-	-	-
	Suspendable dust	-	-	-	-	295.3	0.0	-	-	-	-
	Total	*142.6*	*2,299.7*	*1,025.1*	*255.7*	*919.1*	*468.7*	*33.0*	*146,361.0*	*5,886.7*	*5.5*
Mobile	Agricultural equip.	0.1	0.8	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0
	Commercial equip.	10.9	674.6	29.9	0.9	1.5	1.4	0.0	1,711.0	1.5	0.2
	Construction equip.	85.3	157.4	14.2	11.8	7.7	7.5	0.1	8,639.0	0.7	3.4
	Industrial equip.	1.3	3.9	0.2	0.2	0.1	0.1	0.0	136.0	0.0	0.1
	Residential equip.	0.8	119.5	15.9	0.0	0.4	0.3	0.0	236.0	0.3	0.0
	Recreational equip.	1.3	246.0	69.3	0.2	1.8	1.7	0.0	995.0	1.1	0.0
	Highway traffic	29.6	284.8	21.4	0.3	0.7	0.5	0.8	5,729.0	1.2	1.3
	Local traffic	251.0	2,280.0	158.8	2.9	6.4	4.6	8.9	56,611.0	9.0	13.3
	Airport	2.3	166.7	0.0	0.3	3.8	3.6	0.1	9,821.0	8.3	2.8
	Total	*382.6*	*3,933.6*	*309.9*	*16.6*	*22.5*	*19.7*	*10.0*	*83,888.0*	*22.2*	*21.0*
Point	Energy production	5.5	1.3	0.1	0.0	0.1	0.1	0.0	258.0	0.0	0.0
	Industrial facilities	9.4	18.8	7.8	6.3	32.4	14.7	0.0	0.0	0.0	0.0
	Total	*14.9*	*20.1*	*8.0*	*6.3*	*32.5*	*14.8*	*0.0*	*258.0*	*0.0*	*0.0*
Grand Total		*540.1*	*6,253.3*	*1,342.9*	*278.6*	*974.0*	*503.3*	*42.9*	*230,508.0*	*5,908.9*	*26.6*

Notes:

[a] NO_x is a mono-nitrogen (NO or NO_2); CO is carbon monoxide; VOC is volatile inorganic compounds; SO_x is sulfur oxides (SO, SO_2, and SO_3); PM_{10} is suspended particulate matter with a diameter between 10 and 2.5 μm; $PM_{2.5}$ is suspended particulate matter with a diameter less than 2.5 μm, NH_3 is ammonium; CO_2 is carbon dioxide; CH_4 is methane; and N_2O is nitrous oxide.

[b] Miscellaneous sources include emissions from landfills, gas stations, dry cleaners, bakeries, auto refinishing businesses.

Table 15. Air quality monitoring summary for Whitehorse from 2000 to 2005 with air quality health criteria from Environment Canada (EC) and the World Health Organization (WHO).

Values in bold are those that exceed one/or both of the criteria. (Data sourced from SENES 2008)

CAC	**Ave. Period**	**Health Criteria**		**Maximum Concentration (µg/m^3)**					
		EC	**WHO**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
CO	1-h	35,000	30,000	3,132	1,276	4,408	4,408	2,552	2,088
	8-h	15,000	10,000	2,204	928	1,972	1,856	1,392	1,508
	24-h	-	-	1,508	696	1,276	812	1,392	1,044
	annual	-	-	-	-	464	232	232	348
NO_2	1-h	400	200	-	6	19	25	84	75
	24-h	200	-	-	4	12	10	33	46
	annual	60	40	-	-	2	0	-	8
NO	1-h	-	-	-	258	125	144	131	90
	24-h	-	-	-	54	31	34	21	30
	annual	-	n/a	-	-	4	3	-	1
$PM_{2.5}$	24-h	-	25	n/a	12	11	14	**101**	**80**
	CWS	30							
	annual	-	10	-	-	2	2	5	3

5 SOCIO-ECONOMIC CONDITIONS

The project will occur within the City of Whitehorse. Whitehorse is the largest community in Yukon, making up 76 percent of Yukon's population. The June 2010 population estimate for Whitehorse was 26,418 (Yukon Bureau of Statistics 2010a). This is a population increase of 3.1 percent from June 2009 to June 2010.

The Whitehorse area is in the traditional territory of two Yukon First Nations, the KDFN and the TKC. Both the KDFN and the TKC have negotiated land claims with the territorial and federal government. The First Nation population of Whitehorse makes up 19 percent of the community, compared to 25 percent for the Yukon as a whole (Yukon Bureau of Statistics 2008).

Whitehorse is the government centre of Yukon, which provides support and stability to the community and economy. Government is the major employer, accounting for approximately 20 percent of the total employment. The city also has a diversified business sector, providing services to the entire Territory.

The city's economy is still tied closely to the mining sector, and many of the businesses that service the industry have headquarters in the city. Whitehorse has experienced many booms and busts as a result of the mining industry. Presently, there is an increased demand for natural resources which has stimulated investments in Yukon mineral exploration and in developing new mines. Due to Whitehorse's position as the centre for government and business services, its history in mineral exploration and development, and its growing population and economy, the community has the capacity to support new mining projects.

5.1 SOCIAL CONTEXT

Social Background

Before European contact, the Whitehorse area was used seasonally by First Nations people for salmon harvesting at fish camps along the Yukon River. This was part of a seasonal movement throughout the area by First Nation people, to fish, hunt, trap and trade. These peoples were of Southern Tutchone and Tagish decent originating in the Yukon interior, and Tlingit people from the west coast also frequently visited the area for trade, as well as those from the north and east (Kaska, Han and Gwitch'in). Archaeology digs around the Whitehorse area date use of the area for hunting and fishing camps back to 5,000 years (City of Whitehorse 2010).

The Whitehorse area was first settled in 1897 during the Klondike Gold Rush, where it developed as a transportation hub due to its strategic location at the head of the navigable portion of the Yukon River (City of Whitehorse 2010). In 1900, the White Pass & Yukon Route Railway was completed, linking Whitehorse with the Alaskan port of Skagway, providing better access to the gold fields and serving as a centre for goods coming in and out of the territory. Whitehorse grew rapidly over the next few decades as businesses and industries were developed.

While many of the prospectors were on their way to the Klondike, some discovered copper in the hills near Whitehorse (City of Whitehorse 2010). This band of hills that extends 30 km west of the city is known as the Whitehorse Copper Belt, with the first claims staked in 1898. In these early days, there were numerous mines in operation (Table 16). Copper ore shipments began in 1900 and continued through to 1920. In 1909 the White Pass & Yukon Route built a railway spur to the Pueblo Mine of the Copper Belt along a route which was later used by the Copper Haul Road. The Pueblo Mine contained the richest ore and employed 20 people at one point. The site was abandoned in 1917 after the collapse of the underground mine which killed six miners. The site is now the location of the Icy Waters Fish plant.

There was little activity in the Copper Belt from 1920–1945, but mining resumed after World War II and continued until the 1980s (City of Whitehorse 2010). This second wave of copper mining was made possible with the aid of new geophysical and geochemical exploration techniques able to detect buried deposits. Several new deposits were discovered and some of the older mines were re-developed (Table 17). A mill was constructed at the Whitehorse Copper Mine in 1966, and open-pit mining followed quickly after. Underground mining commenced in 1972 until the ore at the Little Chief open pit was depleted in 1982.

Whitehorse underwent another large transformation during World War II when the United States Army built the Alaska Highway from Dawson Creek, British Columbia to Fairbanks, Alaska to allow for a year-round freight route to Alaska (City of Whitehorse 2010). Whitehorse's location at the halfway point and its rail access to the Pacific Coast served as the principle distribution point for the construction. The 2,500 km road was completed in 1942, and Whitehorse was quickly flooded with US army troops and civilian workers. After the war, the city's economy diversified to include mining, prospecting, transportation, services, government and tourism. The city was incorporated in 1950, with a mayor and four-member council elected, and in 1953 became the capital of the Yukon.

Community Infrastructure and Services

Whitehorse is the capital of Yukon Territory, and is the centre of all government activities. It is also the largest community in Yukon and is the base for the majority of businesses and industries that operate in the territory. Whitehorse provides all the major government services that would be expected for a larger Canadian centre, in terms of health care, education, public safety and other social services. Infrastructure is also reflective of population size and the community's position as the capital of the territory with a public transit system; municipal sewer, drinking water and treatment facilities; an electrical grid; and telephone, internet and cable services. There are a variety of facilities for recreational, arts and cultural activities and a varied retail, restaurant and accommodation business sector.

Aesthetics

Aesthetic values are difficult to quantify or qualify, unless one is talking about a specific area or site (e.g., a scenic viewpoint off the highway). In general, aesthetic values are considered in terms of the natural beauty and wilderness values of the area. As identified in the 2010 Official Community Plan, Whitehorse residents value the natural beauty and closeness to nature that the city offers (City of Whitehorse 2010). These values can be diminished by development either in a visual sense and/or by unpleasant smells or sounds. The Project Area is outside of the city centre and is surrounded by forest and mountains, as well as some industrial use. Therefore, the surrounding aesthetic values would likely be considered low to moderate, considering there is some industrial use of the area resulting in dust and noise at certain times, but there is also some natural and wilderness value to the area as well. The Project Area itself is a decommissioned mine where the natural values have been diminished with the removal of the forest, movement of earth, the processing of ore, and the development of roads and tailings ponds.

Heritage Resources

Heritage resources refer to both archaeological and historical sites. Archaeology sites are related to First Nation people's occupation and use of North America prior to European contact. This period may span from 50,000 years ago to the present. Historic sites are associated with European exploration, settlement and development and in Yukon are often related to the fur trade, gold rush or World War II. Sites are only considered 'historic sites' when they are more than 50 years of age.

Heritage resources within the Project Area directly within the existing mine footprint would have been lost during operation of the mine, and there is no potential for recovery (C. Thomas, pers. comm. 2010). However the peripheral areas that have not been impacted by historic mining activities do have moderate potential for the presence of archaeological sites and moderate to high potential for historic sites related to early Copper Belt prospecting and ore transport (C. Thomas, pers. comm. 2010).

The Project Area includes the historic Little Chief and Middle Chief deposits that were staked in the late 1800s but were not fully developed until 1967 because the deposits were low grade. Compiled research on potential historic sites indicates that there are remains of the railway spur line that connected the Whitehorse Copper Belt mines to the White Pass & Yukon Route Railway, as well as remnants of the loading site and tramline towers on the Little Chief claims (Lot 57) (B. Hogan, pers. comm. 2010). These resources have yet to be investigated by the Cultural Services Branch to determine their significance and condition, and they would have to be recorded before any development occurs in their immediate area (B. Hogan, pers. comm. 2010).

Land and Resource Use

Land and resource use can be divided into '*traditional and domestic*' and '*commercial*' uses. Traditional and domestic uses refer to subsistence and cultural activities undertaken by traditional land users (i.e., First Nation residents) as well as subsistence, residential and recreation activities undertaken by domestic users (i.e., non First-Nation residents). Commercial uses refer to use of the land and resources for commercial purposes, including mining, industrial activities, and tourism. Land and resource use in the Project Area is dominated by recreational activities, followed by industrial/commercial and residential use as delineated in the land tenure section.

Traditional and Domestic Uses

Hunting and fishing do not occur in the Project Area, as there are no fish bearing lakes or streams within the Project Area and there is no hunting permitted within city limits. The area surrounding the project area is within a registered trapping concession (number 409) that covers most of the Whitehorse area south of the Fish Lake Road. However, traplines are limited to forested areas and are only in use between October 1 and March 31, depending on the open trapping season for target species. Other traditional and domestic uses including plant gathering and wood harvesting are also limited to forested areas and thus do not occur in the Project Area. Recreational use remains the main activity in the Project Area and it is one of the more dominant land uses in the surrounding area.

The Mt. Sima Road which provides access to the Project Area also provides access to the Mt. Sima Ski Hill and numerous multi-use recreational trails, including the Trans Canada Trail which follows the Copper Haul Trail to the west of the Project Area. Use of the ski hill is limited to the winter, generally from November to April, however the operators have acquired funding to build a summer adventure park to allow for year round use of the ski hill (use of the ski hill area is also partly considered commercial use). The surrounding trail system is used year round for snowmobiling, cross-country skiing, snowshoeing, dog sledding, biking, hiking and ATV use. In the winter, there are numerous snowmobile trails built and maintained mostly by the Klondike Snowmobile Association and the City of Whitehorse. The Copper Haul Trail is a major trail that connects many multi-use trail areas around Whitehorse, from Fish Lake Road in the north, down past the Wolf Creek country-residential subdivision in the south. It is accessible via the Fish Lake Road, Mt. Sima Road, and several 'Urban Connector' trails that lead to various residential subdivisions of Whitehorse. The majority of these trails are multi-use; however, some are designated as non-motorized only. There is evidence that ATV users use the road networks and tailings areas during the summer, and during the winter there is a snowmobile trail that runs through the site to access the Copper Haul Trail.

Residential land use is located adjacent to the Project Area in the Canyon Crescent subdivision, 400 m northeast of the 'A Valley'. The Mt. Sima Country Residential Subdivision is located approximately 1.7 km southeast of the southern extent of the Project Area.

Commercial Uses

Commercial use of the surrounding area includes gravel quarries, heavy machinery storage facilities, other commercial storage facilities, mineral preparation laboratories, and other commercial ventures. Other commercial land uses such as forestry, hydroelectric development, commercial fishing, oil and gas, and guide outfitting do not occur within or adjacent to the Project Area. Mining and exploration has a history in the area and exploration still likely occurs in surrounding areas to a small extent. There is currently a shortage of land that is properly zoned for industrial uses within the city. The Mt. Sima – Whitehorse Copper Area is one of the few areas within the city that has potential for future industrial lot development.

Table 16.Production of copper ore from early day Copper Belt mines (1898–1920). (Data Source: Watson 1984).

Mine	Dates of operation	Tonnes of ore produced
Arctic Chief	1899–1907	202
Grafter	1899–1917	12,200
War Eagle	1899–1915	900
Pueblo	1899–1917	127,635
Copper King	1898–1920	5,317
Carlisle	1900–1910	907

Table 17.Production of copper ore from later day Copper Belt mines (1967–1982). (Data Source: Watson 1984)

Mine	Dates of operation	Tonnes of ore produced
Little Chief	1967–1982	8,236,400
Black Cub S.	1971	187,000 (20,000 reserve)
Gem	1967–1970	625,000 (reserve)
Arctic Chief	1968–1969	201,800
War Eagle	1970–1971	899,000
Keewenaw	1971	159,000 (202,000 reserve)

5.2 ECONOMY

The 2008 Gross Domestic Product (GDP) figure for the Yukon is $1,903 million (M). This was an increase of 9.7 percent from 2007, compared to a national GDP percentage increase of 4.4 percent over the same period (Yukon Bureau of Statistics 2010b). GDP is a measure of the value of the Yukon's total production of goods and services. Mineral production, in particular, contributed $209 M to the GDP value in 2008, up from $46 M in 2006 and $74 M in 2007 (note, the 2008 mineral production value is preliminary and may be revised).

The total Yukon GDP by industry in 2008 was $1,425 M with a growth rate of 4.3 percent from 2007 to 2008 (Yukon Bureau of Statistics 2009). In 2008, the largest increase was seen in the *'Mining & Quarrying and Oil & Gas Extraction'* sector, with an increase of $26 M, or 56.3 percent from 2007. This sector only represents 5.1 percent of the total Yukon industry GDP, with *'Public Administration'* contributing the greatest share (22.8%), followed by *'Finance & Insurance, Real Estate and Renting & Leasing, and Management of Companies & Enterprises'* (18.0%), *'Construction*' (8.5%), and '*Health Care & Social Assistance'* (8.1%), etc.

The economy of Yukon is driven largely by public sector industries, whose contribution to the GDP tends to be around 40 percent of Yukon's overall economic activity, compared to the Canadian average of 15%. While Yukon's economy was traditionally supported by the mining sector, this industry has seen a lull in activity since the closure of the Faro mine in 1998. In 2004, mineral exploration began to pick up and in 2007, Sherwood Copper officially opened the Minto mine. Many other large quartz mining projects in the Yukon are moving forward from advanced exploration into construction and development in the next few years.

For a closer look at the local economy of Whitehorse, the following economic indicators are discussed below for the Project Area: *employment rates, level of education, occupational experience, and income level and cost of living*. Statistics are provided for the working-age population, those 15 years and older.

5.2.1 EMPLOYMENT RATES

The labour force in Yukon was 18,200 in September 2010, compared to 17,600 in September 2009 (Yukon Bureau of Statistics 2010c). The labour force includes those individuals 15 years of age and older and are either employed, or unemployed and actively looking for work. Out of the labour force 16,900 were employed and 1,300 were unemployed, resulting in an unemployment rate of 7.1 percent and for the territory. Comparably, the unemployment rate in 2009 was 6.3 percent in September. The unemployment rate in Canada was 8.0 percent at this time.

According to the 2006 Statistics Canada census, Whitehorse had an unemployment rate of 7.4 percent, compared to the overall Yukon unemployment rate at that time of 9.4 percent (Statistics Canada 2006).

5.2.2 LEVEL OF EDUCATION/TRAINING

In Whitehorse, 25 percent of the working-age population had a *'college or other non-university certificate or diploma'* (Statistics Canada 2006; Figure 4). Another 24 percent had acquired their *'high school diploma or equivalent'* as their highest level of education. Both of these values are comparable with the Yukon-wide figures. The proportion of the Whitehorse working-age population *'without a certificate, diploma or degree*' represents 20 percent of the population, while the Yukon-wide value was slightly higher at 23 percent. Another 20 percent of the Whitehorse population had a *'university certificate, diploma or degree*' which was slightly higher than the Yukon-wide value of 18 percent. A smaller proportion of the population had *'apprenticeship or trades training'*, 11 percent, compared to 12 percent for the territory.

5.2.3 OCCUPATIONAL EXPERIENCE

The largest proportion of the Whitehorse working-age population is experienced in *'sales and service occupations'* (23%) (Statistics Canada 2006). Second is *'business, finance and administration occupations'* (17%) and third, *'trades, transport and equipment operator occupations*' (15%). These figures are very comparable to Yukon-wide statistics.

5.2.4 INCOME LEVEL AND COST OF LIVING

Median incomes after tax for the working age population in Whitehorse were $30,819 compared to the Yukon-wide statistic of $28,519 in 2005 (Statistics Canada 2006). A more recent value for the territory was $37,343 in 2007, but no value for Whitehorse was available (Yukon Bureau of Statistics 2010d).

The average price of a single house in Whitehorse was $330,200 for the first quarter of 2010. This value is lower than the highest recorded average house price in Whitehorse of $334,900, from the second quarter of 2008 (Yukon Bureau of Statistics 2010e; Figure 5). Over the past six years, the average house price has increased by 75 percent, taking into account the inflation rate over that period of 12.2 percent.

The median rent for an apartment in Whitehorse was $775 per month, as of September 2010, ranging from a median rent of $675 for a bachelor suite to $850 for a 3+ bedroom rental (Yukon Bureau of

Statistics 2010f; Table 18). The apartment vacancy rate in Whitehorse was 0.8% in September 2010, representing seven vacant apartments out of the 837 apartments surveyed. Vacancy rates in Whitehorse have fluctuated over the years due to various booms and busts in the economy. From 2002 to 2004, the vacancy rate fluctuated between 4.0 percent and 9.2 percent, but began to decline further in 2005. The vacancy rate was 0.6 percent in June 2010, the lowest recorded since the record low of 0.3 percent in September 1988.

The demand for housing and rental suites in Whitehorse is influenced by complex interactions between demographic and economic factors which are beyond the scope of this baseline study. However, it is known that in 2003 demand for housing in Whitehorse began to increase, and the previously built-up supply of housing became depleted (City of Whitehorse 2010). In recent years, the municipal and territorial governments have been working to alleviate some of the present and future demand for housing through the planning of new residential developments. These development areas include the newly proposed Ingram Subdivision, the Motorways Property, the Takhini North Neighbourhood, the new Porter Creek residential lots, and the Whistle Bend community. Many of these properties are made available through a lottery process administered by the Lands Management Branch. The largest development of those mentioned above is the Whistle Bend development which is planned to house 8,000 people (lots available in 2012 and 2013).

While Whitehorse has the most expensive housing and rental costs in the Yukon, the fuel and other goods and services are generally lower than in other Yukon communities. Motor fuel prices have remained steady during the last nine months of 2010 at 112.9 cents per litre (Figure 6) and residential heating fuel prices have also remained fairly steady at 100.0 cents per litre (Yukon Bureau of Statistics 2010g; Figure 7). Note, as compared to cities in southern Canada, goods and services are slightly higher in Whitehorse.

Table 18.Median rent and vacancy rates by apartment size for apartments in Whitehorse, September 2010. (Data Source: Yukon Bureau of Statistics 2010f)

Apartment size	Median rent	Vacancy rates (%)
All	$775	0.80
Bachelor	$675	0.18
1 Bedroom	$750	0.70
2 Bedroom	$800	0.80
3+ Bedroom	$850	0.00

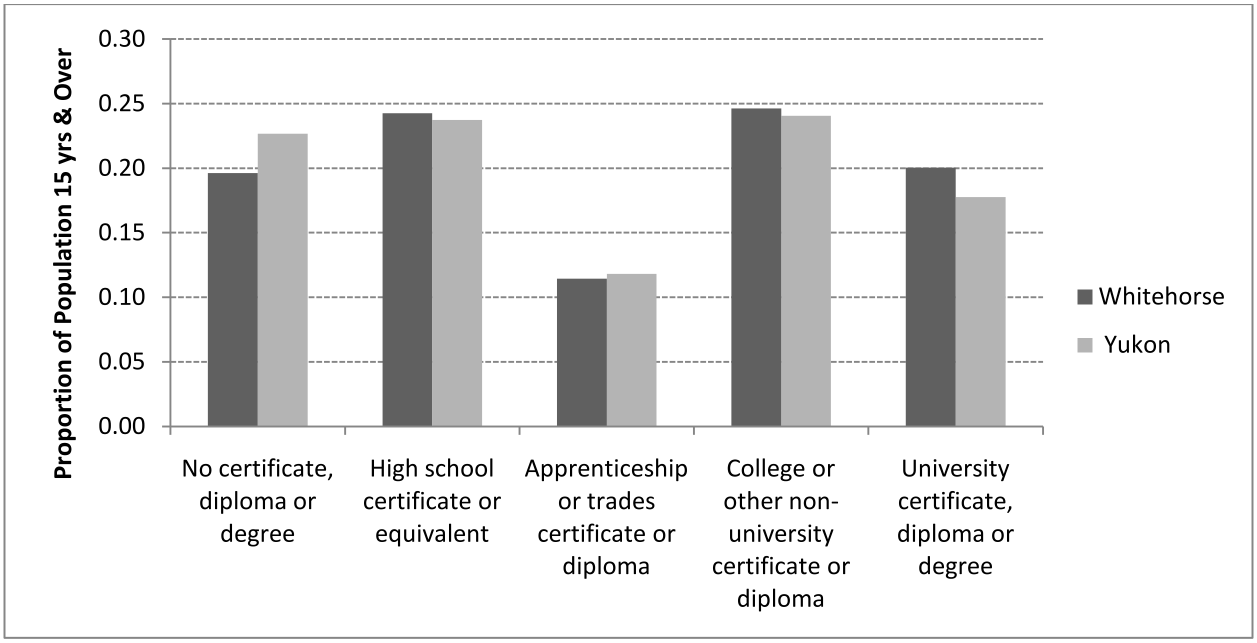

Figure 4. Proportion of the Whitehorse working-age population in specified education/training categories. (Data Source: Statistics Canada 2006)

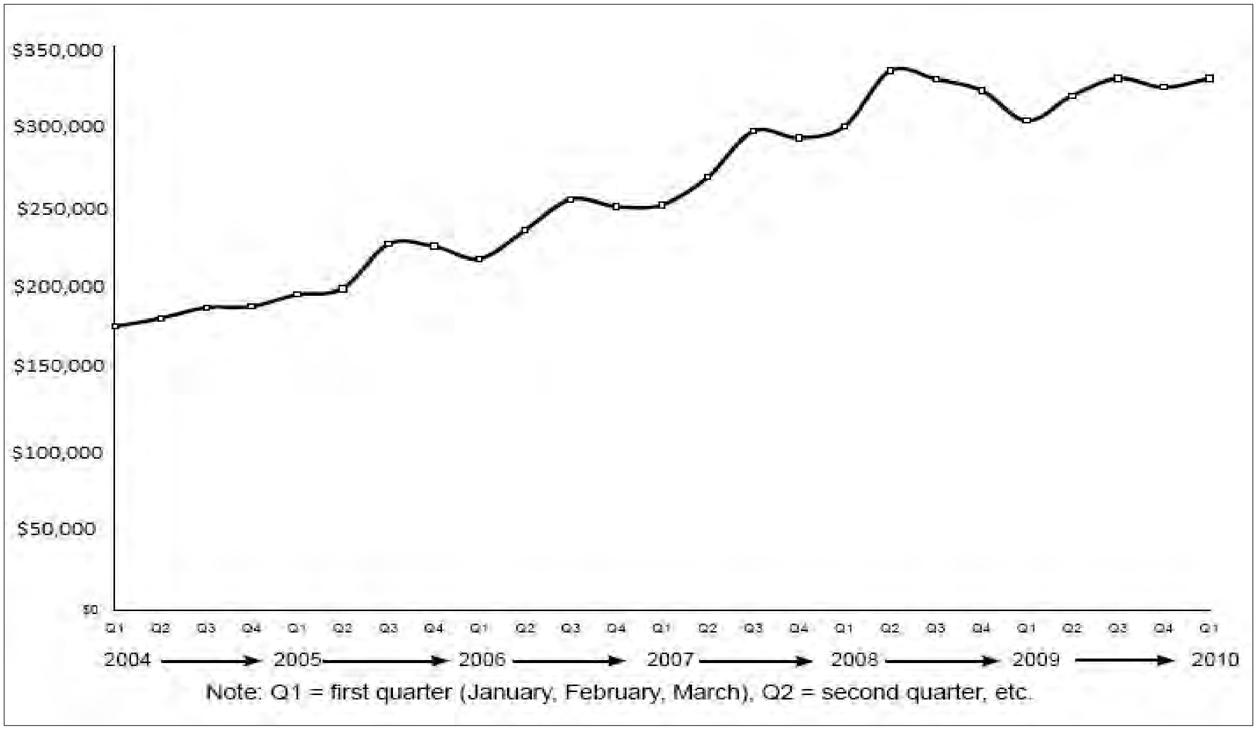

Figure 5. Average single house prices in Whitehorse from the first quarter of 2004 to the first quarter of 2010 (Chart adapted from Yukon Bureau of Statistics 2010e, p.4).

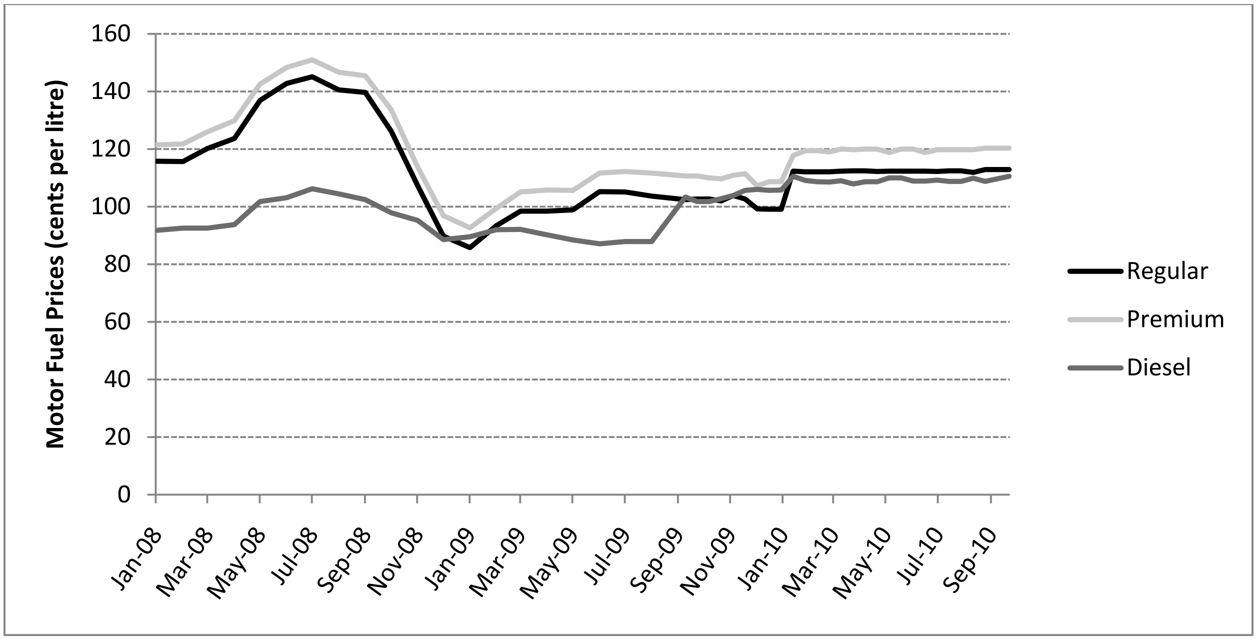

Figure 6. Motor fuel prices in Whitehorse, Yukon from January 2008 to September 2010. (Data Source: Yukon Bureau of Statistics 2010g)

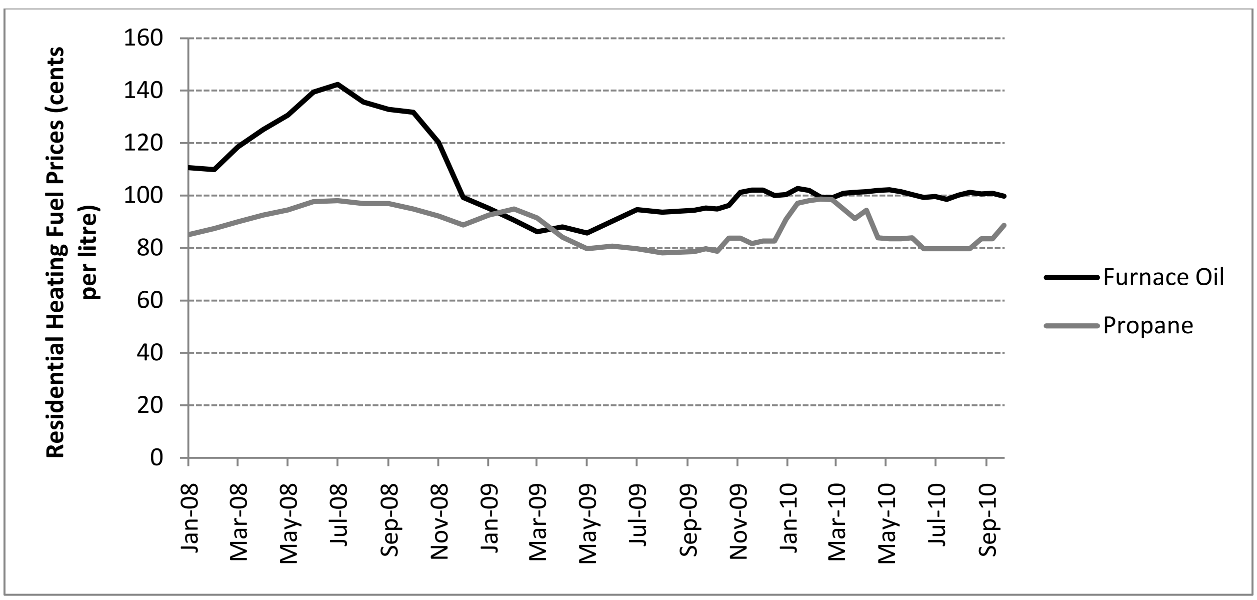

Figure 7. Residential heating fuel prices in Whitehorse, Yukon from January 2008 to September 2010. (Data from Yukon Bureau of Statistics 2010g)

6 NOISE

The Project Area is situated in a part of Whitehorse where ambient noise consists of both human-induced and natural sounds. The area is exposed to considerable sources of noise from surrounding land uses and activities.

The recent development of the Mt. Sima Residential Subdivision resulted in an increase in noise from residential construction (e.g., air compressors, pneumatic nail guns, electric saws, cranes) and residential activities (e.g., ATVs, chainsaws, barking dogs). The Mt. Sima Ski Hill generates considerable noise from the chair lift, tow rope and snow making equipment. The Mt. Sima Industrial Subdivision includes several businesses that produce noise from heavy equipment operation and other on site industrial activities. Also, there is an active gravel extraction operation directly adjacent to the proposed project site.

Mt. Sima Road is a public and partially paved main access road to the Project site and to the surrounding residential, recreational and commercial/industrial areas. There is considerable traffic associated with some of the local land uses. Traffic noise sources are seasonal (no traffic data is available to support this statement; however, as the ski hill is currently the primary destination, it seems logical that light vehicle traffic volumes are higher in winter). In the summer, there is likely more industrial traffic than in winter because construction, mining and other industrial equipment is stored in the subdivision during winter. Many of the vehicles that travel the road in winter are passenger vehicles traveling to the ski hill or off-road vehicles passing through the area to access the alpine.

7 TRAFFIC

The proposed project plans to transport the reprocessed tailings by truck along the Mt. Sima Road, the Alaska Highway, and the Klondike Highway. The Alaska and Klondike highways along this transportation route are among the most heavily used roads in Yukon.

Mt. Sima Road is a municipal road primarily used to by Whitehorse residents to access the Mt. Sima Industrial Park and in winter it is used to access the Mt. Sima Ski Hill. The road is also used by some residents of the Whitehorse Copper subdivision as a commuting route. Government of Yukon Highways and Public Works and the City of Whitehorse were contacted for Mt. Sima Road traffic volumes, however, there is no current data available for use. The area has changed significantly since the last traffic count because of the addition of the new Whitehorse Copper residential subdivision and the expansion of Mt. Sima Industrial Park.

The Alaska Highway is primarily used as a commuting route for residents south of the Whitehorse city centre. The highway also has large transport trucks continuously travelling to and from Yukon and Alaska. In 2008, the average daily traffic volume along the Alaska Highway at Fox Farm Road (km 1,411.6) was 5,645 vehicles/day for the entire year and 6,620 vehicles/day during the summer (Highways and Public Works 2009). Summer volumes are calculated between May 1 and September 30. In the summer, traffic volumes likely increase primarily because of tourist traffic.

The Klondike Highway is a major transportation corridor in Yukon. Residents of the Carcross and Tagish area and people living along the highway (e.g., Annie Lake Road) use the road to either commute to jobs or access Whitehorse's facilities and shopping. Many Yukon residents use the road to travel to Alaska for recreation. It has been used to transport ore to the Skagway port facility, and currently the Minto Mine transports ore using the Klondike Highway. The highway is also a major tourism corridor for private travellers and tour companies that bring thousands of people to Yukon every summer. In 2009, the average daily traffic volume at the Carcross Corner was 1,161 vehicles per day and in the summer was 1445 vehicles/day. In 2009, the average daily traffic volume south of Carcross was 898 vehicles/day (353 sample days) and in the summer was 1,224 vehicles/day. In 2008, the average daily traffic volume on the Klondike Highway at the Fraser border crossing was 219 during entire year and 437 during the summer (May 1–September 30). The breakdown of northbound traffic entering Canada on the Klondike Highway in 2008 was 28,153 cars, 4,523 buses, 2,660 trucks, and 2,027 pedestrians (Highways and Public Works 2009).

Table 19. Summary of the most recent available average daily summer traffic along the proposed ore shipping route (May 1–September 30).
(Traffic volumes include traffic travelling in both directions.)

Year	Mt. Sima Road	Alaska Highway at Fox Farm Road (km 1411.6)	Klondike Highway at Carcross Corner (km 157.7)	Klondike Highway south of Carcross (km 106.3)	Klondike Highway at Canada-USA border (km 24.1)
2005	NA	NA	1,368	1,159	505
2006	NA	NA	1,379	1,153	417
2007	NA	NA	1,403	1,221	435
2008	NA	6,620	1,376	1,158	437
2009	NA	NA	1,445	1,224	NA
Max. (year)	NA	6,620 (2008)	1,573 (1998)[a]	1,268 (1998)	518 (1996)
Min (year)	NA	6,620 (2008)	792 (1984)	1,094 (1993)	343 (1988)

Notes:
[a] Traffic volume is based on 145 days of data.

Table 20. Annual breakdown of the type of northbound highway vehicles crossing the Canada-USA border during the summer months.

Year	Passenger cars	Buses	Trucks
2005	34,254	3,735	1,935
2006	29,599	3,973	1,885
2007	27,165 1	4,570 1	1,640 a
2008	28,153	4,523	2,660
2009	NA	NA	NA
Max. (year)	40,566 (1997)	4,570 (2007)[a]	12,915 (1996)
Min (year)	27,165 (2007)[a]	1,254 (1994)	1,370 (2001)

Notes:
[a] Traffic volume is based on 334 days of data.

8 POTENTIAL EFFECTS AND PROPOSED MITIGATION MEASURES

This section summarizes the predicted potential environmental and socio-economic effects of the project on the identified valued components. We identify and describe each of the project activities that could cause adverse effects to the valued components. For each valued component, we explain how the project will change the components compared to baseline conditions and describe mitigation necessary to remove or reduce potential negative effects.

8.1 IDENTIFICATION OF VALUED ENVIRONMENTAL AND SOCIO-ECONOMIC COMPONENTS

To evaluate the potential effect of the proposed project, we identify valued environmental and socio-economic components (VESECs) that could potentially be affected by the project. VESECs were identified through meetings with stakeholders of the project area. The project has held meetings with all local governments, local industry, non-governmental organizations and public through presentations and workshops.

The project has met with:

1. City of Whitehorse:
   - Mayor and Council
   - Engineering
   - Parks and Recreation
   - Planning
2. Government of Yukon:
   - Premier
   - Economic Development
   - Energy, Mines and Resources
   - Environment
   - Highways and Public Works
   - Community Services
3. Klondike Snowmobile Association
4. Kwanlin Dün First Nation
5. Ta'an Kwäch'än Council
6. Whitehorse Chamber of Commerce
7. Whitehorse Public, through a public meeting 19 October 2010 (12 individuals in attendance at the Mt. Sima Lodge)

8. Yukon Chamber of Mines
9. Yukon Conservation Society
10. Yukon Indian Development Corporation

Identified VESECs:

- Wildlife
- Water quality
- Air quality
- Public health and safety
- Land and resource use
- Local aesthetics
- Economic resources

Regionally important VESECs that will not be impacted by this project include fish and fish habitat, heritage resources, public health and safety through transport of dangerous goods, and wildlife (bird) habitat.

- There are no fish within or near the project site. The closest fish bearing water bodies are McLean Lake and the Yukon River. The project will not interact with these water bodies, and therefore no fish or fish habitat will be adversely affected by project activities.
- There are heritage resources near the project site, but the project will only occur on land currently impacted by the previous mining activity. Should any artifacts be uncovered during project operation, project activities will cease in the area until the Government of Yukon Heritage Resources are able to investigate. Therefore, no heritage resources will be adversely impacted by project activities.
- The project will not require transportation of dangerous goods; therefore, there will be no risk to public health and safety because of transportation of dangerous goods.
- The project footprint contains very poor bird nesting habitat; consequently, wildlife (bird) habitat will not be affected by project activities.
- The area is not known to have value as traditional land uses. There are several blocks of settlement land around the project site, but these lands will not be affected by project activities.

8.1.1 WILDLIFE

Consultation with stakeholders identified that people were aware of wildlife using the area and that there is a small concern that the project activities may impact the abundance and distribution of wildlife in the area through reduction of habitat availability, interference with seasonal movements and/or increased mortality because of collisions with ore trucks. Key species in the Southern Lakes region are moose and woodland caribou. Moose and caribou are a valued harvested species across the Yukon and both species have been declining in abundance in the Southern Lakes during the previous several decades. The northern mountain woodland caribou population is listed as a species of special concern. The local caribou herds, Carcross and Ibex herds, have been recovering from recent population lows that were thought to be mostly cause by overharvest.

8.1.2 WATER QUALITY

The Project area is located upstream of a number of residential areas, and ultimately the Yukon River. It is important that the surface and groundwater quality in the area be preserved as it is used as a domestic water supply source for people living downstream of the site. Also, though there are no fisheries values present on site, the Yukon River is an important fish-bearing watercourse. In addition the wetland areas surrounding the site are likely home to some amphibian species, and used as a drinking water source for wildlife in the area.

8.1.3 AIR QUALITY

The primary air quality concern is increased dust dispersal. Residents of the Canyon Crescent residential subdivision identified dust as a current nuisance and industrial activity on site has the potential to increase dust dispersal. The potential for increased dust dispersal due to project activities is addressed. Emissions of greenhouse gases have become a global concern; consequently, we generally discuss the impact of CO_2 emission context greenhouse gas emissions and use CO_2 as an indicator of other emissions from the project site.

8.1.4 LAND AND RESOURCE USE

Concerns were raised that the project could potentially affect the current and future land uses in the area through destruction of a recreational trail, the enjoyment of recreational activities in the area, and the usability of the land after reclamation is complete. The area is a heavily used for winter recreation and contains an abundance of recreational trails, the Trans Canada Trail and the Mt. Sima Ski Hill. The Mt. Sima Ski Hill expanded operations in 2009 to include summer activities, such as downhill mountain-biking, and has recently been awarded 1.5 million dollars to develop further recreation infrastructure and activities. A reduction in recreational opportunities and enjoyment in the area would be considered an adverse effect of the project. The project area is currently zoned as light and heavy industrial by the City of Whitehorse, and is one of few industrial areas within the city that is available for future industrial lots. Changes to or removal of any future potential for industrial lots would be considered an adverse effect of the project.

8.1.5 LOCAL AESTHETICS

The local aesthetics of the project area was raised as a valued component by Whitehorse residents. Concerns were raised that project activities could potentially affect the local aesthetic of the area through increased light and noise from excavation, reprocessing and transportation activities that will take place on site.

8.1.6 PUBLIC HEALTH AND SAFETY

Public health and safety was identified as a valued component. Concerns were raised that project activities could potentially affect public safety through increased traffic volumes from ore trucking along the transportation route, dispersal of tailings dust away from the site and landscape alteration of the site. Increased traffic was identified as an issue because large trucks transporting ore to the shipping facility could cause a transportation safety issue along the transport route. Increase dust deposition from project activities was identified as a concern; we address dust issues in the air quality assessment. Landscape alteration of the site was identified because there was concern that the project would create landscape hazards that could be a danger for local residents. Hazards could affect public safety because local residents traverse the site while recreating in winter (see Section 5.2).

8.1.7 ECONOMIC RESOURCES

Maintaining and improving the local and regional economy around Whitehorse is important to local residents. The number of employment positions as well as the duration of these jobs is important to the community, as the 'boom and bust' effect often associated with industrial developments does not contribute to stable society. Also, it is important to investigate the potential negative impacts to other local business that may be affected by this Project. Finally economic effects to local First Nations must be investigated.

8.2 PROJECT SCOPE

This section describes the project activities that have the potential to adversely affect the identified valued components. This project has identified four project activities that could impact the identified valued component, these include: construction of the reprocessing facility, excavation and reprocessing of the tailings, transportation of ore, and reclamation of the site (Table 21).

Table 21.Summary of Whitehorse Copper Reclamation project activities.

Project activity	Description	Geographic extent
Construction of plant	The project requires construction of a plant to reprocess the tailings. The reprocessing plant will be constructed on an existing foundation that remains from the original Whitehorse Copper mine.	Project site
Excavation and reprocessing of tailings	The project requires excavation of tailings and transport of the tailings to the plant for reprocessing. Reprocessing will use a magnetic method to remove the magnetite from the tailings. The barren tailings will be used to reclaim the Little Chief open pit.	Project site
Transportation of ore	The project proposes to transport ore using 50 ton trucks from the reprocessing plant to the Skagway shipping facility.	The proposed ore transport route is the project site to the Yukon-BC border on the Klondike Highway
Reclamation of site	Reclamation of the site will include filling of the Little Chief open pit and subsidence with reprocessed barren waste tailings, removal of tailings from the A and B valleys, reclamation of the A and B valleys, alteration of dam structures to remove the potential forming of lakes, and resurfacing/adjusting the Old Pond area for future industrial use.	Project site

8.3 IMPACT ASSESSMENT

8.3.1 WILDLIFE

The project is expected to have a not significant effect on wildlife habitat or mortality.

Habitat

The project activities will not interact with key wildlife in the area. Project activities will increase disturbance in the area which could cause avoidance of the area by wildlife; however, the project site and surrounding area is not recognized as important wildlife habitat (see Section 2.2). This site was a past location of intense mining activity, is zoned as an industrial area by the City of Whitehorse's OCP, and is currently a disturbed area bordered by active industrial, residential and recreational properties. The habitat within and around the project site is used by very few wildlife, the project site is not considered critical habitat for local wildlife, and there are no species of conservation concern that commonly occur on the site. The footprint of the project site is not suitable as foraging habitat because tailings are essentially barren of vegetation. Critical habitat identified for local key wildlife is generally winter range. The footprint of the project site does not occur on winter range of moose and caribou, and project activities will not occur during the winter months, so will not cause a reduction in functional winter habitat around the project site because of sensory disturbance. The Project will notify conservation officers at Yukon Environment about any problem wildlife, ensure that wildlife moving across the project are given the right-of-way and will allow animals suitable time to travel across the site without causing unnecessary stress. No mitigations will be necessary to eliminate potential effects to wildlife at the project site.

The project area is essentially barren and likely provides very limited bird nesting habitat and the project does not require much clearing of land that could be used as nesting habitat—the only clearing will be the bypass trail for recreational users of the area—but, clearing could result in the destruction of bird nests. To mitigate the destruction of bird nests, the Project will complete all clearing prior to the bird nesting season (1 May–15 July).

Once the project is completed, reclamation of the A and B valleys will increase the availability of habitat for all wildlife that occurs in the general area. Reclamation will almost immediately increase the availability of winter habitat for moose. The reclaimed area will also provide nesting and foraging habitat for birds.

Mortality

Industrial projects that occur in Yukon are often scrutinized for their potential to indirectly cause increased mortality of harvest species through increased access for harvesters. Easier access into areas that previously had limited access has resulted in overharvest of target game species in other parts of Yukon. Overharvest should no longer be an issue in the Southern Lakes region because all harvesters can now be regulated. Both local First Nations have signed Final Agreements and Self-Governing Agreements, which mean that all beneficiaries can have their harvest regulated (UFA, Chapter 16). Managing and mitigating the increased access on harvest is the responsibility of First Nation governments and the Government of Yukon. Furthermore, discharging of firearms is illegal within the City of Whitehorse. This project will not result in increased harvest of moose or caribou.

Direct mortality of wildlife because of collisions with ore trucks is a potential issue. Trucks hauling ore to Skagway will pass through key caribou winter range along the Klondike Highway; however, the trucks will only be transporting the ore during summers, so there should be no interactions with caribou along the highway. Moose mortality could occur along the route. Trucks will be travelling slowly enough on the Mt. Sima Road that potential for collisions should be very low, but trucks travelling on the highways could collide with moose, particularly during night driving. The mitigation options for preventing moose mortality are limited, so the Project will monitor moose mortality caused by ore trucks travelling the highways.

8.3.2 WATER QUALITY

The Project is anticipated to have a not significant impact on the surface or groundwater quality due to reprocessing and reclamation activities.

Access Consulting Group (Access) was contracted by Eagle Industrial Mineral to conduct a geochemical assessment of the tailings. The report, *Whitehorse Copper Tailings Reprocessing Geoenvironmental Characterization Report* (Access, 2011), is submitted as a supporting document to this Project proposal. The following text summarizes the results and impact analysis presented in that report.

Geoenvironmental testing was conducted on samples collected in 2010 to assess the potential for acid rock drainage and metal leaching in the reprocessed tailings and waste rock. Testing techniques included acid base accounting, carbon-sulphur analysis, mineralogical analysis, shake flask testing, kinetic testing and standard water quality testing. Tests were completed using de-ionized water to represent meteoric water interactions, and water from the Little Chief open pit was also used for the tailings shake flask tests. Using water from the Little Chief open pit for the shake flask tests provided an account of potential dissolved metal content in the process water. The detailed methods, results and predicted potential impacts are reported in Access (2011).

There are no surface water connections between the Project area and downgradient surface water environments or fish bearing aquatic environments (Section 3.1). The site is hydrologically connected only through groundwater to the closest receiving environment, the Yukon River. The residential groundwater wells that are considered to be impacted by past mining activities are described in Access (2011) Surface water quality was considered for this assessment, but the assessment of water quality impacts is focussed on groundwater quality in the drainages delineated in Figure 3.

To assess the potential impact of the project on water quality, geochemical test results were compared to CCME Freshwater and Aquatic Life guidelines (CCME-FAL). CCME-FAL guidelines were used because these guidelines are more conservative than Health Canada's Drinking Water Guidelines. The basic reclamation plan described in the project description (Volume 1) identifies the removal of tailings from A Valley and B Valley and the placement of the reprocessed materials in the Little Chief open pit, subsidence areas and the Old Pond (Figure 3). These proposed project activities will have a lower level of disturbance than the previous mining activity. This assessment considers the impacts on groundwater quality resulting from relocation of reprocessed materials and waste rock within the groundwater drainages.

Acid Rock Drainage Potential

There will be no water quality impacts associated with acid rock drainage from the reprocessed tailings. Tests indicated that the tailings contain abundant neutralization potential and very small amounts of potentially acid producing material present, which in the Old Pond may already be partially exhausted (Access, 2011). Consequently, acid rock drainage is not an issue for the project.

Metal Leaching Potential

Metal leaching is expected to result in not significant impacts to groundwater quality in the Project area. Shake flask extraction testing showed that some metals could be mobilized during reprocessing of the tailings, but the expected magnitude of the increase in dissolved metals in the at the receiving environment is expected to be very low.

The majority of reprocessed tailings will be placed within the A Valley and Little Chief / Crater Lake groundwater drainages (Figure 3) which have natural dilution factors (based on footprint areas) of 34.4 and 6.2, respectively. Moving the tailings from these drainages to the open pit, subsidence areas and the Old Pond tailings site would increase the A Valley dilution factor to 7.3 and reduce the dilution factor of Little Chief/ Crater Lake to 23.2. The B Valley dilution factor would increase from 29.5 to 72.3. With the exception of 4.95 ha of the Old Pond that will remain within the B Valley drainage, project will remove of almost all tailings from this drainage (see Table 17 and 21 in Access, 2011).

The Little Chief open pit and Crater Lake groundwater drainage basin is 425.95 hectares (Figure 3). Two groundwater monitoring wells (shallow and deep) located in this basin upgradient of the Project Site (MW-N and MW-S) provides a basis for comparison to all other water quality sampling results. Crater Lake showed a CCME-FAL exceedence for copper and Health Canada Drinking Water Guideline exceedence for manganese and uranium (Appendix A).

The A Valley groundwater drainage area is 350.17 hectares, and the tailings occupy 56.62 ha (Figure 3), with a dilution factor of 6.2 (Access, 2011). Water quality samples from this drainage include surface water on the existing tailings, Copper Lake and Copper Seep, and one groundwater well in Canyon Crescent (91-1) (Figure 3). Sampling from 2010 shows that the Copper Seep immediately downgradient of the Old Pond exceeds CCME-FAL for total arsenic, copper, iron and manganese. Further downgradient, Copper Lake exceeds Health Canada Drinking Water guidelines for one metal, Manganese (Appendix A). The proposed removal of the A Valley tailings will increase the amount of surface area available for natural infiltration and recharge in the former A Valley tailings footprint area. Reprocessed tailings in A Valley will be confined to the existing Old Pond footprint and subsidence areas, and the overall dilution factor for A Valley will increase. There are no significant water quality impacts identified for A Valley. However, water quality monitoring at the Canyon

Crescent wells, surface water monitoring in Copper Lake, and future surface water pooling may be conducted to ensure that degradation to the groundwater system is not occurring.

The B Valley groundwater drainage area is 357.82 hectares, and the tailings occupy 4.95 ha, and 7.18 ha for the Old Pond and B Valley tailings areas, respectively (Figure 3). The proposed removal of tailings in B Valley for reprocessing and placement in either the Little Chief open pit or the Old Pond will reduce the tailings surface area to a total 4.95 ha corresponding with the portion of the Old Pond in the B Valley drainage (Access, 2011). The reduction of tailings surface area in the drainage decreases the tailings interaction with meteoric water and increases the dilution factor of the natural basin (Access, 2011). It is assumed that ground and surface water quality conditions in the B Valley drainage will improve or remain unchanged from baseline conditions with the removal of B Valley tailings and resulting natural re-vegetation. No significant water quality impacts are identified for the B Valley groundwater drainage basin. Water quality monitoring at the Canyon Crescent wells and surface water pooling may be conducted.

The receiving environment is unlikely to show substantial variation in dissolved metal concentrations that are outside of baseline variation already observed in the region. Shake flask extraction testing using Little Chief open pit surface water represents the maximum expected concentrations for dissolved metals from reprocessing of the tailings. The results of the shake flask tests indicate that the concentrations of dissolved copper, manganese, molybdenum and selenium increase, while the concentration of cadmium and zinc is expected decrease. The average magnitude of the increase in dissolved metal concentrations within the shake flask water ranges from 1.1 to 10 times the current Little Chief open pit water. The application of the drainage dilution factors to these expected increases in dissolved metals reduces the expected changes to groundwater quality to baseline conditions. The result that other metals did not mobilize during the test suggests that reprocessing of tailings should cause minimal change to groundwater quality for those constituents. Furthermore, any water that remains in the tailings during relocation on the project site will be diluted by meteoric and groundwater inputs. The level of disturbance associated with the project is much smaller than the original mining and the duration of the project is only 6–7 years, so it is reasonable to assume that the project will have a not significant impact on local groundwater.

Mitigation and Monitoring

Project mitigations were not identified beyond the overall intent reclaiming the tailings footprint in A and B Valleys. A surface and groundwater monitoring plan will be developed with as part of the Water License application and will address water quality monitoring during the construction, operation and post-closure phases of the project. Water quality monitoring will involve seasonal water sampling from the downgradient residential drinking water wells and the upgradient monitoring wells. Furthermore, the proponent will collect surface water samples every two months during operation from the same locations sampled during the baseline study. More frequent sampling can be considered during initial stages of operation. Monitoring will inform seasonal and annual variation in water quality, and help at quickly identifying potential water quality issues. The water quality monitoring plan will be refined during the water licensing process.

8.3.3 AIR QUALITY

The project is anticipated to have a not significant impact on local air quality through the dispersal of dust from project activities and/or the emission of air pollutants into the atmosphere from project activities.

Dust

It is possible that dust generated during project activities could be dispersed outside of the project area and could irritate residents in the Canyon Crescent subdivision and other land users in the area (recreationalists). Potential sources of dust include the tailings and the dirt road network. While the tailings actually contain 18–20 percent moisture and are much less prone to dispersion by wind, the surface layer has been subject to evaporation since the closure of the mine in 1982 and the fine dust surface layer is prone to wind erosion. Dust from the tailings pond is currently an issue for Canyon Crescent residents, but only during wind storms and only for short durations. During project activities, after the dry surface layer of tailings is excavated the rest of the tailings will have the higher moisture content and will be less prone to wind erosion. Also, as the tailings are excavated and processed on a site by site basis, sites will either be reclaimed through re-vegetation or resurfaced with gravel for future industrial land use, and thus any existing and future dust issues at the project site will be eliminated. Dust control measures (i.e., water trucks) will be employed as needed to reduce dispersal of dust generated from truck and equipment traffic on the project roads during project operation. Thus, air quality is not anticipated to be adversely affected by dust dispersal.

Emissions

The project will introduce carbon dioxide emissions to the atmosphere from operation of heavy equipment during construction and excavation, re-processing of the tailings at the plant, and transportation of ore to the port facility in Skagway. The project is connected to the electrical grid so will be powered using hydroelectric energy, and will avoid the use of diesel generators. Project activities will also occur during the summer months when demand for power is not at its peak, as opposed to winter months when large amounts of power are required for domestic heating purposes, and diesel is often used to meet demand (Yukon Energy 2008). Transportation of the recovered ore will require 30 round trips per day (total traffic volume of 60) between the re-processing plant and the Skagway port facility using 50 ton ore trucks. However, the project will only be in operation for approximately seven months of the year (in the summer) and thus will have far less impact on CO_2 emission as compared to similar projects that run year-round. The Project consulted with the White Pass & Yukon Route (WP&YR) on the possibility that ore shipments could be transported by rail to Skagway, and they are considering the project along with other potential demand from industrial projects in the area. The Yukon Government does not have CO_2 emissions standards or policy/legislation in place at this time, so it cannot be determined whether this project will have a significant adverse effect on air quality through CO_2 emissions. However, while it is not possible to eliminate all emissions from this project, there is the potential for the reclamation of the A and B valleys to offset some of the emissions, as newly-established vegetation will sequester some of the carbon dioxide emitted from the project.

Issue	Mitigations	Rationale
Generation and dispersal of dust outside of the project area during project activities	Employ dust erosion control measures (water trucks)	The mitigation will reduce dust generation and adverse effects on local air quality during the life of the project and into the future after the completion of the project.
Emissions during project activities	Use hydroelectricity from the grid to power the re-processing plant operation rather than relying on diesel generators	The project will reduce total CO_2 emissions by using hydroelectricity rather than diesel generated electricity which is known to produce more air pollution and greenhouse gases
	Reclaim and re-vegetate the A and B valleys	The reclamation of the A and B valleys will establish vegetation which will serve to sequester some of the CO_2 emitted into the atmosphere as a result of the project.

8.3.4 LAND AND RESOURCE USE

The project is anticipated to have a not significant effect on local land and resource use through reductions in recreational opportunities or enjoyment and/or the future usability of land within the project site.

Recreation

The area around the proposed project is used for a variety of recreational activities. The Trans Canada Trail is directly west of the proposed project site. The Mt. Sima Ski Hill is south of the project location, and is used by both Yukon residents and tourists for summer and winter recreation.

The project is unlikely to affect winter recreational opportunities or enjoyment in the area because project activities will not occur during winter months and the footprint of the project is within the Whitehorse Copper Mine tailings. Therefore, Mt. Sima property will be unaffected by the project. One trail, predominantly used by snowmobilers, will become unusable for public safety reasons as it is currently mapped through the Whitehorse Copper site. This is a short section of trail designed to provide access to the Trans Canada Trail directly west of the project area. The project is working with the Klondike Trails Association and the City of Whitehorse to construct a new trail that bypasses the project site while still providing access to the Trans Canada Trail. The planning of this trail has already begun (see Appendix C), and it is anticipated that the alternate route will be in place before the project is operational. Addressing this trail construction in the seasons before the project operations begin will allow trail users to familiarize themselves with the new trail route before any safety hazards are present. After mitigation it is unlikely that the project affect winter recreational opportunities and enjoyment.

Summer recreational activities overlap with the timing of project activities, so there is a potential for the project to interact with summer recreational activities. All project activities that occur at the project site will only occur within the footprint of the existing disturbance, which has limited recreational value; therefore, it is unlikely that project site activities will impact recreational opportunities and enjoyment. Trucking of ore to the Skagway shipping facilities could affect recreational activities that occur on the roadways. Organized summer activities occur on the highways that will be used as the ore transport route, including: road biking races/time trials and Klondike Trail of '98 International Road Relay. Summer road biking will not be affected by ore trucks because the highways along the route have large shoulders, so trucks will easily pass cyclists without effects. The Klondike Trail of '98 International Road Relay is a large international running race that attracts participants from many parts of North America. The race route is from Skagway to Whitehorse and includes almost the entire ore trucking route required for the project. The race takes place in mid-September and takes about 20 hours for all teams to complete the race. All teams have support vehicles that follow the runners throughout the night. At race checkpoints the highway is essentially blocked due to a large volume of traffic, parked vehicles and pedestrians. The Project will contact the Sport Yukon and Klondike Road Relay organizers to get race details each year, and will alter ore trucking during the race to ensure there is limited interaction between transport trucks and the race. After mitigation it is unlikely that project activities will affect summer recreational opportunities and enjoyment.

The recent and future expansion of Mt. Sima Ski Hill (soon to become the Mt. Sima Adventure Park) means that more summer recreational activities will start to occur in the area; however, all future summer activities at the Mt. Sima Adventure Park will take place on the Mt. Sima property. Other people recreating in the area during summers will not be affected by project activities because all project activities in the area will only occur within the project footprint.

Future Land Use

There was considerable interest in making the land available for future industrial use by municipal and territorial governments, and local industrial businesses. There is currently a shortage of land that is properly zoned for industrial uses within the city. The project site is already zoned for industrial use. To facilitate and expedite the availability of industrial land, the Project will reclaim the area as the project progresses. Through consultation with the Department of Community and Public Works and potential future site users, the reclaimed land will be left in a state that will be easily converted into industrial lots as the project progresses.

Issue	Mitigations	Rationale
Destruction of existing trail	Construction of new trail that bypasses the project site	The mitigation will reduce the potential for interaction between people recreating in the area and project activities.
Direct conflict with Klondike Road Relay	Shutdown of trucking during the Klondike Road Relay	The mitigation will eliminate the potential impact of ore transport affecting the Klondike Road Relay.
Future availability of industrial lots	Reclamation of the tailings area	The mitigation will facilitate and expedite industrial lot development.

8.3.5 LOCAL AESTHETICS

The project is anticipated to have a not significant adverse effect on local aesthetics through minor increased disturbance from light and noise at the project site.

Light

On-site lighting will be required for workplace safety and security. Sources of light will include headlights on trucks, excavators and other equipment, and the tailings processing plant. Lighting at the processing plant will be stationary and be similar to street lamps that are present throughout the streets and roads around Whitehorse so will not significantly change the local aesthetics. Sources of moving lights will include trucks and other heavy equipment working on site, and will be similar in brightness to local street traffic. Light sources will only be visible during twilight and night time hours. Therefore, during summer months (June, July and August) lights on site could be visible for an average of less than six hours per day, while during the spring and fall lights could be visible for an average of less than eight hours per day.

Lights from the project site will potentially be seen from the near and distant areas of Whitehorse, but most light associated with project activities will be obstructed by the forest and topography between the project site and the nearest residential lots in the Canyon Crescent and Mt. Sima subdivisions. Lights at the project area could be visible from other areas of Whitehorse; however, the light will be dispersed (i.e., dim) before reaching distant receptors (e.g., residential areas). Lights at the Project site will not cause a significant reduction to the local aesthetic of the area.

Noise

Noise was raised as a concern during consultations and the proponent notes that this could be an issue that arises as the project activities get closer to residences. The proponent will establish communication channels for residents living close to the project so they are able to provide feedback on project concerns, including noises. The City of Whitehorse *Maintenance Bylaw* addresses noise generated from construction equipment within the city. Exceptions to the bylaw require a permit from the City of Whitehorse. Eagle Minerals will meet with the City of Whitehorse to discuss noise mitigations should they be a concern.

The main source of noise during project construction and operation will be associated with excavating and transporting the tailings using trucks and heavy equipment. Diesel engines and backup alarms on the vehicles will be the primary sources of noise. Backup alarms typically produce sounds between 87 to 100 decibels and only operate when trucks or heavy machinery are engaged in reverse gear. The processing facility operation would generate minimal noise associated with its operations because the plant will be a partially enclosed structure. Although continuous, the noise generated by the reprocessing plant is not expected to reach excessive noise levels. Noises from Project site activities, vehicles and the plant, will be similar to those generated from the nearby industrial lots, and Mt. Sima Ski Hill chairlift and snow making equipment. Project equipment will be active 24 hours/day during the months of operation.

There are no quantitative data on noise levels within the Project Area and it is difficult to predict how project sounds will travel or be perceived in the area because a number of factors affect noise emissions. Many of the factors are dynamic and unpredictable (e.g., wind speed and direction, air temperature, topography, background noise). Therefore, we compare the potential project noises to the current local background noise sources, and use the distances from current noises to potential receptors as an indication of potential effects.

Daytime noises from project site activities will potentially be heard at nearby commercial/industrial and residential lots. Some of the nearby commercial/industrial lots generate similar noises from heavy equipment during normal working hours and are closer to the Mt. Sima residential lots; therefore, the project activities are not predicted to affect the local aesthetic of the nearby commercial/industrial and Mt. Sima residential lots during the normal work hours. Outside normal work hours (6 pm–8 am) noises from project site activities will potentially be heard from nearby commercial/industrial and residential lots. The nearby commercial/industrial lots are generally vacant outside of normal work hours, so no effect of noise is anticipated. The Mt. Sima subdivision is approximately two kilometres from the nearest project activities, and many of those lots are closer to other sources of noise that are similar in nature to the proposed project activities. For example, most of the Mt. Sima residential lots are closer to the Alaska Highway than the project site; the highway has large transport truck activity 24 hours/day. Also, most Mt. Sima lots are closer to the McRae industrial area, which is an active transport truck re-fuelling and rest area 24 hours/day. Given the proximity of Mt. Sima residential lots to varied and continuous noise sources, we anticipate a not significant adverse affect to the local aesthetic of Mt. Sima residential subdivision because of noise from project activities outside normal work hours.

Canyon Crescent subdivision is approximately 1.5 kilometres from the centre of the project area and approximately 2 kilometres from the repossessing plant, but some of the A and B valleys excavation will occur at approximately 750 metres of the nearest Canyon Crescent residence. All Canyon Crescent lots are closer to the Alaska Highway, and associated noise, than project activities. Under certain weather conditions Project activities will be heard at Canyon Crescent residential lots; however, the duration of the project is relatively short (i.e., seven years) and activities will be limited to seven to eight months of the year. After the project is completed and the A and B valleys are reclaimed, the area will be returned to a green space, resulting in no further or future industrial activity within the valleys. Noise generated from diesel engines cannot be completely mitigated, and backup alarms on trucks and equipment are a necessary safety item of industrial/commercial vehicles. The Project will make every effort to route on-site traffic such that the use of back-up alarms is minimized (i.e., use turnaround loops or through roads within the footprint of the current disturbance area). Daytime scheduling of activities that will be close to residences is an option, and may be pursued if residents provide feedback that noise in the evening is an issue. After mitigation there may be residual effects that adversely affect the local aesthetics of Canyon Crescent residential lots because of project excavation noises in the A and B valleys outside normal work hours. Managing potential effects will be done through noise monitoring and through residents providing feedback to noise issues.

Noise from ore trucking to Skagway will be identical to current traffic noise on the highway; therefore, we expect that there will be a not significant change from baseline conditions even with the increased traffic volumes (see Public Health and Safety, Section 8.1.6).

Issue	Mitigations	Rationale
Noise generated from machinery	Construction of a turnaround at the re-processing plant and, when possible, at location where tailings are excavated	The mitigation will reduce the frequency of noise from truck backup alarms
	Eagle Minerals communication channels so local residents can voice noise concerns to the company	The mitigation will provide people with an opportunity to give feedback to noise issues
	Seek a variance from WCB to replace backup alarms with strobe lights during night time operations	Backup alarms will be the noisiest equipment on site, so replacing the alarms with lights will reduce noise
	Regular maintenance of machinery	Maintenance will reduce squeaks and diesel motor noise
	Daytime scheduling of activities that will occur close to residences or are only intermittent (i.e. barren tailings management)	Scheduling will limit the amount of night time activities that occur in proximity to residences

8.3.6 PUBLIC HEALTH AND SAFETY

The project is anticipated to result in a not significant adverse effect on public health and safety through increased traffic along ore transportation route or through landscape alterations.

Traffic

Transportation of the recovered ore will require 30 round trips per day between the re-processing plant and the Skagway port facility during the summer using 50 ton ore trucks. Ore trucking rates will be consistent through the duration of the project. The proposed route includes the Mt. Sima Road, Alaska Highway and Klondike Highway. Transportation safety of the public could be affected by the increased ore truck traffic along the route, because the trucks are large and heavy when fully loaded. Furthermore the intersection at the project site access road and Mt. Sima Road was identified as a transportation safety concern.

The Mt. Sima road is currently used to access the Mt. Sima recreational facilities, the Mt. Sima industrial subdivision and Whitehorse Copper residential subdivision. The current volume of traffic on the road is unknown (McCoy pers. comm. 2010). Recent traffic volumes have likely increased as more homes were built in the Whitehorse Copper residential subdivision, and future traffic volumes will likely continue to increase because of continued residential construction in the subdivision and because of the proposed expansion of the Mt. Sima Adventure Park. It is likely that traffic along the road is highest during winter months. The road is already designed for industrial traffic, and there are no known traffic issues on the road; therefore, the current capacity has likely not been exceeded and the road can handle further industrial traffic without causing transportation safety issues. Residents of the Whitehorse Copper residential subdivision have three alternative access routes, including the Mt. Sima Road, to access the Alaska Highway. Consequently, residents of the Whitehorse Copper subdivision are able to easily adapt if they are concerned about interacting with ore trucks on Mt. Sima Road. To mitigate the potential transportation safety concern at the identified intersection, the Project is proposing to adjust the current intersection on Mt. Sima Road to improve sight lines for trucks leaving the reprocessing site. The Project will notify Highway and Public Works of final traffic volume estimates and will collaborate with the department to determine appropriate infrastructure modifications, including additional signage as necessary. Traffic speeds and signage along the road are currently regulated under applicable legislation.

The Alaska Highway between the Mt. Sima Road and the Carcross Corner is a heavily used section of the Alaska Highway. It is primarily used by Yukon residents living south of the Whitehorse city centre to commute to work, but it is also a major transportation route of goods in and out Yukon and Alaska. In the summer, traffic volumes increase because of tourist traffic. The 2008 (most recent) average daily traffic volumes indicate the project will result in a 0.9 percent increase in summer traffic volumes at Fox Farm Road (the nearest traffic gauge; Table 22). Traffic volumes will not significantly increase on the Alaska Highway portion of the trucking route because of the project; however, ore trucks turning onto the highway could cause congestion and conflict with commuters during the busiest times of the day. To mitigate the impact to transportation safety along the Alaska Highway portion of the trucking route the project will ensure that the trucks travelling on the road will adhere to the stated speed limits and road rules. No traffic congestion will occur because of ore trucks returning to the Project site, because there is a large left turning lane at the Alaska Highway-Mt. Sima Road intersection.

The Klondike Highway between the Carcross Corner and the Yukon border is a section of highway that is primarily used by Yukon residents living along the highway, on the Tagish Road or in Carcross. In the summer, traffic volumes increase because of tourist traffic. The most current traffic data available (2009) indicates the project will result in a 5.2% increase in average summer daily traffic volumes at the Carcross Corner and 4.9% increase in summer daily traffic volumes south of Carcross. The Canada-USA border is not within the assessable area, but the traffic numbers are a good representation of traffic volumes on the Klondike Highway south of Carcross and outside the influence of the community. The most current traffic data available (2008) indicates that the project will result in a 13.7% increase in average summer daily traffic volumes at the Canada-USA border and the truck traffic entering Canada will increase by 223%. While a 13.7% increase in average daily summer traffic volume and the 223% increase total yearly truck traffic at the Canada-USA border is a large increase above the most recent data, the traffic volume and number of trucks is within the highway's capacity and is below the maximum recorded traffic rates. For example, the project is predicted to increase baseline truck traffic entering Canada at the border from 2,660 trucks/year (2008) to 8,600 trucks/year during active reclamation. In 1996 the number of northbound trucks that crossed the border was 12,915 trucks/year. The project is predicted to increase average daily summer traffic volumes from 437 vehicles/day (2008) to 497 vehicles/day. In 1996 the average daily summer traffic volumes were 518 vehicles/day.

As an alternative to trucking ore to Skagway using the Alaska and Klondike highway, the Project has investigated an option of transporting the ore using the existing railway. The Project and White Pass & Yukon Route Railway (White Pass) have discussed the option, and the railroad is considering the potential demand from the project along with the potential demand from other projects in the area. Unless the railroad gets back into the freight haul business. Currently, trucking ore to Skagway is the only transportation option.

After mitigations are applied, the project is anticipated to have a not significant adverse effect on public health and safety through increased traffic along ore transportation route. Standard traffic safety measures will be followed.

Issues	Mitigations	Rationale
Intersection traffic safety	Adjustment of the access road and Mt. Sima Road intersection	Improve sight lines for vehicles leaving the project site

Table 22. Average daily summer traffic along the proposed ore trucking route and expected increase due to transportation of ore.

Year	Mt. Sima Road	Alaska Highway at Fox Farm Road	Klondike Highway at Carcross Corner	Klondike Highway south of Carcross (km 106.3)	Klondike Highway at Canada-US border
2008	NA	6,620	1,376	1158	437
2009	NA	NA	1,445	1224	NA
Max. (year)	NA	6,620 (2008)	1,573 (1998)a	1,268 (1998)	518 (1996)
Percent increase in baseline traffic volumes	NA	0.9%	5.2%	4.9%	13.7%

Notes: [a] Traffic volume is based on 145 days of data.

Landscape Alteration

Project activities will alter the local landscape through excavation and disposal of tailings, and reclamation of the A and B valleys. The Project will excavate tailings from the three sources and dispose of tailings in the Little Chief open pit, subsidence areas around the pit, and some of the tailings will be returned to the Old Pond (see Volume 1). After the Project is complete, tailings in the

A and B valleys will be completely removed and the valleys will be returned to green space, and the Old Pond will be available for development of industrial lots.

Local residents accustomed to using the Whitehorse Copper mine site could be exposed to the hazards while traversing the Project in summer and winter. Extraction of the tailings will be accomplished without producing large steep slopes that could become a public safety hazard. Excavation will be completed systematically to efficiently access all tailing, so the potential hazard areas will be focussed in specific areas that will be reclaimed as the Project progresses. Hazard areas will be easily identifiable through signage and continuous industrial activity which will deter unintentional interactions between the public and the Project. The Project will post signs indicating that there is industrial activity in the area at all access routes to the site. Before seasonal shutdowns, any remaining excavations will be returned to a safe condition through contouring slopes. Signs will remain posted as needed around the site and further signs will be posted as needed near areas where there have been substantial changes to the landscape.

The location currently has several areas where there are public safety hazards including the Little Chief open pit and subsidences. The Little Chief open pit includes near-vertical rock walls that constitute a significant public safety hazard. There are a number of areas where there has been considerable subsidence as the underground workings have collapsed and settled leaving dangerous cracks and fissures. The project reclamation plan proposes to place the reprocessed tailings within the subsidence areas and the pit permanently removing these hazards from the landscape.

Issues	Mitigations	Rationale
Excavation hazards	Excavation planning that will result in small hazard area and contouring of slopes pre-seasonal shutdowns	Will reduce likelihood of public encountering hazardous terrain
	Signs will be posted at all access routes to the site indicating the presence of industrial activity	Public will be deterred from entering the project site, and signs will warn people of landscape changes
Current safety hazards	The Little Chief open pit will be filled with tailings	The high steep walls of the pit will no longer be a safety hazard.
	Subsidence areas will be filled with tailings	Fissures and subsidence areas will no longer be a safety hazard.

8.3.7 ECONOMIC RESOURCES

The project is anticipated to have a positive impact on the local and regional economies.

Once active, the project will be one of few producing mineral extraction operations in Yukon. It will be the only industrial development of this type near Whitehorse, which will contribute to the diversification of the local economy. Also, once reclamation is complete, new industrial lots will become available. Industrial lots are in short supply within the City of Whitehorse; therefore, the project could result in direct economic opportunities and growth within the industrial sector of the local economy.

The Project will be owned and operated by Eagle Whitehorse LLC, of which Eagle Industrial Minerals Corporation is the sole member, and EWH Management LLC is the manager. Eagle Whitehorse LLC and EWH Management LLC are wholly-owned by Eagle Industrial Minerals Corp. which is wholly-owned by Charles E. Eaton. The Project expects to employ approximately 20–25 people full-time during the six to seven months of operation each year for 6 to 7 years. Annual income per employee will average approximately $50–60,000 for a total annual payroll of approximately $1.5 million. Additionally, the Project expects to spend approximately $2.5 million annually in the local area for other goods and services and $5.5 million per year in trucking costs. The Project will design and build the processing plant and obtain the mobile equipment required to operate the Project, and expects to fund permitting costs and the cost of building the processing plant (current estimate approximately $3 million) with internal capital.

Negative effects to local businesses are not anticipated. The project will contribute to the local economy through the purchase of local goods and services and by providing well-paying, skilled jobs to the local workforce. There will be opportunities for local businesses to get involved in the project as the Project is committed to hire local people and businesses as much as possible for the duration of the project. The Project has already contacted some local businesses to discuss employment and partnership opportunities. Local businesses will benefit from this project through the purchase of approximately $2.5 million in goods and services annually, the purchase of $5.5 million in trucking services annually, and an increase in the number of available industrial lots after reclamation is completed.

The small scale of the project will not result in a boom-and-bust effect that is often associated with industrial developments. The local workforce is large enough that the resources needed to run the project will be easily absorbed by Whitehorse’s population and will not cause a shortage of workers in other sectors of the industrial economy. The jobs, though somewhat seasonal, will be desirable for local workers because they will be high paying and the employees will not be required to leave their families for work.

TTC and KDFN are the local self-governing First Nations. The project will provide opportunities for these First Nations to provide goods, services and employees to the project. Neither will experience adverse economic impacts due to the project.

8.3.8 HERITAGE RESOURCES

The project is anticipated to have a not significant impact on heritage resources because there will be no damage or destruction of archaeological or historic sites during project activities.

The project requires various ground works in association with the construction of the plant, excavation of the tailings material, and final reclamation of the site. These proposed project activities will occur within the existing mine footprint, where any archaeological sites have already been lost due to previous mining activities at the site. Heritage resources have received unconfirmed reports that there may be historic resources in the vicinity of the Little Chief mineral claim (Lot 57). These sites have yet to be investigated and recorded by the Cultural Services Branch to determine their significance and condition (B. Hogan, pers. comm. 2010). If any such historical artefacts are discovered on site, project activities will cease in the areas identified until such time as a representative from the Cultural Services Branch can some and investigate the site.

Issue	Mitigations	Rationale
Damage or destruction of archaeological sites during potential project activities outside of existing mine footprint	Notify Yukon Archaeology if project activities are proposed in previously undisturbed areas, and conduct heritage resource inventory and assessment prior to any disturbance.	The mitigation will prevent any damage or destruction of unidentified archaeological sites.
Damage or destruction of historic sites in Little Chief mineral claim within existing mine footprint	Avoid project activities in the immediate vicinity of the identified historic sites.	The mitigation will prevent any damage or destruction of historic sites.

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Appendix A. Project Site Water Quality Data

	Units	Summer 2010								Protection of Freshwater Aquatic Life
		Pit Lake	Old Pond	A Valley	B Valley	Copper Lake	Crater Lake	Copper Seep	Old Pond Seep	
Misc. Inorganics										
Total Hardness ($CaCO_3$)	mg/L	541	212	157	335	556	676	699	564	--
Dissolved Hardness ($CaCO_3$)	mg/L	509	178	145	306	454	549	702	577	--
Alkalinity (Total as $CaCO_3$)	mg/L	110	50	96	190	270	260	370	350	--
Alkalinity (PP as $CaCO_3$)	mg/L	<0.5	<0.5	<0.5	1.4	<0.5	5.8	<0.5	<0.5	--
Bicarbonate (HCO_3)	mg/L	130	61	120	230	330	300	450	430	--
Carbonate (CO_3)	mg/L	<0.5	<0.5	<0.5	1.6	<0.5	7.0	<0.5	<0.5	--
Hydroxide (OH)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--
Anions										
Dissolved Sulphate (SO_4)	mg/L	400	130	59	140	300	330	370	280	--
Dissolved Chloride (Cl)	mg/L	3.3	<0.5	1.2	1.0	13	6.1	4.8	9.9	--
Cations										
Dissolved Calcium (Ca)	mg/L	80.2	52.1	27.9	54.9	120	155	196	171	--
Dissolved Magnesium (Mg)	mg/L	74.9	11.7	18.3	41.0	37.5	39.3	51.9	36.2	--
Dissolved Potassium (K)	mg/L	2.93	4.44	3.63	5.11	4.77	2.71	5.89	5.00	--
Dissolved Sodium (Na)	mg/L	12.9	0.95	6.56	6.64	35.8	13.2	28.0	37.0	--
Physical Properties										
Conductivity	µS/cm	950	376	309	591	1080	1090	1310	1170	--
pH	pH	8.1	8.0	8.0	8.3	8.3	8.4	7.72	7.70	6.5 – 9.0
Physical Properties										
Total Suspended Solids	mg/L	<4	<4	8	4	<4	<4	8	11	--
Total Dissolved Solids	mg/L	710	240	180	370	810	830	970	900	--
Nutrients										
Ammonia (N)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.24	0.95	1.04[A]
Nitrite (N)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	0.06
Nitrate (N)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	13
Nitrate plus Nitrite (N)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	--
Total Phosphorus (P)	mg/L	0.006	<0.005	0.005	0.005	0.008	0.006	0.031	0.088	--

Notes: [A] at pH 8 and water temperature 10°C

CCME TOTAL METALS IN WATER

	Units	Summer 2010								Protection of Freshwater Aquatic Life
		Pit Lake	Old Pond	A Valley	B Valley	Copper Lake	Crater Lake	Copper Seep	Old Pond Seep	
Total Aluminum (Al)	µg/L	32	***452***	***180***	40	10	5	11	***242***	100
Total Antimony (Sb)	µg/L	3.7	<0.5	0.6	<0.5	<0.5	<0.5	5.1	<0.5	--
Total Arsenic (As)	µg/L	3.5	0.9	0.9	1.3	2.8	0.5	***5.1***	***20***	5
Total Barium (Ba)	µg/L	49	39	68	67	144	132	162	144	--
Total Beryllium (Be)	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	--
Total Bismuth (Bi)	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	--
Total Boron (B)	µg/L	<50	<50	<50	<50	59	<50	86	109	--
Total Cadmium (Cd)	µg/L	***0.20***	0.02	0.02	0.05	0.05	0.04	0.02	0.07	Hardness Dep.
Total Chromium (Cr)	µg/L	<1	<1	<1	<1	<1	<1	<1	1	8.9
Total Cobalt (Co)	µg/L	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	--
Total Copper (Cu)	µg/L	***12.2***	***131***	***59.6***	***20.8***	1	3.7	***19.4***	***46.9***	2–4[H]
Total Iron (Fe)	µg/L	37	***1790***	***311***	56	143	108	***1770***	***4770***	300
Total Lead (Pb)	µg/L	<0.2	0.3	<0.2	<0.2	0.3	<0.2	0.2	0.9	1-7[H]
Total Lithium (Li)	µg/L	<5	<5	<5	<5	<5	<5	<5	<5	--
Total Manganese (Mn)	µg/L	6	28	66	16	939	107	5350	8590	--
Total Mercury (Hg)	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.02	0.026
Total Molybdenum (Mo)	µg/L	***516***	56	54	69	65	8	13	27	73
Total Nickel (Ni)	µg/L	<1	<1	<1	<1	<1	<1	2	2	25–150[H]
Total Selenium (Se)	µg/L	***7.2***	***1.5***	0.8	***1.8***	<0.1	0.3	0.1	0.2	1
Total Silicon (Si)	µg/L	3810	2220	2520	5250	9840	8380	10600	11100	--
Total Silver (Ag)	µg/L	<0.02	0.04	<0.02	<0.02	0.04	0.02	<0.02	<0.02	0.1
Total Strontium (Sr)	µg/L	1050	1740	594	655	947	1140	1040	928	--
Total Thallium (Tl)	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.8
Total Tin (Sn)	µg/L	<5	<5	<5	<5	<5	<5	<5	<5	--
Total Titanium (Ti)	µg/L	<5	16	7	<5	<5	<5	<5	9	--
Total Uranium (U)	µg/L	93.4	0.2	0.2	2.3	10.4	36.1	6.6	8.8	--
Total Vanadium (V)	µg/L	<5	<5	<5	<5	<5	<5	<5	<5	--
Total Zinc (Zn)	µg/L	<5	<5	<5	<5	<5	<5	<5	10	30

CCME DISSOLVED METALS IN WATER (WATER)

	Units	Summer 2010							
		Pit Lake	Old Pond	A Valley	B Valley	Copper Lake	Crater Lake	Copper Seep	Old Pond Seep
Dissolved Aluminum (Al)	µg/L	<3	<3	7	<3	<3	4	<3	4
Dissolved Antimony (Sb)	µg/L	4.0	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Arsenic (As)	µg/L	3.7	0.3	0.7	1.3	2.5	0.4	1.2	2.2
Dissolved Barium (Ba)	µg/L	48	33	66	63	142	120	130	136
Dissolved Beryllium (Be)	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Bismuth (Bi)	µg/L	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Boron (B)	µg/L	<50	<50	<50	<50	166	101	81	105
Dissolved Cadmium (Cd)	µg/L	0.25	0.04	0.06	0.07	0.04	0.06	0.02	0.03
Dissolved Chromium (Cr)	µg/L	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Cobalt (Co)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Copper (Cu)	µg/L	8.4	11.9	14.9	11.5	0.9	4.3	1.5	2.4
Dissolved Iron (Fe)	µg/L	<5	<5	<5	<5	23	91	13	23
Dissolved Lead (Pb)	µg/L	<0.2	<0.2	<0.2	<0.2	0.3	0.5	<0.2	<0.2
Dissolved Lithium (Li)	µg/L	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Manganese (Mn)	µg/L	2	5	56	5	845	107	3280	7900
Dissolved Mercury (Hg)	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	0.05
Dissolved Molybdenum (Mo)	µg/L	508	54	53	64	63	8	12	26
Dissolved Nickel (Ni)	µg/L	<1	<1	<1	<1	<1	3	3	3
Dissolved Selenium (Se)	µg/L	7.3	1.4	1.0	2.4	<0.1	0.3	<0.1	<0.1
Dissolved Silver (Ag)	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dissolved Strontium (Sr)	µg/L	971	1700	576	606	899	1040	1040	922
Dissolved Thallium (Tl)	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dissolved Tin (Sn)	µg/L	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Titanium (Ti)	µg/L	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Uranium (U)	µg/L	87.7	<0.1	0.1	2.0	10.1	33.5	6.1	8.7
Dissolved Vanadium (V)	µg/L	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Zinc (Zn)	µg/L	<5	<5	<5	<5	<5	5	14	<5

Appendix B. Residential Well Groundwater Quality Data

RESULTS OF CHEMICAL ANALYSES OF WATER

	Units	91-18 LAMMERS		91-19 C. BOYD		91-20 G. BOYD		91-17 D. BOYD		91-15 PIONEER		CCREM Drinking Water (1987)	Health Canada Drinking Water Guidelines	CCREM Aquatic Freshwater Guidelines	CCME AL Guidelines
Sampling Date		1991	2010	1991	2010	1991	2010	1991	2010	1991	2010				
Physical Properties															
Conductivity	µS/cm	500	551	416	462	419	460	461	512	605	860	--	--	--	--
pH	pH units	7.76	7.80	7.73	7.79	7.65	7.72	7.66	7.81	7.76	8.08	6.5 – 8.5	6.5 – 8.5	6.5 - 9.0	6.5 - 9.0
Anions															
Dissolved Sulphate (SO4)	mg/L	23.2	17	15.3	15	17.7	14	17.2	20	31.3	52	500	500	--	--
Dissolved Chloride (Cl)	mg/L	2	9.1	2.6	6.7	5.7	19	2.4	7.7	32	76	250	250	--	--
Fluoride (F)	mg/L	0.13	0.11	0.13	0.12	0.11	0.10	0.10	0.10	0.12	0.09	1.5	1.5	--	--
Nutrients															
Ammonia (N)	mg/L	--	0.083	--	0.10	--	0.10	--	0.5	--	0.11	--	--	--	1.04
Nitrite (N)	mg/L	--	<0.005	--	<0.005	--	<0.005	--	<0.005	--	0.010	--	--	--	0.06
Nitrate (N)	mg/L	--	1.64	--	0.22	--	0.72	--	4.1	--	3.34	--	10	--	13
Nitrate plus Nitrite (N)	mg/L	--	1.64	--	0.22	--	0.72	--	4.1	--	3.35	--	--	--	--
Physical Properties															
Dissolved Hardness (CaCO3)	mg/L	--	289	--	224	--	216	--	250	--	357	--	--	--	--
Total Suspended Solids	mg/L	<1	<4	<1	<4	3	<4	<1	<4	3	<4	--	--	--	--
Total Dissolved Solids	mg/L	388	310	326	250	323	280	353	270	437	***510***	500	500	--	--
Dissolved Metals by ICPMS															
Dissolved Aluminum (Al)	µg/L	<200	<3	<200	5	<200	4	<200	<3	<200	<3	--	100	100	100
Dissolved Antimony (Sb)	µg/L	<200	<0.5	<200	<0.5	<200	<0.5	<200	<0.5	<200	<0.5	--	6	--	--
Dissolved Arsenic (As)	µg/L	1.6	1.4	1.4	1.9	1.6	1.4	1.6	1.5	0.8	0.2	50	10	50	5
Dissolved Barium (Ba)	µg/L	65	70	65	72	54	58	60	63	90	***112***	100	100	--	--
Dissolved Beryllium (Be)	µg/L	<5	<0.1	<5	<0.1	<5	<0.1	<5	<0.1	<5	<0.1	--	--	--	--
Dissolved Bismuth (Bi)	µg/L	<100	<1	<100	<1	<100	<1	<100	<1	<100	<1	--	--	--	--
Dissolved Boron (B)	µg/L	<100	<50	<100	<50	<100	<50	130	<50	<100	246	5000	500	--	--
Dissolved Cadmium (Cd)	µg/L	<0.2	***0.30***	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	***0.13***	5	5	0.0018	hardness dep
Dissolved Chromium (Cr)	µg/L	<15	<1	<15	<1	<15	<1	<15	<1	<15	<1	50	50	20	8.9
Dissolved Cobalt (Co)	µg/L	<15	<0.5	<15	<0.5	<15	<0.5	<15	<0.5	<15	<0.5	--	--	--	--
Dissolved Copper (Cu)	µg/L	***143***	***33.7***	<10	***5.2***	<10	***14.3***	***82***	***21.0***	***605***	***12.5***	1000	1000	4	2 - 4[H]
Dissolved Iron (Fe)	µg/L	<30	6	58	28	<30	9	<30	7	<30	6	300	300	300	300
Dissolved Lead (Pb)	µg/L	<1	<0.2	1	<0.2	<1	<0.2	2	<0.2	***37***	<0.2	50	10	7	1 - 7[H]
Dissolved Lithium (Li)	µg/L	<15	<5	<15	<5	<15	<5	<15	<5	<15	<5	--	--	--	--
Dissolved Manganese (Mn)	µg/L	<5	2	<5	2	<5	<1	<5	<1	***101***	42	50	50	--	--
Dissolved Mercury (Hg)	µg/L	--	<0.02	--	<0.02	--	<0.02	--	<0.02	--	<0.02	--	1	--	0.026
Dissolved Molybdenum (Mo)	µg/L	<30	1	<30	2	<30	1	<30	2	<30	3	--	--	--	73
Dissolved Nickel (Ni)	µg/L	<20	2	<20	2	<20	2	<20	2	<20	5	--	--	110	25 - 150[H]
Dissolved Selenium (Se)	µg/L	<0.5	0.8	<0.5	<0.1	<0.5	0.2	<0.5	0.2	<0.5	<0.1	10	10	1	1
Dissolved Silicon (Si)	µg/L	6620	7210	6740	7080	6930	7090	6780	6970	6890	6250	--	--	--	--
Dissolved Silver (Ag)	µg/L	<15	<0.02	<15	<0.02	<15	<0.02	<15	<0.02	<15	<0.02	50	--	0.1	0.1
Dissolved Strontium (Sr)	µg/L	420	448	269	302	290	325	378	385	671	813	--	--	--	--
Dissolved Thallium (Tl)	µg/L	<100	<0.05	<100	<0.05	<100	<0.05	<100	<0.05	<100	<0.05	--	--	--	0.8
Dissolved Tin (Sn)	µg/L	<300	<5	<300	<5	<300	<5	<300	<5	<300	<5	--	--	--	--
Dissolved Titanium (Ti)	µg/L	<10	<5	<10	<5	<10	<5	<10	<5	<10	<5	--	--	--	--
Dissolved Uranium (U)	µg/L	--	3.0	--	3.5	--	1.9	--	1.1	--	9.9	--	20	--	--
Dissolved Vanadium (V)	µg/L	<30	<5	<30	<5	<30	<5	<30	<5	<30	<5	--	--	--	--
Dissolved Zinc (Zn)	µg/L	***70***	17	***177***	15	12	12	***51***	7	***106***	30	5000	5000	30	30
Dissolved Zirconium (Zr)	µg/L	--	<0.5	--	<0.5	--	<0.5	--	<0.5	--	<0.5	--	--	--	--
Dissolved Calcium (Ca)	mg/L	64.7	66.2	57.2	52.1	57.3	50.8	63.6	59.4	86.3	94.0	--	--	--	--
Dissolved Magnesium (Mg)	mg/L	27.3	30.0	19.7	22.7	20.5	21.6	23.3	24.6	25	29.6	--	--	--	--
Dissolved Potassium (K)	mg/L	2.3	2.35	2.2	2.02	2.7	2.04	2.3	2.31	2.9	2.87	--	--	--	--
Dissolved Sodium (Na)	mg/L	10.8	10.3	8.9	9.25	9.6	8.45	9.8	11.2	14.5	21.7	--	200	--	--
Dissolved Sulphur (S)	mg/L	--	8	--	7	--	4	--	7	--	19	--	--	--	--

Notes:

- (light blue) exceeds the CCREM protection of freshwater aquatic life guideline (1987)
- (blue) exceeds the CCME protection of freshwater aquatic life guideline (2008)
- (light pink) exceeds the CCREM drinking water guideline (1987)
- (red) exceeds the Health Canada drinking water guideline (2008)

	Units	91-1 BOYD		91-2 LOWRY		91-3 MCKINNON		MW-N	MW-S	CCREM Drinking Water (1987)	Health Canada Drinking Water Guidelines	CCREM Aquatic Freshwater Guidelines	CCME AL Guidelines
Sampling Date		1991	2010	1991	2010	1991	2010	2010	2010				
Physical Properties								Shallow	Deep				
Conductivity	µS/cm	401	479	383	448	411	460	321	492	--	--	--	--
pH		7.71	7.69	7.68	7.68	7.42	7.68	8.00	8.01	6.5 – 8.5	6.5 – 8.5	6.5 - 9.0	6.5 - 9.0
Anions													
Dissolved Sulphate (SO4)	mg/L	15.9	36	9.7	29	10.7	28	19	63	500	500	--	--
Dissolved Chloride (Cl)	mg/L	1.7	7.4	0.6	0.9	1.2	3.1	10	12	250	250	--	--
Fluoride (F)	mg/L	0.08	0.08	0.09	0.09	0.1	0.11	0.13	0.24	1.5	1.5	--	--
Nutrients													
Ammonia (N)	mg/L	--	0.11	--	0.091	--	0.11	<0.005	0.021	--	--	--	1.04
Nitrite (N)	mg/L	--	<0.005	--	<0.005	--	<0.005	0.005	0.006	--	--	--	0.06
Nitrate (N)	mg/L	--	2.11	--	<0.02	--	0.24	0.69	0.05	--	10	--	13
Nitrate plus Nitrite (N)	mg/L	--	2.11	--	<0.02	--	0.24	0.70	0.06	--	--	--	--
Physical Properties													
Dissolved Hardness (CaCO3)	mg/L	--	243	--	225	--	241	148	184	--	--	--	--
Total Suspended Solids	mg/L	<1	<4	<1	<4	<1	<4	260	41	--	--	--	--
Total Dissolved Solids	mg/L	320	280	306	250	320	270	160	260	500	500	--	--
Dissolved Metals by ICPMS													
Dissolved Aluminum (Al)	µg/L	<200	<3	<200	<3	<200	<3	4	4	--	100	100	100
Dissolved Antimony (Sb)	µg/L	<200	<0.5	<200	<0.5	<200	<0.5	<0.5	<0.5	--	6	--	--
Dissolved Arsenic (As)	µg/L	0.5	0.6	0.7	0.4	0.7	1.1	1.6	1.3	50	10	50	5
Dissolved Barium (Ba)	µg/L	65	75	57	60	86	83	33	42	100	100	--	--
Dissolved Beryllium (Be)	µg/L	<5	<0.1	<5	<0.1	<5	<0.1	<0.1	<0.1	--	--	--	--
Dissolved Bismuth (Bi)	µg/L	<100	<1	<100	<1	<100	<1	<1	<1	--	--	--	--
Dissolved Boron (B)	µg/L	<100	<50	<100	<50	<100	<50	<50	<50	5000	500	--	--
Dissolved Cadmium (Cd)	µg/L	0.3	***0.30***	<0.2	***0.21***	0.3	***0.36***	<0.01	***0.22***	5	5	0.0018	hardness dep
Dissolved Chromium (Cr)	µg/L	<15	<1	<15	<1	<15	<1	<1	<1	50	50	20	8.9
Dissolved Cobalt (Co)	µg/L	<15	<0.5	<15	<0.5	<15	<0.5	<0.5	<0.5	--	--	--	--
Dissolved Copper (Cu)	µg/L	***14***	2.1	***47***	***22.8***	***28***	***16.4***	1.7	1.3	1000	1000	4	2 - 4[H]
Dissolved Iron (Fe)	µg/L	34	<5	<30	20	105	<5	<5	<5	300	300	300	300
Dissolved Lead (Pb)	µg/L	<1	0.4	<1	<0.2	1	0.2	<0.2	<0.2	50	10	7	1 - 7[H]
Dissolved Lithium (Li)	µg/L	<15	<5	<15	<5	<15	<5	<5	<5	--	--	--	--
Dissolved Manganese (Mn)	µg/L	<5	<1	<5	2	***61***	<1	3	***125***	50	50	--	--
Dissolved Mercury (Hg)	µg/L	--	<0.02	--	<0.02	--	<0.02	<0.02	<0.02	--	1	--	0.026
Dissolved Molybdenum (Mo)	µg/L	<30	2	<30	2	<30	5	4	19	--	--	--	73
Dissolved Nickel (Ni)	µg/L	<20	2	<20	1	<20	2	2	1	--	--	110	25 - 150[H]
Dissolved Selenium (Se)	µg/L	<0.5	0.3	<0.5	<0.1	<0.5	<0.1	0.8	0.4	10	10	1	1
Dissolved Silicon (Si)	µg/L	5660	6880	5900	7460	7000	8270	4580	7330	--	--	--	--
Dissolved Silver (Ag)	µg/L	<15	<0.02	<15	<0.02	<15	<0.02	<0.02	<0.02	50	--	0.1	0.1
Dissolved Strontium (Sr)	µg/L	276	320	250	287	278	306	184	933	--	--	--	--
Dissolved Thallium (Tl)	µg/L	<100	<0.05	<100	<0.05	<100	<0.05	<0.05	<0.05	--	--	--	0.8
Dissolved Tin (Sn)	µg/L	<300	<5	<300	<5	<300	<5	<5	<5	--	--	--	--
Dissolved Titanium (Ti)	µg/L	<10	<5	<10	<5	<10	<5	<5	<5	--	--	--	--
Dissolved Uranium (U)	µg/L	--	2.4	--	2.3	--	2.2	2.4	***85.7***	--	20	--	--
Dissolved Vanadium (V)	µg/L	<30	<5	<30	<5	<30	<5	<5	<5	--	--	--	--
Dissolved Zinc (Zn)	µg/L	***364***	6	20	***64***	***419***	***73***	8	<5	5000	5000	30	30
Dissolved Zirconium (Zr)	µg/L	--	<0.5	--	<0.5	--	<0.5	<0.5	<0.5	--	--	--	--
Dissolved Calcium (Ca)	mg/L	67.6	75.3	67.1	69.4	70.8	75.6	53.1	48.3	--	--	--	--
Dissolved Magnesium (Mg)	mg/L	12.5	13.4	12.1	12.6	11.6	12.6	3.76	15.5	--	--	--	--
Dissolved Potassium (K)	mg/L	<2	1.65	<2	1.50	<2	1.84	1.57	0.90	--	--	--	--
Dissolved Sodium (Na)	mg/L	4.2	5.65	3.9	4.93	5.7	6.27	5.70	34.3	--	200	--	--
Dissolved Sulphur (S)	mg/L	--	12	--	12	--	11	6	25	--	--	--	--

Notes:
- (light blue) exceeds the CCREM protection of freshwater aquatic life guideline (1987)
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Appendix C. Engagement Report

Prepared by Kirk Cameron (*northSense management consulting*)

1. Introduction and Context

Early in the project planning phase a process for engagement was outlined and deemed a high priority of the assessment work. Although not a formal requirement at the Designated Office (DO) level under the *Yukon Environmental and Socio-economic Assessment Act (YESAA)*, there are a number of reasons why substantial engagement in advance of project start up is advantageous to the project:

1. One primary focus of the Project is to reclaim the Whitehorse Copper site, preparing it for future heavy industrial use (as zoned by the City of Whitehorse). Therefore, it was considered appropriate to consult with parties who have a potential interest in the result of the reclamation work. These consultations allow the Project to maximize the utility of the site post-reclamation for both the current owner (Yukon Government) and potential future owners.
2. There are potential contract and employment opportunities that could be identified through substantive engagement at this stage. The Project believes strongly that the local economy should have the potential to profit from its work. It is clear from discussions to date that the Project could be potentially beneficial to First Nations, local companies and prospective employees from the Whitehorse area.
3. The project footprint borders the Traditional Territory of the Kwanlin Dun First Nation and the Ta'an Kwach'an Council. Therefore it is appropriate to engage early with these First Nations to ensure that their interests and/or concerns are understood and addressed, both from a heritage and traditional values perspective and from an economic perspective.

A number of organizations, governments and individuals were consulted regarding the project over the past five months (Table 23). The project believes that information gathered through these consultations have helped to develop and refine the Project design.

Table 23.Consultation undertaken as part of the Whitehorse Copper Reclamation Project

Date	Organization	Person(s)	Event
April 26, 2010	Yukon Energy, Government of Yukon, Energy, Mines and Resources (EMR)	B. Holmes G. Komarami	Meeting at EMR
April 27, 2010	Previous employee at Whitehorse Copper site	P. Percival	Meeting at Whitehorse Copper site
April 29 2010	White Pass & Yukon Route	M. Brandt	Meeting at White Pass Office, Skagway, Alaska
April 28, 2010	Yukon Environmental and Socio-economic Assessment Board (YESAB)	M. Muller A. Narain	Meeting at Whitehorse YESAB executive office
April 29, 2010	Skagway Ore Terminal Skagway City Manager	J. Coveno T. Smith	Meeting at Skagway Ore Terminal, and Skagway

Date	Organization	Person(s)	Event
			Municipal offices
July 20, 2010	City of Whitehorse (the City)	M. Ellis P. Ross	Meeting at the Whitehorse City Hall
July 20, 2010	EMR	B. McIntyre	Meeting at EMR
July 21, 2010	Kluane Drilling	J. Coyne	Meeting in Whitehorse
August 8, 2010	Yukon Conservation Society	L. Rifkin	Meeting at *northSense* (informal)
August 9, 2010	Yukon Energy Corporation	H. Campbell	Meeting at YEC
August 9, 2010	Yukon Indian Development Corporation (YIDC)	S. Noel	Meeting at YIDC
August 9, 2010	Yukon Economic Development	T. Hayden D. Kobayashi	Meeting at Economic Development
August 26, 2010	Yukon Indian Development Corporation (YIDC)	S. Noel	Meeting at YIDC
August 30, 2010	YIDC	S. Noel	Meeting at YIDC
September 1, 2010	Economic Development	D. Kobayashi C. Ireland	Meeting at Economic Development
September 1, 2010	City of Whitehorse	M. Gau W. Tuck	Meeting at the Whitehorse City Hall
September 2, 2010	White Pass & Yukon Route	M. Brant	Meeting at EDI office in Whitehorse
September 7, 2010	Whitehorse Chamber of Commerce (WCoC)	R. Karp	Meeting at WCoC
September 16, 2010	City of Whitehorse	M. Gau	Phone discussion
September 21, 2010	City of Whitehorse	Mayor Buckway Councillors: Austin, Pillai, Stockdale, Graham, Roberts, Irwin Officials: Shewfelt, Gau, Kindred	Meeting of Council and Senior Management (CASM)
September 22, 2010	Yukon Department of Highways and Public Works	V. Janz J. Warkentin	Meeting at Department of Highways and Public Works
September 23, 2010	Kwanlin Dun First Nations	Chief Smith	Meeting at KDFN
September 23, 2010	WCoC	R. Karp	Meeting at WCoC
September 27, 2010	WCoC	R. Karp	Meeting at WCoC
September 28, 2010	Economic Development	D. Kobayashi	Phone discussion
September 29, 2010	Klondike Snowmobile Association (KSA) & the City	M. Daniels (KSA) D. Hnatchuk (the City)	Meeting at EDI offices
September 29,	Great Northern Ski	R. Nielsen	Phone discussion

Date	Organization	Person(s)	Event
2010	Society (Mt. Sima)		
September 2010	Well owner in area (91-1)	C. Boyd	Well test at property (#31 Canyon Crescent)
September 2010	Well owner in area (91-2)	S. Lowry	Well test at property (#4 Canyon Crescent)
September 2010	Well owner in area (91-3)	J. McKinnon	Well test at property (Whitehorse Riding Stables)
September 2010	Well owner in area (91-15)	M. Kostiuk	Well test at property (Pioneer RV Park)
September 2010	Well owner in area (91-17)	D. & S. Boyd	Well test at property (91092 Alaska Highway)
September 2010	Well owner in area (91-18)	B. & K. Lammers	Well test at property (91086 Alaska Highway)
September 2010	Well owner in area (91-19)	C. & M. Boyd	Well test at property (91082 Alaska Highway)
September 2010	Well owner in area (91-20)	G. & S. Boyd	Well test at property (91084 Alaska Highway)
October 8, 2010	Ta'an Kwäch'än Council	Chief Sam, R. Brown, T. Smith, R. Martin	Meeting at Ta'an Kwach'an office
October 19, 2010	Whitehorse Copper Reclamation Project Discussion Forum	R. Pillai, the City M. Gau the City W. Tuck the City S. Clohosey the City D. Kobayashi, Yukon Government (YG) Economic Development (ED) T. Hayden YG, ED C. Ireland YG, ED W. Carter YG, ED B. Holmes, YG, Energy, Mines and Resources B. Dunn, YG, EMR B. McIntyre, YG, EMR G. Ford, YG, Environment J. Ahlgren, YG, Environment M. Brandt, WP&YR G. Meredith, Great Northern Ski Society (Mt. Sima) K. Byram, Pelly Construction D. Stone, Skookum Construction M. Johnson, TransCanada Pipeline D. Redden, YECL J. Coyne, Kluane Drilling D. Pasloski, Business Investment C. Cowan, EBA	Half day forum, High Country Inn

Date	Organization	Person(s)	Event
		R. Lewis, Arctic Alpine Seed R. Karp, Whitehorse Chamber of Commerce S. Hartland, Whse Chamber of Commerce M. Wark, Yukon Chamber of Mines S. Babcock, Yukon Chamber of Commerce M. Racz, Yukon Real Estate Association	
October 19, 2010	General public	D. Black R. Carlson A. Greetham L. Hanson T. Kopp K. Lammers J. McManus S. Momeyer N. Prasad R. Ricks C. Tobin K. Winnicky	Public forum at Mt. Sima Ski Lodge
November 5, 2010	YG, Energy, Mines and Resources	G. Komarami B. Holmes	Meeting at YG
November 23, 2010	Kwanlin Dun First Nations	S. Bunicich	Meeting at High Country Hotel
December 9, 2010	Northern Vision	P. McDonald	Meeting at Edgewater Hotel
December 9, 2010	Yukon Indian Development Corporation	S. Noel	Meeting at Westmark Hotel
December 10, 2010	Economic Development	H. Brooks D. Kobayashi	Meeting at Economic Development
December 23, 2010	General Public	R. Coyne	Meeting at Whitehorse
December 23, 2010	YIDC	S. Noel	Phone conversation

2. Overview

The general belief expressed almost unanimously throughout consultations is that the Whitehorse Copper reclamation project will make numerous positive contributions to the area. These advantages, expressed by those engaged in the consultation, include:

- Improving the potential utility of the only land in Whitehorse currently identified in the Official Community Plan (OCP) as "industrial" land use;
- Increasing green space, possibly by removing tailings from the A and B valleys;

- Decreasing dust from the tailings surface;
- Providing local employment and contract opportunities for Yukoners; and
- Maximizing the extraction of magnetite from existing tailings.

Some concerns were expressed by meeting participants, and these have helped the Project to compile a more complete list of the VESECs and, where necessary, associated mitigation. These concerns are as follows:

- Potential generation of more dust from site caused by heavy equipment extracting and moving tailings;
- Potential noise generated from heavy equipment and the processing plant which could potentially be heard in neighbouring residential areas;
- Potential for contamination of groundwater that could infiltrate wells on neighbouring residential and commercial properties;
- Possibility of increased equipment and truck traffic impacting wildlife; and
- Potential conflict between increased recreational traffic in transit to the Mt. Sima area along the same road corridor as heavy trucks transporting ore to the Alaska Highway.

3. Engagement with Business and Industry

Reclamation is an important goal of the Project, and the Project would like to reclaim the site in the fashion most appropriate for the local community. Therefore, the Project invited industry, government and community leaders to discuss reclamation planning at a half day discussion forum which was held October 19, 2010 at the High Country Inn, and co-hosted by the Whitehorse Chamber of Commerce.

The minutes from this forum are included in section 8.0: "Reclamation Project Discussions Forum - Notes". Specific interests and views by industry and government expressed at the October 19 forum are identified in following sections.

Invitations were extended to 15 companies in the following sectors: tourism, transportation, building and construction, energy, communications, First Nations business, land development (real estate) and scientific testing.

There was a general consensus that Whitehorse is in need of industrial land in both the medium and long term. Promising developments in the non-renewable resource sectors of mining exploration, mining, and oil and gas (pipeline) are associated with increase transportation needs, increased population, and other direct and indirect economic and social support activities/services. Therefore, it is anticipated that there will be an increase in demand for industrial land in and around Whitehorse next 20 years.

There are a number of attractive features of a reclaimed Whitehorse Copper site, including, but not limited to:

- Proximity to the Whitehorse city centre;
- Proximity to the Alaska Highway;
- Existing road access;
- Existing industrial land use zoning;
- Proximity to the Alaska Highway Pipeline corridor (potential staging for pipe); and
- Proximity to the White Pass & Yukon Route narrow gauge rail at the Utah yard (a possible later stage transportation link with Skagway port if WP&YR gains sufficient bulk haul commitments to put the rail back into service between Carcross and Whitehorse).

There are temporal advantages to staged reclamation, potentially resulting in land available for industrial uses earlier the anticipated seven year Project life span. This was seen as particularly attractive to TransCanada, who may be in need of a staging area within the next five years (October 19 Discussion Forum). The linkage of an economic opportunity (extraction of magnetite) with a reclamation mission provides a feasible plan whereby the land can be returned to a productive state.

4. Engagement with the Public

a. Open House

A public meeting held at the Mt. Sima Ski Lodge on October 19, 2010 to inform, and seek input from, the general public. The location was chosen to ensure maximum access by those living in the area of the Whitehorse Copper site. This event was advertised in the Whitehorse Star and Yukon News, and posters were put up in communities in the general area. Also, due to the proximity of the McLean Lake residents, an email was sent to a local resident who agreed to circulate to all those living in that area.

No major concerns were raised by local residents, and to the contrary, there was considerable support expressed. Following description of the Project, a number of questions were raised and responded to by consultants in attendance.

The range of topics/questions raised included:

- Air quality (dusting);
- Noise from equipment;
- Economic impact; and
- Proximity to Mt. Sima and associated recreational activities (year round).

The VESEC section (Volume II, Section 8) speaks to these topics and questions.

b. Individual Contacts

In addition to the open house, there were a number of individual contacts made. Of particular concern were those neighbours in the area surrounding Whitehorse Copper with wells drawing potable water from wells. EDI was commissioned by the Project in September 2010 to contact property owners and conduct water quality testing of the residential wells. The information generated from testing was then distributed to property owners. It is apparent that there is no link between the chemical/mineral make-up of Whitehorse Copper tailings and ground water tested at the well sites (Volume II, Section 3).

In addition, EDI and *northSense* held discussions with the Klondike Snowmobile Association and the City of Whitehorse, Recreation, regarding the redirection of a popular trail currently traversing the Whitehorse Copper site. The alternative route is a short detour, and is acceptable to both the Association and the City. This diversion will be constructed and properly signed well in advance of the closure of the site to unauthorized vehicular/recreational traffic.

5. Engagement with First Nations

c. Kwanlin Dun First Nations

The Whitehorse Copper site falls within the Traditional Territory of the KDFN. Therefore, keeping with the protocols associated with First Nation Government engagement, the Project met with Chief Mike Smith at KDFN offices September 23, 2010. Chief Smith expressed interest in the project, specifically as it relates to employment and business opportunities for the KDFN. The Chief noted that land selections by the First Nation in this area were made with business possibilities in mind. Therefore, the Project intentions to process tailings and reclaim the site for future industrial purposes comply with the ideals held by the KDFN associated with the site. Chief Smith directed the Project to discuss these matters with First Nations staff in greater detail. As a result, discussions have taken place to help target opportunities for First Nations Citizens and businesses within the Project design. These discussions are ongoing, with the objective to determine where there are economic opportunities for the KDFN and Citizens.

d. Ta'an Kwach'an Council

The Whitehorse Copper site is also within the Traditional Territory of the Ta'an Kwach'an people. Therefore, as with KDFN, it was considered appropriate to open a dialogue with the Chief and council. Due to conflicting schedules it has not been possible to arrange a meeting directly between the Project and the Chief of TKC, Brenda Sam. However, Project community engagement consultant, Kirk Cameron, met with Chief and Council and officials on October 8, 2010 to describe the Project, and to discuss possible concerns and interests of the Council. The TKC expressed an interest in continued dialogue as this project could be of economic value to the Council and TKC Citizens; as such the dialogue will continue in 2011 as the Project develops.

6. Engagement with Governments

e. Government of Yukon

A number of meetings have taken place with Government of Yukon officials in the departments of Economic Development, Energy, Mines and Resources, Environment, and Highways and Public Works (Table 23). In addition to departmental officials, the Project met with staff from the Yukon Water Board and the Yukon Environmental and Socio-economic Assessment Board (both Executive and Whitehorse Designated Office).

These meetings can be characterized as information gathering sessions for the Project and supporting consultants. Through these meetings, information was gathered on a range of subjects:

- Environmental and socio-economic assessment process and timing considerations;
- Regulatory steps, including Water Board, EMR, Highways;
- Economic considerations associated with the project, including links to local investment and relations with First Nations;
- Transportation options including road, rail and port considerations;
- Capacity building and training opportunities for Yukon residents; and
- Environmental considerations in the area, including the positive impacts of reclaiming A and B valleys.

f. City of Whitehorse

Project representatives have met with the Mayor, Councillors and City Officials both individually and through the Council and Senior Management (CASM) forum. The Mayor and Council expressed interest in the project for both its environmental and economic values to Whitehorse and surrounding area.

Discussions addressed potential issues relating to transportation, air quality and water quality. The CASM was pleased with the level of effort expended in meeting with the business community and local area residents. The forethought associated with the pre-Project work with the Klondike Snowmobile Association to re-route current trails to their satisfaction was also appreciated.

7. Follow-up Engagement

Active dialogue on a number of fronts will continue through the life of the Project. In particular, local residents will be included in the continued monitoring of groundwater quality at local well sites. In addition, there will be ongoing discussion with KDFN and TKC concerning potential economic opportunities for the First Nation businesses and Citizens.

8. Reclamation Project Discussion Forum — Notes

Date: Tuesday, October 19, 2010

Location: High Country Inn, Whitehorse

Opening Remarks and Introductions: Rick Karp, Executive Director, Whitehorse Chamber of Commerce

Speakers: Ranj Pillai, Deputy Mayor, City of Whitehorse

Chuck Eaton, President, Eagle Industrial Minerals

Facilitator: Kirk Cameron

Attendees:

INDUSTRY

Transportation: Michael Brandt (White Pass & Yukon Route)

Tourism: Greg Meredith (Mt. Sima)

Building/Construction/Contractors: Keith Byram (Pelly Construction), Darrell Stone (Skookum Construction)

Energy: Mel Johnson (TransCanada Pipelines), Dwight Redden (Yukon Electrical Company Ltd.)

Other: Jim Coyne (Kluane Drilling/H.Coyne & Sons Ltd.), Darrell Pasloski, Chad Cowan (EBA Engineering), Randy Lewis (Arctic Alpine Seed).

Associations: Rick Karp (Whitehorse Chamber), Samson Hartland (Whitehorse Chamber), Mike Wark (Chamber of Mines), Sandy Babcock (Yukon Chamber), Michael Racz (Yukon Real Estate Association)

GOVERNMENT

City of Whitehorse: Wayne Tuck, Mike Gau, Shannon Clohosey, Ranj Pillai.

Government of Yukon (GY): Terry Hayden (Ec. Dev.), Bob Holmes (EMR), Bryony McIntyre (EMR), Denny Kobayashi (Ec. Dev.), Clint Ireland (Ec. Dev.), Wilf Carter (Ec. Dev.), Glenn Ford (Envir.), Julia Ahlgren (Envir.).

SUPPORT

Kirk Cameron (*northSense management consulting*), Amanda Dieckmann (*northSense*), Bill Dunn (EMR), Graeme Pelchat (EDI), Mike Setterington (EDI), Scott Davidson (Access Consulting).

8:30am

1. **Introductions and Presentations**

Rick Karp addressed attendees and opened the meeting.

Introduction of Ranj Pillai, Deputy Mayor, City of Whitehorse

Mr. Pillai thanked Mr. Eaton for providing this opportunity for Industry, Government and others to come together and to provide input on their project, and indicated the City's support of the project.

Rick Karp thanked Economic Development for their support in organizing the forum. He thanked Eagle Industrial Minerals and associated businesses, *northSense management consulting* and EDI for their extensive work establishing the forum.

Introduction of Chuck Eaton, President, Eagle Industrial Minerals

Chuck Eaton presented the Whitehorse Copper Reclamation Project which provided an overview of the project.

2. **Question / Answer Period**

Dwight Redden: When the mine is operating will it be operating at regular hours?

Chuck Eaton: The reclamation will run 24/7 but for only 8 or 9 months a year. We will operate with a small crew of 4 or 5 working each shift.

Terry Hayden: What is the probability of additional subsidence in the area?

Chuck Eaton: No more subsidence will occur.

Wilf Carter: How much land is available for development? How many trucks will be hauling a day?

Chuck Eaton: There will be 120 acres available for development and approximately 30 trucks hauling a day.

Chad Cowan: Are there any concerns with the excess water in the Little Chief pit?

Chuck Eaton: There are no concerns with the excess water.

Greg Meredith: As a "heads up", Mt. Sima has a summer adventure park development under way. By the time you are up and running we will have an impressive adventure park at Sima.

In addition, the road from the intersection down the hill is gravel and dusty. In your plans you may want to address that.

Wilf Carter: After the reclamation project, are you doing the development yourself?

Chuck Eaton: We will not be developing the site. Our role is to extract the magnetite and leave the site in the most advantageous position for future developers.

Wayne Tuck: What is the volume of the production? What is the volume of the reclamation? What is the highest elevation on the site?

Chuck Eaton: Total volume is approximately 20% of overall tailings volume. The highest elevation on the site is approximately 750 metres.

Ranj Pillai: The City has access to funding for reclamation projects. Funding is available to assist with "brown" reclamation projects.

Chuck Eaton: This project does not really qualify as a "brown field" site, so we would not be eligible for such funding.

Mike Racz: Have you considered sending the tailings to Faro to neutralize the acid tailings at that site?

Chuck Eaton: It would likely be an expensive proposition given volume and trucking distances.

Wayne Tuck: Does Little Chief have more water than you need? In order to fill this pit are you using slurry and tailings?

Chuck Eaton: We will be using tailings as fill for the pit.

3. Round Table

The Forum began with a round table with attendees being asked to indicate why they were attending the forum and what interest they had in the project.

Rick Karp (Whitehorse Chamber): This is an exciting project which includes the idea of reclamation and future development and growth of Whitehorse. This is important to the Chamber.

Samson Hartland (Whitehorse Chamber): Echoed Rick Karp's comments.

Randy Lewis (Arctic Alpine Seed): Worked at Whitehorse Copper and worked with Dr. Craig to test vegetative growth on tailings and donated seed to the project.

Mike Racz (Yukon Real Estate Association): Interest is in land development.

Shannon Clohosey (City of Whitehorse): Interest is in reclamation and in having the best possible use of the land.

Mike Gau (City of Whitehorse): For the City there is great difficulty in getting residential land to the public. It is even more difficult for us to have industrial land available. This project is already approved once the reclamation work is done. It is exciting and encouraging to know we will have this land available.

Wayne Tuck (City of Whitehorse): Echoed Mike Gau's comments.

Mel Johnson (TransCanada Pipeline): Interested in this project as they work on Alaska pipeline development (2015-19 time frame). We have interest in potential pipe storage locations and accessing gravel and tailings for engineer fill. Also as a future returning Yukoner I find it an interesting development.

Julia Ahlgren (Envir., YG): Interest in learning about the project from an environmental assessment perspective.

Dwight Redden (Yukon Electrical): Here to represent the company to see how the company can be involved in reclamation and development.

Clint Ireland (Ec. Dev., YG): Looking at this being a nice project for 6-7 years of employment. Access to industrial land is what his clients talk about and are looking for.

Terry Haden (Ec. Dev., YG): Interested in helping proponents gather information to make good business decisions. He is also looking at the long term/ long range from a value added perspective to Yukon.

Glenn Ford (Envir., YG): Interested in the safety of the dams in A and B valleys and other areas of the project.

Sandy Babcock (Yukon Chamber of Commerce): Interested in hearing the scope of the project and economic activities associated with the project. Also pleased to see modern mining practices in place and an opportunity for this to be showcased.

Darrell Pasloski: Here as a local business person who is excited about the opportunity to see a piece of Whitehorse currently of little worth become economically viable and a part of the community. The project will also be a bright light in current mining practice.

Wilf Carter (Ec. Dev., YG): Interested in the land use opportunity.

Jim Coyne (H. Coyne & Sons Ltd): Has some mining claims in the area.

Bill Dunn (EMR, YG): Sees this as a win-win project where there is opportunity to make some money and to clean the site up.

Bob Holmes (EMR, YG): This project is a good example of society's expectation of mine closure. We can do better. Will be involved in YESAA assessment, water license documents etc. EMR will assist with any scientific issues that come up to make the process move as smoothly as possible.

Bryony McIntyre (EMR, YG): Working on lease amendments, project co-ordination. Support.

Chad Cowan (EBA Engineering): Working on environmental issues with company.

Michael Brandt (WP & YR): Interested in the project for potential freight business and proximity to the site (neighbours).

Mike (EDI): Helping with YESAA application and running a base line for the project looking at wildlife issues.

Chuck Eaton spoke about the economic impact of the project indicating these will be good jobs (good wages and steady employment over the life of the project) and that there will be additional economic spin offs to the community.

4. Forum

Kirk Cameron opened the discussion indicating that this forum provided an opportunity for ideas to be discussed as far as potential for the site. He encouraged attendees to contribute their thoughts.

Randy Lewis: Where is the concentrate going? Will it be shipped through Skagway? How much concentrate is going out through Skagway? And this will be for 6 years?

Chuck Eaton: The concentrate is destined for China and will be shipped through Skagway. We anticipate close to 30 trucks a day transporting concentrate to Skagway for the life of the project (6–7 years)

Mike Gau: I'm wondering about the Skagway Road and tourism and the traffic pattern occurring given all new and anticipated mining projects and the overlap with these projects. We will potentially see 30 trucks/day on this project and we have the Selwyn project and others. The overlap with other companies could see 100 trucks a day easily on the highway. Does it make economic sense to look at rail transportation given this traffic?

Michael Brandt: We need to consider the bigger picture beyond just this project. We would need to try to get some certainty of demand from other mines etc. WP & YR is actively involved in the port development in Skagway. Increased truck traffic is an issue for Skagway too not just on the highway. Road capacity is an issue which needs to be firmed up. This is a good base project to start with.

Randy Lewis: What is Yukon Transport status? Might there be other rail opportunities here? Start with Yukon Transport.

Bob Holmes: In terms of current mining activity in the territory we have Minto which is going strong, Wolverine (they ship concentrate to Stewart), Bell Keno and in the future Dublin Gulch, Selwyn, and Eagle Gold in 2013. There is a lot of potential beyond that, lots of gold potential which is not the same as concentrate trucking as these mines ship gold itself. One would have to take a closer look at tonnage.

Randy Lewis: Is Casino out of that valley?

Bob Holmes: No certainty on that yet.

Bill Dunn: They have to go through the regulatory process then it will depend on the market at that point. It is unlikely that we will see it in the next 10 years.

Randy Lewis: What about the Skagway Road. We will start to see more and more transportation associated with mining going through to Skagway. This is one small project on the horizon.

Chuck Eaton: It is hard to envision the rail being upgraded for this project, but it could kick start considerations for projects coming behind. It certainly would help for the terminus to be here rather than in Carcross. I have no doubts it will take considerable financial investment to upgrade the system.

Mel Johnson: Skagway is the natural port to bring in pipe and associated supplies for the Alaska Highway Pipeline. Rail would be a wonderful solution for us as well as for other projects. As far as this project is concerned the corridor for the pipeline runs close to the project. This close proximity could make it suitable for pipe storage or possibly a pipe plant in the vicinity of Whitehorse. There are synergies that could work. At the end of this development there is potential for natural gas use. There is potential to put a station close to this property for power generation for industrial use (mills etc.).

Wayne Tuck: Will it be a 5–6 year time frame for the pipeline project?

Mel Johnson: That is the time frame for the full project. Whitehorse and Skagway are staging points. We anticipate we will need land sooner than this project can deliver.

Randy Lewis: On this project, will YTG be the land owner at reclamation closure?

Bob Holmes: yes

Bryony McIntyre: The City will work with YTG to facilitate a plan for future development.

Randy Lewis: So in thinking about the future of this site it may not make sense to grass the area as there may need to be streets, sewer and other infrastructure put in place.

Bryony McIntyre: Industrial development would be best.

Wayne Tuck: So you are looking at 30 trucks a day or approximately one an hour?

Chuck Eaton: Yes likely a little less than one an hour

Bill Dunn: As an example, Faro ran 26–40 trucks a day when it was operating.

Randy Lewis: How many Minto trucks run now?

Bill Dunn: 8 a day.

Mike Racz: Does the border close?

Michael Brandt: You may want to adjust your schedule for trucking.

In terms of this project the question is how to plan for the future. Planning sometimes leads to a grid lock in the short term due to lack of certainty. The focus is how to reclaim the site and be poised for the future. This is a great project. Keep as flexible as possible. It is great that you are engaging all the stake holders to identify sensitivities at this early stage. This way you are plugged in to everything. I don't think you could pick a better place for industrial development.

Bob Holmes: If Whitehorse is going to grow how much industrial land is available? Is there pressure to develop this as industrial?

Mike Gau: We have just released a new plan which proposes to expand existing areas. There is very little industrial land other than some in Marwell. With respect to large parcels needing little service and lots of land this is prime area. This site is it basically. Everything is in place for this and you don't have to fight. Don't change from light industry.

Wayne Tuck: It is important in the community to have development close by. It is advantageous that this is planned and that YTG can develop it.

Mike Gau: Sima has an industrial area with a 200 metre buffer between it and serviced areas.

Randy Lewis: So Sima industrial area could be developed while other land in the area is buffered and not able to be developed.

Mike Gau: We are lacking large lots of land for intensive industrial uses. These are about the only large areas left. It is not economically feasible to have water and sewer out there.

Randy Lewis: So companies could bring in their own water by delivery.

Wayne Tuck: Ideally consider restoration of this site for industrial use and have the road network meet standards to prevent frost heaves etc. Leave the lots bare. Make sure silt drains to avoid a mess. Valleys A and B returned to green space/ wetland as we have seen decline in wetland.

Michael Brandt: Following your application, YESAB will indicate what is best and this will determine what reclamation might look like. We can come up with a Cadillac plan. What is the mechanism to determine differential and the premiums in this exercise.

Terry Hayden: Market demand assessment in 10 years from now. If there is a profit to be made you can work with the City. What is the cost going to be to develop the site.

Mike Gau: There will be an industrial study for 2011 to assess some of these things

Wayne Tuck: How would you develop the site? Old pond first then A and B?

Chuck Eaton: Yes the plan is old pond then A and B.

Mike Gau: Mt. Sima has plans for an Adventure Park.

Darrell Pasloski: It is more than just a plan as Sima has received Federal funding for that from CANNOR.

Randy Lewis: Determine the best use for this space. What does this industrial land need to look like following reclamation work?

Wayne Tuck: There is a YTG land protocol. You'll want to plan roads on site carefully so that these can be used following the reclamation work.

Darrell Pasloski: It seems that other than Sima, there are no other plans for Industrial land development. It will likely take 7–10 years to see completion there. Difficult to decide what will sit in there. Requirements for industrial sites exist. Return condition back to original site condition. Keep pit footprint small.

Clint Ireland: Warehousing single staging. Industrial lots should be flat gravel lots, not "squishy".

Bryony McIntyre: This project will make industrial land available.

Mike Gau: In developing an area the City plans the area and YTG Community Services cover the cost of development (new roads, drainage etc.). These are big lots with only 10 at Mt. Sima which were not terribly expensive. Infrastructure will be covered from the sale of the lots. Who else is winning? This may determine who will bring money to table for these lots. YTG sells the lots. YTG could come up with some money to develop this land as they will sell these lots and get the money. Claims go back to the original owner.

Bob Holmes: The legal authority to mine tailings is in the lease as these are not quartz claims.

Mel Johnson: The pipeline would buy a lot for maintenance use. Timing is critical to us.

Chuck Eaton: Lots could be ready for industrial use 2 years after we start (2013).

Mel Johnson: The timing looks good for industrial use.

Chuck Eaton: We are planning on starting with the old pond then moving on to A and B in years 5, 6 and 7. We will be working on the old pond 2 years after our start.

Mike Racz: It would make sense for the developer and YG and the City to sit down and do some deep planning about when you remove material and what you put back and where to understand what it will look like.

Randy Lewis: So it sounds like you will be taking material out, shipping, filling, having this lot done, then moving on to another, making lots available one at a time.

Chuck Eaton: Yes

Sandy Babcock: Rather than having YG develop the lots we would like to see YG sell these lots to developers for private development.

Terry Hayden: Need to emphasize the idea of "value" to sell it and the cost of lost opportunity.

Randy Lewis: 10 lots sell for what?

Mike Racz: Sima lots sold for $ 250,000 per lot. This was the sale value and did not include the additional value of the industrial space.

Julia Ahlgren: Are you aware of any plans for the First Nations settlement land around this project.

Kirk Cameron: We have initiated discussions with the First Nations and will continue with these discussions in order to determine what if any plans they have.

Mike Racz: A gravel pad is best to go with for light and Industrial land use.

Randy Lewis: Reclamation could change as possible land use changes.

Bill Dunn: Follow the City Plan on reclamation. It doesn't have to be green, gravel is OK. YESAB and the government's decision documents will play a role.

Randy Lewis: Best to reclaim to basic level.

Dwight Redden: Will there be different compaction levels as you reclaim the site?

Rick Karp: Following reclamation and when YG sells lots there should be an option listed for private development still under light industrial requirements.

Mike Gau: The City's Official plan also reconfigures the Chadburn Lake Reserve. For this project the park reserve crosses the river and approaches the highway from Utah and north. This will open more mixed commercial industrial land for trucking purposes. Good to cluster this use together off the highway and in city limits.

Kirk Cameron called for final thoughts and ideas.

Mike Racz: I think this project is a great idea.

Randy Lewis: I like the idea of pulling all these resources together in one room. It is good to be engaged with this to determine the best overall use for the area. This will be a good development to have such an industrial park. We are still caught in the Yukon economic "two step" — one step forward, two steps back. This was great today. From a reclamation standpoint, reclaim to end use now. Maybe some of the previously existing infrastructure wouldn't have been removed from the site if this discussion had happened earlier. If the City, YTG and other financial contributors can come together it could result in a good plan.

Rick Karp: I'd like to thank Chuck. This has been great.

11:11am meeting ended.