BC 39

Environmental Assessment, Casino Mine/Camp, Yukon Region – Final Report

Prepared for:

Indian and Northern Affairs Canada
Contaminated Sites Office
345 – 300 Main Street
Whitehorse, Yukon

by

Consulting Limited
Environmental Solutions
Unit B3
5109 Harvester Road
Burlington, ON

March, 2000

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(Call Up No. 98-6195-04)

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March, 2000

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1. Executive Summary

MDA Consulting, in association with Arctic Environmental Services, was retained by the Department of Indian and Northern Affairs, Waste Management Program, Yukon Region, to perform a combined Phase 1 and 2 Environmental Site Assessment of the abandoned Casino Mine Camp (CMC). The CMC is located approximately 62° 44' 17" N and 138° 49' 34" W. The purpose of this assessment is to conduct a detailed site inspection, inventory the site, test for possible contamination, and provide recommendations and documentation regarding remediation plans and costs.

Upon approval of the undertaking, MDA initiated a preliminary review of files that were retained by the INAC-Whitehorse and were part of the initial environmental evaluation process. Discussions were conducted with members of the INAC Contaminants/Waste Program, Water Resources Division, and the Environment Directorate Office Manager. Associated with the preliminary site assessment was reconnaissance planning, to determine the best possible method to reach the CMC location.

A site visit/inspection of the abandoned placer mine was completed, to confirm any concerns or issues that may have been detected during the preliminary review as well as to undertake the detailed site assessment. Samples of water and soil were collected during the site inspection for further analysis. Other information was documented including, equipment, buildings and structures, stained soils, waste disposal, tanks and drums, debris, and abandoned transformers.

The facilities located at the airstrip were also inspected. In addition, the main camp site conditions were also observed. In both cases, abandoned equipment, buildings and structures, tanks and drums, stained soil, debris were noted. In addition, the waste disposal site, consisting of an incinerator, received only a cursory examination due to poor weather conditions.

Following the site inspection, a detailed file review was conducted. This files consisted of completed reports, monitoring data and correspondence provided by the INAC. These reports offered information pertaining to water quality, biophysical assessments, which included terrain features, vegetation characteristics, wildlife occurrences, water chemistry, sediment chemistry, and precipitation. It is important to note that this site provides good habitat for moose, caribou, black and grizzly bears, wolves, foxes etc.

Surface water sampling was undertaken for both the Canadian and Casino Creeks as well as from a drainage pipe in the vicinity of the camp. Stained soil samples from selected sites at the abandoned placer mine camp and near the tank farm at the airstrip were

collected to determine total extractable oil and hydrocarbon concentrations. Several stained soil locations were identified at the main camp, but were not sampled.

The Casino Mine Complex consists of five main areas. As noted above, the three sub-sites investigated as part of this investigation included:

- the abandoned placer mine on the upper reaches of Brittania Creek;
- the airstrip which includes laboratory trailers, cores storage sheds and tank farm; and,
- the main camp with numerous buildings and trailers.

In addition, this site includes the main copper deposit exploration site above the airstrip as well as an active placer mine on Canadian Creek. The former was not investigated as it could not be seen from the air at the time of the visit due to poor visibility and had not been referred to in the documents reviewed as part of the preliminary file review. The active placer mine was also not investigated as it was thought to be outside of the site at the time of the visit and personnel were not authorized to inspect active sites.

The abandoned placer mine contains a small fleet of abandoned equipment, one major building and two smaller buildings, a tank farm as well as a debris field containing drums and tanks as well as other mining related equipment. The largest building is a maintenance shed and adjacent generator shed. Both contain stained and hydrocarbon contaminated soils. In addition to drums containing fuel and waste oil near the maintenance building, there are three transformers. Tow of the transformers are labeled as containing PCBs < 1 ppm, while the third, a very old transformer, could not be assessed.

The airstrip includes a rubber tired loader which is leaking oil. Most notable at this site is the large tank farm within an earthen berm within which hydrocarbon contaminated soils have been confirmed. The volume of contaminated soils needs to be determined. This location also includes several sealed drums of AvGAS, several laboratory trailers and a core storage complex.

The main camp consists of several cabins, several accommodation and office trailers, a kitchen, dining and washing complex, maintenance and storage buildings and a generator shed. In addition there is an incinerator facility. Numerous small oil tanks and drums are located in association with the trailers for heating oil and waste oil storage. Hydrocarbon contaminated soils may well exist at each of these locations. Stained soils were clearly visible on the floor of the maintenance building and of the generator shed. The degree and extent of these contaminated soils could not be determined. Debris has been scattered about the camp, likely as a result of vandalism. Serious soil erosion exists in the camp area due to the re-contouring of the site.

Based upon a review of the files available from INAC, compared to the 1999 water quality data, it can be concluded that surface water quality has improved since 1993 in Brittania and Casino Creeks. Presently, there is no indication of total metals concentrations exceeding CCME guidelines in these streams.
The main potential contaminants throughout the Casino Mine site include:

- Hydrocarbon stained soils occur at the placer mine generator facility and within the maintenance shed, at the tank farm as well as beneath rubber tired loader at the airstrip, and near the generator shed and other locations at the main camp;
- Numerous open drums and other containers containing mixtures of fuels and oils in the vicinity of the camp and at the abandoned placer mine site as well as sealed drums with aviation fuel and others with heating oil at the airstrip;
- At least two transformers that may contain PCBs (placarded < 1 ppm) at the abandoned placer mine site;
- Two large propane tanks at the abandoned placer mine site, both containing some quantity of propane;
- Single drum with unknown contents at the camp; and,
- Various chemicals, paints, heating oil, and lubricants improperly stored at the placer mine and at the camp.

The major site hazards at the site include:

- Existing contaminated soil due to hydrocarbons and risk of further contamination due to ongoing leaks or vandalism as well as ongoing migration of the hydrocarbons in the subsurface;
- Potential for further contamination from unsealed drums due to further spillage, or leakage;
- Asbestos board, lead acid batteries, paints and other miscellaneous liquids;
- Potential for CFCs to escape from refrigeration units;
- Miscellaneous metal debris posing risks to animals and humans;
- Possibility of a refuse dump in the vicinity of the incinerator;
- Serious erosion problems, resulting from disturbed vegetation due to exploration activities, placer mining and road construction; and,
- Possibility of increased turbidity of Canadian Creek, as a result of erosion.

Recommended Actions

Due to the conditions at the time of the site visit, and the amount of snow cover, MDA had difficulty producing a complete site assessment for this location. In particular, the main exploration site could not be accessed due to poor visibility and the presence of snow cover would have made any assessment difficult. Additionally, poor conditions and snow cover at the abandoned placer mine, the airstrip and the camp limited time on the ground and the extent to which site inspections could be undertaken including sampling of stained soil and debris identification. Within this context, we offer two alternatives to continue. The first alternative would be a continued and finalized assessment, which

would provide a more thorough delineation of the hydrocarbon contaminated areas including volume estimates as well as an assessment of the main exploration area and the effect of these activities on the terrestrial ecology and options for mitigation. The cost of this task, which will complete the Phase 2 Environmental Site Assessment, is estimated at $33,600.00

The second alternative, in addition to achieving the objectives of the first alternative, would include:

a) central assembly of wastes (i.e. full drums moved to a central point for eventual removal or on-site destruction, transfer of contents of open drums to re-sealable drums and central storage or disposal etc.);
b) tidying debris in the camp area and elimination of the sources of ongoing soil contamination (e.g. draining of leaking tanks and centralized storage or disposal as noted above etc.);
c) eliminating sources of soil contamination from hydrocarbons by draining equipment tanks and crankcases of fuel, oil etc. and place in sealed drums and store centrally or dispose on site;
d) removal and secure storage of all asbestos materials for eventual disposal;
e) over-packing and removal of < 1 ppm PCB transformers
f) appropriate over-packing of paints and other liquids and solvents, lead acid batteries and removal to appropriate disposal or storage area; and,
g) safe and proper recovery of CFC gases from coolers and fridges.

We also recommend that due to the difficulties that will be encountered, experimental revegetation plots using different techniques and grasses be established as part of this phase to assess the feasibility of enhancing the re-colonization of native grass. The work at this stage will be undertaken using test plots and plugging in native and natural grasses with fertilizers and other soil amendments to assess future re-vegetation strategies to control erosion and restore the site vegetation.

The cost of Alternative 2 (which includes the cost of Alternative 1) is estimated to be $87,000.00

These estimates are both considered to be preliminary depending on further discussion with INAC regarding the extent of the work to be conducted and the disposal options for some of the hazardous material.

2. Background

The Department of Indian and Northern Affairs, Waste Management Program, Yukon Region asked MDA to undertake an environmental assessment of the abandoned Casino Mine Camp (CMC) as a call up under the above named standing offer. This report is provided in response to this request.

The Casino deposit is located near the northwest end of the Dawson Range. It lies within an unglaciated area which has allowed the development of a large leached cap overlying a thick zone of supergene enrichment and a hypogene zone which is still open to depth. Many of the creeks draining the area are moderately rich in placer gold (Yukon Minfile #115J 028).

The CMC is located in the Beaver Creek District at 62° 44' 17"N and 138° 49' 34"W. The earliest reported activity in the area was gold placer mining on Canadian Creek in 1911. Tungsten and nickel claims were first staked in 1916. Casino Silver restaked the site in 1965. Casino performed soil sampling and EM surveys in 1966 and 1967. These surveys refocused the potential of the site from silver-lead to the open pit potential for copper and molybdenum.

In late 1967 the Brynelson Group acquired control of Casino and performed grid soil sampling and mapping. Later, Bramalea Resources Ltd. continued exploration with detailed mapping and rotary drilling at 84 holes. Despite a test mill being mobilized to the site, all work stopped in August,1970. Additional drilling occurred (7 holes) in 1973.

Although recognized as one of the largest, highest grade bulk tonnage copper-gold deposits in North America, the Casino property remained inactive throughout the 1970s and early 1980s due to low copper prices. In 1985 the leached cap portion of the property was leased by Archer Cathro & Associates and geochemical surveys and metallurgical testing was conducted with 6018 m of bulldozer trenching directed toward heap leach gold potential. Subsequently, Big Creek Resources evaluated the gold potential of the site with 21 large diameter diamond drill holes in 1992. In 1993, Pacific Sentinel commenced a $7.2 million diamond drilling program (127 holes) and completed an environmental baseline survey. An additional 84 holes were drilled in 1994 for testing plus 34 geotechnical holes.

The property has proven reserves of 380 million tonnes grading 0.3% copper, 0.34 g/t gold and 0.04% molybdenum. The deposit is open laterally and to depth and total reserves are believed to exceed 1 billion tonnes, adequate for 27 years of open pit mining at a production rate of 100,000 tonnes per day (Yukon Minfile #115J 028).

Vehicular access is via the 270 km Casino Trail which has been upgraded to an all weather road for the first 130 km. A 15 km trail provides access up the Britannia Creek

valley from the Yukon River. A barge landing site is located on the Yukon River downstream of the confluence with Britannia Creek. There is a 760 m gravel airstrip on the site (Yukon Minfile #115J 028).

The site is reportedly abandoned with no activity over the past several years. The purpose of this project is to undertake a detailed site inspection to inventory the site, test for the extent of contamination, if any, and to document remediation plans and costs.

3. Preliminary Assessment

3.1. File Review

A preliminary review of the files retained by INAC-Whitehorse as part of the initial environmental evaluation process was undertaken at the INAC offices immediately upon receipt of approval to undertake the work. Specific items of these files were copied for detailed review at MDA's office and for use in the preparation of the final report. The CMC file was not extensive.

3.2. Interviews

Informal discussions were conducted with Mr. Brett Hartshorne and Mr. Pat Roach of INAC, Contaminants/Waste Program, Yukon. Informal information sessions were also conducted with Ms. C. Kormos, Office Manager, Environment Directorate, INAC as well as Mr. H.F. McAlpine, Mr. G. Whitley and Mr. Dave Shearstone, all of the Water Resources Division, INAC-YK. These discussions generally amounted to background information regarding the site in general and its history.

3.3. Reconnaissance Planning

While 4x4 vehicle access may be possible for the site, the remoteness, time of year of the site visit and the ongoing concern regarding snow and poor weather mandated the use of a helicopter to access the site. To allow for sufficient fuel to work at the site, a fuel drum was driven to the air-strip at Minto and the helicopter was refuelled at that location. Upon completion of the site inspection, the fuel drum was returned to the helicopter base at Carmacks.

3.4. First Nations Communications

First nations communications were not undertaken as part of this site assessment.

Figure 1: Location map for Casino Mine/Camp Site, Yukon

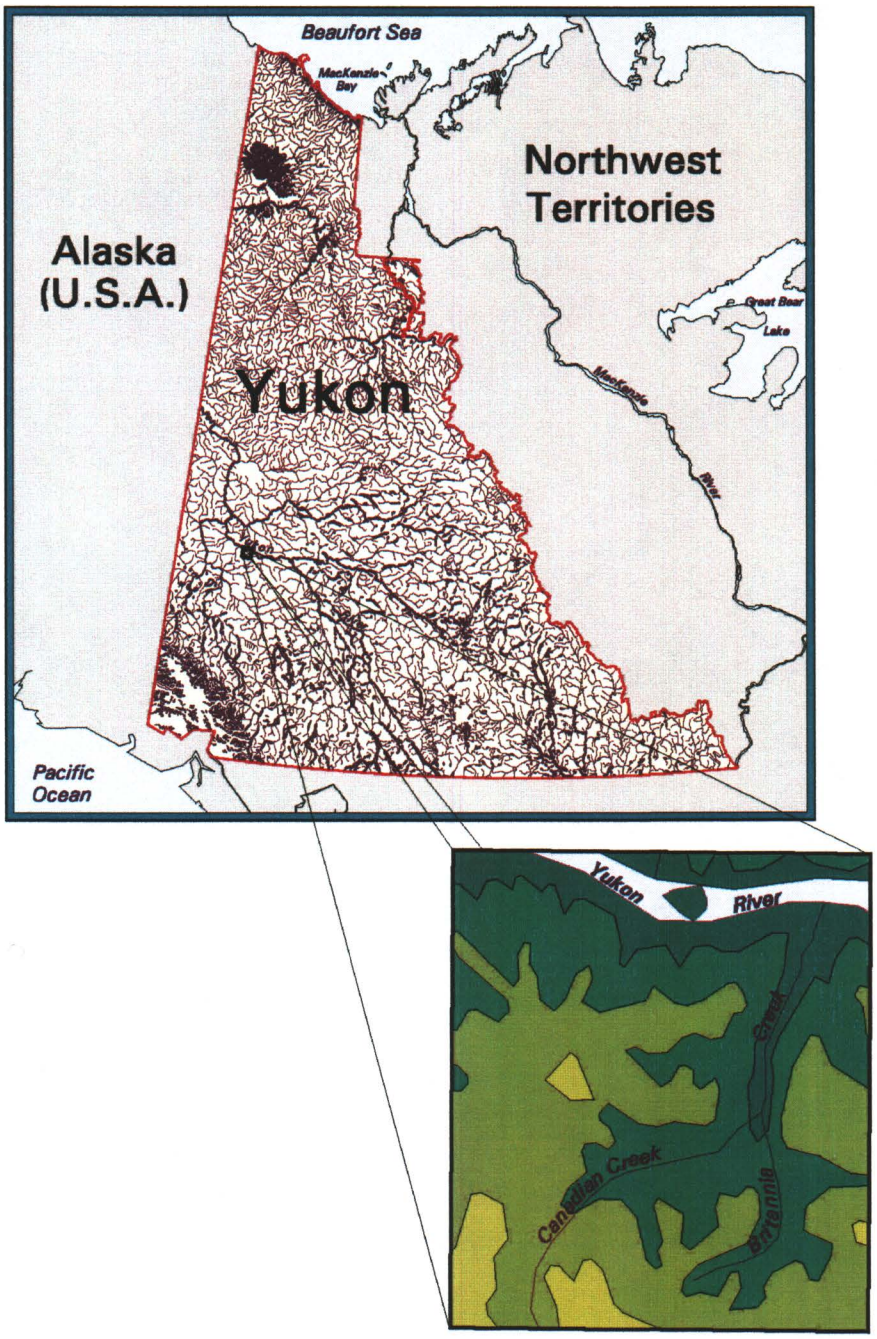
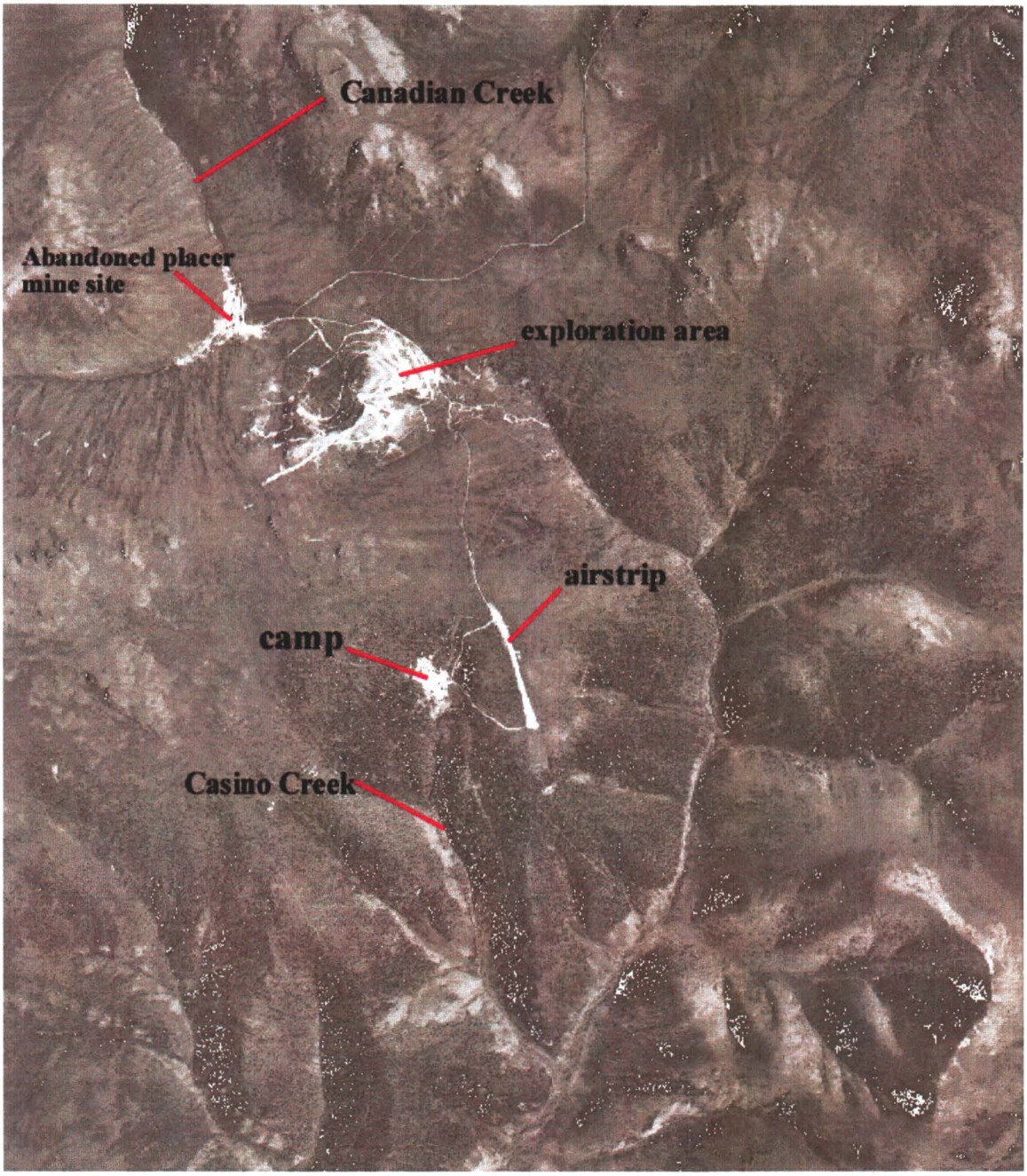


Figure 2: 1989 aerial photograph of Casino mine/camp showing placer mining area, drilling and exploration area, airstrip and camp



4. Site Inspection

4.1. Outline of Inspection Activities

The site inspection is used to visually corroborate indications of possible hazardous materials and conditions uncovered during the review of historical information and interviews. Visual evidence of potential environmental concerns includes, but is not limited to, the following:

- Topography, surface water and drainage;
- Natural habitats, resources and proximity to natural waterways;
- Physical infrastructure;
- Preliminary identification of physical hazards;
- Soil disturbances such as soil removal, filling, tilling, and grading;
- Barren, stained or discoloured surface conditions, including signs of dead and stressed vegetation;
- Waste rock deposits and tailings impoundments;
- Underground and above ground storage tanks and supply lines;
- Chemical, material and waste storage or disposal areas including sumps, pits, ponds and landfills;
- Evidence of groundwater wells, cisterns, cess pools, or septic tanks;
- Electrical transformers, capacitors and other utilities;
- Evidence of spills or surface water discharge;
- Abnormal odours from on-site or off-site sources;

Pertinent observations are photographed and located for our own records at the time of the field reconnaissance. During the site inspection, information regarding the presence of PCB and asbestos-containing materials will be gathered in a preliminary manner only.

The initial site visit to Casino Mine/Camp was attempted on October 2, 1999. With low, cloud we departed Carmacks at 10:20 AM, arriving at Minto at 11:00 AM. We departed Minto at 11:15 AM flying directly to Casino and were forced to turn around after encountering a cloud bank at 3000'. We had to avoid the Yukon River valley due to low-lying cloud in the valley.

On October 3, 1999, the regional weather was somewhat better after morning fog cleared and we again departed Carmacks for Casino around 10:30 AM. We carried a full load of fuel in order to proceed directly across country to Casino without a stop at Minto. We were eventually forced to fly at low altitude along the Yukon River due to fog and freezing conditions in the uplands. Following the Yukon River, the helicopter proceeded up the Brittania Creek valley at near tree top level and found the placer mine site associated with the Casino Mine. This site is located on the headwaters of the Canadian

Creek. At the time of arrival (11:50 AM) and throughout the site inspection it was snowing and approximately 20 to 30 cm of snow overlay the site. The abandoned placer mine site is located at 62° 44' 38" N and 138° 51' 01" W.

After an extensive fly over of the site (shown in Photograph 1) the helicopter landed at the placer mine site. The location of this site relative to the mine, airstrip and camp is best illustrated in the 1989 air photo copied in Figure 2. Due to the poor weather conditions at the time, it was determined that the inspection needed to be conducted as quickly as possible. Consequently, with the assistance of the pilot, three parties were established. One party inspected the equipment storage and tank farm area and the maintenance shed. The second field party inspected the placer mining area and debris that had been sited from the air on the west side of Canadian Creek, opposite the maintenance shed. The third party proceeded to collect water samples from upstream and downstream of the actual mining area on Canadian Creek. Sampling locations for CMC are provided in Table 1.

Photograph 1: Aerial overview of the tank farm and equipment storage area of the placer mining site on the headwaters of Canadian Creek at Casino mine/camp site. The quality of the photograph is limited by the heavy snow falling at the time of the visit.

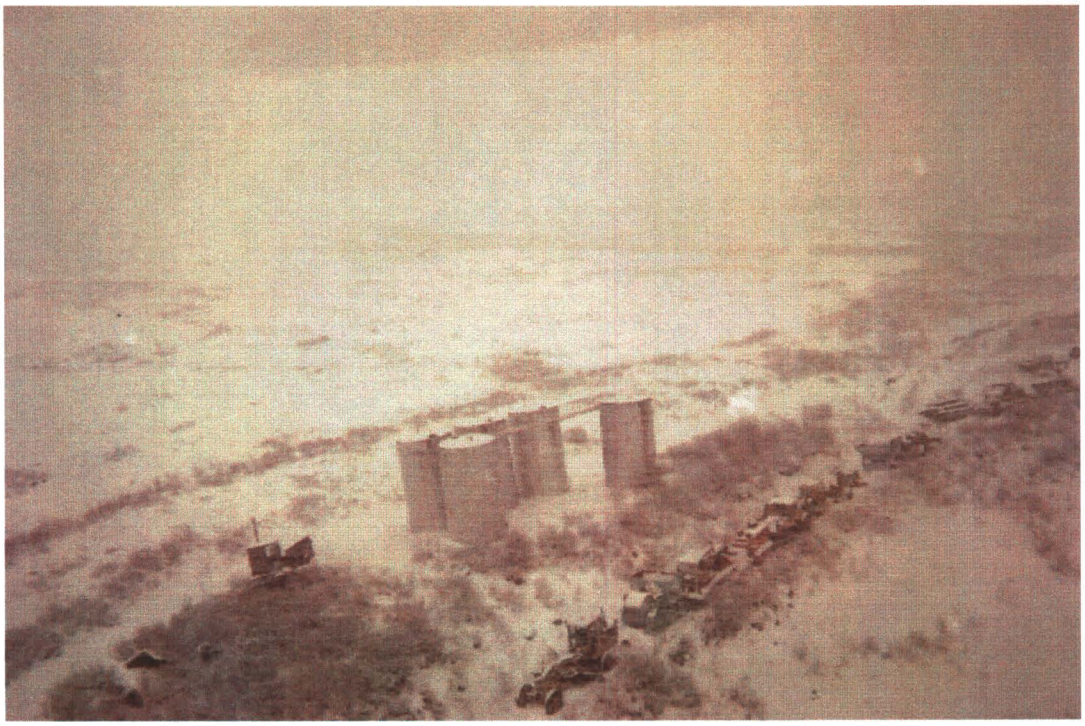


Table 1: List of sample locations for Casino Mine/Camp, October, 1999

Field Sample ID	Sample Description	Latitude / Longitude	Sample Matrix	Date of Sample	Total Metals	Total Extractable Hydrocarbons	Dissolved Metals
CM-W7 – US	Canadian Creek- up-stream placer mine	62° 44' 47"N 138° 50' 59"W	Water	Oct. 3/99	◆		◆
CM-CAMP-DS1	Casino Cr. – down stream of camp	(No GPS due to valley location)	Water	Oct. 3/99	◆		
CM-CAMP-DS2	Casino Cr. – down stream of camp	(No GPS due to valley location)	Water	Oct. 3/99	◆		
CM-CAMP-PIPE-1	Drain pipe from collapsed adit near camp	(No GPS due to valley location)	Groundwater	Oct. 3/99	◆		◆
CM-CAMP-PIPE-2	Drain pipe from collapsed adit near camp	(No GPS due to valley location)	Groundwater	Oct. 3/99	◆		◆
Site 1, 0-15 cm	Maintenance shop floor at placer mining site	62° 44' 38"N 138° 51' 01"W	Soil	Oct. 3/99		◆	
Site 2, 0-15 cm	Generator floor adjacent to maintenance shed at placer mining site	62° 44' 38"N 138° 51' 01"W	Soil	Oct. 3/99		◆	
Airfield, Tank 3, 0-15 cm	Airstrip tank	62° 43' 28.3"N 138° 48' 38.0"W	Soil	Oct. 3/99		◆	
Airfield, Tank 2, 0-15 cm	Airstrip tank	62° 43' 28.3"N 138° 48' 38.0"W	Soil	Oct. 3/99		◆	
Airfield, Tank PSC, 0-15 cm	Airstrip tank	62° 43' 28.3"N 138° 48' 38.0"W	Soil	Oct. 3/99		◆	

Upon completion of the inspection at the placer mining site, we boarded the helicopter to find the airstrip and main camp. One field crew was set down at the airstrip to undertake the site inspection there. The helicopter and remainder of the field crew flew down the valley to the base camp to undertake the assessment there. Due to the steep sided valleys around the camp, it was not possible to obtain a GPS position at the campsite. At the camp, one field party was assigned to collect water samples while the other proceeded to check the camp buildings and site and document it. Due to near freezing temperatures and continuing snowfall, and thus the risk of ice build-up on the helicopter, the pilot was anxious to complete the work as quickly as possible. Detailed inspection of the site was made difficult by the presence of 20-30 cm of fresh snow.

The field crew departed the campsite at approximately 3:30 PM. The helicopter again landed at the airstrip to pick up that crew and proceeded to search the rest of the site for the actual mine/exploration site. Due to the existing snow cover and continuing snowfall limiting visibility and limiting flight above the tree line (no horizon reference), we were unable to locate other areas warranting inspection. We then proceeded down the Canadian Creek valley on the way back to the Yukon River valley.

Upstream of the confluence of the Canadian and Britannia Creeks we observed an active placer mining operation extending for several kilometres along Canadian Creek (see Photograph 2). The creek through and below this site was heavily affected at least by suspended solids and thus it was meaningless to collect a water sample on Canadian and Britannia Creeks above their confluence. Helicopter landing locations were also limited at this location. These samples had been planned in order to compare current water quality with historic measurements taken when the mine was active.

The helicopter proceeded to Minto to refuel. One team member drove the truck and empty fuel drum back to Carmacks. The crew arrived back at Carmacks at approximately 5 PM. While additional time would have been desirable for site inspection at Casino, the weather forecast was not indicating a major improvement over the next few days. As well, with the heavy snowfall that had been received added to that already on the ground, we concluded that further site inspection would produce limited results and resources would be better spent revisiting the site after snowmelt.

4.2. Field Sampling Methods

4.2.1. Water

Field measurements of water quality were determined on-site using a submersible Hydrolab metre.

Water samples for total metals were collected into 500 ml, pre-cleaned by Philip Analytical, nalgene bottles. These bottles were triple rinsed prior to filling. Dissolved metals samples were also collected in 500 ml bottles provided by Philip Analytical.

These bottles were cleaned in the laboratory and preserved with acid by the laboratory in advance, precluding the rinsing of these bottles prior to filling. The dissolved samples were filtered in the laboratory. All water samples were kept refrigerated during storage and shipment to the laboratory in Vancouver.

4.2.2. Soil

Stained and other soil samples were collected into zip-lock bags in the field. The severe weather conditions at the time of visitation to most of the sites forced the delay of analysis of the samples until we had returned to the base each night. Under these circumstances, and due to the fact that very few contaminated soils were identified in the field, all samples collected were transferred to pre-cleaned glass containers and submitted to the analytical laboratory for analysis.

4.3. Description of Site Conditions at Abandoned Placer Mining Site

4.3.1. Equipment

There is a small fleet of equipment stored here that has been used in the placer mining activities. Included are:

- 2 graders
- 1 tandem rock truck
- 1 rubber tired loader
- 3 dozers, complete
- 2 dozers, partially disassembled
- miscellaneous equipment including disassembled dozers, auxiliary diesel engines, pumps, compressors, grizzly, conveyor system, scrap steel

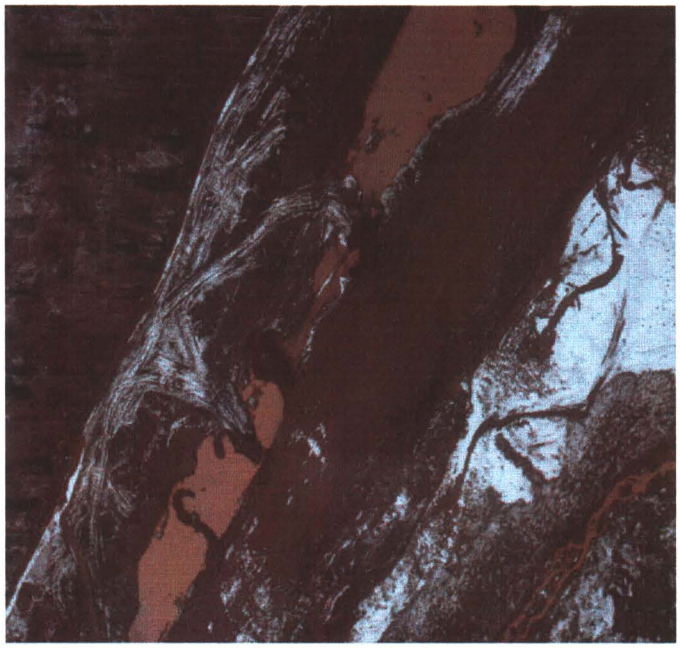
The majority of equipment is lined up on the roadway in the vicinity of the tank farm (see photographs 1 and 3). Some of the miscellaneous equipment is in the same general vicinity but remains scattered (see Photograph 4). The possibility exists for other debris to be located about the site but hidden from view due to the snow cover at the time of the inspection.

Each piece of equipment was not checked for fuel and oil leaks due to the extensive effort that would be required to check this under the snow cover. It is very possible that much of this equipment, due to its age, is leaking hydraulic and other oils. Fuel tanks were not checked to determine the potential for vandalism resulting in fuel oil spills.

4.3.2. Buildings and Structures

There are three buildings left on the placer mining site (Photograph 5). The main structure is the equipment maintenance shed with attached camp generator shed. The

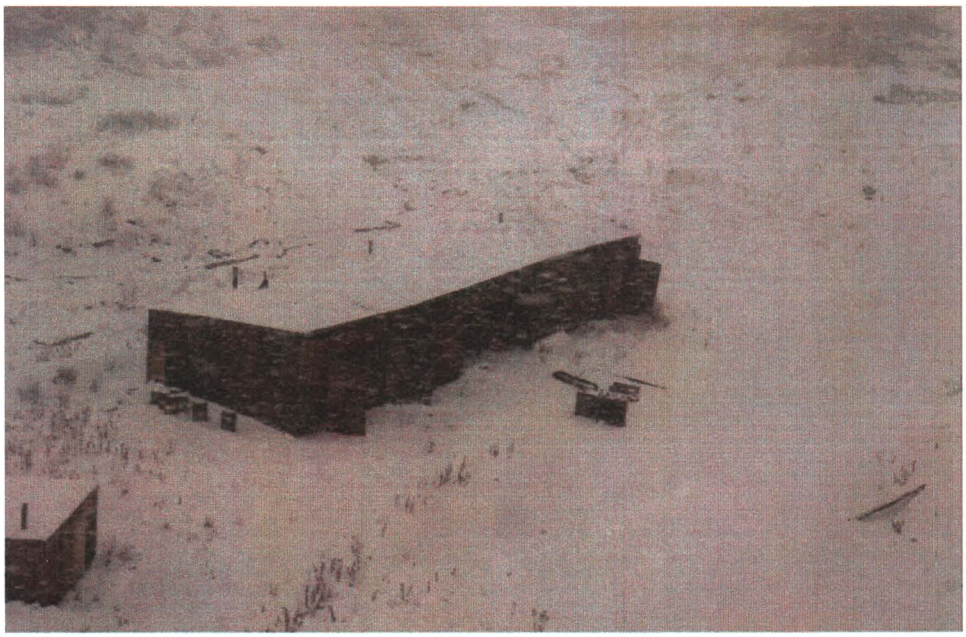
maintenance shed is starting to deteriorate and a section of the roof (see Photograph 6) is precariously perched and could be in danger of collapse as the weight of snow increases. The smaller building (to the left) is a cabin, which appears to be used periodically by transient personnel. The latter building is old but still in reasonably good condition, although the interior is untidy.



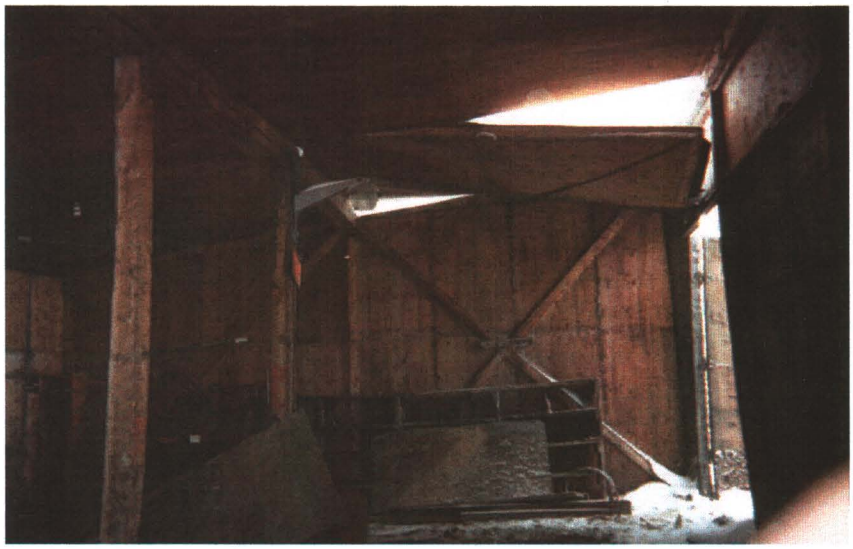
Photograph 2: Aerial view of active placer mining operation on Canadian Creek, downstream of Casino site and above confluence with Britannia Creek

Photograph 3: View of tank farm area and construction equipment stored on roadway in front of the tanks

Photograph 4: View toward maintenance shed with disassembled dozers in foreground and conveyor in the middle ground



Photograph 5: Frame maintenance shed with drums and transformers located at the "near" end of this shed and small cabin (to the left)



Photograph 6: Section of roof on maintenance shed that is in danger of collapse as weight of snow increases

A third, small frame building is located in the vicinity of the tank farm (see Photograph 1). This building, in a poor state of repair, appears to have been used for refueling or possibly for storage of flammable material.

4.3.3. Stained Soils

Without digging through the snow at the site of all areas with the potential to have or have had oil leaks, it was impossible to identify all potential stained soil areas. There is potential for hydrocarbon contamination around the maintenance shed, the tank farm, the equipment storage areas and several other areas where tanks and drums occur. At the tank farm, snow was moved at random locations to check the ground, but no staining was observed. Thus the only soil samples collected were from the packed earth floor of the maintenance/generator shed. Sample 1 was from one of the drive bays (Photographs 7a and 7b) and sample 2 was from the generator part of the building (Photograph 8).

A

Photograph 7a,b: Stained soil in service bay of maintenance building (location of Site 1 sample)

B

Photograph 8: Stained soil on floor of generator part of maintenance shed (Site 2 sample)

4.3.4. Waste Disposal

No waste disposal sites were identified at the abandoned placer mining area. The size of the camp shown at this location in the Waste Site Database (see below) would have required some domestic waste disposal facility. Our inability to find such a site was likely due to the snow cover.

4.3.5. Tanks and Drums

There are three large upright fuel tanks at the site. These are inter-connected by ground level piping. Open side man-holes (Photograph 9) permitted us to verify that these tanks were empty.

Two other large horizontal fuel tanks were located mid-way between the tank farm and the maintenance building (Photograph 10). Both of these tanks were confirmed to be empty. Also evident in Photograph 10 is a large horizontal propane tank. There were actually two of these on site although only one has been shown and both contained propane.

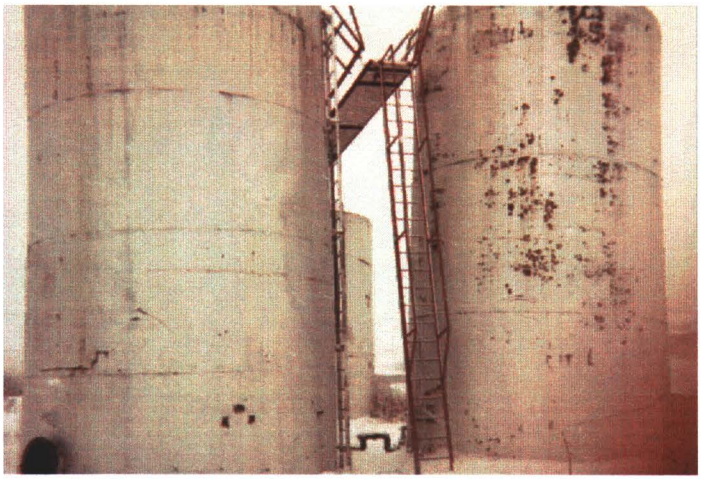
Photograph 11 shows four drums. These are located just behind the large, empty, horizontal fuel tanks shown in the previous photograph. Three of these drums were empty but one was unlabelled but full of an unknown liquid. This drum was secure and apparently not leaking.

Five drums are located on the west-side of the maintenance shed adjacent to where the generators were located (Photograph 12). Two of these were empty, one contained gasoline and the other two contained waste oil. Another drum, full but contents not identified, was located on the west side of Canadian Creek (i.e. opposite side to the maintenance shed) along with other containers with unspecified contents (Photograph 13).

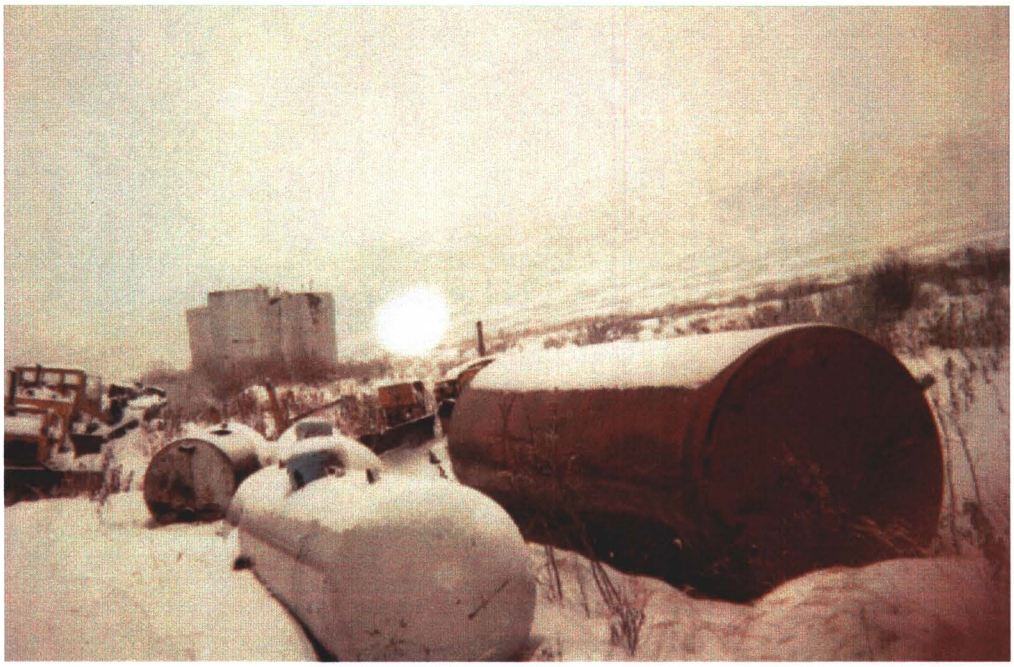
Numerous other drums, some crushed and partially buried, but all apparently empty were located about the site. A further inspection after snow melt would be required to located all of the crushed drums that are located around this site.

4.3.6. Debris

The general condition of the site would suggest that there was likely some quantity of debris at this location; however, much of it was hidden by the snow. Some of the obvious debris included steel decant pipes in the banks of settling ponds along the water course (Photograph 14), crushed drums, and buckets of soil samples on the opposite side of Canadian Creek to the maintenance shed (Photograph 13).



Photograph 9: Three vertical storage tanks on tank farm showing open manhole cover.

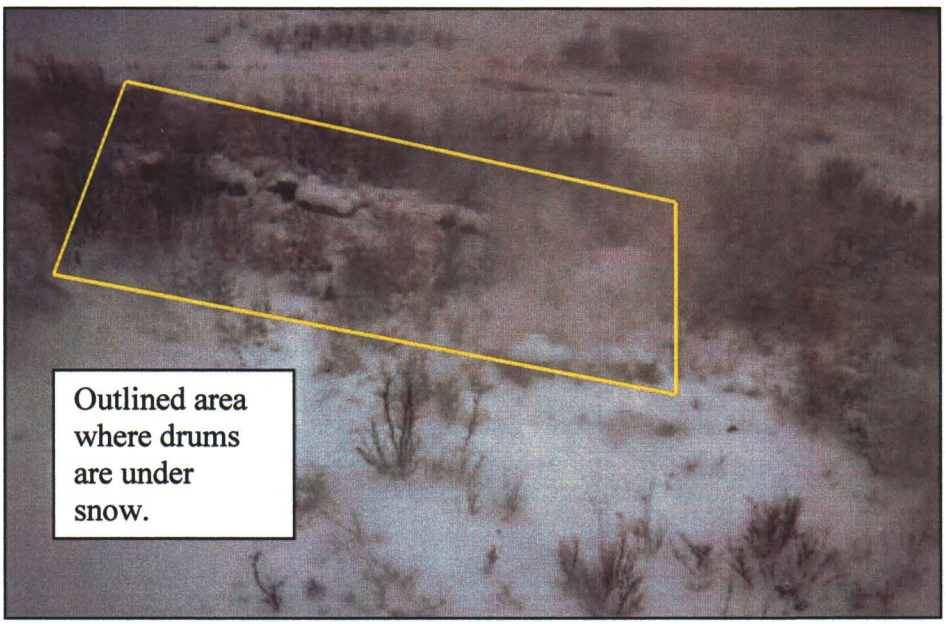


Photograph 10: Two smaller empty horizontal steel tanks and propane tank containing propane

The maintenance shed also contained quantities of old parts, buckets partially full of lubricants and bags of silica sand (Photographs 15 and 16). Also found in the maintenance shed was a small quantity of asbestos brake linings (Photograph 17).

Photograph 11: Drums, all empty but one, located in same area as tanks

Photograph 12: Five drums located adjacent to generator section of maintenance shed – one contained gas, two contained waste oil and two were empty plus two transformers



Photograph 13: ***Debris located on the west side of Canadian Creek, across from the maintenance shed***

Photograph 14: ***Steel decant pipes in constructed ponds along the water course***

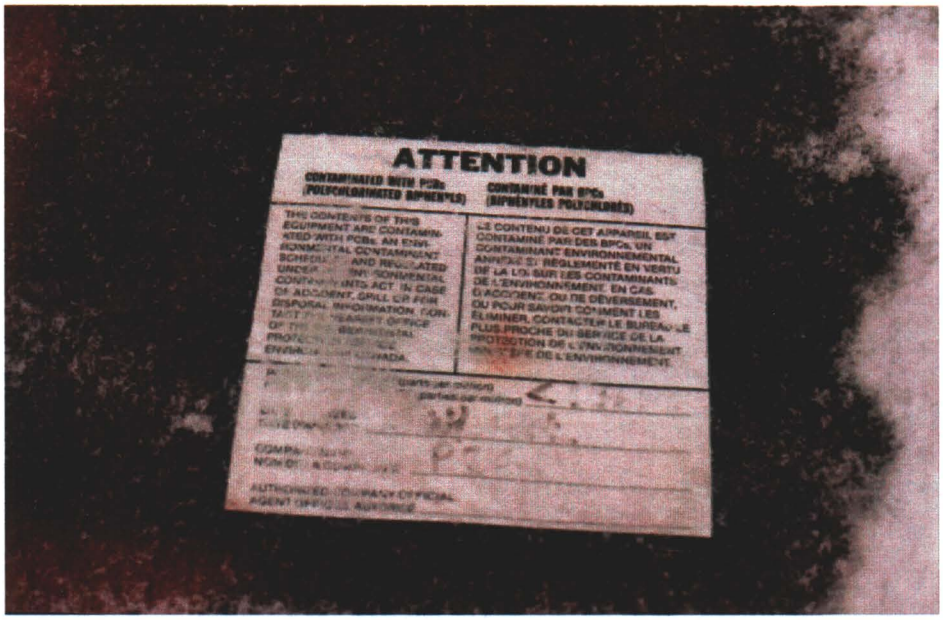
Photograph 15: Assorted debris in the maintenance shed including partially full pails of lubricants

Photograph 16: Bags of silica sand stored in maintenance building

Photograph 17: Asbestos brake pads stored in maintenance building.

4.3.7. Transformers

A total of three (3) transformers were located at the site. Two, shown in Photograph 12, are sitting outside of the maintenance/generator shed. Both of these transformers were placarded as having less than 1 ppm of PCBs (see Photograph 18). The third was just inside of maintenance shed, near the generator part of the building (Photograph 19). This transformer had a patent date of 1905 and appeared to be a sealed, cast iron unit. It is likely that this transformer precedes the use of PCBs but this should be confirmed.



Photograph 18: Placard on two transformers stating that PCBs have been tested and are less than 1 ppm

Photograph 19: Old cast iron case transformer inside maintenance shed

4.4. Description of Site Conditions at Airstrip

4.4.1. Equipment

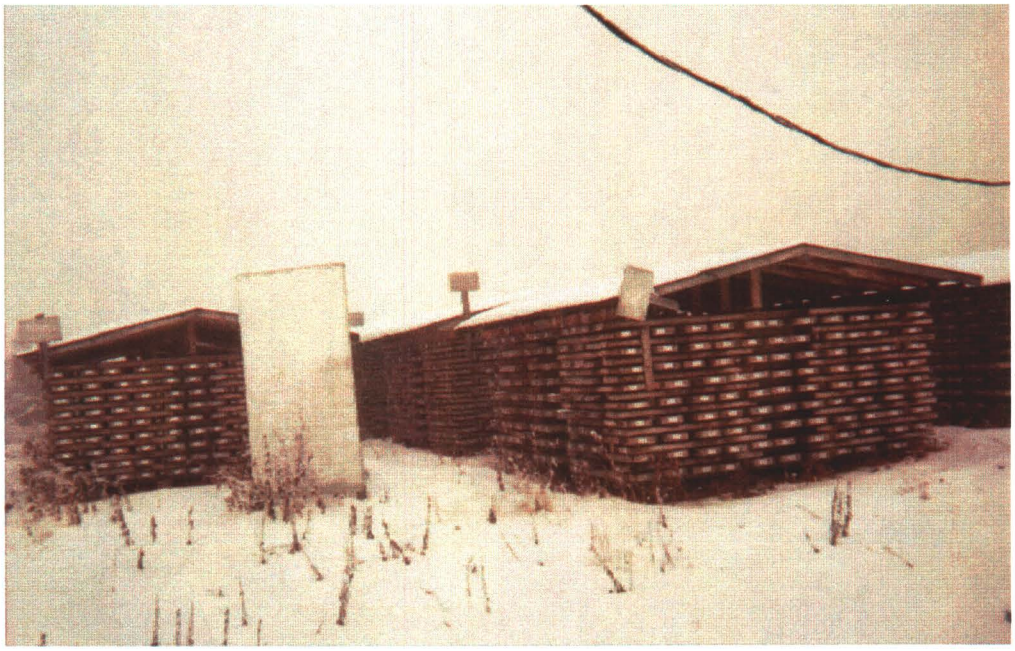
The only equipment at the airstrip at the Casino site was an older rubber tired loader shown in Photograph 20. This equipment is leaking oil and will be considered further in Section 4.4.3.

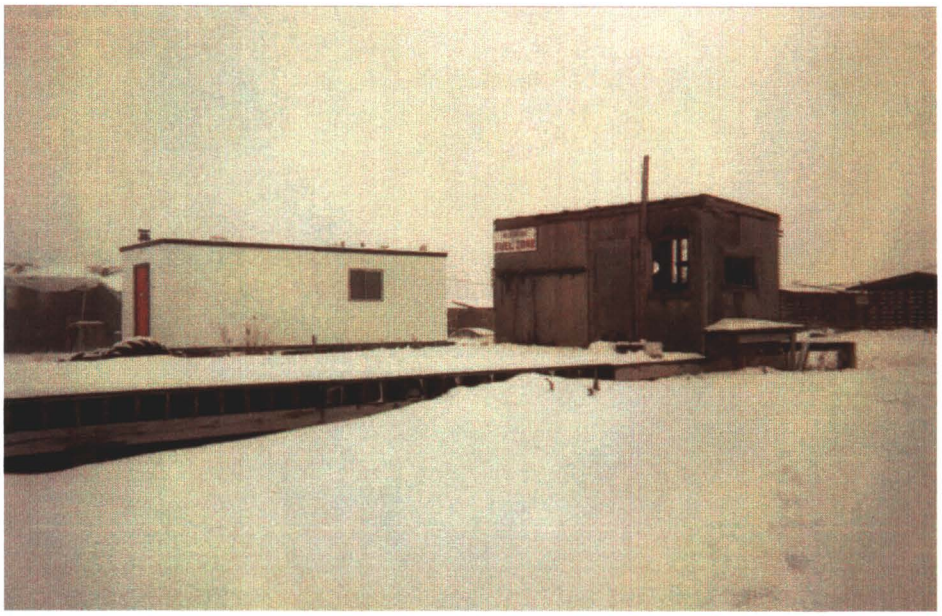
4.4.2. Buildings and Structures

There were over 20 covered core storage structures located at the airstrip. These are well constructed and in good condition as illustrated in Photograph 21. Nearby is a wooden explosives/fuel storage shed with an attached wooden ramp (Photograph 22) and a second small fuel shed near an oval above ground storage tank (Photograph 23) that has partially collapsed. There were no explosives, lubricants or other hazardous items found in the shed.

Photograph 20: Rubber tired loader at airstrip showing oil stained soil

Photograph 21: View of some of the more than 20 core storage sheds located at the airstrip





Photograph 22: View of explosives/fuel shed and attached ramp with metal clad laboratory trailer in background

Photograph 23: Collapsed shed presumably used for refueling or storage of related products.

There were two metal clad trailers used for laboratory or office purposes (see Photographs 22 and 24) located adjacent to a series of core examination sheds (Photographs 25 and 26). As evidenced in Photograph 24, the trailers have been cleaned out as have the core examination sheds, except for the built-in benches.

Other structures at the site included the bermed fuel tank area, the air strip itself and roadways to the exploration area and to the camp.

4.4.3. Tanks and Drums

There was an extensive fuel storage facility at the airstrip. This storage likely supplied the camp as well as the exploration site. The main storage tanks were located within an earthen berm as illustrated in Photographs 27 and 28. Both of these tanks, which likely stored diesel, were confirmed to be empty. A third large storage tank located outside of the bermed area and referred to here as "PSC" tank (Photograph 29) was also confirmed to be empty. A smaller, 1000 gal. oval tank shown in Photograph 23 was determined to be empty.

Numerous drums were scattered about the site. These were labelled as containing heating oil or Avgas. The Avgas drums are not located in a single location as seen in Photograph 29

4.4.4. Waste Disposal

Due to the extensive snow cover and blowing snow at the time of the site visit, it was very difficult to identify waste disposal areas. Almost any location where the soils have been disturbed could have been used for this purpose. None were identified at the airstrip.

4.4.5. Stained Soils

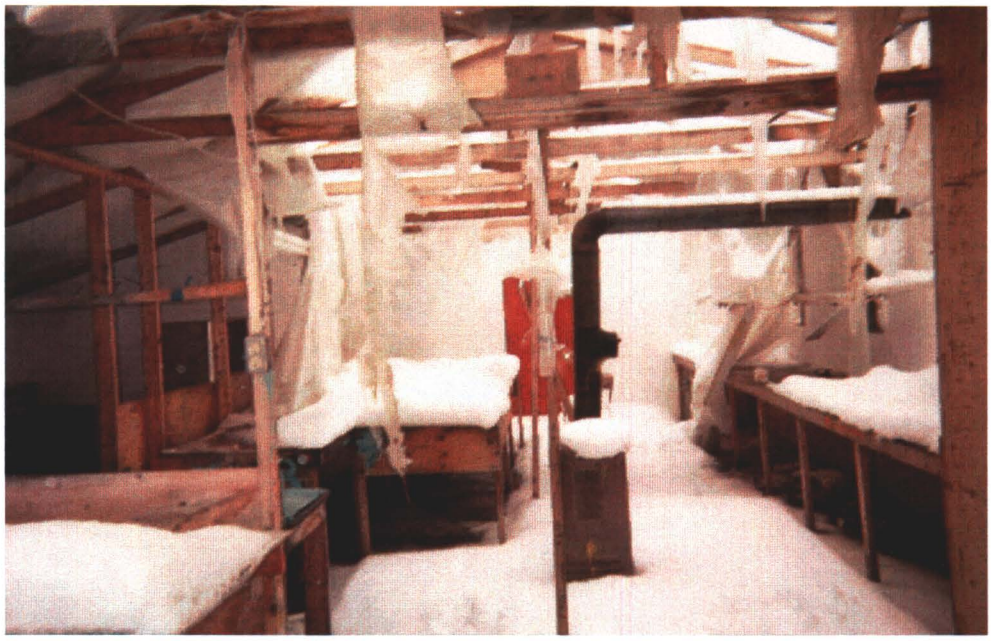
Soil in the vicinity of the Tanks 2 and 3 within the bermed fuel storage area were sampled for hydrocarbon contamination (Photographs 27 and 28). Soil in he vicinity of a third tank (referred to here as PSC and shown in Photograph 29) was also sampled. These sampling locations were chosen near the drains to the tanks; however, the snow cover precluded further definition of the area of the stained soil. The area of these stained soils could be extensive and other areas could exist which were not obvious at the time of the site visit. Areas for further investigation should include the refueling shed and the other storage tanks.

Due to the snow cover, the airstrip itself could not be checked adequately to determine if waste oil had been used for dust control. This is a common practice in remote locations and dust may have been a concern for the workers in the core examination and laboratory

buildings. Soil sampling should be undertaken here if there is any evidence of stained soils during a subsequent visit.

Photograph 24: Interior of laboratory or office trailer at airstrip

Photograph 25: Interior of one of the core examination sheds

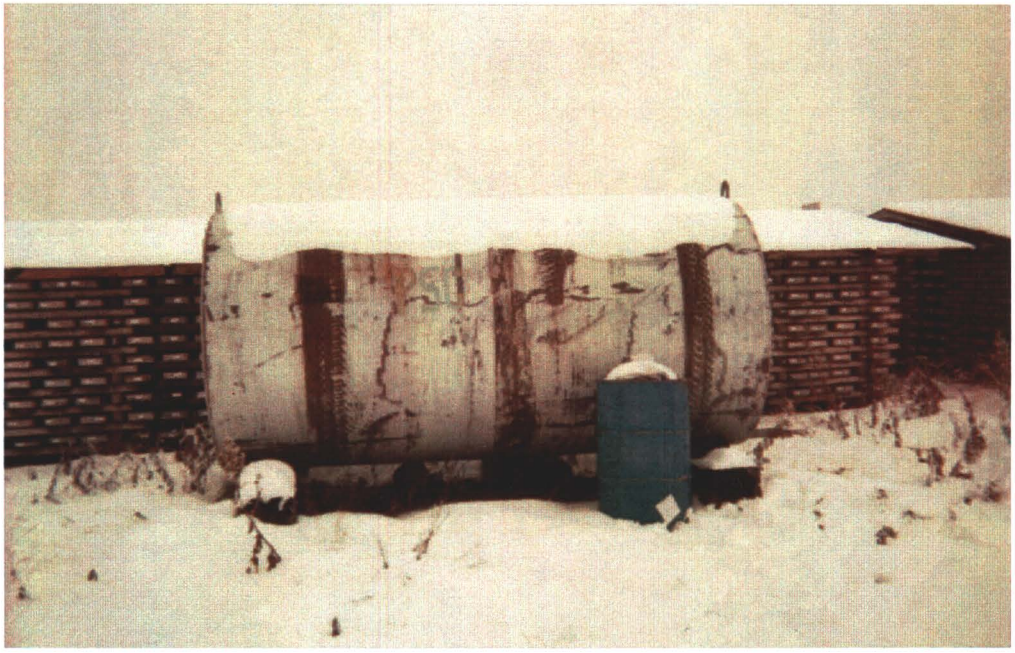


Photograph 26: Interior of one of the core examination sheds

Photograph 27: Soil sampling at fuel tank # 2 showing earthen berm in background

Photograph 28: Soil sampling at fuel tank # 1 showing berm and tank # 2 in background

Photograph 29: "PSC" fuel storage tank outside of bermed area



Photograph 30: Two of a total of 6 Avgas drums found at the airstrip with two large fuel tanks inside of earthen berm in background

4.4.6. Debris

Small amounts of debris were noted around the airstrip including miscellaneous wooden structures in various states of disrepair and old tires. There was no obvious debris that could cause risks to humans and wildlife that have not already been addressed.

4.5. Description of Site Conditions at Camp

4.5.1. Equipment

The only equipment at this location was a small diesel generator (7.5 Kw) located in a small shed above the camp (building 11).

4.5.2. Buildings and Structures

The camp is fairly large with a central area consisting of several cabins, several accommodation and office trailers, a kitchen and dining area and a maintenance and storage building. Above the main camp is another accommodation trailer and the generator shack. There is also a pit above the camp with a large tank that was used as an incinerator. The layout of the camp is illustrated in Figure 3 and the specifics of each building/structure is provided in Table 2.

4.5.3. Tanks and Drums

Numerous small oil tanks and drums used for the same purpose were co-located with the accommodation trailers for the purpose of providing fuel to oil heaters. These included

buildings 1, 7 and 8. Seven drums of which only 2 contained liquids were located outside of building 3. One of these drums contained gasoline and the other was not determined. One drum of heating fuel was located in building 6 and five drums (of which 3 contained heating oil) were located outside of building 9, the main office and kitchen complex.

At the generator shed, there were two five gallon pails of waste oil, one 200 gallon fuel tank (empty) and one 2000 gallon fuel tank with an estimated 200 gallons of diesel. A single, empty propane tank was located near building 10. There was also a large, empty steel tank at this location.

Figure 3: General layout of main camp at Casino Mine/Camp

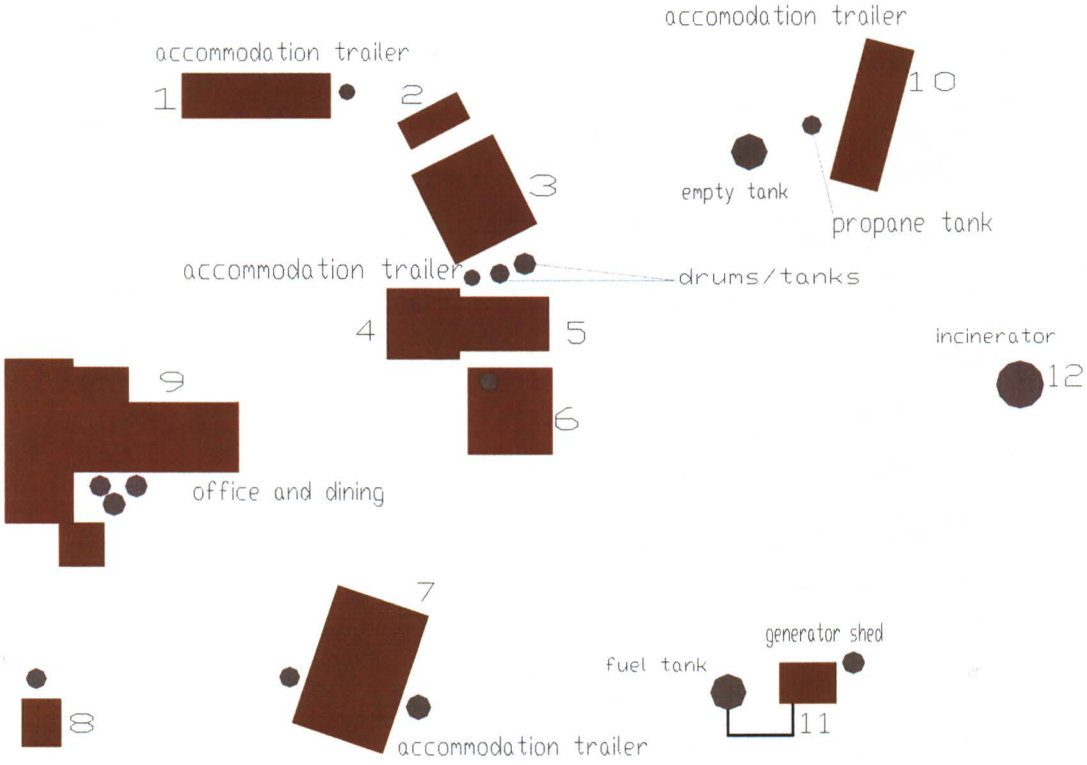


Table 2: Description of building/structure for the Casino Camp (note that the building number assigned in the table corresponds with the number in the sketch map provided in Figure 3). All sizes are approximate

No.	Description	Function	Size (feet)
1	Metal clad portable trailer	Accommodation	10 x 45
2	Metal cold storage locker	Miscellaneous storage	8 x 12
3	Plywood shed	Miscellaneous storage	30 x 22
4	Plywood building	Living quarters with indoor water and sewage tanks	24 x 18
5	Wood structure building adjacent to Building No. 4	Living quarters	16 x 30
6	High ceiling frame/plywood shed	Maintenance and storage	24 x 24
7	2 attached metal clad trailers with plywood entrance and central corridor	accommodation	12 x 48 (each trailer)
8	Plywood shed	Recently used as transient accommodation	10 x 12
9	Combined trailers and plywood structures in a single complex	Office, accommodation, dining and washroom complex, also storage	10 x 16 storage 16 x 12 office 20 x 48 office 20 x 48 kitchen/dining
10	Metal clad trailer	accommodation	10 x 48
11	Plywood shed	Generator shed	16 x 12
12	Incineration site	Camp waste disposal	2000 gal tank

4.5.4. Stained Soils

Stained soils were identified in the large wooden building apparently used as a maintenance/storage shed (building 6) and on the floor of the generator shed (building 11). It had been planned to return to sample these sites upon completion of the inspection of all facilities; however, deterioration of the weather resulted in termination of the site inspection by the pilot and consequently samples were not collected for analysis. Building 11 definitely contains oil contaminated soils and the hydrocarbon concentrations and volume need to be determined. Due to the number of oil tanks located about the

camp, we also suspect the presence of other contaminated soils, although probably in localized patches. This needs to be confirmed as well when snow is not present.

4.5.5. Waste Disposal and Incinerator

A landfill could not be identified due to the extensive snow cover. Above the camp there is an incineration facility located within what appears to be a borrow pit that has been used to provide gravel and fill for local construction. There is some metal debris in and around the incinerator; however, there could also be a debris and ash burial site in this general area. This can only be confirmed with inspection without snow cover and perhaps with the use of a metal detector and other non-intrusive and/or intrusive detection techniques.

4.5.6. Sewage Facilities

An outhouse was located in the vicinity of the camp. Evidently, pressurized water was provided to the kitchen and shower areas although the piping could not be located. It may have been surface and had been removed or it was not visible due to the snow cover. Gray water from showers and the kitchen may have simply been discharged down the bank toward Casino Creek. No flush toilets were located in the buildings and there was no evidence of a septic system.

4.5.7. Erosion

Extensive re-contouring and filling has been undertaken in the area of the camp. The local area has a steep slope down toward Casino Creek and the fill was actively eroding during periods of surface runoff, likely during spring snowmelt. After approximately seven years, there has been little natural re-vegetation and there is a risk of this erosion continuing to occur. Serious erosion could possibly introduce ash and other material from the incineration site, and hydrocarbon contaminated soil from the generator facility to Casino Creek. Other contaminated soil that was not identified due to the snow cover may also be susceptible to erosion.

4.5.8. Debris

The CMC camp apparently had been left in a reasonably good condition with respect to debris when it was closed. The main debris area is in the vicinity of the generator shed and consisted of pipes (plastic and metal), wood and miscellaneous steel. Sometime after closing, it appears that vandalism has occurred with the result being that a large amount of debris has been thrown out of the buildings and strewn about the grounds of the camp. Visible through the snow were pieces of furniture, fire extinguishers etc. The latter included dry chemical and CO_2 type extinguishers. These and other items that were not observed may pose unacceptable risks to humans and animals at the site. This also indicates the susceptibility of this site to further vandalism including fire.

5. Detailed File Review – Previous Environmental Monitoring

5.1. Background

While MDA has undertaken an extensive review of the hard copy material obtained from INAC, MDA is not responsible for any errors and omissions that may occur in this review as a result of material not being available at the time of the file review. Larger reports referred to in this assessment have been referenced, whereas only the author and date have been provided for the internal and external correspondence. In all cases the information provided is sufficient to permit locating the referenced material in the chronological file reviewed at INAC, Water Resources, Whitehorse.

5.2. Preliminary Water Quality Investigation

Baseline water quality sampling was undertaken by INAC, Water Resources Division staff in September, 1993 (memo to file by W. Kettley, Sept. 13, 1993). Water samples and field measurements were taken at a total of 11 sites on the Canadian, Britannia, Casino, Dip and Proctor Creeks as well as upstream and downstream of the confluence of Britannia Creek with the Yukon River. These data are provided in Appendix 1 as part of a memo to D. Cornett from G. Whitley, dated June 2, 1994.

A memo to file from A. von Finster (September 20, 1993) following a vist to CMC on August 25, 1993, noted that Casino Cr. headwaters showed the characteristic red stain/green water of acid rock drainage (ARD).

5.3. Biophysical Assessment

5.3.1. Introduction

Baseline environmental and socio-economic studies were undertaken by Hallam Knight Piesold Ltd. in the summer of 1993. The scope of this work, summarized in Hallam Knight Piesold Ltd. (1993) included surface water quality sampling, meteorology, hydrology, wildlife survey, fisheries survey, vegetation, sediment sampling etc. The results of the first year (and apparently only year) of this study are reported in Hallam Knight Piesold Ltd. (1994). These reports will be used here in this overview.

5.3.2. Terrain Features

The Canadian Cr. valley was noted to have been modified extensively by 1993 (von Finster memo to file, Sept. 20, 1993). Upstream of the placer mine camp on Canadian Creek, the creek flows in a wide alpine valley. A road, characterized as being poorly

constructed with washouts and multiple tracks, extends up the valley. In the upper valley a grid had been laid out by bulldozer. The track grid was diagonal to the existing drainage pattern and a secondary drainage pattern had been established.

Downstream and to the east from the old camp on Canadian Creek, a number of drill sites had been placed. The access routes to these had been poorly planned and executed and long term instability due to the extent, degree and type of disturbance was postulated (von Finster memo to file, Sept. 20, 1993).

5.3.3. Vegetation Characteristics

A vegetation survey was conducted in the CMC area in July, 1993. Vegetation transects were analyzed to determine the species presence and the relative quantity of plants (Hallam Knight Piesold Ltd., 1994). Only a brief summary of this survey is presented here.

In the lower Britannia Creek valley, dominant trees are balsam, poplar and paper birch with some white spruce. Level to gently sloping valley bottom sites in the upper Britannia and Canadian Creek valleys have moderately open black spruce stands with balsam poplar and scattered willow growth. The hummocky ground also supports lingonberry, pink wintergreen, horsetail and a variety of lichen, mosses and fungi. Slopes and well drained ridges with good soil cover consist mostly of trembling aspen varying from sparse growth on south facing slopes to dense growth on east and west facing slopes. White spruce may also occur. The alpine areas are dominated by scrub birch with a sparse distribution of stunted black spruce along with willow and Labrador tea. Ground cover at these higher elevations include mosses and a variety of lichens.

In the upper Casino Creek, the tree layer is comprised mostly of black spruce with willow, scrub birch and Labrador tea comprising the shrub layer. In low, wet areas adjacent to Casino Creek, willows predominate. Scattered black spruce are often present and white spruce and balsam poplar are occasionally present. Beyond the perimeter of the creeks is an extensive muskeg with low densities of black spruce and scrub birch and mountain alder.

5.3.4. Wildlife Occurrence

Wildlife were observed at the CMC site as reported by Hallam Knight Piesold Ltd. (1994). The site provides moderately good habitat for moose and frequent sightings were reported within the area. A population of caribou was observed in the vicinity of the Canadian Creek headwaters from June to August. Von Finster (Memo to file 8900-2-28 by A. von Finster, September 20, 1993) commented that notable in the Canadian Creek valley were the depth and density of caribou roadways on exposed rock slopes. The

tracks were roughly aligned with the Yukon River, implying a migration along the high ground, which defines the eastern edge of the Donjek basin.

Black bear were frequently seen and grizzly bear were sighted, sometimes accompanied by cubs. Lynx were sighted twice in the vicinity of the lower Britannia Creek. Wolf tracks and scat were noted at several sites. Fox were observed in the vicinity of Patton Hill. Wolverine, marten and weasel were seen in the Britannia/Canadian Creek watershed. Snowshoe hare and rodents including beaver, hoary marmot, porcupine, bog lemming, boreal vole and weasels were observed throughout the area (Hallam Knight Piesold Ltd., 1994).

Several species of birds were observed in the area including ravens, spruce grouse, ptarmigan, grey owls and hawks. Flocks of sandhill cranes were also observed during migration (Hallam Knight Piesold Ltd., 1994).

5.3.5. Water Chemistry

The surface water data for sites W7 and W8 (see Figure 4 for locations) from the 1993 survey of Hallam Knight Piesold (1994) are provided in Tables 3 through 6 for trace metals. These sites were selected for detailed presentation here as they are comparable to the sites sampled as part of this project (see section 7). The findings from the full 1993 survey are summarized here with emphasis on the parameters that exceeded the CCME criteria.

Sulphate levels for all water quality sites, except W8, were within the CCME water quality criteria (<100 mg/L) and ranged from 12.5 to 79.8 mg/L. Sulphate levels at site W8 were above the CCME guidelines throughout the sampling period with values ranging from 170 to 236 mg/L. These concentrations were likely natural as a result of the leaching of the mineralized host rocks but may have been exacerbated by the exploration activities.

Total and dissolved antimony, arsenic, chromium, cobalt, mercury, molybdenum, nickel, selenium and uranium were within CCME criteria for all samples. The following metals were above CCME water quality criteria for some or all samples:

- Total aluminum which ranged from 0.013 to 3.93 often exceeded the CCME guideline (0.05 mg/L) at W2, 3, 4, 5, 6a, 6b, 7, 8 and 9.
- Total cadmium levels occasionally exceeded the guidelines (>0.0002 mg/L) at W3, 4, 7 and 8 ranging from <0.0002 to 0.0043 mg/L. Dissolved cadmium was also occasionally above total cadmium guideline at W7 and W8.
- Copper was above the guideline (>0.002 mg/L) in 65% of the samples at sites W1, 2, 3, 4, 5, 6a, 7, 8, and 9 with values ranging from <0.001 to 0.594 mg/L. Dissolved copper concentrations were also high.

- Total iron exceded the guideline (>0.3 mg/L) in a number of samples from sites W4, 6a, 6b, 8 and 9 ranging from <0.03 to 9.09 mg/L. Dissolved iron at W8 even exceeded the guideline for total iron.
- Total zinc were occasionally above the CCME criteria (at sites W1, 8 and 9).
- Total lead, manganese, and silver were within CCME guidelines at all sites except W8. It was also noted that in general, site W8 water has a low pH, high water hardness and contains high concentrations of sulphates and metals. It is speculated that these concentrations are likely contributed by Proctor Gulch water, which is typified by a very low pH and high levels of dissolved solids. Water from Proctor Gulch enters Casino Creek upstream of site W8.

INAC undertook complementary water quality sampling to that of the consultants hired by the mine developer on September 8, 1993 and on May 18 and 19, 1994. These data are provided in Appendices 1 and 2, respectively.

Figure 4: Water and sediment sampling stations established at the Casino Mine/Camp by Hallam Knight Piesold Ltd. (1994)

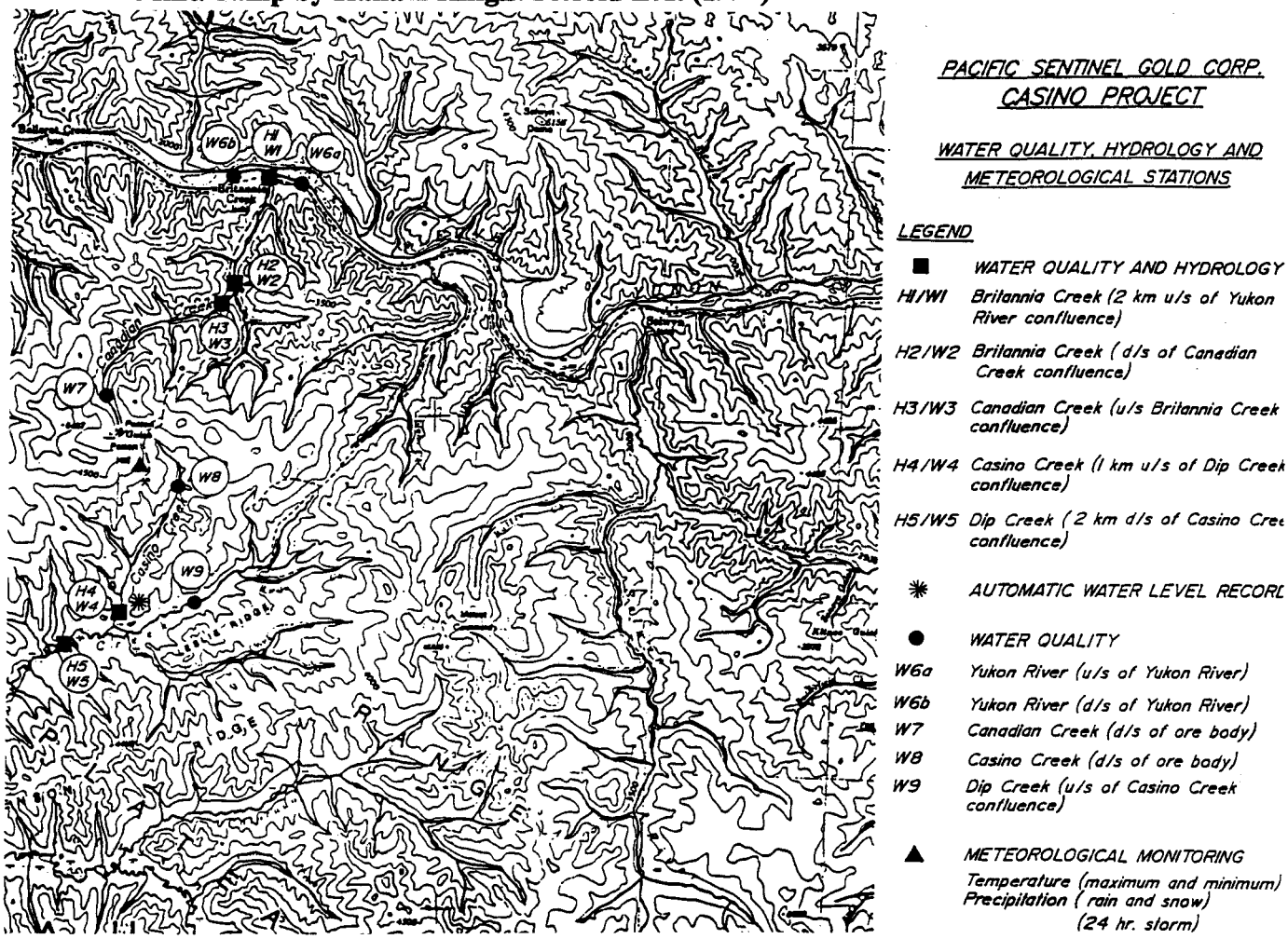


Table 3: Total Metal Concentrations for Canadian Creek (W7), June 1993 to Oct. 1993 (Hallam Knight Piesold Ltd. (1994) (mg/L) (Highlighted cells indicate that the value exceeds CCME (1999) water quality guideline for the protection of aquatic life)

Analyte (mg/L) [CCME, 1999 Guideline]	Canadian Cr. (W7) Upstream of Placer Mining Area - June	Canadian Cr. (W7) Upstream of Placer Mining Area – July	Canadian Cr. (W7) Upstream of Placer Mining Area - August	Canadian Cr. (W7) Upstream of Placer Mining Area - Sept.	Canadian Cr. (W7) Upstream of Placer Mining Area – Oct.(1)	Canadian Cr. (W7) Upstream of Placer Mining Area - Oct.(2)
Hardness (total)	26.6	29.7	37.3	35.8	35.7	35.6
Al [0.1]	0.204	0.084	0.296	0.127	0.088	0.087
Sb	<0.001	<0.001	0.001	0.001	<0.001	<0.001
As [0.005]	0.002	0.002	0.0005	0.0004	0.0003	0.0003
Ba	0.035	0.042	0.045	0.043	0.043	0.043
Be	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bi	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cd [0.000017]	0.0003	<0.0002	0.0002	0.0002	<0.0002	<0.0002
Ca	7.89	8.51	11.2	10.8	10.7	10.7
Cr	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Co	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cu [0.4]	0.003	0.003	0.002	0.003	0.002	0.002
Fe [0.3]	0.148	0.060	0.202	0.094	0.129	0.1333
Pb [0.004-0.007]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Mg	1.7	2.08	2.45	2.15	2.22	2.21
Mn	0.044	<0.005	0.013	<0.005	0.009	0.009
Hg [0.0001]	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	
Mo [0.073]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ni [0.110]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Se [0.001]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ag [0.0001]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sr	0.056	0.071	0.078	0.076	0.073	0.073

Table 4: Summary of Dissolved Metal Concentrations for Canadian Creek, June 1993 to Oct. 1993 (Hallam Knight Piesold Ltd. (1994) (mg/L) (CCME (1999) water quality guidelines are not established for dissolved metals)

Analyte (mg/L)	Canadian Cr. (W7) Upstream of Placer Mining Area - June	Canadian Cr. (W7) Upstream of Placer Mining Area - July	Canadian Cr. (W7) Upstream of Placer Mining Area – August	Canadian Cr. (W7) Upstream of Placer Mining Area - Sept.	Canadian Cr. (W7) Upstream of Placer Mining Area - Oct.(1)	Canadian Cr. (W7) Upstream of Placer Mining Area - Oct.(2)
Al	0.045	0.031	0.013	0.038	0.029	0.024
Sb	<0.0001	<0.0001	0.0001	0.0001	<0.0001	<0.0001
As	0.0001	0.0002	0.0003	0.0002	0.0002	0.0001
Ba	0.035	0.042	0.042	0.043	0.041	0.038
Be	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bi	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cd	0.0003	<0.0002	0.0002	<0.0002	<0.0002	<0.0002
Ca	7.84	8.51	11	10.8	10.7	10.7
Cr	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Co	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cu	0.003	0.002	0.001	0.002	0.002	0.002
Fe	0.046	<0.030	0.043	0.037	<0.030	<0.030
Pb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Mg	1.7	2.06	2.38	2.15	2.20	2.17
Mn	0.04	<0.005	0.01	<0.005	0.005	0.006
Mo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ni	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K	0.58	0.39	0.43	0.56	0.45	0.43
Se	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ag	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Na	2.74	3.40	3.54	4.93	4.09	4.14
Sr	0.054	0.071	0.078	0.076	0.073	0.073
V	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Zn	0.007	0.007	0.012	0.009	0.010	0.012

Table 5: Total Metal Concentrations for Casino Creek (W8), June 1993 to Oct. 1993 (Hallam Knight Piesold Ltd. (1994) (mg/L) (Highlighted cells indicate that the value exceeds CCME (1999) water quality guideline for the protection of aquatic life)

Analyte (mg/L) [CCME, 1999 Guidelines]	Casino Creek (W8) Down-stream of main camp - June	Casino Creek (W8) Down-stream of main camp - July	Casino Creek (W8) Down-stream of main camp – Aug (1)	Casino Creek (W8) Down-stream of main camp – Aug (2)	Casino Creek (W8) Down-stream of main camp – Sept.	Casino Creek (W8) Down-stream of main camp – Oct.
Hardness (total)	176	168	146	146	200	207
Al [0.1]	3.9	3.93	2.77	2.85	3.57	3.77
Sb	0.0001	<0.0001	0.0002	0.0002	<0.0002	0.0010
As [0.005]	0.0002	0.0005	0.0007	0.0007	0.0004	0.0003
Ba	0.035	0.042	0.083	0.083	0.036	0.043
Be	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bi	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cd [0.000017]	0.0016	0.0011	0.001	0.0022	0.0012	0.0043
Ca	53.5	49.3	44.4	44.7	61.8	63.6
Cr	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Co	<0.001	0.018	0.018	0.018	0.028	<0.001
Cu [0.4]	0.489	0.502	0.426	0.431	0.535	0.594
Fe [0.3]	5.8	7.84	4.99	5.04	8.44	9.09
Pb [0.004-0.007]	<0.001	0.001	0.002	0.003	0.002	0.002
Mg	10.5	11.0	8.63	8.72	11.1	11.8
Mn	0.458	0.471	0.356	0.361	0.475	0.484
Hg [0.0001]	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	
Mo [0.073]	<0.001	<0.001	0.002	0.001	<0.001	0.001
Ni [0.110]	0.006	0.006	0.004	0.004	0.006	0.004
Se [0.001]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ag [0.0001]	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001
Sr	0.209	0.211	0.189	0.192	0.235	0.250
U	0.0025	0.0034	0.0027	0.0027	0.003	0.0029
V	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Zn [0.03]	0.102	0.109	0.087	0.086	0.148	0.118

Table 6: Dissolved Metal Concentrations for Casino Creek (W8), June 1993 to Oct. 1993 (Hallam Knight Piesold Ltd. (1994) (mg/L) (CCME (1999) water quality guideline are not established for dissolved metals)

Analyte (mg/L)	Casino Mine (W7) Upstream of Placer Mining Area - June	Casino Mine (W7) Upstream of Placer Mining Area – July	Casino Mine (W7) Upstream of Placer Mining Area - August	Casino Mine (W7) Upstream of Placer Mining Area – Sept.	Casino Mine (W7) Upstream of Placer Mining Area – Oct.(1)	Casino Mine (W7) Upstream of Placer Mining Area – Oct.(2)
Al	0.045	0.031	0.013	0.038	0.029	0.024
Sb	<0.0001	<0.0001	0.0001	0.0001	<0.0001	<0.0001
As	0.0001	0.0002	0.0003	0.0002	0.0002	0.0001
Ba	0.035	0.042	0.042	0.043	0.041	0.038
Be	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bi	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cd	0.0003	<0.0002	0.0002	<0.0002	<0.0002	<0.0002
Ca	7.84	8.51	11	10.8	10.7	10.7
Cr	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Co	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cu	0.003	0.002	0.001	0.002	0.002	0.002
Fe	0.046	<0.030	0.043	0.037	<0.030	<0.030
Pb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Mg	1.7	2.06	2.38	2.15	2.20	2.17
Mn	0.04	<0.005	0.01	<0.005	0.005	0.006
Mo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ni	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K	0.58	0.39	0.43	0.56	0.45	0.43
Se	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ag	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Na	2.74	3.40	3.54	4.93	4.09	4.14
Sr	0.054	0.071	0.078	0.076	0.073	0.073
V	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Zn	0.007	0.007	0.012	0.009	0.010	0.012

5.3.6. Sediment Chemistry

Stream sediments were sampled in September, 1993 at sites W1, 3, 4, 5, 8, 9, S8a, S8b (see Figure 4) (Hallam Knight Piesold Ltd., 1994). Selected data are presented in Table 7.

Sediments from all stations except site S8a (14.5%) contained very low quantities of organic carbon as measured by loss on ignition (LOI) which ranged from 0.55 to 3.28%. Hg levels were low in all samples. Cu and Mo concentrations were highest in upper Casino Creek where the concentrations of Cu not only exceeded the interim freshwater sediment quality guideline (ISQGs) (CCME, 1999) but also exceed the predicted effect level (PEL) (CCME, 1999). As levels in all samples exceeded the ISQGs while the upper Casino Creek exceeded the PEL. Zn levels, are apparently high at all locations although no CCME guidelines have been set. Hallam Knight Piesold Ltd. (1994) indicated that precipitation of As and Zn appears to have occurred at the confluence of Proctor Gulch and Casino Creek, apparently as a result of a pH shift in the water.

Table 7: Summary of Total Metal Concentrations for Sediments from Britannia and Casino Creeks – 1993 (µg/g dry weight) (Hallam Knight Piesold Ltd., 1994) (Highlighted cells indicate that concentration exceeds the interim freshwater sediment quality guideline (ISQGs) [CCME, 1999])

Sampling station	As	Cu	Pb	Hg	Mo	Ag	Zn
W1	16.12	33.72	7.88	0.01	5.30	<2.0	57.13
W3	20.85	43.15	10.27	0.01	8.67	<2.0	56.35
W4	11.50	35.90	23.10	0.02	<4.0	<2.0	81.50
W5	9.26	12.98	13.27	0.02	<4.0	<2.0	70.50
W9	8.99	10.05	10.18	0.02	<4.0	<2.0	60.82
W8	40.90	655.0	59.00	0.03	21.10	<2.0	184.00
S8a	20.00	1670.00	17.00	0.02	37.70	<2.0	77.20
S8b	48.60	396.00	50.80	0.05	<12.0	<6.0	77.50
*PEL	17.0	197	91.3	0.486			

*PEL = predicted effect level (CCME, 1999) defines the level above which adverse effects are expected to occur frequently

5.3.7. Fish Distribution

Fisheries surveys were undertaken in the water courses of the CMC on June 4-6, August 10-13 and September 21-26, 1993 (reports from S. Blundell, Project Biologist, Hallam Knight Piesold Ltd. to Department of Fisheries and Oceans dated June 24, September 1 and October 15, 1993). Both the Britannia/Canadian Creek system and the Casino Creek were assessed. Arctic grayling, both juvenile and adult were found on the Britannia Creek sites with sampling site 1, approximately 3 km upstream from the confluence with the Yukon River, having the largest populations and indicating suitable habitat for over-

wintering. Arctic grayling, round whitefish, juvenile burbot and slimy sculpin were found on Britannia Creek at the confluence with the Yukon River. In Canadian Creek, arctic grayling were found during all sampling trips just above the confluence with Britannia Creek, suggesting good over-wintering habitat here; but higher up, fish were only found during the summer and higher flow periods. Hallam Knight Piesold Ltd. (1994) concluded that this system provides spawning and rearing habitat for a variety of species. The system may also provide habitat for chinook salmon although this requires further investigation.

Slimy sculpin predominated in the lower reaches of Casino Creek although arctic grayling were also detected but in fewer numbers than on the Britannia/Canadian system. No fish were observed in the most upstream reach of Casino Creek. As a result of the decreased flows and the development of anchor ice in winter months, there is limited potential for over wintering habitat in Casino Creek (Hallam Knight Piesold Ltd., 1994).

5.3.8. Precipitation

Rainfall was monitored on-site in 1993 during the exploration phase. Maximum precipitation was observed in July with a monthly cumulative deposition of 123 mm. Minimum precipitation occurred in December at 0.5 mm. Precipitation was comprised exclusively of snow for the months of March, April, November and December (Hallam Knight Piesold Ltd., 1994). Presumably, no observations were made in January and February. Based on 21 years of snow survey data conducted by INAC (station # 09CD-SC01) average water content in the snow pack at Casino Creek is 121 mm (INAC, 1999).

6. Environmental chemistry Data – This Assessment

6.1. Field Analysis – Water chemistry Data

Field measurements were taken upstream and downstream of the abandoned placer mine site on Canadian Creek. The upstream site is believed to correspond with site W7 in earlier sampling. Casino Creek was also sampled downstream of the main camp at approximately W8 in the 1993 sampling. These data are presented in Table 8. Casino Cr. water is highly comparable to Canadian Cr. but with approximately double conductivity.

Hallam Knight Piesold Ltd. (1994) reported data for the period of June to October, 1993. Specific conductance for site W7 ranged from 77.4 to 106 μmhos/cm with a mean of 94.7. These values can not be directly compared to those presented in Table 8 but they do not suggest a major change in conductivity. Turbidity ranged from 0.9 to 5.19 NTU, which also is comparable to the turbidity reported in Table 8. As for pH, which ranged between 7.0 and 7.5 in 1993, there seems to have been a minor decrease to present time,

although this could be due to a number of reasons including the lack of inter-calibration. Current and past pH values suggest basic conditions and no effect from acid drainage from the exploration activities.

The Casino Cr. sample compared to W8 (Hallam Knight Piesold Ltd., 1994) showed essentially neutral pH in 1999 compared to acidic conditions (3.86 – 4.52) in 1993. Turbidity in 1993 ranged from 21.1 to 32.2 NTU, almost 6X present day turbidity. Conductivity in 1993 was approximately double that measured in 1999. The 1993 conditions clearly reflect an impact from the mining and exploration activities.

Table 8: Results of field analysis of water samples from Canadian Creek in the vicinity of the abandoned placer mine and Casino Creek downstream from the camp

Parameter	Canadian Cr.– upstream from abandoned placer mine (W7)	Canadian Cr.– downstream from abandoned placer mine	Casino Cr.– downstream from camp
PH	6.8	6.9	6.7
Specific conductance (μS/cm)	115	117	204
Turbidity (NTU)	4	5	5
Dissolved O_2 (mg/L)	2.2	2.3	1
Temperature (°C)	0.3	0.2	0.5

6.2. Laboratory Results

6.2.1. Surface Water Chemistry

The surface water chemistry data for total metals and dissolved metals from the 1999 sampling of the mine site are reported in Tables 9 and 10, respectively. None of the 1999 samples exceeded the CCME (1999) guidelines for water quality for the protection of aquatic life. This indicates a considerable improvement in the surface water quality since the 1993 survey during active exploration and presumably placer mining at the site. In 1993, Al, Cd, Cu, Fe and Zn exceeded the CCME (1999) guidelines at the comparable sites. One sample from Casino Creek also exceeded the guidelines for Ag. Hardness has also decreased at the site.

The Casino Cr. water and the water sampled from the flowing pipes at camp were highly comparable but had concentrations of hardness as $CaCO_3$, Ba, Ca, Mg, approximately double those of Canadian Cr. Zn was slightly elevated at Casino Cr. as compared to Canadian Cr., Zn was slightly elevated at Casino Cr. versus Casino Cr. as compared to

Canadian Cr., sulphur was approximately double in Canadian Cr. versus Casino Cr. while Na was identical. Concentrations of several dissolved metals in the flowing pipe at the camp were notably higher then the surface waters. These analytes included Cd, Ca, Cu, Fe, Mg, Mn, K, Na, Sr, s and Zn. In fact the concentrations of dissolved Cd, Cu, Fe and Zn exceeded the total metals water quality objective for the protection of aquatic life (CME, 1999). However, the dissolved concentrations in the flowing pipe water have to be questioned as the dissolved concentrations exceed those of the total metals from the same source. As there is excellent agreement between the duplicate total metals and the duplicate dissolved metal samples, single bottle contamination is not evident. Repeat sampling would be required to resolve this issue, particularly as to whether or not the CCME (1999) guidelines are exceeded.

While water quality has clearly improved and likely returned to near pristine conditions, a cursory comparison of the 1993 and 1999 data can be misleading. This is due to the fact that the detection limits used in 1993 are lower than those used in 1999 and thus there are more metal detections in 1993. The detection limits for the metals analysed as part of the 1999 study exceed the CCME (1999) guidelines (e.g. Al, As, Cu, Pb, Se, Ag) and consequently the increased frequency of less than detection limit and absence of guideline exceedences may give a false sense of improved water quality. Nevertheless, it is evident that the quality of the water at this site has generally improved since 1993 and is likely near background conditions. None of the dissolved metals, either in 1993 or 1999 exceeded the CCME (1999) guidelines.

Table 9: Results of Laboratory Analyses for Total Metals for Casino Mine/Camp (mg/L)

Analyte (mg/L)	Canadian Cr. (W7) Upstream of Abandoned Placer Mine	Casino Creek – Downstream of Camp (1)	Casino Creek – Downstream of Camp (2)	Casino Camp – Flowing Pipe Sample 1	Casino Camp – Flowing Pipe Sample 2
Hardness (total)	45.5	97.8	97.0	96.7	99.0
Al	<0.06	<0.06	<0.06	<0.06	<0.06
Sb	<0.02	<0.02	<0.02	<0.02	<0.02
As	<0.04	<0.04	<0.04	<0.04	<0.04
Ba	0.046	0.193	0.192	0.190	0.195
Be	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bi	<0.02	<0.02	<0.02	<0.02	<0.02
B	<0.04	<0.04	<0.04	<0.04	<0.04
Cd	<0.002	<0.002	<0.002	<0.002	<0.002
Ca	13.8	28.0	27.8	27.7	28.4
Cr	<0.002	<0.002	<0.002	<0.002	<0.002
Co	<0.004	<0.004	<0.004	<0.004	<0.004
Cu	<0.003	<0.003	<0.003	<0.003	<0.003
Fe	<0.05	<0.05	<0.05	<0.05	<0.05
Pb	<0.03	<0.03	<0.03	<0.03	<0.03
Mg	2.67	6.76	6.71	6.68	6.83
Mn	<0.002	0.002	0.002	<0.002	<0.002
Hg	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Mo	<0.005	<0.005	<0.005	<0.005	<0.005
Ni	<0.01	<0.01	<0.01	<0.01	<0.01
P	<0.1	<0.1	<0.1	<0.1	<0.1
K	<0.5	1.0	1.0	0.9	0.7
Se	<0.03	<0.03	<0.03	<0.03	<0.03
Ag	<0.03	<0.03	<0.03	<0.03	<0.03
Na	4.7	4.6	4.5	4.6	4.6
Sr	0.092	0.235	0.234	0.231	0.236
S	13.5	6.5	6.4	6.4	6.5
Te	<0.02	<0.02	<0.02	<0.02	<0.02
Ti	<0.03	<0.03	<0.03	<0.03	<0.03
Sn	<0.02	<0.02	<0.02	<0.02	<0.02
Ti	<0.003	<0.003	<0.003	<0.003	<0.003
V	<0.003	<0.003	<0.003	<0.003	<0.003
Zn	<0.01	0.01	0.01	0.01	<0.01
Zr	<0.003	<0.003	<0.003	<0.003	<0.003

Table 10: Results of Laboratory Analyses for Dissolved Metals for Casino Mine/Camp (mg/L) (Highlighted values indicate that the dissolved concentrations exceed the total metals guideline for the protection of aquatic life, (CCME, 1994))

Analyte (mg/L)	Canadian Cr. (W7) Upstream of Abandoned Placer Mine	Casino Creek – Downstream of Camp (1)	Casino Creek – Downstream of Camp (2)	Casino Camp – Flowing Pipe Sample 1	Casino Camp – Flowing Pipe Sample 2
Al	<0.02	NA	NA	<0.02	<0.02
Sb	<0.015	NA	NA	<0.015	<0.015
As	<0.04	NA	NA	<0.04	<0.04
Ba	0.043	NA	NA	0.038	0.038
Be	<0.0010	NA	NA	<0.0010	<0.0010
Bi	<0.02	NA	NA	<0.02	<0.02
B	<0.008	NA	NA	<0.008	<0.008
Cd	<0.002	NA	NA	0.063	0.063
Ca	13.3	NA	NA	46.5	46.9
Cr	<0.002	NA	NA	<0.002	<0.002
Co	<0.003	NA	NA	<0.003	<0.003
Cu	0.002	NA	NA	0.087	0.091
Fe	0.005	NA	NA	0.028	0.017
Pb	<0.02	NA	NA	<0.02	<0.02
Mg	2.70*	NA	NA	12.4	12.5
Mn	<0.002	NA	NA	0.818	0.834
Hg	<0.00005	NA	NA	<0.00005	<0.00005
Mo	<0.004	NA	NA	<0.004	<0.004
Ni	<0.008	NA	NA	<0.008	<0.008
P	<0.04	NA	NA	<0.04	<0.04
K	0.8*	NA	NA	1.7	1.8
Se	<0.03	NA	NA	<0.03	<0.03
Ag	<0.01	NA	NA	<0.01	<0.01
Na	4.52	NA	NA	5.07	5.19
Sr	0.089	NA	NA	0.414	0.422
S	13.6*	NA	NA	22.9	23.1
Te	<0.02	NA	NA	<0.02	<0.02
Ti	<0.02	NA	NA	<0.02	<0.02
Sn	<0.02	NA	NA	<0.02	<0.02
Ti	<0.003	NA	NA	<0.003	<0.003
V	<0.003	NA	NA	<0.003	<0.003
Zn	0.006	NA	NA	3.88	3.95
Zr	<0.003	NA	NA	<0.003	<0.003

*Dissolved > total, within precision of analytical method NA= not analysed

6.2.2. Soil Chemistry

Only soils that indicated obvious staining were sampled as part of the 1999 environmental site assessment and these were analysed only for total extractable hydrocarbons. These data are presented in Table 11. Additional stained soil in the generator building and near the fuel storage tank as well as and on the floor of the maintenance building, all located at the main camp, were not sampled but are also likely

to be contaminated with hydrocarbons. Other localized soil contamination likely existis in the vicinity of the heating oil supply tanks about the main buildings of the camp.

Table 11: Laboratory results for stained soils from Casino Mine/Camp (Bold, highlighted values exceed the YTG soil regulation)

Sample Number/Location	Total Extractable Hydrocarbons (µg/g) (C11-C30+)
Site 1, 0-15 cm (placer mining site shop floor)	**7400**
Site 2, 0-15 cm (placer mining site generator room floor)	2710
Airstrip, Tank 3, 0-15 cm	**24200**
Airstrip, Tank 2, 0-15 cm	1700
Airstrip, Tank PSC, 0-15 cm	**5820**

NA = not available

All of the sites sampled had measurable concentrations of total extractable hydrocarbons (TEH) ranging from 1700 to 24,200 µg/g. CCME (1999) does not provide soil quality guidelines for total hydrocarbons but rather provides guidelines for several individual PAHs. Yukon Territorial Government (YTG) regulations for petroleum hydrocarbons in soil are not to exceed 5000 µg/g. For comparison, Ontario Ministry of Environment (MOE) (1996) has established soil criteria for petroleum hydrocarbons (gas/diesel) at 1000 µg/g for residential/parkland land use soil and for industry/commercial land use soil. The criteria for heavy oils are 1000 and 5000 µg/g for residential/parkland land use soil and for industry/commercial land use soil, respectively. As these hydrocarbons are likely light oils, primarily diesel and heating oil, the lower standard would apply in an Ontario situation.

Due to the snow cover at the site at the time of inspection, an estimate of the contaminated surface area could not be made. Regardless, there are significant volumes of contaminated hydrocarbon soils at the abandoned placer mine site, the air strip and at the main camp that need further characterization and quantification.

7. Archeological/Heritage/Historical Features

There was no evidence of archaeological, heritage or historical features at the site; however, snow cover would have precluded any identification on the ground. Physical disturbances at the active areas of the site would have destroyed or masked any sites in the immediate area of the most disturbed zones.

8. Results of Inspection and File Review

8.1. Extent of CMC

The site inspection planning had been guided by the information contained for this site in the Yukon Waste Sites Database (Site no. BC039). The information therein was limited to the 1993 era and concerned only the placer site on the Canadian Creek. As illustrated in Figure 5, the property extends from the Yukon River, up the Canadian and Britannia Creek valleys, across the main exploration complex centred on Patton Hill and down the Casino Creek watershed to its confluence with Victor Cr. The Casino Creek valley was destined to be used for tailings disposal. The database information did not mention the extensive exploration work on Patton Hill, the airstrip and the main camp in the Casino Creek valley. Additionally, it did not note an active placer mine on the Canadian Creek above the confluence with Britannia Creek. In short, this site is considerably more extensive then indicated in the database and here will be considered as consisting of:

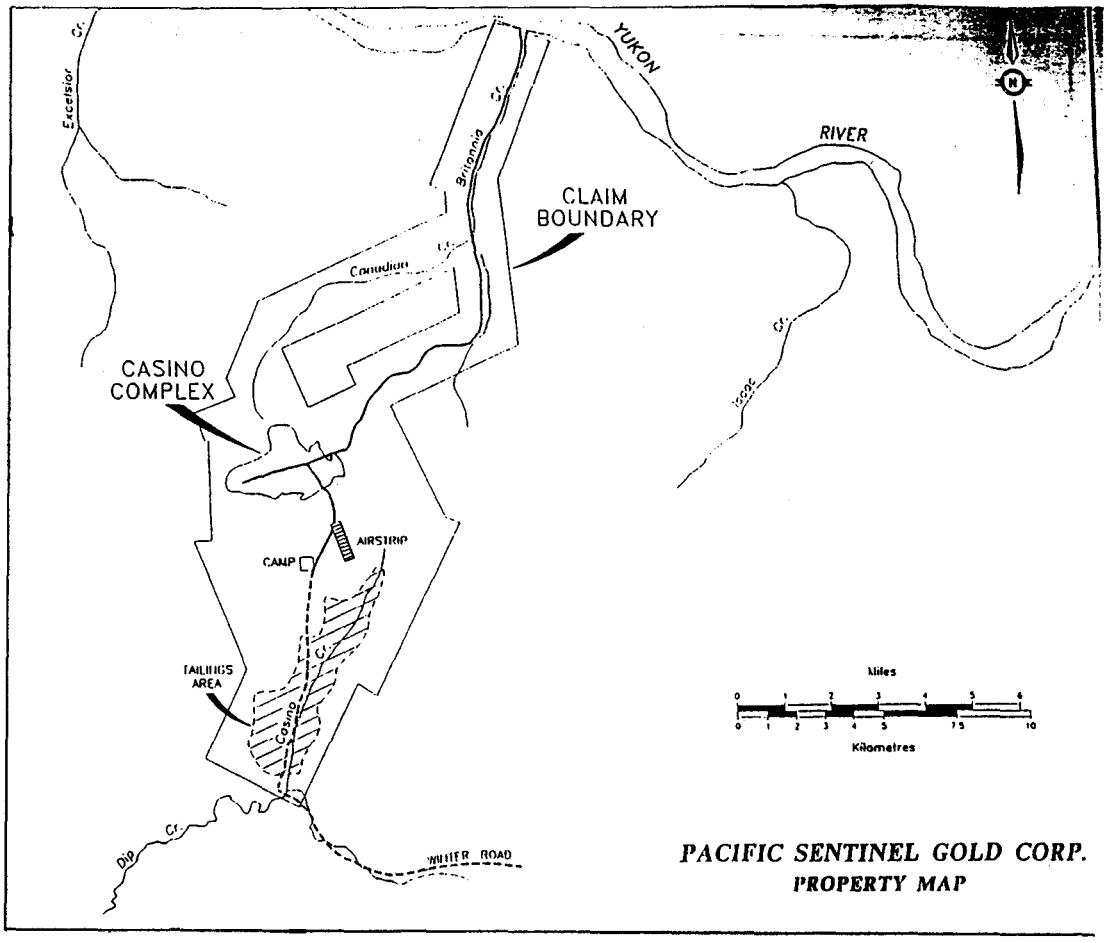
- abandoned placer mine on the upper reaches of Canadian Creek;
- an airstrip and adjacent core storage and fuel storage facilities;
- a main camp in the valley of Casino Creek and below the airstrip;
- the exploration site centred on Patton Hill; and,
- the active placer mine on the lower reaches of Canadian Creek.

This assessment did not include the latter two locations. The exploration site on Patton Hill could not be accessed due to poor visibility and snow cover. The active placer mine was not known to be part of the site based on the information reviewed prior to the inspection and the inspectors had no authorization to inspect an active mine site. Thus the question arises as to whether the CMC is really an abandoned mine site? Discussions of this issue with Mr. Brett Hartshorne (INAC, Contaminated Sites Office, Yukon, March 22/00) confirmed that we were to address the site as abandoned and to exclude the active placer mine from the assessment.

8.2. Water Quality

The limited surface water and groundwater sampling undertaken at this site demonstrated that the quality of the water in 1999 had improved over that of 1993 and could be considered as indicative of background water chemistry. Even the water in the flowing pipes from the main camp site, apparently from a collapsed adit or some diversion, were comparable to the surface water from Casino Creek and showed no indication of high metals concentrations either particulate or dissolved.

Figure 5: Pacific Sentinel Gold Corp. property map for the Casino Mine/camp



8.3. Listing of Potential Contaminants

The large area of the site and the intensive activities have clearly had a significant impact on the terrain, especially in the placer mining area on Canadian Cr. Nevertheless, upon abandonment, effort had been directed toward closing the site in a reasonably responsible manner. Unfortunately, since that time, it appears that vandalism has resulted in debris being removed from the buildings and scattered on the property. This was most obvious at the camp site where fire extinguishers and other items lay scattered. Due to the snow cover, these could not be appropriately photographed or documented.

The potential contaminants and associated risks for the three areas of the Casino Mine site that were investigated, specifically the abandoned placer mine site, the airstrip and the camp, are document in Tables 12, 13 and 14, respectively

Table 12: Listing of Potential Contaminants, Locations and Potential Risk/Liability at the Abandoned Placer Mine Location of the Casino Mine/Camp

Location	Potential Contaminant	Risk/Liability/Action
Maintenance/generator shed	2 cans silica sand 16 silica sand bags 30 bags of bentonite 5 x 5gal pails of P3Esso Extra oil Asbestos brake pads	None None None Potential for oil release via rusting or vandalism. Exposure and inappropriate disposal
Maintenance/generator shed	Stained soil in maintenance area Stained soil in generator part of maintenance building	Soil exceeds YTG regulations, extent of contamination needs to be defined and then cleaned up Soil sampled does not exceed regulations but further sampling and cleanup may be required
Maintenance/generator shed	5 drums on west side of maintenance shed – 2 empty, 1 gas, 2 waste oil	Potential for leaks or vandalism causing fire risk (gas) or soil contamination and perhaps reaching Canadian Creek, soil sampling may be required due to contamination that was not visible due to snow cover
Maintenance/generator shed	2 Transformers (PCB < 1 ppm) 1 Transformer (unknown contents)	Potential for vandalism could release low concentration PCB oils
General Area	2 large propane tanks both containing propane 4 drums below tank farm – 3 empty, one full with contents unknown	Potential for leaks or vandalism causing explosion/fire risk Potential for leaks or vandalism causing soil contamination and perhaps reaching Canadian Creek

Table 13: Listing of Potential Contaminants, Locations and Potential Risk/Liability at the Airstrip Location of the Casino Mine/Camp

Location	Potential Contaminant	Risk/Liability/Action
General	Eastfield Resources, Avgas, 4 drums full, 3 empty Transnorth, Avgas, 2 drums full	Potential fuel release due to vandalism – soil contamination could occur Same as above
Explosives/Fuel Shack	½ litre brake fluid 1/8 litre paint thinner 5 gal pail Lub Tub drilling lubricant 1 litre 4-stroke 20-50	Little risk/liability
AST's on Airstrip Site	2 bermed diesel tanks, (empty). Location of soil samples 3 and 4 Un-bermed diesel, empty, tank labelled PSC (location of soil sample 5) Oval tank near shed (empty)	Contaminated soil associated with tank 3 – extent of contamination needs to be defined and cleanup will be required Contaminated soil associated with tank – extent of contamination needs to be confirmed, cleanup required No risk, soil should be checked for staining after snow melt
Rubber tired loader	Oil leaking	Contaminated soil – extent needs to be confirmed, cleanup will be required.
Laboratory, on Airstrip Site	No chemical 5 drums heating oil	No liability. Potential for oil release and contamination of soil, existing soil contamination to be checked after snow melt

Table 14: Listing of Potential Contaminants, Locations and Potential Risk/Liability at the Camp Location of the Casino Mine/Camp

Location (building #)	Potential Contaminant	Risk/Liability/Action
1. Accommodation trailer	Asbestos board on wall by 4 oil heaters 1 x 200 gal. oil tank, empty 1 x 45 gal drum, empty	Risk of asbestos in air or improper disposal, remove board and dispose No risk, soil contamination to be checked after snow melt
2. Cold storage locker	17 x 3.67 L paint cans, full to part full 3 x 1 L paint cans – full	Vandalism could cause fire risk or soil contamination, paint should be removed and properly recycled
3. Plywood shed	Adjacent – 7 drums, 5 empty, 1 with gasoline, one with unknown liquid	Leaking or vandalism could cause fire risk or soil contamination, risk of soil contamination to be confirmed after snow melt
6. Wood Structure building	3 lead acid batteries 1 x 1 gal. Red Devil liquid for chemically cleaning furnaces 2 bags portland cement 1 x 1 gal. brake fluid 1 drum heating fuel broken asbestos board approx. 15 gals waste oil in open container 2 x 5 gal plastic pails of heating fuel stained soil (not tested)	Risk of further soil contamination due to leaks or vandalism for hydrocarbons Risk of lead contamination and asbestos in air or improper disposal, items should be removed and appropriately disposed Fire hazard Soil testing required to confirm presence or absence of contaminated soil, risk is low
7. Attached accommodation trailers	2 x 45 gal drums for heating oil (empty) asbestos insulation board	 Risk of asbestos in air or improper disposal
8. Plywood shed	2 x 45 gal drums – outside, 1 empty, 1 half full of heating oil	Leaking or vandalism could cause fire risk or soil contamination, existing soil contamination to be confirmed after snow melt
9. Combined trailers and plywood structures	5 x 45 gal drums outside – 3 full of heating oil 1 lead acid battery 1 pop cooler 1 large fridge	Leaking or vandalism could cause fire risk or soil contamination, possible soil contamination to be confirmed after snow melt Proper disposal required Risk of CFCs leaking accidentally or through vandalism or improper disposal

10. Accommodation trailer	1 x 200 lb. Propane tank (empty) 1 large steel tank – empty asbestos board backing behind stoves	No risk No risk Risk of asbestos in air or improper disposal, remove and dispose
11. Plywood generator shed	Stained soil in area of generators (not sampled) 2 x 5 gal. pails of waste oil 1 x 200 gal fuel tank – empty 1 x 2000 gal tank with ≈ 200 gal. diesel	Extent of soil contamination needs to be confirmed and cleanup will be required Leaking or vandalism could cause further soil contamination, define level of contamination after snow melt and remediate as required
12. Incinerator	Scrap metal and ash	No significant risk, further inspection of site required after snow melt

8.4. Site Hazards

Within the limitations of our ability to inspect this site due to the snow cover, there are a number of identifiable risks/hazards associated with the three areas of the CMC that were inspected. The main concerns are contaminated soil due to hydrocarbons as noted in Tables 12, 13 and 14. There is also potential for further contamination from spillage and leakage from drums and tanks containing AvGas, diesel or heating fuel, waste oils and gasoline. Asbestos board, lead acid batteries, paints and other miscellaneous liquids need to be removed and properly disposed. There is a risk of CFCs escaping from the refrigeration units in the dining complex although it was not confirmed that these are presently charged.

Metal debris was identified at the placer mine site and other minor debris, such as fire extinguishers were scattered in the vicinity of the camp. Risks to animal and human safety may also exist which will only be found during a follow-up visit after snow melt. The incinerator area may also contain a refuse dump, which could not be identified at the time of the visit.

Serious erosion was evident in the vicinity of the camp. Vegetation had been removed during leveling and re-contouring, and the construction of roads and revegetation, either natural or man assisted has not occurred. The re-contouring has frequently run across natural drainage areas without culverts and consequently ponding appears to have occurred followed by failure and extensive gullying. Continued erosion may deliver contaminated soil to Casino Creek.

In the vicinity of the placer mine, trenching and exploration roads have been reported to have resulted in increased erosion and essentially, the extension of existing drainage channels. This could result in gullying, loss of vegetation and increased turbidity in the Canadian Creek. It could also affect permafrost and vegetation availability for visiting caribou and moose. Due to the snow cover we could not assess the extent of this hazard nor could we identify mitigative measures.

Based upon the exploration activities that we have seen at other planned open pit mines, we expect that the main ore are on Patton Hill has been extensively scarred. The air photo indicates that a great deal of vegetation has been removed. This could increase the acidity of drainage waters, it could increase erosion and has obviously reduced available vegetation for visiting ungulates. Due to weather and snow cover, this was not investigated specifically.

8.5. Recommended Actions

The late timing of the visit to this site and the presence of snowcover at the time of the visit significantly reduced the effectiveness of this site assessment. Some areas were missed (e.g. the exploration area at Patton Hill) while other areas could not be adequately assessed. Therefore our first and primary recommendation has to be that this site has to be re-visited after snow melt in 2000. That site visit will be able to fill in many of the questions that remain as part of this initial investigation. While another visit to the site in October 1999 would have been useful, to allow further investigation, the snow cover which appeared likely to remain for the winter, would have limited any assessment. Thus we pulled out preferring to use our preliminary information to effect a more comprehensive survey at a later date.

Specific recommendations that relate to the "basic cleanup" of the site include:

1. Removal or on-site burning of the remaining fuels in drums and/or tanks;
2. Removal and appropriate disposal of all asbestos materials;
3. Further definition of stained soils at the maintenance shed at the abandoned placer mine site and removal from the site or appropriate remediation (bioremediation or otherwise) at a central location on the site;
4. Further definition of stained soils at the tanks inside the berm at the airstrip and removal from the site or appropriate remediation (bioremediation or otherwise) at a central location on the site;
5. Further definition of stained soils at the generator shed at the camp site and removal from the site or appropriate remediation (bioremediation or otherwise) at a central location on the site;
6. Removal and appropriate disposal of the <1 ppm PCB transformers; testing of soils in the vicinity of the transformers for residual PCBs;
7. collection of assorted inert and metallic debris including pipes and empty drums and other material from the area of the camp and burial at a central location on the site;

8. Removal of paint, other liquids and solvents, lead acid batteries etc. to a central facility off-site for eventual disposal;
9. Proper recovery of CFC gas from the pop cooler and fridge at the camp so as to avoid accidental atmospheric release.
10. Check all equipment for oil leaks (as was observed at the loader near the airstrip) and if necessary, drain and dispose of crankcase and fuel tank contents to avoid further leaks and contaminated soil.

We anticipate that there will eventually be several 10s of tonnes of hydrocarbon contaminated soil at CMC which will have to be removed and remediated. Due to the remoteness of the site, it may be most practical to move the contaminated soil to a central site on CMC and undertake bioremediation on-site. This may take more than one season to complete but is likely the most cost-effective approach. Final decision on the remediation approach will have to await full evaluation of the volume of contaminated soils. Equipment on the site could be utilised to for all excavation, demolition and burial of wastes with approval of owner (if available).

The items noted above are considered to be appropriate immediate actions and are referred to here as a "basic cleanup" that is necessary to avoid further contamination or the transport of contaminants from the site and to begin the restoration of the site.

The "basic cleanup" is not intended to be a "full clean-up and remediation" of the site. The full clean up and remediation will include demolition and disposal of frame buildings built on site. Accomodation and work trailers, tanks and equipment will have to be removed. Core sheds should be demolished and the cores landfilled. Finally, disturbed areas in the vicinity of the camp, the airstrip, the exploration site and the placer mine site will have to be rehabilitated through re-contouring. Revegetation will have to be actively encouraged in this area as most of the site is above the tree line and thus grass planting will have to be undertaken. Experimental plots will likely be required to determine the preparation requirements and success rates of such revegetation efforts.

This level of effort is justified at this site, we believe, because of the obvious ecological importance of the site as noted above. Specifically, it provides habitat for a caribou, moose, bears and a wide range of animals as well as for a variety of birds. It lies at the headwaters of a number of significant watersheds with the Canadian and Britannia Creek systems providing fish habitat, at least without the influence of the downstream placer mine activities.

8.6. Cost Estimates

As noted above, there are a number of contaminated areas and site specific problems that could not be fully assessed during the fall, 1999 site visit. The reason for this was the poor weather conditions at the time of the visit and the presence of snow cover at the site, especially at higher elevations. Rather than utilizing the helicopter and field personnel budget waiting on standby while the weather improved, it was decided to terminate the field work, return unused helicopter expenses to the client and concentrate on a detailed assessment of all information available in preparation for a further field inspection in 2000. Based upon our current knowledge of the site, and the work remaining to complete a thorough Phase 2 Environmental Site Assessment, we provide the following budget (Table 15).

However, we consider the effort to complete the Phase 2 on its own, without undertaking some or all of the elements of the "basic cleanup" of the site, as outlined in the previous section, as an inefficient approach. Unfortunately, cost estimates for the full remediation of the site are premature until the quantities of the hydrocarbon contaminated soils are fully quantified as these will likely be the major expense at this stage. As a result, what we would like to propose is a combined plan incorporating the completion of the Phase 2 ESA and some aspects of the Phase 3 Environmental Site Assessment. The components of the Phase 3 to be included are:

h) preliminary central assembly of wastes (i.e. full drums moved to a central point for eventual removal or on-site destruction, transfer of contents of open drums to re-sealable drums and central storage or disposal etc.);
i) tidying debris in the camp area and elimination of the sources of ongoing soil contamination (e.g. draining of leaking tanks etc.);
j) eliminating sources of soil contamination from hydrocarbons by draining equipment tanks and crankcases of fuel, oil etc. and place in sealed drums and store centrally or dispose on site;
k) removal and secure storage of all asbestos materials for eventual disposal;
l) over-packing and removal of < 1 ppm PCB transformers
m) appropriate over-packing of paints and other liquids and solvents, lead acid batteries and removal to appropriate disposal or storage area; and,
n) safe and proper recovery of CFC gases from coolers and fridges.

We also recommend that due to the difficulties that will be encountered, that it is appropriate at this stage to implement experimental revegetation plots using different techniques and grasses to assess the feasibility of enhancing the re-colonization of native grass. The work at this stage will be undertaken using test plots and plugging in native and natural grasses with fertilizers and other soil amendments to assess future re-vegetation strategies to control erosion and restore the site vegetation.

Table 15: Preliminary cost estimates for Completion of Phase 2 Environmental Site Assessment

Person	Daily Rate	No. of Days	Total Cost	Cumulative total
File Review & Field Work				
D. Gregor	$ 960.00	4	$ 3840.00	
Engineer or Scientist	$ 960.00	4	$ 3840.00	
Environmental Technologist	$ 550.00	4	$ 2200.00	
First Nation Contractor	$ 400.00	4	$ 1600.00	
Subtotal			$ 11,400.00	$ 11 ,400.00
Data Review & Report Preparation				
D. Gregor	$ 960.00	3	$ 2,880.00	
Engineer or Scientist	$ 960.00	0	$	
Environmental Technologist	$ 550.00	5	$ 2,750.00	
Subtotal			$ 5,630.00	$ 5,630.00

Chargeable Expenses	Daily Rate	No. of Days	No. of Units	Total Cost	Cumulative total
Truck Rental (including gas)	$ 160.00	4	1	$ 640.00	
Helicopter (hourly)	$ 850.00	1	8	$ 6,800.00	
Aircraft (site has airstrip) (hourly)	$ 500.00	0	0	$	
Trailer Rental	$ 50.00	0	0	$	
Meals & Incidentals	$ 60.00	4	4	$ 960.00	
Accomodation	$ 150.00	4	3	$ 1,800.00	
Portable Drill Unit	$ 50.00	4	1	$ 200.00	
Miscellaneous Field supplies				$ 200.00	
Subtotal				$ 10,600.00	$ 10,600.00

Report Preparation	Unit rate			
Miscellaneous			$ 100.00	
Scanning (unit rate)	$ 10.00	30	$ 300.00	
Photocopying & Report Production	$ 0.17	300	$ 51.00	
Air Freight & Courier			$ 200.00	
Subtotal			$ 651.00	$ 651.00

Laboratory Analysis	Sample Charge	Number of Samples	Total Cost	Cumulative total
Field Physicals	$ 10.00	20	$ 200.00	
Lab Physicals	$ 30.00	20	$ 600.00	
Metals in soil	$ 35.00	10	$ 350.00	
Metals in water (diss. & total)	$ 30.00	16	$ 480.00	
Cyanide in soils	$ 25.00	0	$ -	
Cyanide in water	$ 25.00	0	$ -	
Hg in soil	$ 12.00		$ -	
Hg in water	$ 12.00	10	$ -	
Hydrocarbons in soil (field tests)	$ 10.00	200	$ 2,000.00	
Hydrocarbons in soil (lab tests)	$ 55.00	20	$ 1,100.00	
PCBs in soil (screening)	$ 20.00	20	$ 400.00	
PCBs in soil (lab confirmation)	$ 50.00	5	$ 250.00	
Subtotal			$ 5,380.00	$ 5,380.00
			TOTAL	**$ 33,661.00**

Monitoring of revegetation plots will occur in subsequent years and have not been budgeted here. We would propose that someone from Little Salmon/Carmacks First Nation could be trained to conduct the monitoring of revegetation plots and this could be undertaken at relatively low cost in the future.

The time required to complete this work is estimated to be about 10 days on site plus mobilization and de-mobilization and various sub-contract costs. Subsequently, data will have to be summarized, cost estimates prepared and all findings summarized in a final report. This assumes that the hydrocarbons have remained in the overburden and have not entered bedrock fractures etc. and thus migrated to depth. If hydrocarbons have migrated to depth and entered bedrock, then further consideration will have to be given to the extent of remediation of hydrocarbon contaminated soils.

A preliminary budget for completing the Phase 2 and commencing the identified aspects of the Phase 3 Environmental Site Assessment of CMC is provided in Table 16. Please note that the budget identified in Table 16 includes all aspects of the budget identified in Table 15 and **is not in addition to** the budget required to complete the Phase 2 ESA.

Table 16: Preliminary cost estimates for completing Phase 2 and commencing specific aspects of a Phase 3 Environmental Site Assessment

Person	Daily Rate	No. of Days	Total Cost	Cumulative total
File Review & Field Work				
D. Gregor	$ 960.00	14	$ 13,440.00	
Engineer or Scientist	$ 960.00	5	$ 4,800.00	
Environmental Technologist	$ 550.00	14	$ 7,700.00	
First Nations Contractor	$ 400.00	12	$ 4,800.00	
First Nations Contractor	$ 400.00	12	$ 4,800.00	
Plant scientist	$700	5	$ 3,500.00	
Subtotal			$ 39,040.00	$ 39,040.00
Data Review & Report Preparation				
D. Gregor	$ 960.00	5	$ 4,800.00	
Engineer or Scientist	$ 960.00	3	$ 2,880.00	
Environmental Technologist	$ 610.00	10	$ 6,100.00	
First Nations Contractor	$ 400.00	0	$ -	
First Nations Contractor	$400	0	$ -	
Subtotal			$ 13,780.00	$ 13,780.00

Chargeable Expenses	Daily Rate	No. of Days	No. of Units	Total Cost	
Truck Rental	$ 130.00	14	1	$ 1,820.00	
Helicopter (hourly)	$ 850.00		8	$ 6,800.00	
Aircraft (site has airstrip) (hourly)*	$ 500.00		12	$ 6,000.00	
Trailer Rental	$ 50.00	14	1	$ 700.00	
Meals & Incidentals	$ 60.00	62	1	$ 3,720.00	
Accomodation (hotel only -camp will be set up)	$ 100.00	4	4	$ 1,600.00	
Camp (10 days) (miscellaneous expenses)	$ 50.00	12	1	$ 600.00	
ATV Rental	$ 175.00	14	2	$ 4,900.00	
Portable Drill Unit (including generator)	$ 75.00	12	1	$ 900.00	
Miscellaneous Field supplies				$ 1,000.00	
*helicopter hours have been retained for transferring drums etc. and travel at site as well as set up)					
Subtotal				$ 28,040.00	$ 28,040.00

Report Preparation	Unit rate			
Miscellaneous			$ 200.00	
Scanning (unit rate)	$ 10.00	30	$ 300.00	
Photocopying & Report Production	$ 0.17	300	$ 51.00	
Air Freight & Courier			$ 200.00	
Subtotal			$ 751.00	$ 751.00

Laboratory Analysis

	Sample Charge	Number of Samples	Total Cost		
Field Physicals	$ 10.00	20	$ 200.00		
Laboratory Physicals	$ 30.00	20	$ 600.00		
Metals in soil	$ 35.00	10	$ 350.00		
Metals in water (diss. & total)	$ 30.00	16	$ 480.00		
Cyanide in soils	$ 25.00	0	$ -		
Cyanide in water	$ 25.00	0	$ -		
Hg in soil	$ 12.00	0	$ -		
Hg in water	$ 12.00	0	$ -		
Hydrocarbons in soil (field tests)	$ 10.00	200	$ 2,000.00		
Hydrocarbons in soil (lab tests)	$ 55.00	20	$ 1,100.00		
PCBs in soil (screening)	$ 20.00	20	$ 400.00		
PCBs in soil (lab confirmation)	$ 50.00	5	$ 250.00		
Subtotal			$ 5,380.00	$	5,380.00
			TOTAL	**$**	**86,991.00**

9. References

CCME, 1994. Canadian Environmental Quality Guidelines. Canadian Council of Ministers of the Environment, c/o Manitoba Statutory Publications, 200 Vaughan Street, Winnipeg, MB, Canada.

Hallam Knight Piesold Ltd., 1993. Casino Project - Environmental Monitoring Program Baseline Environmental and Socioeconomic Studies. Prepared for Northern Affairs Program, Environment and Land Claims, Whitehorse, YT. Prepared by Hallam Knight Piesold Ltd., 1450-750 Pender St., Vancouver, B.C.

Hallam Knight Piesold Ltd., 1994. Casino Project – Data Report 1993. Prepared for Pacific Sentinel Gold Corporation, 1020-800 West Pender St., Vancouver, B.C. Prepared by Hallam Knight Piesold Ltd., 1450-750 Pender St., Vancouver, B.C.

Indian and Northern Affairs Canada (INAC), 1999. Snow Survey Bulletin and Water Supply Forecast, May 1, 1999, Yukon Territory. Prepared and issued by: Water Resources Division, Indian and Northern Affairs Canada. pp. 27.

Appendices

Appendix 1: Water quality data from the INAC sampling of the Casino Mine/Camp on September 8, 1993

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MEMORANDUM **NOTE DE SERVICE**

TO / À	Dan Cornett Head Environmental Assessment
FROM / DE	Gerry Whitley Administrator Pollution Control

SECURITY - CLASSIFICATION - DE SÉCURITÉ	
OUR FILE – N / RÉFÉRENCE	Casino
YOUR FILE – V / RÉFÉRENCE	
DATE	June 2 1994

SUBJECT / OBJET: Casino property

I have attached the results of Wayne Kettley's sampling of the Casino property on September 8 1993. Note that Casino Creek downstream of Procter (W-8) was acid and contained metals.

Noted!

Results should be cross checked with company data when submission arrives.

DC

Government of Canada | Gouvernement du Canada

MEMORANDUM NOTE DE SERVICE

TO / À: FILE	SECURITY - CLASSIFICATION - DE SÉCURITÉ
	OUR FILE – N / RÉFÉRENCE: CASINO
	YOUR FILE – V / RÉFÉRENCE
FROM / DE: WAYNE KETTLEY WATER QUALITY TECHNICIAN WATER RESOURCES DIVISION	DATE: FEB.14/94

SUBJECT / OBJET

LABORATORY RESULTS OF SEPT.8 & 9/93 SAMPLING.

ATTACHED ARE THE LAB RESULTS FOR THE SEPT 8 & 9 /93 SAMPLING OF THE CASINO BASELINE.

SEE PRIOR MEMO TO FILE DATED SEPT.13/93 FOR FURTHER INFORMATION ABOUT THIS SAMPLING EVENT.

OF INTEREST IS SAMPLE W-8 CASINO CREEK DOWNSTREAM (30 METERS) OF PROCTOR CONFLUENCE. THIS SAMPLE HAS NO ALKALINITY AND A PH OF 4 TO 5.

WAYNE KETTLEY

ATT.

C.C. W.Q.F.F.

Environment Canada
Laboratories
1195 Marine Drive
West Vancouver, B.C.
V7V 1N8 (604)666-6767

Lab Reference #
9 3 1 8 5 9

23:46 01-Dec-93

F I N A L R E P O R T

Identification: CASINO

Type of Sample: SEDIMENT

Submitted by: THOMSON,PAT
INAC WHITEHORSE YT
WATER RESOURCES
INAC
FED.GOVT

Logged in: 17-Sep-93 (4 samples)

Completed: 01-Dec-93 (137 results)

Charged to: 99-100
INAC WHITEHORSE

Analyzed for: METALS, WRB

Checked by: _____

Notes:

[1] -in preparation for metals analysis, rocks, pieces of wood and other debris larger than approximately 0.5 mm were removed. The remaining sample was seived to obtain the -100 mesh fraction, a portion of which was digested for analysis.
[2] -particle sizing analysis was performed by the Water Survey of Canada laboratory in New Westminster, B. C. Note that results indicate the percentage of the total sample that was finer than the indicated size.
[3] -metals data are reported in dry weight.

RESULTS FOR CASINO SAMPLES

Parameter Analyzed		Units	3125 W4 931859-001	3130 W8 931859-002	3133 931859-003	3134 931859-004
METALS/SEDIMENT (ICP)	AG	ug/g	<2	<2	<2	<2
	AL	ug/g	22000	19100	21700	10300
	AS	ug/g	10	41	29	52
	BA	ug/g	250	250	301	169
	BE	ug/g	.8	.6	.6	.3
	CA	ug/g	8510	3570	4740	1400
	CD	ug/g	<.8	<.8	<.8	<.8
	CO	ug/g	21.8	18.5	22	5.6
	CR	ug/g	30.2	23.8	26.1	18.6
	CU	ug/g	95.7	405	899	299
	FE	ug/g	35700	60100	45300	203000
	K	ug/g	2330	1880	2280	1700
	MG	ug/g	8160	4700	5180	2390
	MN	ug/g	752	516	533	197
	MO	ug/g	3	33	54	20
	NA	ug/g	450	180	240	90
	NI	ug/g	26	17	19	<3
	P	ug/g	730	800	820	810
	PB	ug/g	33	56	30	92
	SB	ug/g	<8	8	<8	10
	SI	ug/g	283	267	386	350
	SN	ug/g	<8	<8	<8	10
	SR	ug/g	55.1	32.1	45.5	13
	TI	ug/g	1790	1090	1110	558
	V	ug/g	100	78	75	97
	ZN	ug/g	136	126	92.4	124
SIZE/-0.063 MM (-230 MESH)		%	7.2	24.9	13.4	17.0
.15 MM (-100 MESH)		%	10.9	34.8	19.6	36.5
.25 MM (-60 MESH)		%	16.8	43.1	26.1	54.3
.50 MM (-35 MESH)		%	46.2	59.7	41.5	76.0
/-1.0 MM (-18 MESH)		%	78.0	74.5	55.3	83.7
/-2.0 MM (-10 MESH)		%	96.0	86.5	69.3	88.1
/+2.0 MM (10 MESH)		%	4.0	13.5	30.7	11.9
TOTAL SAMPLE WEIGHT		g	113.0	136.4	143.5	95.7

Environment Canada
Laboratories
195 Marine Drive
West Vancouver, B.C.
V7V 1N8 (604)666-6767

Lab Reference #
9 3 1 8 8 4

23:10 04-Feb-94

F I N A L R E P O R T

Identification: CASINO

Type of Sample: FRESH WATER

Submitted by: THOMSON,PAT
INAC WHITEHORSE YT
WATER RESOURCES
INAC
FED.GOVT

Logged in: 22-Sep-93 (11 samples)

Completed: 04-Feb-94 (1177 results)

Charged to: 99-100
INAC WATER RESOURCES

Analyzed for: INORGANICS, METALS

Checked by: _____

RESULTS FOR CASINO SAMPLES

Parameter Analyzed		Units	3122 W-1 931884-001	3123 W-2 931884-002	3124 W-3 931884-003	3125 W-4 931884-004	3126 W-5 931884-005
ALKALINITY		mg/l	82	70	67	82	74
CHLORIDE		mg/l	.6	.5	.4	.4	.3
CONDUCTIVITY		uS/cm	293	240	240	242	191
CYANIDE		mg/l	<.03	<.03	<.03	<.03	<.03
CYANIDE/WEAK ACID DISSOC.		mg/l	<.03	<.03	<.03	<.03	<.03
FLUORIDE		mg/l	.12	0.09	0.09	0.07	0.06
METALS/DISS.(WATER-ICP SCAN)	AG	mg/l	<.01	<.01	<.01	<.01	<.01
	AL	mg/l	<.05	<.05	<.05	<.05	<.05
	AS	mg/l	<.05	<.05	<.05	<.05	<.05
	B	mg/l	<.01	<.01	<.01	<.01	<.01
	BA	mg/l	.066	.059	.054	.066	.057
	BE	mg/l	.002	.001	<.001	<.001	<.001
	CA	mg/l	39.4	32.2	32.8	37.1	27.3
	CD	mg/l	<.005	<.005	<.005	<.005	<.005
	CO	mg/l	<.005	<.005	<.005	<.005	<.005
	CR	mg/l	<.005	.008	<.005	<.005	<.005
	CU	mg/l	.005	.005	.006	.011	.006
	FE	mg/l	.019	.03	.026	.033	.052
	K	mg/l	1.6	1.5	1.4	1	.9
	MG	mg/l	13.5	10.7	10.5	9.4	7.5
	MN	mg/l	.002	.005	.005	.026	.021
	MO	mg/l	<.01	<.01	<.01	<.01	<.01
	NA	mg/l	3.1	3.1	3	3.3	3.3
	NI	mg/l	<.02	<.02	<.02	<.02	<.02
	P	mg/l	<.1	<.1	<.1	<.1	<.1
	PB	mg/l	<.05	<.05	<.05	<.05	<.05
	SB	mg/l	<.05	<.05	<.05	<.05	<.05
	SE	mg/l	<.05	<.05	<.05	<.05	<.05
	SI	mg/l	4.91	5.51	5.77	5.83	5.28
	SN	mg/l	<.05	<.05	<.05	<.05	<.05
	SR	mg/l	.215	.203	.19	.202	.18
	TI	mg/l	<.002	<.002	<.002	<.002	<.002
	V	mg/l	<.01	<.01	<.01	<.01	<.01
	ZN	mg/l	.006	.005	.009	.011	.007
.HARDNESS/CA+MG	HC	mg/l	154	124	125	131	99
/TOTAL	HT	mg/l	154	125	126	132	99.5
/EXT.(WATER-ICP SCAN)	AG	mg/l	<.01	<.01	<.01	<.01	<.01
	AL	mg/l	<.05	.08	.07	.11	.07
	AS	mg/l	<.05	<.05	<.05	<.05	<.05
	B	mg/l	<.01	<.01	<.01	<.01	<.01
	BA	mg/l	.064	.059	.054	.067	.058
	BE	mg/l	.001	.001	.001	.001	.001
	CA	mg/l	43.7	35.1	36.4	41	30.4
	CD	mg/l	<.005	<.005	<.005	<.005	<.005
	CO	mg/l	<.005	<.005	<.005	<.005	<.005
	CR	mg/l	<.005	<.005	<.005	<.005	.009
	CU	mg/l	.006	.01	.007	.019	.007
	FE	mg/l	.043	.081	.098	.259	.174
	K	mg/l	1.6	1.3	1.3	1	.7
	MG	mg/l	13.4	10.6	10.4	9.3	7.5
	MN	mg/l	.007	.006	.007	.028	.027

RESULTS FOR CASINO SAMPLES

Parameter Analyzed		Units	3122 W-1 931884-001	3123 W-2 931884-002	3124 W-3 931884-003	3125 W-4 931884-004	3126 W-5 931884-005
ETALS/EXT.(WATER-ICP SCAN)	MO	mg/l	<.01	<.01	<.01	<.01	<.01
	NA	mg/l	3.1	3	2.9	3.4	3
	NI	mg/l	<.02	.02	<.02	<.02	<.02
	P	mg/l	<.1	<.1	<.1	<.1	<.1
	PB	mg/l	<.05	<.05	<.05	<.05	<.05
	SB	mg/l	<.05	<.05	<.05	<.05	<.05
	SE	mg/l	<.05	<.05	<.05	<.05	<.05
	SI	mg/l	5.08	5.5	5.82	5.94	5.39
	SN	mg/l	<.05	<.05	<.05	<.05	<.05
	SR	mg/l	.218	.2	.189	.201	.181
	TI	mg/l	<.002	<.002	.003	.003	<.002
	V	mg/l	<.01	<.01	<.01	<.01	<.01
	ZN	mg/l	.011	.006	.016	.02	.009
.HARDNESS/CA+MG	HC	mg/l	165	131	134	141	107
/TOTAL	HT	mg/l	165	132	134	142	107
/TOTAL (WATER-HG)	HG	mg/l	<.00005	<.00005	<.00005	<.00005	<.00005
(WATER-ICP)	AG	mg/l	<.01	<.01	<.01	<.01	<.01
	AL	mg/l	<.06	.06	.06	.1	.08
	AS	mg/l	<.06	<.06	<.06	<.06	<.06
	B	mg/l	<.01	<.01	<.01	<.01	<.01
	BA	mg/l	.068	.062	.059	.068	.06
	BE	mg/l	.002	.002	.002	.002	.001
	CA	mg/l	43.6	33.6	34.5	39.1	29
	CD	mg/l	<.006	<.006	<.006	<.006	<.006
	CO	mg/l	<.006	<.006	<.006	<.006	<.006
	CR	mg/l	.059	.012	<.006	<.006	<.006
	CU	mg/l	.054	.006	.013	.017	.008
	FE	mg/l	.142	.121	.123	.242	.179
	K	mg/l	1.8	1.5	1.5	1	.8
	MG	mg/l	12.8	10.7	9.8	9.3	6.8
	MN	mg/l	.082	.006	.007	.027	.023
	MO	mg/l	<.01	<.01	<.01	<.01	<.01
	NA	mg/l	3.5	3.3	3.3	3.6	3.3
	NI	mg/l	.13	<.02	<.02	<.02	<.02
	P	mg/l	<.1	<.1	<.1	<.1	<.1
	PB	mg/l	<.06	<.06	<.06	<.06	<.06
	SB	mg/l	<.06	<.06	<.06	<.06	<.06
	SE	mg/l	<.06	<.06	<.06	<.06	<.06
	SI	mg/l	5.22	5.61	6.03	5.83	5.48
	SN	mg/l	<.06	<.06	<.06	<.06	<.06
	SR	mg/l	.215	.201	.178	.196	.181
	TI	mg/l	<.002	<.002	.003	.004	.004
	V	mg/l	<.01	<.01	<.01	<.01	<.01
	ZN	mg/l	.078	.004	.012	.013	.007
ITROGEN/AMMONIA		mg/l	.002	.009	.003	.005	<.002
/NITRITE		mg/l	<.002	<.002	<.002	<.002	<.002
/NITRITE+NITRATE		mg/l	.247	.27	.232	.188	.153
		Rel.U.	7.81	7.80	7.87	7.84	7.79
OSPHORUS/TOTAL		mg/l	.003	.003	.003	.003	.004
RESIDUE/FILTERABLE		mg/l	210	170	170	170	130
/NON-FILTERABLE		mg/l	<10	<10	<10	<10	<9

RESULTS FOR CASINO SAMPLES

Parameter Analyzed	Units	3122 W-1 931884-001	3123 W-2 931884-002	3124 W-3 931884-003	3125 W-4 931884-004	3126 W-5 931884-005
SULPHATE	mg/l	64	46	50.1	41	20
TURBIDITY	FTU	.30	.42	.54	1.4	.66

RESULTS FOR CASINO SAMPLES

Parameter Analyzed		Units	3127 W-6 931884-006	3128 W-7 931884-007	3129 W-7 931884-008	3130 W-8 931884-009	3131 W-9 931884-010
ALKALINITY		mg/l	67	68	12	<1.0	81
CHLORIDE		mg/l	.4	.3	.6	.5	<.2
CONDUCTIVITY		uS/cm	161	181	100	505	190
CYANIDE		mg/l	<.03	<.03	<.03	<.03	<.03
CYANIDE/WEAK ACID DISSOC.		mg/l	<.03	<.03	<.03	<.03	<.03
FLUORIDE		mg/l	0.12	0.12	0.08	0.25	0.06
METALS/DISS.(WATER-ICP SCAN)	AG	mg/l	<.01	<.01	<.01	<.01	<.01
	AL	mg/l	<.05	<.05	.07	2.89	<.05
	AS	mg/l	<.05	<.05	<.05	<.05	<.05
	B	mg/l	<.01	<.01	<.01	.01	<.01
	BA	mg/l	.04	.044	.041	.036	.057
	BE	mg/l	<.001	<.001	<.001	.003	.001
	CA	mg/l	25.7	27.5	12	75.3	29.7
	CD	mg/l	<.005	<.005	<.005	<.005	<.005
	CO	mg/l	<.005	<.005	<.005	.013	<.005
	CR	mg/l	<.005	<.005	<.005	<.005	<.005
	CU	mg/l	<.005	<.005	<.005	.492	.005
	FE	mg/l	.016	.015	.044	6.54	.074
	K	mg/l	.6	.8	.4	1.3	.7
	MG	mg/l	5.6	6.6	2.1	11	7.2
	MN	mg/l	.004	.007	.002	.414	.024
	MO	mg/l	<.01	<.01	<.01	<.01	<.01
	NA	mg/l	1.6	1.9	3.1	4.4	3.5
	NI	mg/l	<.02	<.02	<.02	<.02	<.02
	P	mg/l	<.1	<.1	<.1	<.1	<.1
	PB	mg/l	<.05	<.05	<.05	<.05	<.05
	SB	mg/l	<.05	<.05	<.05	<.05	<.05
	SE	mg/l	<.05	<.05	<.05	<.05	<.05
	SI	mg/l	2.65	2.94	9.88	11	5.56
	SN	mg/l	<.05	<.05	<.05	<.05	<.05
	SR	mg/l	.112	.125	.076	.244	.2
	TI	mg/l	<.002	<.002	<.002	.002	.002
	V	mg/l	<.01	<.01	<.01	.01	<.01
	ZN	mg/l	.003	.013	.013	.152	.002
.HARDNESS/CA+MG	HC	mg/l	87.4	96.1	38.5	233	104
/TOTAL	HT	mg/l	87.7	96.3	39	258	105
/EXT.(WATER-ICP SCAN)	AG	mg/l	<.01	<.01	<.01	<.01	<.01
	AL	mg/l	.11	.15	.14	3.51	.07
	AS	mg/l	<.05	<.05	<.05	<.05	<.05
	B	mg/l	<.01	<.01	<.01	.01	<.01
	BA	mg/l	.044	.048	.043	.039	.056
	BE	mg/l	.001	.001	<.001	.003	<.001
	CA	mg/l	29.1	31.4	13.8	81.4	31.2
	CD	mg/l	<.005	<.005	<.005	<.005	<.005
	CO	mg/l	<.005	<.005	<.005	.017	<.005
	CR	mg/l	<.005	<.005	<.005	.006	.009
	CU	mg/l	<.005	.005	<.005	.523	<.005
	FE	mg/l	.158	.234	.143	9.29	.168
	K	mg/l	.6	.8	.4	1.2	.6
	MG	mg/l	5.7	6.7	2.1	10.8	7
	MN	mg/l	.01	.018	.002	.496	.026

RESULTS FOR CASINO SAMPLES

Parameter Analyzed		Units	3127 W-6 931884-006	3128 W-7 931884-007	3129 W-7 931884-008	3130 W-8 931884-009	3131 W-9 931884-010
METALS/EXT.(WATER-ICP SCAN)	MO	mg/l	<.01	<.01	<.01	<.01	<.01
	NA	mg/l	1.4	1.7	3.2	4.6	3.2
	NI	mg/l	<.02	<.02	<.02	<.02	<.02
	P	mg/l	<.1	<.1	<.1	<.1	<.1
	PB	mg/l	<.05	<.05	<.05	<.05	<.05
	SB	mg/l	<.05	<.05	<.05	<.05	<.05
	SE	mg/l	<.05	<.05	<.05	<.05	<.05
	SI	mg/l	2.88	3.24	10.2	11.6	5.53
	SN	mg/l	<.05	<.05	<.05	<.05	<.05
	SR	mg/l	.114	.126	.076	.241	.195
	TI	mg/l	.002	.005	.003	.003	.004
	V	mg/l	<.01	<.01	<.01	.01	<.01
	ZN	mg/l	.013	.017	.014	.166	.006
.HARDNESS/CA+MG	HC	mg/l	96	106	42.9	248	107
/TOTAL	HT	mg/l	96.9	107	43.9	280	108
/TOTAL (WATER-HG)	HG	mg/l	<.00005	<.00005	<.00005	.00007	.00006
(WATER-ICP)	AG	mg/l	<.01	<.01	<.01	<.01	<.01
	AL	mg/l	.1	.25	.16	3.96	.08
	AS	mg/l	<.06	<.06	<.06	<.06	<.06
	B	mg/l	<.01	<.01	<.01	<.01	<.01
	BA	mg/l	.047	.056	.049	.046	.06
	BE	mg/l	.001	.001	<.001	.002	.001
	CA	mg/l	28.5	30.8	17.2	81.6	29.8
	CD	mg/l	<.006	<.006	<.006	<.006	<.006
	CO	mg/l	<.006	<.006	<.006	.019	<.006
	CR	mg/l	<.006	.007	.006	<.006	.024
	CU	mg/l	<.006	<.006	.006	.553	.017
	FE	mg/l	.177	.318	.272	9.19	.192
	K	mg/l	.7	1	.5	1.6	.8
	MG	mg/l	5.4	6.5	2.1	11	6.6
	MN	mg/l	.008	.016	.003	.493	.048
	MO	mg/l	<.01	<.01	<.01	<.01	<.01
	NA	mg/l	1.6	2	3.8	5.8	3.7
	NI	mg/l	<.02	<.02	<.02	<.02	.04
	P	mg/l	<.1	<.1	<.1	<.1	<.1
	PB	mg/l	<.06	<.06	<.06	<.06	<.06
	SB	mg/l	<.06	<.06	<.06	<.06	<.06
	SE	mg/l	<.06	<.06	<.06	<.06	<.06
	SI	mg/l	3.26	3.99	10.5	12.8	5.6
	SN	mg/l	<.06	<.06	<.06	<.06	<.06
	SR	mg/l	.11	.124	.074	.247	.203
	TI	mg/l	.004	.01	.01	.01	.004
	V	mg/l	<.01	<.01	<.01	<.01	<.01
	ZN	mg/l	.01	.017	.022	.167	.008
ITROGEN/AMMONIA		mg/l	.007	.031	.044	.026	.016
/NITRITE		mg/l	<.002	<.002	<.002	<.002	<.002
/NITRITE+NITRATE		mg/l	.007	.036	.017	.118	.166
H		Rel.U.	8.00	7.88	7.12	3.88	7.76
HOSPHORUS/TOTAL		mg/l	.005	.008	.008	.013	.008
ESIDUE/FILTERABLE		mg/l	90	110	80	370	130
/NON-FILTERABLE		mg/l	<10	<8	<9	20	<10

RESULTS FOR CASINO SAMPLES

Parameter Analyzed	Units	3127 W-6 931884-006	3128 W-7 931884-007	3129 W-7 931884-008	3130 W-8 931884-009	3131 W-9 931884-010
SULPHATE	mg/l	14.5	20.3	32	200	14
TURBIDITY	FTU	2.2	2.1	.75	17	.54

RESULTS FOR CASINO SAMPLES

Parameter Analyzed		Units	3132 BLNK 931884-011
ALKALINITY		mg/l	<1.0
CHLORIDE		mg/l	<.2
CONDUCTIVITY		uS/cm	1.4
CYANIDE		mg/l	-
CYANIDE/WEAK ACID DISSOC.		mg/l	-
FLUORIDE		mg/l	<0.02
METALS/DISS.(WATER-ICP SCAN)	AG	mg/l	<.01
	AL	mg/l	<.05
	AS	mg/l	<.05
	B	mg/l	<.01
	BA	mg/l	<.001
	BE	mg/l	<.001
	CA	mg/l	<.1
	CD	mg/l	<.005
	CO	mg/l	<.005
	CR	mg/l	<.005
	CU	mg/l	<.005
	FE	mg/l	<.005
	K	mg/l	<.1
	MG	mg/l	<.1
	MN	mg/l	.002
	MO	mg/l	<.01
	NA	mg/l	<.1
	NI	mg/l	<.02
	P	mg/l	<.1
	PB	mg/l	<.05
	SB	mg/l	<.05
	SE	mg/l	<.05
	SI	mg/l	<.05
	SN	mg/l	<.05
	SR	mg/l	<.001
	TI	mg/l	.002
	V	mg/l	<.01
	ZN	mg/l	<.002
.HARDNESS/CA+MG	HC	mg/l	<.4
/TOTAL	HT	mg/l	<.4
/EXT.(WATER-ICP SCAN)	AG	mg/l	<.01
	AL	mg/l	<.05
	AS	mg/l	<.05
	B	mg/l	<.01
	BA	mg/l	<.001
	BE	mg/l	<.001
	CA	mg/l	<.1
	CD	mg/l	<.005
	CO	mg/l	<.005
	CR	mg/l	<.005
	CU	mg/l	<.005
	FE	mg/l	.008
	K	mg/l	<.1
	MG	mg/l	<.1
	MN	mg/l	<.001

RESULTS FOR CASINO SAMPLES

Parameter Analyzed		Units	3132 BLANK 931884-011
METALS/EXT.(WATER-ICP SCAN)	MO	mg/l	<.01
	NA	mg/l	<.1
	NI	mg/l	<.02
	P	mg/l	<.1
	PB	mg/l	<.05
	SB	mg/l	<.05
	SE	mg/l	<.05
	SI	mg/l	<.05
	SN	mg/l	<.05
	SR	mg/l	<.001
	TI	mg/l	<.002
	V	mg/l	<.01
	ZN	mg/l	.005
.HARDNESS/CA+MG	HC	mg/l	<.4
/TOTAL	HT	mg/l	<.4
/TOTAL (WATER-HG)	HG	mg/l	.00008
(WATER-ICP)	AG	mg/l	<.01
	AL	mg/l	<.06
	AS	mg/l	<.06
	B	mg/l	<.01
	BA	mg/l	<.001
	BE	mg/l	<.001
	CA	mg/l	<.1
	CD	mg/l	<.006
	CO	mg/l	<.006
	CR	mg/l	<.006
	CU	mg/l	<.006
	FE	mg/l	.018
	K	mg/l	<.1
	MG	mg/l	<.1
	MN	mg/l	.001
	MO	mg/l	<.01
	NA	mg/l	<.1
	NI	mg/l	<.02
	P	mg/l	<.1
	PB	mg/l	<.06
	SB	mg/l	<.06
	SE	mg/l	<.06
	SI	mg/l	<.06
	SN	mg/l	<.06
	SR	mg/l	<.001
	TI	mg/l	<.002
	V	mg/l	<.01
	ZN	mg/l	.003
NITROGEN/AMMONIA		mg/l	<.002
/NITRITE		mg/l	<.002
/NITRITE+NITRATE		mg/l	.006
PH		Rel.U.	5.87
PHOSPHORUS/TOTAL		mg/l	<.002
RESIDUE/FILTERABLE		mg/l	<10
/NON-FILTERABLE		mg/l	<9

RESULTS FOR CASINO SAMPLES

Parameter Analyzed	Units	3132 B Blank 931884-011
SULPHATE	mg/l	.5
TURBIDITY	FTU	1.1

Appendix 2: Memorandum to file from W. Kettley (May 26, 1994) including field and laboratory data for baseline sampling of Casino Mine/Camp, May 18 & 19, 1994

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

To / À: FILE

From / De: WAYNE KETTLEY
WATER QUALITY TECHNICIAN
WATER RESOURCES DIVISION

Security Classification – Classification de sécurité:

Our File – Notre référence: **CASINO**

Your File – Votre référence:

Date: MAY 26/94

Subject / Objet: **BASELINE SAMPLING OF CASINO ON MAY 18 & 19/94.**

ON MAY 18 & 19/94 A BASELINE SAMPLING OF THE CASINO PROPERTY WAS CONDUCTED BY KETTLEY. I WAS ACCOMPANIED BY MR GIBSON OF GIBSON AND ASSOCIATES WHO WAS ALSO TAKING WATER QUALITY SAMPLES FOR THE PACIFIC SENTINEL GOLD CORP. OUR SAMPLES WERE SPLIT SAMPLES THEREFORE THE TWO SETS OF LAB RESULTS SHOULD BE QUITE COMPARABLE.

THE FOLLOWING ARE NOTES AND OBSERVATIONS FROM THIS SAMPLING:

-WEATHER ON MAY 18 WAS CLEAR AND WARM, +18°C. ON MAY 19 40% CLOUD AND ABOUT 12°C. ALL TRAILS CLEAR OF SNOW EXCEPT FOR A 1.5 KM STRETCH ON THE BRITANNIA CREEK ROAD NEAR EAST FACE OF SUMMIT.

-SEEN A BEAR AND SEEN BEAR SIGN. SOMETHING, MAYBE A BEAR RIPPED THE DATA LOGGER OFF THE TREE AT W-4.(LOGGER WAS SECURED WITH 6 INCH SPIKES DRIVEN IN 4 INCHES.)

-SAMPLES ARE SPLIT DUPLICATE SAMPLES FROM A 2 LITER CONTAINER. OUR LARGEST SAMPLE WAS 1 LITER IN SIZE, THEREFORE EACH OF OUR CORRESPONDING SAMPLES WERE DUPLICATES BUT THE ENTIRE SAMPLE WAS NOT A DUPLICATE. I.E. THE ROUTINE CHEMISTRY (1 LITER EACH) WERE DUPLICATES, THE CYANIDE (1 LITER EACH) WERE DUPLICATES, BUT THE ROUTINE CHEMISTRY TOGETHER WITH THE CYANIDE SAMPLES WERE NOT DUPLICATES OF EACH OTHER. THIS WAS DUE TO THE SPACE LIMITATIONS ON THE FOUR WHEELERS TO CARRY A LARGE ENOUGH CONTAINER TO ACCOMMODATE ALL THE SAMPLE.

-ATTACHED ARE THE LAB ANALYSES. SAMPLES LABELLED "DUPLICATE" ARE LAB DUPLICATE ANALYSES OF THAT SAMPLE. THE SAMPLE LABELLED "BLANK" IS A SAMPLE OF OUR FIELD LAB REAGENT WATER PRESERVED IN THE APPROPRIATE BOTTLES AND FOR DISSOLVED METALS, FILTERED, THEN PRESERVED.

STATION	LAB NO.	PH	COND. µMHOS	TEMP. °C	FLOW L/S	NOTES
W-1	4078	7.7	189.2	4.2	1079	
W-2	4079	7.6	115.6	3.1	1203	
W-3	4080	7.6	135.1	4.2	715	
W-4	4081	7.9	192.2	4.6	501	

STATION	LAB NO.	PH	COND. μMHOS	TEMP. °C	FLOW L/S	NOTES
W-4D	4082					NOTE 1
W-5	4083	7.7	157.0	5.1	1563	
W-6A	4084	8.0	174.1	10.6		NOTE 2
W-6B	4085	8.1	176.5	9.6		NOTE 2
W-7	4086	6.7	27.2	2.6	N.T.	NOTE 3
W-8	4087	4.8	594	6.4	N.T.	NOTE 4
W-9	4088	7.8	151.2	3.6	N.T.	

N.T.= NOT TAKEN.

NOTES:

1.THIS IS A SAMPLE OF W-4 TAKEN AT THE SAME PLACE ONLY ABOUT 10 MINUTES APART.

2.SAMPLED 60 CM OUT FROM SHORE. THERE WAS A LOT OF SHORE ICE WHICH WAS MELTING AND RUNNING INTO RIVER, UNDOUBTEDLY AFFECTING SAMPLE. BUT DUE TO THE SILTINESS OF THE RIVER WATER AND THE DROP OFF NATURE OF RIVER BANKS, WE WERE UNABLE TO GET A SAMPLE (WITH HIP WADERS) FARTHER OUT INTO THE RIVER.

3.AT THIS SITE ONE COULD SEE THAT THERE WAS AT LEAST ABOUT 3 METERS OF GLACIATED ICE HERE DURING THE WINTER OF WHICH ABOUT 1/3 REMAIN IN PLACES.

4.THERE IS A DIAMOND DRILL WATER PUMP STATION IN STREAM ABOUT 40 METERS UPSTREAM FROM THIS STATION. IT IS A DIESEL PUMP WHICH DOES LEAK DIESEL AND OIL. THE AFFECT ON SAMPLE UNKNOWN.

Wayne Kettley

WAYNE KETTLEY

ATT.

C.C. W.Q.F.F.
W.R.F.F.

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1

Tel:(604)438-5226
Fax:(604)436-0565

ANALYSIS OF WATER SAMPLES

To: NORTHERN AFFAIRS PROGRAM
DIAND/WATER RESOURCES
204 Range Road
Whitehorse, Y.T.
Y1A 3V1

Workorder: 23334
Received : 25-May-94
Completed: 02-Jun-94

Attn: Pat Thomson

Re: Base Line Water Samples

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1

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To: NORTHERN AFFAIRS PROGRAM

W/O: 23334 Page 1

Sample type	fresh	fresh	fresh	fresh	fresh
Identification	4078 W-1	4078 W-1	4079 W2	4079 W2	4080 W3
Lab Reference #	23334-001	23334-001	23334-002	23334-002	23334-00
PHYSICAL TESTS - ALKALINITY					
Hydroxide CaCO3	< 5.	-	< 5.	-	< 5.
Carbonate CaCO3	< 5.	-	< 5.	-	< 5.
Bicarb. CaCO3	50.	-	35.	-	33.
Total Alk. CaCO3	50.	-	35.	-	33.
Results in	mg/L		mg/L		mg/L
PHYSICAL TESTS					
Conduct. uS/cm	185.	-	113.	-	130.
pH	7.7	-	7.4	-	7.5
Turbidity FTU	2.	-	7.	-	12.
SOLIDS					
Suspended 105C	< 5.	-	22.	-	21.
Dissolved 105C	154.	-	95.	-	109.
Results in	mg/L		mg/L		mg/L
ANIONS BY IEC					
Chloride Cl	0.4	-	0.3	-	0.3
Fluoride F	< 1.	-	< 1.	-	< 1.
Nitrate NO3-N	0.2	-	0.1	-	0.1
Nitrite NO2-N	< 0.5	-	< 0.5	-	< 0.5
Sulfate SO4	39.5	-	19.9	-	29.5
Results in	mg/L		mg/L		mg/L
NITROGEN					
Ammonia NH3-N	< 0.05	-	< 0.05	-	< 0.05
Results in	mg/L		mg/L		mg/L
PHOSPHOROUS					
Ortho PO4-P	< 0.005	-	0.005	-	0.009
Total Dis PO4-P	0.049	-	0.059	-	0.034
Results in	mg/L		mg/L		mg/L
Total Cyanide CN	0.023	-	0.021	-	0.02
Results in	mg/L		mg/L		mg/L

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To: NORTHERN AFFAIRS PROGRAM W/O: 23334 Page 2

Sample type		fresh	fresh	fresh	fresh	fresh
Identification		4078	4078	4079	4079	4080
		W-1	W-1	W2	W2	W3
Lab Reference #		23334-001	23334-001	23334-002	23334-002	23334-003
ICP - ULTRASONIC NEBULIZATION-- Method used		field filt. DISSOLVED	uwave HNO3 TOTAL	field filt. DISSOLVED	uwave HNO3 TOTAL	field filt. DISSOLVED
Aluminum	Al	0.10	0.18	0.15	0.72	0.1
Antimony	Sb	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Arsenic	As	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Barium	Ba	0.0433	0.0457	0.0378	0.0544	0.0327
Beryllium	Be	< 0.0002	< 0.0002	< 0.0002	0.0003	< 0.0002
Bismuth	Bi	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Cadmium	Cd	< 0.0006	< 0.0006	< 0.0006	< 0.0006	< 0.0006
Calcium	Ca	21.0	21.1	13.0	13.0	14.8
Chromium	Cr	< 0.001	< 0.001	< 0.001	0.002	< 0.001
Cobalt	Co	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Copper	Cu	0.009	0.012	0.007	0.013	0.01
Iron	Fe	0.118	0.288	0.155	1.07	0.161
Lead	Pb	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lithium	Li	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Magnesium	Mg	7.46	7.53	4.37	4.47	4.95
Manganese	Mn	0.006	0.011	0.028	0.049	0.01
Molybdenum	Mo	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nickel	Ni	0.002	0.003	< 0.001	0.004	0.003
Phosphorus	P	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Potassium	K	1.5	1.6	1.2	1.4	1.3
Selenium	Se	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Silicon	Si	2.82	2.91	2.23	3.09	2.84
Silver	Ag	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Sodium	Na	2.43	2.43	1.73	1.75	2.00
Strontium	Sr	0.13	0.13	0.09	0.09	0.09
Sulfur	S	11.6	11.6	5.9	6.0	8.2
Tin	Sn	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Titanium	Ti	0.003	0.008	0.003	0.043	0.003
Thorium	Th	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Uranium	U	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07
Vanadium	V	< 0.002	< 0.002	< 0.002	0.002	< 0.002
Zinc	Zn	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Zirconium	Zr	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Results in		mg/L	mg/L	mg/L	mg/L	mg/L

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To: NORTHERN AFFAIRS PROGRAM W/O: 23334 Page 3

Sample type	fresh	fresh	fresh	fresh	fresh
Identification	4080 W3	4081 W4	4081 W4	4081 W4	4081 W4
Fraction				DUPLICATE	DUPLICATE
Lab Reference #	23334-003	23334-004A	23334-004A	23334-004B	23334-004
PHYSICAL TESTS - ALKALINITY					
Hydroxide CaCO3	-	< 5.	-	< 5.	-
Carbonate CaCO3	-	< 5.	-	< 5.	-
Bicarb. CaCO3	-	60.	-	62.	-
Total Alk. CaCO3	-	60.	-	62.	-
Results in		mg/L		mg/L	
PHYSICAL TESTS					
Conduct. uS/cm	-	185.	-	185.	-
pH	-	7.9	-	7.9	-
Turbidity FTU	-	8.	-	8.	-
SOLIDS					
Suspended 105C	-	13.	-	14.	-
Dissolved 105C	-	141.	-	139.	-
Results in		mg/L		mg/L	
ANIONS BY IEC					
Chloride Cl	-	< 0.3	-	< 0.3	-
Fluoride F	-	< 1.	-	< 1.	-
Nitrate NO3-N	-	0.09	-	0.09	-
Nitrite NO2-N	-	< 0.5	-	< 0.5	-
Sulfate SO4	-	29.6	-	30.9	-
Results in		mg/L		mg/L	
NITROGEN					
Ammonia NH3-N	-	< 0.05	-	< 0.05	-
Results in		mg/L		mg/L	
PHOSPHOROUS					
Ortho PO4-P	-	< 0.005	-	< 0.005	-
Total Dis PO4-P	-	0.020	-	0.016	-
Results in		mg/L		mg/L	
Total Cyanide CN	-	0.021	-	-	-
Results in		mg/L			

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To: NORTHERN AFFAIRS PROGRAM W/O: 23334 Page 4

Sample type		fresh	fresh	fresh	fresh	fresh
Identification		4080	4081	4081	4081	4081
		W3	W4	W4	W4	W4
Fraction					DUPLICATE	DUPLICATE
Lab Reference #		23334-003	23334-004A	23334-004A	23334-004B	23334-004B
ICP - ULTRASONIC NEBULIZATION--						
Method used		uwave HNO3 TOTAL	field filt. DISSOLVED	uwave HNO3 TOTAL	field filt. DISSOLVED	uwave HNO3 TOTAL
Aluminum	Al	0.80	0.02	0.27	0.03	0.45
Antimony	Sb	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Arsenic	As	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Barium	Ba	0.0492	0.0467	0.0608	0.0485	0.0587
Beryllium	Be	0.0002	< 0.0002	0.0003	< 0.0002	< 0.0002
Bismuth	Bi	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Cadmium	Cd	< 0.0006	< 0.0006	< 0.0006	< 0.0006	< 0.0006
Calcium	Ca	15.4	21.3	23.9	22.2	22.7
Chromium	Cr	0.002	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	Co	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Copper	Cu	0.020	0.011	0.018	0.012	0.018
Iron	Fe	1.30	0.072	0.489	0.073	0.671
Lead	Pb	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lithium	Li	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Magnesium	Mg	5.29	6.21	6.99	6.46	6.67
Manganese	Mn	0.036	0.031	0.053	0.032	0.051
Molybdenum	Mo	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nickel	Ni	0.003	< 0.001	0.001	0.001	0.002
Phosphorus	P	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Potassium	K	1.6	1.3	1.5	1.2	1.6
Selenium	Se	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Silicon	Si	4.00	3.56	4.41	3.71	4.44
Silver	Ag	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Sodium	Na	2.14	3.16	3.61	3.27	3.51
Strontium	Sr	0.10	0.13	0.15	0.14	0.14
Sulfur	S	8.8	8.1	9.7	8.5	9.0
Tin	Sn	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Titanium	Ti	0.046	0.001	0.016	0.001	0.026
Thorium	Th	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Uranium	U	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07
Vanadium	V	0.003	< 0.002	0.003	< 0.002	0.003
Zinc	Zn	0.007	< 0.005	< 0.005	< 0.005	< 0.005
Zirconium	Zr	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Results in		mg/L	mg/L	mg/L	mg/L	mg/L

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To: NORTHERN AFFAIRS PROGRAM W/O: 23334 Page 5

Sample type		fresh	fresh	fresh	fresh	fresh
Identification		4082	4082	4083	4083	4084
		W4D	W4D	W5	W5	W6A
Lab Reference #		23334-005	23334-005	23334-006	23334-006	23334-007
PHYSICAL TESTS - ALKALINITY						
Hydroxide	CaCO3	< 5.	-	< 5.	-	< 5.
Carbonate	CaCO3	< 5.	-	< 5.	-	< 5.
Bicarb.	CaCO3	60.	-	60.	-	63.
Total Alk.	CaCO3	60.	-	60.	-	63.
Results in		mg/L		mg/L		mg/L
PHYSICAL TESTS						
Conduct.	uS/cm	185.	-	150.	-	170.
pH		7.9	-	7.9	-	8.0
Turbidity	FTU	5.	-	5.	-	34.
SOLIDS						
Suspended	105C	13.	-	12.	-	52.
Dissolved	105C	143.	-	123.	-	117.
Results in		mg/L		mg/L		mg/L
ANIONS BY IEC						
Chloride	Cl	< 0.3	-	< 0.3	-	< 0.3
Fluoride	F	< 1.	-	< 1.	-	< 1.
Nitrate	NO3-N	0.08	-	0.07	-	< 0.05
Nitrite	NO2-N	< 0.5	-	< 0.5	-	< 0.5
Sulfate	SO4	29.1	-	19.2	-	20.6
Results in		mg/L		mg/L		mg/L
NITROGEN						
Ammonia	NH3-N	< 0.05	-	< 0.05	-	< 0.05
Results in		mg/L		mg/L		mg/L
PHOSPHOROUS						
Ortho	PO4-P	< 0.005	-	< 0.005	-	0.011
Total Dis	PO4-P	0.035	-	0.069	-	0.030
Results in		mg/L		mg/L		mg/L
Total Cyanide	CN	0.01	-	0.017	-	0.01[illegible]
Results in		mg/L		mg/L		mg/L

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To: NORTHERN AFFAIRS PROGRAM W/O: 23334 Page 6

Sample type	fresh	fresh	fresh	fresh	fresh
Identification	4082 W4D	4082 W4D	4083 W5	4083 W5	4084 W6A
Lab Reference #	23334-005	23334-005	23334-006	23334-006	23334-007
ICP - ULTRASONIC NEBULIZATION-- Method used	field filt. DISSOLVED	uwave HNO3 TOTAL	field filt. DISSOLVED	uwave HNO3 TOTAL	field filt. DISSOLVED
Aluminum Al	0.02	0.02	0.04	0.19	0.17
Antimony Sb	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Arsenic As	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Barium Ba	0.0468	0.0535	0.0402	0.0556	0.0537
Beryllium Be	< 0.0002	< 0.0002	< 0.0002	0.0003	< 0.0002
Bismuth Bi	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Cadmium Cd	< 0.0006	< 0.0006	< 0.0006	< 0.0006	< 0.0006
Calcium Ca	20.4	24.3	20.8	21.4	22.0
Chromium Cr	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt Co	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Copper Cu	0.007	0.017	0.005	0.012	0.013
Iron Fe	0.086	0.11	0.084	0.391	0.311
Lead Pb	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lithium Li	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Magnesium Mg	6.70	7.11	5.46	6.02	6.47
Manganese Mn	0.039	0.039	0.007	0.062	0.046
Molybdenum Mo	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nickel Ni	< 0.001	< 0.001	0.002	0.004	0.003
Phosphorus P	< 0.06	0.17	< 0.06	< 0.06	< 0.06
Potassium K	1.2	1.5	1.	1.4	1.1
Selenium Se	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Silicon Si	3.64	4.19	2.53	4.08	3.77
Silver Ag	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Sodium Na	3.10	4.18	1.68	3.22	3.20
Strontium Sr	0.14	0.15	0.10	0.14	0.13
Sulfur S	5.2	10.0	4.8	5.5	8.3
Tin Sn	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Titanium Ti	0.001	0.002	0.002	0.011	0.008
Thorium Th	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Uranium U	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07
Vanadium V	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Zinc Zn	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Zirconium Zr	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Results in	mg/L	mg/L	mg/L	mg/L	mg/L

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To: NORTHERN AFFAIRS PROGRAM

W/O: 23334 Page

Sample type	fresh	fresh	fresh	fresh	fresh
Identification	4084 W6A	4085 W6B	4085 W6B	4086 W7	4086 W7
Lab Reference #	23334-007	23334-008	23334-008	23334-009	23334-009
PHYSICAL TESTS - ALKALINITY					
Hydroxide CaCO3	-	< 5.	-	< 5.	-
Carbonate CaCO3	-	< 5.	-	< 5.	-
Bicarb. CaCO3	-	64.	-	4.	-
Total Alk. CaCO3	-	64.	-	4.	-
Results in		mg/L		mg/L	
PHYSICAL TESTS					
Conduct. uS/cm	-	170.	-	26.	-
pH	-	8.0	-	6.3	-
Turbidity FTU	-	36.	-	24.	-
SOLIDS					
Suspended 105C	-	61.	-	162.	-
Dissolved 105C	-	122.	-	23.	-
Results in		mg/L		mg/L	
ANIONS BY IEC					
Chloride Cl	-	< 0.3	-	0.11	-
Fluoride F	-	< 1.	-	< 0.2	-
Nitrate NO3-N	-	0.05	-	< 0.01	-
Nitrite NO2-N	-	< 0.5	-	< 0.1	-
Sulfate SO4	-	20.3	-	4.9	-
Results in		mg/L		mg/L	
NITROGEN					
Ammonia NH3-N	-	< 0.05	-	< 0.05	-
Results in		mg/L		mg/L	
PHOSPHOROUS					
Ortho PO4-P	-	0.009	-	0.005	-
Total Dis PO4-P	-	0.054	-	0.060	-
Results in		mg/L		mg/L	
Total Cyanide CN	-	0.015	-	0.016	-
Results in		mg/L		mg/L	

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1
Tel:(604)438-5226
Fax:(604)436-0565

To: NORTHERN AFFAIRS PROGRAM W/O: 23334 Page 8

Sample type		fresh	fresh	fresh	fresh	fresh
Identification		4084	4085	4085	4086	4086
		W6A	W6B	W6B	W7	W7
Lab Reference #		23334-007	23334-008	23334-008	23334-009	23334-009
ICP - ULTRASONIC NEBULIZATION						
Method used		uwave HNO3 TOTAL	field filt. DISSOLVED	uwave HNO3 TOTAL	field filt. DISSOLVED	uwave HNO3 TOTAL
Aluminum	Al	0.42	0.06	0.72	0.16	2.6
Antimony	Sb	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Arsenic	As	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Barium	Ba	0.0773	0.0436	0.0780	0.0170	0.0580
Beryllium	Be	0.0002	< 0.0002	< 0.0002	< 0.0002	0.0002
Bismuth	Bi	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Cadmium	Cd	< 0.0006	< 0.0006	< 0.0006	< 0.0006	< 0.0006
Calcium	Ca	25.4	22.2	22.9	2.98	3.72
Chromium	Cr	0.001	0.001	0.001	< 0.001	0.004
Cobalt	Co	< 0.001	< 0.001	< 0.001	< 0.001	0.001
Copper	Cu	0.013	0.007	0.012	0.006	0.019
Iron	Fe	0.932	0.11	1.40	0.190	3.72
Lead	Pb	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lithium	Li	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Magnesium	Mg	6.75	6.09	6.12	0.52	1.28
Manganese	Mn	0.052	0.015	0.060	0.019	0.076
Molybdenum	Mo	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nickel	Ni	0.007	0.002	0.004	0.002	0.002
Phosphorus	P	< 0.06	< 0.06	< 0.06	< 0.06	0.09
Potassium	K	1.4	1.1	1.4	0.5	1.
Selenium	Se	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Silicon	Si	3.85	2.73	3.74	2.18	5.72
Silver	Ag	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Sodium	Na	3.23	1.88	1.88	0.91	1.1
Strontium	Sr	0.12	0.1	0.1	0.02	0.03
Sulfur	S	8.4	5.9	5.9	1.4	1.5
Tin	Sn	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Titanium	Ti	0.014	0.003	0.028	0.001	0.173
Thorium	Th	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Uranium	U	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07
Vanadium	V	0.002	< 0.002	0.003	< 0.002	0.008
Zinc	Zn	0.010	< 0.005	0.011	< 0.005	0.024
Zirconium	Zr	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Results in		mg/L	mg/L	mg/L	mg/L	mg/L

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1

Tel:(604)438-52[illegible]
Fax:(604)436-0565

To: NORTHERN AFFAIRS PROGRAM W/O: 23334 Page [illegible]

Sample type	fresh	fresh	fresh	fresh	fresh
Identification	4087 W8	4087 W8	4088 W9	4088 W9	4088 W9
Fraction					DUPLICATE
Lab Reference #	23334-010	23334-010	23334-011A	23334-011A	23334-011
PHYSICAL TESTS - ALKALINITY					
Hydroxide CaCO3	< 5.	-	< 5.	-	< 5.
Carbonate CaCO3	< 5.	-	< 5.	-	< 5.
Bicarb. CaCO3	< 5.	-	62.	-	62.
Total Alk. CaCO3	< 5.	-	62.	-	62.
Results in	mg/L		mg/L		mg/L
PHYSICAL TESTS					
Conduct. uS/cm	610.	-	150.	-	150.
pH	3.7	-	7.8	-	7.8
Turbidity FTU	50.	-	20.	-	20.
SOLIDS					
Suspended 105C	33./ 34.	-	109.	-	-
Dissolved 105C	468./465.	-	118.	-	-
Results in	mg/L		mg/L		
ANIONS BY IEC					
Chloride Cl	< 1.	-	0.4	-	0.4
Fluoride F	< 2.	-	< 0.5	-	< 0.5
Nitrate NO3-N	< 0.2	-	0.09	-	0.07
Nitrite NO2-N	< 2.	-	< 0.5	-	< 0.5
Sulfate SO4	314	-	10.8	-	11.5
Results in	mg/L		mg/L		mg/L
NITROGEN					
Ammonia NH3-N	< 0.05	-	< 0.05	-	< 0.05
Results in	mg/L		mg/L		mg/L
PHOSPHOROUS					
Ortho PO4-P	< 0.005	-	< 0.005	-	< 0.005
Total Dis PO4-P	0.024	-	0.020	-	0.01[illegible]
Results in	mg/L		mg/L		mg/L
Total Cyanide CN	0.01	-	0.025	-	0.025
Results in	mg/L		mg/L		mg/L

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1
Tel:(604)438-5226
Fax:(604)436-0565

To: NORTHERN AFFAIRS PROGRAM W/O: 23334 Page 10

Sample type		fresh	fresh	fresh	fresh	fresh
Identification		4087 W8	4087 W8	4088 W9	4088 W9	4088 W9
Fraction						DUPLICATE
Lab Reference #		23334-010	23334-010	23334-011A	23334-011A	23334-011B
ICP - ULTRASONIC NEBULIZATION--						
Method used		field filt. DISSOLVED	uwave HNO3 TOTAL	field filt. DISSOLVED	uwave HNO3 TOTAL	field filt. DISSOLVED
Aluminum	Al	5.7	5.8	0.02	1.63	0.02
Antimony	Sb	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Arsenic	As	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Barium	Ba	0.0247	0.0320	0.0467	0.0952	0.0491
Beryllium	Be	0.0005	0.0008	< 0.0002	0.0004	< 0.0002
Bismuth	Bi	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Cadmium	Cd	0.0017	0.0019	< 0.0006	< 0.0006	< 0.0006
Calcium	Ca	75.8	76.5	17.0	19.5	17.7
Chromium	Cr	< 0.001	0.001	< 0.001	0.003	< 0.001
Cobalt	Co	0.022	0.025	< 0.001	< 0.001	< 0.001
Copper	Cu	0.648	0.716	0.006	0.013	0.008
Iron	Fe	8.77	10.5	0.173	2.8	0.177
Lead	Pb	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lithium	Li	< 0.002	0.004	< 0.002	0.004	< 0.002
Magnesium	Mg	11.8	12.6	4.77	5.79	4.96
Manganese	Mn	0.633	0.689	0.073	0.221	0.077
Molybdenum	Mo	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nickel	Ni	0.008	0.008	0.004	0.004	0.004
Phosphorus	P	< 0.06	< 0.06	< 0.06	0.1	< 0.06
Potassium	K	1.7	2.2	0.9	1.3	1.1
Selenium	Se	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Silicon	Si	7.14	8.08	3.35	6.07	3.50
Silver	Ag	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Sodium	Na	6.03	6.48	3.29	3.66	3.45
Strontium	Sr	0.19	0.21	0.13	0.16	0.14
Sulfur	S	98.	99.	3.1	3.6	3.3
Tin	Sn	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Titanium	Ti	0.001	0.013	0.002	0.092	0.002
Thorium	Th	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Uranium	U	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07
Vanadium	V	< 0.002	< 0.002	< 0.002	0.008	< 0.002
Zinc	Zn	0.131	0.142	< 0.005	0.01	< 0.005
Zirconium	Zr	< 0.001	0.002	< 0.001	< 0.001	< 0.001
Results in		mg/L	mg/L	mg/L	mg/L	mg/L

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1

Tel:(604)438-52
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To: NORTHERN AFFAIRS PROGRAM W/O: 23334 Page

Sample type	fresh	fresh	fresh
Identification	4088	4089	4089
	W9	BLANK	BLANK
Fraction	DUPLICATE		
Lab Reference #	23334-011B	23334-012	23334-012
PHYSICAL TESTS - ALKALINITY			
Hydroxide CaCO3	-	< 5.	-
Carbonate CaCO3	-	< 5.	-
Bicarb. CaCO3	-	2.	-
Total Alk. CaCO3	-	2.	-
Results in		mg/L	
PHYSICAL TESTS			
Conduct. uS/cm	-	1.	-
pH	-	5.4	-
Turbidity FTU	-	< 1.	-
SOLIDS			
Suspended 105C	-	< 5.	-
Dissolved 105C	-	< 5.	-
Results in		mg/L	
ANIONS BY IEC			
Chloride Cl	-	< 0.05	-
Fluoride F	-	< 0.1	-
Nitrate NO3-N	-	< 0.01	-
Nitrite NO2-N	-	< 0.1	-
Sulfate SO4	-	< 0.03	-
Results in		mg/L	
NITROGEN			
Ammonia NH3-N	-	< 0.05	-
Results in		mg/L	
PHOSPHOROUS			
Ortho PO4-P	-	< 0.005	-
Total Dis PO4-P	-	0.030	-
Results in		mg/L	
Total Cyanide CN	-	-	-

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1

Tel:(604)438-522
Fax:(604)436-056

To: NORTHERN AFFAIRS PROGRAM

W/O: 23334 Page 1

Sample type		fresh	fresh	fresh
Identification		4088 W9	4089 BLANK	4089 BLANK
Fraction		DUPLICATE		
Lab Reference #		23334-011B	23334-012	23334-012
ICP - ULTRASONIC NEBULIZATION				
Method used		uwave HNO3 TOTAL	field filt. DISSOLVED	uwave HNO3 TOTAL
Aluminum	Al	1.63	0.04	< 0.01
Antimony	Sb	< 0.02	< 0.02	< 0.02
Arsenic	As	< 0.02	< 0.02	< 0.02
Barium	Ba	0.0952	< 0.0006	< 0.0006
Beryllium	Be	0.0004	< 0.0002	< 0.0002
Bismuth	Bi	< 0.02	< 0.02	< 0.02
Cadmium	Cd	< 0.0006	< 0.0006	< 0.0006
Calcium	Ca	19.5	0.08	< 0.01
Chromium	Cr	0.003	0.001	< 0.001
Cobalt	Co	< 0.001	< 0.001	< 0.001
Copper	Cu	0.013	< 0.002	< 0.002
Iron	Fe	2.8	0.012	0.005
Lead	Pb	< 0.01	< 0.01	< 0.01
Lithium	Li	0.004	< 0.002	< 0.002
Magnesium	Mg	5.78	< 0.01	< 0.01
Manganese	Mn	0.221	< 0.001	< 0.001
Molybdenum	Mo	< 0.005	< 0.005	< 0.005
Nickel	Ni	0.004	< 0.001	< 0.001
Phosphorus	P	0.1	< 0.06	< 0.06
Potassium	K	1.3	< 0.2	< 0.2
Selenium	Se	< 0.02	< 0.02	< 0.02
Silicon	Si	6.07	< 0.06	< 0.06
Silver	Ag	< 0.001	< 0.001	< 0.001
Sodium	Na	3.66	< 0.06	< 0.06
Strontium	Sr	0.16	< 0.01	< 0.01
Sulfur	S	3.6	< 0.1	< 0.1
Tin	Sn	< 0.01	< 0.01	< 0.01
Titanium	Ti	0.092	0.002	< 0.001
Thorium	Th	< 0.01	< 0.01	< 0.01
Uranium	U	< 0.07	< 0.07	< 0.07
Vanadium	V	0.008	< 0.002	< 0.002
Zinc	Zn	0.01	< 0.005	< 0.005
Zirconium	Zr	< 0.001	< 0.001	< 0.001
Results in		mg/L	mg/L	mg/L

Appendix 3: Complete analytical reports from Philip Analytical and Northwest Laboratories

PHILIP SERVICES

PHILIP ANALYTICAL
10-Nov-99
Page 1 of 39

Certificate of Analysis

8577 Commerce Court
Burnaby, B.C.
Canada V5A 4N5
Tel 604 444 4808
Fax 604 444 4511

Reported To :

Client Code 87

#163-3017 ST. CLAJR AVE
BURLINGTON, ON.
L7N 3P5

Attention : D. GREGOR
Phone : (905) 333-0427
FAX : (905) 333-9723

Project Information :

Project ID : MDA-99-1
Submitted By: D. GREGOR

REVISED 99/11/10

Requisition Forms :

Form 08040421 received on 07-Oct-99 logged on 7-Oct-99 completed on 14-Oct-99
Form 08040420 received on 07-Oct-99 logged on 7-Oct-99 completed on 16-Oct-99
Form 08040422 received on 07-Oct-99 logged on 7-Oct-99 completed on 19-Oct-99

Remarks :

- All organic data is blank corrected except for PCDD/F, Hi-res MS and CLP volatile analyses
- 'MDL' = Method Detection Limit, '<' = Less than MDL, '—' = Not analyzed
- Solids results are based on dry weight except Biota Analyses & Special Waste Oil & Grease
- Organic analyses are not corrected for extraction recovery standards except for Isotope Dilution methods, (i.e. CARB 429 PAH, all PCDD/F and DBD/DBF analyses)
- All Groundwater samples except BTEX/VOC's or Purgeable Hydrocarbons are decanted and/or filtered prior to analysis unless otherwise mandated by regulatory agency
- This report shall not be reproduced except in full, without the written approval of the laboratory

Methods used by Philip are based upon those found in 'Standard Methods for the Examination of Water and Wastewater', 19th Edition, published by the American Public Health Association, or on US EPA protocols found in the 'Test Methods For Evaluating Solid Waste, Physical/Chemical Method, SW846', 3rd Edition. Other procedures are based on methodologies accepted by the appropriate regulatory agency. Methodology briefs are available by written request.

All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies, quality assurance and quality control procedures except where otherwise agreed to by the client and testing company in writing. Liability for any and all use of these test results shall be limited to the actual cost of the pertinent analysis done. There is no other warranty expressed or implied. Your samples will be retained at Philip for a period of 30 days from receipt of data or as per contract.

PHILIP Project Manager: James Teshima

TOTAL CYANIDE ADDED TO SOIL SAMPLES.

PHILIP SERVICES CORP.

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Sparcode	Parameter	Unit	MDL						
			Philip ID :	99056561	99056562	99056563	99056564	99056565	99056566
			Client ID :	MSGM-6-1	MSGM-6-2	MSGM-T2	MSGM-T3	MSGM-T4	MSGM-LA-1
PHYSICAL									
00250760	Moisture	%(W/W)	0.1	24.0	29.9	8.4	15.4	14.1	4.2
GENERAL INORGANICS									
2105AA06	Cyanide(SAD) + Thiocyanate	ug/g	0.02	32	0.60	25	71	59 (1)	—
0157AA09	Cyanide W.A.D.	ug/g	0.02	< 0.02	< 0.02	0.04	0.08	0.07 (2)	---
CN-TAA05	Cyanide Total	ug/g	0.02	2.2	0.22	2.3	7.6	4.5	—
METALS TOTAL									
Al-T200S	Aluminum	ug/g	10	21500	16100	6190	8830	8180	---
Sb-T200S	Antimony	ug/g	2	< 2	< 2	< 2	< 2	< 2	—
As-T200S	Arsenic	ug/g	8	13	< 8	69	42	58	—
Ba-T200S	Barium	ug/g	0.1	334	215	35.1	46.6	34.9	—
Be-T200S	Beryllium	ug/g	0.1	0.8	0.6	1.3	1.7	1.5	---
Bi-T200S	Bismuth	ug/g	2	< 2	< 2	< 2	< 2	< 2	---
Cd-T200S	Cadmium	ug/g	0.2	0.6	0.4	< 0.2	0.4	0.5	---
Ca-T200S	Calcium	ug/g	40	8110	7240	42300	52100	51400	---
Cr-T200S	Chromium	ug/g	0.2	27.0	18.8	10.9	16.3	14.8	—
Co-T200S	Cobalt	ug/g	0.3	11.1	8.5	4.8	5.6	5.2	—
Cu-T200S	Copper	ug/g	0.5	132	76.6	89.9	184	135	—
Fe-T200S	Iron	ug/g	10.0	37000	28300	22500	25700	24400	---
Pb-T200S	Lead	ug/g	2	25	18	13	24	22	---
Mg-T200S	Magnesium	ug/g	10	10900	9300	4790	7250	6570	—
Mn-T200S	Manganese	ug/g	0.2	818	722	525	676	613	—
Hg-T200M	Mercury	ug/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	—
Mo-T200S	Molybdenum	ug/g	0.4	< 0.4	< 0.4	1.9	1.7	2.2	—
Ni-T200S	Nickel	ug/g	0.8	14.8	11.9	2.5	3.0	2.7	—
P__T200S	Phosphorus	ug/g	4	821	767	520	619	596	—
K__T200S	Potassium	ug/g	100	3080	2400	779	1100	923	—
Se-T200S	Selenium	ug/g	3	< 3	< 3	< 3	< 3	< 3	---
Ag-T200S	Silver	ug/g	1	< 1	< 1	< 1	< 1	< 1	—
Na_T200S	Sodium	ug/g	10	587	487	315	457	578	---
Sr-T200S	Strontium	ug/g	0.1	63.4	47.3	94.9	122	116	---
S__T200S	Sulphur	ug/g	10	226	172	9440	8530	8790	---
Te-T200S	Tellurium	ug/g	5	< 5	< 5	< 5	< 5	< 5	---
Tl-T200S	Thallium	ug/g	5	< 5	< 5	< 5	< 5	< 5	—
Sn-T200S	Tin	ug/g	2	< 2	< 2	< 2	< 2	< 2	---
Ti-T200S	Titanium	ug/g	0.3	981	841	30.1	65.5	63.7	---
			Matrix :	Soil	Soil	Soil	Soil	Soil	Soil
			Sampled on:	99/09/30	99/09/30	99/10/04	99/10/04	99/10/04	99/10/04

CONTINUED on page 3

PHILIP SERVICES corp.

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Sparcode	Parameter	Unit	MDL						
			Philip ID :	99056561	99056562	99056563	99056564	99056565	99056566
			Client ID :	MSGM-6-1	MSGM-6-2	MSGM-T2	MSGM-T3	MSGM-T4	MSGM-LA-1
V--T200S	Vanadium	ug/g	0.3	56.3	43.2	12.6	18.7	17.9	---
Zn-T200S	Zinc	ug/g	0.5	164	111	94.8	150	121	---
Zr-T200S	Zirconium	ug/g	0.3	1.9	1.7	2.7	3.3	2.7	---
HYDROCARBONS									
H104PT12	Hydrocarbons C5-C10	ug/g	10	---	---	---	---	---	< 10
VOLATILE ORGANICS-MAH									
EX995170	Volat. Soil Extract.	date		---	---	---	---	---	991008
B020PT12	Benzene	ug/g	0.04	---	---	---	---	---	< 0.04
B021PT12	Ethylbenzene	ug/g	0.10	---	---	---	---	---	< 0.10
T001PT12	Toluene	ug/g	0.10	---	---	---	---	---	< 0.10
X_882_10	Xylenes	ug/g	0.1	---	---	---	---	---	< 0.1
VOC SURROGATE RECOVERY									
VS01PT12	Bromofluorobenzene	%	0	---	---	---	---	---	94
VS03PT12	d8-Toluene	%	0	---	---	---	---	---	101
			Matrix :	Soil	Soil	Soil	Soil	Soil	Soil
			Sampled on:	99/09/30	99/09/30	99/10/04	99/10/04	99/10/04	99/10/04

Result comments and/or text results :

(1) POST LEACH SPIKE.
(2) LOW SAMPLE SPIKE RECOVERY DUE TO MATRIX INTERFERENCE.

PHILIP SERVICES corp

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Spsrcode	Parameter	Unit	MDL						
			Philip ID :	99056567	99056568	99056569	99056570	99056571	99056572
			Client ID :	MSGM-UA-1	MSGM-LF-1	WC-HL-1	WC-CAMP-1	MSGM-1700m	MSGM-6-2
PHYSICAL									
0107CALC	Hardness Total -T	mg/L		---	---	---	---	---	374
00250760	Moisture	%(W/W)	0.1	10.0	20.6	8.4	22.9	---	---
GENERAL INORGANICS									
2105AA04	Cyanide(SAD) + Thiocyanate	mg/L	0.001	---	---	---	---	< 0.001	< 0.001
METALS TOTAL									
Al-T0042	Aluminum	mg/L	0.06	---	---	---	---	---	< 0.06
Sb-T0042	Antimony	mg/L	0.02	---	---	---	---	---	< 0.02
As-T0042	Arsenic	mg/L	0.04	---	---	---	---	---	< 0.04
Ba-T0042	Barium	mg/L	0.001	---	---	---	---	---	0.044
Be-T0042	Beryllium	mg/L	0.0002	---	---	---	---	---	< 0.0002
Bi-T0042	Bismuth	mg/L	0.02	---	---	---	---	---	< 0.02
B--T0042	Boron	mg/L	0.04	---	---	---	---	---	< 0.04
Cd-T0042	Cadmium	mg/L	0.002	---	---	---	---	---	< 0.002
Ca-T0042	Calcium	mg/L	0.05	---	---	---	---	---	135
Cr-T0042	Chromium	mg/L	0.002	---	---	---	---	---	0.004
Co-T0042	Cobalt	mg/L	0.004	---	---	---	---	---	< 0.004
Cu-T0042	Copper	mg/L	0.003	---	---	---	---	---	0.016
Fe-T0042	Iron	mg/L	0.05	---	---	---	---	---	< 0.05
Pb-T0042	Lead	mg/L	0.03	---	---	---	---	---	< 0.03
Mg-T0042	Magnesium	mg/L	0.05	---	---	---	---	---	8.89
Mn-T0042	Manganese	mg/L	0.002	---	---	---	---	---	< 0.002
Hg-T0310	Mercury	mg/L	0.00005	---	---	---	---	---	< 0.00005
Mo-T0042	Molybdenum	mg/L	0.005	---	---	---	---	---	0.014
Ni-T0042	Nickel	mg/L	0.01	---	---	---	---	---	< 0.01
P__T0042	Phosphorus	mg/L	0.1	---	---	---	---	---	< 0.1
K__T0042	Potassium	mg/L	0.5	---	---	---	---	---	5.6
Se-T0042	Selenium	mg/L	0.03	---	---	---	---	---	< 0.03
Ag-T0042	Silver	mg/L	0.03	---	---	---	---	---	< 0.03
Na_T0042	Sodium	mg/L	0.5	---	---	---	---	---	17.8
Sr-T0042	Strontium	mg/L	0.001	---	---	---	---	---	0.529
S__T0042	Sulphur	mg/L	0.1	---	---	---	---	---	122
Te-T0042	Tellurium	mg/L	0.02	---	---	---	---	---	< 0.02
Tl-T0042	Thallium	mg/L	0.03	---	---	---	---	---	< 0.03
Sn-T0042	Tin	mg/L	0.02	---	---	---	---	---	< 0.02
Ti-T0042	Titanium	mg/L	0.003	---	---	---	---	---	< 0.003
			Matrix :	Soil	Soil	Soil	Soil	Water	Water
			Sampled on:	99/10/04	99/10/04	99/10/05	99/10/05	99/10/04	99/09/30

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PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Sparcode	Parameter	Unit	MDL						
			Philip ID :	99056567	99056568	99056569	99056570	99056571	99056572
			Client ID :	MSGM-UA-1	MSGM-LF-1	WC-HL-1	WC-CAMP-1	MSGM-1700m	MSGM-6-2
V--T0042	Vanadium	mg/L	0.003	---	---	---	---	---	< 0.003
Zn-T0042	Zinc	mg/L	0.01	---	---	---	---	---	< 0.01
Zr-T0042	Zirconium	mg/L	0.003	---	---	---	---	---	< 0.003
HYDROCARBONS									
H104PT12	Hydrocarbons C5-C10	ug/g	10	< 10	< 10	< 10	< 10	---	---
VOLATILE ORGANICS-MAH									
EX995170	Volat. Soil Extract.	date		991008	991008	991008	991008	---	---
B020PT12	Benzene	ug/g	0.04	< 0.04	0.05	< 0.04	< 0.04	---	---
B021PT12	Ethylbenzene	ug/g	0.10	< 0.10	< 0.10	< 0.10	< 0.10	---	---
T001PT12	Toluene	ug/g	0.10	< 0.10	< 0.10	< 0.10	< 0.10	---	---
X_882_10	Xylenes	ug/g	0.1	< 0.1	< 0.1	< 0.1	< 0.1	---	---
VOC SURROGATE RECOVERY									
VS01PT12	Bromofluorobenzene	%	0	91	98	96	95	---	---
VS03PT12	d8-Toluene	%	0	101	99	99	99	---	---
			Matrix :	Soil	Soil	Soil	Soil	Water	Water
			Sampled on:	99/10/04	99/10/04	99/10/05	99/10/05	99/10/04	99/09/30

PHILIP SERVICES CORP

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -

Project : MDA-99-1

Sparcode	Parameter	Unit	MDL						
			Philip ID :	99056573	99056574	99056575	99056576	99056577	99056578
			Client ID :	MSGM-AD1 T-1800m	MSGM-6-3	MSGM-9	MSGM-6-1	WC-DS	WC-US
PHYSICAL									
0107CALC	Hardness Total -T	mg/L		120	361	42.8	365	163	156
1107CALC	Hardness Total -D	mg/L		128	---	---	---	177	171
GENERAL INORGANICS									
2105AA04	Cyanide(SAD) + Thiocyana	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
METALS TOTAL									
Al-T0042	Aluminum	mg/L	0.06	< 0.06	< 0.06	< 0.06	0.07	< 0.06	< 0.06
Sb-T0042	Antimony	mg/L	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
As-T0042	Arsenic	mg/L	0.04	< 0.04	0.04	< 0.04	< 0.04	< 0.04	< 0.04
Ba-T0042	Barium	mg/L	0.001	0.011	0.043	0.020	0.043	0.040	0.041
Be-T0042	Beryllium	mg/L	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Bi-T0042	Bismuth	mg/L	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
B--T0042	Boron	mg/L	0.04	< 0.04	0.05	< 0.04	0.04	< 0.04	< 0.04
Cd-T0042	Cadmium	mg/L	0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Ca-T0042	Calcium	mg/L	0.05	44.2	130	15.0	132	46.8	38.2
Cr-T0042	Chromium	mg/L	0.002	0.002	0.006	< 0.002	0.003	< 0.002	< 0.002
Co-T0042	Cobalt	mg/L	0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Cu-T0042	Copper	mg/L	0.003	< 0.003	0.016	< 0.003	0.014	< 0.003	< 0.003
Fe-T0042	Iron	mg/L	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.08	0.10
Pb-T0042	Lead	mg/L	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Mg-T0042	Magnesium	mg/L	0.05	2.34	8.74	1.31	8.68	11.2	14.6
Mn-T0042	Manganese	mg/L	0.002	< 0.002	< 0.002	0.003	< 0.002	0.007	0.014
Hg-T0310	Mercury	mg/L	0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Mo-T0042	Molybdenum	mg/L	0.005	< 0.005	0.015	< 0.005	0.017	< 0.005	< 0.005
Ni-T0042	Nickel	mg/L	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
P__T0042	Phosphorus	mg/L	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
K__T0042	Potassium	mg/L	0.5	< 0.5	5.7	< 0.5	5.3	< 0.5	< 0.5
Se-T0042	Selenium	mg/L	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Ag-T0042	Silver	mg/L	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Na_T0042	Sodium	mg/L	0.5	2.2	17.9	1.5	17.4	10.0	15.8
Sr-T0042	Strontium	mg/L	0.001	0.189	0.520	0.084	0.514	0.470	0.434
S__T0042	Sulphur	mg/L	0.1	28.1	119	4.6	118	14.8	11.2
Te-T0042	Tellurium	mg/L	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Tl-T0042	Thallium	mg/L	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Sn-T0042	Tin	mg/L	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
			Matrix :	Water	Water	Water	Water	Water	Water
			Sampled on:	99/10/04	99/09/30	99/09/30	99/09/30	99/10/02	99/10/02

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PHILIP SERVICES CORP.

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -
Project : MDA-99-1

				Philip ID :	99056573	99056574	99056575	99056576	99056577	99056578
				Client ID :	MSGM-AD1 T-1800m	MSGM-6-3	MSGM-9	MSGM-6-1	WC-DS	WC-US
Spurcode	Parameter	Unit	MDL							
Ti-T0042	Titanium	mg/L	0.003		< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
V--T0042	Vanadium	mg/L	0.003		< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Zn-T0042	Zinc	mg/L	0.01		< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Zr-T0042	Zirconium	mg/L	0.003		< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
METALS DISSOLVED										
Al-D0031	Aluminum Dissolved	mg/L	0.02		< 0.02	---	---	---	< 0.02	< 0.02
Sb-D0031	Antimony Dissolved	mg/L	0.015		< 0.015	---	---	---	< 0.015	< 0.015
As-D0031	Arsenic Dissolved	mg/L	0.04		< 0.04	---	---	---	< 0.04	< 0.04
Ba-D0031	Barium Dissolved	mg/L	0.001		0.012 (1)	---	---	---	0.042 (1)	0.043
Be-D0031	Beryllium Dissolved	mg/L	0.0010		< 0.0010	---	---	---	< 0.0010	< 0.0010
Bi-D0031	Bismuth Dissolved	mg/L	0.02		< 0.02	---	---	---	< 0.02	< 0.02
B--D0031	Boron Dissolved	mg/L	0.008		< 0.008	---	---	---	0.012	0.010
Cd-D0031	Cadmium Dissolved	mg/L	0.002		< 0.002	---	---	---	< 0.002	< 0.002
Ca-D0031	Calcium Dissolved	mg/L	0.01		47.3	---	---	---	50.8	42.0
Cr-D0031	Chromium Dissolved	mg/L	0.002		< 0.002	---	---	---	< 0.002	< 0.002
Co-D0031	Cobalt Dissolved	mg/L	0.003		< 0.003	---	---	---	< 0.003	< 0.003
Cu-D0031	Copper Dissolved	mg/L	0.001		< 0.001	---	---	---	< 0.001	< 0.001
Fe-D0031	Iron Dissolved	mg/L	0.003		< 0.003	---	---	---	0.075	0.094
Pb-D0031	Lead Dissolved	mg/L	0.02		< 0.02	---	---	---	< 0.02	< 0.02
Mg-D0031	Magnesium Dissolved	mg/L	0.02		2.50 (1)	---	---	---	12.2	16.1
Mn-D0031	Manganese Dissolved	mg/L	0.002		< 0.002	---	---	---	0.008 (1)	0.016
Hg-D0310	Mercury Dissolved	mg/L	0.00005		< 0.00005	---	---	---	< 0.00005	< 0.00005
Mo-D0031	Molybdenum Dissolved	mg/L	0.004		< 0.004	---	---	---	< 0.004	< 0.004
Ni-D0031	Nickel Dissolved	mg/L	0.008		< 0.008	---	---	---	< 0.008	< 0.008
P__D0031	Phosphorus Dissolved	mg/L	0.04		< 0.04	---	---	---	< 0.04	< 0.04
K__D0031	Potassium Dissolved	mg/L	0.4		< 0.4	---	---	---	< 0.4	< 0.4
Se-D0031	Selenium Dissolved	mg/L	0.03		< 0.03	---	---	---	< 0.03	< 0.03
Ag-D0031	Silver Dissolved	mg/L	0.01		< 0.01	---	---	---	< 0.01	< 0.01
Na_D0031	Sodium Dissolved	mg/L	0.01		1.80	---	---	---	10.8	17.4
Sr-D0031	Strontium Dissolved	mg/L	0.001		0.201 (1)	---	---	---	0.501 (1)	0.474
S__D0031	Sulfur Dissolved	mg/L	0.03		30.4	---	---	---	16.1	12.3
Te-D0031	Tellurium Dissolved	mg/L	0.02		< 0.02	---	---	---	< 0.02	< 0.02
Tl-D0031	Thallium Dissolved	mg/L	0.02		< 0.02	---	---	---	< 0.02	< 0.02
Sn-D0031	Tin Dissolved	mg/L	0.02		< 0.02	---	---	---	< 0.02	< 0.02
Ti-D0031	Titanium Dissolved	mg/L	0.003		< 0.003	---	---	---	< 0.003	< 0.003
V--D0031	Vanadium Dissolved	mg/L	0.003		< 0.003	---	---	---	< 0.003	< 0.003
Zn-D0031	Zinc Dissolved	mg/L	0.002		0.004	---	---	---	< 0.002	< 0.002
				Matrix :	Water	Water	Water	Water	Water	Water
				Sampled on:	99/10/04	99/09/30	99/09/30	99/09/30	99/10/02	99/10/02

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PHILIP SERVICES corp.

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -
Project : MDA-99-1

			Philip ID :	99056573	99056574	99056575	99056576	99056577	99056578
			Client ID :	MSGM-ADI T-1800m	MSGM-6-3	MSGM-9	MSGM-6-1	WC-DS	WC-US
Sparcode	Parameter	Unit	MDL						
Zr-D0031	Zirconium Dissolved	mg/L	0.003	< 0.003	—	—	—	< 0.003	< 0.003
			Matrix :	Water	Water	Water	Water	Water	Water
			Sampled on:	99/10/04	99/09/30	99/09/30	99/09/30	99/10/02	99/10/02

Result comments and/or text results :

(1) Diss > Total, within precision of analytical method.

PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -

Project : MDA-99-1

			Philip ID :	99056579	99056580	99056581	99056582	99056554	99056555
			Client ID :	MSGM-TRIB	MSGM-ADIT-1800A	MSGM-TRIB	MSGM-1700m	CM-PIPE 1	CM-PIPE 2
Sparcode	**Parameter**	**Unit**	**MDL**						
PHYSICAL									
1107CALC	Hardness Total -D	mg/L		21.0	131	23.4	165	---	---
0107CALC	Hardness Total -T	mg/L		—	116	—	176	96.7	99.0
GENERAL INORGANICS									
2105AA04	Cyanide(SAD) + Thiocyanate	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	---	—
METALS TOTAL									
Al-T0042	Aluminum	mg/L	0.06	---	< 0.06	—	< 0.06	< 0.06	< 0.06
Sb-T0042	Antimony	mg/L	0.02	—	< 0.02	—	< 0.02	< 0.02	< 0.02
As-T0042	Arsenic	mg/L	0.04	—	< 0.04	—	< 0.04	< 0.04	< 0.04
Ba-T0042	Barium	mg/L	0.001	—	0.011	---	0.014	0.190	0.195
Be-T0042	Beryllium	mg/L	0.0002	---	< 0.0002	—	< 0.0002	< 0.0002	< 0.0002
Bi-T0042	Bismuth	mg/L	0.02	---	< 0.02	—	< 0.02	< 0.02	< 0.02
B--T0042	Boron	mg/L	0.04	—	< 0.04	---	< 0.04	< 0.04	< 0.04
Cd-T0042	Cadmium	mg/L	0.002	---	< 0.002	---	< 0.002	< 0.002	< 0.002
Ca-T0042	Calcium	mg/L	0.05	—	42.9	—	64.3	27.7	28.4
Cr-T0042	Chromium	mg/L	0.002	---	< 0.002	—	< 0.002	< 0.002	< 0.002
Co-T0042	Cobalt	mg/L	0.004	---	< 0.004	—	< 0.004	< 0.004	< 0.004
Cu-T0042	Copper	mg/L	0.003	—	< 0.003	---	< 0.003	< 0.003	< 0.003
Fe-T0042	Iron	mg/L	0.05	—	< 0.05	---	< 0.05	< 0.05	< 0.05
Pb-T0042	Lead	mg/L	0.03	---	< 0.03	—	< 0.03	< 0.03	< 0.03
Mg-T0042	Magnesium	mg/L	0.05	—	2.21	—	3.67	6.68	6.83
Mn-T0042	Manganese	mg/L	0.002	—	< 0.002	---	< 0.002	< 0.002	< 0.002
Hg-T0310	Mercury	mg/L	0.00005	---	< 0.00005	—	< 0.00005	< 0.00005	< 0.00005
Mo-T0042	Molybdenum	mg/L	0.005	---	< 0.005	—	< 0.005	< 0.005	< 0.005
Ni-T0042	Nickel	mg/L	0.01	—	< 0.01	---	< 0.01	< 0.01	< 0.01
P__T0042	Phosphorus	mg/L	0.1	—	< 0.1	—	< 0.1	< 0.1	< 0.1
K__T0042	Potassium	mg/L	0.5	—	< 0.5	---	< 0.5	0.9	0.7
Se-T0042	Selenium	mg/L	0.03	---	< 0.03	—	< 0.03	< 0.03	< 0.03
Ag-T0042	Silver	mg/L	0.03	---	< 0.03	—	< 0.03	< 0.03	< 0.03
Na_T0042	Sodium	mg/L	0.5	—	1.6	---	2.8	4.6	4.6
Sr-T0042	Strontium	mg/L	0.001	—	0.179	—	0.272	0.231	0.236
S__T0042	Sulphur	mg/L	0.1	—	26.9	---	42.4 (1)	6.4	6.5
Te-T0042	Tellurium	mg/L	0.02	—	< 0.02	---	< 0.02	< 0.02	< 0.02
Tl-T0042	Thallium	mg/L	0.03	—	< 0.03	---	< 0.03	< 0.03	< 0.03
Sn-T0042	Tin	mg/L	0.02	---	< 0.02	—	< 0.02	< 0.02	< 0.02
			Matrix :	Water	Water	Water	Water	Water	Water
			Sampled on:	99/10/04	99/10/04	99/10/04	99/10/04	99/10/03	99/10/03

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PHILIP SERVICES CORP

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Sparcode	Parameter	Unit	MDL						
			Philip ID :	99056579	99056580	99056581	99056582	99056554	99056555
			Client ID :	MSGM-TRIB	MSGM-ADIT-1800A	MSGM-TRIB	MSGM-1700m	CM-PIPE 1	CM-PIPE 2
Ti-T0042	Titanium	mg/L	0.003	—	< 0.003	—	< 0.003	< 0.003	< 0.003
V--T0042	Vanadium	mg/L	0.003	—	< 0.003	—	< 0.003	< 0.003	< 0.003
Zn-T0042	Zinc	mg/L	0.01	—	< 0.01	—	< 0.01	0.01	< 0.01
Zr-T0042	Zirconium	mg/L	0.003	—	< 0.003	—	< 0.003	< 0.003	< 0.003
METALS DISSOLVED									
Al-D0031	Aluminum Dissolved	mg/L	0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Sb-D0031	Antimony Dissolved	mg/L	0.015	< 0.015	< 0.015	< 0.015	< 0.015	---	---
As-D0031	Arsenic Dissolved	mg/L	0.04	< 0.04	< 0.04	< 0.04	< 0.04	---	---
Ba-D0031	Barium Dissolved	mg/L	0.001	0.004	0.013	0.002	0.014 (1)	---	---
Be-D0031	Beryllium Dissolved	mg/L	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	---	---
Bi-D0031	Bismuth Dissolved	mg/L	0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
B--D0031	Boron Dissolved	mg/L	0.008	< 0.008	< 0.008	< 0.008	< 0.008	---	---
Cd-D0031	Cadmium Dissolved	mg/L	0.002	< 0.002	< 0.002	< 0.002	< 0.002	---	---
Ca-D0031	Calcium Dissolved	mg/L	0.01	7.83	48.5	8.87	60.1	---	---
Cr-D0031	Chromium Dissolved	mg/L	0.002	< 0.002	< 0.002	< 0.002	< 0.002	---	---
Co-D0031	Cobalt Dissolved	mg/L	0.003	< 0.003	< 0.003	< 0.003	< 0.003	---	---
Cu-D0031	Copper Dissolved	mg/L	0.001	0.001	< 0.001	< 0.001	< 0.001	---	---
Fe-D0031	Iron Dissolved	mg/L	0.003	0.003	< 0.003	0.006	< 0.003	---	---
Pb-D0031	Lead Dissolved	mg/L	0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Mg-D0031	Magnesium Dissolved	mg/L	0.02	0.34	2.38	0.30	3.69 (1)	---	---
Mn-D0031	Manganese Dissolved	mg/L	0.002	0.014	0.016	< 0.002	< 0.002	---	---
Hg-D0310	Mercury Dissolved	mg/L	0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	---	---
Mo-D0031	Molybdenum Dissolved	mg/L	0.004	< 0.004	< 0.004	< 0.004	< 0.004	---	---
Ni-D0031	Nickel Dissolved	mg/L	0.008	< 0.008	< 0.008	< 0.008	< 0.008	---	---
P__D0031	Phosphorus Dissolved	mg/L	0.04	< 0.04	< 0.04	< 0.04	< 0.04	---	---
K__D0031	Potassium Dissolved	mg/L	0.4	< 0.4	< 0.4	< 0.4	< 0.4	---	---
Se-D0031	Selenium Dissolved	mg/L	0.03	< 0.03	< 0.03	< 0.03	< 0.03	---	---
Ag-D0031	Silver Dissolved	mg/L	0.01	< 0.01	< 0.01	< 0.01	< 0.01	---	---
Na_D0031	Sodium Dissolved	mg/L	0.01	1.39	1.74 (1)	1.34	2.72	---	---
Sr-D0031	Strontium Dissolved	mg/L	0.001	0.025	0.185 (1)	0.028	0.255	---	---
S__D0031	Sulfur Dissolved	mg/L	0.03	1.74	31.3	1.59	44.4	---	---
Te-D0031	Tellurium Dissolved	mg/L	0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Tl-D0031	Thallium Dissolved	mg/L	0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Sn-D0031	Tin Dissolved	mg/L	0.02	< 0.02	< 0.02	< 0.02	< 0.02	---	---
Ti-D0031	Titanium Dissolved	mg/L	0.003	< 0.003	< 0.003	< 0.003	< 0.003	---	---
V--D0031	Vanadium Dissolved	mg/L	0.003	< 0.003	< 0.003	< 0.003	< 0.003	---	---
Zn-D0031	Zinc Dissolved	mg/L	0.002	0.004	0.005	< 0.002	< 0.002	---	---
			Matrix :	Water	Water	Water	Water	Water	Water
			Sampled on:	99/10/04	99/10/04	99/10/04	99/10/04	99/10/03	99/10/03

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PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -
Project : MDA-99-1

				Philip ID :	99056579	99056580	99056581	99056582	99056554	99056555
				Client ID :	MSGM-TRIB	MSGM-ADIT-1800A	MSGM-TRIB	MSGM-1700m	CM-PIPE 1	CM-PIPE 2
Sparcode	**Parameter**	**Unit**	**MDL**							
Zr-D0031	Zirconium Dissolved	mg/L	0.003		< 0.003	< 0.003	< 0.003	< 0.003	---	---
				Matrix :	Water	Water	Water	Water	Water	Water
				Sampled on:	99/10/04	99/10/04	99/10/04	99/10/04	99/10/03	99/10/03

Result comments and/or text results :

(1) Diss > Total, within precision of analytical method.

PHILIP SERVICES CORP.

PHILIP ANALYTICAL

10-Nov-99

ANALYTICAL REPORT

Client : -
Project : MDA-99-1

			Philip ID :	99056556	99056557	99056558	99056559	99056560
			Client ID :	CM-W7-US	CM-CAMP-DS 1	CM-CAMP-DS 2	CM-CAMP -PIPE 1	CM-CAMP -PIPE 2
Sparcode	**Parameter**	**Unit**	**MDL**					
PHYSICAL								
0107CALC	Hardness Total -T	mg/L		45.5	97.8	97.0	---	---
1107CALC	Hardness Total -D	mg/L		44.3	---	---	167	169
METALS TOTAL								
Al-T0042	Aluminum	mg/L	0.06	< 0.06	< 0.06	< 0.06	---	---
Sb-T0042	Antimony	mg/L	0.02	< 0.02	< 0.02	< 0.02	---	---
As-T0042	Arsenic	mg/L	0.04	< 0.04	< 0.04	< 0.04	---	---
Ba-T0042	Barium	mg/L	0.001	0.046	0.193	0.192	---	---
Be-T0042	Beryllium	mg/L	0.0002	< 0.0002	< 0.0002	< 0.0002	---	---
Bi-T0042	Bismuth	mg/L	0.02	< 0.02	< 0.02	< 0.02	---	---
B--T0042	Boron	mg/L	0.04	< 0.04	< 0.04	< 0.04	---	---
Cd-T0042	Cadmium	mg/L	0.002	< 0.002	< 0.002	< 0.002	---	---
Ca-T0042	Calcium	mg/L	0.05	13.8	28.0	27.8	---	---
Cr-T0042	Chromium	mg/L	0.002	< 0.002	< 0.002	< 0.002	---	---
Co-T0042	Cobalt	mg/L	0.004	< 0.004	< 0.004	< 0.004	---	---
Cu-T0042	Copper	mg/L	0.003	< 0.003	< 0.003	< 0.003	---	---
Fe-T0042	Iron	mg/L	0.05	< 0.05	< 0.05	< 0.05	---	---
Pb-T0042	Lead	mg/L	0.03	< 0.03	< 0.03	< 0.03	---	---
Mg-T0042	Magnesium	mg/L	0.05	2.67	6.76	6.71	---	---
Mn-T0042	Manganese	mg/L	0.002	< 0.002	0.002	0.002	---	---
Hg-T0310	Mercury	mg/L	0.00005	< 0.00005	< 0.00005	< 0.00005	---	---
Mo-T0042	Molybdenum	mg/L	0.005	< 0.005	< 0.005	< 0.005	---	---
Ni-T0042	Nickel	mg/L	0.01	< 0.01	< 0.01	< 0.01	---	---
P__T0042	Phosphorus	mg/L	0.1	< 0.1	< 0.1	< 0.1	---	---
K__T0042	Potassium	mg/L	0.5	< 0.5	1.0	1.0	---	---
Se-T0042	Selenium	mg/L	0.03	< 0.03	< 0.03	< 0.03	---	---
Ag-T0042	Silver	mg/L	0.03	< 0.03	< 0.03	< 0.03	---	---
Na_T0042	Sodium	mg/L	0.5	4.7	4.6	4.5	---	---
Sr-T0042	Strontium	mg/L	0.001	0.092	0.235	0.234	---	---
S__T0042	Sulphur	mg/L	0.1	13.5	6.5	6.4	---	---
Te-T0042	Tellurium	mg/L	0.02	< 0.02	< 0.02	< 0.02	---	---
Tl-T0042	Thallium	mg/L	0.03	< 0.03	< 0.03	< 0.03	---	---
Sn-T0042	Tin	mg/L	0.02	< 0.02	< 0.02	< 0.02	---	---
Ti-T0042	Titanium	mg/L	0.003	< 0.003	< 0.003	< 0.003	---	---
V--T0042	Vanadium	mg/L	0.003	< 0.003	< 0.003	< 0.003	---	---
Zn-T0042	Zinc	mg/L	0.01	< 0.01	0.01	0.01	---	---
			Matrix :	Water	Water	Water	Water	Water
			Sampled on:	99/10/03	99/10/03	99/10/03	99/10/03	99/10/03

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PHILIP SERVICES corp

PHILIP ANALYTICAL

ANALYTICAL REPORT

10-Nov-99

Client : -
Project : MDA-99-1

Sparcode	Parameter	Unit	MDL					
			Philip ID :	99056556	99056557	99056558	99056559	99056560
			Client ID :	CM-W7-US	CM-CAMP-DS 1	CM-CAMP-DS 2	CM-CAMP -PIPE 1	CM-CAMP -PIPE 2
Zr-T0042	Zirconium	mg/L	0.003	< 0.003	< 0.003	< 0.003	---	---
METALS DISSOLVED								
Al-D0031	Aluminum Dissolved	mg/L	0.02	< 0.02	---	---	< 0.02	< 0.02
Sb-D0031	Antimony Dissolved	mg/L	0.015	< 0.015	---	---	< 0.015	< 0.015
As-D0031	Arsenic Dissolved	mg/L	0.04	< 0.04	---	---	< 0.04	< 0.04
Ba-D0031	Barium Dissolved	mg/L	0.001	0.043	---	---	0.038	0.038
Be-D0031	Beryllium Dissolved	mg/L	0.0010	< 0.0010	---	---	< 0.0010	< 0.0010
Bi-D0031	Bismuth Dissolved	mg/L	0.02	< 0.02	---	---	< 0.02	< 0.02
B--D0031	Boron Dissolved	mg/L	0.008	< 0.008	---	---	< 0.008	< 0.008
Cd-D0031	Cadmium Dissolved	mg/L	0.002	< 0.002	---	---	0.063	0.063
Ca-D0031	Calcium Dissolved	mg/L	0.01	13.3	---	---	46.5	46.9
Cr-D0031	Chromium Dissolved	mg/L	0.002	< 0.002	---	---	< 0.002	< 0.002
Co-D0031	Cobalt Dissolved	mg/L	0.003	< 0.003	---	---	< 0.003	< 0.003
Cu-D0031	Copper Dissolved	mg/L	0.001	0.002	---	---	0.087	0.091
Fe-D0031	Iron Dissolved	mg/L	0.003	0.005	---	---	0.028	0.017
Pb-D0031	Lead Dissolved	mg/L	0.02	< 0.02	---	---	< 0.02	< 0.02
Mg-D0031	Magnesium Dissolved	mg/L	0.02	2.70 (1)	---	---	12.4	12.5
Mn-D0031	Manganese Dissolved	mg/L	0.002	< 0.002	---	---	0.818	0.834
Hg-D0310	Mercury Dissolved	mg/L	0.00005	< 0.00005	---	---	< 0.00005	< 0.00005
Mo-D0031	Molybdenum Dissolved	mg/L	0.004	0.005	---	---	< 0.004	< 0.004
Ni-D0031	Nickel Dissolved	mg/L	0.008	< 0.008	---	---	< 0.008	< 0.008
P__D0031	Phosphorus Dissolved	mg/L	0.04	< 0.04	---	---	< 0.04	< 0.04
K__D0031	Potassium Dissolved	mg/L	0.4	0.8 (1)	---	---	1.7	1.8
Se-D0031	Selenium Dissolved	mg/L	0.03	< 0.03	---	---	< 0.03	< 0.03
Ag-D0031	Silver Dissolved	mg/L	0.01	< 0.01	---	---	< 0.01	< 0.01
Na_D0031	Sodium Dissolved	mg/L	0.01	4.52	---	---	5.07	5.19
Sr-D0031	Strontium Dissolved	mg/L	0.001	0.089	---	---	0.414	0.422
S__D0031	Sulfur Dissolved	mg/L	0.03	13.6 (1)	---	---	22.9	23.1
Te-D0031	Tellurium Dissolved	mg/L	0.02	< 0.02	---	---	< 0.02	< 0.02
Tl-D0031	Thallium Dissolved	mg/L	0.02	< 0.02	---	---	< 0.02	< 0.02
Sn-D0031	Tin Dissolved	mg/L	0.02	< 0.02	---	---	< 0.02	< 0.02
Ti-D0031	Titanium Dissolved	mg/L	0.003	< 0.003	---	---	< 0.003	< 0.003
V--D0031	Vanadium Dissolved	mg/L	0.003	< 0.003	---	---	< 0.003	< 0.003
Zn-D0031	Zinc Dissolved	mg/L	0.002	0.006	---	---	3.88	3.95
Zr-D0031	Zirconium Dissolved	mg/L	0.003	< 0.003	---	---	< 0.003	< 0.003
			Matrix :	Water	Water	Water	Water	Water
			Sampled on:	99/10/03	99/10/03	99/10/03	99/10/03	99/10/03

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PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99
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ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Result comments and/or text results :

(1) Diss > Total, within precision of analytical method.

PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99

DUPLICATE SUMMARY

Parameter	Client ID	Philip ID	Sample Conc.	Duplicate Conc.	MDL	Unit	Relative % Diff.
Cyanide Total	MSGM-6-2	99056562	0.22	0.21	0.02	ug/g	4.65
Cyanide(SAD) + Thiocyanate	MSGM-T4	99056565	59	61	0.02	ug/g	-3.33
Cyanide W.A.D.	MSGM-T4	99056565	0.07	0.08	0.02	ug/g	-13.33
Mercury	MSGM-6-3	99056574	< 0.00005	< 0.00005	0.00005	mg/L	0.00
Silver	MSGM-1700m	99056582	< 0.03	< 0.03	0.03	mg/L	0.00
Aluminum	MSGM-1700m	99056582	< 0.06	< 0.06	0.06	mg/L	0.00
Arsenic	MSGM-1700m	99056582	< 0.04	< 0.04	0.04	mg/L	0.00
Boron	MSGM-1700m	99056582	< 0.04	< 0.04	0.04	mg/L	0.00
Barium	MSGM-1700m	99056582	0.014	0.014	0.001	mg/L	0.00
Beryllium	MSGM-1700m	99056582	< 0.0002	< 0.0002	0.0002	mg/L	0.00
Bismuth	MSGM-1700m	99056582	< 0.02	< 0.02	0.02	mg/L	0.00
Calcium	MSGM-1700m	99056582	64.3	63.8	0.05	mg/L	0.78
Cadmium	MSGM-1700m	99056582	< 0.002	< 0.002	0.002	mg/L	0.00
Cobalt	MSGM-1700m	99056582	< 0.004	< 0.004	0.004	mg/L	0.00
Chromium	MSGM-1700m	99056582	< 0.002	< 0.002	0.002	mg/L	0.00
Copper	MSGM-1700m	99056582	< 0.003	< 0.003	0.003	mg/L	0.00
Iron	MSGM-1700m	99056582	< 0.05	< 0.05	0.05	mg/L	0.00
Potassium	MSGM-1700m	99056582	< 0.5	< 0.5	0.5	mg/L	0.00
Magnesium	MSGM-1700m	99056582	3.67	3.64	0.05	mg/L	0.82
Manganese	MSGM-1700m	99056582	< 0.002	< 0.002	0.002	mg/L	0.00
Molybdenum	MSGM-1700m	99056582	< 0.005	< 0.005	0.005	mg/L	0.00
Sodium	MSGM-1700m	99056582	2.8	2.8	0.5	mg/L	0.00
Nickel	MSGM-1700m	99056582	< 0.01	< 0.01	0.01	mg/L	0.00
Phosphorus	MSGM-1700m	99056582	< 0.1	< 0.1	0.1	mg/L	0.00
Lead	MSGM-1700m	99056582	< 0.03	< 0.03	0.03	mg/L	0.00
Sulphur	MSGM-1700m	99056582	42.4	42.0	0.1	mg/L	0.95
Antimony	MSGM-1700m	99056582	< 0.02	< 0.02	0.02	mg/L	0.00
Selenium	MSGM-1700m	99056582	< 0.03	< 0.03	0.03	mg/L	0.00
Tin	MSGM-1700m	99056582	< 0.02	< 0.02	0.02	mg/L	0.00
Strontium	MSGM-1700m	99056582	0.272	0.269	0.001	mg/L	1.11
Tellurium	MSGM-1700m	99056582	< 0.02	< 0.02	0.02	mg/L	0.00
Titanium	MSGM-1700m	99056582	< 0.003	< 0.003	0.003	mg/L	0.00
Thallium	MSGM-1700m	99056582	< 0.03	< 0.03	0.03	mg/L	0.00
Vanadium	MSGM-1700m	99056582	< 0.003	< 0.003	0.003	mg/L	0.00
Zinc	MSGM-1700m	99056582	< 0.01	< 0.01	0.01	mg/L	0.00
Zirconium	MSGM-1700m	99056582	< 0.003	< 0.003	0.003	mg/L	0.00
Cyanide(SAD) + Thiocyanate	MSGM-1700m	99056582	< 0.001	< 0.001	0.001	mg/L	0.00
Silver	CM-CAMP-DS 1	99056557	< 0.03	< 0.03	0.03	mg/L	0.00

PHILIP SERVICES CORP

PHILIP ANALYTICAL

10-Nov-99

DUPLICATE SUMMARY

Parameter	Client ID	Philip ID	Sample Conc.	Duplicate Conc.	MDL	Unit	Relative % Diff.
Aluminum	CM-CAMP-DS 1	99056557	< 0.06	< 0.06	0.06	mg/L	0.00
Arsenic	CM-CAMP-DS 1	99056557	< 0.04	< 0.04	0.04	mg/L	0.00
Boron	CM-CAMP-DS 1	99056557	< 0.04	< 0.04	0.04	mg/L	0.00
Barium	CM-CAMP-DS 1	99056557	0.193	0.190	0.001	mg/L	1.57
Beryllium	CM-CAMP-DS 1	99056557	< 0.0002	< 0.0002	0.0002	mg/L	0.00
Bismuth	CM-CAMP-DS 1	99056557	< 0.02	< 0.02	0.02	mg/L	0.00
Calcium	CM-CAMP-DS 1	99056557	28.0	28.2	0.05	mg/L	-0.71
Cadmium	CM-CAMP-DS 1	99056557	< 0.002	< 0.002	0.002	mg/L	0.00
Cobalt	CM-CAMP-DS 1	99056557	< 0.004	< 0.004	0.004	mg/L	0.00
Chromium	CM-CAMP-DS 1	99056557	< 0.002	< 0.002	0.002	mg/L	0.00
Copper	CM-CAMP-DS 1	99056557	< 0.003	< 0.003	0.003	mg/L	0.00
Iron	CM-CAMP-DS 1	99056557	< 0.05	< 0.05	0.05	mg/L	0.00
Potassium	CM-CAMP-DS 1	99056557	1.0	1.0	0.5	mg/L	0.00
Magnesium	CM-CAMP-DS 1	99056557	6.76	6.69	0.05	mg/L	1.04
Manganese	CM-CAMP-DS 1	99056557	0.002	0.002	0.002	mg/L	0.00
Molybdenum	CM-CAMP-DS 1	99056557	< 0.005	< 0.005	0.005	mg/L	0.00
Sodium	CM-CAMP-DS 1	99056557	4.6	4.5	0.5	mg/L	2.20
Nickel	CM-CAMP-DS 1	99056557	< 0.01	< 0.01	0.01	mg/L	0.00
Phosphorus	CM-CAMP-DS 1	99056557	< 0.1	< 0.1	0.1	mg/L	0.00
Lead	CM-CAMP-DS 1	99056557	< 0.03	< 0.03	0.03	mg/L	0.00
Sulphur	CM-CAMP-DS 1	99056557	6.5	6.4	0.1	mg/L	1.55
Antimony	CM-CAMP-DS 1	99056557	< 0.02	< 0.02	0.02	mg/L	0.00
Selenium	CM-CAMP-DS 1	99056557	< 0.03	< 0.03	0.03	mg/L	0.00
Tin	CM-CAMP-DS 1	99056557	< 0.02	< 0.02	0.02	mg/L	0.00
Strontium	CM-CAMP-DS 1	99056557	0.235	0.232	0.001	mg/L	1.28
Tellurium	CM-CAMP-DS 1	99056557	< 0.02	< 0.02	0.02	mg/L	0.00
Titanium	CM-CAMP-DS 1	99056557	< 0.003	< 0.003	0.003	mg/L	0.00
Thallium	CM-CAMP-DS 1	99056557	< 0.03	< 0.03	0.03	mg/L	0.00
Vanadium	CM-CAMP-DS 1	99056557	< 0.003	< 0.003	0.003	mg/L	0.00
Zinc	CM-CAMP-DS 1	99056557	0.01	< 0.01	0.01	mg/L	0.00
Zirconium	CM-CAMP-DS 1	99056557	< 0.003	< 0.003	0.003	mg/L	0.00

PHILIP SERVICES CORP.

PHILIP ANALYTICAL

10-Nov-99

SPIKE SUMMARY

Parameter	Client ID	Philip ID	Sample Conc.	Sample & Spike Conc.	Spike Amount	Unit	Percent Recovery
Cyanide(SAD) + Thiocyanate	Blank Spike. Batch :	94101657	< 0.02	0.40	.4	ug/g	96
Cyanide W.A.D.	Blank Spike. Batch :	94101659	< 0.02	0.41	.4	ug/g	101
Aluminum	Blank Spike. Batch :	94203406	< 10	8070	9518	ug/g	85
Barium	Blank Spike. Batch :	94203406	< 0.1	104	102	ug/g	102
Calcium	Blank Spike. Batch :	94203406	< 40	137000	137000	ug/g	100
Cadmium	Blank Spike. Batch :	94203406	< 0.2	33.1	34	ug/g	97
Cobalt	Blank Spike. Batch :	94203406	< 0.3	28.5	28	ug/g	102
Chromium	Blank Spike. Batch :	94203406	0.2	45.1	44.35	ug/g	101
Copper	Blank Spike. Batch :	94203406	< 0.5	747	690	ug/g	108
Iron	Blank Spike. Batch :	94203406	< 10.0	21100	20406	ug/g	103
Magnesium	Blank Spike. Batch :	94203406	< 10	6190	6086	ug/g	102
Manganese	Blank Spike. Batch :	94203406	< 0.2	430	425	ug/g	101
Nickel	Blank Spike. Batch :	94203406	< 0.8	230	231	ug/g	100
Lead	Blank Spike. Batch :	94203406	< 2	230	233	ug/g	99
Strontium	Blank Spike. Batch :	94203406	< 0.1	197	202	ug/g	98
Vanadium	Blank Spike. Batch :	94203406	< 0.3	17.0	19	ug/g	89
Zinc	Blank Spike. Batch :	94203406	0.6	6990	6775	ug/g	103
Mercury	Blank Spike. Batch :	94203410	< 0.05	6.40	6.25	ug/g	102
Cyanide Total	Blank Spike. Batch :	94101861	< 0.02	0.32	.4	ug/g	80
Cyanide(SAD) + Thiocyanate	MSGM-T4	99056565	59	96	46.5641	ug/g	81
Cyanide W.A.D.	MSGM-T4	99056565	0.07	0.21	.465641	ug/g	30
Benzene	Blank Spike. Batch :	95204563	< 0.04	2.3	2.15	ug/g	105
Toluene	Blank Spike. Batch :	95204563	< 0.10	2.1	2.15	ug/g	98
Ethylbenzene	Blank Spike. Batch :	95204563	< 0.10	2.1	2.15	ug/g	97
Benzene	Blank Spike. Batch :	95204560	< 0.04	2.1	2.15	ug/g	99
Toluene	Blank Spike. Batch :	95204560	< 0.10	2.1	2.15	ug/g	97
Ethylbenzene	Blank Spike. Batch :	95204560	< 0.10	2.1	2.15	ug/g	99
Cyanide(SAD) + Thiocyanate	Blank Spike. Batch :	94101657	< 0.001	0.020	.02	mg/L	98
Aluminum	Blank Spike. Batch :	94203402	< 0.06	3.86	4	mg/L	97
Boron	Blank Spike. Batch :	94203402	< 0.04	0.96	1	mg/L	96
Barium	Blank Spike. Batch :	94203402	< 0.001	0.095	.1	mg/L	95
Beryllium	Blank Spike. Batch :	94203402	< 0.0002	0.0906	.1	mg/L	91
Bismuth	Blank Spike. Batch :	94203402	< 0.02	1.94	2	mg/L	97
Calcium	Blank Spike. Batch :	94203402	0.06	10.2	10	mg/L	101
Cadmium	Blank Spike. Batch :	94203402	< 0.002	0.191	.2	mg/L	95
Cobalt	Blank Spike. Batch :	94203402	< 0.004	0.286	.3	mg/L	95
Chromium	Blank Spike. Batch :	94203402	< 0.002	0.289	.3	mg/L	96
Copper	Blank Spike. Batch :	94203402	< 0.003	0.196	.2	mg/L	98

PHILIP SERVICES CORP

PHILIP ANALYTICAL

10-Nov-99

SPIKE SUMMARY

Parameter	Client ID	Philip ID	Sample Conc.	Sample & Spike Conc.	Spike Amount	Unit	Percent Recovery
Iron	Blank Spike. Batch :	94203402	< 0.05	0.97	1	mg/L	97
Potassium	Blank Spike. Batch :	94203402	< 0.5	43.3	44.7	mg/L	97
Magnesium	Blank Spike. Batch :	94203402	< 0.05	4.86	5	mg/L	97
Manganese	Blank Spike. Batch :	94203402	< 0.002	0.191	.2	mg/L	95
Molybdenum	Blank Spike. Batch :	94203402	< 0.005	0.394	.4	mg/L	98
Sodium	Blank Spike. Batch :	94203402	< 0.5	5.0	5	mg/L	99
Nickel	Blank Spike. Batch :	94203402	< 0.01	0.78	.8	mg/L	97
Phosphorus	Blank Spike. Batch :	94203402	< 0.1	3.9	4	mg/L	97
Sulphur	Blank Spike. Batch :	94203402	< 0.1	9.8	10	mg/L	98
Antimony	Blank Spike. Batch :	94203402	< 0.02	1.68	1.62	mg/L	104
Tin	Blank Spike. Batch :	94203402	< 0.02	1.93	2	mg/L	96
Strontium	Blank Spike. Batch :	94203402	< 0.001	0.095	.1	mg/L	95
Tellurium	Blank Spike. Batch :	94203402	< 0.02	1.99	2	mg/L	99
Titanium	Blank Spike. Batch :	94203402	< 0.003	0.288	.28	mg/L	103
Thallium	Blank Spike. Batch :	94203402	< 0.03	1.84	2	mg/L	92
Vanadium	Blank Spike. Batch :	94203402	< 0.003	0.479	.5	mg/L	96
Zinc	Blank Spike. Batch :	94203402	< 0.01	0.19	.2	mg/L	96
Zirconium	Blank Spike. Batch :	94203402	< 0.003	0.288	.3	mg/L	96
Mercury	Blank Spike. Batch :	94203381	< 0.00005	0.00047	.0005	mg/L	94
Aluminum Dissolved	Blank Spike. Batch :	94203403	< 0.02	3.97	4	mg/L	99
Arsenic Dissolved	Blank Spike. Batch :	94203403	< 0.04	3.94	4	mg/L	98
Boron Dissolved	Blank Spike. Batch :	94203403	< 0.008	1.01	1	mg/L	101
Barium Dissolved	Blank Spike. Batch :	94203403	< 0.001	0.097	.1	mg/L	97
Beryllium Dissolved	Blank Spike. Batch :	94203403	< 0.0010	0.0945	.1	mg/L	95
Bismuth Dissolved	Blank Spike. Batch :	94203403	< 0.02	2.04	2	mg/L	102
Calcium Dissolved	Blank Spike. Batch :	94203403	< 0.01	10.6	10	mg/L	106
Cadmium Dissolved	Blank Spike. Batch :	94203403	< 0.002	0.198	.2	mg/L	99
Cobalt Dissolved	Blank Spike. Batch :	94203403	< 0.003	0.296	.3	mg/L	99
Chromium Dissolved	Blank Spike. Batch :	94203403	< 0.002	0.299	.3	mg/L	100
Copper Dissolved	Blank Spike. Batch :	94203403	< 0.001	0.203	.2	mg/L	101
Iron Dissolved	Blank Spike. Batch :	94203403	< 0.003	1.01	1	mg/L	101
Potassium Dissolved	Blank Spike. Batch :	94203403	< 0.4	44.8	44.7	mg/L	100
Magnesium Dissolved	Blank Spike. Batch :	94203403	< 0.02	5.04	5	mg/L	101
Manganese Dissolved	Blank Spike. Batch :	94203403	< 0.002	0.197	.2	mg/L	99
Molybdenum Dissolved	Blank Spike. Batch :	94203403	< 0.004	0.403	.4	mg/L	101
Sodium Dissolved	Blank Spike. Batch :	94203403	< 0.01	5.21	5	mg/L	104
Nickel Dissolved	Blank Spike. Batch :	94203403	< 0.008	0.814	.8	mg/L	102
Phosphorus Dissolved	Blank Spike. Batch :	94203403	< 0.04	4.00	4	mg/L	100

PHILIP SERVICES CORP

PHILIP ANALYTICAL

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SPIKE SUMMARY

Parameter	Client ID	Philip ID	Sample Conc.	Sample & Spike Conc.	Spike Amount	Unit	Percent Recovery
Lead Dissolved	Blank Spike. Batch :	94203403	< 0.02	1.96	2	mg/L	98
Sulfur Dissolved	Blank Spike. Batch :	94203403	< 0.03	10.1	10	mg/L	101
Antimony Dissolved	Blank Spike. Batch :	94203403	< 0.015	1.77	1.62	mg/L	109
Selenium Dissolved	Blank Spike. Batch :	94203403	< 0.03	3.01	3	mg/L	100
Tin Dissolved	Blank Spike. Batch :	94203403	< 0.02	1.98	2	mg/L	99
Strontium Dissolved	Blank Spike. Batch :	94203403	< 0.001	0.098	.1	mg/L	98
Tellurium Dissolved	Blank Spike. Batch :	94203403	< 0.02	2.06	2	mg/L	103
Titanium Dissolved	Blank Spike. Batch :	94203403	< 0.003	0.299	.28	mg/L	107
Thallium Dissolved	Blank Spike. Batch :	94203403	< 0.02	1.95	2	mg/L	97
Vanadium Dissolved	Blank Spike. Batch :	94203403	< 0.003	0.496	.5	mg/L	99
Zinc Dissolved	Blank Spike. Batch :	94203403	< 0.002	0.199	.2	mg/L	100
Zirconium Dissolved	Blank Spike. Batch :	94203403	< 0.003	0.298	.3	mg/L	99
Mercury Dissolved	Blank Spike. Batch :	94203395	< 0.00005	0.00045	.0005	mg/L	90
Mercury	MSGM-6-3	99056574	< 0.00005	0.00053	.0005	mg/L	110
Aluminum Dissolved	Blank Spike. Batch :	94203413	< 0.02	3.80	4	mg/L	95
Arsenic Dissolved	Blank Spike. Batch :	94203413	< 0.04	3.92	4	mg/L	98
Boron Dissolved	Blank Spike. Batch :	94203413	< 0.008	0.963	1	mg/L	96
Barium Dissolved	Blank Spike. Batch :	94203413	< 0.001	0.090	.1	mg/L	90
Beryllium Dissolved	Blank Spike. Batch :	94203413	< 0.0010	0.0934	.1	mg/L	93
Bismuth Dissolved	Blank Spike. Batch :	94203413	< 0.02	2.07	2	mg/L	104
Calcium Dissolved	Blank Spike. Batch :	94203413	< 0.01	9.73	10	mg/L	97
Cadmium Dissolved	Blank Spike. Batch :	94203413	< 0.002	0.207	.2	mg/L	103
Cobalt Dissolved	Blank Spike. Batch :	94203413	< 0.003	0.312	.3	mg/L	104
Chromium Dissolved	Blank Spike. Batch :	94203413	< 0.002	0.302	.3	mg/L	101
Copper Dissolved	Blank Spike. Batch :	94203413	< 0.001	0.191	.2	mg/L	96
Iron Dissolved	Blank Spike. Batch :	94203413	< 0.003	1.01	1	mg/L	101
Potassium Dissolved	Blank Spike. Batch :	94203413	< 0.4	42.6	44.7	mg/L	96
Magnesium Dissolved	Blank Spike. Batch :	94203413	< 0.02	4.86	5	mg/L	97
Manganese Dissolved	Blank Spike. Batch :	94203413	< 0.002	0.199	.2	mg/L	100
Molybdenum Dissolved	Blank Spike. Batch :	94203413	< 0.004	0.412	.4	mg/L	103
Sodium Dissolved	Blank Spike. Batch :	94203413	< 0.01	4.83	5	mg/L	97
Nickel Dissolved	Blank Spike. Batch :	94203413	< 0.008	0.820	.8	mg/L	103
Phosphorus Dissolved	Blank Spike. Batch :	94203413	< 0.04	4.06	4	mg/L	101
Lead Dissolved	Blank Spike. Batch :	94203413	< 0.02	2.07	2	mg/L	104
Sulfur Dissolved	Blank Spike. Batch :	94203413	< 0.03	10.1	10	mg/L	101
Antimony Dissolved	Blank Spike. Batch :	94203413	< 0.015	1.79	1.62	mg/L	111
Selenium Dissolved	Blank Spike. Batch :	94203413	< 0.03	2.97	3	mg/L	100
Tin Dissolved	Blank Spike. Batch :	94203413	< 0.02	2.12	2	mg/L	106

PHILIP SERVICES

PHILIP ANALYTICAL

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SPIKE SUMMARY

Parameter	Client ID	Philip ID	Sample Conc.	Sample & Spike Conc.	Spike Amount	Unit	Percent Recovery
Strontium Dissolved	Blank Spike. Batch :	94203413	< 0.001	0.091	.1	mg/L	91
Tellurium Dissolved	Blank Spike. Batch :	94203413	< 0.02	2.07	2	mg/L	103
Titanium Dissolved	Blank Spike. Batch :	94203413	< 0.003	0.288	.28	mg/L	103
Thallium Dissolved	Blank Spike. Batch :	94203413	< 0.02	2.03	2	mg/L	101
Vanadium Dissolved	Blank Spike. Batch :	94203413	< 0.003	0.483	.5	mg/L	97
Zinc Dissolved	Blank Spike. Batch :	94203413	< 0.002	0.204	.2	mg/L	102
Zirconium Dissolved	Blank Spike. Batch :	94203413	< 0.003	0.290	.3	mg/L	97
Mercury Dissolved	Blank Spike. Batch :	94203443	< 0.00005	0.00045	.0005	mg/L	90
Cobalt	MSGM-1700m	99056582	< 0.004	2.04	2	mg/L	102
Chromium	MSGM-1700m	99056582	< 0.002	2.03	2	mg/L	101
Copper	MSGM-1700m	99056582	< 0.003	2.11	2	mg/L	106
Manganese	MSGM-1700m	99056582	< 0.002	2.03	2	mg/L	102
Zinc	MSGM-1700m	99056582	< 0.01	2.08	2	mg/L	104
Cyanide(SAD) + Thiocyanate	MSGM-1700m	99056582	< 0.001	0.021	.02	mg/L	107
Aluminum Dissolved	Blank Spike. Batch :	94203444	< 0.02	3.70	4	mg/L	92
Arsenic Dissolved	Blank Spike. Batch :	94203444	< 0.04	3.76	4	mg/L	94
Boron Dissolved	Blank Spike. Batch :	94203444	< 0.008	0.904	1	mg/L	90
Barium Dissolved	Blank Spike. Batch :	94203444	< 0.001	0.087	.1	mg/L	87
Beryllium Dissolved	Blank Spike. Batch :	94203444	< 0.0010	0.0861	.1	mg/L	86
Bismuth Dissolved	Blank Spike. Batch :	94203444	< 0.02	1.92	2	mg/L	96
Calcium Dissolved	Blank Spike. Batch :	94203444	< 0.01	9.48	10	mg/L	95
Cadmium Dissolved	Blank Spike. Batch :	94203444	< 0.002	0.191	.2	mg/L	96
Cobalt Dissolved	Blank Spike. Batch :	94203444	< 0.003	0.285	.3	mg/L	95
Chromium Dissolved	Blank Spike. Batch :	94203444	< 0.002	0.283	.3	mg/L	94
Copper Dissolved	Blank Spike. Batch :	94203444	< 0.001	0.187	.2	mg/L	93
Iron Dissolved	Blank Spike. Batch :	94203444	< 0.003	0.950	1	mg/L	95
Potassium Dissolved	Blank Spike. Batch :	94203444	< 0.4	42.0	44.7	mg/L	93
Magnesium Dissolved	Blank Spike. Batch :	94203444	< 0.02	4.68	5	mg/L	93
Manganese Dissolved	Blank Spike. Batch :	94203444	< 0.002	0.187	.2	mg/L	93
Molybdenum Dissolved	Blank Spike. Batch :	94203444	< 0.004	0.395	.4	mg/L	98
Sodium Dissolved	Blank Spike. Batch :	94203444	< 0.01	4.64	5	mg/L	93
Nickel Dissolved	Blank Spike. Batch :	94203444	< 0.008	0.770	.8	mg/L	96
Phosphorus Dissolved	Blank Spike. Batch :	94203444	< 0.04	3.77	4	mg/L	94
Lead Dissolved	Blank Spike. Batch :	94203444	< 0.02	1.92	2	mg/L	96
Sulfur Dissolved	Blank Spike. Batch :	94203444	< 0.03	9.49	10	mg/L	95
Antimony Dissolved	Blank Spike. Batch :	94203444	< 0.015	1.65	1.62	mg/L	102
Selenium Dissolved	Blank Spike. Batch :	94203444	< 0.03	2.75	3	mg/L	91
Tin Dissolved	Blank Spike. Batch :	94203444	< 0.02	1.93	2	mg/L	97

PHILIP SERVICES

PHILIP ANALYTICAL

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SPIKE SUMMARY

Parameter	Client ID	Philip ID	Sample Conc.	Sample & Spike Conc.	Spike Amount	Unit	Percent Recovery
Strontium Dissolved	Blank Spike. Batch :	94203444	< 0.001	0.089	.1	mg/L	89
Tellurium Dissolved	Blank Spike. Batch :	94203444	< 0.02	1.93	2	mg/L	96
Titanium Dissolved	Blank Spike. Batch :	94203444	< 0.003	0.279	.28	mg/L	100
Thallium Dissolved	Blank Spike. Batch :	94203444	< 0.02	1.87	2	mg/L	93
Vanadium Dissolved	Blank Spike. Batch :	94203444	< 0.003	0.465	.5	mg/L	93
Zinc Dissolved	Blank Spike. Batch :	94203444	< 0.002	0.189	.2	mg/L	95
Zirconium Dissolved	Blank Spike. Batch :	94203444	< 0.003	0.274	.3	mg/L	91
Mercury Dissolved	Blank Spike. Batch :	94203470	< 0.00005	0.00046	.0005	mg/L	92
Cobalt	CM-CAMP-DS 1	99056557	< 0.004	2.03	2	mg/L	102
Chromium	CM-CAMP-DS 1	99056557	< 0.002	2.02	2	mg/L	101
Copper	CM-CAMP-DS 1	99056557	< 0.003	2.09	2	mg/L	104
Manganese	CM-CAMP-DS 1	99056557	0.002	2.02	2	mg/L	101
Zinc	CM-CAMP-DS 1	99056557	0.01	2.05	2	mg/L	102
Aluminum Dissolved	Blank Spike. Batch :	94203438	< 0.02	3.97	4	mg/L	99
Arsenic Dissolved	Blank Spike. Batch :	94203438	< 0.04	3.94	4	mg/L	98
Boron Dissolved	Blank Spike. Batch :	94203438	< 0.008	1.01	1	mg/L	101
Barium Dissolved	Blank Spike. Batch :	94203438	< 0.001	0.097	.1	mg/L	97
Beryllium Dissolved	Blank Spike. Batch :	94203438	< 0.0010	0.0945	.1	mg/L	95
Bismuth Dissolved	Blank Spike. Batch :	94203438	< 0.02	2.04	2	mg/L	102
Calcium Dissolved	Blank Spike. Batch :	94203438	< 0.01	10.6	10	mg/L	106
Cadmium Dissolved	Blank Spike. Batch :	94203438	< 0.002	0.198	.2	mg/L	99
Cobalt Dissolved	Blank Spike. Batch :	94203438	< 0.003	0.296	.3	mg/L	99
Chromium Dissolved	Blank Spike. Batch :	94203438	< 0.002	0.299	.3	mg/L	100
Copper Dissolved	Blank Spike. Batch :	94203438	< 0.001	0.203	.2	mg/L	101
Iron Dissolved	Blank Spike. Batch :	94203438	< 0.003	1.01	1	mg/L	101
Potassium Dissolved	Blank Spike. Batch :	94203438	< 0.4	44.8	44.7	mg/L	100
Magnesium Dissolved	Blank Spike. Batch :	94203438	< 0.02	5.04	5	mg/L	101
Manganese Dissolved	Blank Spike. Batch :	94203438	< 0.002	0.197	.2	mg/L	99
Molybdenum Dissolved	Blank Spike. Batch :	94203438	< 0.004	0.403	.4	mg/L	101
Sodium Dissolved	Blank Spike. Batch :	94203438	< 0.01	5.21	5	mg/L	104
Nickel Dissolved	Blank Spike. Batch :	94203438	< 0.008	0.814	.8	mg/L	102
Phosphorus Dissolved	Blank Spike. Batch :	94203438	< 0.04	4.00	4	mg/L	100
Lead Dissolved	Blank Spike. Batch :	94203438	< 0.02	1.96	2	mg/L	98
Sulfur Dissolved	Blank Spike. Batch :	94203438	< 0.03	10.1	10	mg/L	101
Antimony Dissolved	Blank Spike. Batch :	94203438	< 0.015	1.77	1.62	mg/L	109
Selenium Dissolved	Blank Spike. Batch :	94203438	< 0.03	3.01	3	mg/L	100
Tin Dissolved	Blank Spike. Batch :	94203438	< 0.02	1.98	2	mg/L	99
Strontium Dissolved	Blank Spike. Batch :	94203438	< 0.001	0.098	.1	mg/L	98

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PHILIP ANALYTICAL

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SPIKE SUMMARY

Parameter	Client ID	Philip ID	Sample Conc.	Sample & Spike Conc.	Spike Amount	Unit	Percent Recovery
Tellurium Dissolved	Blank Spike. Batch :	94203438	< 0.02	2.06	2	mg/L	103
Titanium Dissolved	Blank Spike. Batch :	94203438	< 0.003	0.299	.28	mg/L	107
Thallium Dissolved	Blank Spike. Batch :	94203438	< 0.02	1.95	2	mg/L	97
Vanadium Dissolved	Blank Spike. Batch :	94203438	< 0.003	0.496	.5	mg/L	99
Zinc Dissolved	Blank Spike. Batch :	94203438	< 0.002	0.199	.2	mg/L	100
Zirconium Dissolved	Blank Spike. Batch :	94203438	< 0.003	0.298	.3	mg/L	99
Mercury Dissolved	Blank Spike. Batch :	94203442	< 0.00005	0.00045	.0005	mg/L	90

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PHILIP ANALYTICAL

10-Nov-99

ANALYSIS DATES

	Philip ID:	99056561	99056562	99056563	99056564
	Client ID:	MSGM-6-1	MSGM-6-2	MSGM-T2	MSGM-T3
00250760	Moisture	08-OCT-1999	08-OCT-1999	08-OCT-1999	08-OCT-1999
2105AA06	Cyanide(SAD) + Thiocyanate	08-OCT-1999	08-OCT-1999	08-OCT-1999	08-OCT-1999
0157AA09	Cyanide W.A.D.	08-OCT-1999	08-OCT-1999	08-OCT-1999	08-OCT-1999
CN-TAA05	Cyanide Total	03-NOV-1999	03-NOV-1999	03-NOV-1999	03-NOV-1999
Hg-T200M	Mercury	13-OCT-1999	13-OCT-1999	13-OCT-1999	13-OCT-1999
ICP-200S	Metals Pkg:ICP Soil	12-OCT-1999	12-OCT-1999	12-OCT-1999	12-OCT-1999
	Matrix:	Soil	Soil	Soil	Soil
	Sampled on:	30-SEP-1999	30-SEP-1999	4-OCT-1999	4-OCT-1999

PHILIP SERVICES CORP

PHILIP ANALYTICAL

10-Nov-99

ANALYSIS DATES

	Philip ID:	99056565	99056566	99056567	99056568
	Client ID:	MSGM-T4	MSGM-LA-1	MSGM-UA-1	MSGM-LF-1
00250760	Moisture	08-OCT-1999	08-OCT-1999	08-OCT-1999	08-OCT-1999
2105AA06	Cyanide(SAD) + Thiocyanate	08-OCT-1999	---	---	---
0157AA09	Cyanide W.A.D.	08-OCT-1999	---	---	---
CN-TAA05	Cyanide Total	03-NOV-1999	---	---	---
Hg-T200M	Mercury	13-OCT-1999	---	---	---
ICP-200S	Metals Pkg:ICP Soil	12-OCT-1999	---	---	---
PKG-BT18	BTEX by P&T	---	12-OCT-1999	12-OCT-1999	10-OCT-1999
	Matrix:	Soil	Soil	Soil	Soil
	Sampled on:	4-OCT-1999	4-OCT-1999	4-OCT-1999	4-OCT-1999

PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99

ANALYSIS DATES

	Philip ID:	99056569	99056570	99056571	99056572
	Client ID:	WC-HL-1	WC-CAMP-1	MSGM-1700m	MSGM-6-2
00250760	Moisture	08-OCT-1999	08-OCT-1999	—	—
2105AA06	Cyanide(SAD) + Thiocyanate	—	—	08-OCT-1999	08-OCT-1999
Hg-T200M	Mercury	—	—	—	12-OCT-1999
MET-F	Metals ICP Water Total	—	—	—	12-OCT-1999
PKG-BT18	BTEX by P&T	10-OCT-1999	10-OCT-1999	—	—
	Matrix:	Soil	Soil	Water	Water
	Sampled on:	5-OCT-1999	5-OCT-1999	4-OCT-1999	30-SEP-1999

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PHILIP ANALYTICAL

10-Nov-99

ANALYSIS DATES

	Philip ID:	99056573	99056574	99056575	99056576
	Client ID:	MSGM-AD1 T-1800m	MSGM-6-3	MSGM-9	MSGM-6-1
2105AA06	Cyanide(SAD) + Thiocyanate	08-OCT-1999	08-OCT-1999	08-OCT-1999	08-OCT-1999
Hg-T200M	Mercury	12-OCT-1999	12-OCT-1999	12-OCT-1999	12-OCT-1999
MET-F	Metals ICP Water Total	12-OCT-1999	12-OCT-1999	12-OCT-1999	12-OCT-1999
Hg-D0310	Mercury Dissolved	14-OCT-1999	---	---	---
PKG_G	Metals ICP Water Dissolved	12-OCT-1999	---	---	---
	Matrix:	Water	Water	Water	Water
	Sampled on:	4-OCT-1999	30-SEP-1999	30-SEP-1999	30-SEP-1999

PHILIP SERVICES CORP

PHILIP ANALYTICAL

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ANALYSIS DATES

	Philip ID:	99056577	99056578	99056579	99056580
	Client ID:	WC-DS	WC-US	MSGM-TRIB	MSGM-ADI T-1800A
2105AA06	Cyanide(SAD) + Thiocyanate	08-OCT-1999	08-OCT-1999	08-OCT-1999	08-OCT-1999
Hg-T200M	Mercury	12-OCT-1999	12-OCT-1999	---	12-OCT-1999
MET-F	Metals ICP Water Total	12-OCT-1999	12-OCT-1999	---	12-OCT-1999
Hg-D0310	Mercury Dissolved	14-OCT-1999	14-OCT-1999	15-OCT-1999	14-OCT-1999
PKG_G	Metals ICP Water Dissolved	12-OCT-1999	12-OCT-1999	13-OCT-1999	13-OCT-1999
	Matrix:	Water	Water	Water	Water
	Sampled on:	2-OCT-1999	2-OCT-1999	4-OCT-1999	4-OCT-1999

PHILIP SERVICES CORP

PHILIP ANALYTICAL

10-Nov-99

ANALYSIS DATES

	Philip ID:	99056581	99056582	99056554	99056555
	Client ID:	MSGM-TRIB A	MSGM-1700m	CM-PIPE 1	CM-PIPE 2
2105AA06	Cyanide(SAD) + Thiocyanate	08-OCT-1999	08-OCT-1999	—	—
Hg-T200M	Mercury	—	12-OCT-1999	12-OCT-1999	12-OCT-1999
MET-F	Metals ICP Water Total	—	12-OCT-1999	12-OCT-1999	12-OCT-1999
Hg-D0310	Mercury Dissolved	14-OCT-1999	15-OCT-1999	—	—
PKG_G	Metals ICP Water Dissolved	12-OCT-1999	13-OCT-1999	—	—
	Matrix:	Water	Water	Water	Water
	Sampled on:	4-OCT-1999	4-OCT-1999	3-OCT-1999	3-OCT-1999

PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99

ANALYSIS DATES

	Philip ID:	99056556	99056557	99056558	99056559
	Client ID:	CM-W7-US	CM-CAMP-DS 1	CM-CAMP-DS 2	CM-CAMP -PIPE 1
Hg-T200M	Mercury	12-OCT-1999	12-OCT-1999	12-OCT-1999	---
MET-F	Metals ICP Water Total	12-OCT-1999	12-OCT-1999	12-OCT-1999	---
Hg-D0310	Mercury Dissolved	15-OCT-1999	---	---	14-OCT-1999
PKG_G	Metals ICP Water Dissolved	14-OCT-1999	---	---	14-OCT-1999
	Matrix:	Water	Water	Water	Water
	Sampled on:	3-OCT-1999	3-OCT-1999	3-OCT-1999	3-OCT-1999

PHILIP SERVICES CORPORATION

PHILIP ANALYTICAL

10-Nov-99

ANALYSIS DATES

	Philip ID:	99056560
	Client ID:	CM-CAMP -PIPE 2
Hg-D0310	Mercury Dissolved	14-OCT-1999
PKG_G	Metals ICP Water Dissolved	14-OCT-1999
	Matrix:	Water
	Sampled on:	3-OCT-1999

PHILIP SERVICES CORP.

PHILIP ANALYTICAL

10-Nov-99

BATCH NUMBERS

	Philip ID:	99056561	99056562	99056563	99056564
	Client ID:	MSGM-6-1	MSGM-6-2	MSGM-T2	MSGM-T3
00250760	Moisture	94403600	94403600	94403600	94403600
2105AA06	Cyanide(SAD) + Thiocyanate	94101657	94101657	94101657	94101657
0157AA09	Cyanide W.A.D.	94101659	94101659	94101659	94101659
CN-TAA05	Cyanide Total	94101861	94101861	94101861	94101861
Hg-T200M	Mercury	94203410	94203410	94203410	94203410
ICP-200S	Metals Pkg:ICP Soil	94203406	94203406	94203406	94203406
	Matrix:	Soil	Soil	Soil	Soil
	Sampled on:	30-SEP-1999	30-SEP-1999	4-OCT-1999	4-OCT-1999

PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99

BATCH NUMBERS

	Philip ID:	99056565	99056566	99056567	99056568
	Client ID:	MSGM-T4	MSGM-LA-1	MSGM-UA-1	MSGM-LF-1
00250760	Moisture	94403600	94403600	94403600	94403600
2105AA06	Cyanide(SAD) + Thiocyanate	94101657	—	—	—
0157AA09	Cyanide W.A.D.	94101659	—	—	—
CN-TAA05	Cyanide Total	94101861	—	—	—
Hg-T200M	Mercury	94203410	—	—	—
ICP-200S	Metals Pkg:ICP Soil	94203406	—	—	—
PKG-BT18	BTEX by P&T	—	95204563	95204563	95204560
	Matrix:	Soil	Soil	Soil	Soil
	Sampled on:	4-OCT-1999	4-OCT-1999	4-OCT-1999	4-OCT-1999

PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99

BATCH NUMBERS

	Philip ID:	99056569	99056570	99056571	99056572
	Client ID:	WC-HL-1	WC-CAMP-1	MSGM-1700m	MSGM-6-2
00250760	Moisture	94403600	94403600	---	---
2105AA06	Cyanide(SAD) + Thiocyanate	---	---	94101657	94101657
Hg-T200M	Mercury	---	---	---	94203381
MET-P	Metals ICP Water Total	---	---	---	94203402
PKG-BT18	BTEX by P&T	95204560	95204560	---	---
	Matrix:	Soil	Soil	Water	Water
	Sampled on:	5-OCT-1999	5-OCT-1999	4-OCT-1999	30-SEP-1999

PHILIP SERVICES CORP

PHILIP ANALYTICAL

10-Nov-99

BATCH NUMBERS

	Philip ID:	99056573	99056574	99056575	99056576
	Client ID:	MSGM-AD1 T-1800m	MSGM-6-3	MSGM-9	MSGM-6-1
2105AA06	Cyanide(SAD) + Thiocyanate	94101657	94101657	94101657	94101657
Hg-T200M	Mercury	94203381	94203381	94203381	94203381
MET-F	Metals ICP Water Total	94203402	94203402	94203402	94203402
Hg-D0310	Mercury Dissolved	94203395	---	---	---
PKG_G	Metals ICP Water Dissolved	94203403	---	---	---
	Matrix:	Water	Water	Water	Water
	Sampled on:	4-OCT-1999	30-SEP-1999	30-SEP-1999	30-SEP-1999

PHILIP SERVICES CORP

PHILIP ANALYTICAL

10-Nov-99

BATCH NUMBERS

	Philip ID:	99056577	99056578	99056579	99056580
	Client ID:	WC-DS	WC-US	MSGM-TRIB	MSGM-ADI T-1800A
2105AA06	Cyanide(SAD) + Thiocyanate	94101657	94101657	94101657	94101657
Hg-T200M	Mercury	94203381	94203381	---	94203381
MET-F	Metals ICP Water Total	94203402	94203402	---	94203402
Hg-D0310	Mercury Dissolved	94203395	94203395	94203443	94203395
PKG_G	Metals ICP Water Dissolved	94203403	94203403	94203413	94203413
	Matrix:	Water	Water	Water	Water
	Sampled on:	2-OCT-1999	2-OCT-1999	4-OCT-1999	4-OCT-1999

PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99
Page 36 of 39

BATCH NUMBERS

	Philip ID:	99056581	99056582	99056554	99056555
	Client ID:	MSGM-TRIB A	MSGM-1700m	CM-PIPE 1	CM-PIPE 2
2105AA06	Cyanide(SAD) + Thiocyanate	94101657	94101657	—	—
Hg-T200M	Mercury	—	94203381	94203381	94203381
MET-F	Metals ICP Water Total	—	94203402	94203402	94203402
Hg-D0310	Mercury Dissolved	94203395	94203443	—	—
PKG_G	Metals ICP Water Dissolved	94203403	94203413	—	—
	Matrix:	Water	Water	Water	Water
	Sampled on:	4-OCT-1999	4-OCT-1999	3-OCT-1999	3-OCT-1999

PHILIP SERVICES CORP

PHILIP ANALYTICAL

10-Nov-99

BATCH NUMBERS

	Philip ID:	99056556	99056557	99056558	99056559
	Client ID:	CM-W7-US	CM-CAMP-DS 1	CM-CAMP-DS 2	CM-CAMP -PIPE 1
Hg-T200M	Mercury	94203381	94203381	94203381	---
MET-F	Metals ICP Water Total	94203402	94203402	94203402	---
Hg-D0310	Mercury Dissolved	94203470	---	---	94203442
PKG_G	Metals ICP Water Dissolved	94203444	---	---	94203438
	Matrix:	Water	Water	Water	Water
	Sampled on:	3-OCT-1999	3-OCT-1999	3-OCT-1999	3-OCT-1999

PHILIP SERVICES

PHILIP ANALYTICAL

10-Nov-99
Page 38 of 39

BATCH NUMBERS

	Philip ID:	99056560
	Client ID:	CM-CAMP -PIPE 2
Hg-D0310	Mercury Dissolved	94203442
PKG_G	Metals ICP Water Dissolved	94203438
	Matrix:	Water
	Sampled on:	3-OCT-1999

PHILIP SERVICES CORP.

PHILIP ANALYTICAL

10-Nov-99

BLANK SUMMARY

All method blanks were less than MDL, except the following:

Parameter	Batch	Sparcode	Blank Conc.	MDL	Unit
Chromium	94203406	Cr-T200S	0.2	0.2	ug/g
Zinc	94203406	Zn-T200S	0.6	0.5	ug/g
Calcium	94203402	Ca-T0042	0.06	0.05	mg/L

PHILIP SERVICES CORP
PHILIP ANALYTICAL SERVICES
8577 Commerce Court
Burnaby, B.C. V5A 4N5
Phone: (604) 444-4808
Fax: (604) 444-4511
Toll Free: 1-800-440-4808

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

PAGE 1 OF 2

ANALYSIS REQUEST 8040421

COMPANY NAME: MPA CONSULTING LIMITED

PH. #: 905-333-0427
FAX #: 905-333-9723

COMPANY ADDRESS: #163, 3017 St Clair Ave. BURLINGTON, ON L7N 3P5

CLIENT PROJECT ID: (#) MOA-99-1

SAMPLER NAME (PRINT): D. GREGOR

PROJECT MANAGER: D. GREGOR

#	FIELD SAMPLE ID	PHILIP LAB # (Lab Use Only)	MATRIX: GROUND WATER	SURFACE WATER	SOIL	OTHER	# CONTAINERS	SAMPLING: DATE	TIME	HEADSPACE VAPOUR	TOTAL METALS K2 + Hg	CYANIDE SPO3	BTEX/LIGHT HC GC/FID-HT
1	MSGM-6-1	56561			✓		1	SEPT 30/99	1631		✓	✓	
2	MSGM-6-2	56562			✓		1	"	1630		✓	✓	
3	MSGM-T2	56563			✓		1	OCT 4/99	14:25		✓	✓	
4	MSGM-T3	56564			✓		1	OCT 4/99	14:30		✓	✓	
5	MSGM-T4	56565			✓		1	OCT 4/99	14:44		✓	✓	
6	MSGM-LA-1	56566			✓		1	OCT 4/99	15:26				✓
7	MSGM-UA-1	56567			✓		1	OCT 4/99	15:36				✓
8	MSGM-LF-1	56568			✓		1	OCT 4/99	16:30				✓
9	WC-HL-1	56569			✓		1	OCT 5/99	11:20				✓
10	WC-CAMP-1	56570			✓		1	OCT 5/99	11:30				✓
11													
12													

TAT
- Two Week ☑
- One Week ☐
- 48 Hours ☐
- 24 Hours ☐
- Other: _____

P.O. NUMBER:

SPECIAL DETECTION LIMITS / CONTAMINANT TYPE

ACCOUNTING CONTACT: D. GREGOR

SPECIAL REPORTING OR BILLING INSTRUCTIONS

EDT ☐

LAB USE ONLY
ARRIVAL TEMPERATURE °C
LAB INFORMATION
Oct 15
THIOCYANATE
Nov 9

CUSTODY RECORD

RELINQUISHED BY SAMPLER: D. GREGOR	DATE: OCT 5/99	TIME: 1830	RECEIVED BY:
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
RELINQUISHED BY:	DATE: OCT 7/99	TIME: 1040	RECEIVED BY LABORATORY:

PHILIP SERVICES CORP

PHILIP ANALYTICAL SERVICES
8577 Commerce Court
Burnaby, B.C. V5A 4N5
Phone: (604) 444-4808
Fax: (604) 444-4511
Toll Free: 1-800-440-4808

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

PAGE 1 OF 2

ANALYSIS REQUEST 8040421

COMPANY NAME: MDA CONSULTING LIMITED

PH. #: 905-333-0427
FAX #: 905-333-9723

COMPANY ADDRESS: #163, 3017 St Clair Ave. BURLINGTON, ON L7N 3P5

CLIENT PROJECT ID: (#) MDA-99-1

SAMPLER NAME (PRINT): D. GREGOR

PROJECT MANAGER: D. GREGOR

	FIELD SAMPLE ID	PHILIP LAB # (Lab Use Only)	MATRIX: GROUND WATER	MATRIX: SURFACE WATER	MATRIX: SOIL	MATRIX: OTHER	# CONTAINERS	SAMPLING: DATE	SAMPLING: TIME	HEADSPACE VAPOUR	TOTAL METALS KP + Hg	CYANIDE SPO3	BTEX/LIGHT HC
1	MSGM-6-1	505561			✓		1	SEPT 30/99	1631		✓	✓	
2	MSGM-6-2	505562			✓		1	"	1630		✓	✓	
3	MSGM-T2	505563			✓		1	OCT 4/99	14:28		✓	✓	
4	MSGM-T3	505564			✓		1	OCT 4/99	14:30		✓	✓	
5	MSGM-T4	505565			✓		1	OCT 4/99	14:44		✓	✓	
6	MSGM-LA-1	505566			✓		1	OCT 4/99	15:24				✓
7	MSGM-UA-1	505567			✓		1	OCT 4/99	15:36				✓
8	MSGM-LF-1	505568			✓		1	OCT 4/99	16:30				✓
9	WC-HL-1	505569			✓		1	OCT 5/99	11:20				✓
10	WC-CAMP-1	505570			✓		1	OCT 5/99	11:30				✓
11													
12													

TAT
- Two Week ☑
- One Week ☐
- 48 Hours ☐
- 24 Hours ☐
- Other: _____

P.O. NUMBER:

SPECIAL DETECTION LIMITS / CONTAMINANT TYPE

ACCOUNTING CONTACT: D. GREGOR

SPECIAL REPORTING OR BILLING INSTRUCTIONS

EDT ☐

LAB USE ONLY
ARRIVAL TEMPERATURE °C
LAB INFORMATION
Oct 15
THROUGH DATE Nov 9

CUSTODY RECORD

RELINQUISHED BY SAMPLER: D. GREGOR	DATE Oct 5/99	TIME 1830	RECEIVED BY:
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
RELINQUISHED BY:	DATE Oct 7/99	TIME 1040	RECEIVED BY LABORATORY:

11/15/99 12:04 FAX 604 444 4511 PHILIP ANALYTICAL-B.C. 040/045

PHILIP SERVICES CORP.
8577 Commerce Court
Burnaby, B.C. V5A 4N5
Phone: (604) 444-4808
Fax: (604) 444-4511
Toll Free: 1-800-440-4808

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

PAGE ___ OF ___

ANALYSIS REQUEST 8040420

COMPANY NAME: MDA CONSULTING LIMITED

PH. #: 905-333-0427

FAX #: 905-333-9723

COMPANY ADDRESS: #163-3017 ST. CLAIR AVE. BURLINGTON, ON L7N 3P5

CLIENT PROJECT ID: (#) MDA-99-1

SAMPLER NAME (PRINT): D. GREGOR/P. ZURACHENKO

PROJECT MANAGER: D. GREGOR

	FIELD SAMPLE ID	PHILIP LAB # (Lab Use Only)	MATRIX: GROUND WATER	MATRIX: SURFACE WATER	MATRIX: SOIL	MATRIX: OTHER	# CONTAINERS	SAMPLING: DATE	SAMPLING: TIME	SAMPLING: HEADSPACE VAPOUR	TOTAL METALS ICP+HG	CYANIDE SAD	DISS. METALS *
1	MSGM-1700M	56571		✓			I	OCT 4/99	1645			✓	○
2	MSGM-6-2	56572		✓			II	SEP/30/99	1602		✓	✓	
3	MSGM-ADIT-1800	56573		✓			III	OCT 4/99	15:55		✓	✓	✓
4	MSGM-6-3	56574		✓			II	SEPT 30/99	16:10		✓	✓	
5	MSGM-9	56575		✓			II	SEPT 30/99	15:10		✓	✓	
6	MSGM-6-1	56576		✓			II	SEPT 30/99	1600		✓	✓	
7	WC-DS	56577		✓			III	Oct 2/99	1200		✓	✓	✓
8	WC-US	56578		✓			III	OCT 2/99	1200		✓	✓	✓
9	MSGM-TRIB	56579		✓			II	OCT 4/99	1630			✓	✓
10	MSGM-ADIT-1800A	56580		✓			III	OCT 4/99	1555		✓	✓	✓
11	MSGM-TRIBA	56581		✓			II	OCT 4/99	1630			✓	✓
12	MSGM-1700M	56582		✓			III	OCT 4/99	1645		✓	✓	✓

TAT
- Two Week ☑
- One Week ☐
- 48 Hours ☐
- 24 Hours ☐
- Other: _____

P.O. NUMBER:

SPECIAL DETECTION LIMITS / CONTAMINANT TYPE: * NOTE - DISSOLVED METALS HAVE NOT BEEN FILTERED

ACCOUNTING CONTACT: D. GREGOR

SPECIAL REPORTING OR BILLING INSTRUCTIONS

EDT ☐

LAB USE ONLY

ARRIVAL TEMPERATURE °C: 4°

LAB INFORMATION: Oct 15 PM

CUSTODY RECORD

RELINQUISHED BY SAMPLER: D. GREGOR	DATE: OCT 5/99	TIME: 21 30	RECEIVED BY:
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
RELINQUISHED BY:	DATE: Oct 7/99	TIME: 1046	RECEIVED BY LABORATORY: M

PHILIP SERVICES CORP
PHILIP ANALYTICAL SERVICES
8577 Commerce Court
Burnaby, B.C. V5A 4N5
Phone: (604) 444-4808
Fax: (604) 444-4511
Toll Free: 1-800-440-4808

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

ANALYSIS REQUEST 8040422

COMPANY NAME: MDA CONSULTING

PH. #: 905-333-0427
FAX #: 905-333-9723

COMPANY ADDRESS: #163-3017 ST. CAIR AVE BURLINGTON ON, L7N 3P5

CLIENT PROJECT ID: (#) MDA-99-1

SAMPLER NAME (PRINT): D. GREGOR/P. ZURACHENKO

PROJECT MANAGER: D. GREGOR

	FIELD SAMPLE ID	PHILIP LAB # (Lab Use Only)	MATRIX: GROUND WATER	MATRIX: SURFACE WATER	MATRIX: SOIL	MATRIX: OTHER	# CONTAINERS	SAMPLING: DATE	SAMPLING: TIME	HEADSPACE VAPOUR	DISS. METALS	TTL. METALS (ICP+HG)
1	CM-PIPE 1	56554	✓	✓			1	OCT 3/99	1400		✓	✓
2	CM-PIPE 2	56555	✓	✓			1	"	1400		✓	✓
3	~~CM-PIPE 3~~		~~✓~~				~~1~~	~~"~~	~~1400~~		~~✓~~	
4	~~CM-PIPE 4~~		~~✓~~				~~1~~	~~"~~	~~1400~~		~~✓~~	
5	CM-W7-US	56556		✓			11	OCT 3/99	1200		✓	✓
6	CM-CAMP-DS1	56557		✓			1	OCT 3/99	1400			✓
7	CM-CAMP-DS2	56558		✓			1	OCT 3/99	1400			✓
8	CM-Camp-pipe1	56559									X	
9	CM-camp-pipe2	56560									X	
10												
11												
12												

TAT
- Two Week ☐
- One Week ☐
- 48 Hours ☐
- 24 Hours ☐
- Other: _____

P.O. NUMBER:

SPECIAL DETECTION LIMITS / CONTAMINANT TYPE: DISS. METALS - NOT FILTERED

ACCOUNTING CONTACT: D. GREGOR

SPECIAL REPORTING OR BILLING INSTRUCTIONS

EDT ☐

LAB USE ONLY
ARRIVAL TEMPERATURE °C
LAB INFORMATION 4° Oct 15 PM

CUSTODY RECORD

RELINQUISHED BY SAMPLER:	DATE Oct 5/99	TIME 21:30	RECEIVED BY:
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
RELINQUISHED BY:	DATE Oct 7/99	TIME 1040	RECEIVED BY LABORATORY:

SAMPLE INTEGRITY RECORD

Client: MDA CONSULTING
Date: OCT 7/99 **Initials:** OCT 7/99 **COC Form #:** 8040422

The following bottles were received for the above project:

Sample	100mL AG	180mL AG		1L AG	1L CG	1L PL	500mL PL	500mL AG	500mL CG	250mL PL HNO3	250mL PL H2SO4	250mL PL	250mL PL Filt/Pres	250mL PL Filt	MICRO	100mL AG	40mL vials	Trip/Field Blk	Plastic Bag	Air sample	Other
1										1											
2										1											
3										2											
4										1											
5										1											
6																					
7																					
8										1											
9										1											
10																					
11																					
12																					

The following observations were made regarding the above project:

- ☐ Sample Requisition Form/Written Instruction
- ☐ Missing Sample
- ☐ Extra Sample
- ☐ Incorrect Sample ID
- ☐ Physical Damage and/or Contamination
- ☐ Inappropriate Sample Temperature
- ☐ Preservative Required
- ☐ Hold Time Exceeded
- ☐ Incompatible Sample Container(s)
- ☐ Inadequate Sample Volume
- ☐ Headspace Present
- ☐ Filtering Required

Diss bottle for pipe 1 & 2 samples

Comments: 2 extra samples cm-camp-pipe1
cm-camp-pipe2
assumed CMPipe1
CMPipe2
Diss metals sample cm-W7-W3 could not be filtered at lab. Preserved in field

SAMPLE INTEGRITY RECORD

Client: MPA
Date: Oct 7/99 **Initials:** A.J. **COC Form #:** 804042-1.

The following bottles were received for the above project:

	100mL AG	60mL AG	1L AG	1L CG	1L PL	500mL PL	500mL AG	500mL CG	250mL PL HNO3	250mL PL H2SO4	250mL PL	250mL PL Filt/Pres	250mL PL Filt	MICRO	100mL AG	40mL vials	Trip/Field Blk	Plastic Bag	Air sample	Other
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10		✓																		
11																				
12																				

The following observations were made regarding the above project:

- ☐ Sample Requisition Form/Written Instruction
- ☐ Missing Sample
- ☐ Extra Sample
- ☐ Incorrect Sample ID
- ☐ Physical Damage and/or Contamination
- ☐ Inappropriate Sample Temperature
- ☐ Preservative Required
- ☐ Hold Time Exceeded
- ☐ Incompatible Sample Container(s)
- ☐ Inadequate Sample Volume
- ☐ Headspace Present
- ☐ Filtering Required

Comments:

PHILIP ANALYTICAL SERVICES

SAMPLE INTEGRITY RECORD

Client: MDA
Date: Oct 7/99 **Initials:** AJ **COC Form #:** 8040420

The following bottles were received for the above project:

Sample No.	100mL AG	180mL AG		1L AG	1L CG	1L PL	500mL PL	500mL AG	500mL CG	250mL PL HNO3	250mL PL H2SO4	250mL PL	250mL PL Filt/Pres	250mL PL Filt	MICRO	100mL AG	40mL vials	Trip/Field Blk	Plastic Bag	Air sample	Other 250mL (PL) NaOH
1												1									1
2										1											1
3										1		1									1
4										1											1
5										1											1
6										1											1
7										2											1
8										2											1
9										2		1									1
10										1		1									1
11										1											1
12										1											1

The following observations were made regarding the above project:

- ☐ Sample Requisition Form/Written Instruction
- ☐ Missing Sample
- ☐ Extra Sample
- ☐ Incorrect Sample ID
- ☐ Physical Damage and/or Contamination
- ☐ Inappropriate Sample Temperature
- ☐ Preservative Required
- ☐ Hold Time Exceeded
- ☐ Incompatible Sample Container(s)
- ☐ Inadequate Sample Volume
- ☐ Headspace Present
- ☐ Filtering Required

Comments:
Dis. metals for WC-DS, WC-US, MSGM-Trib A could not be filtered by lab. Preserved in field