PHASE 1 & 2
ENVIRONMENTAL SITE ASSESSMENT
BEAR CREEK COMPLEX,
DAWSON CITY, YT

Project No. 0201-01-15178002
March 2002

PHASE 1 & 2
ENVIRONMENTAL SITE ASSESSMENT
BEAR CREEK COMPLEX,
DAWSON CITY, YT

Submitted To:

PARKS CANADA
Haines Junction, Yukon

Prepared by:

EBA ENGINEERING CONSULTANTS LTD.
Whitehorse, Yukon

Project No. 0201-01-15178002

March 2002

EXECUTIVE SUMMARY

This report presents the results of Phase 1 & 2 Environmental Site Assessments (ESA) of Bear Creek Complex, Dawson City, Yukon (the Site). The Site, considered part of the Klondike National Historic Sites (KNHS), was used as an industrial complex made up of at least 65 buildings and related structures. From 1905 to 1966 the Site was the Klondike headquarters for corporate mining interests, acting as the administrative and repair centre for the goldfields' dredging operations. In 1975 Parks Canada acquired the Site and since the purchase its primary function has been as a storage compound for the major archaeological, curatorial and general works collections under the control of KNHS. In 1987 the complex was officially open for public tours under the auspices of the Yukon co-operating association, Heritage North.

In the summer of 2001 Parks Canada supplied EBA with various parts of reports that were completed on the Bear Creek Complex. From that information and the completion a preliminary site visit during the summer of 2001, EBA identified sixteen potential and actual environmental concerns associated with the Site. Some of the concerns are listed below.

- Old Transformers – could possibly contain PCBs.
- Underground Storage Tanks (USTs) – manufactured on site in the early to mid 1900's may still contain product and may have leaked during and after their use.
- Aboveground Storage Tanks (ASTs) – some very large tanks manufactured on site in the early to mid 1900's may still contain product and may have leaked during and after their use. Some newer tanks (with wooden supports, on wooden decks or without stands) presently being used to supply heating fuel to some of the heated structures.
- Various small containers – some with known and others with unknown contents located in warehouses, mechanical shops, and machine shops.
- 45-Gallon drums – located throughout the entire site. Conditions vary from empty to full, from dented to leaking, contents were identified through a combination of laboratory analysis, field determination (grease, tar) or were assumed based on labels and visual/olfactory verification.
- Old Mercury Vapour Lamps – located in Engineering Drafting Office.
- Products containing PCBs – Located in the two electrical warehouses.
- 10-Gallon containers – located in the Gas House, they contain asbestos and calcium carbide.
- Mercury – there still maybe small quantities of mercury located within the present Gold Room and there may be mercury in the ground near the site of the previous Gold Room.

The objective of the Phase 1 ESA was to identify actual and potential site contamination through evaluation and reporting of existing information collected through records review, a site visit, and interviews. The methodology employed for this assessment was consistent with CSA Standard Z768-94, *Phase I Environmental Site Assessment.* The results of a Phase 1 ESA assist in reducing uncertainty about potential environmental liabilities and may be a used to determine the need for further investigation of the property.

The objective of the Phase 2 ESA was to verify the concentrations of contaminants through a sampling and analytical testing program targeting potential areas of contamination identified on

the site during the preliminary site visit. The Phase 2 ESA also incorporated a drum identification and sampling program.
As part of the Phase 1 and 2 ESAs, Mr. Chad Cowan, an EBA representative, completed three site visits from the summer of 2001 to the spring of 2002. The first site visit was completed on June 28, 2001. This visit involved completing visual inspections inside and out of all structures located on the site. The second site visit was completed on October 4, 2001. This visit involved a visual inspection of the island homes area and collection of samples from the following locations:

- Soil from beneath an old transformer located near one of the remaining homes on the island.
- Soil from the ground surface of the Blacksmith Shop.
- Soil from the 900 Ton Press sump located in the Machine Shop.
- Water and Soil from the ground surface within and outside the Diesel Fuel Pump House.
- Oil from two different transformers locations that were identified on the Site.

The site visit also included a review of the available KNHS records in Dawson City. The third site visit was completed on March 19, 2002. The purpose of this visit was to complete a drum identification and sampling program.

Evidence of potential environmental contamination was discovered during the Phase 1 environmental assessment work for the Site. Various locations previously identified as areas of potential concern (APECs) could possibly have petroleum hydrocarbon, metal, asbestos, or PCB contamination. Further subsurface and surface investigative work will be required to determine whether or not there is contaminant concentrations exceeding the applicable regulatory guidelines and standards.

Evidence of environmental contamination was discovered during the Phase 2 ESA work for the Site. Petroleum hydrocarbon and metal contamination exceeding the applicable regulatory guidelines and standards was detected in the suficial soils associated with the Blacksmith Shop, Machine Shop, Tin Shop, and the Diesel Fuel Pump House.

EBA has listed the following recommendations based on the findings of the Phase 1 and 2 ESA in relation to each of the following 16 APECs identified on the site. The numbers in brackets correspond to location identifiers in the report figures.

- **APEC 1:** Two soil samples have already been collected from the ground surface inside the Blacksmith Shop (1) and Machine Shop (2). Additional soil samples should be collected for laboratory analyses from other surface locations within the structures and also from the subsurface to assist in determining the extent of vertical migration.
- **APEC 2:** One soil sample was already collected from the ground surface inside the rear portion of the Tin Shop (4). Additional soil samples should be collected for laboratory analyses from the surrounding area and from the subsurface to assist in determining the extent of lateral and vertical migration.
- **APEC 3:** Two soil samples and one water sample have already been collected from the ground surface inside and outside of the Diesel Fuel Pump House (60). Additional

soil samples should be collected for laboratory analyses from the surrounding area and subsurface inside and outside to assist in determining the extent of lateral and vertical migration.

- **APEC 4:** Liquid mercury was discovered in the sluice box sump inside the Gold Room (29). Further inspection of the sump drain and outside collection box should be completed to determine if liquid mercury is present.
- **APEC 5:** The boiler piping in the Mess Hall and Bunkhouse (22) might be insulated with asbestos. An inspection of the piping should be completed to determine if asbestos is present.
- **APEC 6:** There are USTs associated with the Fuel Pump Island (10). A subsurface investigation should be complete in the vicinity of the USTs to determine if there is hydrocarbon contamination within the soil or groundwater resulting from leaking USTs or feedlines.
- **APEC 7:** There was noticeable hydrocarbon staining beneath the drums located within the Open Storage (34). Further investigation should be completed to determine the concentrations near the surface and if there is hydrocarbon contamination within the subsurface.
- **APEC 8:** There was noticeable hydrocarbon staining on the ground beneath the drums located near the Gasoline Storage Warehouse (42). Further investigation of the near surface soils should be completed to determine the concentrations near the surface and if there is hydrocarbon contamination within the subsurface.
- **APEC 9:** There was noticeable hydrocarbon staining within the wooden floor planking inside Electrical Workshop (38). The ground surface beneath the structure should be investigated for hydrocarbon staining, which might include collecting soil samples for laboratory analyses.
- **APEC 10:** There were miscellaneous waste items from the workshops that were disposed of in the Bear Creek Bone Yard (95). A visual inspection was completed without moving any material. A more thorough visual inspection of this area for hazardous products should be completed.
- **APEC 11:** There was noticeable hydrocarbon staining associated with the old transformer area of the Parks Canada Bone Yard (96). Additional investigative work should be completed in the area to determine the vertical extent of the hydrocarbon staining and whether or not there are PCBs associated with the hydrocarbon product.
- **APEC 12:** There is the possibility that a heating fuel UST is buried next to the VIP Guest House (11). Further subsurface investigative work should be completed in this area for possible hydrocarbon contamination.
- **APEC 13:** There were various cables located throughout the site. These items should be inspected for lubricating products that may have contained PCBs.
- **APEC 14:** There were various chemicals and petroleum products in both glass and metal containers. Those products regulated as special waste should be disposed of accordingly.
- **APEC 15:** There were heating oil ASTs located on the site that are being used. Some of the ASTs are supported by wooden stands, which should be replaced with metal stands supported by concrete pads. The subsurface soils located beneath the ASTs should also be investigated for hydrocarbon contamination.

- **APEC 16:** There were numerous 205 litre (45 gallon) drums located throughout the site. The majority of them were empty but some of them contained products such as grease, waste oil, gasoline, solvent, and tar. Many of the drums have leaked or are leaking. A drum cleanup and product disposal program should be developed.

The NCS scoring sheets indicate the Site received a NCS score of 59. Accordingly, the Site receives a risk rating of Class 2 (medium risk potential) where further action is likely required. The NCS classification is appropriate for this Site, as further assessment and restoration work is recommended for some of the individual areas of potential concern.

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 BACKGROUND 1
1.2 PROJECT OBJECTIVE 2
1.3 SCOPE OF WORK 2
1.4 AUTHORIZATION 3

2.0 PHASE 1 ENVIRONMENTAL SITE ASSESSMENT 4

2.1 SITE DESCRIPTION 4
2.1.1 Location 4
2.1.2 Adjacent Land Use 4
2.2 RECORDS REVIEW 4
2.2.1 Land Title 4
2.2.2 Aerial Photographs 5
2.2.3 Environment Canada Spills Records 7
2.2.4 Contaminated Sites Registry 7
2.2.5 Environmental Health Services 7
2.3 SITE VISITS 8
2.4 INTERVIEWS 8
2.4.1 Ms. Louise Ranger 8
2.4.2 Mr. John Gould 9
2.4.3 Ms. Jannice Troberg 9
2.4.4 Ms. Merna Butterworth 9
2.4.5 Mr. Newt Webster 10
2.4.6 Mr. Benny Warnsby 10
2.4.7 Mr. Basil Charman and Mrs. Daphne Charman 11
2.5 STRATIGRAPHY AND GROUNDWATER 12
2.6 BUILDING AND AREA IDENTIFICATION 13

3.0 ENVIRONMENTAL ISSUES 17

3.1 ASBESTOS CONTAINING MATERIALS 18
3.2 UNDERGROUND STORAGE TANKS (USTS) 18
3.3 ABOVEGROUND STORAGE TANKS (ASTS) 19
3.4 POLYCHLORINATED BIPHENYLS (PCBS) 21

3.5 MERCURY 26
3.6 MISCELLANEOUS ENVIRONMENTAL ISSUES 27
3.6.1 Various Products at Bear Creek Complex 27
3.6.2 Chemical Water Analysis – Bear Creek Residence Well 28
3.6.3 Water Quality – Bear Creek 28
3.6.4 Unknown Material in Gold Room Shed 29
3.6.5 900 Tonne Press Sump Box Drain 29
3.7 WATER AND SEWER SERVICES 29
3.8 SPECIAL WASTE COLLECTION AND STORAGE 29

4.0 PHASE 2 ENVIRONMENTAL SITE ASSESSMENT 30

4.1 FIELD PROGRAM 30
4.2 REGULATORY CRITERIA 31
4.3 CHEMICAL LABORATORY ANALYSIS 31
4.4 ANALYTICAL RESULTS 32
4.4.1 Soil 32
4.4.2 Water and Oil 33
4.5 MERCURY IN THE GOLD ROOM 34
4.6 DRUM IDENTIFICATION AND SAMPLING PROGRAM 34

5.0 DISCUSSION 35

5.1 PHASE 1 ESA - AREAS OF POTENTIAL ENVIRONMENTAL CONCERN 35
5.2 PHASE 2 ESA – FIELDWORK 36
5.3 CCME NATIONAL CLASSIFICATION SYSTEM (NCS) 37

6.0 CONCLUSIONS AND RECOMMENDATIONS 37

7.0 LIMITATIONS 39

8.0 CLOSURE 40

FIGURES AND TABLES

Figure 1: Site Plan Showing Location of Structures Within the Compound
Figure 2: Site Plan Showing Island Residential Homes
Figure 3: Air photos Depicting Site Features and Development
Figure 4: Site Plan Showing Soil, Water, and Oil Sampling Locations
Figure 5: Site Plan Showing Location of Drums Containing Various Petroleum Products
Figure 6: Site Plan Showing Areas Of Potential Environmental Concern (APEC)

Table 2.2.1: History of Title Information (date of property acquition and the registered owner).
Table 2.2.2: Review of Air Photos Noting Pertinent Information.
Table 2.6: Identification of Structures Located on the Site
Table 3.3: AST Location and Related Pertinent Information
Table 4.4.1: Soil Analysis Results
Table 4.4.2: Water and Oil Analysis Results
Table 4.6: Assumed Contents, Number of Drums, Approximate Volume, and Pertinent Information

APPENDICES

Appendix A: Land Titles Information

Appendix B: PCB Historic Documentation

Appendix C: Mercury Historic Documentation

Appendix D: Miscellaneous Environmental Items Historic Documentation

Appendix E: ALS Environmental Analytical Report

Appendix F: Drum Identification and Sampling Data Tables

Appendix G: CCME National Classification System (NCS) Scoring Sheets

1.0 INTRODUCTION

This report presents the results of Phase 1 & 2 Environmental Site Assessments (ESA) of Bear Creek Complex, Dawson City, Yukon (the Site). Mr. Chad Cowan, E.I.T. of the EBA Engineering Consults Ltd. (EBA) Whitehorse office carried out the assessment.

This report incorporates and is subject to the attached EBA Environmental Report - General Conditions.

1.1 Background

Bear Creek Complex, considered part of the Klondike National Historic Sites (KNHS), was used as an industrial complex made up of at least 65 buildings and related structures. From 1905 to 1966 the Site was the Klondike headquarters for corporate mining interests, acting as the administrative and repair centre for the goldfields' dredging operations. In 1975 Parks Canada acquired the Site and since the purchase its primary function has been as a storage compound for the major archaeological, curatorial and general works collections under the control of KNHS. In 1987 the complex was officially open for public tours under the auspices of the Yukon co-operating association, Heritage North.

In the summer of 2001 Parks Canada supplied EBA with various parts of reports that were completed on the Bear Creek Complex. From that information and the completion a preliminary site visit during the summer of 2001, EBA identified many but not all of the potential and actual environmental concerns associated with the Site. Some of the concerns are listed below.

- Old Transformers – could possibly contain PCBs.
- Underground Storage Tanks (USTs) –manufactured on site in the early to mid 1900's may still contain product and may have leaked during and after their use.
- Aboveground Storage Tanks (ASTs) – some very large tanks manufactured on site in the early to mid 1900's may still contain product and may have leaked during and after their use. Some newer tanks presently are being used to supply heating fuel to some of the heated structures.
- Various small containers – some with known and others with unknown contents located in warehouses, mechanical shops, and machine shops.
- 45-Gallon drums – located throughout the entire site. Conditions vary from empty to full, from dented to leaking, from known to unknown contents.

- Old Mercury Vapour Lamps – located in Engineering Drafting Office.
- Products containing PCBs – Located in the two electrical warehouses.
- 45 Litre (10 Gallon) containers – located in the Gas House, they contain asbestos and calcium carbide.
- Mercury – there still maybe small quantities of mercury located within the present Gold Room and there may be mercury in the ground near the site of the previous Gold Room.

1.2 Project Objective

The objective of the Phase 1 ESA was to identify actual and potential site contamination through evaluation and reporting of existing information collected through records review, a site visit and interviews. The methodology employed for this assessment was consistent with CSA Standard Z768-94, *Phase I Environmental Site Assessment.* The results of a Phase 1 ESA assist in reducing uncertainty about potential environmental liabilities and may be a used to determine the need for further investigation of the property.

The objective of the Phase 2 ESA was to verify the actual concentrations of contaminants through a sampling and analytical testing program targeting potential areas of contamination identified on the site during the preliminary site visit. The Phase 2 ESA also incorporated a drum identification and sampling program. It is noted that subsurface sampling could not be completed for the Phase 2 ESA, pending acceptance of an environmental screening report for the subsurface sampling program.

1.3 Scope of Work

The Phase 1 ESA consisted of the following tasks:

- An historical title search to determine all previous owners of the subject properties.
- Obtained and reviewed historical aerial photographs for changes in land use over time, from 1946 to present.
- Conducted a search of Environment Canada, Environmental Protection Branch Spill Records to determine if there have been any documented spills on the property or adjacent properties in the past.
- Conducted a search of the Contaminated Sites Registry to determine if the site has been designated as a contaminated site.
- Conducted a search of the Environmental Health Services records to determine if any permits had been issued or concerns had been raised in regard to the sewage disposal or drinking water sources.

- Conducted two site visits to visually inspect the property and record any pertinent information. Photographs were taken and pertinent observations were noted regarding the site and adjacent land use.
- Conducted interviews with previous and present site employees.
- Evaluated the information collected with respect to actual or potential contamination.

The Phase 2 ESA consisted of the following tasks:

- Developed a soil and water sampling program based on information collected during the preliminary site visit portion of the assessment.
- Collected samples from surface soils identified during the preliminary site visit as having hydrocarbon contamination.
- Collected one water and two oil samples.
- Collected and submitted soil samples for analysis of benzene, toluene, ethylbenzene and xylene (BTEX), total extractable hydrocarbons, volatile petroleum hydrocarbons, and metals. Analytical samples were submitted to Aurora Laboratory Services Ltd. (ALS) in Vancouver, BC, who are accredited by the ***Canadian Association for Environmental Analytical Laboratories*** (CAEAL) for the requested analyses.
- As part of the ESA work, EBA completed an inventory and preliminary sampling program of various 205 litre (45 gallon) drums that were scattered throughout the site. Approximately 15% of the drums were sampled and all drums of concern were labelled.
- EBA completed this report discussing any environmental concerns associated with the site, in particular how the concentrations of contaminants relate to the Yukon *Contaminated Sites Regulations (CSR), 1996,* the *Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Criteria for Contaminated Sites, 1999,* and the *CCME Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil, 2001*, for fine and coarse grained soils.
- As part of the Phase 2 ESA work, EBA also completed the Detailed Evaluation Form of the National Classification System (NCS) for Contaminated Sites (attached).

1.4 Authorization

This assessment was completed under the standing offer between EBA Engineering Consultants Ltd. (EBA) and Parks Canada. The Bear Creek Complex is one of the sites in the Yukon where EBA has completed Phase 1 and 2 Environmental Site Assessments. A formal work plan was prepared for review prior to the initiation of work on this project. Final authorization to proceed was received from Mr. Dale Hansen during a conference call on August 10, 2001.

2.0 PHASE 1 ENVIRONMENTAL SITE ASSESSMENT

2.1 Site Description

2.1.1 Location

The Site is located along the south side of the Klondike Highway (No. 2) approximately 10 km east of the downtown area of Dawson City, Yukon (shown on Figures 1 and 2). The site is situated in the Klondike Valley, and encompasses a portion of the old Klondike River and Bear Creek channels. Throughout the report the numbers in brackets listed after a building/facility name are associated with the building/facility number shown in Figures 1 and 2.

2.1.2 Adjacent Land Use

The adjacent land to the north is presently occupied by one residential property and old dredge tailings. To the east the land has been developed into the Bear Creek residential subdivision, which incorporates various properties situated along either side of the old Klondike Highway. To the south along the Bear Creek Valley there is placer mining activity. To the west there are only the remains of the dredge tailings.

2.2 Records Review

2.2.1 Land Title

The legal description of the property is Lot 582, Group 1052, in the Yukon Territory, as shown on a plan of record in the Land Titles Office for the Yukon Land Registration District under number 30863. Comprehensive documentation of previous ownership of the subject property is located in Appendix A.

The following table summarizes the past title transfer transactions to present for each of the lots.

Table 2.2.1

History of Title Information (date of property acquition and the registered owner).

DATE OF ACQUITION AND REGISTERED OWNER	
DATE	**LOT 582, GROUP 1052**
Prior to May 12, 1969	Her Majesty the Queen in Right of Canada
May 12, 1969	Yukon Consolidated Gold Corporation (YCGC)
October 11, 1972	A & S Anti-Pollution Salvage Services Ltd.
February 12, 1973	Ernie Stricker
September 14, 1973	Bear Creek Holdings Ltd.
May 14, 1975	Her Majesty the Queen in Right of Canada

2.2.2 Aerial Photographs

A review of air photos dated 1951, 1960, 1979, 1990 and 1995 was undertaken. The following table summarizes the information collected. Figure 3 also shows air photo information as it pertains to the historical review.

Table 2.2.2

Review of Air Photos Noting Pertinent Information

(Reference numbers can be found on Figures 1 & 2)

DATE	PHOTO	DESCRIPTION
1951	A 13139 – 181	• The air photo's scale of 1:35,000 makes it difficult to recognize distinct features on the site. • Most of the present day structures were identified on the site. • The old Klondike Highway ran along the southern edge of the Klondike Valley through the middle of the site. • The residential area located to the north on the island was well developed. Approximately 11 structures were identified on the island. • There was minimal placer mining development along the Bear Creek Valley located to the south.
1960	A17155 - 96	• Most structures were identified on the site. There was a large structure, the Roadhouse (68) located at the east end of the property along the south side of the old Klondike Highway that was not identified in the previous 1951 air photo. • There were 18 structures identified on the residential island. • The new Klondike Highway was constructed to the north along the southern edge of the Klondike River. A new access road into the site was also constructed. • The pump island located in a central location of the site was noticeable. • The large aboveground storage tanks associated with the Diesel Fuel Pump House (60) located along the south-eastern property line were also noticeable. • There was minimal mining development along the Bear Creek Valley.
1979	A25131 – 94	• Some of the residential dwellings located on the island were moved off site (relocated to Dawson City). From the air photo approximately 12 of the structures were removed. • Some the other structures, such as the Roadhouse (68), located within the industrial complex were also removed from the site.
1990	A27664 – 150	• Most of the site's structures were still standing. • The residential area on the island was abandoned and was overgrown with vegetation. • There was a residential property located to the north along the west side of the access road. • There was an increase in residential development (Bear Creek Subdivision) to the east. • There was an increase in the placier mining development along the Bear Creek Valley.
1995	A28237 – 214	• There was little to no change to the site. • The residential area located on the island to the north is overgrown with thick vegetation. • Placier mining development continued along the Bear Creek Valley.

In summary, since initial development there have been minimal changes to the Site and the surrounding area. Potential sources of contamination identified during the air photo review in proximity to the Site include:

- The use of the Fuel Pump Island (10): The fuel pump island was identified in the 1951 air photo. There are underground storage tanks (USTs) associated with the pump island that are still buried on the site.

- The use of large aboveground storage tanks (ASTs) associated with the Diesel Fuel Pump House (60) was identified in 1960 air photo.
- Metal debris located throughout the site: As part of the minimal site development some of the small ponds have been filled in with dredge tailings and metal debris, which may have consisted of old 205 litre (45-gallon) drums.
- Adjacent land use: Placer mining development along the Bear Creek Valley has increased over the years and there is the possibility that contaminants associated with placer mining practices may have impacted groundwater and surface water bodies located within the Site's boundaries.

2.2.3 Environment Canada Spills Records

Environment Canada has maintained the fuel spill reports since 1972. A review of the spill records indicates that there have been no spills recorded on the Site or surrounding area.

2.2.4 Contaminated Sites Registry

A review of Contaminated Sites information from Government of Yukon, Department of Environmental Protection and Assessment Branch verified that the subject property and adjacent properties are not presently designated as Contaminated Sites.

2.2.5 Environmental Health Services

A review of the Government of Yukon, Health and Social Services, Environmental Health Services records was completed by EBA. The only information that was available was an approval for a permit (#000241) for a private sewage disposal system that was issued by Health and Welfare Canada, Occupational and Environmental Health Services on December 12, 1994.

On August 5, 1993, KNHS applied for a permit to install a sewage holding tank for the KNHS mechanical shop that occupies the Cat Repair Shop (8) within the Bear Creek Complex. A 6820 litre (1500 gallon) insulated fibreglass sewage tank was installed along the eastern side of the structure for the purpose of holding septage/grey water waste from a toilet, wash basin, and an emergency shower located within the structure. It was also noted that the groundwater table was at an approximate depth of 2.0 m and that the building's water was delivered to the site.

2.3 Site Visits

As part of the Phase 1 and Phase 2 ESAs, Mr. Chad Cowan, an EBA representative, completed three site visits from the summer of 2001 to the spring of 2002.

The first site visit was completed on June 28, 2001. Ms. Louise Ranger of the Klondike National Historic Sites accompanied Mr. Cowan during this site visit. This visit involved completing visual inspections inside and out of all structures located on the site.

The second site visit was completed on October 4, 2001. This visit involved a visual inspection of the island homes area and collection of samples from the following locations:

- Soil from beneath an old transformer located near one of the remaining homes on the island.
- Soil from the ground surface of the Blacksmith Shop (1).
- Soil from the 900 Ton Press sump located in the Machine Shop (2).
- Water and Soil from the ground surface within and outside the Diesel Fuel Pump House (60).
- Oil from two different transformers (47 and 48) that were identified on the Site.

The site visit also included a review of the available KNHS records in Dawson City.

The third site visit was completed on March 19, 2002. The purpose of this visit was to complete a drum identification and sampling program.

Photographs were taken during each of the site visits and relevant site photographs are attached in the photograph section of this report.

2.4 Interviews

2.4.1 Ms. Louise Ranger

Ms. Ranger accompanied the EBA representative during the first site visit and answered most of the initial questions about the site. She is presently employed by Parks Canada KNHS as a Collections Assistant and also occupies the staff house that is located on the site. She mentioned that she assisted in the liquid mercury cleanup in the Gold Room (29) in 1978. Information provided by Ms. Ranger has been incorporated into the relevant sections of this report.

2.4.2 Mr. John Gould

Mr. Gould accompanied the EBA representative during the second site visit to discuss the history of the site. Mr. Gould is now retired but in the mid 1970s was a Parks Canada Interpretive Officer. During his employment he helped in collecting historical information about various sites through the Dawson City area including some historical information about the Bear Creek Complex, which can be found in the KNHS archive records in Dawson City.

2.4.3 Ms. Jannice Troberg

Ms. Troberg was contacted by telephone in her Dawson office. Ms. Troberg was born in Dawson City and has lived most of her life in the Dawson City area. Part of her childhood from 1956 to 1966 was spent living at Bear Creek in the Troberg's House (94) that was situated on the residential area (the island) located north of the complex (shown on Figure 3). Her father worked for Yukon Consolidated Gold Corporation (YCGC) during their occupancy at Bear Creek. She recalls that during this time period there were more structures located on the site. She mentioned that after 1966, when operation of the site ceased, a few of the structures were dismantled and removed from the area. The old Roadhouse (68) and the Curling Club (75) were two of the structures that were removed from the site. She also mentioned that later during the 1970s a lot of the residential structures located on the island were relocated to the downtown area of Dawson City. She recalls there being a tennis court on the site located next to the small pond near the entrance to the Bear Creek Valley.

2.4.4 Ms. Merna Butterworth

EBA contacted Ms. Butterworth by telephone from her home located near the Site. In the late 1980s and early 1990s she was employed as a Bear Creek Complex site interpreter. During this period Parks Canada had contracted out all of the interpretive work to Heritage North. She verified that the family names that are associated with each of the residences on the island are correct. Ms. Butterworth also mentioned that all of the structures located on the island had electrical power that was supplied from North Fork. When asked if she knew if the homes had septic field and water wells, she replied that she wasn't completely sure but recollects that each home had a shallow water well and could possibly have had a septic field or leach pit.

2.4.5 Mr. Newt Webster

Mr. Webster was contacted by phone from his home in Dawson City. From 1940 to 1967 Mr. Webster was employed by YCGC and worked at the North Fork Power Generating Station located 24 km east of Bear Creek Complex. Even though he lived at North Fork he was familiar with the onsite workings of Bear Creek Complex. When asked about the electrical warehouses, he mentioned that there were four to five buildings that used to house electrical components and supplies, some of it being transformers, capacitors, porcelain cut outs, and lightning arrestors, for everyday operations on and off site. When asked if he knew of any electrical transformers that may have contained PCBs, he replied that many of the transformers that YCGC used did not contain PCBs.

2.4.6 Mr. Benny Warnsby

Mr. Warnsby was contacted by phone at from his home in Whitehorse. He was employed by YCGC and worked with Mr. Newt Webster at the North Fork Generating Station from 1952 to 1960. Even though he lived at North Fork Mr. Warnsby was also familiar with the Bear Creek Complex since that was where all of the electrical supplies was kept. When asked if he thought that any of the YCGC transformers, capacitors or resisters might have contained PCBs, he mentioned that most of them did not but there were a few that did.

Mr. Warnsby was also familiar with the island homes development and the families that occupied those homes. When asked if he knew how the homes were supplied with water he mentioned that all of the homes were connected through a piping system to a central Groundwater Well (97). He also mentioned that to the best of his knowledge each home had its own septic system.

Mr. Warnsby knew most of the island home residences. He mentioned that during his time of employment the following families occupied the island homes. There were the May, Creamer, Rogers, Cunningham, DuBois, Van Dykes, Trobergs, Newmen, DeRomeri, Hilton, and Minet families. He also mentioned three other family names that were before his time and they were the Comforts, Hares, and Smith.

Mr. Warnsby also mentioned that while he was working for the YCGC the garbage from Bear Creek Complex was hauled to the Dawson City dump. He figures that was not always the case and prior to his employment with YCGC there was a garbage dumping area on the site. He was

not certain of the location. The use of an onsite garbage dump (other than the Bone Yard) was not mentioned in any other interviews and is, at this time, considered speculation.

2.4.7 Mr. Basil Charman and Mrs. Daphne Charman

A meeting was conducted with the Charmans in their Whitehorse home. Their son David was also present during the meeting. Both Mr. and Mrs. Charman were employed by YCGC from 1950 to 1968 (when the YCGC operation shut down). During their employment they resided in homes that were located near or on the property. At one time they occupied one of the dwellings on the island. Mr. Charman started with a seasonal position with YCGC and in 1951 became a machinist working in the Machine Shop. Mrs. Charman was a full time housewife but she also completed odd jobs for the company, one such job was sewing closed the asbestos bags that were used in the Gas Generating House (5) during the acetylene making process. When asked if asbestos was used any where else on the Site Mr. Charman said the only other place there might be asbestos is the insulated pipes associated with the boiler in the Mess Hall and Bunkhouse (22).

Both Mr. and Mrs. Charman were familiar with the development of the site, and residents of the island homes and surrounding area. During the meeting they were helpful in determining the families that occupied the island homes. They were also helpful in identifying what each building located within the compound was used for.

When asked if they knew if the island homes were hooked up to sewer and water, Mr. Charman mentioned that the homes were hooked up to a sewer and water system in the mid 1950s. Water was supplied to each home through underground pipes from a central Groundwater Well (97). The sewer system consisted of each dwelling having a septic tank, which was connected to one main sewer drain, which allowed the effluent to be drained off into the nearby slough (old river channel). Prior to the installation of the sewer drain pipe each dwelling had a septic tank with leach pit. Prior to being hooked up the central water well each of the dwelling had individual wells.

The buildings that were not located on the island but within the compound were connected to a similar system, which again drained effluent into the nearby slough. Water was supplied from a Water Pump House (71) that was originally located between VIP Guest House (11) and the Stenographer's House (13) shown on Figure 1. A new Water Pump House (12) was constructed east of the original location on the other side of the syphon bridge.

If a residence did not have a sewage disposal system the occupants used honey pots. A contractor from Dawson City would empty the honey pots on a regular basis and haul the waste to a sewage disposal area in Dawson City. The same procedure was used for the domestic solid waste - a contractor from Dawson City would complete regular trips out to Bear Creek Complex to pick up the garbage and haul it back to the Dawson City municipal landfill.

When asked about the wastes that were generated from the various shops (carpentry, blacksmith, machine, automotive, and dozer), Mr. Charman mentioned that all of the waste generated from these shops was hauled out to the Bear Creek "Bone Yard" (95), which is located along the southern bank, just southwest of the tailings pond, at the entrance to the Bear Creek valley (shown on Figure 1). He mentioned that almost everything except the sewage and garbage was hauled out to the bone yard. Some of the waste stream consisted of metal shavings, broken and worn out parts, and various wood products. He also mentioned that the lime residue bi-product from the production of acetylene was also dumped out in the Bear Creek "Bone Yard" (95).

When asked about the underground petroleum fuel storage tanks (USTs) located at the Fuel Pump Island (10), Mr. Charman recalled that the pumps supplied regular leaded gasoline and diesel fuel. He mentioned that USTs were constructed out of old water pipeline and made in the machine shop. When asked about the aboveground storage tanks (ASTs) associated with the Diesel Fuel Pump House (60) he also mentioned that they were constructed out of the old water pipeline and made in the machine shop.

2.5 Stratigraphy and Groundwater

The Bear Creek Complex is located in the flood plain of the Klondike River. Although unconfirmed, it is suspected that the hydraulic gradient in the vicinity of the subject site flows in a northerly direction towards the Klondike River. Based on the surface elevations of the nearby ponds it was thought that the depth to groundwater across the site would range from 2.0 to 3.0 m.

Since the eastern portion of the Bear Creek Complex, including the residential island, were never dredged it is suspected that the soil stratigraphy consists of a thin layer of organics underlain by silt with some sand over sandy gravel. Permafrost may still be encountered in undisturbed areas were the organic layer remains thick.

2.6 Building and Area Identification

Based on the information collected during the site visits, review of available KNHS records, and interviews with former employees, Table 2.6 was created about the buildings that were and are still located on the site. All of the structures have been numbered and their locations are shown on Figures 1 and 2.

Table 2.6

Identification of Structures Located on the Site

Identification #	Identification Name	Pertinent Information
1 & 2	Blacksmith Shop & Machine Shop	Both shops are considered part of one large structure. Canadian Klondike Mining Company (CKMC) constructed the structure around 1909. The structure burnt down twice once in 1918 and again in 1936. The final reconstruction by the Yukon Consolidated Gold Corporation (YCGC) included extension of the structure to the south. In 1937 the structure housed a 900-tonne press, three large heavy duty lathes, light plate rolls, plate shears, various drill presses, grinding machines, forging hammer, welders, planers, air compressors, and a precipitron.
3	No. 2 Warehouse	One of the original warehouses that were used to house a wide variety of items, ranging from heavy-duty motors to wire cable to coconut matting. This building is presently being used for storage for KNHS artifacts.
4	Tin Shop	Originally used as a gas generating house later converted to the tin shop. The original location for the tin house was in the Machine Shop (2) half way down on the east side.
5	Gas Generating House	Not certain when the structure was erected but was in operation in 1937.
6	Carpenter Shop	This structure was constructed by CKMC and was originally used as a small blacksmith shop and for horseshoeing. In 1936 it was converted into a carpenter shop.
7	Auto Repair Shop	Originally this structure was used as the Caterpillar tractor repair building, and in 1937 it was converted into a storage building and later an auto repair shop.
8	Cat Repair Shop	Constructed next to auto repair shop in 1937 to replace the inadequate caterpillar tractor repair building.
9	Garage	This structure was one of the original structures located on the site. It was privately owned and was used for wood storage for the Road House.
10	Fuel Pump Island	Installed in the mid 1930s, the pump island consisted of two fuel pumps each connected to an underground storage tank (UST). The USTs were made in the machine shop out of sections of heavy gauge pipe obtained from the dismantled Yukon Gold pipeline.
11	VIP's Guest House (Joe Boyle House)	Originally Joe Boyle's residence, was later occupied by MacMillan (one of the dredgemasters). In 1936 the structure was used for the main office in the rear and engineers office in the front. In 1941 the offices were moved to a new building and Andy Baird used the structure as a residence.
12	New Water Pump House	Used to supply water to the whole complex.
13	Stenographer's House	Occupied by the secretaries.

Identification #	Identification Name	Pertinent Information
14	Amren's House (Staff House)	Originally used for living quarters for the secretaries and later in 1947-48 was occupied by an electrician by the name of Rudy Amrens. It is presently being used a staff house for Parks Canada employees.
15, 16, & 17	Garages	Originally there was one garage used to house the few motorized vehicles that were on the site. As the number of vehicles increased the additional garage facilities were constructed in order to start the engines during the winter months.
18	Transformer Shed	Used to house one small transformer switch.
19	Engineers Residence	Originally used as the CKMC engineering office in rear and the main office in the front. Later in 1936 it was used to house the engineers that worked for YCGC.
20 & 21	G.M.'s Residence and Garage (Gloslie House)	Used by the General Manager.
22	Mess Hall & Bunkhouse	This structure was built in 1936 to replace the old bunkhouse. Later in 1939 all camp toilets were rebuilt to conform to the requirements of the medical health officer.
23	Open Lumber Storage Shed	Used to store building materials.
24	Warm Storage Building	Constructed in 1909 it was originally used as a mess and bunkhouse. After the construction of the new mess hall and bunkhouse in 1936 the structure was used as a warm storage building for perishables.
25	Pipe Storage	Used to store all different sizes of pipe.
26	Parts Storage Racks	Used for storage of metal products that were used on the dredges.
27	No. 1 Warehouse	One of the original warehouses better known as a huge hardware store.
28	Eng. & Drafting Office	The structure was originally the Arlington Bunkhouse that was relocated to Bear Creek in 1940 and later occupied in 1941. This large structure also had four to five rooms in the back that were used for a small dormitory.
29	Gold Room	Built in 1940 to replace the old gold room that was constructed in 1916. The old gold room was located approximately to the east of the new gold room. The new gold room had a poured concrete foundation and floor, flat iron lining, insulation, a tilted retort furnace, floor drains with mercury traps, a concrete vault, and a fully equipped office. The old gold room structure was moved to the island and used as a residence.
30	Timber Storage Shed	Used for storage of lumber
31	Hay Shed	Used for storage of hay for the teams of horses that were used prior to acquiring vehicles.
32	Oats Shed	Used for storage of oats for the teams of horses that were used prior to acquiring vehicles.
33	Oil Storage	Constructed in the early 1940s the structures were used to house gasoline drums and other oil associated products, well away from most living quarters. The oil storage warehouse is presently being used for storage of KNHS artifacts, the St. Andrews Church Pipe Organ.
34	Open Storage	
35	Dredge Warehouse	Originally a hay warehouse at Guggieville was dismantled and re-assembled at Bear Creek in 1938. This building was mainly used for the storage of motors, pumps, and dredge equipment, which gave it the title the dredge warehouse. It was equipped with a travelling crane that facilitated retrieval of heavy parts. It is presently being used for storage of KNHS artifacts.

Identification #	Identification Name	Pertinent Information
36	Cold Storage	Used for storage of meats and vegetables.
37, 38, 39, 40 & 41	Electrical Warehouses (40 & 41 – Removed)	Used as a repair shop, and warehouses for storage of electrical parts and motors. 37 - motor storage warehouse, 38 - electrical repair shop, 39 - electrical warehouse, 40 - electrical storage warehouse, & 41 – transformer house.
42	Gasoline Storage Warehouse	Constructed in the mid – 1930s the structure was used for storage of thousands of gasoline cans. It is presently being used for storage of KNHS artifacts.
43	Metal Storage Area	Storage area for 40 ton spud (dredge rotation pin) and other metal products.
44 &45	Pump House #1 and #2	Mobile pump houses used off site.
46	Winch House for Large Hoist (1)	Large cable winch used during the operation of large hoist located along the west side of the blacksmith and machine shops.
47	Mobile Electrical Shed	Mobile electrical shed with transformers.
48	Transformer Shed	Used to house one small transformer switch.
49	Wash House	Equipped with toilets, sinks and showers.
50	Storage Shed	Used for storage of various equipment.
51	Water Well	Directly connected to the pump house and used to supply water to the complex.
52	Old Bunkhouse	Used to house the single men that worked for the CKMC prior to 1936 when the new bunkhouse was constructed. After 1936 the structure was used by YCGC to house the overflow of seasonal workers.
53	Cooks and Waiters Residence	Used as a residence for the cooks and waiters.
54	Old Gas & Oil Warehouse - Removed	Used to store petroleum products.
55	Wood Shed	Used for the storage of wood.
56	Root House	Used for the storage of vegetables and other produce.
57	Sampling Shed	Used as cold storage for soil samples.
58	Open Storage (Oil)	Used for storage of various oil products. It is presently being used by KNHS for storage of special waste products generated from other historic sites in the Dawson City area.
59	Winch House for Large Hoist (2)	Large cable winch used during the operation of large hoist located along the west side of the blacksmith and machine shops.
60	Diesel Fuel Pump House	Small shed housing the electrical pumps for two long lineal above ground storage tanks (ASTs). The ASTs were made in the machine shop out of sections of heavy gauge pipe obtained from the dismantled Yukon Gold pipeline.
61 & 62	Storage Sheds	Used for storage of various equipment.
63	Mobile Hoist	Cable Hoist that ran along rails.
64	Warehouse - Removed	The contents that were stored in this structure are unknown.
65	Tennis Court - Removed	Constructed by the residences
66	Powder House	Used for storage of the explosive equipment.
67	Detonator House	Used for storage of detonator caps.
68	Old Roadhouse - Removed (Privately Owned)	Constructed in the 1910s it was used to house a bar, rooms, and restaurant. It was torn down sometime in the 1950s.
69	Old Warehouse - Removed (Privately Owned)	The contents that were stored in this structure are unknown.
70	Old Garage - Removed	The exact use of this structure is unknown.

Identification #	Identification Name	Pertinent Information
	(Privately Owned)	
71	Old Water Pump House	Used to supply water to two residences (Amren's and Boyle's), the engineering and drafting building, fire hydrant shed, auto repair shop, gas generating house, and to the fountain in the machine shop. It was dismantled in 1951.
72 & 73	Unknown Structures	The use of these structures is unknown.
74	Community Hall	Constructed after 1939. Used for YCGC gatherings. The main structure (upper floor) used to be the Bunk House for Camp No. 3 at the Ogilvie River Bridge.
75	Curling Club - Removed	Constructed in the 1950s and later torn down sometime in the 1970s. The building, which housed one sheet of natural ice, was constructed with materials from #3 Dredge after it was shut down.
76	Dwelling - Removed	It was thought the house was originally moved on to the island in the late 1940s. Some of the occupants were Smith (accountant), Stutter (engineer), and Aldcroft (worked in the Gas House). The house was eventually moved off of the site.
77	Dwelling - Removed	It was thought the house was originally moved on to the island in the late 1940s. One of the occupants may have been Carnsew (thought to be an accountant).
78	Dwelling - Removed	It was thought the house was constructed on site in the late 1940s. One of the occupants was McLaren who worked in one of the warehouses and later became the manager of No. 4 Dredge. The house was eventually moved off the site.
79	Dwelling - Removed	It was thought the house was originally moved on to the island in the late 1940s. Some of the occupants were Sherbino (warehouse superintendent), Hayes (worked in one of the warehouses), Taylor (accountant), and Hilton (started in the warehouse and ended up working in the office). The house was eventually moved off of the site.
80	Dwelling - Removed	It was thought the house was originally moved on to the island in the late 1940s. Some of the occupants were Cunningham (who started in personnel and later worked in one of the warehouses), and Tichurst (who worked in one of the warehouses). The house was eventually moved off of the site.
81	Dwelling - Removed	The one and only residence of this house was May who built the house in the late 1940s and left in 1966.
82	Dwelling	It was thought the house was originally moved on to the island in the late 1940s. Some of the occupants were Hooley, Kilbride, and Ravenhill (welder in the Machine Shop). The house remains on the site.
83	Dwelling - Removed	It was a company house built in 1948 and was occupied by Creamer (surveyor). The house was eventually moved off the site.
84	Dwelling - Removed	It was thought the house was built on the island in the late 1940s. Some of the occupants were Rogers (machine shop superintendent and later became site manager), and Minet (blacksmith and later became machine shop foreman). The house was eventually moved off the site.
85	Dwelling - Removed	It was a company house built in 1948 and was occupied by Creamer (surveyor) and later King (who worked in the Gold Room). The house was eventually moved off the site.
86	Dwelling	It was thought Fournier had built the house on the island in the late 1930s and later occupied by Hand (Master Mechanic at Clear Creek), and Cazian (welder in the Machine Shop). The house

Identification #	Identification Name	Pertinent Information
		remains on site.
87	Dwelling	It was thought the house was originally moved on to the island in the 1940s. Some of the occupants were Hare (dozer mechanic), Charman (machinist), Stark, and Pols. The house remains on site.
88	Dwelling - Removed	It was thought the house was originally moved on to the island in the early 1950s. Some of the occupants were Van Dyke (mechanic foreman) and Hoggan (dredge superintendent). The house was eventually moved off the site.
89	Dwelling - Removed	It was thought the house was originally moved on to the island in the early 1950s. One of the occupants was Coell (who worked in the Gold Room). The house was eventually moved off the site.
90	Dwelling - Removed	It was thought the house was originally moved on to the island in the early 1950s. Some of the occupants were Anderson, Neumenn (who worked in an electrical warehouse), and Smeeton (automotive mechanic). The house was eventually moved off the site.
91	Dwelling - Removed	It was thought the house was originally moved on to the island in the early 1950s. One of the occupants was Minet (blacksmith and later became machine shop foreman). The house was eventually moved off the site.
92	Dwelling	It was thought the house was originally moved on to the island in the early 1950s. Some of the occupants were Hilton (started in the warehouse and ended up working in the office), and Grychuk (heavy equipment operator). The house remains on site.
93	Dwelling - Removed	It was thought the house was originally moved on to the island in the early 1950s. Some of the occupants were Snare (carpenter), Giamaco (carpenter), and Mosure (automotive mechanic). The house was eventually moved off the site.
94	Dwelling	It was thought the house was the original Gold Room that was located between the GM's Residence and the Engineer's Residence. Being a log building it was thought that the structure was taken apart and rebuilt on the island in the early 1940s. The only occupants of the house were Lewis (who worked in one of the warehouses) and Troberg (thawing superintendent). The house remains on site.
95	Bear Creek Bone Yard	This area was used as a disposal area for the waste stream that was generated from the Carpentry, Automotive, Machine, Blacksmith, and Cat Repair Shops.
96	Parks Canada Bone Yard	This area is presently being used by Parks Canada for storage of old ASTs and USTs, old transformer cases, creosote coated lumber, other wood products, and scrap metal.
97	Groundwater Well	This water well was constructed as part of the residential water supply system that replaced all of the individual water wells located at each island resident.

3.0 ENVIRONMENTAL ISSUES

Based on the review of the available historical information, site visits and interview with persons familiar with the site, the following environmental issues have been identified and discussed in detail.

3.1 Asbestos Containing Materials

There was only one small container of asbestos that was identified on the Site (Photograph 1). It was a sealed metal container located in the Gas Generating House (5). The container had a clear plastic lid for viewing. The word 'CONDEMMED' was written on the exterior of the container. Ms. Ranger had mentioned that the container might have some historical value and that may be the reason for it remaining on the Site.

It was not confirmed but there might be asbestos associated with the insulated boiler piping in the Mess Hall and Bunkhouse.

During the interior and exterior inspection of the structures it was noted that asbestos board or siding was not used on any of the structures.

3.2 Underground Storage Tanks (USTs)

Petroleum USTs were identified in two areas. The first area is the Fuel Pump Island (10) where two USTs were identified under the wooden platform located just east of the fuel pumps. It was thought that the USTs were made in the machine shop out of sections of heavy gauge pipe obtained from the dismantled Yukon Gold pipeline. It was also thought that the USTs supplied leaded gasoline and diesel fuel to each of the two distribution pumps. During the second site visit the USTs were dipped and it was determined that they still contained small quantities of petroleum product.

The second area was the Gold Room (29) where a UST was identified along the north side of the structure. The UST was placed in the Gold Room's sump box and could be associated with fuel supply for the kiln. Once again there was a small quantity of petroleum product remaining in the UST.

There was one other area located along the northern side of the VIP's Guest House (11) that may have an underground storage tank. During the first site visit there was a vent pipe running from the ground surface up the side of the house but there was no filler pipe noticed in the vicinity of the vent pipe (Photograph 2). This vent pipe could also be associated with the septic tank that was installed between the VIP's Guest House (11) and the Stenographer's House (13).

The only other USTs that were identified on the site were the various septic tanks associated with the residential homes on the island, Machine Shop (2), Engineering Office (28), the residences and bunkhouses located in the compound area, and the Cat Repair Shop (8), which is presently the Parks Canada Machanical Shop. Three of the former septic tank locations were identified on old engineered site drawings; a septic tank located between the Auto Repair Shop (7) and Machine Shop (2), a septic tank located between the VIP Guest House (11) and the Stenographer's House (13), and another septic tank situated along the southern side of residential Dwelling #90. After reviewing the Environmental Health's records a fourth sewage holding tank was identified on the site. It was installed in 1993 along the eastern side of the Cat Repair Shop (8) and is connected to the bathroom facilities associated with the building.

During the June 2001 site visit, Ms. Ranger, who is presently residing in the Amren House (14), mentioned that house was hooked up to a septic field system located to the south in front of the building.

3.3 Aboveground Storage Tanks (ASTs)

During the site visit there were ASTs identified throughout the site. The following table lists the location and any pertinent information associated with the AST.

Table 3.3

AST Location and Related Pertinent Information

Location	Pertinent Information
Staff House (14)	There was a yellow 2275 litre AST strapped to wooden timber supports between the Staff House (14) and the Garage (15), and is presently being used to supply heating oil to the Staff House (14). In the mid 1990s a rubber membrane liner was placed beneath the AST for spill and leak protection. There was noticeable hydrocarbon staining beneath the tank. (Photograph 3)
Cat Repair Shop (8)	There were two ASTs located along the exterior walls of the building. One 1590 litre AST was situated along the eastern side of the building. It was supported by a metal stand and was also placed in a containment cell that was constructed in the mid 1990s with a rubber membrane liner. The other 1140 litre AST was situated along the western side of the building. It was also supported by a metal stand but the was no containment cell. Both tanks are presently supplying heating oil to the building. There was no noticeable hydrocarbon staining beneath either of the tanks. (Photograph 4 and 5)
New Water Pump House (12)	There was one 2275 litre AST supported by a metal stand that was positioned on a wooden deck. This tank is presently being used to supply heating oil to the building's furnace. There was no noticeable hydrocarbon staining beneath the tank. (Photograph 6)
Warm Storage Building (24)	There was one 1140 litre AST supported by a wooden stand that was situated at the northwest corner of the building. This tank is presently being used to supply heating oil to the building's furnace. There was no noticeable hydrocarbon staining beneath the tank. (Photograph 7)
Diesel Fuel Pump House (60)	There were two long linear ASTs that were sitting on the ground along the eastern property boundary. The ASTs were made in the machine shop out of sections of heavy gauge pipe obtained from the dismantled Yukon Gold pipeline. The dimensions of the tanks measured 1.2 m in diameter and 18 m in length, which amounts to an approximate volume of 20,400 litres per tank. At the southern end of the ASTs a small shed enclosed a pump and hose. This was where heavy equipment used to refuel. During the site visit there was approximately 100 mm of product in the bottom of each of the ASTs. There was noticeable hydrocarbon staining throughout the interior and entrance of the shed. There was a waste oil tank with grate situated next to the entrance of the shed, which had some waste oil sitting in the bottom. (Photograph 8)
Adjacent grounds south of the Carpenter Shop	There was a yellow 2275 litre AST situated near the northeast corner of the Gas Generation House (5) south the Carpenter Shop (6). During the site visit the AST was approximately half full with some type of diesel product. (Photograph 9)
Parks Canada Bone Yard	There were numerous ASTs identified in this area. The different sizes are listed below. (Photograph 10) • One 1140 litre AST – presently being used for refuelling equipment. • Four 1140 litre ASTs – one on a metal stand and they were all empty. • One 2275 litre AST – empty and sitting on the ground. • One 2275 litre UST – situated at the western end of the bone yard. It was empty and sitting on the ground. • Two 4550 litre tanks – possibly USTs. They were empty. • One 9100 litre AST – moved to the site during the 2001 summer from a Parks Canada property in Dawson City. • One 113700 litre AST – empty and supported by metal legs.

3.4 Polychlorinated Biphenyls (PCBs)

The KNHS Bear Creek environmental files were reviewed by EBA and the following documentation was collected in relation to PCB identification and cleanup at the Bear Creek Complex. The following documentation is attached in Appendix B.

1. In a letter dated August 31, 1982 addressed to the Project Manager of Parks Canada in Dawson City, Mr Doug Davidge, Senior Technician for Environmental Protection Services (EPS) – Yukon Branch mentioned that he completed a visual inspection of Bear Creek Complex and collected soil, oil, and floor scraping samples from various buildings and grounds, which were analysed for Polychlorinated Biphenyls (PCBs). Traces of PCBs were found in the Electrical Maintenance Sheds (both floor scrapings and oil can contents).

2. A message dated May 6, 1985 sent to Mr. Rob McCandless of KNHS from Mr. Doug Davidge, mentioned that Mr. Michael Gates, Curator of Collections for KNHS, had contacted EPS to inquire about the PCB survey that EPS had completed at Bear Creek Complex in 1982. He wanted assurances that it would be all right to work and handle the material in the building where EPS had detected PCBs.

3. In another letter dated May 8, 1985 addressed to Mr. Colin Wykes, Director of EPS, Mr. J. G. Elliott, Superintendent for KNHS mentioned that there were PCB concerns with building #38. He also mentioned that Mr. McCandless was going to complete further random sampling in building #38 during a routine trip to Dawson in July, 1985.

4. In a memorandum dated June 12, 1985 addressed to all sections of Parks Canada, Mr. John Wierda of KNHS mentioned that on June 11, 1985 he accompanied Mr. Doug Kittle of EPS and Vern Parkins of Northern Canada Power Commission formerly a lineman with YCGC during a site visit of Bear Creek Complex to examine the electrical equipment. They identified several locations where oil-filled electrical equipment may have been stored or emptied. During their site visit they found evidence of contamination, a capacitor in a location known as the Parks Canada Bone Yard located just south of building #33. He also mentioned that EPS was sending Mr. Bob Allan to do some testing and that he would arrive on June 13, 1985.

5. In a letter dated June 18, 1985 addressed to Mr. Allison Fisk, Superintendent of KNHS, Mr. Colin Wykes mentioned that EPS had agreed to supply KNHS with a plan for dealing with the short-term problem, the removal of the PCB capacitor and any contaminated soil. He also mentioned the medium and long term plans (search and removal of any other contaminated equipment), and that EPS was prepared to undertake reconnaissance soil sampling in areas of suspected contamination, through equipment labels, or verbal evidence.

6. In a letter dated June 18, 1985 addressed to Mr. Allison Fisk, Mr. Doug Kittle discussed the procedures for removal of the PCB-filled capacitor from Bear Creek and preparations for its secure storage. He mentioned the following in the letter:
    - the personal protective equipment those handling the capacitor should wear,
    - the recovery and storage materials that are required for safe transport and where a storage container could be purchased, and
    - the procedures to follow during the recovery of the capacitor and contaminated soil located beneath it, and finally proper exterior labelling of the storage container.

7. In a letter date July 9, 1985 addressed to Mr. Colin Wykes, Director of EPS, Mr. Allison Fisk mentions that he was in contact with Mr. Ken Wiles of the EPS – Vancouver office in which Mr. Wiles had made arrangements for Mr. Tom Finnbogason of Enviro Chem Ltd. to arrive in Bear Creek on July 10, 1985 for the purpose of inventorying possible PCB contamination sites, taking samples for later analysis, and providing an educational program for the KNHS staff.

8. In a memorandum dated July 15, 1985 addressed to Mr. J Buccini, Director of EPS - Commercial Chemicals Branch, Mr. B.A. Keskins, P.Eng., Regional Director for EPS – P&Y, mentioned what had and was being done about the PCB contamination that was discovered at the Bear Creek Complex. It was an update of the previous conversations between KNHS and EPS letters above. There was one thing in the memorandum that was not noted in the above mentioned letters - that EPS completed another inspection in 1983, after the initial inspection in 1982, and failed to find any equipment labelled as PCBs.

9. In a handwritten memorandum dated July 23, 1985 addressed to Mr. Rod Blair of KNHS, Mr. Bruce Shore mentioned that the PCB cleanup was completed that same day. The operation was conducted according to the procedures outlined in the June 18, 1985 letter from Mr. Doug Kittle to Mr. Allison Fisk. All cleanup equipment, including clothing and tools, along with the capacitor, adjacent soil, and two ballasts were sealed in the special barrel. The barrel was then turned over to the storesperson for appropriate disposal.

10. In a Briefing Note about the Status of PCBs at Bear Creek dated July 23, 1985 Mr. Don MacMillan mentioned that the survey by the Vancouver consultant, Enviro Chem Ltd., included the collection of 40 samples for laboratory analysis. Preliminary PCB survey results indicate that of the two PCB capacitors located on the site, one is still in good condition, in service, and does not require any contaminant or disposal action.

11. In a letter dated August 20, 1985 addressed to Mr. Allison Fisk, Mr. Thomas Finnbogason had received the analytical results for the PCB inspection and sampling program undertaken at the Bear Creek Complex. He mentioned that Environmental Protection Service Chemistry analyzed all samples. A total of 20 samples were taken during a complete visual inspection of the site. His findings concluded that with the exception of the leaking PCB capacitor, the electrical equipment at the Bear Creek Complex pre-dates the extensive use of PCBs in electrical apparatus. He also mentioned

that he thought the PCB capacitor was brought on to the site after termination of the YCGC operations. During his site inspection there was only one other PCB equipment positively identified and that was a small power-factor-correction-capacitor located in the control panel of the precipitron in the Machine Shop. The capacitor was in very good condition and did not require removal and disposal at that time. He did recommend that regular inspections of the capacitor be completed for signs of weeping or leaks. Besides the location of the damaged PCB capacitor, his inspection concluded that there was PCB contamination in wood scrapings from the floor of the Electrical Warehouse (39). The results warranted further sampling. Based on further sampling results, recommendations will be made for the clean up of the floor.

12. In a memorandum dated August 21, 1985 addressed to Ms. Sonia Francke of EPS Laboratory Services and a letter dated September 6, 1985, addressed to Tom Finbogason, Mr. Doug Kittle mentioned that 11 samples were collected from the wooden floor in building #39 and a few other miscellaneous locations for analysis of PCB content. The laboratory analysis was completed on September 6, 1985, and the results were shown on a figure showing the grid system where floor samples were collected. There were areas with much higher concentrations of PCBs than the sample taken earlier in the summer. There was also still contamination in the soil beneath the capacitor.

13. In a letter dated September 30, 1985 addressed to Mr. Rod Blair, Works Superintendent for KNHS, Mr. Rob McCandless of EPS mentioned that all of the shaded areas identified on the attached sketch were scraped and washed with solvent. All of the equipment used and the floor scrapings were sealed in a PCB drum and sent to EPS in Whitehorse. Additional core samples of the timber planking in the areas of heaviest contamination were collected and sent out for laboratory analysis.

14. In a memorandum dated February 13, 1986 addressed to Mr. Thomas Finnboganson, Mr. Rob McCandless mentioned that the analytical results for the core samples collected from the floor planking in building #39, confirmed that PCB contamination did penetrate the planking and that the planking will have to be removed.

15. In a memorandum dated March 14, 1986 addressed to Mr. Rob McCandless, Mr. Ken Wile, Program Officer for EPS – Contaminants Control mentioned that in regard to the PCB remedial measures required in Electrical Warehouse (39) at Bear Creek Complex, the heavily contaminated flooring should be removed and replaced. The contaminated waste material should be stored at the EPS secure facility in Whitehorse. The floor should then be covered with plywood or epoxy to eliminate the possibility of exposing the workers to any residual PCB.

16. In a letter dated April 17, 1986 addressed to Mr. Alison Fisk, Mr. John Polak, Director of EPS – Yukon Branch, updated the KNHS of what was required to complete the PCB contaminant clean up in the Electrical Warehouse (39) at Bear Creek Complex.

17. In a memorandum dated October 3, 1986 addressed to Mr. Doug Kittle from Mr. Rod Blair, KNHS acknowledged that they were the owners of two drums of wood contaminated with PCBs and that they would accept responsibility for the disposal costs.

18. In a letter dated September 9, 1988 distributed to the following departments, Yukon Hazardous Waste Storage Committee Members, Yukon Disaster Committee Members, PCB Waste Storage Site owners, fire departments in Whitehorse, Watson Lake, Faro and Dawson City, and the Board of Health for the City of Whitehorse, Mr. R. Allan, Emergency Response Manager for Environmental Protection (EP) - Yukon Branch had attached a copy of an inventory of PCB waste storage sites in the Yukon Territory. As of September 1, 1988 Parks Canada's Bear Creek Compound was listed as a PCB waste storage site that was storing one 5 L capacitor.

19. In a letter dated September 27, 1988 addressed to Mr. B.A. Heskin, Regional Director for EP – Pacific and Yukon, Mr. George Mackenzie-Grieve, Chief of EP – Yukon Branch mentioned that EP had received a drum of PCB waste from KNHS to add to the three drums of PCB waste that were already being stored for KNHS at the EP storage site.

20. In a letter dated December 5, 1988 distributed to the following departments, fire departments in Whitehorse and Watson Lake, RCMP in Whitehorse, Whitehorse Emergency Planning, Yukon EMO Coordinator, EP – Vancouver, EP- Ottawa, and Yukon Renewable Resources, Mr. R. Allan of EP – Yukon Branch had attached an updated inventory of PCB waste storage sites in the Yukon. On the attached list Parks Canada's Bear Creek Compound was crossed out and there was a written comment stating that the one capacitor that was being stored at Bear Creek Compound was transferred to the EP – Whse PCB waste storage facility.

21. In a memorandum dated September 22, 1993 addressed to Mr. Allison Fisk, Mr. Steve Arrell mentioned that he submitted the EP – Whitehorse PCB inventory to Chem-Security (Alberta) Ltd. for approval for destruction at their Alberta Special Waste Treatment Centre in Swan Hills. He mentioned that the KNHS's inventory consisted of two 5 L PCB capacitors and two drums of PCB contaminated debris.

22. In a memorandum dated February 3, 1994 addressed to Mr. Allison Fisk, Mr. Steve Arrell mentioned that he had received a cost quote for three drums of debris, a capacitor in another drum, and two ballasts in a 5 gallon plastic pail. He also mentioned that Chem-Security was hoping to pick-up the PCBs in mid March 1993.

23. In a note to file dated November 3, 1994 Mr. Arrell mentioned that on August 16, 1994 EP received a Certificate of Disposal Waste from Chem-Security (Alberta) Ltd. The material was then deleted from the National PCB Inventory. On the Certificate of Disposal the PCB material was listed as contaminated debris contained in three drums, lamp ballasts contained in a 5 gallon plastic pail, and electrical capacitors contained in another drum. According to the EPS inventory list that was attached to the note there were two drums of debris (Drums #2 and #3), one 5 gallon plastic pail containing two lamp ballasts, and one drum containing two capacitors (Drum #1).

In summary, after all of the site inspections and sample collection programs completed by EP and KNHS, PCBs were found in various locations through out the site. There were only two areas that were heavily contaminated with PCBs, and another location where electrical equipment containing PCBs was still in place. The areas of concern are listed below:

1. A leaking capacitor in the bone yard located just west of the Oil Storage (33) building.
2. Another capacitor located in the control panel of the precipitron in the Machine Shop (2).
3. The floor planking located at various locations within the Electrical Warehouse (39).

The above information confirms the following:

- The leaking capacitor was cleaned up but some of the affected soil located beneath the capacitor remains in place. The exact location of the capacitor could not be determined from the available information.
- The heavily PCB contaminated floor planking was removed from the Electrical Warehouse (39). A 2002 March inspection of the building confirmed that the areas where the floor planking was removed were replaced with plywood.
- Even though there was no documentation about the removal of the capacitor from the Machine Shop (2) there was the EP inventory lists showing that in September 1988 there was one PCB capacitor being stored at Bear Creek Complex and that in December 1988 it was transferred to the EP – Whitehorse PCB storage facility. In 1994 the EP inventory list confirmed the two capacitors from the Bear Creek Complex were in EP - Whitehorse PCB storage prior to disposal.

During the June 2001 site visit, old electrical transformers and switches of various sizes were identified on the site in an area designated as the Parks Canada Bone Yard (96) (Photograph 12). Some of these transformers were used on the Site while others were relocated to the bone yard from other KNHS locations in the Dawson City area. There was hydrocarbon staining noticed on the ground surface in the area of the transformers, and the interior and exterior of the transformer cases. It was originally thought that these transformers may have contained PCBs but from information documented above about soil samples that were collected from the area, the laboratory analytical results confirmed that PCB concentrations were detected but were very low.

There were also old transformers and switches identified on the Bear Creek Complex property that were still in place in some of the site structures that may have contained PCBs. The locations are listed below:

- Transformer Shed (18) – housed an old transformer switch.
- Mobile Electrical Shed (47) – housed electrical panel box and transformers. (Photo 12)
- Transformer Shed (48) – housed an old transformer switch. (Photo 13)

- Gas Generating House (5) – there was a resistor switch located in a small room at the rear of the building. (Photo 14)
- Machine Shop (2) – there was a resistor switch (similar to the one that was in the Gas Generating House) located inside along the eastern side of the shop.
- Old Transformer – the box-shaped transformer was situated on an electrical pole near Transformer Shed (48). (Photo 15)

It is also noted that PCB containing oil was used as a rust inhibitor on parts such as cables. Since there are still significant quantities of cable on site, these should be checked for PCB concentrations.

3.5 Mercury

The KNHS Bear Creek environmental files were reviewed by EBA and the following documentation was collected in relation to Mercury identification and cleanup in the Gold Room (29) at the Bear Creek Complex. The following documentation is attached in Appendix C.

1. In a memorandum dated June 5, 1978 addressed to Dr. D.C. Dimitroff, the Programs Medical Officer for Medical Services Branch of Health and Welfare Canada (MSB-HWC), Mr. Grant Lundy, Environmental Health Officer for YTG-HS, mentioned that he had completed the mercury vapour sampling of the Gold Room (29) on June 2, 1978. Samples were taken at various locations within the building; the four corners of the main room, and from all pieces of equipment and working areas. There was a floor plan attached to the memo. The testing confirmed that there was no mercury vapour present in the room air itself, but could still be present in some of the metal parts of the processing equipment. There was liquid mercury present in the end of sluice box and the pipe end of the retourting system. Based on the findings the following recommendations were to block off both ends of the retourting system, remove all existing chemicals and liquid mercury prior to commencing tours, and cleanup crews should wear protective clothing and equipment.

2. In a letter dated June 8, 1978 addressed to Mr. Michael Gates of KNHS, Dr. Dimitroff mentioned that prior to opening for public touring, the retourting system be blocked off at both ends, that existing chemicals and all liquid mercury be removed from floor, cracks, walls, piping, containers, etc., and that the ceiling and walls and floor be washed down with appropriate chemical cleansing compounds to remove mercury compounds. He also mentioned that after cleaning has taken place a final inspection be completed by the Environmental Health Officer.

3. In a memorandum dated December 15, 1993 addressed to Mr. Gary McMillan of KNHS, Mr. Michael Gates mentioned that in 1978 he supervised the cleanup of free-standing

mercury in the Gold Room at Bear Creek. A small vacuum pump was used to suck up the free-standing material which as he recalled amounted to a few ounces.

Available construction plans for the Gold Room indicate a collection box located along the northern exterior wall of the structure that was used to collect all of the fine grained material that ended up on the floor and what was discarded out the drain end of the sluice box. At this point it was thought that there should be no more mercury mixed in with the material, but there is the possibility that some mercury drained into the collection box. During the March 2002 site visit the collection box was located outside the Gold Room (29) (Photo 16). The lid for the box could not be opened because it was nailed down. There was a filler pipe sticking out the top of the lid, which was thought to be connected to an UST that may have been used to supply heating oil to the structure.

During the June 2001 EBA site visit an inspection of the Engineer's Office building was completed. There were mercury vapour lamps located in a box under a table located in the photocopy room. It is believed that they were with the blue print developing machine that was still in place during the visit (Photo 17).

3.6 Miscellaneous Environmental Issues

After reviewing the KNHS Bear Creek files the following documentation was collected in relation to miscellaneous environmental issues associated with the Bear Creek Complex. The following documentation is attached in Appendix D.

3.6.1 Various Products at Bear Creek Complex

In a letter dated June 20, 1978 addressed to Mr. Michael Gates, Mr. W. Robson of EPS – Yukon Branch mentioned that he had received the analytical results for unknown samples collected from the Bear Creek Complex. The material in the Gold Room (29) that was found in the large square tin and the drawer was Sodium Carbonate. The material from the Dredge Warehouse (35) was Sodium Sulphate. The material (had an ash appearance) from the Blacksmith Shop near the forge contained some lead and a bit of Cadmium. The material from the Gold Room that looked like asbestos was asbestos and the sample that was collected from Cave & Co. Assay Supplies box was Silica Dioxide or Aluminium Silicate. He also mentioned that he would be in touch at a later date to advise on disposal of the different materials.

During the review of the KNHS historical records, there was no other documentation found that stated that these materials were removed from the site. During the site visit the materials listed above were not identified suggesting that they had been removed from their locations.

During the June 2001 site visit there were various products in small metal or glass containers discovered near or in the following buildings:

- Carpenter Shop (6) – there were various small pails containing paints and varnishes.
- Machine shop (2) – there were various small pails containing lubricants and paints.
- Electrical Warehouse (38) – there were various metal tins containing motor oil, kerosene, and transmission oil. The floor was covered with oil staining.
- Electrical Warehouse (37) – there were various products consisting of metal tins with unknown products, old dry cell batteries, brush killer, Naptha, one box containing telephone batteries.
- Auto Repair Shop (7) – there were various glass bottles and metal tins containing Naptha, linopaste, insulating varnish, cutting oil, chassis grease, tractor roller lubricant, metal seal, block weld, cold solder, caustic soda, diesel lubricant, methyl hydrate, roller lubricating dye, transmission fluid, and unknown products.
- Gas Generating House (5) – there were acetylene bottles, small drums of calcium carbide, electrical motor oil, and Duralube grease.
- No. 2 Warehouse (3) – there were various containers with contents consisting of calcium carbide, methyl chloride, and ammonia alkali.
- Engineering Residence (19) – there were small bottles with unknown contents.

3.6.2 Chemical Water Analysis – Bear Creek Residence Well

In a letter dated August 27, 1984 addressed to Mr. John Malfair of Parks Canada, Mr. Rob Leach, Environmental Health Officer for MSB-HWC, mentioned that subsequent water samples indicate that there is no lead in the water supply and that the lead isolated in the initial sample may be related to the recent plumbing work that was carried out in the residence. Based on the findings he suggested that the water run for a while before using.

3.6.3 Water Quality – Bear Creek

In a handwritten memorandum dated February 26, 1986 addressed to Mr. Rod Blair of KNHS, Mr. Bruce Shore mentioned that Mr. Rob Leach of Health and Welfare Canada had contacted him about the coliform analyses results for water samples collected from Bear Creek. The results

indicated that there were no total or fecal coliforms present at the time of sampling. The sampling location was not identified in the memo.

3.6.4 Unknown Material in Gold Room Shed

In a final analytical report dated February 8, 1989, submitted to Mr. Michael Gates from Environment Canada Laboratory Services an unknown material from the Gold Room Shed ground surface was submitted for metal analysis. The analytical report concluded that both analyses and physical characteristics indicate that a large portion of the material is probably ferric sulphate. Cyanide, mercury, and other toxic metals were not present in sufficient quantities to render the material hazardous. However, the material was still removed from the Gold Room to another location (unknown).

3.6.5 900 Tonne Press Sump Box Drain

After reviewing the available engineering drawing for the construction of the 900 tonne press foundation that is located in the Machine Shop (2) it was noticed that there was a sump drain situated at the bottom of the sump box. During the site visit the drain could not be identified at the bottom of the sump.

3.7 Water and Sewer Services

After reviewing the available KNHS information, and conducting interviews with former employees, the following has been concluded in regard to the water and sewer services that were used on the property. In the 1950s there were water and sewer services connected to the Machine Shop (2), Auto Repair Shop (7), Gas Generating House (5), VIP Guest House (11), Stenographer's House (13), Amren's House (14), and all of the residential houses (island homes) located on the island to the north. Two shallow wells supplied water, one well located east of the Stenographer's House (13) that supplied water to all of the structures previously mentioned. The island homes received water from another well located on the island.

3.8 Special Waste Collection and Storage

In a letter dated August 31, 1993 addressed to Mr. Kelly DeWalt of the KNHS, Mr. Don Wilson, Waste Management Coordinator, Municipal Engineering, Government of Yukon (YTG-ME), mentioned that a contract for the collection of and removal of special waste was awarded to

Philip Environmental and that the collection was to occur during the weeks of Sept. 13-17 and Sept. 20-24. Mr. Wilson mentioned that YTG-ME had an inventory list with applicable disposal costs for the special waste that was being held by KNHS. The letter and inventory list have been attached in Appendix E.

In a handwritten memorandum dated August 23, 1994, addressed to Mr. Michael Gates, Ms. Louise Ranger of KNHS mentioned that two large boxes of asbestos (short fibres) were removed from the SS Keno and delivered to Bear Creek to be stored in one of the open sheds. She mentioned that at that time she was not sure about storage in this shed since all previously stored materials had been removed.

EBA suspects that this open shed is the Open Storage (58) that is presently being used by KNHS for storage of special waste (Photo 18).

In a letter dated March 9, 2000 addressed to Mr. Irwin Gaw of KNHS, Ms. Janine Kostelnik, an Environmental Protection Analyst for Government of Yukon – Renewable Resources, mentioned that the KNHS had acquired a special waste permit. The permit allows KNHS to generate, store, or otherwise handle the following special wastes; waste oil (leachable toxic waste), waste solvents (petroleum distillates), and waste paint thinner (paint related material). Bear Creek Complex was chosen as the location for storage of the special waste.

4.0 PHASE 2 ENVIRONMENTAL SITE ASSESSMENT

4.1 Field Program

During the October 2001 site visit minimal Phase 2 ESA work was completed on the Site. This work was limited to the collection of surface soil and liquid samples since authorization from Parks Canada to collect subsurface soil and groundwater samples during the 2001 field season was not provided.

The Phase 2 ESA fieldwork that was completed on the site consisted of the following:

- Collected two soil samples and one water sample near the Diesel Fuel Pump House (60) for hydrocarbon analysis. Soil sample BC-#1 was collected from the ground surface next to the waste oil drum located next to the building. Soil sample BC-#2 and water sample BC-#W2 were collected from the ground surface inside the structure.
- Collected two soil samples from two locations within the Blacksmith Shop (1) and Machine Shop (2) for metal and hydrocarbon analysis. Soil sample BC-#3 was collected

from the ground surface near the blacksmith forge. Soil sample BC-#4 was collected from the bottom of the 900 tonne press sump box.

- Collected soil sample BC-#5 from the ground floor inside the Tin Shop (4). The material was white in colour.
- Collected soil sample BC-#6 from beneath a transformer located in the residential island for PCB analysis. The transformer was empty with very little staining on the exterior of the casing.
- Collected oil sample BC-Oil#1 from one transformer located in the Mobile Electrical Shed (47) for PCB analysis.
- Collected oil sample BC-Oil#2 from the transformer switch located in a Transformer Shed (48) for PCB analysis.

All sample locations have been identified on Figures 1, 2 and 4.

4.2 Regulatory Criteria

As the specific area of interest is located on Federal Crown Land, Canadian Environmental Quality Guidelines published by the Canadian Council of Ministers of the Environment (1999) "CCME" are used in evaluating the concentration of any contaminants found in sediments or surface water. For soil, the *Canadian Soil Quality Guidelines for the Protection of the Environment and Human Health (EHH)* and the *Canadian-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil (CCME, updated 2001)* are used, while for surface water, the *Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 1999)* are considered applicable.

Since the site is located in the Yukon, the *Yukon Contaminated Sites Regulations "CSR"* are used as a standard for any chemical constituents that do not have a CCME guideline. All CSR standards are shown for comparison purposes.

4.3 Chemical Laboratory Analysis

All samples collected for analysis were stored and shipped in a cooler (maintained at or below 4°C) to ALS Environmental in Vancouver, BC. This is a laboratory accredited under *The Canadian Association for Environmental Analytical Laboratories* (CAEAL) for the analysis requested.

Analytical test methodologies are included in Appendix E as part of the chemical analysis report.

4.4 Analytical Results

4.4.1 Soil

The results from laboratory analysis of the soil samples submitted are presented in Table 4.4.1. ALS Environmental chemical analysis report is included in Appendix E. The applicable regulatory standards and guidelines are also listed on Table 4.4.1 for direct numerical comparison.

Table 4.4.1:
Soil Analysis Results

All units expressed in µg/g (ppm) unless stated otherwise.

PARAMETER	SAMPLE NUMBER AND DEPTH						CSR*	CCME	
								EHH**	PHC***
Sample # (BC-)	#1	#2	#3	#4	#5	#6	-	-	-
Depth (m)	surface	surface	surface	surface	surface	surface	-	-	-
Moisture (%)	7.5	21.2	11.0	1.5	2.4	17.8	-	-	-
pH	-	-	6.29	7.69	**8.9**	-	-	6 to 8	-
Total Metals									
Antimony	-	-	**93**	**148**	<10		40	40	
Arsenic	-	-	**32**	**105**	5		60[1]	12	
Barium	-	-	162	145	50		2000	2000	
Beryllium	-	-	<1	<2	<0.5		8	8	
Cadmium	-	-	5	<2	<0.5		2.5[1]	22	
Chromium	-	-	**320**	**1590**	10		60[1]	87	
Cobalt	-	-	31	77	2		300	300	
Copper	-	-	**959**	**689**	45		250[1]	91	
Lead	-	-	**1320**	**1020**	<50		2000[1]	260	
Mercury	-	-	**17.8**	**17.5**	0.73		10	24	
Molybdenum	-	-	**59**	**237**	<4		40	40	
Nickel	-	-	**421**	**6260**	7		500	50	
Selenium	-	-	0.6	0.8	0.2		10	10	
Silver	-	-	<4	<8	<2		40	40	
Tin	-	-	184	**408**	<5		300	300	
Vanadium	-	-	34	62	12		-	130	
Zinc	-	-	**1830**	**341**	64		200[1]	360	
Polychlorinated Biphenyls									
Polychlorinated Biphenyls						<0.05	50	33	
Extractable Petroleum Hydrocarbons									
EPH(C10-C19) in Soil	**1960**	**8690**	274	837	1120		2000	-	1500[2]
EPH(C19-C32) in Soil	**32800**	**2760**	1350	**45400**	**49200**		5000	-	2500[3]

Note:
Bold and underline indicates that concentrations exceed the CSR standards or CCME
* - Contaminated Sites Regulations (Yukon). Generic soil standards for commercial land use.
1 – Matrix Numerical soil standards for commercial land use. Toxicity to soil invertebrates and plants or Groundwater to surface water used by aquatic life. (which ever is more stringent)
** - Canadian Soil Quality Guidelines for the Protection of the Environment and Human Health.
*** - Canada-Wide Standards for Petroleum Hydrocarbons In Fine Grained Soil, 2000. (Commercial Land Use)
2 – Hydrocarbon Ranges >C10 - C16
3 – Hydrocarbon Ranges >C16 - C34

The analytical results show that hydrocarbon concentrations in samples collected from the Diesel Fuel Pump House (60), Machine Shop (2), and Tin Shop (4) exceed regulatory guidelines and standards. Soil samples BC-#1, BC-#4, and BC-#5 had EPH(C19-C32) concentrations that are considered to be special waste. The results also show that various metal concentrations in samples BC-#3 and BC-#4 collected from the Blacksmith Shop (1) and Machine Shop (2) exceeded the regulatory guidelines and standards.

The results indicate that PCB concentrations in soil sample BC-#5 collected from beneath an old transformer that was located on the residential island grounds did not exceed the regulatory guidelines or standards.

4.4.2 Water and Oil

The results from laboratory analysis of the water and oil samples submitted are presented in Table 4.4.2. ALS Environmental chemical analysis report is included in Appendix E. The applicable regulatory standards and guidelines are also listed on Table 4.4.2 for direct numerical comparison.

Table 4.4.2:
Water and Oil Analysis Results
All units expressed in mg/L (ppm) for water and µg/g (ppm) for oil unless stated otherwise.

PARAMETER	**SAMPLE NUMBER AND DEPTH**			**CSR***	**CCME****
Sample # (BC-)	#W2	Oil#1	Oil#2	-	-
Location	surface	transformer	switch	-	-
Non Halogenated Volatiles					
Benzene	<0.0005	-	-	3	0.37
Ethylbenzene	<0.0005	-	-	7	0.09
Toluene	<0.0005	-	-	3	0.002
Meta & para-Xylene	<0.0005	-	-	-	-
Ortho-Xylene	<0.0005	-	-	-	-
Volatile Hyodrcarbons (VH6-10)	<0.1	-	-	1.5	
VPH	<0.1	-	-	1.5	
Extractable Hydrocarbons-					
EPH10-19[1]	**0.9**	-	-	0.5[2]	
EPH19-32[1]	**1**	-	-	0.5[2]	
Polychlorinated Biphenyls					
Total PCBs	-	<10	<10	-	-

Note:
Bold and underline indicates that concentrations exceed the CSR standards or CCME
* - Contaminated Sites Regulations (Yukon). Generic water standards for commercial land use.
** - Canadian Water Quality Guidelines for the Protection of Aquatic Life.
1- EPH10-19 is equivalent to EHw10-19
2- EHw10-19

The analytical results for the surface water sample collected from the pond water located within the Diesel Fuel Pump House (60) indicate that EPH10-19 (EHw10-19) concentrations marginally exceed the applicable CSR standards for extractable hydrocarbons. The results also indicate that the PCB concentrations in the two oil samples collected from the site were below the laboratory detection limit of 0.001%.

4.5 Mercury in the Gold Room

During the October 2001 site visit, as part of a more thorough inspection of the Gold Room (29), EBA completed an inspection of the sump located at the bottom end of the sluice box (Photo 20). Soil was removed from the bottom of the sump, and some liquid mercury was discovered. Further inspection of the sump indicated that it contained a drain. The direction of the drain could not be determined but it was thought that it might be connected to the large collection box that is situated outside the north exterior wall of the structure.

4.6 Drum Identification and Sampling Program

As part of the Phase 2 ESA 2001 fieldwork, Parks Canada requested that a drum identification and sampling program be completed on the Site, which was not completed until March 2002. There were two aspects to the program; the first aspect was to locate and label all of the 205 litre (45 gallon) drums scattered throughout the Site. Drum locations are shown on Figure 5. The second aspect was to sample approximately 15% to 20% of the drums to assist in determining the average contents of all of the drums that were partially full to full. The attached data tables found in Appendix F of this report list the drum identification number, location, drum colour, size, volume of contents, and assumed contents unless the drum was sampled.

There were a total of 172 drums identified and labelled on the site, and 66 of those drums contained some type of petroleum product consisting of grease, waste oil, gasoline, solvent, or tar. Eleven of the drums were sampled to determine the contents of which consisted of waste oil or gasoline. Selection of the drums for random sampling was based on whether the drum already had labelling identifying the contents or through visual observations such as drums that contained

grease or tar. Based on the field observations and random sampling the following Table 4.6 lists the assumed contents, number of drums, approximate volume, and other pertinent information.

Table 4.6
Assumed Contents, Number of Drums, Approximate Volume, and Pertinent Information

Contents	Number of Drums	Approx. Volume (L)	Comments
Grease	12	2460	Most of the drums that contained some type of grease had a full removable lid.
Waste Oil	41	6684	Some of the drums that were situated in the open contained water as well as waste oil. Approximately 10% of the volume is assumed to be water.
Gasoline	10	1586	Most of the drums were situated in the open and contained water as well as gasoline. Approximately 33% of the volume is assumed to be water.
Solvent	1	205	The drum was situated near the Diesel Fuel Pump House (60) and the Cat Repair Shop (8).
Tar	2	410	There was obvious product staining on the exterior of the drums.

5.0 DISCUSSION

5.1 Phase 1 ESA - Areas of Potential Environmental Concern

After reviewing the Phase 1 ESA information, interviews, and completing the site visits, there were various areas identified as areas of potential environmental concern (APEC), requiring some Phase 2 ESA work. The APECs are listed below and shown on Figure 6.

- **APEC 1:** Hydrocarbon staining located throughout the Blacksmith Shop (1) and Machine Shop (2).
- **APEC 2:** Hydrocarbon staining on the ground floor in the southern portion of the Tin Shop (4).
- **APEC 3:** Hydrocarbon staining located throughout the Diesel Fuel Pump House (60).
- **APEC 4:** Liquid mercury that may be present in the Gold Room (29) building and the collection box located along the northern exterior wall of the building.
- **APEC 5:** Asbestos insulated piping associated with the boiler system in the Mess Hall and Bunkhouse (22).
- **APEC 6:** The abandoned USTs and feedlines associated with the Fuel Pump Island (10).
- **APEC 7:** Noticeable hydrocarbon staining associated with the leaking drums located in the Open Storage (34).
- **APEC 8:** Noticeable hydrocarbon staining associated with leaking drums that are situated on the adjacent grounds north of the Gasoline Storage Warehouse (42).
- **APEC 9:** Noticeable hydrocarbon staining located on the wooden floor planking located in the Electrical Workshop (38).
- **APEC 10:** Miscellaneous waste items from the workshops that were disposed of in the Bear Creek Bone Yard (95) located southwest of the Tailings Pond near the

entrance to the Bear Creek Valley.

- **APEC 11:** Location of the old transformers located in the Parks Canada Bone Yard (96) located behind building #33. The hydrocarbon product noticed on the surface could also be at depth beneath the transformers.
- **APEC 12:** There could possibly be an UST associated with the vent pipe located along the northern exterior wall of the VIP Guest House (11).
- **APEC 13:** There were various cables located throughout the site. It was noted that in the past PCB containing oil was use as a rust inhibitor on cables. The cables identified on site should be checked for possible PCB concentrations.
- **APEC 14:** All of the unknown and known chemicals and petroleum products that are in metal and glass containers that were identified in various structures on the Site. This includes the mercury vapour tubes identified in the Engineering Office (28).
- **APEC 15:** All of the 205 litre (45 gallon) drums located throughout the site, which were suspected to contain various hydrocarbon products such grease, lubricating oils, waste oils, and fuels.
- **APEC 16:** Heating oil ASTs associated with various structures that are presently being used.

5.2 Phase 2 ESA – Fieldwork

Some of the Phase 2 ESA work was completed during the October 2001 site visit. Soil samples were collected from surface locations associated with APECs 1, 2 and 3. One water sample was collected from the pond water associated with APEC 3. Both soil and water samples were analyzed for petroleum hydrocarbons and the analytical results confirmed that there were hydrocarbon concentrations exceeding the applicable regulatory guidelines and standards. Soil samples from APEC 1 and 2 were also analyzed for metals and the analytical results confirmed that there were metal concentration exceedances associated with APEC 1.

Oil samples were collected from two pieces of electrical equipment, a transformer and a transformer switch associated with APEC 12 (transformer shed (48) and mobile electrical shed (45)). The analytical results confirmed that there were no PCBs present in the transformer oil contained within the two pieces of equipment.

Liquid mercury was recovered from the sump located at the end of the sluice box that was located inside the Gold Room (29). There might be liquid mercury in the drain that is associated with the sump.

Field testing was completed on the various products that were collected from selected drums. The products samples collected from the drums were identified as being waste oil, lubricating oil, and gasoline.

5.3 CCME National Classification System (NCS)

The CCME National Classification System (NCS) is a method for evaluating contaminated sites according to their current or potential adverse impact on human health and the environment. It was developed to establish a scientifically defensible system for comparable assessment of contaminated sites across Canada. At the requested of Parks Canada, this system was used to assess the level of risk associated with the contaminants observed within soil and water from the Site. The NCS uses known site conditions and contamination factors, and assigns them points based on a defined numerical scale. Some interpretation is required, and estimates are permissible. The following information was used to determine the classification of the site:

1. Concentrations from the field sampling and lab-testing program.
2. Distances to water bodies and the type of adjacent land use.

The NCS scoring sheets are included in Appendix G. As indicated by the NCS scoring sheets, the Site received a NCS score of 59. Accordingly, the Site receives a risk rating of Class 2 (medium risk potential) where further action is likely required. The NCS classification is appropriate for this Site, as further assessment and restoration work is expected to be recommended for some of the individual areas of potential concern.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Evidence of potential environmental contamination was discovered during the Phase 1 environmental assessment work for the Site. Various locations previously identified as APECs could possibly have petroleum hydrocarbon, metal, asbestos, or PCB contamination. Further subsurface and surface investigative work will be required to determine whether or not there are contaminant concentrations exceeding the applicably regulatory guidelines and standards.

Evidence of actual environmental contamination was discovered during the Phase 2 environmental assessment work for the Site. Petroleum hydrocarbon and metal contamination

exceeding the applicable regulatory guidelines and standards was detected in the surficial soils associated with the Blacksmith Shop (1), Machine Shop (2), Tin Shop (4), and the Diesel Fuel Pump House (60).

EBA has listed the following recommendations based on the findings of the Phase 1 and Phase 2 ESA in relation to each APEC identified on the site.

- **APEC 1:** Two soil samples have already been collected from the ground surface inside the Blacksmith Shop (1) and Machine Shop (2). Additional soil samples should be collected for laboratory analyses from other surface locations within the structures and also from the subsurface to assist in determining the extent of vertical migration.
- **APEC 2:** One soil sample was already collected from the ground surface inside the rear portion of the Tin Shop (4). Additional soil samples should be collected for laboratory analyses from the surrounding area and from the subsurface to assist in determining the extent of lateral and vertical migration.
- **APEC 3:** Two soil samples and one water sample have already been collected from the ground surface inside and outside of the Diesel Fuel Pump House (60). Additional soil samples should be collected for laboratory analyses from the surrounding area and subsurface inside and outside to assist in determining the extent of lateral and vertical migration.
- **APEC 4:** Liquid mercury was discovered in the sluice box sump inside the Gold Room (29). Further inspection of the sump drain and outside collection box should be completed to determine if liquid mercury is present.
- **APEC 5:** The boiler piping in the Mess Hall and Bunkhouse (22) might be insulated with asbestos. An inspection of the piping should be completed to determine if asbestos is present.
- **APEC 6:** There are USTs associated with the Fuel Pump Island (10). A subsurface investigation should be complete in the vicinity of the USTs to determine if there is hydrocarbon contamination within the soil or groundwater resulting from leaking USTs or feedlines.
- **APEC 7:** There was noticeable hydrocarbon staining beneath the drums located within the Open Storage (34). Further investigation should be completed to determine the concentrations near the surface and if there is hydrocarbon contamination within the subsurface.
- **APEC 8:** There was noticeable hydrocarbon staining on the ground beneath the drums located near the Gasoline Storage Warehouse (42). Further investigation of the near surface soils should be completed to determine the concentrations near the surface and if there is hydrocarbon contamination within the subsurface.
- **APEC 9:** There was noticeable hydrocarbon staining within the wooden floor planking inside Electrical Workshop (38). The ground surface beneath the structure should be investigated for hydrocarbon staining, which might include collecting soil samples for laboratory analyses.

- **APEC 10:** There were miscellaneous waste items from the workshops that were disposed of in the Bear Creek Bone Yard (95). A visual inspection was completed without moving any material. A more thorough visual inspection of this area for hazardous products should be completed.
- **APEC 11:** There was noticeable hydrocarbon staining associated with the old transformer area of the Parks Canada Bone Yard (96). Additional investigative work should be completed in the area to determine the vertical extent of the hydrocarbon staining and whether or not there are PCBs associated with the hydrocarbon product.
- **APEC 12:** There is the possibility that a heating fuel UST is buried next to the VIP Guest House (11). Further subsurface investigative work should be completed in this area for possible hydrocarbon contamination.
- **APEC 13:** There were various cables located throughout the site. These items should be inspected for lubricating products that may have contained PCBs.
- **APEC 14:** There were various chemicals and petroleum products in both glass and metal containers. Those products regulated as special waste should be disposed of accordingly.
- **APEC 15:** There were heating oil ASTs located on the site that are being used. Some of the ASTs are supported by wooden stands, which should be replaced with metal stands supported by concrete pads. The subsurface soils located beneath the ASTs should also be investigated for hydrocarbon contamination.
- **APEC 16:** There were numerous 205 litre (45 gallon) drums located throughout the site. The majority of them were empty but some of them contained products such as grease, waste oil, gasoline, solvent, and tar. Many of the drums have leaked or are leaking. A drum cleanup and product disposal program should be developed.

7.0 LIMITATIONS

Conclusions and recommendations presented in this report are based on the environmental assessment as described in the previous sections. This report has been prepared for the exclusive use of Parks Canada for the evaluation of Bear Creek Complex near Dawson City, Yukon. It has been prepared in accordance with generally accepted geo–environmental practices. For further limitations regarding the use of this report, reference should be made to the EBA Environmental Report - General Conditions attached, which form a part of this report.

8.0 CLOSURE

EBA trusts this report meets your present requirements, and we would be pleased to assist you with any future assessment, restoration, and/or development work planned for the Site. If you have questions or concerns, please do not hesitate to call the undersigned.

Respectfully submitted,
EBA Engineering Consultants Ltd.

Reviewed by,

Chadwyck P. Cowan, E.I.T.
Junior Environmental Engineer
(Direct Line: (867) 668-2071, ext.29)
(e-mail:ccowan@eba.ca)

Donald J. Wilson, B.Sc.
Senior Environmental Scientist
(Direct Line: (867) 668-2071, ext. 23)
(e-mail: dwilson@eba.ca)

CPC/dw

\\Ibm1_ccowan\0201 CPC\Projects\2001\01-15178002 Bear Creek Compound\Documentation\15178002 Phase 1 & 2 ESA draft 04 JRT copy to Parks.doc

FIGURES

PHOTOGRAPHS

APPENDIX A

Land Title Information

APPENDIX B

PCB Historical Documentation

APPENDIX C

Mercury Historical Documentation

APPENDIX D

Miscellaneous Environmental Items Historic Documentation

APPENDIX E

ALS Environmental Analytical Report

APPENDIX F

Drum Identification and Sampling Data Tables

APPENDIX G

CCME National Classification System (NCS) Scoring Sheets