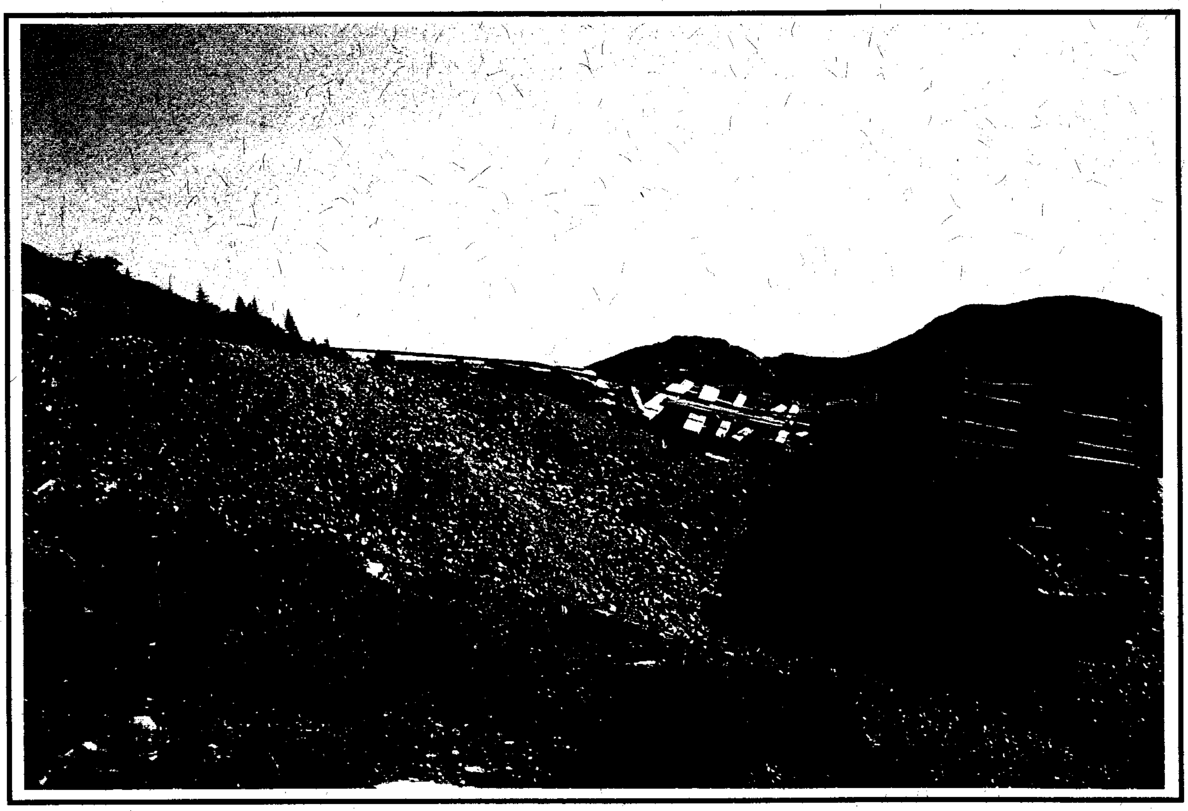
MU-0721

PWGSC

Quality in Environmental Services

PHASE II ENVIRONMENTAL ASSESSMENT OF THE SILVER SEVEN ABANDONED MINE SITE



prepared for:

Action on Waste Program
Indian and Northern Affairs Canada

prepared by:

Environmental Services
Public Works and Government Services Canada

February 1997

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Canada

Printed on recycled paper

PHASE II
ENVIRONMENTAL ASSESSMENT
of the
SILVER SEVEN MINE SITE

Prepared for:

Action on Waste Program
Indian and Northern Affairs Canada

Prepared by:

Environmental Services
Public Works and Government Services Canada

March 1997

EXECUTIVE SUMMARY

A phase II environmental assessment was conducted at the Silver Seven abandoned mine site (60^{0}19'20'' N, 130 40'30'' W) in July, 1996 by Environmental Services, Public Works and Government Services Canada for the Action on Waste Program, Indian and Northern Affairs Canada. Based on the findings of the Phase I investigation performed in 1993 by DIAND Technical Services, a phase II assessment was conducted to a) identify potential environmental and human health risks associated with the present condition of the mine site, and b) provide recommendations and preliminary cost estimates for remediation of those risks. At this time a field investigation of the abandoned mine site was conducted to evaluate environmental and human safety concerns with respect to: mine openings and workings; buildings and infrastructure; waste disposal areas; waste rock disposal areas; surface water (including adit and waste rock seepage, and receiving waters); and hazardous and non-hazardous materials on the site.

The results of the investigation concluded that although the condition of the adit and raise are stable, neither opening is adequately secured from public and wildlife access. Health and safety concerns arose over the condition of buildings and infrastructure on site (eg. ore bin) which could jeopardize both human and animal safety. Aesthetic concerns arose from the presence of deteriorated buildings, metal 205 litre drums as well as assorted metal and wooden waste scattered about the site. A minor concern also arose over a small area of hydrocarbon stained soil in the vicinity of the old machine shop.

Minor environmental risks exist relating to the tailings at the mill site based on contained values exceeding CCME guidelines for lead, zinc, and silver. However, since the volume is small contained and chemically unavailable over the long term annual monitoring for a period of 5 years should be sufficient.

Using applicable federal and territorial criteria as well as northern mine reclamation guidelines, recommendations are to secure the single adit and raise openings using surrounding rock and soil, crush and bury empty oil barrels on site, demolish and burn remaining wooden buildings and structures on site and scarify and fertilize a minor amount of hydrocarbon soil found on site.

Should further development occur on the site, regulatory agencies should ensure that an acid drainage prevention plan is developed which includes detailed measures for handling and disposal of mineralized waste rock.

Summary of Recommendations & Costs

ASSESSMENT COMPONENT	RISK	RECOMMENDATION
1. Building, Infrastructure, Equipment		
Machine shop, bunkhouse, core shack and tent frame	Health and Safety Concern	Demolish and burn on site
Wood crib ore bin and trestle	Health and Safety Concern	Demolish and burn on site
2. Non-Hazardous Waste Material		
Timbers, misc. wood waste	Health and Safety Concern	Burn on site
Misc. metal debris	Aesthetic Concern	Bury on site
3. Hazardous Materials		
Hydrocarbon stains, machine shop	Aesthetic concern	Scarify and fertilize on site.
4. Water Quality		
Mine Seepage - None	None	None
Site Drainage - Minor	Minor Environmental Risk	None
Receiving Waters - None	None	None
5. Waste Rock Disposal Areas		
adit level - 2,175 m^3	Minor Environmental Risk	None
6. Mine Openings		
Raise at upper level	Health and Safety Concern	Seal with available waste rock
7. Tailings		
Mill site - 140 m^3	Minor Environmental Risk	Monitor yearly for 5 years.

1.0 INTRODUCTION AND BACKGROUND

TABLE OF CONTENTS

1.0 INTRODUCTION AND BACKGROUND

In 1993, assessments of 49 abandoned Yukon mine exploration and development sites were completed under the Arctic Environmental Strategy - Action on Waste program by DIAND Technical Services. These assessments were intended to provide a general overview of historical activities, describe site infrastructure, workings and wastes, describe existing environmental or safety concerns on each site, and provide general recommendations for remediation or mitigation work, as appropriate.

The Silver Seven site consists of both a mine site and mill site. Concerns were identified for each area. At the Silver Seven mine site, the overview assessments identified concerns associated with:

(a) a high priority for improving safety aspects at the site
(b) a moderate priority for the clean up of dilapidated buildings & infrastructure

At the Silver Seven mill site, the overview assessments identified concerns associated with:

(a) a medium priority for the sampling of tailings and surrounding vegetation to determine levels and extent of contamination

No aesthetic concern was expressed with respect to existing buildings' deterioration. No rock, soil or water samples were collected for this overview assessment.

Indian and Northern Affairs Canada has determined that further investigation is warranted. Environmental Services, Public Works and Government Services Canada was retained to conduct an environmental assessment of the Dale abandoned mine site to a) identify specific environmental and human safety risks and aesthetic concerns; b) provide clean-up recommendations; and c) provide a Class "D" cost estimate for recommended remediation or mitigation measures.

1.1 Location:

The Silver Seven mine site is located at 60°08'07"N, 132°5'44"W and approximately 13 km east northeast of Rancheria, YT. The mine site consists of one adit at the main mine level, with a raise and shaft at upper trenching level. The toe of the prominent waste rock disposal area (at the main adit area) from the minesite is located approximately 700 metres north northwest and 138 m above an unnamed tributary of Boulder Creek.

An abandoned mill site is located at 60°05'55"N, 130°23'25"W approximately 12.5 km east of Rancheria, Y.T., 5 km south southeast of the mine site, 250 m north of Veronica Lake and 300 m west of Boulder Creek.

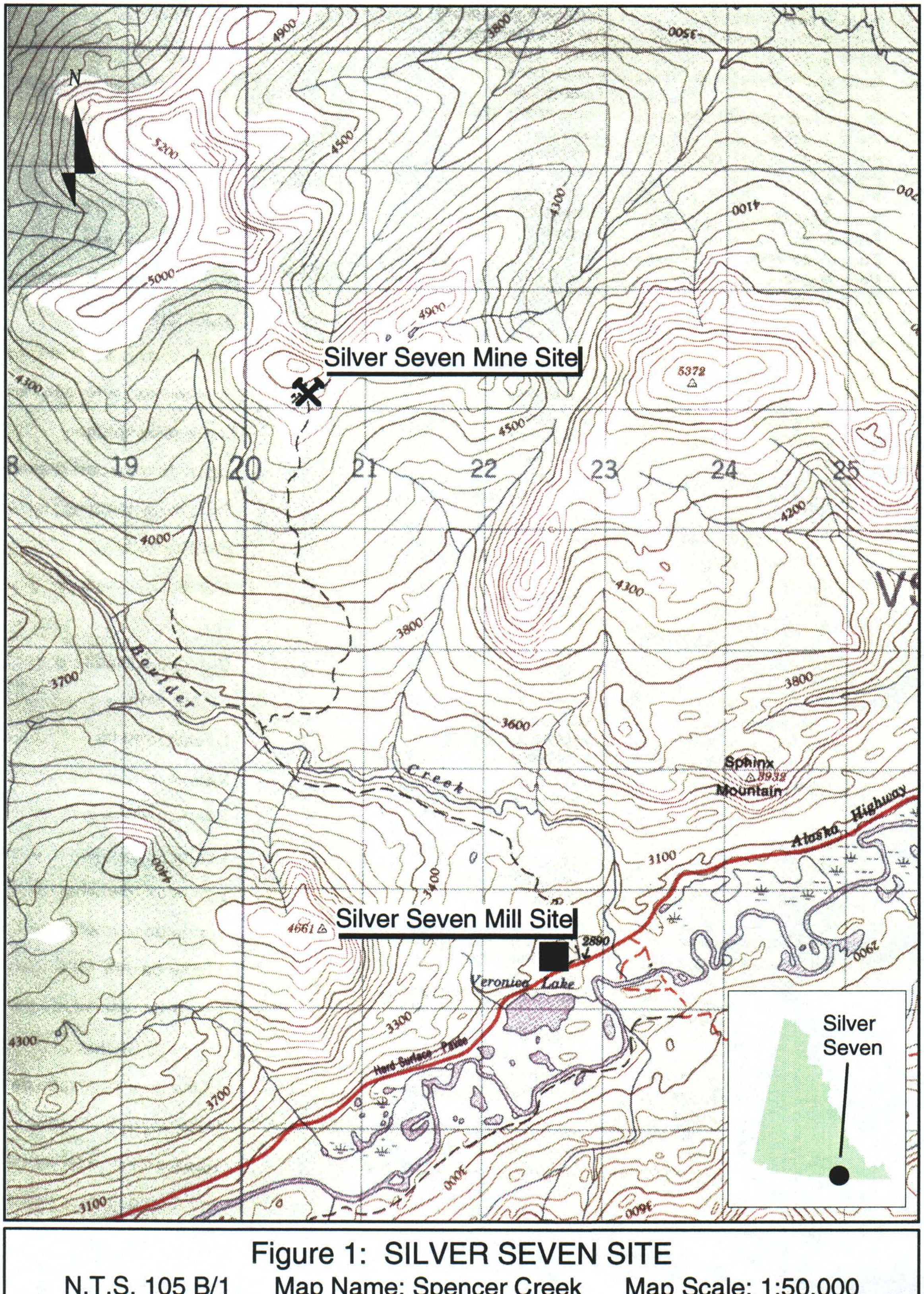
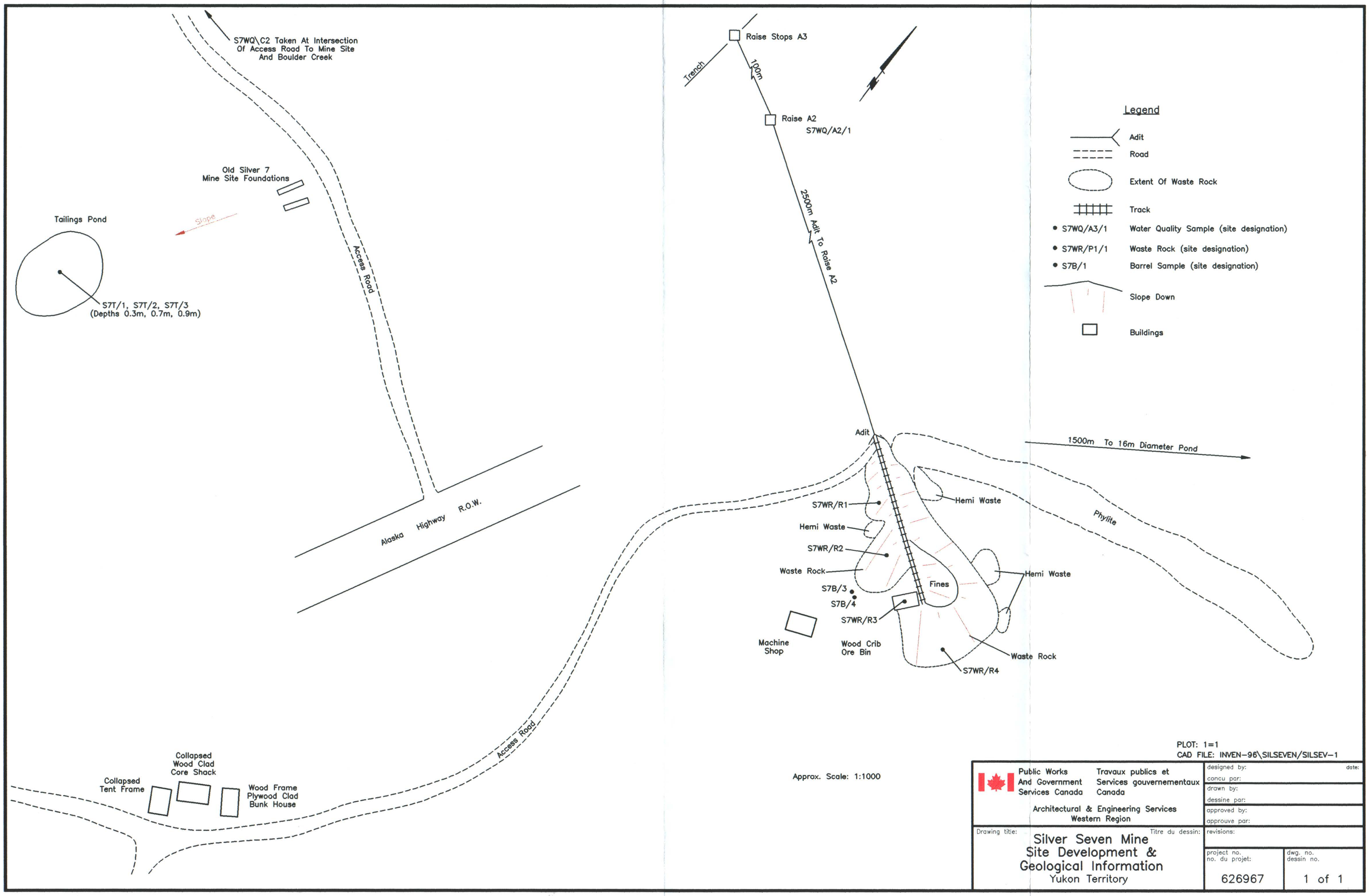


Figure 1: SILVER SEVEN SITE

N.T.S. 105 B/1 Map Name: Spencer Creek Map Scale: 1:50,000

Latitude: 60° 08' 07" N Longitude: 130° 25' 44" W


S7WQ\C2 Taken At Intersection Of Access Road To Mine Site And Boulder Creek
Old Silver 7 Mine Site Foundations
Slope
Tailings Pond
S7T/1, S7T/2, S7T/3 (Depths 0.3m, 0.7m, 0.9m)
Access Road
Alaska Highway R.O.W.
Collapsed Tent Frame
Collapsed Wood Clad Core Shack
Wood Frame Plywood Clad Bunk House
Access Road
Raise Stops A3
Trench
100m
Raise A2
S7WQ/A2/1
2500m Adit To Raise A2
Adit
1500m To 16m Diameter Pond
S7WR/R1
Hemi Waste
S7WR/R2
Waste Rock
S7B/3
S7B/4
S7WR/R3
Fines
Hemi Waste
Phylite
Hemi Waste
Waste Rock
S7WR/R4
Machine Shop
Wood Crib Ore Bin
Legend
Adit
Road
Extent Of Waste Rock
Track
S7WQ/A3/1 Water Quality Sample (site designation)
S7WR/P1/1 Waste Rock (site designation)
S7B/1 Barrel Sample (site designation)
Slope Down
Buildings
Approx. Scale: 1:1000
PLOT: 1=1
CAD FILE: INVEN-96\SILSEVEN/SILSEV-1
Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services Western Region
Drawing title:
Titre du dessin:
Silver Seven Mine Site Development & Geological Information Yukon Territory
designed by:
concu par:
date:
drawn by:
dessine par:
approved by:
approuve par:
revisions:
project no. no. du projet:
626967
dwg. no. dessin no.
1 of 1

1.2 Overview of Site Development:

The Silver Seven, or Fiddler, mine property was first explored by Cominco in 1943, likely as a strategic metal source. Work has continued up to 1989 with development focused on tungsten mineralization hosting a series of en echelon polymetallic quartz veins. The property includes both the mine and exploration site at the summit of a peak north of Boulder Creek, and a small mill facility roughly 130 metres north from the edge of the Alaska Highway, 250 metres west of Boulder Creek. Work on the Silver Seven mine site has focused on three areas based on Department of Indian Affairs and Northern Development (DIAND) and Yukon Territorial Government (YTG) assessment file and MinFile data.

In 1951-53, a total of 233.1 m of underground development was completed on the Fiddler Main zone. Two dilapidated mine buildings and the floor of a third building still stand near the portal area. A series of bulldozer trenching programs in 1970-71, 1976, 1978 and 1987 extended over an area up to a kilometre east and west along the flanking ridge tops to the Fiddler East and the Fiddler West zones. Four diamond drill holes totalling 2,155 metres were completed from the Fiddler Main to approximately 800 metres to the northwest. Further information concerning current claims status is available upon request.

A 45.4 (metric) tonne mill was constructed during the 1951-53 mining operation approximately 5 kilometres to the southeast where the mine road meets the Alaska Highway. Charred timbers suggested the mill building was destroyed by fire. A small tailings pond areas is located directly below the mill site.

1.3 Site Access:

Although access to the site was listed as being located at mile 701 of the Alaska Highway, the access road (on the north side of the highway) is overgrown with vegetation and difficult to spot from the highway. This road is actually located 200 m west of a bridge over Boulder Creek and 300 m east of Veronica Lake **(See Figure 1)**.

The Silver Seven site consists of a mill site located a short distance to the west of the main trail to the mine site. Access is also available to the mill site by means of a short hike (100 m) through dense brush which borders the north side of the Alaska Highway. The seven km trail leading up to the Silver Seven mine site is overgrown, rough, steep and suitable only for travel on ATV. The mill site is situated at an elevation of 881 m and the mine site at an elevation of 1,509 m.

2.0 PURPOSE AND SCOPE OF WORK

The following assessment activities were completed:

- Inspection of mine openings and workings, buildings and infrastructure, and waste disposal areas;
- Photo documentation and mapping of relevant site features;

- Sampling of waste rock disposal areas, stained soils, surface water (including adit and waste rock seepage, and receiving waters) and barrel contents;
- Identification and inventory of hazardous and non-hazardous materials on the site;
- Identification of potential or actual environmental pathways and receptors for site contaminants; and
- Assessment of human safety hazards and potential for accidental or deliberate access to hazardous areas.

Upon completion of these activities, preliminary cost estimates were generated to meet the following remediation/mitigation requirements:

- Physical stabilization of waste rock disposal areas;
- Chemical stabilization of the waste rock disposal areas as appropriate to local and background conditions, taking into account impact, on-site resources, and accessibility;
- Sealing of all mine openings;
- Consolidation and landfill of all non-hazardous, non-combustible solid wastes;
- Remediation or removal and disposal of contaminated soils as required to meet the more stringent of: Yukon Government's Contaminated Sites Regulations (1996) Schedule 1; and Canadian Council of Ministers of the Environment's Interim Canadian Environmental Quality Criteria for Contaminated Sites (1991) Commercial/Industrial criteria for soils;
- Removal and disposal of hazardous solid wastes;
- Draining, cleaning and disposal of drums or other containers containing petroleum products or other liquid hazardous wastes;
- Onsite flaring or removal and off-site disposal of petroleum products and other liquid hazardous wastes; and
- Demolition of buildings and infrastructure to foundation level and burning of combustible non-hazardous materials in approved location

3.0 SITE ASSESSMENT METHODOLOGY

3.1 Assumptions:

At each mine site, the assessment was limited to the area specifically developed or occupied for mine exploration or mining purposes and immediately adjacent areas within applicable claim boundaries as well as off-site environmental resources believed to be affected by mine exploration or development activities. Water samples were taken off-site to determine potential impact to surface water bodies due to mining activities. Access roadways to mine sites were not included in the assessments.

3.2 ASSESSMENT CRITERIA

3.2.1 Criteria and Guidelines

Metal Mining Liquid Effluent Regulations and Guidelines (Environmental Protection Service, Environment Canada, 1977)

The intent of the requirements defined in this document is to limit the discharge of deleterious substances from base-metal, uranium and iron ore mines. These requirements are uniformly applied national standards and intended to provide protection for fish and other aquatic life.

Interim Canadian Environmental Quality Criteria for Contaminated Sites (Canadian Council of Ministers of the Environment, 1992)

The Canadian Council of Ministers of the Environment (CCME) Interim Canadian Environmental Quality Criteria for Contaminated Sites are numerical limits for contaminants in soil and water intended to protect, maintain or improve environmental quality and human health at contaminated sites in general. CCME criteria include two types of benchmarks for soil and water quality - assessment criteria and remediation criteria. Assessment criteria are approximate background concentrations or approximate analytical detection limits for contaminants in soil and water, and remediation criteria are used as clean-up benchmarks based upon intended land use. Remediation criteria do not address site-specific conditions. They are considered generally protective of human and environmental health for specified uses of soil and water at contaminated sites. The remediation criteria for soil are classified by three land uses:

1) Agricultural,
2) Residential/Parkland, and
3) Commercial/Industrial.

Remediation criteria for water are classified by four uses of water likely of concern at contaminated sites:

1) Freshwater aquatic life,
2) Irrigation,
3) Livestock watering, and
4) Drinking water.

Contaminated Sites Regulations (draft) (Yukon Government, 1996)

According to these draft regulations a site is contaminated if it used for agricultural, commercial, industrial, parkland, or residential land use and contains a substance in concentration greater than or equal to:

(I) the generic numerical soil standard of Schedule 1, or
(ii) the matrix (pathway specific) numerical soil standards of Schedule 2

and, surface or groundwater used for aquatic life, irrigation, livestock, or drinking water which exceeds a concentration greater than or equal to:

(I) the generic numerical water standard of Schedule 3, or
(ii) the local background concentration of that substance in the soil, surface water, or groundwater.

Below 3 metres of the surface, commercial land use criteria is applicable.

Mine Reclamation in Northwest Territories and Yukon (INAC, 1992)

This report defines factors which are to be considered in reclamation of abandoned mine sites operating in northern climates. Factors include:

- open pit and underground mines;
- special mines such as uranium, sand and gravel, and coal;
- waste rock and tailings disposal;
- acid generation and leaching; and
- estimating cleanup costs.

3.2.2 Application of Criteria and Guidelines

The following assessment criteria were used for the Silver Seven abandoned mine site:

A. Soils:

CCME: Remediation Criteria for Soil - Commercial/Industrial standard

YUKON RENEWABLE RESOURCES: Draft Contaminated Sites Regulations - used for hydrocarbon screening parameters

B. Water:

Envir. Canada: Metal Mining Liquid Effluent Regulations and Guidelines - are compared to seepage from mine openings, and river/stream water quality

Background: Downstream water quality results of rivers and streams are compared to the results of upstream (background) water quality.

CCME: Remediation Criteria for Water - Freshwater Aquatic Life guideline for river and stream water quality

[Note: In this screening assessment of water quality, analytical results are primarily compared to background values which may more accurately characterize the local environment.]

C. Mine Clean-Up and Reclamation:

INAC: Mine Reclamation in Northwest Territories and Yukon

3.3 METHODS

3.3.1 Background Information

Available background information was consolidated from the Yukon Chamber of Mines mine records, Whitehorse Public Library, Yukon Archives holdings, and records and reports from the Yukon Renewable Resources Library, Yukon Water Board, DIAND Lands Branch, DIAND Water Resources, and DIAND Library. INAC (1994) provided an overview assessment of the Silver Hart mine site to that date.

Other published information sources were examined for site or regional information as applicable. On the basis of available information, knowledge gaps regarding existing or potential safety and environmental risks at the site were identified and a site assessment plan was developed.

3.3.2 Site Assessment Components

A site assessment was conducted to identify existing or potential safety and environmental risks on the site. The assessment included the following components:

Waste Rock disposal areas were inspected and sampled by a professional geologist to assess acid rock drainage potential by:

- Identifying waste rock mineralization with potential to release acidic and/or metal-contaminated drainage
- Mapping and logging waste rock, tailings, pit walls and rock faces
- Collecting and field testing representative samples of mine wastes

Mine Openings were inspected and documented to identify closure requirements.

Non-Hazardous Site Debris was inventoried.

Contaminated Soil Areas were measured and sampled to determine the degree and type of contamination and estimate soil volumes for remediation.

Hazardous Materials were inventoried and sampled for identification of contaminant constituents, as necessary.

Buildings and other Structures were inspected for hazardous material and assessed for stability.

Borrow Sources were identified and assessed for accessibility and approximate quantity and type of granular material.

Scale site plans were prepared to identify the dimensions and locations site structures, mine workings and adits, waste rock disposal areas, on-site sampling locations (as applicable), and any other pertinent information.

3.3.3 Sampling Methods and Quality Assurance

Test Pit Sampling

Test pits were excavated to a depth of about 0.3 m to 1.0 m. Horizons in the test pit walls were logged, noting colour/weathering, rock composition, primary and secondary mineralization, particle size distribution, paste pH and paste conductivity, and moisture content. The test pit and was photographed and its location was marked on the field map. Approximately 2 kg of rock was collected at each sample site. For test pits showing a homogeneous wall face, a plastic sheet was placed at the bottom of the test pit and the pit wall was cut vertically down with a cleaned shovel. All rock larger than 75 mm in size was discarded. The sample was coned and quartered, discarding opposite quarters, until a 2 kg sample was obtained. For test pit walls showing clearly-distinguishable horizons (distinguishable by the sulphide and carbonate contents), the horizons were sampled individually.

Water Sampling

Samples were collected from surface streams upstream and downstream of mine related flows, and from representative seeps emanating from waste rock, tailings, pit walls, and/or adits. 250 ml water samples were collected by hand, facing upstream, ensuring that the sample is not contaminated by disturbed sediment, debris and other floating materials. Sample bottles were rinsed three times with water from the sample stream prior to collecting the sample. Two (2) ml of HNO_3 were immediately added to water samples destined for metals analyses. For analyses of non-metallic parameters, water samples were brim-filled to minimise head space, placed in a cooler, and maintained at 4° C until delivery to the laboratory.

Soil Sampling

Soil lithology was recorded from observations of the side walls of the test pit, and soil samples for both field and laboratory testing were collected. Observations were recorded for each soil sample site, including soil particle size, consistency, colour, moisture, discolouration, stratification, odour, and any other observations of significance. Samples were collected at depth intervals selected on the basis of stratigraphic observations and anticipated or apparent contamination. The lab samples were collected using disposable latex gloves and decontaminated stainless steel sampling utensils. All samples intended for organic analyses were stored in laboratory-cleaned 250 ml glass jars; samples intended for metals analyses were placed in new "Whirl-Pak" bags. All samples were placed in a cooler for shipment to the laboratory.

Barrel, Pail, and Above-Ground Storage Tank Sampling

Barrels and pails suspected as containing hydrocarbons were sampled with 1.2 m clean hollow glass rods ("drum thieves"), capable of extracting up to 25 ml of product. The rods were inserted into the drum or pail, and the uppermost open tip was sealed to maintain the sample within the rod as it was extracted from the drum or pail. The sampled hydrocarbon was then drained into a 40-ml laboratory-cleaned vial. The extractions were repeated until at least 20-30 ml of product was obtained. The vial was then sealed and placed in a container for shipment to the laboratory. Each used drum thief rod was subsequently destroyed to prevent accidental re-use.

A total of four 205 litre barrels were sampled during the site visit and 2 samples were submitted for analysis for petroleum hydrocarbons and halogens. Although both samples were above detection limits, the contents of both barrels could be "flared off " easily on site. No tanks or other drums were identified on site.

Quality Assurance

Quality Assurance (QA) is a set of procedures for ensuring that the results of chemical analyses are, and can be shown to be, accurately representative of field conditions. A complete QA program includes both a field component and a laboratory component. In addition to the standard sample collection methods outlined above, the field QA measures that were implemented for this assessment study include:

- chain of custody procedures and forms;
- a sample labelling and sample location identification scheme;
- laboratory preparation of all sampling containers;
- laboratory defined sample preservation and shipping procedures; and
- regular maintenance (including re-calibration) and cleaning of field equipment.

Laboratory QA measures included replicate analyses of selected soil and water samples. Replicate analytical results were submitted with each analytical report.

4.0 ENVIRONMENTAL SETTING

4.1 Mineralization

The Silver Seven Mine & Mill sites are both located within the Liard River Ecoregion and most of the area that comprises this region is underlain by rocks of a sedimentary type and less so by metamorphic rocks. Shale, slate, conglomerate, limestone, chert, argillite and dolomite are common. (Ecoregions of Yukon Territory, Oswald, E.T. & Senyk, J.P., p.26)

The Silver Seven property is underlain by limy Cambrian phyllites of the Cassiar Platform, near the eastern contact of the northwest trending Jurassic quartz monzonite to granodiorite Cassiar Batholith. The phyllites form tight, near-isoclinal folds and are locally altered by contact metamorphism to skarn.

The Silver Seven property hosts silver, tungsten, tin, copper, zinc, lead and fluorine mineralization in three zones: Fiddler Main, Fiddler East and Fiddler West. Massive sulphide ore mineralization was not observed and is not referred to in reports on the property. Less than 2% pyrite and pyrrhotite were observed in waste rock piles as coarse blebs in quartz veins and disseminated in the host phyllite. Mineralization is considered related to Tertiary igneous activity as indicated by mineral age dating of the veins (MinFile Report 105B 004).

The mineralization occurs in a variety of occurrence types, including:

1. northeast trending, en echelon wolframite - scheelite -flourite - sphalerite - galena - pyrrhotite - pyrite quartz veins, associated secondary cassiterite quartz veins, and disseminated sheelite - wolframite - pyrrhotite - pyrite skarns in the Fiddler Main and Fiddler West zones;

2. scheelite quartz stockworks and silicified breccia zones in the Fiddler East, and;

3. minor, northwest trending, massive galena veins in a showing located a kilometre north.

Reported assays range from 8.45% WO_3 across an average width of 0.34 metres along 15 metres of strike length in the Fiddler Main zone. In the Fiddler East, samples assayed up to 0.54% WO_3 with traces Pb, Zn and Cu over widths of up to 2.1 metres. The Fiddler West zone is silver rich with results that ranged up to 569.1 g/t Ag, 0.2% Cu, 3.2% Pb, traces Sn and 0.7% WO_3 across 0.9 metres. The best result from skarn mineralization was 38 metres of 0.07% WO_3 obtained from the 1980 drilling.

4.2 Surface Hydrology

No surface water was observed in the area of the Silver Seven mine. Creeks originating a kilometre from the mine site, drain north and south from the area. Boulder Creek was sampled **(S7WQ-C2)** where it is forded by the mine road in the creek valley 2.5 kilometres to the south at an elevation of 1030 metres. Boulder Creek has a cross section at this point of approximately 3.5 metres by 0.5 metres.

The Silver Seven mine site occupies a southeastern facing ridge varying in elevation from 1494 m to 1525 m. The headwaters of an unnamed tributary are situated 700 m south southeast of the adit entrance and flow southeast to connect with another unnamed tributary which in turn flows southwest to connect with Boulder Creek. The headwaters of a second unnamed tributary are located approximately 180 m west and 140 m below the adit entrance. This tributary joins Boulder Creek 2 ½ km to the southwest which in turn empties into the

Rancheria River which in turn flows northeastward and empties into the Liard River. The Liard River itself eventually empties into the Mackenzie River.

The Silver Seven Mill Site is located 5 1/4 km south southeast of the mine adit, 250 m north of Veronica Lake and 300 m west of Boulder Creek. The site is situated on a western facing hill which slopes down to a low lying bowl shaped area (30 m in diameter) which was the depository for the mine waste. Due to its circular shape (when viewed from overhead), this area mistakenly appears as a small circular lake on the N.T.S. map. No other receiving bodies of water abut the mill site.

4.3 Climate

The Silver Seven mine site lies in the Liard River Ecoregion which comprises an area of 21,275 km^2 and is located in the southeastern portion of the Yukon Territory. The site is situated within the southeastern portion of the Yukon and is subject to a predominating cold continental climate which provides colder winter and warmer summer temperatures than other areas of the Yukon which are under a more significant marine influence.

Generally speaking, the climate of this portion of the Yukon consists of long cold winters and short warm summers. Mean annual temperatures are below freezing and vary from a low of -25 °C to a high of 15°C with annual precipitation varying from 375 mm to 500 mm, increasing with elevation and during the summer months of July, August and September.

More specifically, for the Liard River Ecoregion, annual precipitation averages 430 mm with amounts in the west averaging 400 mm and increasing to 625 mm in the eastern portions of the ecoregion. Mean annual temperature is -3°C at an elevation of 685 m with a January mean of -25 °C and a July mean of 15 °C. (Ecoregions of Yukon Territory, Oswald, E.T. & Senyk, J.P., p. 14 & p. 26)

4.4 Vegetation

The Liard River Ecoregion, comprising an area of 21,725 m^2 with predominate stands of black and white spruce and lodgepole pine is included in the Eastern Yukon forest subregion. Dry sites containing aspen and alpine fir predominate in subalpine regions where the treeline is located at 1500 m elevation. The ecoregion is forested primarily with closed stands of conifers and hardwoods reaching heights of 30 m adjacent to river terraces and has the highest potential for growing trees of any Yukon area.

Both the Silver Seven mine and mill sites lie within the B26c forest region. This ecoregion is forested primarily with closed stands of conifers and some hardwoods and is reputed to have the highest potential for growing trees of any Yukon area. While open black spruce and (occasionally lodgepole pine) form extensive forests, white spruce (occasionally mixed with aspen or lodgepole pine) occurs on warmer and better drained sites below subalpine. In the subalpine area itself, alpine fir predominates. Lodgepole pine tends to predominate in hilly areas as a result of fire while aspen appears in pure or mixed stands on south facing slopes.

Paper birch appears scattered throughout other species on upland slopes with a northern orientation. (Soil, Site & Land Classification, Rowe, J.S. 1972).

Understory vegetation consists of shrub and moss growth beneath mature conifer stands along with alder, soapberry, blueberry, rose and willows. Coarse textured soils are covered with lichens, forbs and various shrubs. Much of the site is composed of moderately well drained areas which are covered by sedge or sphagnum hummocks/tussocks which in turn support ericaceous shrubs, cinquefoil or lichens. Ground birch and willow tend to become prevalent above treeline.

4.5 Fish and Wildlife Resources

River systems in the Silver Seven mine and mill site region include the Rancheria River, Boulder Creek and Spencer Creek. Fish species reported to be found in the Liard River system generally include: Arctic Grayling, Burbot, Dolly Varden Char, Emerald Shiner, Finescale Dace, Flathead Chub, Goldeye, Inconnu, Lake Chub, Lake Trout, Lake Whitefish, Longnose Dace, Longnose Sucker, Mountain Whitefish, Ninespinie Stickleback, Northern Pike, Rainbow Trout, Round Whitefish, Slimy Sculpin, Spottail Shiner, Trout Perch, White Sucker, and Yellow Walleye.

The species of most importance to domestic and sports fisheries includes Arctic Grayling, Dolly Varden Char, Lake Trout and Northern Pike. (Foothills Pipelines Ltd. 1976).The Silver Seven mine site includes primarily boreal and subalpine vegetation which serves to provide summer and fall range for small numbers of moose and caribou **(See Photo # 8).** The site is located within year round mountain goat, thinhorn sheep, moose and woodland caribou (Little Rancheria herd) range. Golden eagles are known to nest nearby and hunt around the mine site (Interview Val Loewen, Habitat Inventory Specialist, Government of Yukon, Dec. 9, 1996).

Food resources are minimal during winter months due to snow depth. Black bear are present in small numbers at lower elevations with grizzlies occasionally moving through the area. Other small animals which may occur in the area include: wolf, coyote, red fox, lynx, marten, wolverine, mink, river otter, and ermine. Beaver and muskrat likely occur at lower elevations. Bird species in the area would include hawks, falcons, owls, ptarmigan, spruce grouse, and (diving duck) waterfowl (Silver Hart Project Overview Report, Norecol Environmental Consultants, Dec. 1987. p. 4-2 to 4-4).

4.6 Site Topography and Soils

The Silver Seven exploration and mine site is located above 1,500 m elevation on a gently sloping, predominantly south facing system of alpine mountain ridges. The slopes below 1400 metres are covered with a veneer of patches of ablation and lodgment till and widespread colluvium and reworked till. Above 1400 metres, bedrock exposures of approximately 10% to 20% of the area are exposed through a cover of colluvium and reworked till. Glacially formed cirque basins along some of the north facing slopes are generally steeper and have significant rock face exposures.

The Silver Seven mill site is located along the north bench of the Rancheria River valley at an elevation of approximately 1180 metres. The area is underlain by unconsolidated glaciofluvial deposits of sand, silt and gravel. Both the Silver Seven mine and mill sites were covered by a minimum of three ice advances which moved north from the Cassiar Mountains. Each of these advances was in turn deflected eastward by the Pelly Mountains and again when the Cassiar ice came in contact with ice moving southward from the Selwyn and Logan Mountains. As the area is permeated with glacial deposits of the morainal, glaciofluvial and lacustrine variety, few rocky outcroppings remain. (Ecoregions of Yukon Territory, Oswald, E.T. & Senyk, J.P., p.26)

The main adit of the Silver Seven mine site is situated on a 10° slope facing southeasterward at an elevation of 1509 m. The upper raise A2 is situated approximately 250 m to the northwest at an elevation of 1524 m and an additional raise is situated in an adjacent upper trenching area **(See Photos 1 - 3)**.

Outbuildings within the vicinity of the adit consisted of a ore bin facility and tool shed located at elevations of approximately 1519 m and 1517 m respectively with the tool shed situated 20 m southwest of the ore bin. A wood frame plywood clad bunkhouse structure and a wood frame core shed (now collapsed) were identified further to the southwest of the adit entrance at an elevation of approximately 1520 m. A large fan shaped area of waste rock tailings originates at the adit entrance and extends southeastward for approximately 50 m providing support for the rail line. More recent trenching activities have occurred west of the main adit adjacent to the raise.

4.7 Permafrost

The Silver Seven site is situated within the scattered permafrost subzone of discontinuous permafrost zone that stretches across 80% of the land mass of the Yukon. In this area, permafrost tends to be localized with the active layer varying in thickness and depth. Quite often, the relative distribution of permafrost varies according to terrain and elevation.

5.0 SITE DESCRIPTION AND FINDINGS

5.1 Buildings, Infrastructure, Equipment

Although the Silver Seven site consists of both mine and mill areas, the infrastructure is limited to wood frame buildings on the mine site. Three structures of significance remaining on the SilverSeven mine site are situated within 100 m of the vicinity of the adit entrance (as detailed in table below) and are in poor condition. The remaining cook/bunk/outhouse structure is located at the top of the trail 100 m from the main adit to the upper adit area. No structures remain standing at the Silver Seven mill site except for the original concrete foundation which supported the mill structure. No obvious signs of soil staining were found on either site. **(See Photos 1 - 4)**

Table 1: Buildings, Infrastructure, Equipment

Structure	Construction Features	Interior Contents
Ore Bin / Load Out Facility	Wood timber (log) framed ore loading facility 4 m x 7 m x 6 m	Interior of structure loaded with waste material exerting pressure on structure and leading to dilapidated condition
Mechanical/ Tool Shed	Wood framed, plywood clad walls & floor, metal clad peaked roof; 6 m x Seven m x 4 m; risk to visitors of collapse.	Raised wood frame plywood clad floor over west ½ of floor area and in state of serious deterioration; south wall collapsing;
Core Rack Structure	Wood frame, plywood clad walls & floor collapsed.	n/a
Living Quarters	- 3.6 X 4.9 m X 2.4 m log structure covered with plastic and nylon tarpaulins, wood floor on wood joist frame 0.6 m above grade; heat supplied by oil stove from 3 X 205 l drums to north of structure	Interior in very poor condition

Outbuildings within the vicinity of the adit consisted of a ore bin facility and tool shed with the tool shed situated 20 m southwest of the ore bin (see Photos 2 & 4). A wood frame plywood clad bunkhouse structure and a wood frame core shed (now collapsed) were identified further to the southwest of the adit entrance at an elevation of approximately 1520 m.

A large fan shaped area of waste rock tailings originates at the adit entrance and extends southeastward for approximately 50 m providing support for the rail line. More recent trenching activities have occurred west of the main adit adjacent to the raise **(see Photos 2, 3, 6 & 7).**

5.2 Non-Hazardous Waste Materials

In the vicinity of the Silver Seven mine site adit area, 60 m of metal rail and trestle were found together with the wooden ore bin structure located at the end of the trestle **(see Photo 3)**. Four rusting 205 l. barrels were identified below the adit and wood and miscellaneous metal waste were scatted on either wide of the waste rock pile leading out from the adit **(see Photos 4 & 6)**.

Wood and metal debris could also be found in the vicinity of the upper raise and trenching areas **(see Photos 9, 10, & 11)**. At the Silver Seven mill site, wood and concrete waste from the old milling operation were found. Findings are summarized in **Table 2** below.

5.3 Hazardous Materials

No signs of stained soils were observed during the course of the site inspection at the Silver Seven mine site and consequently no soil samples were taken at this location. However, a total of 3 X 205 litre steel barrels were scattered about the main site with several more scattered within 200 m of the main adit. Samples of petroleum product were taken from 2 partially full 205 litre metal barrels in tact in an upright position **(Barrels S7BL-3 and S7BL-4)** located downslope from the mine adit. Results obtained from laboratory analysis for Total Organic Halogens were above detection limits for **Barrels S7BL-3 and S7BL-4**. Both samples were also analyzed for PCB and found to be within detection limits. Sample results are summarized in **Table 3** below.

Table 2: Non-Hazardous Waste Materials

Waste Material	Number/ Volume	Location	Comments
Logs & lumber debris	<50 m^3	Adit entrance, head of waste dump & down slope, & camp area below	Non - preserved, burnable
205 litre barrels	16	3 at camp, 5 at adit, and 11 at upper trenching area	Most empty with minor residue of H^2O & sludge; 3 at camp full of diesel fuel & in use.
Metal scrap, old rail sections, duct- work	<10 m^3	Scattered around adit and downslope of adit on waste dump	Non burnable and rusted

Table 3: Hazardous Waste Materials:

Waste Material	Number / Volume	Location	Parameter	Comments
Barrel S7BL-3	1 @ 205 litres / 5 litres	Approximately 100 m downslope south east of adit	Total Organic Halogen	Exceeds detection limit by factor of 2.5
			PCBs	Within Detection Limits
Barrel S7BL-4	1 @ 205 litres / 5 litres	Approximately 100 m downslope south east of adit	Total Organic Halogen	Exceeds Detection Limits
			PCBs	Within Detection Limits

5.4 Surface Water Quality

Complete analytical results are provided in **Appendix C**. Where analytical results exceeded CCME Interim Canadian Environmental Quality Criteria for Contaminated Sites (Interim Remediation Criteria), specific parameters are identified in the chart below.

The Silver Seven mine site area is dry and exhibited no surface water and only minor groundwater seepage. No water emanated from the portal area. A minor seepage was noted below the waste rock dumps, but was insufficient for sampling. The raise had 0.5 metres of standing melt water which was sampled **(S7WQ-A2-1)** capping an ice/rock blockage 3 metres down from the collar at surface. No evidence of ephemeral or permanent surface water flows were observed in the tailings area and no groundwater seepage occurred in the tailings soil pit.

Results for total metals for the sample were generally below detection for all elements except calcium (28.1 mg/L), magnesium (0.84 mg/L), silicon (3.20 mg/L) and strontium (0.182 mg/L), each of which are not identified as hazardous in the Yukon in accordance with the Canadian Water Quality Guidelines (CCME, 1995). Results from sampling are presented below:

Table 4 Surface Water Samples - Significant Results

Sample ID	Sample Location	pH	Conductivity (μmhos/cm)	Metallic Parameters	Non-Metallic Inorganics
S7WQ-A2-1	Raise A2 at elevation of	7.52 [7.6]	335 [190]	n/a	n/a
S7WQ-C2	Boulder Creek @ intersection with access road, 3 km south of mine site at elev. of 1021 m	7.75 [7.9]	146 [110]	n/a	n/a

Notes:
1) Ph and conductivity readings in square brackets are field measurements; non-bracketed readings are lab measurements
2) Low field conductivity readings for all samples may have been due to a calibration error on the conductivity meter.
3) n/a indicates that none of the readings from analytical samples submitted to the lab exhibited levels beyond parameters identified

Mine and Development Area Waters

The Silver Seven mine site area is dry and exhibited no surface water and only minor groundwater seepage. No water emanated from the portal area. A minor seepage was noted below the waste rock dumps, but was insufficient for sampling. The raise had 0.5 metres of standing melt water which was sampled (S7WQ-A2-1) capping an ice/rock blockage 3 metres down from the collar at surface. Results for total metals for the sample were generally below detection for all elements except calcium (68.7 mg/L), iron (0.29 mg/L), magnesium (0.79 mg/L), manganese (0.042 mg/L), silicon (2.73 mg/L) and strontium (0.445 mg/L), none of which are identified as hazardous in the Yukon (CCME, 1995). No evidence of ephemeral or permanent surface water flows were observed in the tailings area and no groundwater seepage occurred in the tailings soil pit.

5.5 Waste Rock Disposal Areas

All development muck and ore was hauled on track mounted cars out the 1,500 metre portal and end dumped off a 35 m trestle. Ore was dumped into a wooden ore bin, now partially collapsed, along the west side of the trestle. A total of approximately 2,175 m^3 of waste rock, including the ore bin material is located at the portal area. There are three visually distinguishable waste rock piles in the dump, and material in the ore bin. Material included a portion of quartz vein mineralized with traces to 5% sulphide (sphalerite, galena, pyrrhotite, pyrite) and oxide (wolframite-scheelite) ore minerals **(See Photos 4 - 6)**.

The first waste rock material located in dumps just west of the portal comprise only 210 m^3 and were presumably from the earliest development work done **(sample S7WR-R1)**. This material is 85% phyllite with minor (15%) mineralized quartz vein material and exhibits 15% rusty weathering. A larger 525 m^3 section of the pile located between this and the ore bin is comprised of phyllite with 30% mineralized quartz content **(sample S7WR -R2)**. This material is 50% rusty weathered. Approximately 1400 m^3 of waste rock fills the area under the trestle. This material is 20% rusty weathered and is comprised of phyllite with 25% mineralized quartz vein **(sample S7WR-R4)**.

The material in the ore bin comprised 40 m^3 **(sample S7WR-R3)** of 50% mineralized quartz vein in phyllite with 35% rusty weathering. Trenches exposing the Fiddler Main zone 200 m to the northeast from the portal show evidence of surface blasting and as a result are partially filled with broken rock. A volume for this material was not estimated, and was not considered significant. Drill core is scattered in broken boxes near the old buildings west of the portal as well as at a saddle on the ridge approximately 600 metres to the northwest. The core is primarily of calcareous phyllites, but has sections of skarn mineralization with minor sulphides.

A **Determination of the Acid Rock Drainage Potential** for the main adit and mine site workings for this site is available in **Appendix A.**

5.6 Mine Openings

Development at the Fiddler Main between 1951 and 1953 included a 161.5 m adit and a 71.6 m raise to surface. The adit was likely driven perpendicular to the veins at azimuth 315^0 and the raise driven up dip in ore. The adit portal is located at approximate UTM coordinates 6667230 m North and 420620 m East, and an elevation 1500 m.

The adit has not been timbered, even around the portal, but is in sound condition with only very minor failures of the backs noted. The raise, which comes to surface approximately 175 m to the northwest of the portal at an elevation of approximately 1570 m, was blocked 3 m down from surface by ice and rock. Evidence of second raise to surface, possibly from a sublevel, or a glory hole is collapsed approximately 26 m further to the northwest.

Table 5: <u>Mine Openings</u>

Adit/Raise	Location	Drift Length	Condition
A1	1500 m elev.	137 metres	2 m X 3 m portal (no supporting timbers) excavated
R1	1570 m	71.6 m	Blocked 3 m down from the surface by ice and rock

Extensive trenching and stripping of the mine site and adjoining ridges was completed in 1978 and 1987. A minimum 13 shallow trenches totalling greater than 850 m in length and more than 2 km of roads were inventoried over an area extending 800 m northwest and 300 m east of the mine portal. More development work not inventoried in this site assessment was observed outside of this area, including numerous trenches at lower elevations to the south along the mine access road.

5.7 Tailings

A small unspecified volume of ore was processed through the Silver Seven mill. Today, concrete foundations and metal scraps are all that remain of the mill. There is a small ore stockpile of rusty weathered vein material above the mill site of approximately less than 20 m^3 which was not sampled. The mill tailings were discharged along a shallow 70 metre ditch to a small topographically isolated kettle depression below.

The tails appear to have been deposited directly on the native soils with no site preparation. Approximately 180 m^3 of tails material were deposited in an area 20 m in diameter. A profile pit was dug 0.70 m to the basement soils. Three samples were taken of the tails **(S7T-1 and -2)** and the basement soils **(S7T-3)**. The upper 0.3 m (approximately 80 m^3) of the tails is a slightly oxidized yellow brown layered sand and silty sand material.

The lower 0.4 m (approximately 70 m^3) of the tails material is gray to yellow green and displays no oxidation. A second pit dug in undisturbed native soils adjacent to the tails area were similar in colour and texture to those sampled from the base of the tails profile pit. The tails material was ground to minus 0.3 cm in size, with approximately 50% minus 0.1 cm and comprised of 30% quartz.

A **Determination of the Acid Rock Drainage Potential** for the mine site and the mill site workings is available in **Appendix A.**

6.0 CONCLUSIONS

The primary concern is the health and safety of humans and wildlife relating to the mine opening and the raise in the upper workings area. A secondary concern is the aesthetic appearance of the dilapidated ore bin and glass and metal debris found on the site.

6.1 HEALTH AND SAFETY

The primary health and safety risk at this site is the risk to humans and animals from the open adit at the main mine level and the unsecured raise at the upper level. Another significant concern is the condition of the ore bin and the stability of the waste rock pile supporting the trestle and rails leading into the adit. Secondary health and safety concerns arose from the dilapidated condition of the buildings on site and the possibility of collapse.

6.2 ENVIRONMENTAL RISKS

The overall environmental risks of the Silver Seven mine site relating to mining and exploration activity are considered low. The potential for acid generation is low as indicated by the ABA results, the predominance of limy composition of the bedrock hosts, the lack of mine and surface waters and the limited iron sulphide mineralization present. Metals contamination is also considered low.

Overall risks associated with the Silver Seven mill tailings is considered medium low, based on the contained metals values that exceed CCME (1991) guidelines for lead, zinc, and silver. However, the volume of material is small, isolated and likely chemically unavailable over the long term. A leach extraction test is required to fully assess the potential threat to the environment that the tails represent. The results of this environmental assessment of the potential for acid generation and metals contamination resulting from mining and exploration work done at the mine site and the mill tailings are limited by a number of parameters as listed below:

1. Samples taken to represent the various rock dumps and tails were analyzed for total metals and no leach tests were conducted;

2. The static analytical procedures used for the ABA, although definitive in their results, can only be considered indicative of the potential for acid generation and kinetic testing would be required to more accurately establish a prediction model;

3. The detection limits for some metals in the total metals analysis of the water samples were not sensitive enough to meet CCME (1995) guidelines.All water sample concentrations (except for Zn for **S7WQ-A2**) were found to be below method detection limits for all elements identified as parameters for "Freshwater Aquatic Life Remediation Criteria for Water" by Canadian Council of Ministers of the Environment (CCME). 1995. Canadian Water Quality Guidelines.

The results of this environmental assessment of the geologically related aspects of the Silver Seven site can be considered indicative of the present state of the site and its potential to adversely affect the immediate surrounding environment. No further testing is recommended at this time based on the generally low to medium low environmental risks identified and the present body of data available. More intense sampling and definitive analytical procedures would be required to accurately rest those parameters identified in this study as a potential risk.

6.3 AESTHETIC CONCERNS

Aesthetic concerns arose on the site from the proliferation of metal barrels and wood waste scattered about the site as well as minor hydrocarbon staining in the machine shop area.

7.0 RECOMMENDATIONS

Recommended remediation and management actions are compliant with applicable federal or territorial regulations and criteria, are reliant upon available technology, and are intended to be appropriate for local conditions and sensitivities. The overall priority rating assigned to the clean-up and remediation recommendations for the Silver Seven abandoned mine site is Medium Low.

Recommendation 1

It is recommended that both the mine opening and upper raise opening be secured from human and animal access for health and safety reasons by covering the opening with existing waste rock. Should the mine need to be reopened, access to workings is achievable with heavy equipment.

Recommendation 2

It is recommended that the wood trestle and ore bin configuration be demolished and burned or buried as appropriate to minimize risk to humans and animals. Further all remaining wood structures on site should be demolished and burned on site for aesthetic, health and safety reasons. Any remaining metal waste on site (including rails, empty barrels, and associated waste) should be buried on site using available rock material.

Recommendation 3

Additional water quality sampling is not required as there is no acid generating waste present on-site. Should further development occur on the site, regulatory agencies should ensure that an acid drainage prevention plan is developed which includes detailed measures for handling and disposal of mineralized waste rock in the tailing pond area. A minor environmental risks exists at the mill tailings pond and yearly monitoring of acid rock drainage potential should occur yearly for 5 years.

8.0 COST ESTIMATES TO IMPLEMENT RECOMMENDATIONS

Recommended remediation and management actions are compliant with applicable federal or territorial regulations and criteria, are reliant upon available technology, and are intended to be appropriate for local conditions and sensitivities. An estimated breakdown of expected remediation/mitigation costs to an accuracy of 25% is provided under separate cover to this report. The cost estimate includes contractor and project management costs and contingencies. The estimated cost to implement the recommendations is provided under separate cover.

REFERENCES:

Canadian Council of Ministers of the Environment (CCME). 1995. Canadian Water Quality Guidelines.

Canadian Council of Ministers of the Environment, 1991. Interim Canadian Environmental Quality Criteria for Contaminated Sites. The National Contaminated Sites and Remediation Program.

DIAND Technical Services: 1993; Assessment Report 105B-01-2, Silver Seven.

Klassen, R. W.; 1983; Wolf Lake Surficial Geology; Map 14-1982; Geological Survey of Canada.

Oswald, E.T., and Senyk, J.P., Ecoregions of Yukon Territory, Canadian Forestry Service

Poole, W. H., J. A. Roddick, L.H. Green; 1960; Wolf Lake Geology; Map 10-1960; Geological Survey of Canada.

Sevensma, P. H., J. W. McLeod. 1969. Boulder Creek Area, Silver Seven Exploration Limited, Assessment Report No. 60681

Steffen, Robertson, and Kirsten (B.C.), 1992. Mine Reclamation in Northwest Territories and Yukon. Prepared for Northern Water Resource Studies, Northern Affairs Program, DIAND. Report No. QS-8476-000-EF-A1, Minister of Supply and Services Canada.

Yukon MinFile:. Update March 1993 Exploration and Geological Services Division, Department of Indian Affairs and Northern Development.

APPENDIX A

DETERMINATION OF ACID ROCK DRAINAGE POTENTIAL

MINE SITE:

Results of the static modified Sobek method acid-base accounting (ABA) for the Silver Seven property indicate that the waste rock material at the adit dump site has Neutralizing Potential/Acid Potential ratios (NP/AP) near or above 3. The results are listed below:

Silver Seven (Fiddler) Property Acid-Base Accounting Results - Waste Rock							
Sample No.	**Paste pH**	**Sulphur (Total) %**	**Sulphur (SO_4) %**	**Acid Potential (AP*)**	**Neutral. Potential (NP*)**	**Net NP***	**NP/AP**
S7WR-R1	7.85	0.85	0.00	26.6	75.5	48.9	2.8
S7WR-R2	8.05	0.55	0.00	17.2	186.1	168.9	10.8
S7WR-R3	8.23	0.52	0.00	16.3	97.0	80.8	6.0
S7WR-R4	8.23	0.46	0.00	14.4	271.3	257.9	18.9

AP and NP reported in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.

These results indicate that the waste rock on the Silver Seven mine site property is a net consumer of acid and is not expected to generate acid runoff that would pose a risk to any water courses or the environment generally. The limy regional bedrock geology and derived colluvium at the site would provide further buffering of any acid drainage generated on the site.

Results from sampling the waste rock in the mine dump range up to 4,838 Pb, 2,418 ppm Zn and 43.3 g/tonne Ag (sample S7WR-R3 from the ore bin). These results exceed the Canadian Environmental Quality Criteria for Contaminated Sites (CCME, 1991) but are not considered to pose a significant risk to the environment due to the limited volume of material and the remoteness and the general background metals levels of the site.

MILL SITE:

A small unspecified volume of ore was processed through the Silver Seven mill. Today, concrete foundations and metal scraps are all that remain of the mill. There is a small ore stockpile of rusty weathered vein material above the mill site of approximately less than 20 m^3 which was not sampled.

The mill tailings were discharged along a shallow 70 metre ditch to a small topographically isolated kettle depression below. The tails appear to have been deposited directly on the native soils with no site preparation. Approximately 180 m^3 of tails material were deposited in an area 20 m in diameter.

A profile pit was dug 0.70 m to the basement soils. Three samples were taken of the tails (S7T-1 and -2) and the basement soils (S7T-3). The upper 0.3 m (approximately 80 m^3) of the tails is a slightly oxidized yellow brown layered sand and silty sand material.

The lower 0.4 m (approximately 70 m^3) of the tails material is gray to yellow green and displays no oxidation. A second pit dug in undisturbed native soils adjacent to the tails area were similar in colour and texture to those sampled from the base of the tails profile pit. The tails material was ground to minus 0.3 cm in size, with approximately 50% minus 0.1 cm and comprised of 30% quartz.

Results of the static modified Sobek method acid-base accounting (ABA) for the Silver Seven mill site are provided in Table indicate that the tails material has Neutralizing Potential/Acid Potential ratios (NP/AP) above 3. The NP/AP result for the sample of basement soil is lower, but not considered a risk. The results are listed below:

Silver Seven (Fiddler) Property Acid-Base Accounting Results - Mill Tailings							
Sample No.	**Paste pH**	**Sulphur (Total) %**	**Sulphur (SO_4) %**	**Acid Potential (AP*)**	**Neutral. Potential(NP*)**	**Net NP***	**NP/AP**
S7T-1	8.25	0.30	0.00	9.4	37.8	28.4	4.0
S7T-2	8.24	0.44	0.00	13.8	132.8	119.0	9.7
S7T-3	7.59	0.06	0.00	1.9	4.2	2.3	2.2

*** AP and NP reported in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.**

These results indicate that the tails material at the Silver Seven mill site are net consumers of acid and are not expected to generate acid runoff. The lower NP/AP ratio of the basement soils is considered natural and not the result of leaching from the tails above. This is suggested by a significantly lower total sulphur content of 0.06%. The tails are elevated in silver, copper, lead and zinc, the upper more oxidized layer having 2 to 7 times the levels of the lower layer as follows:

Silver Seven Mill Tailings Sample Results						
Sample No.	**Description**	**Depth (m)**	**Pb (ppm)**	**Zn (ppm)**	**Cu (ppm)**	**Ag (ppm)**
S7T-1	Tails	0.0-0.3	9161	1664	2292	71.2
S7T-2	Tails	0.3-0.7	1000	1068	353	12.8
S7T-3	Base Soil	0.7-0.9	121	253	26	0.8
CCME Remediation Criteria for Soil	Industrial Sites	-soils	1000	1500	500	40

The sampling results suggest variation in the ore and/or mill recoveries towards the end of the mining operation. The upper 0.3 m (60 m^3) of the tails exceed the CCME (1991) guideline criteria for industrial sites for lead, zinc and silver. Results of the static modified Sobek method acid-base accounting (ABA) for the Silver Seven mill site are provided in Table indicate that the tails material has Neutralizing Potential/Acid Potential ratios (NP/AP) above 3. The NP/AP result for the sample of basement soil is lower, but not considered a risk. The results are listed below:

Silver Seven (Fiddler) Property Acid-Base Accounting Results - Mill Tailings							
Sample No.	**Paste pH**	**Sulphur (Total) %**	**Sulphur (SO_4) %**	**Acid Potential (AP*)**	**Neutral. Potential (NP*)**	**Net NP***	**NP/AP**
S7T-1	8.25	0.30	0.00	9.4	37.8	28.4	4.0
S7T-2	8.24	0.44	0.00	13.8	132.8	119.0	9.7
S7T-3	7.59	0.06	0.00	1.9	4.2	2.3	2.2

AP and NP reported in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.

These results indicate that the tails material at the Silver Seven mill site are net consumers of acid and are not expected to generate acid runoff. The lower NP/AP ratio of the basement soils is considered natural and not the result of leaching from the tails above. This is suggested by a significantly lower total sulphur content of 0.06%.

RECOMMENDATIONS:

Remediation of the site is not considered feasible primarily due to the high transportation cost to and from the site. The most economical and effective way to control the migration of contaminants would be to place an impermeable dry cover over the tails. The overall environmental risk of this material is limited based on the its small volume, reasonable physical containment, remote location, absence of surface water, and the low annual precipitation in the area. The levels of metals in the basement soils (although elevated compared to typical background results from regional geochemical surveys) are not unusual or significantly anomalous. This suggests that although the tails material is concentrated in these metals, especially at the surface, the metals are not very mobile. The slightly base pH non-acid generation of the tails and moderate alkalinity of surface waters will help to maintain this situation(CCME, 1991). Background metals levels in the native soils surrounding the tailings area are unknown and no leach extraction test were conducted on the tails.

APPENDIX B

SITE PHOTOGRAPHS

Photo 1. Main level adit view from access road looking northeast.

Photo 2. Trestle on top of waste rock leading to log framed ore bin at right.

Photo 3. Rusted metal track running from adit entrance along waste rock escarpment.

Photo 4. Machine shop/maintenance/equipment shed adjacent to ore bin with partially full 205 litre barrels in foreground and wood waste in background.

Photo 5. Uncovered adit entrance with wood frame, overburden and track. Note risk of collapse of overhead rock.

Photo 6. Excavating on west side of trestle for waste rock samples.

Photo 7. Conducting paste pH & conductivity tests on waste rock sample gravel.

Photo 8. Portion of access road leading to upper level trenching and associated workings.

Photo 9. All terrain vehicles parked by claim stake marker.

Photo 10. Collapsed shaft found in upper trenching area.

Photo 11. Entrance to upper level raise with plywood cover attached.

Photo 12. Inspecting interior of upper level raise.

Photo 13. View down slope from access road to foundations of former Silver Seven mill site.

Photo 14. View down slope from access road to foundations of former Silver Seven mill site..

Photo 15. Silver 7 mill site tailing pond which appears as small lake on NTS map 105/B1

Photo 16. Close up of material excavated from mill tailing pond.

APPENDIX C

ANALYTICAL RESULTS

CHEMICAL ANALYSIS REPORT

Date: INTERIM

ASL File No. G3599

Report On: 762-186 Water Analysis

Report To: **Public Works & Gov't Services**
Environmental Services
204-1166 Alberni Street
Vancouver, BC
V6E 3W5

Attention: **Mr. Tim Sackmann**, Manager, Contaminated Sites

Received: July 31, 1996

ASL ANALYTICAL SERVICE LABORATORIES LTD.
per:

Heather A. Ross, B.Sc.
Project Chemist

RESULTS OF ANALYSIS - Water File No. G3599

			DLWQ-A1	DLWQ-TR2	DLWQ-TR3	DLWQ-C4	S7WQ-A2-1
			96 07 25 11:30	96 07 25 15:00	96 07 25 15:30	96 07 25 17:30	96 07 26 16:30
Physical Tests							
Conductivity (umhos/cm)			51.5	41.7	61.2	32.3	335
pH			6.51	6.97	7.08	7.17	7.52
Dissolved Anions							
Acidity		CaCO3	15.5	1.9	2.7	1.9	5.5
Alkalinity - Total		CaCO3	19.1	13.5	20.8	14.5	108
Sulphate	SO4		<1.0	2.8	4.0	<1.0	60.4
Total Metals							
Aluminum	T-Al		1.1	1.0	<0.2	<0.2	<0.2
Antimony	T-Sb		<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	T-As		<0.2	<0.2	<0.2	<0.2	<0.2
Barium	T-Ba		0.03	0.08	0.02	<0.01	<0.01
Beryllium	T-Be		<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	T-Bi		<0.1	<0.1	<0.1	<0.1	<0.1
Boron	T-B		<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	T-Cd		[redacted]	[redacted]	<0.01	<0.01	<0.01
Calcium	T-Ca		5.08	6.57	7.77	4.77	68.7
Chromium	T-Cr		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	T-Co		<0.01	<0.01	<0.01	<0.01	<0.01
Copper	T-Cu		<0.01	0.01	<0.01	<0.01	<0.01
Iron	T-Fe		[redacted]	[redacted]	0.15	<0.03	0.29
Lead	T-Pb		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Lithium	T-Li		<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	T-Mg		0.70	0.92	0.41	0.25	0.79
Manganese	T-Mn		0.458	0.253	0.026	<0.005	0.042
Molybdenum	T-Mo		<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	T-Ni		<0.02	<0.02	<0.02	<0.02	<0.02
Phosphorus	T-P		<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	T-K		2	<2	<2	<2	<2
Selenium	T-Se		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Silicon	T-Si		3.03	1.33	0.64	1.44	2.73
Silver	T-Ag		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Sodium	T-Na		<2	<2	<2	<2	<2
Strontium	T-Sr		0.065	0.079	0.052	0.056	0.455
Thallium	T-Tl		<0.1	<0.1	<0.1	<0.1	<0.1
Tin	T-Sn		<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	T-Ti		0.03	0.02	<0.01	<0.01	<0.01
Vanadium	T-V		<0.03	<0.03	<0.03	<0.03	<0.03

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

RESULTS OF ANALYSIS - Water File No. G3599

		DLWQ-A1	DLWQ-TR2	DLWQ-TR3	DLWQ-C4	S7WQ-A2-1
		96 07 25 11:30	96 07 25 15:00	96 07 25 15:30	96 07 25 17:30	96 07 26 16:30
Total Metals						
Zinc	T-Zn	0.025	[redacted]	[redacted]	<0.005	[redacted]

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

RESULTS OF ANALYSIS - Water File No. G3599

			SILVER 7	LAC JAM.		
			S7WQ-C2	LJWQ-C1-1	LTWQ-A1-1	LTWQ-C1-2
			96 07 26 17:30	96 07 28	96 07 28	96 07 28
Physical Tests						
Conductivity (umhos/cm)			146	106	260	79.7
pH			7.75	7.37	7.52	7.33
Dissolved Anions						
Acidity		CaCO3	2.3	2.5	2.9	1.9
Alkalinity - Total		CaCO3	68.9	20.7	24.3	14.6
Sulphate	SO4		6.5	28.4	89.0	22.1
Total Metals						
Aluminum	T-Al		[redacted]	[redacted]	[redacted]	[redacted]
Antimony	T-Sb		<0.2	<0.2	<0.2	<0.2
Arsenic	T-As		[redacted]	[redacted]	[redacted]	[redacted]
Barium	T-Ba		<0.01	<0.01	<0.01	<0.01
Beryllium	T-Be		<0.005	<0.005	<0.005	<0.005
Bismuth	T-Bi		<0.1	<0.1	<0.1	<0.1
Boron	T-B		<0.1	<0.1	<0.1	<0.1
Cadmium	T-Cd		[redacted]	[redacted]	[redacted]	[redacted]
Calcium	T-Ca		28.1	16.7	42.2	11.2
Chromium	T-Cr		[redacted]	[redacted]	[redacted]	[redacted]
Cobalt	T-Co		<0.01	<0.01	<0.01	<0.01
Copper	T-Cu		[redacted]	[redacted]	[redacted]	[redacted]
Iron	T-Fe		<0.03	<0.03	<0.03	<0.03
Lead	T-Pb		[redacted]	[redacted]	[redacted]	[redacted]
Lithium	T-Li		<0.01	<0.01	<0.01	<0.01
Magnesium	T-Mg		0.84	0.93	2.56	1.22
Manganese	T-Mn		<0.005	<0.005	<0.005	<0.005
Molybdenum	T-Mo		<0.03	<0.03	0.29	<0.03
Nickel	T-Ni		<0.02	<0.02	<0.02	<0.02
Phosphorus	T-P		<0.3	<0.3	<0.3	<0.3
Potassium	T-K		<2	<2	<2	<2
Selenium	T-Se		[redacted]	[redacted]	[redacted]	[redacted]
Silicon	T-Si		3.20	2.22	6.98	4.93
Silver	T-Ag		[redacted]	[redacted]	[redacted]	[redacted]
Sodium	T-Na		<2	<2	<2	<2
Strontium	T-Sr		0.182	0.051	0.112	0.043
Thallium	T-Tl		<0.1	<0.1	<0.1	<0.1
Tin	T-Sn		<0.03	<0.03	<0.03	<0.03
Titanium	T-Ti		<0.01	<0.01	<0.01	<0.01
Vanadium	T-V		<0.03	<0.03	<0.03	<0.03

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

RESULTS OF ANALYSIS - Water File No. G3599

		S7WQ-C2	LJWQ-C1-1	LTWQ-A1-1	LTWQ-C1-2
		96 07 26 17:30	96 07 28	96 07 28	96 07 28
Total Metals					
Zinc	T-Zn	<0.005	<0.005	0.005	<0.005

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates

File No. G3599

SILVER 1.

Water			S7WQ-A2-1 96 07 26 16:30	S7WQ-A2-1 QC # 69041
Physical Tests				
Conductivity (umhos/cm)			335	334
pH			7.52	7.58
Dissolved Anions				
Acidity		CaCO3	IP	IP
Alkalinity - Total		CaCO3	108	109
Sulphate	SO4		60.4	60.0

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Replicates File No. G3599

Water		S7WQ-A2-1 96 07 26 16:30	SILVER 1. S7WQ-A2-1 QC # 69041
Total Metals			
Aluminum	T-Al	<[redacted]	<[redacted]
Antimony	T-Sb	<0.2	<0.2
Arsenic	T-As	[redacted]	[redacted]
Barium	T-Ba	<0.01	<0.01
Beryllium	T-Be	<0.005	<0.005
Bismuth	T-Bi	<0.1	<0.1
Boron	T-B	<0.1	<0.1
Cadmium	T-Cd	[redacted]	[redacted]
Calcium	T-Ca	68.7	69.9
Chromium	T-Cr	<0.01	<0.01
Cobalt	T-Co	<0.01	<0.01
Copper	T-Cu	[redacted]	[redacted]
Iron	T-Fe	0.29	0.29
Lead	T-Pb	[redacted]	[redacted]
Lithium	T-Li	<0.01	<0.01
Magnesium	T-Mg	0.79	0.83
Manganese	T-Mn	0.042	0.042
Molybdenum	T-Mo	<0.03	<0.03
Nickel	T-Ni	<0.02	<0.02
Phosphorus	T-P	<0.3	<0.3
Potassium	T-K	<2	<2
Selenium	T-Se	[redacted]	[redacted]
Silicon	T-Si	2.73	2.76
Silver	T-Ag	[redacted]	[redacted]
Sodium	T-Na	<2	<2
Strontium	T-Sr	0.455	0.465
Thallium	T-Tl	<0.1	<0.1
Tin	T-Sn	<0.03	<0.03
Titanium	T-Ti	<0.01	<0.01
Vanadium	T-V	<0.03	<0.03
Zinc	T-Zn	[redacted]	[redacted]

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Outlines of the methodologies utilized for the analysis of the samples submitted are as follows:

rror opening method file.

Extractable Organic Halide (EOX) in Oil

This analysis is carried out using a procedure that is consistent with the requirements of the appropriate regulatory agencies and adapted from U.S. EPA Method 9020 (Publ. # SW-846, 3rd ed., Washington, DC 20460). The procedure involves extracting a subsample with ethyl acetate and analysing the extract with a TOX analyser.

Moisture

This analysis is carried out gravimetrically by drying the sample to constant weight at 103 C.

Conventional Parameters in Sediment/Soil

These analyses are carried out on a leachable basis. The procedure involves mixing with reagent grade water and leaching for several hours. The leachate is centrifuged and analysed in accordance with "Standard Methods for the Examination of Water and Wastewater" 17th ed. published by the American Public Health Association, 1989.

Metals in Sediment/Soil

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 Method 3050 or Method 3051, published by the United States Environmental Protection Agency (EPA). The procedures involve a digestion using a 1:1 ratio of nitric acid and hydrochloric acid, along with hotplate or microwave heating. Instrumental analysis is by atomic absorption spectrophotometry (EPA Method 7000) and/or inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010).

Method Limitation: The stated acid digestion will provide excellent results for total recoverable metals; however, it is only partially effective on mineralized or non-environmentally available metals.

Polycyclic Aromatic Hydrocarbons in Sediment/Soil

This analysis is carried out using a procedure adapted by ASL from U.S. EPA Methods 3500, 3630, and 8270 (Publ. #SW-846 3rd ed., Washington, DC 20460). The procedure involves a microwave assisted extraction with dichloromethane followed by a clean-up using silica gel column chromatography. This clean-up procedure has been found to effectively remove aliphatic and heterocyclic hydrocarbons which could potentially interfere with the analysis. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection.

Conventional Parameters in Water

These analyses are carried out in accordance with procedures described in "Methods for Chemical Analysis of Water and Wastes" (USEPA), "Manual for the Chemical Analysis of Water, Wastewaters, Sediments and Biological Tissues" (BCMOE), and/or "Standard Methods for the Examination of Water and Wastewater" (APHA). Further details are available on request.

Metals in Water

This analysis is carried out in accordance with procedures described in "Standard Methods for the Examination of Water and Wastewater" 19th Edition 1995 published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion or filtration (EPA Method 3005), followed by instrumental analysis by atomic absorption spectrophotometry (EPA Method 7000), inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010), and/or inductively coupled plasma - mass spectrometry (EPA Method 6020).

Mercury in Water

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" 19th Edition 1995 published by the American Public Health Association. A cold-oxidation procedure involving bromine monochloride is used, followed by instrumental analysis by cold-vapour atomic absorption spectrophotometry (CVAAS).

End of Report