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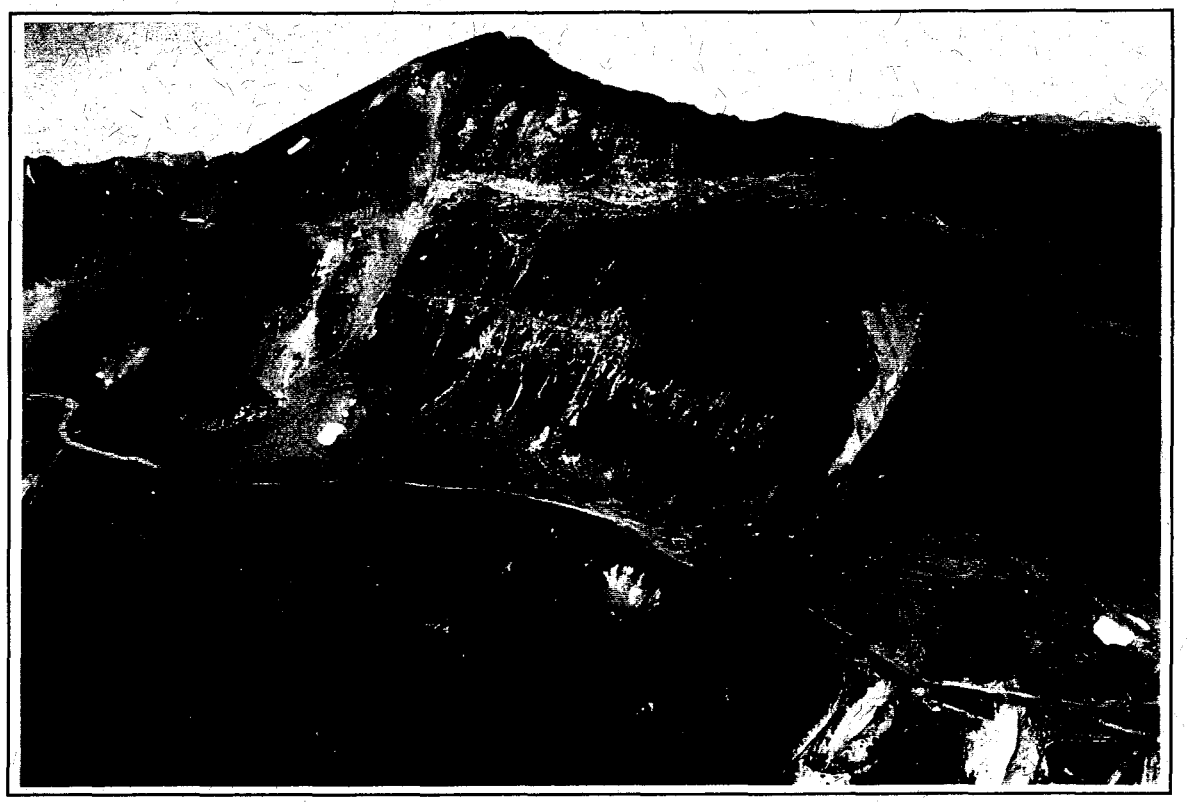
PWGSC

Quality in Environmental Services

PHASE II ENVIRONMENTAL ASSESSMENT OF THE STORMY ABANDONED 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

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

Canada

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OF THE

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EXECUTIVE SUMMARY

A phase II environmental assessment was conducted at the Stormy Abandoned Mine site (61° 29'38"N and 132° 48'36"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 mine adit, at the exploration camp is not adequately secured from public and wildlife access. Four buildings and several other camp structures, left at the camp site, present health and safety hazards. An assessment of the acid rock drainage potential shows that the risk to the environment due to the presence of the waste rock and adit is insignificant at this time. One 205 litre barrel, containing liquid hydrocarbons discovered at the camp site is in fair shape and presents a minor environmental risk. Based on the sampling results, the barrel contents are suitable for incineration. One old battery discovered at the camp location is a minor environmental and health and safety risk. Aesthetic concerns arise from the buildings and infrastructure, and a small quantity of miscellaneous debris scattered though out the site.

Using applicable federal and territorial criteria, background characteristics, as well as northern mine reclamation guidelines, it is recommended that the mine opening be secured from human and animal access for health and safety reasons. The adit should be covered with surrounding rock and soil using available equipment. Timbers should be removed and buried along with other site debris. It is recommended that all buildings be demolished and buried on site. Waste material that is combustible and non-hazardous may be burned on site. The Core Library run by the Chamber of Mines in Whitehorse should be notified of the inventory of cores. Waste petroleum hydrocarbons on site should immediately be removed and disposed appropriately. It is recommended that barrel contents be incinerated. This may be done by air transporting the barrels to a central disposal location for incineration using a portable incinerator. If a cleanup is conducted along with a regional program, the barrel contents may be incinerated at a temporary barrel incineration facility established for the purpose of incinerating waste hydrocarbons at several mine sites in the area.

It is recommended that the waste battery stored on site be properly packaged, labeled, transported and disposed at an approved hazardous waste disposal facility in accordance with the Transportation of Dangerous Goods Act.

Miscellaneous site debris should be collected and buried on-site.

Summary of Conclusions and Recommendations

ASSESSMENT COMPONENT	RISK	RECOMMENDATION
1. Building, Infrastructure, Equipment		
4 buildings (incl core shed with subst. Quant. of core)	Health and Safety	Burn, Notify core library for removal
2. Non-Hazardous Waste Material		
wood, metal, and plastic debris	Aesthetic	Collect and bury in trench
20 Empty Barrels - scattered	Aesthetic	Collect and bury in trench
Rail piles (< 5 m^3) - upper site	Aesthetic	Collect and bury in trench
3. Hazardous Materials		
1 barrel - lower site	Environmental	Remove and incinerate
1 old battery	Environmental	Remove from site
4. Water Quality		
Mine Seepage - upper adit	Minor environmental risk	No Action
Site Drainage - None		
Receiving Waters - creek	Minor environmental risk	No Action
5. Waste Rock Disposal Areas		
1 small piles - 306 tonnes	Minor environmental risk	No Action
6. Mine Openings		
1 adit (upper site) - open, partly sealed	Health and Safety	Seal with local rock and soil
7. Tailings		
None		

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1.0 INTRODUCTION AND BACKGROUND

Phase I 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 in 1993. These assessments were intended to provide a general overview of historical activities, describe site infrastructure, workings and wastes, describe possible environmental or safety concerns on each site, and provide recommendations for follow-up work.

The phase I investigation of the Stormy abandoned mine site revealed that there exists an adit sealed by wood, four building structures, rock core, several empty barrels, miscellaneous solid debris, and a small quantity of waste rock.

In light of these findings, Indian and Northern Affairs Canada determined that further investigation is warranted. Environmental Services of Public Works and Government Services Canada was retained to conduct a phase II environmental assessment of the Stormy abandoned mine site. The goals of this assessment are to a) identify specific environmental and human safety risks; b) provide cleanup recommendations; and c) provide a Class "D" (± 25%) cost estimate for mitigation of these risks.

1.1 LOCATION

Stormy mine site is located at 61° 29'38"N latitude and 132° 48'36"W longitude (Figure 1). It is located approximately 20km east of the South Canol Highway at Upper Sheep Creek near the top of a ridge on an unnamed mountain of the St. Cyr Range of the Pelly Mountains. This ridge separates the Upper Sheep Creek and Seagull Creek drainage basins. The site is between 1500-1700 m above sea level.

The Stormy mine site is composed of an exploration and camp site, both above the treeline. The exploration site is at approximately 1700 m elevation and the camp site is located at approximately 1500 m elevation.

1.2 OVERVIEW OF SITE DEVELOPMENT

The following work history has been is compiled from the Yukon Minfile record 105F 011 and pertains primarily to the development of the property. The property was staked in 1955 by A. Racicot for Conwest Exploration Ltd. as the Ann claims. In 1959, 320m of drifting and 1055m of underground drilling (36 holes) was completed.

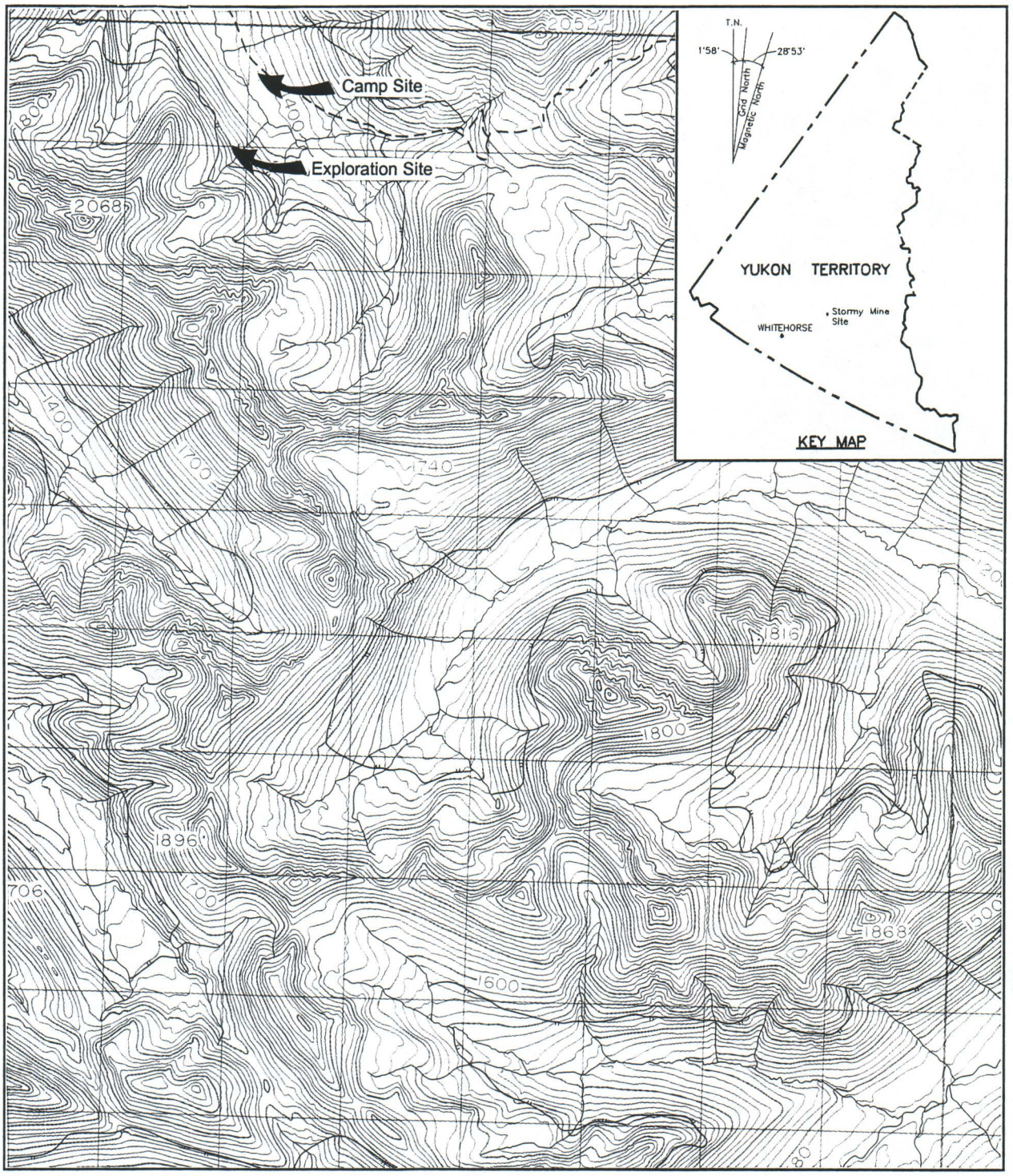

Figure 1. Location of Stormy Mine - 1:50,000, NTS-105F/7 [Energy Mines and Resources Canada: 1984]

Trenching was carried out in 1968. In 1979-80, the underground workings were rehabilitated and bulk sampled, and eight holes (690m) were drilled.

1.3 SITE ACCESS

The site is reached by first travelling the South Canol Highway to a trail intersecting the highway on the north side of the Upper Sheep Creek. From this intersection the site is reached by travelling 20km east on a trail following the Upper Sheep Creek valley. This trail can be travelled using four wheel drive vehicles crossing several small creeks. Alternatively, the site may be accessed by helicopter.

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

The assessment was limited to the area specifically developed or occupied for exploration or mining purposes, and adjacent areas and resources believed to be affected by these 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.

Barrel Clean Up Protocol (INAC, 1992)

See Appendix E for protocol on testing and cleaning of barrels and contents.

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 Stormy 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. Barrel Clean Up

INAC:	Barrel Clean Up Protocol

D. 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 Stormy abandoned 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 analyses of contaminant constituents, as necessary.

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

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

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, 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 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 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.

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 minimize 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, discoloration, stratification, odour, and 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 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 Above-Ground Storage Tank (AST) was sampled with a stainless steel Bacon bomb sampler. A plunger at the tip of the sampler depressed when contact with the tank bottom was made, allowing petroleum product to enter the body of the sampler. When the sampler was raised, the plunger closed to seal the sampler and allow removal of the sample from the AST. The sampled hydrocarbon was then drained into a 40-ml laboratory-cleaned vial which was then sealed and placed in a container for shipment to the laboratory. The bomb sampler was cleaned with laboratory-grade detergent between sampling events.

Since hydrocarbon samples were collected only for analyses of Total Halides and metals, no cooling or other preservative was required.

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 labeling 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 deposit is located along a contact aureole between Lower Cambrian limestones and siltstones, and the intruding Rose Lake Stock (DIAND, 1993). The stock is composed of biotite granite with rare manganese oxide and molybdenite veins. Cobbles containing dark red garnet (possibly pyrope) were observed outside the adit but other minerals commonly associated with skarns, such as epidote and magnetite, were less common. Rare (approximately <2%), disseminated pyrite was noted in some areas.

The major commodities identified at this site are molybdenum and tungsten.

4.2 SURFACE HYDROLOGY

The adit is located on a steep ridge that drains south-east to a tributary stream of Seagull Creek (see Figure 1). The exploration site is well above the tributary stream.

4.3 CLIMATE

The closest climatological information is from the town of Ross River, 61° 59' N, 132° 27' W; 698m above sea level (Environment Canada, 1980). Total annual precipitation is 263.5 mm. This consists of 152.1mm of rainfall and 105.8mm of snowfall. Highest levels of rainfall occur in July and highest levels of snowfall occur in January. Temperatures range from -28.6° C in January to 12.8° C in July. The mean annual temperature is -5.7° C.

4.4 VEGETATION

Stormy is found within the Pelly Mountains ecoregion. Much of the ecoregion lies above the treeline, and is dominated by treeless tundra vegetation including lichens, dwarf ericaceous shrubs, birch and willows. Wetter sites are occupied by grasses, sedges, cottongrass and mosses. Subalpine regions are characterized by open stands of black and white spruce and alpine fir. Valleys and lower elevation slopes may be occupied by aspen and scrub birch.

4.5 FISH AND WILDLIFE RESOURCES

Typical mammals in the ecoregion include grizzly and black bear, moose, caribou, beaver fox, wolf and hare. Typical bird species include rock and willow ptarmigan, raven and golden eagle.

4.6 SITE TOPOGRAPHY AND SOILS

The regional and site topography are mountainous, with a relief of about 1400 metres at the Lower Sheep River to 2,100 metres at some of the higher peaks. The mountains, though steep, are rounded with few cliffs and rock outcrops and can be easily traversed.

Much of the ecoregion is covered by a thin layer of eutric brunisolic soils. A blanket of recent volcanic ash 10-30cm thick covers most of the region. Turbic cryosols occur sparsely in poorly drained areas.

Topography above the mine site exhibits typical upper-alpine features such as stone nets and felsenmeer interspersed with hummocky tundra. Steep upper slopes are

covered with talus or scree material contributed by freeze-thaw fracturing of sedimentary rock. The slope is uniformly covered with talus; at lower elevations, fractured shale outcrops are interspersed with hummocky flats and gentle slopes.

4.7 PERMAFROST

Stormy is in a discontinuous permafrost zone. No attempt was made to establish the presence or absence of permafrost at this site.

5.0 SITE DESCRIPTION AND FINDINGS

5.1 BUILDING, INFRASTRUCTURE, and EQUIPMENT

Table 1 lists all site buildings and structures by size, construction, and contents. Site observation showed that there were three buildings and three tent pads at the camp site and one building at the exploration site. Structures were all in fair to poor condition and did not indicate any historical value.

Table 1 Buildings, Infrastructure, and Equipment

ITEM	SIZE	MATERIALS	CONTENTS
Shed (Exploration Site)	6.5x4x3 m	wood (2x4 construct.), asphalt paper roofing	- small quantity metal scrap
Bath House	4x2.5x3 m	wood (2x4 construct.),	- 1 plastic shower stall - 1 wood table
Mess/Cook House	8x3x3 m	wood (2x4 construct.), Lino flooring, asphalt paper rooofing	- 1 wood table - 1 wood bench
Core /Assay Shed	5x5x2.5 m	wood (timber & post construct.), Asphalt paper roof	- 70 x 4 rod trays cores - 1 barrel cutaway (burner)
Tent Pad	3x3 m	wood (2x4 construct.)	- none

5.2 NON-HAZARDOUS WASTE MATERIALS

The non-hazardous waste materials observed in and around the site are listed in Table 2. Non-hazardous waste debris was observed at both the exploration and camp sites. The debris is primarily wooden timbers, steel tracks, and empty barrels.

Table 2 Non-Hazardous Waste Materials

Waste Material	Number/Volume	Location	Comments
Timbers	10 - 4"diam 10' sect.	exploration site	
Rails	8 - 5 m sect.	exploration site	
Drill Rods	10 units	exploration site	on hill side in front of adit
Ladder	50'	exploration site	on slope between sites
Metal Pipe	2 m^3	at hill base between camps	piled
Metal Scrap	4 m^3	at hill base between camps	piled
Empty Barrels	20	scattered throughout site. (2 at camp site)	no visible staining
Debris	< 5 m	scattered throughout camp site	mostly wood, cores

5.3 HAZARDOUS MATERIALS

Very little hazardous material was detected on site. One old and dry battery was located in the mess building. No soil staining was observed.

One barrel was located at the base of the prominent hill below the adit. The barrel contents were tested for disposal by incineration. The results are presented in Table 3 and indicate that the contents are suitable for incineration.

Table 3 Results of Barrel Sampling for Incineration

Parameter	Barrel Clean up Criteria (ppm)	#1 (ppm)
Cadmium	2	< 1
Chromium	10	< 1
Lead	100	< 1
Total Organic Halides	1000	< 2
PCBs	2	N/R

Note: N/R - not required as TOX analysis is less than 2 ppm, N/A - not available

5.4 SURFACE WATER QUALITY

Three water quality samples were collected at the site: one from the adit (STOWQ/A1), and one each from upstream and downstream of the exploration site (STOWQ/STR1/1 and STOWQ/STR1/2, respectively). Results of water quality analyses are presented in the Appendix and summarized in Table 4.

The adit entrance was blocked by snow. Thus, the water from the adit passed beneath the snow prior to collection and may have been diluted. The adit water (A1) was alkaline (pH=7.7) and had moderate conductivity (305 μS/cm). The sulphate concentration was 77 mg/L. Water quality was within the Metal Mine Liquid Effluent Guidelines (MMLE, 1977).

Water upstream of the exploration site (STOWQ/STR1/1) had a laboratory pH and a conductivity of 7.3 and 58 μS/cm, respectively. The acidity of the stream water was higher (5.4 mg/L) than the adit water, and the conductivity, alkalinity, and sulphate were lower, possibly indicating a lack of limestone and sulfides in the headwaters of the stream. Metal concentrations were low, however, for a few metals the detection limits used were greater than the Canadian Council of Ministers of the Environment (CCME, 1987) guidelines.

Compared to the upstream sample, the sample collected downstream of the workings (STOWQ/STR1/2) contained higher concentrations of calcium, magnesium, strontium, and alkalinity, all characteristic of the weathering of

carbonate rocks. The sulphate concentration was also higher (24.6 mg/L) and may indicate a contribution from the disturbed exploration area, although mineralization at the site includes only a small amount of sulphide minerals. Concentrations of all other metals were below detection by the analytical methods used.

Table 4 Surface Water Samples - Significant Results

Sample ID	Sample Location	pH	Conductivity (µS/cm)	Metals	Other
STOWQ/A1	Adit	7.68	305	low	SO_4 = 77 mg/L
STOWQ/STR1/1	Upstream approx. 25 m from exploration site	7.31	68	low	SO_4 = 4 mg/L
STOWQ/STR1/2	Downstream approx. 150 m from exploration site	7.86	163	low	SO_4 = 25 mg/L

5.5 WASTE ROCK DISPOSAL AREAS

Approximately 20 tonnes of rock was deposited directly outside the adit at the exploration site. The material is composed of a buff colored, biotite granite with rare manganese oxide veins, <2% disseminated pyrite and molybdenite, and approximately 5% hematite. The pile is composed primarily of cobbles and boulders with little sediment.

Downhill from the biotite granite waste and spread out approximately 30 meters to the east, is rock composed of red-brown siltstone and schist, that has primarily resulted from road building. There is approximately 40 tonnes of this material which contains little mineralization.

One sample was collected from a pit dug into the pile containing the buff-colored biotite granite. The pit was 35 cm deep. The top two centimeters was composed of a thick, dry armour. Material below the armour was composed of pebbles and cobbles with a brown to light brown, clayey-sand matrix. The clasts were composed of siltstones and quartz vein material, and approximately 10% had limonite or hematite staining. The sand matrix had no staining. A few fine roots reached down to approximately 10 cm.

Results of these analyses are presented in the Appendix and summarized in Table 5. Sample STORMYWR/P1 had a paste pH and paste conductivity of 8.5 and 120

μS/cm, respectively. The total sulphur concentration was 0.35% and 0.25% of this was present as sulphate. The NP/AP ratio was 5.9, indicating that the material is not acid generating. Metal concentrations were generally low except for moderate concentrations (approximately 100 ppm) of arsenic and zinc.

Table 5 Summary Acid/Base Accounting Test Results

Sample #	Paste pH	Total S (%)	SO4 (%)	NP/AP
STORMWR/P1	7.91	0.35	0.25	5.90

5.6 MINE OPENINGS AND EXCAVATIONS

One adit is located at the exploration site on the south facing slope of an unnamed mountain. The entrance to the adit was covered with snow at the time of the visit. Clearing snow from the top of the opening revealed a closure temporarily secured with a timber and plywood cladding structure.

5.7 TAILINGS

No milling of ore was done on site. Therefore, no tailings are present.

6.0 CONCLUSIONS

6.1 HEALTH AND SAFETY RISKS

The adit closure is a temporary structure and is not permanently secured from public and wildlife access. For most of the year the adit opening is blocked with snow.

Four building structures are on site and present a safety hazard to the public if left unmaintained. Some buildings contain waste debris and are easily accessed.

6.2 ENVIRONMENTAL RISKS

The waste rock at the site poses insignificant environmental risk. The material is not potentially acid generating and does not appear to be causing a negative impact on the water course downstream of the exploration site.

A minor environmental risk exists as a result the abandonment of petroleum hydrocarbons on site. One barrel, in poor condition, contains approximately 200 litres of a liquid organic waste. Based on laboratory analysis, the disposal of liquid waste may be locally incinerated.

6.3 AESTHETIC CONCERNS

There is a significant aesthetic concern due to the presence of buildings and waste debris scattered throughout both the exploration and camp sites.

There is only a small amount of waste rock at the site (~20 tonnes) and does not cause any significant aesthetic concern.

There are many road cuts and trenches into the steep hillside and the adjacent ridge the extends northwest of the adit. Approximately 7 trenches have been constructed in the valley below the adit. These cuts effect the aesthetics of the area, and encroachment of the native vegetation is occurring slowly.

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.

Recommendation 1.

It is recommended that the mine adit be secured from human and animal access for health and safety reasons. The adit should be covered with surrounding rock and soil using available equipment. Timbers should be removed and buried along with other site debris. Should the mine need to be reopened, access to workings is achievable with heavy equipment.

Recommendation 2.

It is recommended that all buildings be demolished and buried on site. Waste material that is non-hazardous combustible may be burned on site.

Recommendation 3.

It is recommended that waste rock at the site be left as it is.

Recommendation 4.

Reclamation of the trench areas is not recommended because of the remoteness of the site. Furthermore, recontouring would disturb the revegetation that has occurred.

Recommendation 5.

Waste petroleum hydrocarbons on site should be immediately removed from the site and disposed appropriately. It is recommended that barrel contents be incinerated. This may be done using a portable incinerator by air transporting the barrels to a central disposal location. If cleanup of this is conducted along with a regional cleanup, the barrel contents may be incinerated at a temporary barrel incineration facility established for the purpose of incinerating waste hydrocarbons at several mine sites in the area.

Recommendation 6.

It is recommended that the miscellaneous site debris be collected and buried on-site for aesthetic reasons.

8.0 COST ESTIMATES TO IMPLEMENT RECOMMENDATIONS

A cost estimate of expected site remediation costs to an accuracy of 25% is provided under a separate cover. The cost estimate includes contractor and project management costs and contingency.

REFERENCES

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

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Environment Canada Atmospheric Environment Service. Canadian Climate Normals. 1961-1990.

Environment Canada Atmospheric Environment Service. Canadian Climate Normals. 1951-1980.

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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 Government, Minfile record 105F 011

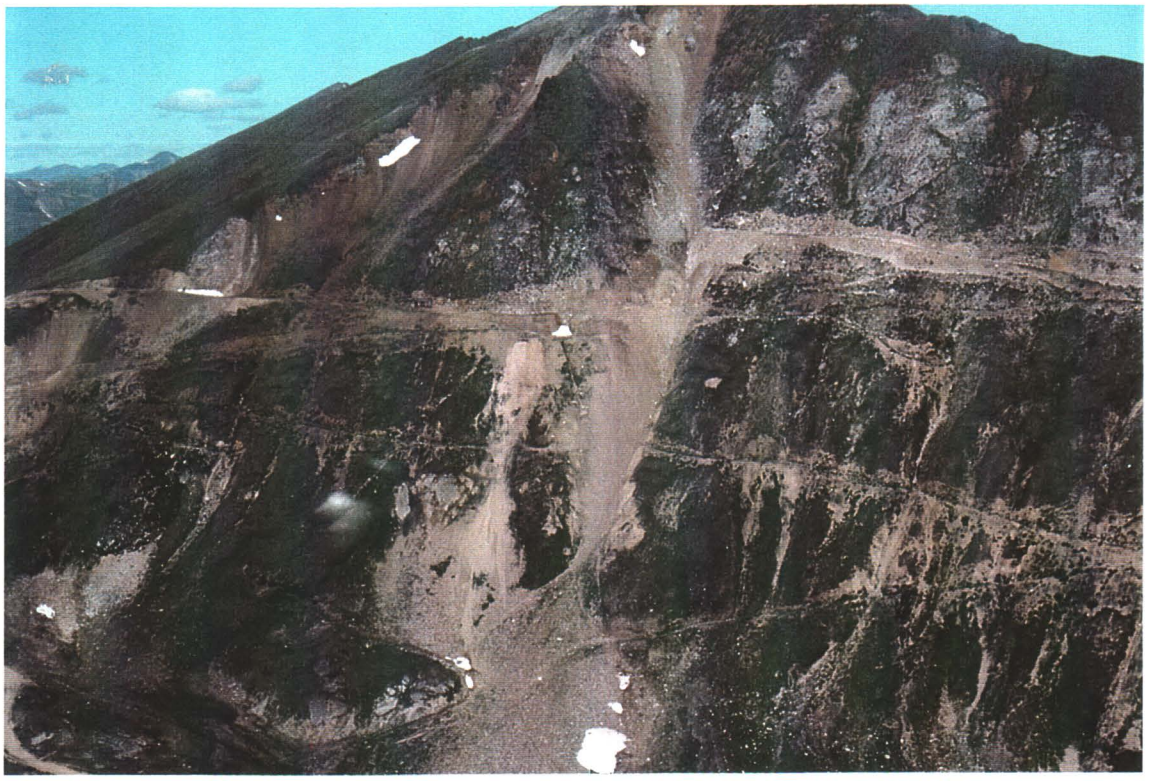
APPENDIX A

Site Photographs

STORMY
Photographic Record

July 23, 1996

Photos	Description
S. # 1	Aerial View of the Exploration Site
S. # 2	Aerial View of the Camp Site and Trenches
S. # 3	Camp Site and Slope to Upper Site
S. # 4	Camp Site from Upper Site
S. # 5	Adit at Upper Site
S. # 6	Adit Seal
S. # 7	Seepage from Adit and Snow Melt
S. # 8	Building at Upper Site
S. # 9	Interior of Building at Upper Site
S. # 10	Kitchen and Mess Building
S. # 11	Kitchen and Mess Interior
S. # 12	Core Storage and Assay Building
S. # 13	Core Storage
S. # 14	Site Debris by Core Storage and Assay Building
S. # 15	Burner
S. # 16	Tent Pads
S. # 17	Waste Rock Sample - Sto-wr-p1-1
S. # 18	Outhouse
S. # 19	Barrels in Drainage Basin
S. # 20	Barrel Sample Sto-br1-1
S. # 21	Trenches
S. # 22	Trench
S. # 23	Upstream Water Sample
S. # 24	Downstream Water Sample



Photo# 1: Aerial View of the Exploration Site

Photo# 2: Aerial View of the Camp Site and Trenches

Photo# 3: Camp Site and Slope to Upper Site

Photo# 4: Camp Site from Upper Site

Photo# 5: Adit at Upper Site

Photo# 6: Adit Seal

Photo# 7: Seepage from Adit and Snow Melt

Photo# 8: Building at Upper Site

Photo# 9: Interior of Building at Upper Site

Photo# 10: Kitchen and Mess Building

Photo# 11: Kitchen and Mess Interior

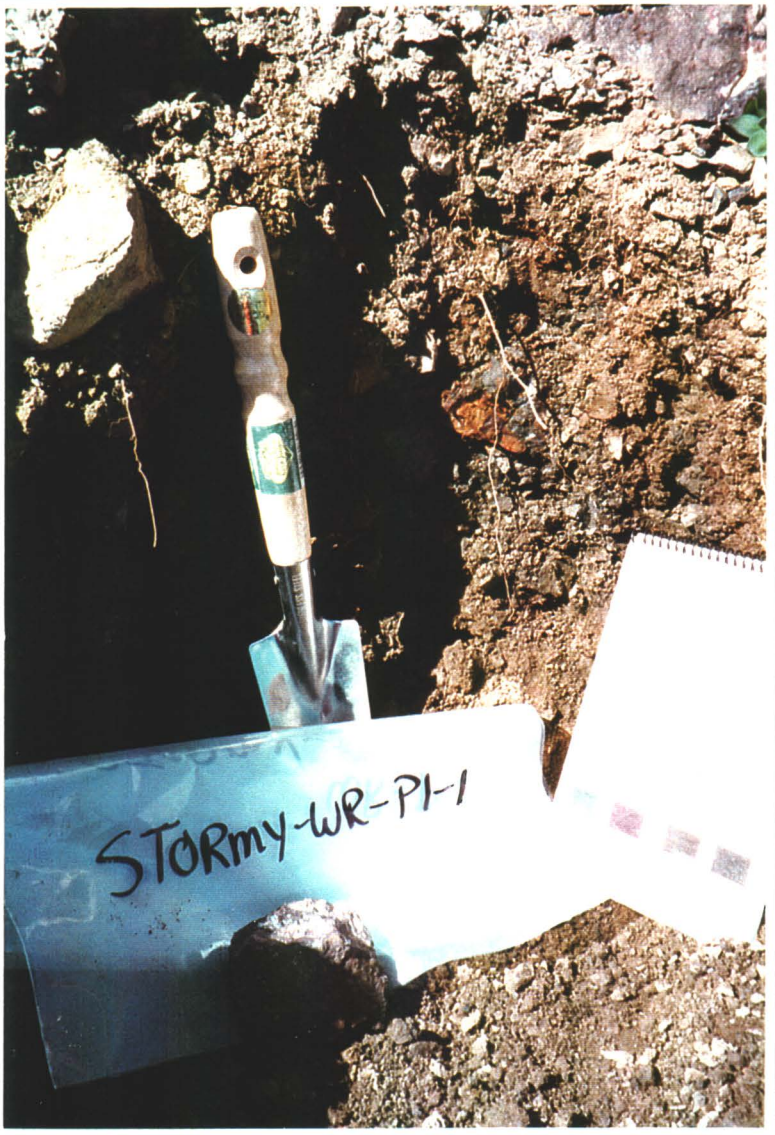
Photo# 12: Core Storage and Assay Building

Photo# 13: Core Storage

Photo#14: Site Debris by Core Storage and Assay Building

Photo# 15: Burner

Photo# 16: Tent Pads



Photo# 17: Waste Rock Sample
Sto-wr-p1-1

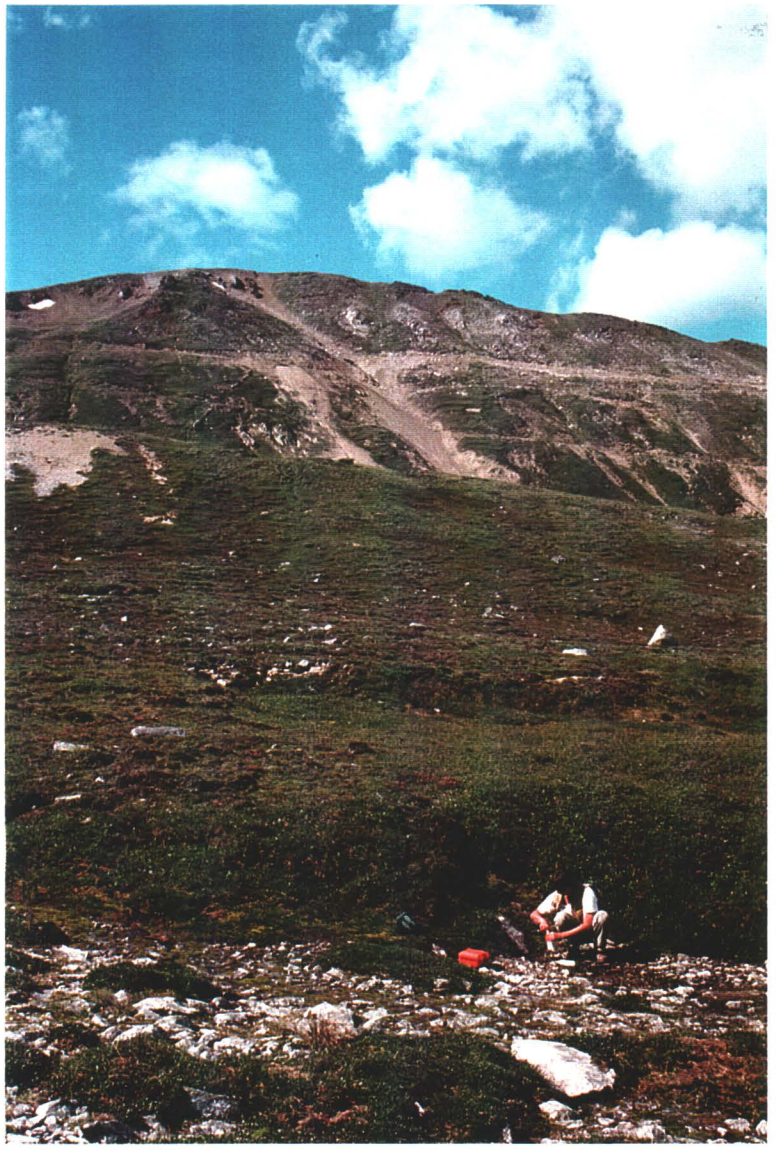
Photo# 18: Outhouse

Photo# 19: Barrels in Drainage Basin

Photo# 20: Barrel Sample Sto-brl-1

Photo# 21: Trenches

Photo# 22: Trench



Photo# 23: Upstream Water Sample

Photo# 24: Downstream Water Sample

APPENDIX B

Analytical Results

RESULTS OF ANALYSIS - Water File No. G3602

			Stump-WQ A1-1	Stump-WQ STR1-1	Stump-WQ -STR2-1	Stump-WQ -STR1-2	STO-WQ-A 1-1
			96 07 25	96 07 25	96 07 25	96 07 25	96 07 27
Physical Tests							
Conductivity (umhos/cm)			800	452	554	441	305
pH			7.86	8.10	8.16	8.17	7.68
Dissolved Anions							
Acidity		CaCO3	10.5	1.2	1.9	1.2	3.9
Alkalinity - Total		CaCO3	366	178	268	168	70.2
Sulphate	SO4		105	73.3	59.4	75.3	77.4
Total Metals							
Aluminum	T-Al		<0.2	<0.2	<0.2	<0.2	1.0
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	0.09	0.07	0.08	<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		71.5	56.4	52.8	56.4	53.6
Chromium	T-Cr		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	T-Co		<0.01	<0.01	<0.01	<0.01	0.02
Copper	T-Cu		<0.01	<0.01	<0.01	<0.01	<0.01
Iron	T-Fe		<0.03	<0.03	0.29	0.05	1.10
Lead	T-Pb		<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	T-Li		0.03	<0.01	<0.01	<0.01	<0.01
Magnesium	T-Mg		70.8	24.4	42.9	23.8	5.30
Manganese	T-Mn		<0.005	<0.005	0.026	0.005	0.655
Molybdenum	T-Mo		<0.03	<0.03	<0.03	<0.03	0.14
Nickel	T-Ni		<0.02	<0.02	<0.02	<0.02	0.09
Phosphorus	T-P		<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	T-K		6	<2	<2	<2	<2
Selenium	T-Se		<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	T-Si		2.65	2.17	2.38	2.15	3.42
Silver	T-Ag		<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	T-Na		11	<2	3	<2	<2
Strontium	T-Sr		1.47	0.205	0.386	0.196	0.093
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		<0.01	<0.01	<0.01	<0.01	0.01
Vanadium	T-V		<0.03	<0.03	<0.03	<0.03	<0.03

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

RESULTS OF ANALYSIS - Water File No. G3602

		Stump-WQ A1-1	Stump-WQ -STR1-1	Stump-WQ -STR2-1	Stump-WQ -STR1-2	STO-WQ-A 1-1
		96 07 25	96 07 25	96 07 25	96 07 25	96 07 27
Total Metals						
Zinc	T-Zn	0.007	0.006	<0.005	0.006	0.011

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

RESULTS OF ANALYSIS - Water

File No. G3602

			STO-WQ-STR-1 96 07 27	STO WQ-STR-2 96 07 27
Physical Tests				
Conductivity (umhos/cm)			58.0	163
pH			7.31	7.86
Dissolved Anions				
Acidity		CaCO3	5.4	1.4
Alkalinity - Total		CaCO3	22.3	56.6
Sulphate	SO4		4.2	24.6
Total Metals				
Aluminum	T-Al		<0.2	<0.2
Antimony	T-Sb		<0.2	<0.2
Arsenic	T-As		<0.2	<0.2
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		<0.01	<0.01
Calcium	T-Ca		9.29	28.7
Chromium	T-Cr		<0.01	<0.01
Cobalt	T-Co		<0.01	<0.01
Copper	T-Cu		<0.01	<0.01
Iron	T-Fe		<0.03	<0.03
Lead	T-Pb		<0.05	<0.05
Lithium	T-Li		<0.01	<0.01
Magnesium	T-Mg		0.46	1.59
Manganese	T-Mn		<0.005	<0.005
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		<0.2	<0.2
Silicon	T-Si		1.93	2.17
Silver	T-Ag		<0.01	<0.01
Sodium	T-Na		<2	<2
Strontium	T-Sr		0.053	0.082
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

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

RESULTS OF ANALYSIS - Water

File No. G3602

		STO-WQ-STR-1	STO-WQ-STR-2
		96 07 27	96 07 27
Total Metals			
Zinc	T-Zn	<0.005	<0.005

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

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

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).

End of Report

MW

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

PUBLIC WORKS CANADA
ATTENTION : MICHAEL NAHIR

TOX SAMPLES

Sample Description : STORMY-BRI-2
Sample Date & Time : 27-07-96
Sampled By :
Sample Type : GRAB
Sample Received Date: October 18, 1996
Sample Station Code :

Chemex Worksheet Number : 96-07805-4
Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996
Analysis Date : November 11, 1996

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Total Organic Halogens (TOX)		ug/g	< 2	2.

CHEMEX Labs Alberta Inc.

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Chemex Project Number : PUBI010-0502
Sample Access :
Sample Matrix : LIQUID
Report Date : November 15, 1996

BATCH SPECIFIC QUALITY ASSURANCE REPORT

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUM ANAL	MATRIX SPIKES DUP Rr	MATRIX SPIKES RECOV %	MATRIX SPIKES CONTROL LIMITS LOWER	MATRIX SPIKES CONTROL LIMITS UPPER	CALIBRATION CHECK RECOV %	CALIBRATION CHECK CONTROL LIMITS LOWER	CALIBRATION CHECK CONTROL LIMITS UPPER
Total Organic Halogens (TOX)	11-11-96	1 DCF	N.A.	NOT APPLICABLE			101.4	80.0	120.0

POWERTECH LABS INC.

Results of Analysis
Powertech Labs Ref: 96171
ASL Ref: G3601

ASL Ref	Powertech Ref	Organic Halogen mg/L	Arsenic mg/L	Cadmium mg/L	Chromium mg/L	Lead mg/L
Tin-Br1- 1	96171-1	<300	<4	<1	<1	297
Tin-Br1- 3	96171-3	<300	<4	<1	<1	14.1
Tin-Br1- 4	96171-4	<300	<4	<1	<1	510
Tin-Br1- 5	96171-5	<300	<4	<1	<1	43.1
Stump-BR 1-1	96172-1	<300	<4	<1	<1	51.7
HOEY-Br 1-1	96173-1	<300	<4	<1	<1	7.8
Cong-Br1 -1	96174-1	<300	<4	<1	<1	4.3
DLB-2	96175-1	<300	<4	<1	<1	23.9
S7BL-3	96175-6	<300	<4	<1	<1	<1
S7BL-4	96175-7	<300	<4	<1	<1	<1

Analytical Service Laboratories
1988 Triumph St.
Vancouver, B.C.
V5L 1K5

Date: 8 August 1996

Project#: 1513-44
Powertech Ref#: 96171
P.O.#: ASL Ref G3601

Attention: Heather Ross

Re: Waste Oil Analysis

Number of samples received:	16
Number of samples analyzed:	10
Sample Type:	Waste Organic Liquids
Date Received:	Aug 02, 1996
Date Reported:	Aug 08, 1996 (by fax)

METHODOLOGY

Organic Halogen was determined by a laboratory test method mod. 9020 and was analyzed with a Mitsubishi TOX 10 analyzer. Elements were determined in accordance with laboratory test method ASTM D5185.
Some of the samples contained a layer of water. The water layer was excluded from the analyses. Only the organic liquid layer (oil or fuel) was analyzed. Some of the samples received did not contain an oil or fuel layer and were likely composed of mainly water. The water samples were not analyzed as per discussion with ASL. The ASL lab numbers of the samples not analyzed are as follows: G3601-4, G3602-9, G3605-2,3,4,5.

Results:

Results of analysis are attached

Prepared By: _____
Ed Hall
Sr. Chemical Technologist

Approved By: _____
H. Schellhase
Research Chemist
Applied Chemistry

CLIENT : STEFFEN, ROBERTSON AND KIRSTEN
PROJECT : PWGSC
PROJECT # : P118302
TEST : MODIFIED SOBEK METHOD ACID-BASE ACCOUNTING

SAMPLE #	PASTE pH	S(T) %	S(SO4) %	AP	NP	NET NP	NP/AP
HOEY/WR/P1-1	7.55	1.01	0.31	21.9	272.0	250.1	12.4
HOEY/WR/P2-1	7.45	2.15	0.31	57.5	101.6	44.1	1.8
HOEY/WR/P3-1	7.69	1.61	0.25	42.5	109.3	66.8	2.6
HOEY/WR/P4-1	8.50	0.68	0.37	9.7	383.5	373.8	39.6
HOEY/WR/P5-1	8.13	1.03	0.27	23.8	105.0	81.3	4.4
STORMY/WR/P1-1	7.91	0.35	0.25	3.1	18.4	15.3	5.9
STU/WR/P1-1	6.90	8.02	0.20	244.4	142.6	-101.8	0.6
STU/WR/P2-1	6.70	2.22	0.30	60.0	125.4	65.4	2.1
STU/WR/P3-1	7.78	1.72	0.26	45.6	115.3	69.6	2.5
STU/WR/P3-2	8.59	0.71	0.27	13.8	171.5	157.8	12.5
STU/WR/P4-1	6.59	6.92	0.43	202.8	-2.9	-205.7	<0.1
STU/WR/P5-1	9.14	0.40	0.17	7.2	171.5	164.3	23.9
STU/WR/P6-1	7.63	4.64	0.42	131.9	55.4	-76.4	0.4
STU/WR/P7-1	8.02	5.24	0.15	159.1	147.2	-11.9	0.9
STU/WR/P8-1	7.16	1.03	0.35	21.3	316.9	295.6	14.9

AP = ACID POTENTIAL IN TONNES $CaCO_3$ EQUIVALENT PER 1000 TONNES OF MATERIAL.

NP = NEUTRALIZATION POTENTIAL IN TONNES $CaCO_3$ EQUIVALENT PER 1000 TONNES OF MATERIAL.

NET NP = NET NEUTRALIZATION POTENTIAL = TONNES $CaCO_3$ EQUIVALENT PER 1000 TONNES OF MATERIAL.

APPENDIX C

Sampling Records

BARREL SAMPLING

PROJECT NAME: STORMY-MWC [illegible] **SAMPLE #:** ST [illegible]

Location: [illegible] *Date:* 7/[illegible]

Name of sampler: [illegible]

Physical Observation

Condition of barrel: poor (fair) good

Size (L): (205L) other Labels

Soil staining: Y/(N)

Barrel Contents

Quantity of liquid: 1/4 (1/2) 3/4 full

Colour of liquid: (light) dark multiphase other

Suspected type of liquid: gasoline jet fuel waste oil glycol oil
other [illegible]

Sludge observed: Y/(N) Quantity [illegible]

Analysis (if required)

Type of sample taken: composite (grab)

Analysis required: (metals) PCBs (chlorine) other

Comments: [illegible]

Sample # Format site name - BL number
eg. Tintina-BL1

BL =barrel
W=water
S=soil
WR=waste rock

WATER SAMPLING

PROJECT NAME: STORMY MINE NAME OF SAMPLER: Michael Nahir

Location: _____ Date: 7/27/96

SAMPLE#: STO-WQ-A1-1 (TM/[illegible]) pH: 6.7 Eh: 230

Location description: Seepage from Adit (source on Adit)

Analysis: metals water chem Eh total sulphur

SAMPLE#: STO-WQ-STR-1 pH: 7.0 Eh: 40

Location description: Upstream seepage (valley) background water sample

Analysis: metals water chem Eh total sulphur

SAMPLE#: STO-WQ-STR-2 pH: 8.2 Eh: 150

Location description: Down stream of Site incld. trenches

Analysis: metals water chem Eh total sulphur

SAMPLE#: _____ pH: _____

Location description: _____

Analysis: metals water chem Eh total sulphur

SAMPLE#: _____ pH: _____

Location description: _____

Analysis: metals water chem Eh total sulphur

Comments: _____

Sample # Format site name-Wnumber
eg. Tintina-W1

BL=barrel S=soil
W=water WR=waste rock

APPENDIX D

Barrel Clean Up Protocol

BARREL CLEAN UP PROTOCOL

A flow diagram of the methodology for the processing, cleanup and disposal of barrels is attached.

A. Inspection

1. *The area around the barrels should be tested with a VOC metre to ensure safe working conditions. If the VOC levels exceed 20% of the Lower Explosive Limit (LEL), then all work shall be conducted in accordance with appropriate sections of the NIOSH Guidelines, the National Fire Code of Canada and the TDGA for flammable and combustible materials.*

2. *All barrels are to be inspected to address the following items which shall be recorded and used as a guide when opening barrels (section B.3):*

    1. *Symbols, words, or other marks on the barrel that identify its contents, and/or that its contents are hazardous: e.g. radioactive, explosive, corrosive, toxic, flammable.*
    2. *Symbols, works, or other marks on the barrel that indicate that it contains discarded laboratory chemicals, reagents, or other potentially dangerous materials in small-volume containers.*
    3. *Signs of deterioration or damage such as corrosion, rust, or leaks at seams, rims, and V grooves.*
    4. *Spillage or discolouration on the top and sides of the barrel.*
    5. *Signs that the barrel is under pressure such as bulging and swelling.*

B. Opening and Sampling

1. *Pressurized barrels are extremely hazardous and shall be opened with extreme caution. Only non-sparking equipment shall be used to open barrels. All personnel responsible for opening barrels shall be provided with appropriate safety equipment and clothing. Procedures outlined in NIOSH USEPA 1988 Safety and Health Compliance for Managers (165.8) USEPA-29-CFR, 1910-1920, shall be followed.*

2. *If the bungs can readily be moved; then the barrels shall be opened slowing allowing time for any pressure in the barrel to be released before the bung is fully removed.*

3. *If the bungs are not readily moved, or inspection suggests that opening of the barrel presents a special hazard, then the barrels shall be vented remotely to relieve any internal pressure that may be present prior to opening. Remote venting shall be conducted using a suitable device such as a sharp spear weighted and dropped from an appropriate height or released from a tube housing a spring to penetrate the barrel. The remote venting operation shall be conducted from a safe distance from other site operations and from behind suitable walls or barricades. After sampling, the spear opening shall be plugged.*

4. *Samples of the contents of all barrels shall be extracted using a drum thief. All barrels shall be clearly numbered using spray paint or other suitable marker.*

5. *Barrels shall not be transported until it has been determined that they are not under pressure, do not leak and are sufficiently sound for transport.*

6. *Barrels containing less than 50 mm of liquid may be combined with compatible material prior to sampling; samples inferred to contain only water on a visual examination shall be tested prior to this consolidation. Barrel contents which consist of black oil shall not be consolidated.*

7. *Consolidation of barrel contents shall take place in a secure barrel processing area. At many DEW Line sites several caches of barrels are present and, therefore, it may be desirable to establish several secure sorting areas; barrels scattered on the tundra may be vented, then closed, and then transported to a barrel sorting area for sampling and possible consolidation.*

C. Testing

1. *Liquid samples shall be inspected and classified as either containing water or organic materials. Samples thought to contain water shall be analysed on-site to confirm that they are indeed water and contain less than 2% glycols or alcohols by Fourier transform infrared spectroscopy (FTIR).*

2. *The contents of barrels containing organic materials, including aqueous samples which contain more than 2% glycols or alcohols, shall be tested for PCBs, Total chlorine, cadmium, chromium and lead, in addition to identification of the major components e.g. fuel oil, lubricating oil. Samples containing greater than 1000 ppm chlorine shall be further tested to identify the chlorinated compounds present.*

3. *Contents of barrels which contain two or more phrases shall have all phrases analysed; the organic phases as described above and the aqueous phases to ascertain whether it contains less than 2% organics. In addition, the aqueous phases shall be tested for any components found in the organic phases above the criteria described below.*

D. Disposal of Barrel Contents

1. *Barrels containing only rust and sediment shall be treated as empty barrels.*

2. *Barrel contents comprising water only (less than 2% glycols or alcohols) shall be transferred to an open vessel such as a utility tub or half-barrel and any organic material removal by agitation with a pillow or segment of oil absorbent material. The water may then be discarded on to the ground that is a minimum of 30 metres distance from natural drainage courses. Used oil absorbent material shall be treated as described in Section D.5.*

3. *Barrel contents which are composed of water with glycols and/or alcohols or*

organics phases, and which contain less than 2 ppm PCBs, 1000 ppm chlorine, 2 ppm cadmium, 10 ppm chromium and 100 ppm lead, may be disposed of by incineration. Alternatively these contents may be disposed of off-site at a licensed disposal facility. The solid residual material resulting from incineration shall be subjected to a leachate extraction test. Material found to be not leachate toxic material shall be treated as hazardous waste, packaged in accordance with TDGA and/or IATA regulations as required, and disposed of off-site at a licensed disposal facility.

4. *Barrel contents which contain greater than 2 ppm PCBs, 1000 ppm chlorine, 2 ppm cadmium, 10 ppm chromium or 1000 ppm lead shall be disposed of off-site at a licensed disposal facility. Contents may be combined with compatible materials for shipping purposes (note section E.1). Flash point may be required to be determined if they cannot be inferred from the product identification.*

5. *Used oil absorbent material should be treated as hazardous waste and disposed of off-site at a licensed disposal facility unless, it is shown to be uncontaminated with PCBs (<2 ppm), chlorine (<1000 ppm) cadmium (<2 ppm), chromium (<10 ppm) and lead (<100 ppm) in which case it may be incinerated on site.*

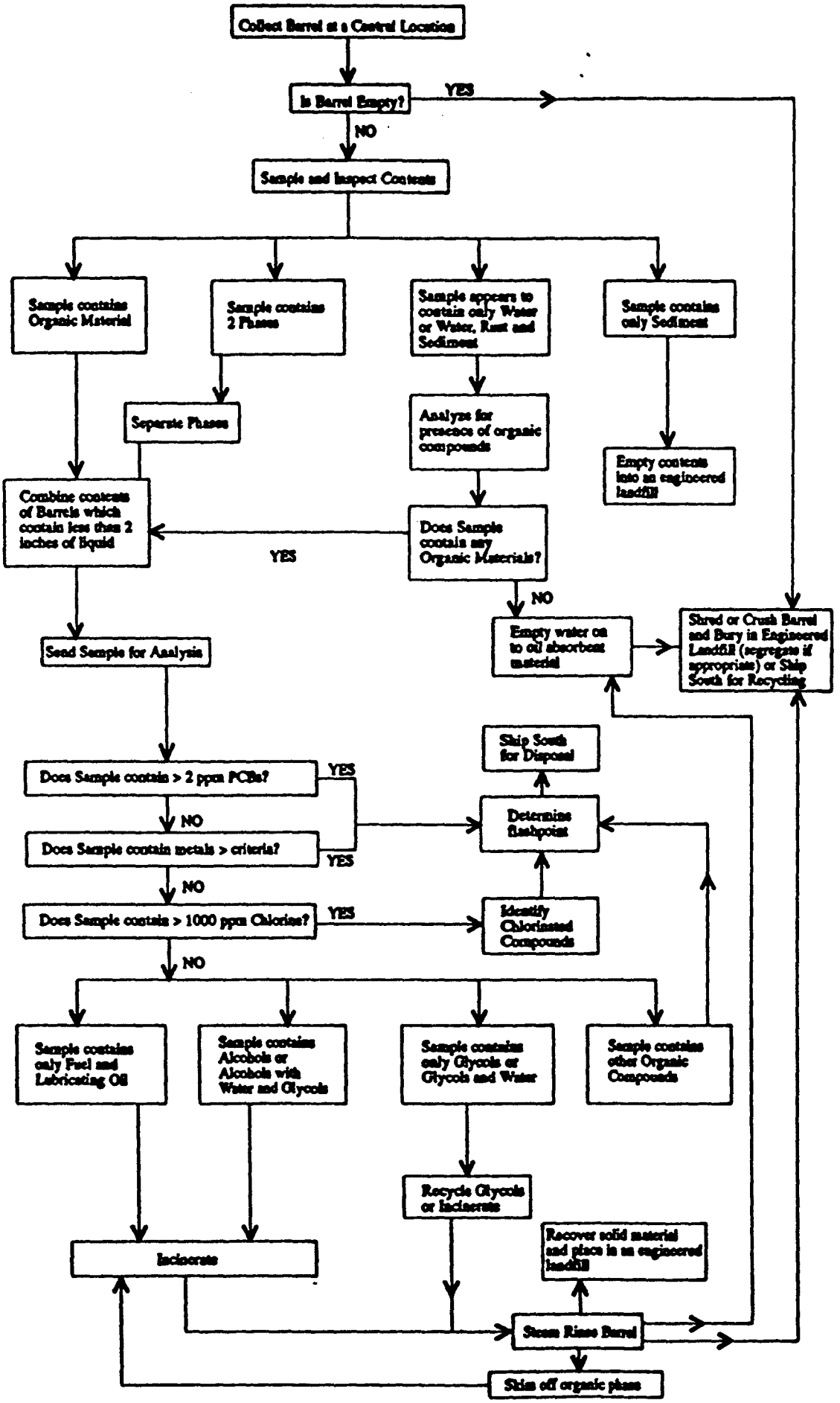
E. Cleaning and Disposing of Barrels

1. *Empty barrels resulting from consolidation of contaminated material (Section D.4) shall be triple rinsed with solvent (varsol, diesel, etc.) Prior to steam cleaning; solvent washings shall be added to the bulked contaminated products unless analysed separately and shown to be suitable for incineration. Alternatively, the empty barrels may be shipped off-site and labelled appropriately (TDGA).*

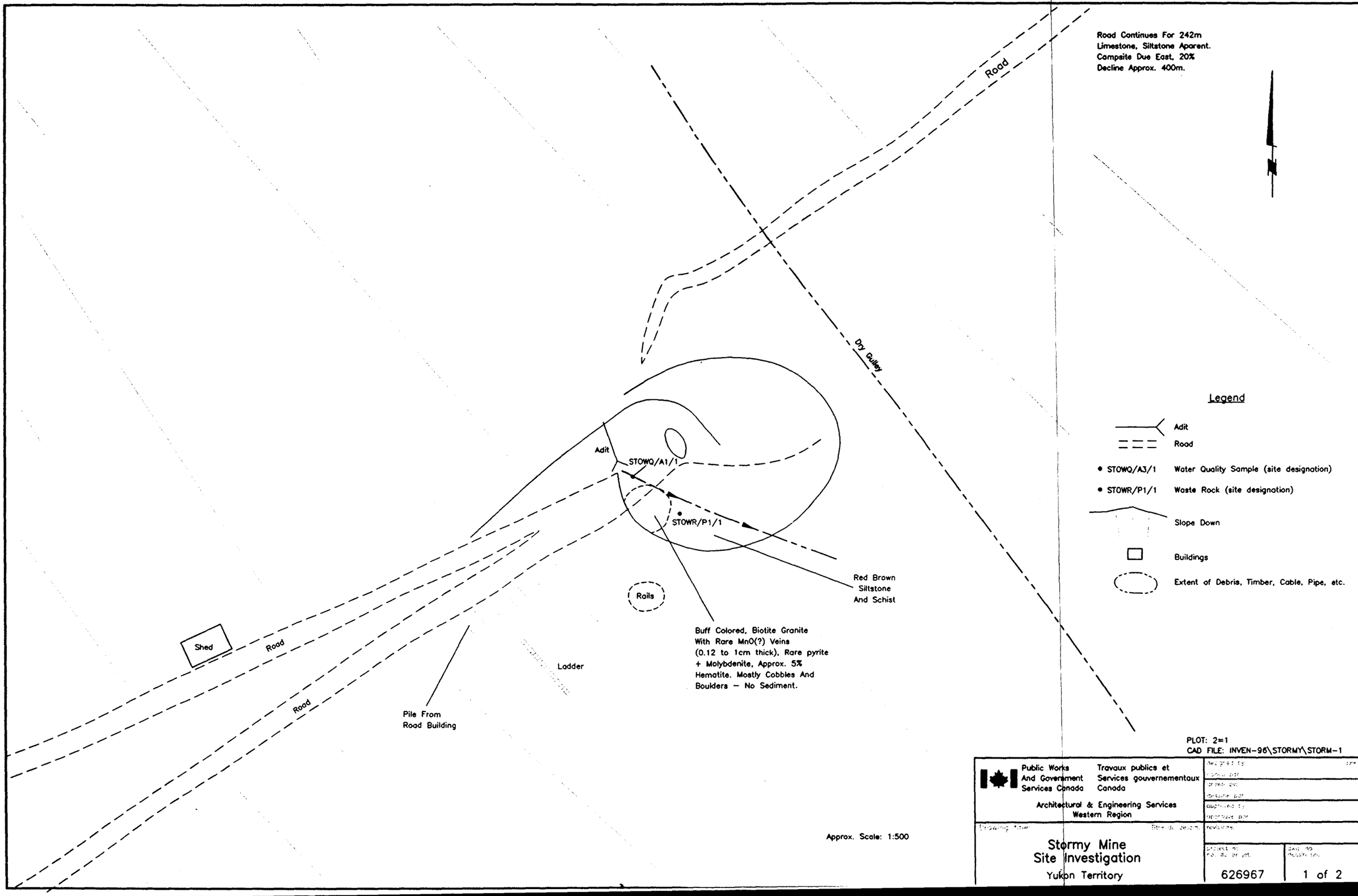
2. *Only empty barrels resulting from consolidation of small volumes (section B.6), from incineration (section D.3) and from solvent washing (section E.1) require steam cleaning; after cleaning they shall be treated as described in E.3. Recycling of rinsate is permitted. The resulting wash water shall have any organic material removed by agitation with a pillow or segment of oil absorbent material. The water shall then be analysed for cadmium, chromium and lead. If these metals are present at less than 0.01, 0.10 and 0.10 ppm respectively, then the water may be discarded on land that is a minimum of 30 metres from natural drainage courses, but if not then it shall be disposed of off-site at a licensed disposal facility. Alternatively, the wash water may be shipped off site without testing for disposal at a licensed disposal facility. Used absorbent material shall be disposed of as described in section D.5.*

3. *Empty barrels may be crushed or shredded and be landfilled on-site as non-hazardous wastes. The barrels shall be crushed in such a manner so as to reduce their volume by a minimum of 75%. Shredded barrels may be disposed of off-site as recycled metals.*

FLOW CHART FOR THE DEW LINE CLEANUP OF BARRELS



DRAWINGS



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Yukon Territory

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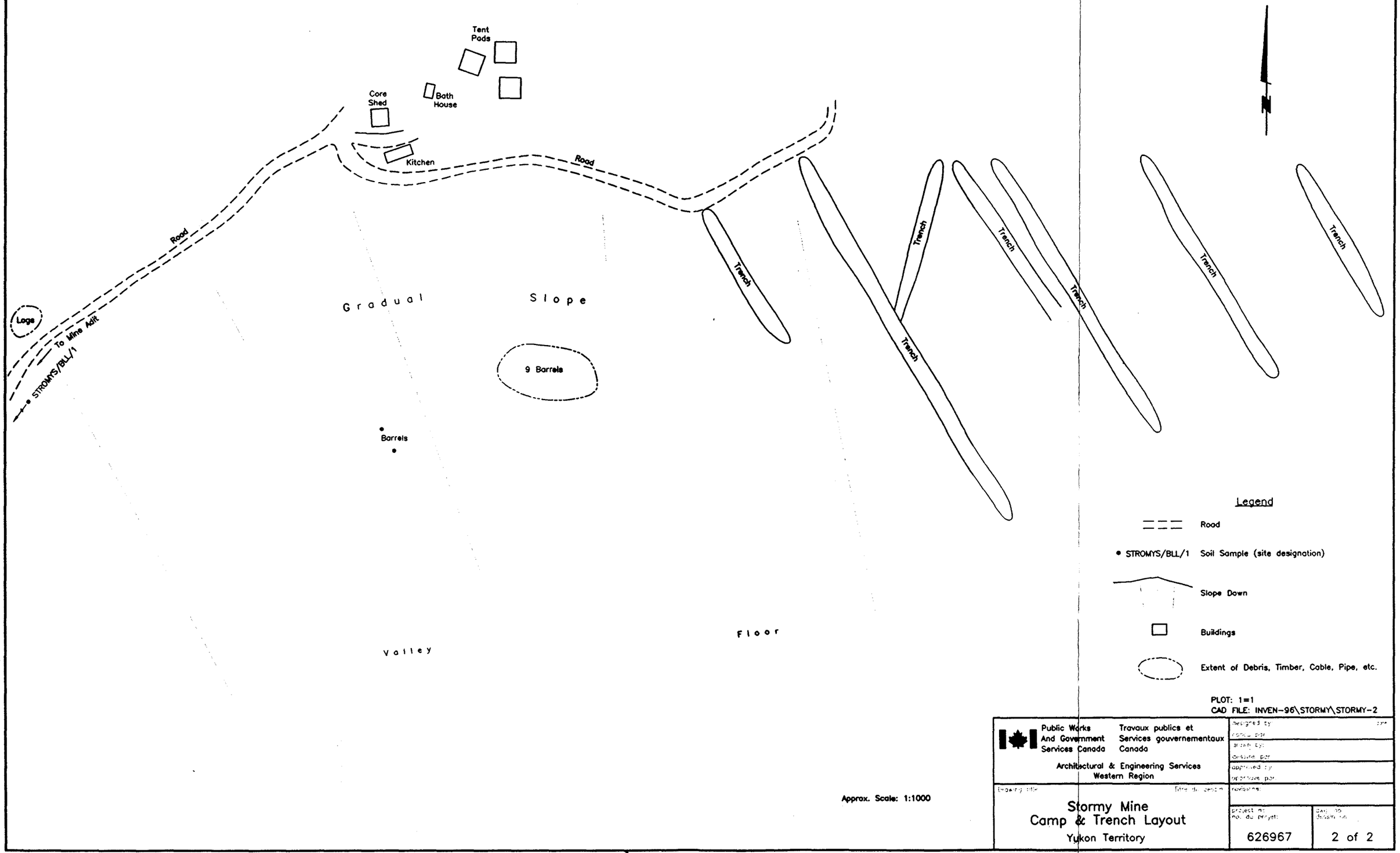
Dwg. no. / No. du dess.: 1 of 2



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Designed by / conçu par:
Drawn by / dessiné par:
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Dwg. no. / dessin no.: 2 of 2