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Quality in Environmental Services

PHASE II ENVIRONMENTAL ASSESSMENT
OF THE
DALE
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

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EXECUTIVE SUMMARY

A phase II environmental assessment was conducted at the Dale abandoned mine site (60°11'03" N, 135° 13'08'' 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.

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 the single adit opening is in relatively unstable condition, underbuilt and is not adequately secured from public and wildlife access. A minor environmental concern exists as a result of a single barrel below the adit (DLB-2) full of petroleum hydrocarbon solution and rusting. An assessment of the acid rock drainage potential shows that the risk to the environment due to the presence of waste rock and adits are currently insignificant. Aesthetic concerns arise from one full 205 litre fuel tank behind cabin, numerous 205 litre drums scattered below the adit and throughout the upper trenching area as well as metal and wood waste scattered below the adit area.

Using applicable federal and territorial criteria as well as northern mine reclamation guidelines, the recommendations are secure the single adit opening using surrounding rock and soil, flare off fuels on site, incinerate wood waste and structures on site, and bury metal drums and waste on site.

SUMMARY OF CONCLUSIONS & RECOMMENDATIONS

ASSESSMENT COMPONENT	RISK	RECOMMENDATION
1. Building, Infrastructure, Equipment		
Log structure in lower camp area	Aesthetic Concern	Demolish & burn on site.
Wood core storage behind camp trailer	Aesthetic Concern	Haul out for site salvage
A-frame canopy	Aesthetic Concern	Demolish & burn combustibles & bury metal waste
2. Non-Hazardous Waste Material		
Logs & lumber debris @ adit entrance	Health & Safety / Aesthetic Concern	Burn on site
205 litre barrels	Aesthetic Concern	Bury on site
Metal scrap, old rail & ductwork	Aesthetic Concern	Bury on site
3. Hazardous Materials		
Barrel DLB-2	Environmental Concern	Flare off on site & bury barrel with waste rock
4. Water Quality		
Mine Seepage	None	None
Site Drainage	None	None
Receiving Waters	None	None
5. Waste Rock Disposal Areas		
Below adit and upper trenchworks	None	None
6. Mine Openings		
Adit open and accessible	Health and Safety Concern	Seal with available waste rock
7. Tailings		
None	None	None

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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.

At the Dale site, the overview assessments identified concerns associated solely with site clean up:

(a) removal of waste barrels scattered about the exploration area
(b) removal and storage of recoverable core samples from the site, and
(c) the burning of wood structures in a suitable area

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

In light of these preliminary findings, 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 Silver Hart abandoned mine site to a) identify specific environmental and human safety risks; b) provide clean-up recommendations; and c) provide a Class "D" cost estimate for remediation or mitigation of those risks.

1.1 Location:

The Dale site is located at 60^{0}01'38"N, 130^{0}28'02"W and is located approximately 15 km south southeast of Rancheria, YT at an elevation between 1494 m and 1676 m. The toe of the waste rock disposal area is located approximately 200 metres west and 60 m above Freer Creek (Figure 1). Development work on the Dale property has focused on a system of narrow, high-grade silver-quartz-carbonate stringer veins and has been limited to exploration and minor high grade bulk sampling work.

1.2 Overview of Site Development:

Work on the Dale dates back to 1952, based on Department of Indian Affairs and Northern Development (DIAND) and Yukon Territorial Government (YTG) assessment file and MinFile data. Work conducted on the site includes: approximately 6 km of road building, over 450 metres of trenching, 6 diamond drill holes and the driving of a 180 metre adit (MinFile 105B 007). Trenching has produced some large waste piles of stripped overburden, and a smaller waste dump of development muck from the adit. A small shack, a core rack and a partially demolished shelter exist on the site. A reported total of 29.52 tonnes of hand cobbed ore have been shipped from the site (MinFile 105B 007). There has been no mineral processing on the site and there are no mill tailings. The Dale site has been the focus of recent exploration activity with extensive trenching work, road building and rehabilitation of the adit portal and the cabin completed in 1994/95.

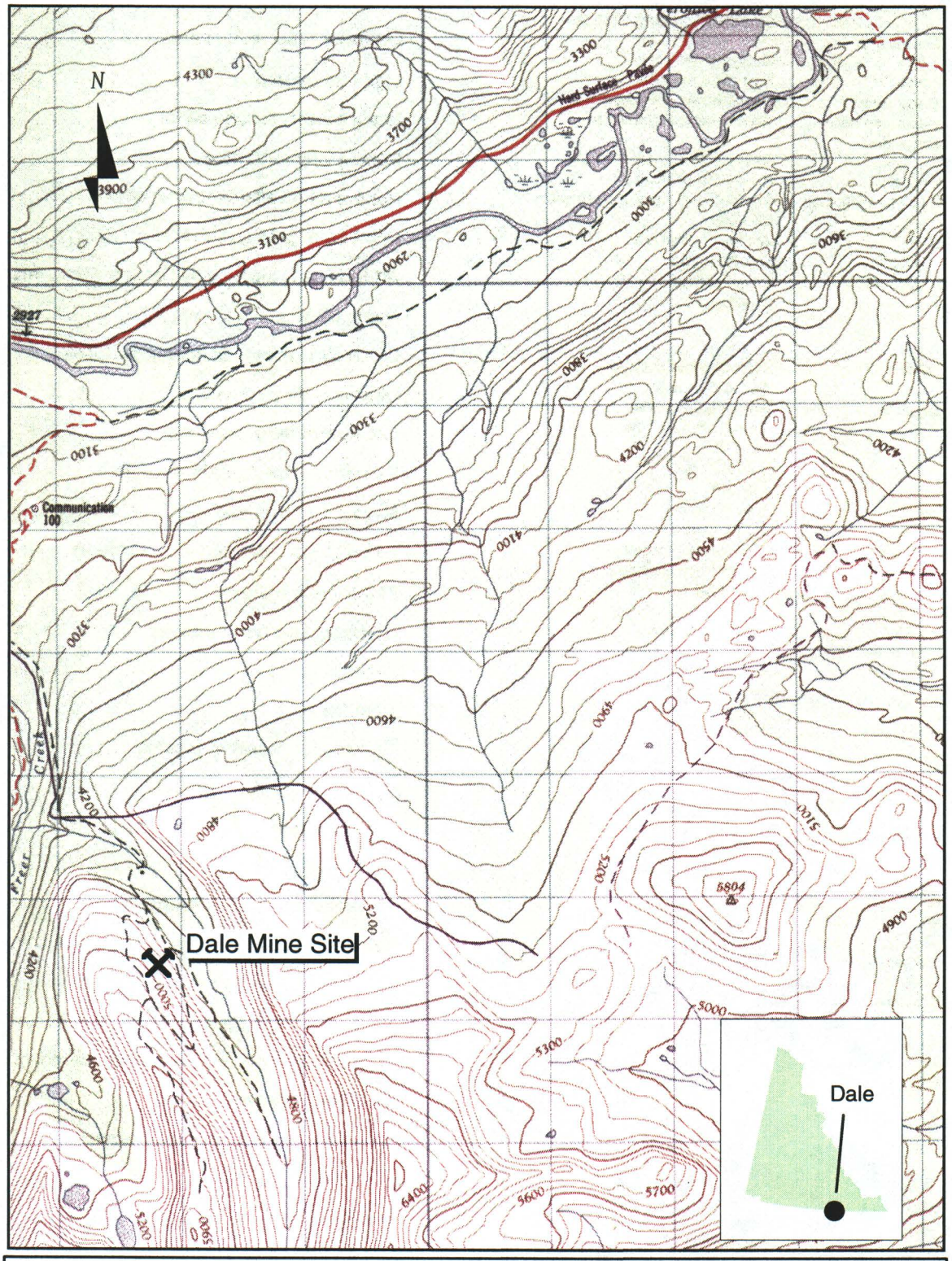
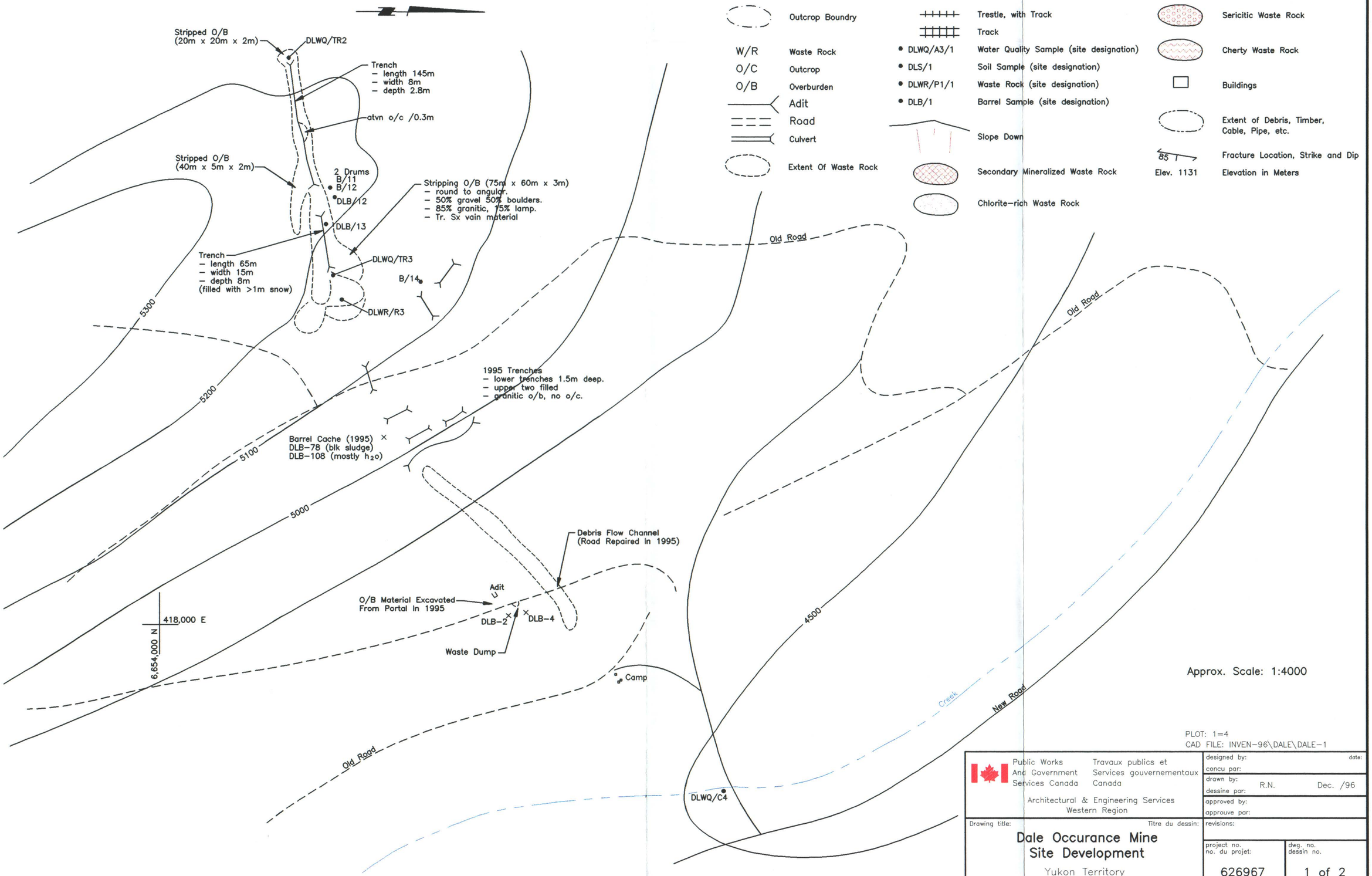


Figure 1: DALE SITE

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

Latitude: 60° 01' 38" N Longitude: 130° 28' 02" W



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PLOT: 1=4
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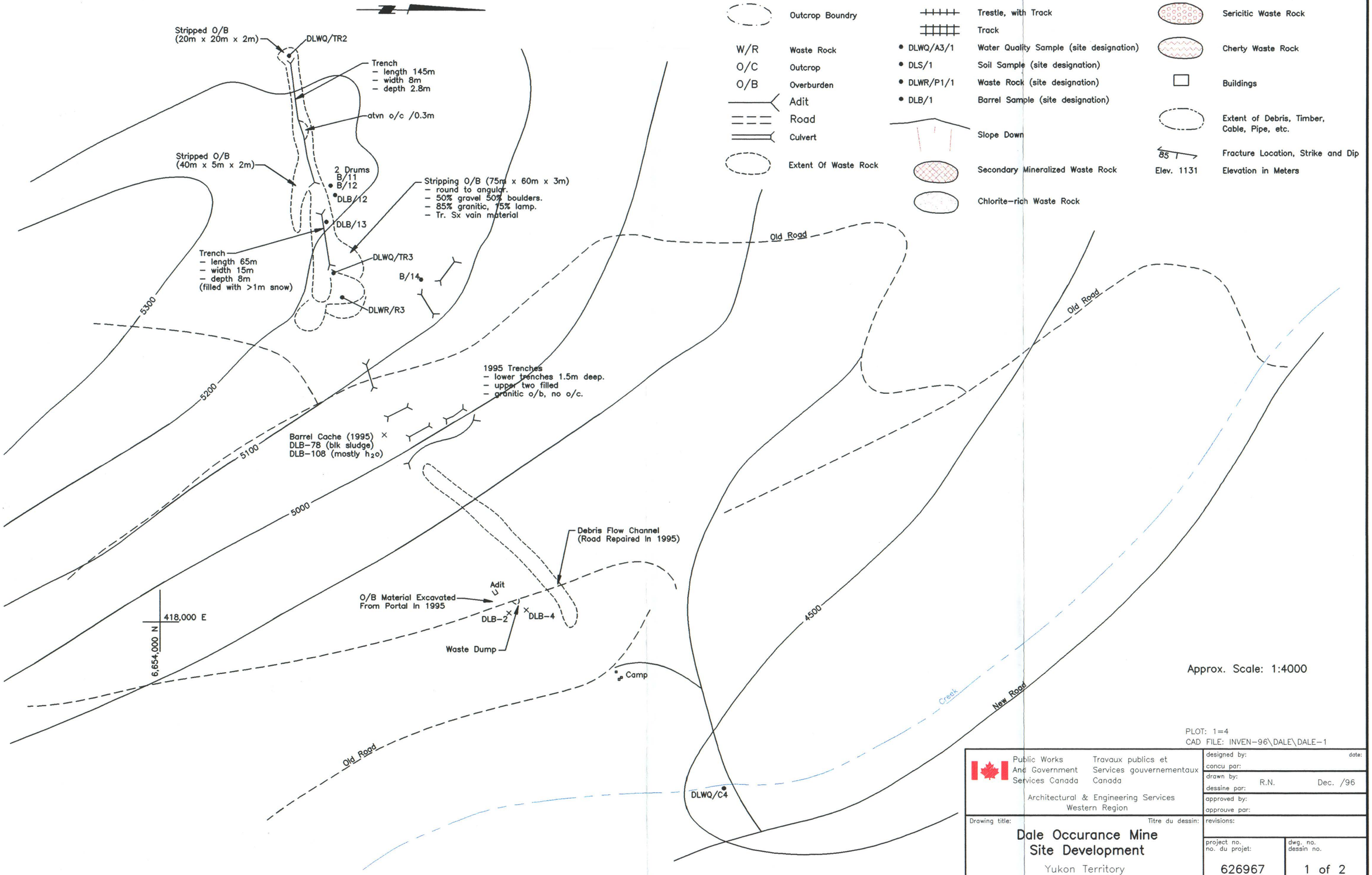
Yukon Territory

project no. / no. du projet: 626967
dwg. no. / dessin no. 1 of 2



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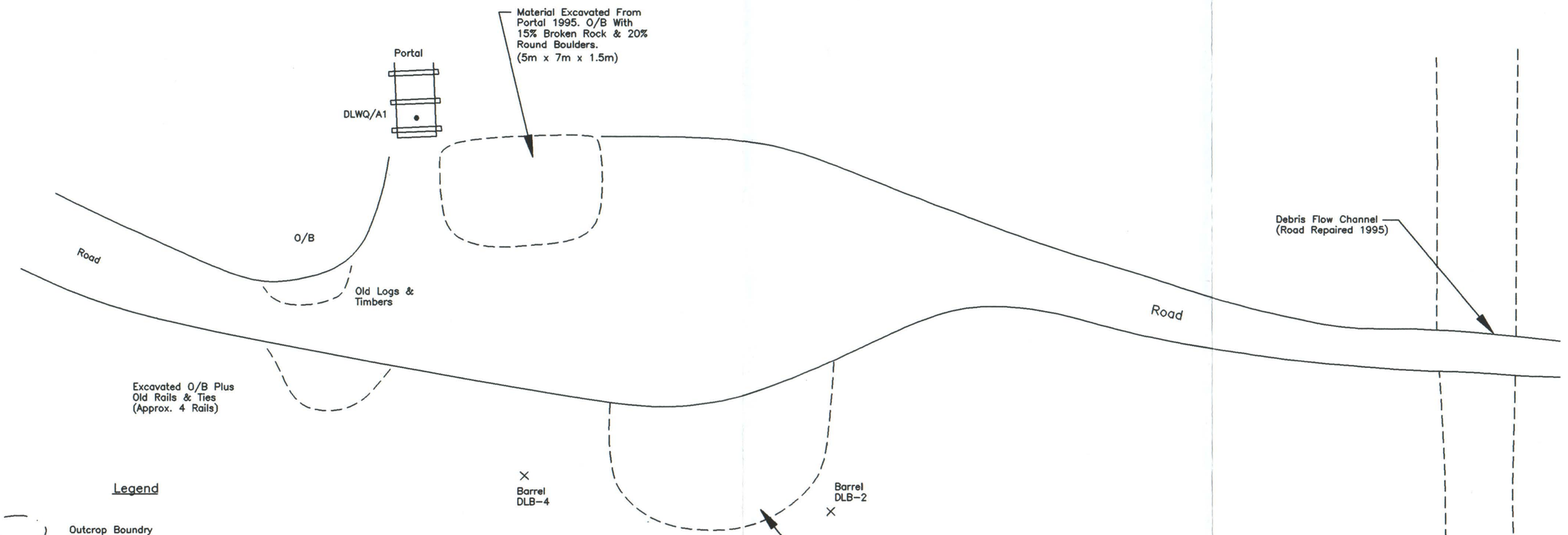

Legend

- Outcrop Boundry
- W/R — Waste Rock
- O/C — Outcrop
- O/B — Overburden
- Adit
- Road
- Culvert
- Extent Of Waste Rock
- Trestle, with Track
- Track
- DLWQ/A3/1 — Water Quality Sample (site designation)
- DLS/1 — Soil Sample (site designation)
- DLWR/P1/1 — Waste Rock (site designation)
- DLB/1 — Barrel Sample (site designation)
- Slope Down
- Secondary Mineralized Waste Rock
- Chlorite–rich Waste Rock
- Sericitic Waste Rock
- Cherty Waste Rock
- Buildings
- Extent of Debris, Timber, Cable, Pipe, etc.
- 85 — Fracture Location, Strike and Dip
- Elev. 1131 — Elevation in Meters

Approx. Scale: 1:200

PLOT: 5=1
CAD FILE: INVEN–96\DALE\DALE–2

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Dale Occurance Mine Adit Area Detail

Yukon Territory

project no. / no. du projet: 626967

dwg. no. / dessin no. 2 of 2

Since the Dale site is considered an active mining area claim status information obtained from the Watson Lake, Y.T. Mining Recorder's Office was accessed. Mineral tenure on the Dale site is comprised of 54 grouped and contiguous two post claims currently held by Mountain Highgrade Mines Ltd. of P.O. Box 5348, Whitehorse, Yukon, V1A 4Z2. The majority of the development work is centred on the Frostbite 1-5 and 38 claims. Further information concerning current claims status is available upon request.

1.3 Site Access:

By road, the site can be accessed by the Alaska Highway approximately 7 km east of Rancheria at Freer Creek. A Northwestel communications station is visible from the highway to the south. Access to the site is located 5 km by road south of Mile 708, Alaska Highway where a service road adjacent to an unmarked NorwesTel building (painted white) on the south side of the highway. Access is available by means of steep roads with rough surfaces and numerous washouts suitable for 4 wheel drives and ATVs only. The adit can be reached within 30 minutes.

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 Hart 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 Dale 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. One partially full 205 litre fuel drum was identified behind the camp area cabin. A number of other 205 litre drums were sampled on site however only one drum below the adit was found to have elevated levels of hydrocarbons **(See Table 3)**. The sampled petroleum product was then drained into a 40-ml laboratory-cleaned vial which was then sealed and placed in a container for shipment to the laboratory.

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 Dale mine site is 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 geology of the Dale property is dominated by medium grained, equigranular, biotite quartz monzonite of the Cassiar Batholith. Mineralization on the Dale property occurs along narrow, discontinuous, east-west trending stringer veins hosted in a 1 to 4 metre wide shear zone of propylitic and argillic alteration. Sub-parallel lamprophyric dykes occur locally within the shear zone. The veins have been exposed along a strike length of 700 metres extending west from an elevation of approximately 1300 metres within the southeast tributary basin of Freer Creek to an elevation of approximately 1620 metres at the top of the adjacent ridge. The vein mineralization consists of irregular 0.01 to 0.30 metre wide pockets of silver rich, semi-massive galena, sphalerite and tetrahedrite in a quartz-carbonate gangue. The overall sulphide content of the shear is very low, probably below 1%. No disseminated alteration halo of sulphide mineralization was noted. Assays of 1,203 g/t Ag, 13.4% Pb, 12.2% Zn and 1.85 g/t Au have been reported from typical vein samples (MinFile Report 105B 007).

4.2 Surface Hydrology

The Dale mine site occupies a northeastern facing ridge varying in elevation from 1400 m to 1525 m **(See Figure 1).** Although there are no streams in the immediate vicinity of the adit a major tributary of Freer Creek is located 200 m downslope in the vicinity of the exploration camp area. This branch flows 1.5 km northwest to join the main stream. This stream then flows 4.2 km north to the Rancheria River which in turn flows northeastward and empties into the Liard River. The Liard River itself eventually empties into the Mackenzie River. Three small unnamed lakes lie approximately 1 km west from the upper trench workings of the mine site at an elevation of 4600 ft.

Although no tributaries were shown on the 1:50000 map leading to this lake, trench work excavations had reached the western side of the ridge that lead downslope toward the lake. However, the watercourse led eastward and was derived from snowmelt. No other mining activities were observed in the area. To identify possible metallic inputs from the mine site, surface water samples were obtained from the adit opening, from trenching areas above the adit and from Freer Creek near the base camp. 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.

4.3 Climate

The Dale 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. Virtually, the entire Dale site lies 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

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 Rancheria River is reported to support a sport fishery for Arctic Grayling, Dolly Varden Char (Foothills Pilelines Ltd., 1976). Both the Rancheria and Meister River systems possess important overwintering habitats for many fish species that move into smaller tributaries in the spring following breakup. Two unnamed creeks located northwest of Oake Creek drain to the northeast and into Meister River about 3 and 4 km downstream from Caribou Lake.

The subject site includes primarily boreal and subalpine vegetation which serves to provide summer and fall range for small numbers of moose and caribou. 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 along the marshy edges of Northwind, Roy and Edgar Lakes. Bird species in the area would include hawks, falcons, owls, ptarmigan, spruce grouse, and (diving duck) waterfowl (Silver Hart Project Overview Report, prepared by Norecol Environmental Consultants, Dec. 1987. p. 4-2 to 4-4).

4.6 Site Topography and Soils

The Dale site was 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 active portion of the site is partially situated on a 30^0 slope facing northeasterward at an elevation of 1402 m with exploration camp areas located downslope at an elevation of 1310 m approximately 92 m below the adit entrance (see Photo 14). An additional exploration area is located approximately 1.0 km north of the adit entrance at a level of 1524 m. **(see Photo 12)**.

More recent trenching activities have occurred southwest and up slope 150 m from the adit location **(see Photo 11).** The Dale exploration development work area extends 800 metres west along the length of the shear zone that hosts the Dale vein **(See Drawing 1)**. The creek valley and adjacent ridges trend northwest. The valley has a broad glacially formed U-shape with a thick cover of colluvium and till obscuring the bedrock on the valley bottom and much of the east facing slopes, except on the steeper sections between 1420 metres and 1520 metres elevation. Rocky cliffs are exposed through the colluvium and till cover up most of the steeper west facing slopes to the ridges which are broad with large areas of exposed outcrop sloping moderately off to the east.

4.7 Permafrost

The Dale 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

The only structures of significance remaining on this site are situated in the exploration camp area adjacent to Freer Creek at the m level and consist of a one room log structure, a core rack structure attached to the living structure and a dilapidated wood frame metal clad "A frame" structure **(see Photos 15, 17 & 19)**. There were indications in the living quarters that mining activities are still taking place **(see Photo 16)**. Buildings, infrastructure and equipment identified on site are detailed in **Table 1** below.

Table 1: Buildings, Infrastructure, Equipment

Structure	Construction Features	Interior Contents
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	- 2 wood frame bunk beds, 1 "airtight" wood burning stove, electrical wiring for light fixture,
Core Rack Structure	- Wood frame core rack structure located north of living quarters partially supporting 1 X 205 l drum containing diesel oil (3/4 full but not leaking)	n/a
A-frame Canopy	- log structure with metal roof appears to be only remaining component of log structure	- minor instances of stained soil; 4 l container of engine oil

5.2 Non Hazardous Waste Materials

Minor amounts of log and lumber debris, old rail sections, ductwork and 10 rusting 205 l. barrels were identified below the adit **(see Photo 9).** Numerous barrels scattered about upper trenching area above adit as well as at the exploration camp area below adit **(see Photo 10 & 17)**. Garbage consisting of old equipment and metal waste is strewn about the camp area however, no waste dump, landfill or borrow sites were identified.

A total of 16 x 205 litre steel barrels were scattered about the site in 2 main areas. Five barrels were identified below the adit location scattered about the waste rock disposal area. A further 11 barrels were scattered across the upper trenching area. Non-hazardous waste materials observed in and around the site are listed in **Table 2 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

5.3 Hazardous Waste Materials

No signs of stained soils were observed during the site inspection and no soil samples were taken. Samples of petroleum product were taken from Barrels DLB-2 (30 m northwest and 10 m downslope from adit), Barrel No. DLB-4 (located 50 m east of DLB-2), DLB-7b (upper trenching area barrel cache), DLB-10b (upper trenching area barrel cache), and DLB-12 (at the western extent of upper level trench workings).

Table 3: Hazardous Waste Materials:

Waste Material	Number / Volume	Location	Parameter	Comments
Barrel DLB-2	1 @ 205 litres / 5 litres	- 30 m NW & 10 m downslope from adit	Total Organic Halogen	Exceeds detection limit by factor of 3
			PCBs	Within Detection Limits
Barrel DLB-4	1 @ 205 litres / 5 litres	- 50 m east of DLB-2	Total Organic Halogen	Within Detection Limits
			PCBs	Within Detection Limits
Barrel DLB-7b	1 @ 205 litres / 5 litres	- upper trenching area barrel cache	Total Organic Halogen	Exceeds detection limit by 1 ug/g
			PCBs	Within Detection Limits
Barrel DLB-10b	1 @ 205 litres / 5 litres	- upper trenching area barrel cache	Total Organic Halogen	Within Detection Limits
			PCBs	Within Detection Limits
Barrel DLB-12	1 @ 205 litres / 5 litres	- western upper level trench workings	Total Organic Halogen	Within Detection Limits
			PCBs	Within Detection Limits

Results obtained from laboratory analysis for Total Organic Halogens were within detection limits for Barrels DLB-4, DLB-10b, and DLB-12, slightly elevated for DLB-7b. Samples DLB-2 & DLB-7b were analyzed for PCBs. Results obtained for Barrel DLB-B2 exceed detection limits by a factor of 3 as summarized in **Table 3** below.

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. It should be noted that whereas results provided by the analytical laboratory were expressed in milligrams per liter, CCME Remediation Criteria for Water (Freshwater Aquatic Life standard) are expressed in micrograms per litre. Thus, analytical results provided in Appendix C should be multiplied by 1000 to provide an accurate reflection of readings with respect to the CCME Criteria.

The water samples collected on the Dale property from underground and surface mineral exploration workings were from snow melt waters and can not be considered representative of groundwater conditions. The adit was not actively producing water when the site was visited. Snow accumulated in the portal had produced a small pool of standing melt water which was sampled **(DLWQ-A1)**. The trenches at the ridge summit were full of snow and the waters draining from them are presumed to have been melt water. Sample **DLWQ-TR2** was collected from a small flow at the west end of the trench and sample **DLWQ-TR3** was collected from flows at the east end.

Table 4 **Surface Water Samples - Significant Results**

Sample ID	Sample Location	Ph	Conductivity (μmhos/cm)	Metallic Parameters	Non-Metallic Inorganics
DLWQ-A1	Adit A1 at elevation of 1402 m	6.51 [6.4]	51.5 [20]	Al, Fe, Ag, Se	n/a
DLWQ-TR2	Trench (west end) located 225 m above adit.	6.97 [7.6]	41.7 [30]	Fe, Zn	n/a
DLWQ-TR3	Trench (east end) located 225 m above adit.	7.08 [6.7]	61.2 [20]	Zn	n/a
DLWQ-C4	Freer Creek near camp located approximately 92 m below the adit entrance.	7.17 [7.1]	32.3 [20]	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) The designation "n/a" indicates that none of the readings from analytical samples submitted to the lab exhibited levels beyond parameters identified

5.5 Waste Rock Disposal Areas

Waste rock from the development of the adit was end dumped 20 metres northeast of the portal area. **(see Photos 4 & 8)**. The material is homogenous, composed primarily of medium grained, equigranular, biotite quartz monzonite of the Cassiar Batholith with no observed vein material or sulphide content. It is angular and is comprised of 50% minus 0.5 cm. material, 30% 0.5 cm. to 3.0 cm. material and 20% 3.0 cm. to 20.0 cm. material.

There is an estimated 400 m^3 of material over an area of 300 m^2 extending down the 35 degree slope. The waste rock material has a 15 cm. zone of weak oxidation at the surface. A single, representative sample was collected **(DLWR-R1)** from a 0.8 metre profile of the waste dump. The waste dumps of stripped overburden from the uppermost trenches are significant in size **(see Photos 11, 12)**. Although recently developed, the stripped material is comprised of 7 push dumped piles approximately covering 4,500 m^2 in area and totaling 13,500 m^3 in volume. The texture of the waste rock piles was approximately 60% minus 0.5 cm. material, 30% 0.5 cm. to 3.0 cm. material and 10% 3.0 cm. to 20.0 cm. material. A representative sample was collected from a 0.6 metre profile at the eastern end of the waste dumps **(DLWR-R2).** Trace volumes of galena-tetrahedrite quartz vein were observed in the material comprised of an estimated 85% granodiorite/quartz monzonite and 15% lamprophyre dyke. Lead and zinc values reported in the sample are higher (806 ppm Pb and 1949 ppm Zn) than expected based on visual inspections. This result is considered to be anomalous or spurious and likely not representative of all the stripped waste rock piles, however more detailed sampling would be required to establish this conclusion. More detailed sampling of the stripped material was not undertaken due to the fact that the trenching work was done as part of an active mineral exploration program by the current claim holders.

5.6 Mine openings

A single adit is located on the Frostbite 2 claim at approximately 1,430 metres elevation and UTM coordinates 6654400 N and 417960 E. The first 6 metres of the portal were re-conditioned in 1994 (MinFile Report 105B 007) with new alpine balsam fir logs 0.15 to 0.30 metres. It extends 5.5 metres out from the rock collar and measures 1.7 metres wide by 2.2 metres high. A total of 7.5 metres of the portal is visible, with the remainder blocked by a screen of chain link fencing at 4 metres and a plastic sheet at 7.5 metres. The adit was partly blocked by a 0.4 metre high pile of frozen snow. The adit is in good repair, but has been underbuilt with the use of undersized timbers and chainlink fencing along its length on both sides instead of horizontal planking.

The original underground work was done with track mounted equipment. The track, or the portion extending out the portal area, has been removed and dumped just south of the waste rock dump. The old portal timbers have been piled just south of the new portal. There are numerous recent cat trenches and associated piles of stripped overburden on the property extending along the trend of the shear zone between 1520 metres and 1600 metres elevation. A total of 10 trenches were inventoried totaling approximately 500 metres in length.

The 4 trenches located between 1520 metres and 1540 metres are oriented north-south along the slope contour. No bedrock is exposed and they have been partially backfilled. Three of these

trenches observed between 1540 metres and 1585 metres oriented east-west down the slope and 1 is over 15 metres wide. Two trenches are located end to end over a total length of 250 metres along the east-west trend of the vein and shear zone at the crest of the ridge at 1590 metres elevation. The trenches are 2 to 3 metres deep and were filled with snow at the time of inspection.

Table 5 Mine Openings

Adit	Location	Drift Length	Condition
A1	Lower Site, elev. 1430 m	7.5 m	- good condition but underbuilt due to undersize timbers & chainlink fencing rather than horizontal planking

5.7 Tailings

No milling or ore processing has occurred on the Dale site, with the exception of hand cobbing of vein material. No mill tailings were present on the site as a result.

6.0 CONCLUSIONS

The primary concern at the Dale mine site is the health and safety of humans and wildlife relating to the collapsing mine openings. A secondary concern is the aesthetic appearance of scattered timbers, miscellaneous wood waste below the adit as well as miscellaneous metal debris below the adit and at the upper trenchworks.

6.1 Health and Safety

The single adit at the main level is unsecured from public and wildlife access and essentially underbuilt.

6.2 Environmental Risks

The environmental risks relating to mineral exploration activities on the Dale property are considered low, largely due to the limited volume of the resource present, the limited scale of development work done on the site, the lack of mine waters draining the site and workings, and low levels of metals . All water sample concentrations 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. Exceptions included Al, Fe, Ag, & Se for **DLWQ-A1**, Fe & Zn for **DLWQ-TR2**, and Zn for **DLWQ-TR3**.

6.3 Aesthetic Concerns

Aesthetic concerns arise from the presence of barrels, metal and wood debris both at the adit and upper trenchworks level.

7.0 RECOMMENDATIONS

Recommended remediation and management actions are in compliance with applicable federal or territorial regulations and criteria, rely upon available technology and intended to be appropriate for local conditions and sensitivities.

Recommendation 1:

The single mine opening should be secured from human and animal access for health and safety reasons. Since site access is good, adits should be covered with surrounding rock and soil using readily available equipment. Timbers and associated wood debris should be burned on site. Should the mine need to be reopened, access to underground workings is achievable with heavy equipment.

Recommendation 2:

Empty barrels should be cleaned and crushed prior to being buried in available rock overburen. Assorted metal debris (including barrels) should be gathered from around the site and buried in one location with other site debris.

Recommendation 3:

Wood core storage racks in lower emcampment area should be retained. Flare off remaining fuel drum behind log cabin, burn log cabin, bury metal roofing of A frame, and burn A frame in place.

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:

DIAND Technical Services. 1993. Assessment Report 105B-01-1, Dale Abandoned Mine Site

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APPENDIX A

DETERMINATION OF ACID ROCK DRAINAGE POTENTIAL

Results of the static geochemical analysis and modified Sobek method acid-base accounting (ABA) indicate that the waste rock material in both the adit dump site and the stripped piles are listed below:

Dale Property Acid-Base Accounting Results - Waste Rock							
Sample No.	**Paste pH**	**Sulphur (Total) %**	**Sulphur (SO_4) %**	**Acid Potential (AP*)**	**Neutral. Potential(NP*)**	**Net NP (NNP*)**	**NP/AP**
DLWR-R1	8.85	0.04	0.00	1.3	18.0	16.8	14.4
DLWR-R2	8.36	0.08	0.00	2.5	20.0	17.5	8.0

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

Based on the low total sulphur content, positive Net NP, and a NP/AP ratio over 3:1, it can be concluded that the waste rock on the Dale property is a net consumer of acid and is not expected to generate acid runoff that would pose any risk to Freer Creek and its tributaries. Also, a significant proportion of the available sulpher is from galena and sphalerite, and not as significant a

APPENDIX B

SITE PHOTOGRAPHS

Photo 1 . Access road at adit level with loser level access road at rear (looking north).

Photo 2. Portal entrance to adit with access road to upper trenching at left (looking north).

Photo 3. Under built single adit (1.7 m X 2.2 m) built of fir logs.

Photo 4. Excavating waste rock test pit sample hole DL-WR-R1 below (east) of adit entrance.

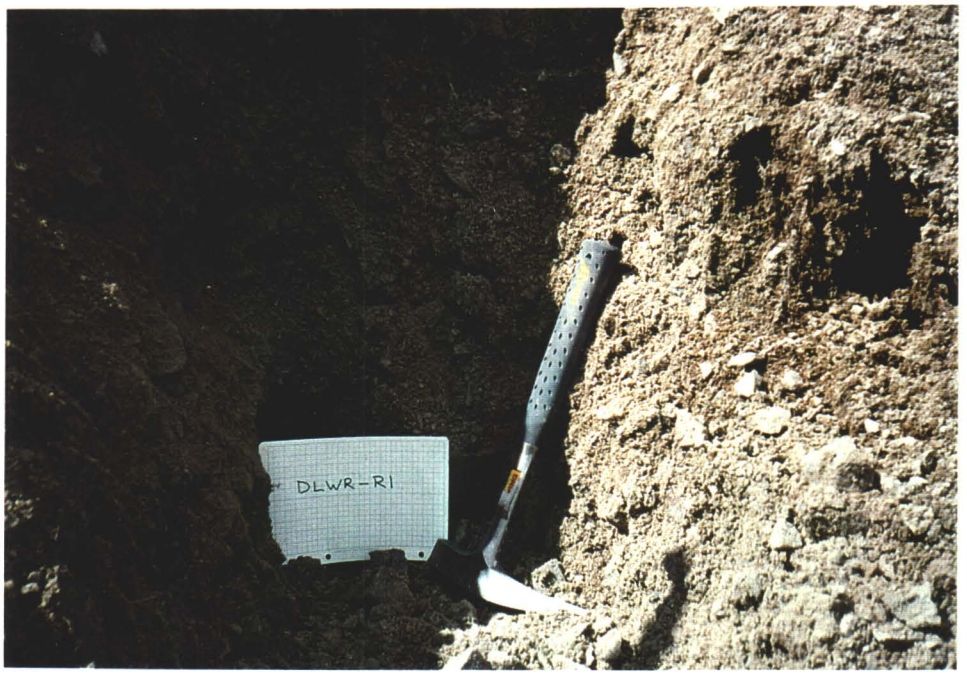

Photo 5. Details of waste rock sample hole DL-WR-R1

Photo 6. Determining conductivity during pH paste tests on waste rock samples at site.

Photo 7. Preparing to place 65 ml sifted waste rock sample in beaker prior to determining paste pH and conductivity.

Photo 8. Empty 205 litre rusting metal drums on rocky slope below adit entrance.

Photo 9. 205 litre barrel DL-B2 located on rocky slope below adit entrance.

Photo 10. Empty 205 litre rusting metal drums scattered about upper trenching area.

Photo11. Detail of trench workings above main adit level.

Photo 12. Upper trench workings leading west to snow melt.

Photo 13. Western extent of upper level trench workings.

Photo 14. View from adit level of exploration camp adjacent to unnamed tributary of Freer Creek.

Photo 15. Log structure living quarters covered with tarpaulin (wood floor)

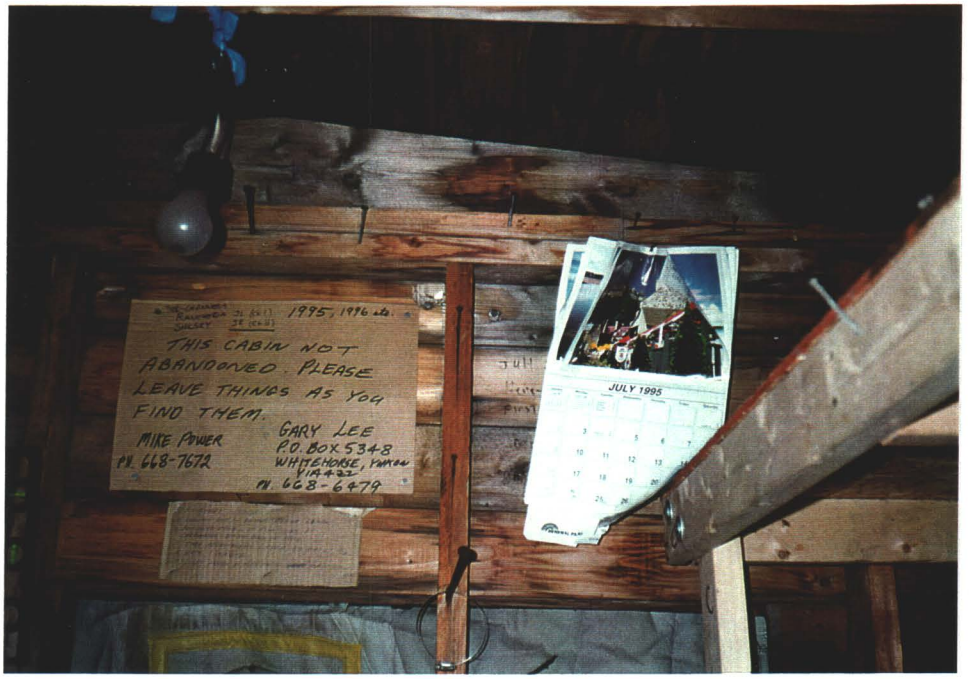

Photo16. Interior of living quarters with notice identifying site as active.

Photo 17. Core racks in rear of living quarters used to support drum for dispensing of fuel oil to stove.

Photo 18. Use of 12 mm barrel drum thief to extract sample of petroleum hydrocarbon liquids for collection in sample bottles.

Photo 19. Wood frame metal clad A-frame former roof of log structure used for storage.

Photo 20. Water quality sample site at access road crossing of unnamed tributary of Freer Creek.

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

DALE SILVER 7.

			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		<0.01	<0.01	<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		[illegible]	[illegible]	0.15	<0.03	0.29
Lead	T-Pb		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silicon	T-Si		3.03	1.33	0.64	1.44	2.73
Silver	T-Ag		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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

DALE SILVER 7.

		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.

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