

Environmental Assessment, Western Coppermine/Williams Creek, Yukon Region – Final Report



Prepared for:



Indian and Northern Affairs
Canada

Contaminated Sites Office
345 – 300 Main Street
Whitehorse, Yukon

by

MDA

Consulting Limited
Environmental Solutions


Unit B3
5109 Harvester Road
Burlington, ON

March, 2000

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(Call Up No. 98-6195-03)

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In Association With

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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, to produce a **detailed current condition** environmental report related to the Western Coppermine/Williams Creek exploration site, Yukon (approx. 62° 21' N, 136° 21' W). This study included the following major components:

- i. Completion of a preliminary file review involving files provided by the INAC-Whitehorse as part of a water licensing process for the mine;
- ii. Informal discussions with individuals involved with INAC, Contaminants/Waste Program, for the Yukon region;
- iii. Communication with the local Little Salmon/Carmacks First Nation to identify issues and concerns regarding the condition of the abandoned Western Coppermine;
- iv. Site inspection as well as sampling to determine the current condition of the Copper-mine location; and,
- v. An intensive file review including all water license documents and departmental correspondence.

The site was visited on two occasions, October 2, 1999, and on October 5, 1999. The latter visit included Mr. Joe Bellmore of Little Salmon/Carmacks First Nation. The absence of snow cover at the time of the second visit permitted confirmation of observations made earlier and allowed the identification and sampling of some stained soils.

The only equipment left at the site is a fuel truck. All of the fuel tanks on the truck were empty. There are only two buildings remaining. The first is a plywood tent frame and the second, which likely pre-dates the recent exploration at the site, is a log tent frame. Core and sample stocks remain neatly piled.

A small landfill is located along the road near the exploration camp. Exposed debris consists of empty drums and other metal containers, equipment parts, old tires etc. Other debris scattered about the site includes empty drums, reinforcing rod, well casing and drill stem.

The site has been severely “scarred” as a result of exploration activities including trenches of several metres depth. A large area, the site of the proposed heap leach, has been cleared and trenched or excavated at several locations. A number of test wells have been installed in this area. None of these were sampled as all appeared to be dry.

The detailed review of information filed as part of the Initial Environmental Evaluation (IEE) of the site provided information on surface water quality, aquatic and terrestrial biological conditions, terrain features, vegetation characteristics, wildlife occurrence, sediment chemistry of the streams, fish distribution and precipitation. This information was used for comparison with current conditions as appropriate.

The results of the surface water quality testing undertaken as part of this investigation, indicate that the water is currently pristine with respect to dissolved and total metals. Although based on limited data, there is little reason to believe that stagnated exploration activities are impacting on the surface water quality. In fact none of the total metals concentrations, including Cu, exceeded CCME guidelines. Higher concentrations may occur as a direct result of spring runoff causing increased erosion from disturbed areas. These effects are likely small and act only for a limited time period.

The two stained soil samples did not show measurable concentrations of hydrocarbons or BTEX compounds. The cause of the staining is therefore not clear but the impact is likely limited.

Western Coppermine has to date only been an exploration site and consequently the risks and hazards for the site are generally limited. Nevertheless, there are a number of potential physical site hazards. Specifically:

- The extensive trenching may pose some threat to wildlife and humans due to the placement of debris along the top of the trenches, creating a falling debris hazard as well as physical danger;
- The loss of tree cover and excavations throughout the proposed heap leach site raises concerns with respect to severe erosion or slumping and increased soil temperatures that may change the permafrost regime;
- The exploration trenches, and the increased retention of snow and snowmelt could decrease stability, and change the hydrogeologic and hydrologic regimes, thus impacting Williams Creek;
- Core and sample storage piles could pose a risk, due to the possibility of collapse; and
- Metal debris in the core/sample storage area near the log cabin, at the landfill and scattered throughout the site, pose a hazard to people and wildlife.

In order to return the site to a more natural state, the following items could be considered:

- the fuel truck should be removed;



- the deepest exploration trenches and pits on the ore bodies should be re-contoured with the excavated debris;
- the test wells from the proposed heap leach sites and others that may be present at other locations, should be removed;
- the geotechnical investigation trenches on the heap leach site should be re-contoured to minimize infiltration and reduce permafrost thawing and revegetation should be undertaken to enhance slope stability;
- metal debris, including empty drums, well pipe, and reinforcing rods should be removed from the site and recycled or disposed of at an approved facility;
- cores and samples should be landfilled;
- combustible materials should be burned on site (e.g. core boxes, tent frame) and the ashes landfilled; and
- the landfill should be contoured and leveled with native soils and revegetated.

While these are not recommendations for fully rehabilitating the site, they are offered for consideration in order to enhance the naturalization of the site.

2. Background

The Department of Indian and Northern Affairs, Waste Management Program, Yukon Region retained MDA to undertake an environmental assessment of the abandoned Western Copper-mine or Williams Creek (WC) site as a call up under the above named standing offer. This report is provided to summarize the findings of the fieldwork and file review that has been undertaken in response to this request.

The WC is located approximately 26 miles west of Carmacks, Yukon (approximately 62° 21'N, 136° 21'W) and is normally accessible by road, using a four-wheel drive vehicle. However, due to the presence of several centimetres of snow at the time of the field investigation and the poor condition of the access road, it was necessary to use helicopters to access the site. Williams Creek, a year round tributary of the Yukon River (see Figure 1) flows in the valley feature at the base of the main ore body and the planned heap leach facility.

Extensive exploration has been conducted at this site in recent years in anticipation of the establishment of an open pit copper mine. Major recent exploration began in the early 1990s with trenches being excavated in the area of the proposed open pit mine. It had been proposed to utilize heap leach at this site and a large shallow valley immediately to the west of the main copper deposit had been cleared and disturbed. This included the extension of exploration trenches and the installation of several groundwater piezometers (Figure 2).

Other trenches extended away from the main ore site, their purpose was essentially to explore the extent of the ore body. Until the file review is complete for this project, earlier exploration activity and possible mining activity cannot be confirmed. However, as with most exploitable sites in the Yukon, there is likely a long history of exploration and extraction at this site.

The objective of this environmental assessment is to provide a **detailed current condition**, environmental report on the site prior to devolution to the Yukon Territorial Government. This detailed current condition report will focus on the issues that have been identified as part of the application of the Water License .

As instructed by INAC – Yukon personnel, this report will not undertake assessment vies a vis regulations and criteria, neither will it provide recommendations or costs for future work at this site.

3. Preliminary Assessment

3.1. File Review

A preliminary review of the files retained by INAC-Whitehorse as part of the water licensing 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.

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

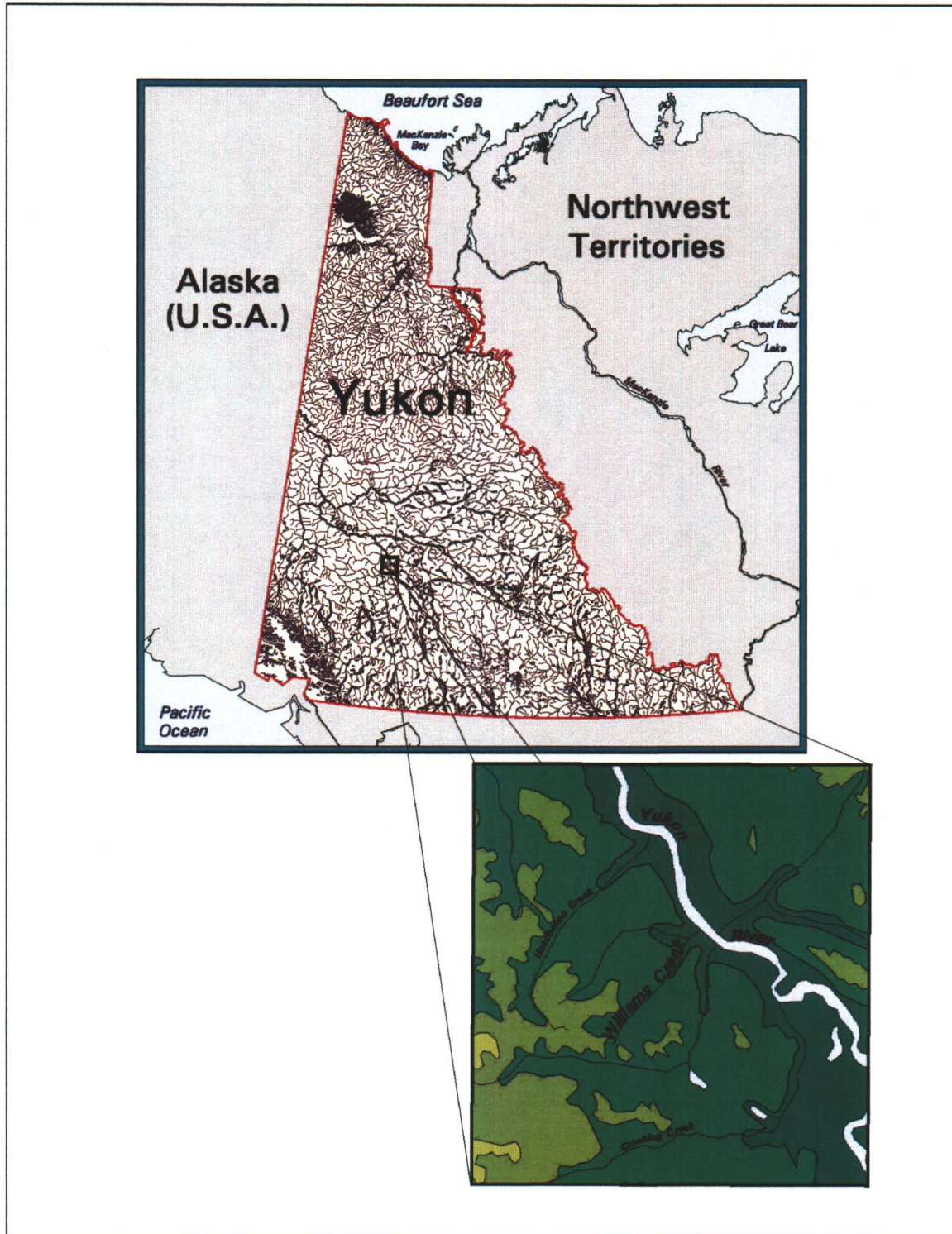
Initially, it had been anticipated that the site would be accessible by using four-wheel drive vehicles. However, the main obstacle to vehicular access was the presence of approximately 10 cm of snow overlying unfrozen soil. This made vehicular access very difficult even with four wheel drive especially due to the poor condition of the road including washouts and ruts. Consequently, it was determined that helicopter access was the most efficient means to undertake this work. The use of the helicopter was a cost-effective alternative to the approximately 4 hours of travel time that would be required for the four person field team using two vehicles for safety purposes. As well, the helicopter travel could be integrated with another, simultaneous project based out of Carmacks for which a helicopter was the only means of access.

3.4. First Nations Communications

WC is located on the north valley slope of Williams Creek, which flows into the Yukon River downstream of Carmacks. The Little Salmon/Carmacks First Nation has had a long standing concern about the development of the site, particularly with respect to the impact of the heap leach facility on the natural water resources, and habitat within. As well, they have a concern as to the impact of the development on the wildlife and the habitat within traditional areas. On the other hand, with the recent closing of another



Figure 1: Location map for Western Coppermine/Williams Creek Site, Yukon



mine in the vicinity, which employed numerous band members, there is a strong interest in seeing the WC facility developed with appropriate environmental safeguards.

Consequently, several telephone discussions were held with Mr. Chris Noble, Director, Land, Resources and Infrastructure for the Little Salmon/Carmacks First Nation. A meeting was set up for Monday, October 4, 1999 at the Band office, to discuss concerns about the site and to plan a site visit. Unfortunately, for reasons beyond the control of MDA, that meeting did not occur, and a second meeting was established for Tuesday, October 5, 1999. Attending the Tuesday meeting were Chris Noble, Joe Bellmore, Land Resource Technician for Little Salmon/Carmacks First Nation and D. Gregor, MDA. All other MDA and AES staff had been sent back to Whitehorse at this time to undertake other work.

The development of the WC site was discussed in a general way. Mr. Noble indicated that the site had been visited officially by someone from the Band approximately one year ago. MDA invited Mr. Noble and Mr. Bellmore to visit the site that day to participate in a second field inspection. Mr. Bellmore was able to do so. The timing of this second visit was indeed appropriate as the 10 cm of snow that had been present at the time of the previous visit had largely disappeared, allowing a more thorough inspection.

A duplicate set of photographs for the Western Copper site, complete with annotations, was provided to Mr. Noble by MDA in November, 1999.

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 were 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 was gathered in a preliminary manner only.

The initial site visit to Western Coppermine was attempted on October 1, 1999 by vehicle. Although we attempted to access the site the conditions of the road, including approximately 10 cm of fresh snow over unfrozen ground, and deep ruts and washouts, prevented us from reaching the site. This experience clearly demonstrated that about four hours would be required to drive to and from the site, clearly substantiating the appropriateness of using a helicopter to access the site.

The morning of October 2, 1999, brought relatively poor weather with a low ceiling. The field party set off by helicopter to go to the Casino Gold Mine but was forced to turn around due to a low ceiling and icing conditions. On the return to Carmacks, we were able to land at the WC site and conduct our inspection on that day with a team of four. Due to the opportunistic nature of this site visit, we were unable to arrange for a representative from the Little Salmon/Carmacks First Nation to join us. (Mr. Noble was out of town and Mr. Bellmore was on holidays. Nevertheless, with the generally poor weather at the time, it was decided to continue with the site visit and arrange a subsequent visit with a band representative.

After an extensive fly over of the site (shown in Photograph 1) the helicopter landed at the WC camp. 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 heap leach facility and the exploration activities of the main ore body. The second field party inspected the base of the heap leach site including the sample storage area and the camp, while a third party proceeded to collect the upstream water sample from Williams Creek. Upon completion of the inspection, we followed Williams Creek to its confluence with the Yukon River with the helicopter, where an additional water sample was collected (See Table 1 for a complete listing of the samples collected and the list of analyses requested for each sample).

The site was revisited on Tuesday, October 5, 1999 following a meeting with representatives of the Little Salmon/Carmacks First Nation. As the site visit had been completed, only D. Gregor was in attendance at the meeting, and was accompanied to a second site visit by Mr. Joe Bellmore. The weather on October 5 was much better than during the earlier site visit, permitting the helicopter to set the field team down on top of

the mountain, basically in the midst of the primary ore body. The helicopter then proceeded to the base camp area while Gregor and Bellmore proceeded to check out the exploration area, the heap leach site and the camp area. The general absence of snow during this visit allowed us to confirm the earlier observations and at least permitted a more careful inspection for stained soils and other debris which may have been hidden during the initial visit.

Photograph 1: Aerial overview of the Western Coppermine/Williams Creek site with main ore body shown right centre and cleared heap leach area in left centre



Table 1: List of sample locations for Western Coppermine/Williams Creek, October, 1999

Field Sample ID	Sample Description	Latitude / Longitude	Sample Matrix	Date of Sample	Total Metals	Cyanide	BTEX Light Hydrocarbons	Dissolved Metals
WC-DS	Williams Cr. – down stream (mouth)	62° 23' 39.3"N 136° 36' 37.1"W	Water	Oct. 2/99	◆	◆		◆
WC-US	Williams Cr. – upstream	62° 05' 25"N 136° 16' 55"W	Water	Oct. 2/99	◆	◆		◆
WC-HL-1	Stained soil near piezometer		Soil	Oct. 5/99			◆	
WC-Camp-1	Stained soil on west side of camp		Soil	Oct. 5/99			◆	



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 nalgene bottles, pre-cleaned by Philip Services Corporation (PSC). These bottles were triple rinsed prior to filling. Dissolved metals samples were also collected in 500 ml bottles provided by analytical laboratory. Samples collected into these bottles were preserved using acid added to the bottles by the laboratory in advance. It was necessary to add the acid to the sample bottles in the laboratory, due to the urgent need for the sample bottles. Shipment of the preservative in glass vials would have to be via ground transportation, and would have been too slow to permit timely sampling. 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

4.3.1. Equipment

The only equipment left on site was the 1980's vintage fuel truck shown in Photograph 2. This was located in the vicinity of the exploration camp (see Figure 2), approximately 100 m from the road crossing of Williams Creek. The main tank, the fuel tank and the drums located on the truck were empty. The truck is apparently owned by Tercon Construction of Kamloops, B.C.

4.3.2. Buildings and Structures

There are two buildings left on the WC site. The log tent frame shown in Photograph 3, may have pre-existed the development of the mine site as it appears to be quite old. The only other building is the plywood tent frame shown in Photograph 4. This was a part of the camp. These buildings contained only minor quantities of refuse resulting from previous usage and were generally in poor condition.

The only other structures present at the site, were the core and sample stocks illustrated in Photograph 5. These remain relatively neat at this time but the core boxes will continue to deteriorate until the piles collapse.



Photograph 2: Abandoned fuel truck near exploration camp

Photograph 3: Log tent frame near exploration camp





*Photograph 4:
Plywood tent frame
at exploration camp*

*Photograph 5:
Core and sample
box storage area
along road way in
vicinity of
exploration camp*



4.3.3. Stained Soils

The initial visit did not identify any stained soils and thus no soil sampling was undertaken at that time. This was largely a result of the blanket of snow on the soil. However, by the time of the site visit on October 5, 1999, a great deal of the snow had melted permitting the identification of several stained soil areas. One was sampled near a piezometer at the base of the heap leach site (WC-HL-1) (see Photograph 6). This appeared to be the result of the leaking or spilling of oil from the drill rig. Other well sites were inspected but this was the only one with significant stained soil present. The staining covered an area of approximately 1 m by 3 m to an undetermined depth.

A second stained soil sample was collected in front of the log cabin near the road way on the west side of the camp. This also covered an area of approximately 1 m by 3 m to a depth of approximately 20 cm (Photograph 7). Stained soil was not observed in the vicinity of the fuel truck, the only vehicle left at the site.

Photograph 6: Stained soil adjacent to well near base of the proposed heap leach site



*Photograph 6:
Stained soil
adjacent to well
near base of the
proposed heap
leach site*



Photograph 7: Stained soil in front of the log cabin tent frame (see Photograph 3) near the exploration camp



Photograph 8: Partially covered landfill site in the vicinity of the exploration camp

4.3.4. Waste Disposal

The only waste disposal site located at WC was adjacent to the roadway near the camp and core/sample storage area (see Figure 2 and Photograph 8). A wide assortment of non-combustible debris is exposed at this site. Most of this debris seems to be empty drums and other metal containers, equipment parts, old tires etc.

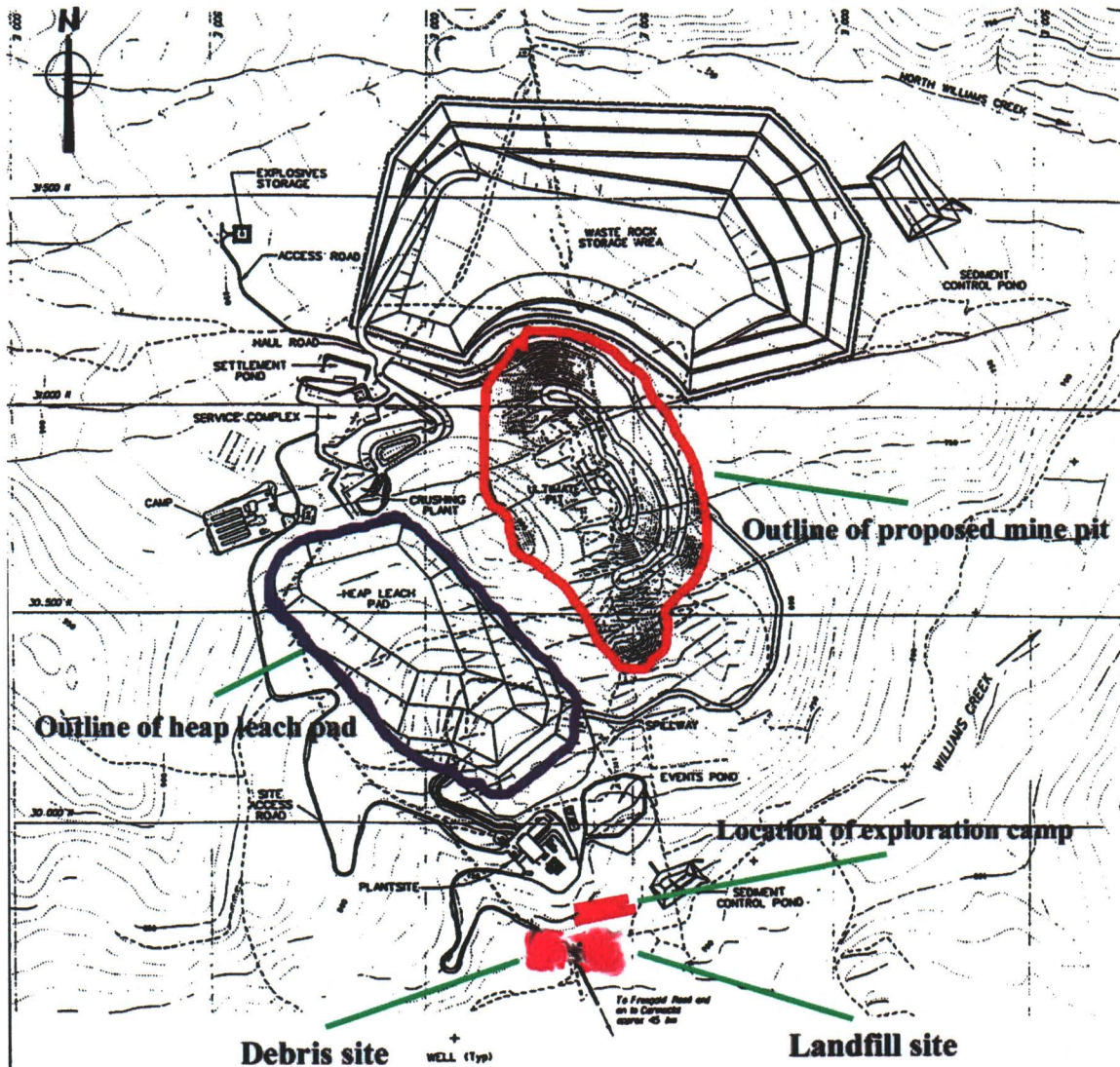
4.3.5. Debris

Debris was quite limited at the site and generally confined to the edge of the roadway in the area of the camp and core/sample storage (see Figure 2). Debris included empty drums, core storage and reinforcing rod (Photographs 9 and 10) and well casing and drill stem in front of the abandoned shack (Photograph 11).



Photograph 9: Crushed and empty drums in vicinity of exploration camp

Figure 2: General map of the Williams Creek/Western Coppermine site showing main ore body, proposed heap leach site, camp, landfill and debris sites





Photograph 10: Steel reinforcing rod stored along with cores and soil samples in the exploration camp area



Photograph 11: Discarded well pipe and drill stem in front of log tent frame near the exploration camp

4.3.6. Exploration Activities

Mineral and geotechnical exploration activities at the site are extensive, and have severely altered the landscape of the site. Exploration trenches, and cat tracks radiate from the primary mineral site for more than a kilometre in some cases. The primary mineral site (see Figure 2) has been extensively disturbed and a majority of the native vegetation has been removed as shown in Photograph 12. In some cases the trenches are several metres deep as illustrated in Photograph 13. The native surficial material in the vicinity of the ore deposit is shallow gravelly till over the fractured bedrock containing the ore.



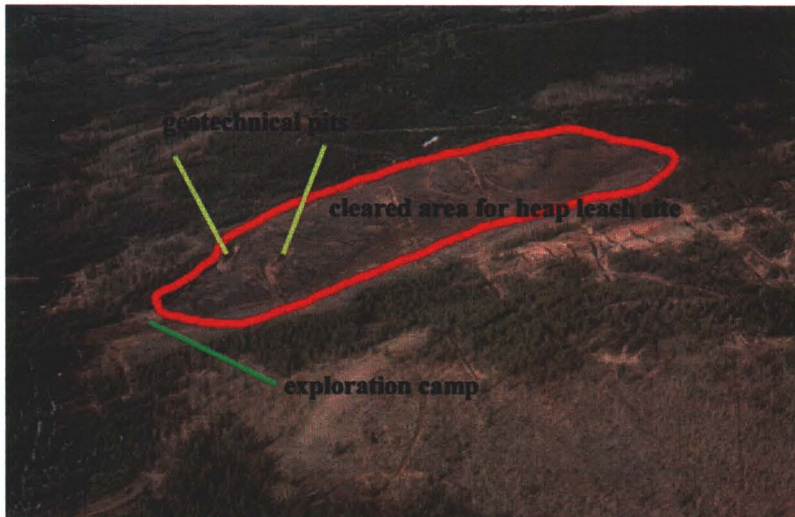
Photograph 12: Area of main ore body showing deforestation and extensive trenching which could result in increased erosion

Photograph 13: Example of extensive exploration trenching in main ore body – excavation into bedrock is approximately 2 m deep with waste material stored on both sides



4.3.7. Heap Leach site

The proposed heap leach site is immediately to the west of the main ore body in a broad valley. Prior to clearing, this valley had been naturally vegetated by native conifers. An aerial view of this site is shown in Photograph 14 with the downhill slope from right to left. The valley has a relatively thick overburden consisting of silty-clay glacial till with cobble and boulders (Photograph 15). Discontinuous permafrost can be expected at this location.



Photograph 14: Aerial view of proposed heap leach site with exploration camp to left of cleared area

Photograph 15: Poorly sorted till material comprising the surficial sediments in a geotechnical test pit on the proposed heap leach site



5. Detailed File Review

5.1. Background

INAC – Water Resources maintains files on the mine as a result of the requirement for a Water License under the *Yukon Waters Act*. Background information on the mine, required for the initial license application is required as well as reports on any license renewals and on conditions established for the license. MDA undertook a preliminary review of these files and identified key reports and documents for further review. These were copied and returned to MDA's offices for thorough review, and the key points of these reviews are synthesized here.

It is important to note here that the site has never operated as a mine, and as such a Water License has not been issued. Also, a great deal of the correspondence retained on file by INAC relates to a "Pilot Test Leach". This was not conducted at the exploration site but instead was conducted at Carmacks. Consequently, the Pilot Test Leach site is not part of this assessment.

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. In addition, as opposed to referencing every report referred to or every piece of correspondence, only the author and date have been provided for correspondence items. Sufficient information is provided to permit anyone to find the referenced material in the chronological file reviewed at INAC, Water Resources, Whitehorse.

5.2. Overview

The Williams Creek property is situated on the northeast flank of the unglaciated Dawson Range, which is part of the Klondike Plateau, an uplifted erosion surface dissected by narrow valleys. The site was not glaciated during the Pleistocene, with the exception of weak valley glaciation as a result of small lateral moraines and kame terraces. Overburden is generally less than 1 m in thickness and consists of a number of centimetres of moss and organic material overlying 5 to 20 cm of white felsic volcanic ash with 10 cm of organics, all forming part of an A soil horizon with an underlying B soil horizon consisting of 15 to 50 cm of red-brown soil overlying bedrock (Archer Cathro & Associates (1981) Ltd., 1991).

In the late 1960s, exploration of porphyry copper deposits in the Dawson Range led to the discovery of the Casino porphyry copper deposit located 104 km northwest of Williams Cr. The Williams Creek property was staked at this time by G. Wing of Whitehorse to cover copper occurrences he had found prior to the Casino discovery. Subsequent



exploration located 13 mineralized zones, which have been explored by bulldozer trenching, and 8 of these zones have been drill tested. The No. 1 zone was the best of these and is the main subject of this investigation (Archer Cathro & Associates (1981) Ltd., 1991).

Exploration of the No. 1 Zone consisted of bulldozer trenching and two X-ray diamond drill holes in 1970. In 1971, work programs consisted of soil sampling, geophysical surveys, bulldozer trenching, road construction and 25 diamond drill holes. Eight additional drill holes were completed in 1972 to confirm a reserve of approximately 15 million tonnes of ore grading 1% copper. The downturn in copper in the early 1980s essentially ended exploration and development.

In 1989, Western Copper Holdings Ltd. and Thermal Exploration Co. collected 3 tonnes of surface oxide material for testing of leaching characteristics. An initial environmental baseline study was undertaken about the same time using Burns & Gibson of Whitehorse and a road upgrade study was undertaken by Boreal Consulting Services of Whitehorse.

The proposed production of the mine was to be approximately 40 tonnes per day from an open pit, approximately 800 m by 240 m. Pit walls were to be at a 55° slope. At the end of the mine life, in 10-12 years, the pit was to be approximately 180 m deep. (A. Purdy memorandum to file, July 22, 1993).

5.3. Geotechnical Investigations

Knight Piesold Ltd. (1993) undertook geotechnical investigations in August and September, 1992 to investigate the type and distribution of surficial materials and the near surface foundation conditions for four (4) potential heap leach pad sites, the mine waste dump facility foundation and the water storage dam foundation. Although test pits and monitoring wells were installed, none of the potential heap leach sites appear to coincide with the area that was eventually cleared for the heap leach pad. All four of these sites were to the north of the main ore body. Some findings were interesting, nevertheless, including:

- test pits encountered a variety of material including fluvial deposits ranging from sandy to silty clays, clayey silts, silty sands and stratified sands and gravels;
- The fine grained soils exposed in the test pits were frost susceptible and revealed ground ice;
- The depth to permafrost ranged from 0.5 to 5 m resulting in a saturated, poorly drained active layer; and,
- High rates of groundwater seepage were observed in the most permeable units.

In general, the geotechnical implications for the potential heap leach sites are as follows:

- the varying depth to permafrost as well as the variability in material types would result in thaw settlements and differential settlements which may affect the heap drainage and damage the liner and pad;
- the weak foundation soils would result in potential instabilities through the foundation materials or along the foundation liner interface resulting in translational failure surfaces;
- in some areas the active layer was saturated; and,
- extensive earthworks would be required to adequately drain the site and flatten portions of the slope to an acceptable grade for leach pad construction.

None of the potential heap leach sites were particularly suitable, although Site C, closest to the area that was eventually cleared, was described as having the most suitable surficial material. The study concluded that further detailed site investigations were required to support a preliminary design and an application for a mine development certificate (Knight Piesold Ltd., 1993).

In February, 1995, Western Copper again contracted to Knight Piesold Ltd. to undertake additional geotechnical work for an alternate leach pad site (memorandum and attachments from K. Simpson, February 16, 1995). This project included:

- test trenching
- overburden drilling and sampling
- rock coring
- permafrost investigations
- groundwater well installations
- hydraulic conductivity testing.

A total of 7 boreholes were proposed for the proposed heap leach pad site and groundwater wells were subsequently installed to measure hydraulic conductivities and water levels. One hole was dedicated for the deployment of a thermistor string in order to measure permafrost. The 1996 report on these geotechnical and hydrogeological investigations by Knight Piesold was not located in the file review. A summary report on the geotechnical site investigations for the heap leach pad was undertaken by ACCESS Consulting Group (1998) on behalf of INAC. This report considered the most recent geotechnical work at the site, which had been undertaken by EBA Engineering Consultants Ltd. in October, 1997 (EBA, 1997).

5.4. Archaeology/Heritage Resources

An archaeological assessment of Williams Creek valley was conducted in August, 1992. Two historical archaeological sites were identified and recorded in the lower portion of the Williams Creek system (Kilborn Engineering, 1994).



The first site (115-I/07/001) is located approximately 1.25 km northwest of the confluence of Williams Creek and the Yukon River. It consists of a partially collapsed log barn and a quantity of associated domestic and mining-related artifacts of the 1930s to 1940s vintage. An abandoned mine adit was located approximately 400 m west of this historic site.

The second site (115-I/005) is located along the bank of the Yukon River approximately 1.25 km southeast of its confluence with Williams Creek. It consists of the collapsed remains of a large historic log cabin and was thought to have been associated with the previous site. The feasibility study recommended that these sites not be disturbed but if this was not possible, then a systematic data recovery program should be carried out for these sites.

Evidently, there were no archaeological/heritage sites in the immediate vicinity of the proposed mine.

5.5. Key Environmental Concerns from IEE

Several reviews of the IEE (initial environmental evaluation) were undertaken to identify gaps and key environmental concerns. This section attempts to synthesize these concerns as outlined within the various reports reviewed from the files.

Environmental Protection, Environment Canada, provided a list of comments to INAC on January 13, 1995 (memorandum from B. Godin to D. Adam, Jan. 13, 1995, see Appendix 1). Some of the most relevant comments from this memorandum include:

- despite geotechnical drilling and well installation there was uncertainty with respect to the importance of groundwater and potential permafrost problems associated with the heap leach pad location and the location of other project components;
- concern was expressed regarding the integrity of the liner of the heap leach pad due to the permafrost melting under the pad due to the heat of the solution as well as the exothermic nature of the leach process; and,
- the ability of the soils underlying the heap leach site with respect to geomorphology and the ability to attenuate potential acid leaks from the heap leach had not been adequately addressed.

AGRA Earth and Environmental (1995) reviewed specific components of the Western Copper IEE on behalf of INAC. The main concerns identified by AGRA coincided with the concerns identified by Environment Canada outlined above, and were with respect to geotechnical investigations. Specifically, the reviewers state that there "... is an unknown risk of slope failure, differential settlement and creep. These occurrences might lead to failure of the leach pad liner and significant leakage of pregnant leachate solution

to the ground water system". In addition, there was a concern about the level of information characterizing the permeability, extent and consistency of a reportedly low permeable soil layer in the general area of the heap leach site.

6. Environmental Monitoring

6.1. Preliminary Water Quality Investigation

The preliminary water quality investigation was undertaken in 1989 (Burns and Gibson, 1990). The objective of this work was to "obtain preliminary baseline water quality of the waters in the area of a copper/gold deposit which is expected to be developed as a mine". Some points of note from this study include:

- a) South facing slopes tend to be steeper, better drained and less eroded by water than the north facing slopes;
- b) South facing slopes are vegetated by aspen, poplar and pine with marginal undergrowth of grasses and sedges;
- c) North facing slopes which have more snowpack accumulation and more melt water runoff, are vegetated by spruce, alder, and willow with thick undergrowth of blueberry, buffaloberry, Labrador tea and moss. The moss presumably overlies zones of discontinuous permafrost;
- d) The stream channel in the study area is characterized by a straight channel with few meanders or side channels and the channel is consistently in mid-valley with heavy alder and willow growth along the bank crests; and
- e) Channel banks are lined by moss and undergrowth vegetation resulting in the assumption that the channel is not subject to high freshet flows in spring and early summer.

As part of this study, water samples were taken from the mainstem Williams Cr. and all tributaries with surface flow entering the mainstem. A total of 12 stations were established of which 4 were dry and 8 were sampled on October 13 and 14, 1989. The results of this sampling are provided in Appendix 1.

6.2. Biophysical Assessment

P.A. Harder and Associates Ltd. were retained in 1991 to conduct the initial assessment of aquatic resources in the study area and develop recommendations for a detailed environmental assessment. An interim report was submitted in 1993 and further field work was conducted during the summers of 1992 and 1993 to prepare a report on the environmental baseline conditions for the Initial Environmental Evaluation (IEE) (Harder and Associates, 1994). The scope of this report included assessments of:

- terrain and vegetation characteristics;

- wildlife habitat capabilities;
- surficial hydrology and climate;
- water quality;
- aquatic resources; and
- natural resource use.

Some of the most relevant points from this work are highlighted below:

6.2.1. Terrain Features

Permafrost tends to occur on many north facing slopes at depths of 40 to 50 cm and are overlain by mosses. Ground ice occurs throughout the main valley of Williams Creek at depths of 10 to 20 cm in the sands and silts that comprise the surficial deposits of the broad floodplain. Slope erosion processes are generally confined to minor gully erosion and land sliding. These processes are predominant on the terraces and steep slopes occurring on the north side of Williams Creek. The proposed heap leach pad site is a moderately sloping area, reportedly characterized by a blanket of moderately well drained glacial till overlying bedrock. Harder and Associates (1994) also reported that erosional processes did not affect this area.

6.2.2. Vegetation Characteristics

White spruce and black spruce are the common tree species in the area. Black spruce predominates the poorly drained areas whereas the white spruce stands occur in the better drained areas. Paper birch and trembling aspen often occur while lodgepole pine seems to occur in areas influenced by fire. Poplar often occurs on disturbed sites.

Where black spruce occurs as a continuous stand, feathermoss tends to dominate the understorey forming a complete ground cover. Willows and other shrubs occur where the tree stands are less dense. In the floodplain and poorly drained areas, sedge and sphagnum tussocks are common. On the south facing slopes, sagewort grasses and forbs occur as a continuous cover along with trembling aspen in sheltered areas.

6.2.3. Wildlife Occurrence

The survey reported in Harder and Associates (1994) was conducted in August. Ideally, the best time for ungulates and large carnivores is winter and birds should be surveyed in May or June. As well, the authors noted that the survey was conducted one year after the lynx population crashed in a ten year cycle. Moose were not seen, although, moose had been sighted infrequently by crews in the exploration camp. Grizzly and wolf could predate the moose and hunting by humans may also have an effect, given access to the site is possible using the road. Caribou tracks were sited in the area. Grizzly, black bear and coyote signs were observed in the area. Wolverine, mink and ermine are expected to

occur but were not sighted. While the hare population had crashed, red squirrel was very common and evidence of ground squirrel and porcupine was noted.

Suitable habitat occurs for spruce grouse although no birds were seen. Golden eagle nests were observed near the Yukon River but no birds were observed. Other species of raptors are likely present but only the American kestrel was seen.

6.2.4. Water Chemistry

Background water samples were collected quarterly between October, 1989 and October, 1992 from the sites with flow that are located in Figure 3. Twelve of the 32 elements that are included in the ICAP analysis for total and dissolved metals were consistently below detection limits. Average total and dissolved concentrations for selected elements frequently above detection are provided in Tables 2 and 3, respectively. These data will provide a background against which to view the water quality samples collected as part of this study.

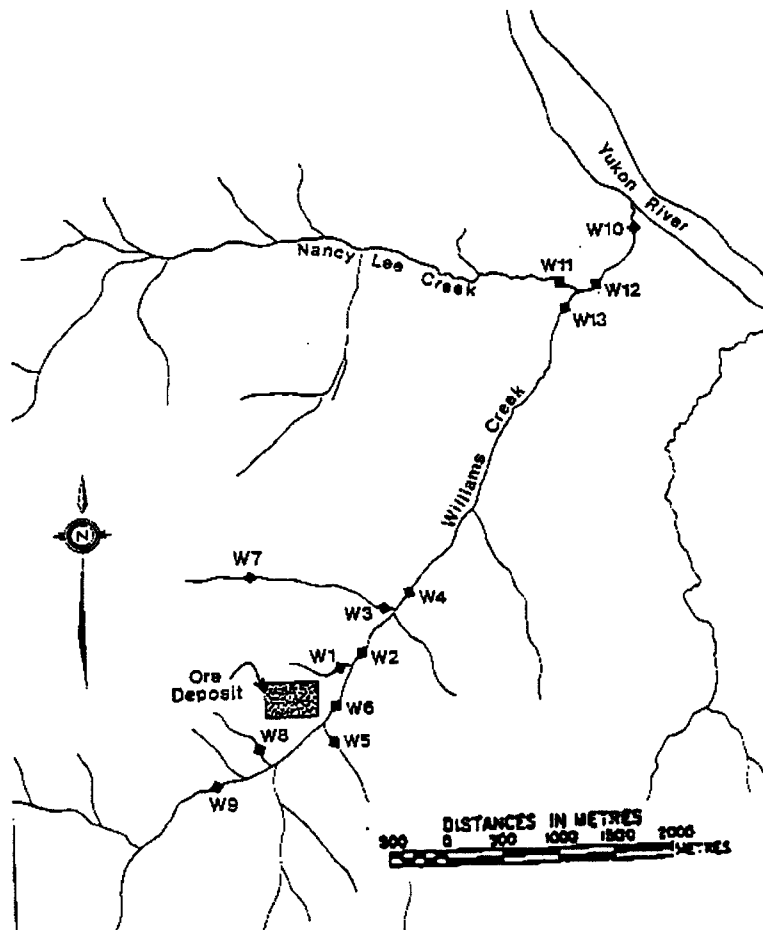


Figure 3: Water sampling stations established at Williams Creek site by Harder & Associates (1994)

Table 2: Summary of Total Metal Concentrations for Williams Creek, Oct. 1989 to Oct. 1992 (Harder and Associates (1994) (mg/L) (Highlighted cells indicate that the value exceeds CCME (1999) water quality guideline)

Element	W10	W4	W9	W11	W1	W3	W5	W7	W2	W6
n	5	6	6	3	6	5	6	6	1	1
Al	0.18	1.14	0.03	0.06	0.02	0.04	3.23	0.06	ND	ND
As	0.05	0.05	0.06	0.07	0.06	ND	0.06	0.06	ND	ND
Cd	ND	ND	0.003	ND	0.0003	ND	0.0004	0.0003	ND	ND
Ca	37.0	37.7	41.1	36.8	60.6	41.2	26.1	40.9	44.2	43.8
Cu	0.003	0.006	0.002	0.003	0.002	0.005	0.018	0.005	ND	0.001
Fe	0.35	2.16	0.66	0.14	0.14	0.15	8.43	2.10	0.37	0.64
Pb	ND	0.004	ND	ND	ND	ND	0.007	0.004	ND	ND
Mg	7.7	10.2	14.1	8.7	13.3	7.9	7.0	8.3	12.8	13.9
Na	6.19	9.66	11.9	8.7	9.0	6.5	6.6	6.2	12.8	14.3
Zn	0.045	0.018	0.006	0.006	0.012	0.014	0.035	0.010	0.033	0.108

ND= not detectable

Table 3: Summary of Dissolved Metal Concentrations for Williams Creek, Oct. 1989 to Oct. 1992 (Harder and Associates (1994) (mg/L)

Element	W10	W4	W9	W11	W1	W3	W5	W7
n	5	5	5	3	5	4	5	5
Al	0.04	0.02	0.18	0.05	ND	0.03	0.04	0.02
As	0.05	0.06	0.05	0.06	0.06	ND	0.005	0.06
Cd	ND	ND	ND	ND	ND	ND	ND	ND
Ca	35.4	34.0	39.5	34.9	59.4	35.0	23.6	37.5
Cu	0.002	0.001	ND	0.002	ND	0.001	0.002	0.002
Fe	0.11	0.37	0.38	0.10	0.05	0.14	0.62	1.98
Pb	ND	ND	ND	ND	ND	ND	ND	ND
Mg	7.1	9.1	12.9	8.4	12.8	7.3	5.9	7.3
Na	5.7	8.7	10.2	6.9	9.5	6.0	5.6	6.2
Zn	0.005	0.004	0.004	0.003	0.004	0.004	0.005	0.005

ND = not detectable



6.2.5. Sediment Chemistry

Stream bed sediment samples were collected from Williams and Nancy Lee Creeks during July and August, 1992. The major constituents are iron, aluminum, calcium and magnesium. Of the 32 elements analysed, seven were below the detection limit in all samples. The range of concentrations in the sediments are reported in Table 4. Only Cu had concentrations which from time to time exceeded the CCME Interim Sediment quality Guidelines (CCME, 1999) and this likely reflects background levels in this area.

Table 4: Range of Total Metal Concentrations for Sediments from Williams and Nancy Lee Creeks – July and August, 1992 ($\mu\text{g/g}$) (Harder and Associates, 1994)

Element	Concentration	Element	Concentration
Al	6750-9980	K	
Ba	67-201	Pb	5.0-9.0
Be	0.2-0.3	Li	ND-200
Ca	6550-9770	Se	ND
Cd	ND-0.3	Si	270-760
Co	5.2-7.4	Na	230-540
Cr	16.4-22.4	Sr	46.6-70.7
Cu	10.1-75.8	Th	ND-7.0
Fe	13300-21800	Ti	539-704
K	940-1400	U	ND
Mg	3730-5370	V	30-52
Mn	184-412	Zn	30.8-48.0

6.2.6. Fish Distribution

Harder and Associates (1994) reported on the results of a study of the fish distribution in Williams Creek in August and October, 1991 and August, 1992. No fish were captured as part of the August survey. Investigations of bed material indicated low numbers of benthic invertebrates at all sites.

The fall, 1991 survey identified chinook salmon fry and one slimy sculpin, but only at the lower sampling site. No fish were collected at the upper sites closer to the proposed mine.

In August, 1992, additional sampling was conducted in the lower reaches of Williams Creek. Chinook fry, slimy sculpin, longnose suckers and a single juvenile grayling were caught within 250 m upstream of the confluence with the Yukon River. Fish were not caught farther upstream, including in the vicinity of the mine access road crossing indicating an absence of fish from Williams Creek other than close to the Yukon River.

6.2.7. Precipitation

Historical precipitation data for Carmacks and Fort Selkirk indicates that approximately 60 to 65% of the annual precipitation total (170 to 179 mm) occurs as rainfall in the period between May and September. The maximum monthly rainfall total typically occurs in July and averages 50 to 55 mm (Kilborn Engineering, 1994).

Snow course sites were operated at the mine site by Western Copper from January 31 to May 16, 1992. An additional 92 mm of precipitation falls as snow, on average, at Carmacks, primarily between October and March. Thus the total precipitation is approximately 270 mm of which about 34% falls as snow. Due to the increased elevation at Williams Creek, and based on the on-site measurements, the mine site will receive greater amounts of precipitation on average than Carmacks (Harder and Associates, 1994).

6.3. Other Water quality Investigations

INAC undertook a baseline water quality sampling of Williams Creek in May, 1994. Samples were collected at five of the sample sites established as part of the biophysical assessment of Williams Creek. The memorandum to file (W. Kettley, May 25, 1994) regarding the sampling and the field and laboratory results are presented in Appendix 2

7. Environmental chemistry Data – This Assessment

7.1. Field Analysis – Water chemistry Data

Water samples were collected at the upstream site (i.e. at the culvert for the access road near the west end of the camp) and at the mouth of Williams Creek. The results of these field analyses are presented in Table 2.

Table 5: Results of field analysis of water samples from Williams Creek

Parameter	Williams Cr. – upstream (62° 05'25"N, 136° 16'55"W)	Williams Cr. – at mouth (62° 23'29"N, 136° 36'37"W)
PH	7.5	7.9
Specific conductance (mV)	343	330
Turbidity (NTU)	4	5
Temperature (°C)	0.3	0.8



7.2. Laboratory Results

7.2.1. Surface Water Chemistry

The results of upstream sampling (at exploration road crossing of Williams Creek, comparable to W9 of the bioassessment report [Harder and Associates, 1994] and downstream sampling (at confluence with the Yukon River –comparable to W10 of Harder and Associates, 1994) were sampled for total and dissolved metals as part of this assessment. These data are presented in Table 6. The concentrations of total metals in October, 1999 were consistently lower than the metals concentrations reported for samples collected between October, 1989 and October, 1992 (Table 2). None of the metals measured in October, 1999, exceeded the CCME (1999) surface water quality objectives. This observation is in part due to the absence of samples from stations more directly impacted by the mine than are W9 and W10. It is also likely a result of the cessation of exploration activities at the Williams Creek mine site several years prior to the current assessment. Thus the water chemistry has returned to pre-exploration conditions. Even Cu is non-detectable in the 1999 samples.

The dissolved metals for the 1999 samples are also consistently less than reported earlier by Harder and Associates (1994). All in all, the quality of the water of Williams Creek, as sampled in October, 1999, can be considered pristine.

Table 6: Results of Laboratory Analyses for Williams Creek Water Samples (mg/L)

Analyte (mg/L)	Williams Creek – upstream [WC-US] (total)	Williams Creek – downstream [WC-DS] (total)	Williams Creek – upstream [WC- US] (dissolved)	Williams Creek – downstream [WC- DS] (dissolved)
Hardness (total)	163	156		
Cyanide (SAD + thiocyanate)	<0.001	<0.001		
Al	<0.06	<0.06	<0.02	<0.02
Sb	<0.02	<0.02	<0.015	<0.015
As	<0.04	<0.04	<0.04	<0.04
Ba	0.040	0.041	0.042	0.043
Be	<0.0002	<0.0002	<0.0010	<0.0010
Bi	<0.02	<0.02	<0.02	<0.02
B	<0.04	<0.04	0.012	0.010
Cd	<0.002	<0.002	<0.002	<0.002
Ca	46.8	38.2	50.8	42.0
Cr	<0.002	<0.002	0.002	<0.002
Co	<0.004	<0.004	<0.003	<0.003
Cu	<0.003	<0.003	<0.001	<0.001
Fe	0.08	0.10	0.075	0.094
Pb	<0.03	<0.03	<0.02	<0.02
Mg	11.2	14.6	12.2	16.1
Mn	0.007	0.014	0.008	0.016
Hg	<0.00005	<0.00005	<0.00005	<0.00005
Mo	<0.005	<0.005	<0.004	<0.004
Ni	<0.01	<0.01	<0.008	<0.008
P	<0.1	<0.1	<0.04	<0.04
K	<0.5	<0.5	<0.4	<0.4
Se	<0.03	<0.03	<0.03	<0.03
Ag	<0.03	<0.03	<0.01	<0.01
Na	10.0	15.8	10.8	17.4
Sr	0.470	0.434	0.501	0.474
S	14.8	11.2	16.1	12.3
Te	<0.02	<0.02	<0.02	<0.02
Ti	<0.03	<0.03	<0.02	<0.02
Sn	<0.02	<0.02	<0.02	<0.02
Ti	<0.003	<0.003	<0.003	<0.003
V	<0.003	<0.003	<0.003	<0.003
Zn	<0.01	<0.01	<0.002	<0.002
Zr	<0.003	<0.003	<0.003	<0.003

7.2.2. Soil Chemistry

Two locations of stained soil were identified on the second visit to western Copper. These sites were not located on the first visit due to the snow cover. Both samples were sent directly to the laboratory for analysis of total hydrocarbons and benzene, toluene, ethylbenzene and xylene (BTEX). The analytical data are presented in Table 7. None of the compounds were above the detection limits suggesting that the staining is old and the compounds may have been volatilized or alternatively, the staining is due to a non-hydrocarbon based liquid. In any event, the limited area affected by the staining and the



low concentrations suggests little concern with respect to hydrocarbons contamination at the site.

Table 7: Laboratory results for stained soils from Williams Creek/Western Coppermine site

Sample Number/Location	Hydrocarbons (mg/Kg) PSC	Benzene (mg/Kg) (PSC)	Ethylbenzene (mg/Kg) (PSC)	Toluene (mg/Kg) (PSC)	Xylenes (mg/Kg) (PSC)
WC-HL-1	<10	<0.04	<0.10	<0.10	<0.1
WC-Camp-1	<10	<0.04	<0.10	<0.10	<0.1

8. Archeological/Heritage/Historical Features

There was no evidence of archaeological, heritage or historical features at the site; however, disturbances at the main ore zone and at the heap leach site and at the camp would have obliterated these. Personnel from the Little Salmon/Carmacks First Nations did not alert us to any potential sites at this location either in pre-inspection discussions or during the site visits. As noted in section 6.4, there are two archaeological sites in the vicinity of the Williams Creek confluence with the Yukon River, but these were not inspected as part of this assessment due to their remoteness to the actual exploration site.

9. Results of Inspection and File Review

9.1. Water Quality

The results of the water chemistry analysis from this study indicate that the water of Williams Creek, both in the vicinity of the exploration site and the confluence of the Williams Creek and Yukon River is essentially pristine with respect to dissolved and total metals. While based on a limited sampling, temporally and spatially, there is little reason to believe that the stagnated exploration activities are deleteriously impacting upon surface water quality. The exception may be during spring snowmelt when drainage from the exploration site may directly affect the creek water quality. However, the increased runoff from undisturbed parts of the basin will likely dilute these potentially higher concentrations. Although the laboratories differ, there is a strong indication that the quality of the water has returned to essentially pristine conditions from the time period of the biophysical assessment (1989-1992), a period of active exploration. None of the total metals, including copper, exceeded the CCME (1994) guidelines in the 1999 sampling.

9.2. Listing of Potential Contaminants

The Western Coppermine site, to date, has only been an exploration site. Thus the activities have been limited to exploration and preparation of the heap leach facility. With the absence of any on-site milling activities the potential for a large number of contaminants are limited. Based on this assessment, the following potential contaminants have been identified:

- Very minor soil staining at one of the test well sites likely resulting from leaks or spills from the drill equipment. While similar staining may exist at other wells, it was not identified due to snow cover at the time of inspection. Soils tests indicate non-detectable concentrations of hydrocarbons and BTEX compounds, indicating that the spill is either very limited, has weathered to the point that the concentrations are now very low, or is not a typical hydrocarbon.
- There is no potential for spills and leaks from main tanks, oil drums and truck fuel tank of the fuel truck near the base camp as all were empty. There is a small risk of oil leaks from the crankcase, transmission and rearend; however, nothing was evident at the time of inspection.
- There is an unknown and undefined quantity of mixed debris in the small landfill located adjacent to the camp. Surficial debris consisted of empty drums, tires, machine parts and miscellaneous camp items. There was no evidence of soil staining suggesting waste oil had been disposed of, and thus no soil samples were collected.

9.3. Site Hazards

The extensive trenching throughout the site is a definite aesthetic concern and may pose some risk to wildlife and humans. Some of the trenches are several metres deep with vertical sides in the bedrock and excavated debris piled along both sides of the trench creating a falling debris hazard as well as a physical danger.

The extensive clearing and working of the heap leach site could make the hill side more prone to severe erosion and/or slumping should conditions be appropriate (e.g. a large melt or rainfall event on unfrozen soils or a slip face at the permafrost boundary). There was no evidence of excessive erosion or slumping to date at the site likely as a result of the relatively deep permafrost, the permeable nature of the surficial material and the relatively limited snow accumulation and rainfall in this area. Nevertheless, the loss of tree cover, the exposed soils which could result in increased soil temperatures thus changing the permafrost regime, the trenches which could intercept water or store larger than normal quantities of snow, could all result in decreased stability of the south facing slope. Whether this results in mass wasting (slumps, slides) or increased erosion causing a larger sediment load to Williams Creek during high runoff events can not be determined, although the potential definitely exists.

Additionally, as mentioned above, a number of monitoring wells have been installed across the heap leach site. These were generally sealed and those that could be accessed seemed to be dry but this was not confirmed. These were believed to have been installed as part of the 1995 geotechnical investigations, but the report confirming this and the well logs was not located in the file. Based upon well records for other bore holes from other possible heap leach sites, only the bore holes near the valley contained water. There is no reason to expect contamination in these wells, due to the absence of development of the heap leach facility, and thus there is no need to determine the presence of water in the wells and submit water samples for testing.

The other concern at the site is the hazard risk to people and wildlife in the sample storage area due to metal debris and falling storage piles. This will become a greater hazard as the core boxes and piles continue to deteriorate.

Aesthetically, the trenching and test pits, the metal debris around the exploration camp, the poorly covered landfill and the core and sample storage area are all a concern.

9.4. Naturalization Initiatives

If the site has been abandoned then a number of actions could be undertaken that would enhance the naturalization of the site. These include:

1. Removal of the fuel truck;
2. The deepest exploration trenches and pits on the ore bodies should be re-contoured with the excavated debris;
3. The test wells from the proposed heap leach sites, and any others that may still be present at other locations, should be removed;
4. The geotechnical investigation trenches on the heap leach site should be re-contoured to minimize infiltration and reduce permafrost thawing and revegetation should be undertaken to enhance slope stability;
5. Exposed metal debris, including empty drums, well pipe, and reinforcing rods should be removed from the site and recycled or disposed of at an approved facility;
6. Cores and samples should be landfilled;
7. Combustible materials should be burned on site (e.g. core boxes, tent frame) and the ashes landfilled; and
8. The landfill should be contoured and leveled with native soils and revegetated.

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11. Appendices



**Appendix 1: Water quality data from the “Preliminary Water Quality Investigation
of Williams Creek, 1989” (Burns and Gibson, 1990)**



TABLE 2

WATER QUALITY DATA

Sample Site	W1	W2	W3	W4	W5	W6	W7	W9
Date								
pH	7.7	7.7	7.5	7.7	7.5	7.9	7.7	7.8
Conductivity uS/cm	462	431	380	395	157	415	325	505
Suspended Solids mg/l	20	9	<5	<5	<5	<5	<5	<5
ICAP METALS mg/l								
Aluminum	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Antimony	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Barium	0.146	0.035	0.037	0.031	0.013	0.034	0.037	0.043
Beryllium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron	0.004	<0.001	<0.001	<0.001	<0.001	0.002	0.007	0.004
Cadmium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Calcium	55.3	44.2	52.4	40.5	18.8	43.8	38.2	44.2
Chromium	0.0066	<0.0002	0.0024	<0.0002	0.0016	0.0012	0.0081	0.0005
Cobalt	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Copper	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0010	0.0090	<0.0005
Iron	0.161	0.371	0.84	0.519	0.458	0.687	0.135	0.199
Lead	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	<0.002
Lithium	0.26	0.20	0.34	0.35	0.35	0.30	0.36	0.29
Magnesium	11.2	12.8	8.89	10.7	4.16	13.9	6.84	18.2
Manganese	<0.001	0.058	0.570	0.077	0.046	0.101	0.025	0.015
Mercury	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	0.015	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	0.0009	0.0015	0.0009	0.0014	0.0029	0.0018	0.0020	0.0012
Phosphorus	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Potassium	1.1	0.9	0.8	0.8	<0.2	0.9	0.3	1.3
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silicon	4.42	3.99	4.33	4.86	5.53	5.08	4.69	4.92
Silver	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium	9.37	12.6	7.32	11.2	5.57	14.3	7.21	19.1
Strontium	0.644	0.444	0.481	0.372	0.089	0.426	0.161	0.583
Thorium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Titanium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Vanadium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Zinc	0.0476	0.0330	0.0523	0.0578	0.0661	0.0103	0.0185	0.0054
ANIONS mg/l								
Chloride	4.70	3.60	2.80	3.60	1.01	1.30	2.60	2.00
Fluoride	3.6	1.1	<1	<1	<1	<1	<1	<1
Nitrate	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulfate	129	76.0	21.0	47.0	3.29	51.0	15.1	54.0
Nitrite	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	<0.003	<0.003
Orthophosphate	0.014	0.014	0.017	0.022	0.007	0.017	0.009	0.008
Ammonia	0.10	0.05	0.06	<0.05	<0.05	0.05	0.05	0.03
Alkalinity as CaCO3	53	100	180	120	69	140	120	170
Hardness as CaCO3	184.2	183.1	187.4	145.1	64	163.6	123.6	165.3

**Appendix 2: Memorandum to file from W. Kettley (May 25, 1994) including field
and laboratory data for baseline sampling of Williams Creek, May 13, 1994**

FILE

WAYNE KETTLEY
WATER QUALITY TECHNICIAN
WATER RESOURCES DIVISION

Security Classification - Classification de sécurité
Our File - Notre référence WILLIAMS CREEK
Your File - Votre référence
Date MAY 25/94

BASELINE SAMPLING OF WILLIAMS CREEK ON MAY 13/94.

AN ATTEMPT AT BASELINE SAMPLING OF WILLIAMS CREEK WAS CONDUCTED ON MAY 13/94 BY KETTLEY. I WAS GUIDED ON SITE BY JOHN GIBSON. THE FOLLOWING ARE NOTES AND OBSERVATIONS OF THIS SAMPLING:

-WEATHER WAS VERY MISERABLE; HAIL, RAIN, LIGHTNING AND THUNDER. VERY WET. THIS LEFT THE FREEGOLD ROAD A LITTLE SLIPPERY.

-ACCESS TO SITE IS ABOUT 22 KM DOWN FREEGOLD ROAD FROM CARMACKS AND ABOUT 13 KM RIGHT TAKE OFF ROAD INTO WILLIAMS CREEK. THIS 13 KM WAS DRIVEN ON FOUR WHEELERS AS THERE IS NO CROSSINGS AT MERRICE AND WILLIAMS CREEKS.

-THERE WERE 11 DESIGNATED WATER QUALITY STATIONS ON WILLIAMS CREEK AND ITS TRIBUTARIES AS OUTLINED IN THE REPORT "BIOPHYSICAL ASSESSMENT OF THE WILLIAMS CREEK MINE SITE" PREPARED BY P.A. HARDER AND ASSOCIATES LTD OF VICTORIA. HOWEVER W-8 IS INTERMITTENT IN NATURE AND W-2 & W-6 ARE OF MAIN STEM WILLIAMS CREEK AND HAVE BEEN DISCONTINUED BECAUSE IT IS SAMPLED AT W-4 (GIBSON). I DID NOT SAMPLE W-2 & W-6 EITHER. W-8 WAS DRY ON THIS OCCASION.

-THERE ARE TWO WATER QUALITY STATIONS (W-10 & W-11) ON THE LOWER END OF WILLIAMS AND NANCY LEE CREEKS, THAT WERE INACCESSIBLE ON THIS TRIP. THESE STATIONS ARE BEST ACCESSED BY BOAT ON THE YUKON RIVER (GIBSON). THERE IS A TRAIL (OLD UKHM TRAIL) ALONG THE YUKON RIVER BUT IT IS QUITE ROUGH AND IT CROSSES THE CROSSING AND MERRICE CREEKS AT THERE HIGHEST FLOW POINTS WHICH WOULD BE FAIRLY HIGH AT THIS POINT IN THE YEAR.

-MR. GIBSON DID NOT TAKE WATER SAMPLES AS THEY HAVE SUSPENDED THEIR SAMPLING AT THIS POINT IN TIME.

-ATTACHED ARE THE LAB ANALYSES. LAB REFERENCE NUMBER 23281-004B IS A LAB DUPLICATE ANALYSIS OF 23281-004A.

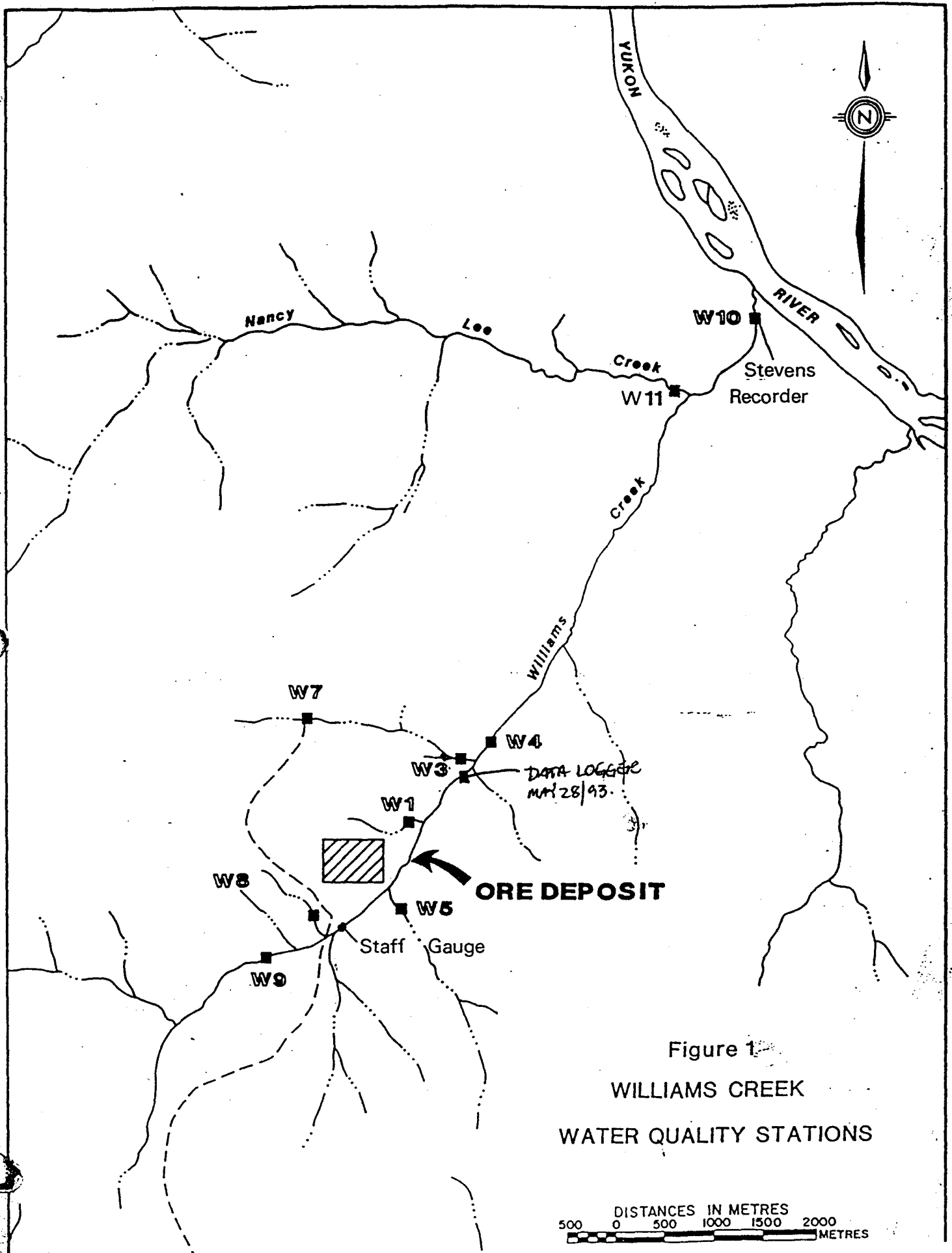


Figure 1
 WILLIAMS CREEK
 WATER QUALITY STATIONS

DISTANCES IN METRES
 500 0 500 1000 1500 2000 METRES

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ANALYSIS OF WATER SAMPLES

To: NORTHERN AFFAIRS PROGRAM
WATER LABORATORY
#345-300 Main St.,
Whitehorse, Yukon
Y1A 2B5

Workorder: 23281
Received: 17-May-94
Completed: 30-May-94

Attn: Pat Thomson

Re: William's Creek Fresh Water

METHODOLOGY

Samples were analysed using procedures detailed in publications of the American Public Health Association, U.S Environmental Protection Agency, B.C Ministry of the Environment, and Environment Canada - Conservation and Protection.

Dissolved metals were determined in a filtered (0.45 um) and acidified sample aliquot by ICP-AES with ultrasonic nebulization (EPA Method 200.7).

Total metals were determined in a sample aliquot which was acid digested in a closed teflon vessel in a microwave oven (EPA Method 3015). The digest was analyzed by ICP-AES with ultrasonic nebulization (EPA Method 200.7)

STATION	LAB NO.	PH	COND. μ MHOS	TEMP. $^{\circ}$ C	FLOW L/S	NOTES
W-1						NOTE 1
W-2						NOTE 2
W-3	4069	7.6	247	2.3	9 EST.	
W-4	4070	7.8	218	1.4	52	NOTE 3
W-5	4071	7.4	137.0	3.0	N.T.	NOTE 4
W-6						NOTE 2
W-7	4072	7.3	147.3	3.0	N.T.	
W-8						NOTE 5
W-9	4073	7.6	202	1.4	38	
W-10						NOTE 6
W-11						NOTE 6

N.T. = NOT TAKEN.

NOTES:

1. NO DISTINGUISHABLE FLOW. SITE DISTURBED BY A BACK HOE.
2. STATION DISCONTINUED.
3. FLOW ESTIMATED BY WAY OF FLOW MEASURED ON WILLIAMS CREEK AT DATA LOGGER LOCATION (SEE MAP) PLUS ESTIMATED FLOW AT W-3. FLOW AT DATA LOGGER STATION WAS 43 L/S.
4. WATER FLOW VERY SPREAD OUT FLOWING THROUGH MOSS AND BUCK BRUSH THEREFORE WAS UNABLE TO OBTAIN FLOW.
5. SITE DRY.
6. INACCESSIBLE.

WAYNE KETTLEY

ATT.

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

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To: NORTHERN AFFAIRS PROGRAM

W/O: 23281 Page 1

Sample type	fresh	fresh	fresh	fresh	fresh
Identification	4069 W3	4069 W3	4070, W4	4070, W4	4071, W5
	13-May-94	13-May-94	13-May-94	13-May-94	13-May-94
Lab Reference #	23281-001	23281-001	23281-002	23281-002	23281-003

PHYSICAL TESTS - ALKALINITY					
Hydroxide CaCO3	< 5.	-	< 5.	-	< 5.
Carbonate CaCO3	< 5.	-	< 5.	-	< 5.
Bicarb. CaCO3	112.	-	79.	-	50.
Total Alk. CaCO3	112.	-	79.	-	50.
Results in	ms/L		ms/L		ms/L

PHYSICAL TESTS					
Conduct. us/cm	240.	-	207.	-	135.
pH	7.7	-	7.8	-	7.8
Turbidity FTU	1.	-	2.	-	2.

SOLIDS					
Suspended 105C	< 5.	-	< 5.	-	6.
Dissolved 105C	188.	-	179.	-	129.
Results in	ms/L		ms/L		ms/L

ANIONS BY IEC					
Chloride Cl	0.83	-	0.78	-	0.59
Fluoride F	< 1.	-	< 1.	-	< 1.
Nitrate NO3-N	< 0.05	-	< 0.05	-	< 0.05
Nitrite NO2-N	< 0.5	-	< 0.5	-	< 0.5
Sulfate SO4	14	-	18.6	-	11.6
Results in	ms/L		ms/L		ms/L

NITROGEN					
Ammonia NH3-N	< 0.05	-	0.07	-	< 0.05
Results in	ms/L		ms/L		ms/L

PHOSPHOROUS					
Total PO4-F	0.008	-	0.040	-	0.009
Results in	ms/L		ms/L		ms/L

TOTAL HARDNESS					
T Hardness CaCO3	110.	105.	88.2	83.1	52.4

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To: NORTHERN AFFAIRS PROGRAM

W/O: 23281 Page

Sample type		fresh		fresh		fresh		fresh		fresh	
Identification		4069 W3		4069 W3		4070, W4		4070, W4		4071, W5	
		13-May-94		13-May-94		13-May-94		13-May-94		13-May-94	
Lab Reference #		23281-001		23281-001		23281-002		23281-002		23281-003	
ICP - ULTRASONIC NEBULIZATION											
Method used		filt. 0.45µl uwave HNO3				filt. 0.45µl uwave HNO3				filt. 0.45µl	
		DISSOLVED				TOTAL				DISSOLVED	
Aluminum	Al	< 0.01		0.04		< 0.01		0.03		0.01	
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	0.039		0.040		0.030		0.030		0.023	
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	< 0.0005		0.0005		< 0.0005		0.0005		0.0005	
Calcium	Ca	33.9		33.9		24.5		25.0		15.1	
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	0.023		0.028		0.021		0.016		0.009	
Iron	Fe	0.160		0.380		0.245		0.390		0.076	
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	5.96		6.00		6.43		6.50		3.51	
Manganese	Mn	0.097		0.124		0.068		0.069		0.007	
Molybdenum	Mo	< 0.005		0.005		< 0.005		0.005		0.005	
Nickel	Ni	0.005		0.005		0.004		0.003		0.004	
Phosphorus	P	< 0.05		0.05		< 0.05		0.05		0.05	
Potassium	K	1.4		1.4		1.2		1.		1.1	
Selenium	Se	< 0.02		0.02		< 0.02		0.02		0.02	
Silicon	Si	6.17		6.23		5.09		5.10		4.97	
Silver	Ag	< 0.001		0.001		< 0.001		0.001		0.001	
Sodium	Na	5.37		5.41		6.55		6.58		5.22	
Strontium	Sr	0.248		0.235		0.229		0.218		0.085	
Sulfur	S	3.93		3.92		5.39		5.40		3.08	
Tin	Sn	< 0.01		0.01		< 0.01		0.01		0.01	
Titanium	Ti	0.002		0.005		0.002		0.004		0.002	
Thorium	Th	< 0.01		0.01		< 0.01		0.01		0.01	
Uranium	U	< 0.06		0.06		< 0.06		0.06		0.06	
Vanadium	V	< 0.002		0.002		< 0.002		0.002		0.002	
Zinc	Zn	< 0.005		0.005		< 0.005		0.005		0.008	
Zirconium	Zr	< 0.001		0.001		< 0.001		0.001		0.001	
Results in		mg/L				mg/L				mg/L	

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To: NORTHERN AFFAIRS PROGRAM

W/O: 23281 Page 3

Sample type		fresh	fresh	fresh	fresh	fresh
Identification		4071, W5	4072, W7	4072, W7	4072, W7	4072, W7
		13-May-94	13-May-94	13-May-94	13-May-94	13-May-94
Lab Reference #		23281-003	23281-004A	23281-004A	23281-004B	23281-004B
PHYSICAL TESTS - ALKALINITY						
Hydroxide	CaCO3	-	< 5.	-	< 5.	-
Carbonate	CaCO3	-	< 5.	-	< 5.	-
Bicarb.	CaCO3	-	73.	-	74.	-
Total Alk.	CaCO3	-	73.	-	74.	-
Results in			mg/L		mg/L	
PHYSICAL TESTS						
Conduct.	uS/cm	-	145.	-	143.	-
pH		-	7.7	-	7.7	-
Turbidity	FTU	-	1.	-	1.	-
SOLIDS						
Suspended	105C	-	< 5.	-	< 5.	-
Dissolved	105C	-	145.	-	147.	-
Results in			mg/L		mg/L	
ANIONS BY IEC						
Chloride	Cl	-	< 0.3	-	< 0.3	-
Fluoride	F	-	< 1.	-	< 1.	-
Nitrate	NO3-N	-	< 0.05	-	< 0.05	-
Nitrite	NO2-N	-	< 0.5	-	< 0.5	-
Sulfate	SO4	-	4.6	-	4.6	-
Results in			mg/L		mg/L	
NITROGEN						
Ammonia	NH3-N	-	< 0.05	-	< 0.05	-
Results in			mg/L		mg/L	
PHOSPHOROUS						
Total	PO4-P	-	< 0.005	-	< 0.005	-
Results in			mg/L		mg/L	
TOTAL HARDNESS						
T Hardness	CaCO3	53.3	61.5	62.9	61.7	63.5

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To: NORTHERN AFFAIRS PROGRAM

W/O: 23281 Page 4

Sample type	fresh	fresh	fresh	liquid	liquid
Identification	4071, W5	4072, W7	4072, W7	4072, W7	4072, W7
	13-May-94	13-May-94	13-May-94	13-May-94	13-May-94
Lab Reference #	23281-003	23281-004A	23281-004A	23281-004B	23281-004B

ICP - ULTRASONIC NEBULIZATION-

Method used	luwave HNO3		filt. 0.45u		luwave HNO3		filt. 0.45u		luwave HNO3	
	TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
Aluminum	Al	0.25	<	0.01	<	0.01	<	0.01	<	0.01
Antimony	Sb	<	0.02	<	0.02	<	0.02	<	0.02	<
Arsenic	As	<	0.02	<	0.02	<	0.02	<	0.02	<
Barium	Ba	0.024		0.027		0.024		0.025		0.024
Beryllium	Be	<	0.0002	<	0.0002	<	0.0002	<	0.0002	<
Bismuth	Bi	<	0.02	<	0.02	<	0.02	<	0.02	<
Cadmium	Cd	<	0.0005	<	0.0005	<	0.0005	<	0.0005	<
Calcium	Ca	15.2		18.8		19.2		18.9		19.4
Chromium	Cr	0.001	<	0.001	<	0.001	<	0.001	<	0.001
Cobalt	Co	<	0.001	<	0.001	<	0.001	<	0.001	<
Copper	Cu	0.023		0.01		0.014		0.021		0.014
Iron	Fe	0.447		0.166		0.172		0.175		0.175
Lead	Pb	<	0.01	<	0.01	<	0.01	<	0.01	<
Lithium	Li	<	0.002	<	0.002	<	0.002	<	0.002	<
Magnesium	Mg	3.55		3.41		3.54		3.44		3.57
Manganese	Mn	0.014		0.012		0.013		0.011		0.013
Molybdenum	Mo	<	0.005	<	0.005	<	0.005	<	0.005	<
Nickel	Ni	0.002		0.004		0.003		0.005		0.001
Phosphorus	P	<	0.05	<	0.05	<	0.05	<	0.05	<
Potassium	K	1.2		1.		1.0		1.		1.2
Selenium	Se	<	0.02	<	0.02	<	0.02	<	0.02	<
Silicon	Si	5.26		5.25		5.42		5.27		5.46
Silver	Ag	<	0.001	<	0.001	<	0.001	<	0.001	<
Sodium	Na	5.25		3.48		3.48		3.54		3.60
Strontium	Sr	0.086		0.082		0.086		0.084		0.088
Sulfur	S	2.99		1.32		1.31		1.35		1.38
Tin	Sn	<	0.01	<	0.01	<	0.01	<	0.01	<
Titanium	Ti	0.016		0.002		0.002		0.002		0.002
Thorium	Th	<	0.01	<	0.01	<	0.01	<	0.01	<
Uranium	U	<	0.06	<	0.06	<	0.06	<	0.06	<
Vanadium	V	<	0.002	<	0.002	<	0.002	<	0.002	<
Zinc	Zn	<	0.005	<	0.005	<	0.005	<	0.005	<
Zirconium	Zr	<	0.001	<	0.001	<	0.001	<	0.001	<
Results in		ms/L		ms/L		ms/L		ms/L		ms/L

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To: NORTHERN AFFAIRS PROGRAM

W/O: 23281 Page 5

Sample type	fresh	fresh
Identification	4073, W9	4073, W9
	13-May-94	13-May-94
Lab Reference #	23281-005	23281-005

PHYSICAL TESTS - ALKALINITY

Hydroxide CaCO3	< 5.	-
Carbonate CaCO3	< 5.	-
Bicarb. CaCO3	102.	-
Total Alk. CaCO3	102.	-
Results in	mg/L	

PHYSICAL TESTS

Conduct. uS/cm	200.	-
pH	7.8	-
Turbidity FTU	1.	-

SOLIDS

Suspended 105C	< 5.	-
Dissolved 105C	160.	-
Results in	mg/L	

ANIONS BY IEC

Chloride Cl	0.5	-
Fluoride F	< 1.	-
Nitrate NO3-N	< 0.05	-
Nitrite NO2-N	< 0.5	-
Sulfate SO4	14.4	-
Results in	mg/L	

NITROGEN

Ammonia NH3-N	< 0.05	-
Results in	mg/L	

PHOSPHOROUS

Total PO4-P	< 0.005	-
Results in	mg/L	

TOTAL HARDNESS

T Hardness CaCO3	76.5	79.8
------------------	------	------

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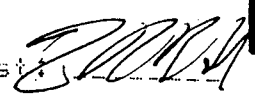
Tel: (604) 438-5224
Fax: (604) 436-0566

To: NORTHERN AFFAIRS PROGRAM

W/O: 23281 Page 6

Sample type		fresh	fresh
Identification		4073, W9	4073, W9
		13-May-94	13-May-94
Lab Reference #		23281-005	23281-005
ICP - ULTRASONIC NEBULIZATION			
Method used		filt. 0.45µm DISSOLVED	ultrasonic wave HNO3 TOTAL
Aluminum	Al	< 0.01	0.01
Antimony	Sb	< 0.02	< 0.02
Arsenic	As	< 0.02	< 0.02
Barium	Ba	0.027	0.028
Beryllium	Be	< 0.0002	< 0.0002
Bismuth	Bi	< 0.02	< 0.02
Cadmium	Cd	< 0.0005	< 0.0005
Calcium	Ca	20.1	20.9
Chromium	Cr	< 0.001	< 0.001
Cobalt	Co	< 0.001	< 0.001
Copper	Cu	0.022	0.027
Iron	Fe	0.098	0.137
Lead	Pb	< 0.01	< 0.01
Lithium	Li	< 0.002	< 0.002
Magnesium	Mg	6.30	6.60
Manganese	Mn	0.021	0.023
Molybdenum	Mo	< 0.005	< 0.005
Nickel	Ni	0.002	0.002
Phosphorus	P	< 0.05	< 0.05
Potassium	K	1.1	1.1
Selenium	Se	< 0.02	< 0.02
Silicon	Si	4.60	4.80
Silver	Ag	< 0.001	< 0.001
Sodium	Na	6.72	6.72
Strontium	Sr	0.222	0.238
Sulfur	S	3.60	3.71
Tin	Sn	< 0.01	< 0.01
Titanium	Ti	0.002	0.003
Thorium	Th	< 0.01	< 0.01
Uranium	U	< 0.06	< 0.06
Vanadium	V	< 0.002	0.002
Zinc	Zn	< 0.005	< 0.005
Zirconium	Zr	< 0.001	< 0.001
Results in		mg/L	mg/L

Test results are for internal use only. Quanta Trace liability is limited to the testing fee paid.

Analyst: 

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



**PHILIP ANALYTICAL**

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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.



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ANALYTICAL REPORT

Client : -
Project : MDA-99-1

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

Sparcode	Parameter	Unit	MDL						
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	---
Bc-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
Sampled on: 99/09/30 99/09/30 99/10/04 99/10/04 99/10/04 99/10/04

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ANALYTICAL REPORT

Client : -
Project : MDA-99-1

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

Sparcode	Parameter	Unit	MDL						
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.



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ANALYTICAL REPORT

Client :
Project : MDA-99-1

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

Sparcode	Parameter	Unit	MDL						
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) + Thiocyanatg/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 ANALYTICAL

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ANALYTICAL REPORT

Client :
Project : MDA-99-1

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

Sparcode	Parameter	Unit	MDL						
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 ANALYTICAL

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ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Philip ID : 99056573 99056574 99056575 99056576 99056577 99056578
Client ID : MSGM-ADI MSGM-6-3 MSGM-9 MSGM-6-1 WC-DS WC-US
T-1800m

Sparcode	Parameter	Unit	MDL						
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) + Thiocyanate	mg/L	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
METALS TOTAL									
Al-T0042	Aluminium	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
Str-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 ANALYTICAL

ANALYTICAL REPORT

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Client :
Project : MDA-99-1

Philip ID : 99056573 99056574 99056575 99056576 99056577 99056578
Client ID : MSGM-AD1 MSGM-6-3 MSGM-9 MSGM-6-1 WC-DS WC-US
T-1800m

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
Co-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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ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Philip ID :	99056573	99056574	99056575	99056576	99056577	99056578
Client ID :	MSGM-ADI	MSGM-6-3	MSGM-9	MSGM-6-1	WC-DS	WC-US
	T-1800m					

Sparcode	Parameter	Unit	MDL						
Zr-D0031	Zirconium Dissolved	mg/L	0.003	< 0.003	--	--	--	< 0.003	< 0.003
				Matrix :	Water	Water	Water	Water	Water
				Sampled on:	99/10/04	99/09/30	99/09/30	99/09/30	99/10/02

Result comments and/or text results :

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



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ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Philip ID : 99056579 99056580 99056581 99056582 99056554 99056555
Client ID : MSGM-TRIB MSGM-ADI MSGM-TRIB MSGM-1700mCM-PIPE 1 CM-PIPE 2
T-1800A

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
Sampled on: 99/10/04 99/10/04 99/10/04 99/10/04 99/10/03 99/10/03



PHILIP ANALYTICAL

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Client : -
Project : MDA-99-1

Philip ID : 99056579 99056580 99056581 99056582 99056554 99056555
Client ID : MSGM-TRIB MSGM-ADI MSGM-TRIB MSGM-1700mCM-PIPE 1 CM-PIPE 2
T-1800A

Sparcode	Parameter	Unit	MDL						
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-D00310	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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ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Philip ID : 99056579 99056580 99056581 99056582 99056554 99056555
Client ID : MSGM-TRIB MSGM-ADI MSGM-TRIB MSGM-1700mCM-PIPE 1 CM-PIPE 2
T-1800A

Sparcode	Parameter	Unit	MDL						
Zr-D0031	Zirconium Dissolved	mg/L	0.003	< 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.



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ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Philip ID : 99056556 99056557 99056558 99056559 99056560
Client ID : CM-W7-US CM-CAMP-DS CM-CAMP-DS CM-CAMP CM-CAMP
1 2 -PIPE 1 -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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ANALYTICAL REPORT

Client :
Project : MDA-99-1

Philip ID : 99056556 99056557 99056558 99056559 99056560
Client ID : CM-W7-US CM-CAMP-DS CM-CAMP-DS CM-CAMP CM-CAMP
1 2 -PIPE 1 -PIPE 2

Sparcode	Parameter	Unit	MDL					
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	0.3 (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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ANALYTICAL REPORT

Client : -
Project : MDA-99-1

Result comments and/or text results :

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



PHILIP ANALYTICAL

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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



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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



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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



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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



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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



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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	1.98	2	mg/L	97



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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

**PHILIP ANALYTICAL**10-Nov-99
Page 22 of 39**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

**PHILIP ANALYTICAL**

10-Nov-99
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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 ANALYTICAL

10-Nov-99
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ANALYSIS DATES

	Philip ID: Client ID:	99056565 MSGM-T4	99056566 MSGM-LA-1	99056567 MSGM-UA-1	99056568 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: Sampled on:	Soil 4-OCT-1999	Soil 4-OCT-1999	Soil 4-OCT-1999	Soil 4-OCT-1999



PHILIP ANALYTICAL

10-Nov-99
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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



PHILIP ANALYTICAL

10-Nov-99
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ANALYSIS DATES

Philip ID:	99056573	99056574	99056575	99056576
Client ID:	MSGM-ADI 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 ANALYTICAL

10-Nov-99
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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 ANALYTICAL**

10-Nov-99
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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 ANALYTICAL**

10-Nov-99
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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 ANALYTICAL

10-Nov-99
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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 ANALYTICAL

10-Nov-99
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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 ANALYTICAL

10-Nov-99
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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 ANALYTICAL

10-Nov-99
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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-F	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 ANALYTICAL

10-Nov-99
Page 34 of 39

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 ANALYTICAL**

10-Nov-99
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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 ANALYTICAL

10-Nov-99
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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 ANALYTICAL

10-Nov-99
Page 37 of 39

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 ANALYTICAL

10-Nov-99
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BATCH NUMBERS

Philip ID: 99056560
Client ID: CM-CAMP
-PIPE 2

Fig-D0310	Mercury Dissolved	94203442
PKG_G	Metals ICP Water Dissolved	94203438

Matrix: Water
Sampled on: 3-OCT-1999

**PHILIP ANALYTICAL**10-Nov-99
Page 39 of 39**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



B577 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

8040421

COMPANY NAME:
MPA CONSULTING LIMITED

PH. #: **905-333-0427**
FAX #: **905-333-9923**

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				# CONTAINERS	SAMPLING			TOTAL METALS K2+HS	CYANIDE SPWD	BTEX/LIGHT HC
		GROUND WATER	SURFACE WATER	SOIL	OTHER		DATE	TIME	HEADSPACE VAPOUR			
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	14:28		✓	✓	
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	16:24			✓	
7 MSGM-LA-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: _____

PO. NUMBER:

SPECIAL DETECTION LIMITS / CONTAMINANT TYPE

LAB USE ONLY

ARRIVAL TEMPERATURE °C

LAB INFORMATION
40 Oct 15
THIOCYANATE PO7
2019

ACCOUNTING CONTACT:
D. GREGOR

SPECIAL REPORTING OR BILLING INSTRUCTIONS
EDT

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: **U**

CUSTODY RECORD

11/15/98 12:04 FAX 604 444 4511 PHILIP ANALYTICAL-B.C. 040/045



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

8040420

COMPANY NAME:
MDA CONSULTING LIMITED

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

PH. #: **905-333-0427**
FAX #: **905-333-9723**
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				# CONTAINERS	SAMPLING			HEADSPACE VAPOUR	ANALYSIS REQUEST
		GROUND WATER	SURFACE WATER	SOIL	OTHER		DATE	TIME			
1 MS6M-1700M	56571	✓				1	OCT 4/99	1645		✓	TOTAL METALS ICP+HS CYANIDE SAP DISS. METALS
2 MS6M-6-2	56572	✓				11	SEP 30/99	1602	✓	✓	
3 MS6M-ADIT-1800	56573	✓				111	OCT 4/99	15:55	✓	✓	
4 MS6M-6-3	56574	✓				11	SEPT 30/99	16:10	✓	✓	
5 MS6M-9	56575	✓				11	SEPT 30/99	15:10	✓	✓	
6 MS6M-6-1	56576	✓				11	SEPT 30/99	1600	✓	✓	
7 WC-DS	56577	✓				111	OCT 2/99	1200	✓	✓	
8 WC-US	56578	✓				111	OCT 2/99	1200	✓	✓	
9 MS6M-TRIB	56579	✓				11	OCT 4/99	1630	✓	✓	
10 MS6M-ADIT-1800A	56580	✓				111	OCT 4/99	1555	✓	✓	
11 MS6M-TRIBA	56581	✓				11	OCT 4/99	1630	✓	✓	
12 MS6M-1700M	56582	✓				111	OCT 4/99	1645	✓	✓	

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

P.O. NUMBER:

ACCOUNTING CONTACT:
D. GREGOR

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

SPECIAL REPORTING OR BILLING INSTRUCTIONS

EDT

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

CUSTODY RECORD

RELINQUISHED BY SAMPLER: D. GREGOR	DATE: OCT 5/99	TIME: 2130	RECEIVED BY:
RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:
RELINQUISHED BY:	DATE: OCT 7/99	TIME: 1046	RECEIVED BY LABORATORY: M

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: (A)
MDA-99-1

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

PROJECT MANAGER:
D. GREGOR

FIELD SAMPLE ID	PHILIP LAB # (Lab Use Only)	MATRIX				# CONTAINERS	SAMPLING		
		GROUND WATER	SURFACE WATER	SOIL	OTHER		DATE	TIME	HEADSPACE VAPOUR
1 CM-PIPE 1	56554	✓				1	OCT 3/99	1400	
2 CM-PIPE 2	56555	✓				1	"	1400	
3 CM-PIPE 3	56556	✓				1	"	1400	✓
4 CM-PIPE 4	56557	✓				1	"	1400	✓
5 CM-W7-US	56558	✓				11	OCT 3/99	1200	✓
6 CM-CAMP-DS1	56559	✓				1	OCT 3/99	1400	✓
7 CM-CAMP-DS2	56560	✓				1	OCT 3/99	1400	✓
8 CM-camp-pipe1	56561								XX
9 CM-camp-pipe2	56562								XX
10									
11									
12									

DISS. METALS
TTL. METALS

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

PO. NUMBER:

ACCOUNTING CONTACT:
D. GREGOR

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

SPECIAL REPORTING OR BILLING INSTRUCTIONS
EDT

ARRIVAL TEMPERATURE °C
LAB USE ONLY
LAB INFORMATION
40 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: H

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 Fil/Pres	250mL PL Fil	MICRO	100mL AG	40mL vials	Trip/Field BIK	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

Diss bottle for pipe 1 & 2
2 samples

Comments:

2 extra samples cm-camp-pipe 1
cm-camp-pipe 2
assumed cm pipe 1
cm pipe 2
Diss labels sample cm-wfus could not be filtered
at lab. Preserved in field

