# Report on the Findings of Investigations into Chinook Salmon Spawning Habitat Assessments Conducted on the Pelly River near Anvil Creek During August of 2009

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# Report on the Findings of Investigations into Chinook Salmon Spawning Habitat Assessments Conducted on the Pelly River near Anvil Creek During August of 2009

## 1.0 INTRODUCTION

This report details the findings of an investigation conducted by White Mountain Environmental Consulting (WMEC) into chinook salmon spawning on the Pelly River, near Anvil Creek during August of 2009. Prior to this study very little information had been collected on the extent, location and preferred habitat of chinook salmon spawning in this area of the main stem Pelly River. The project was conducted under the authority of license to collect fish CL-09-46, issued by the Federal Department of Fisheries and Oceans.

Previous to this investigation in 2004, WMEC, in association with Selkirk First Nations conducted an assessment of the Pelly River as part of a study of the downstream effects of the Faro mine complex. A component of that assessment was documenting chinook salmon spawning areas on the Pelly River. In review of the results it was noted that while habitats both upstream and downstream of Anvil Creek appeared similar there were no salmon spawning downstream of Anvil Creek while spawning activity upstream was very extensive. This result raised the question if the habitats are the same why not the same level of utilization and could there possibly be an influence on water quality from Anvil Creek and the Faro Mine?

## 2.0 OBJECTIVES

The primary objective of this investigation was to map and describe chinook spawning locations in the Pelly River between Faro and Anvil Creek and then to determine if the area downstream of Anvil Creek has suitable chinook spawning habitats. The secondary objective was to collect genetic information from spawning chinook salmon from the study area.

The actual stream morphology of the Pelly River within the study area changed significantly over the past two years. Unknown to the field crew the river had cut a new main channel upstream of Anvil Creek in 2007 leaving a 4 kilometer reach of the prime spawning habitat alienated from the main flow. The new channel follows an old side channel that is visible as a thin line on the topographic maps. The original intent of this project was to revisit known spawning locations within the alienated reach, describe them, and then evaluate similar habitats down stream of Anvil Creek, determine the level of salmon utilization and compare the two separate areas. Of particular interest was to denote habitats upstream of Anvil Creek that had spawning activity and then to find similar areas downstream with no spawning activity and compare the sites using water samples and sub bottom profiling. The natural environmental changes had a significant impact on our planned program of study which was altered to accommodate the changes.

## 3.0 STUDY AREA

This study was focused on chinook spawning locations on the Pelly River between Faro and Anvil Creek and short reach downstream of Anvil Creek, with the principle study area centered around Anvil Creek (Figure 1). Anvil Creek carries the outflow waters from the Faro mine complex and enters the Pelly River approximately 50 (air) kilometers down stream of the Faro Bridge. Due to low water in the river at the time of study the crew was only able to access the reach of the Pelly River from the Faro Bridge to 800 meters downstream of Anvil Creek.

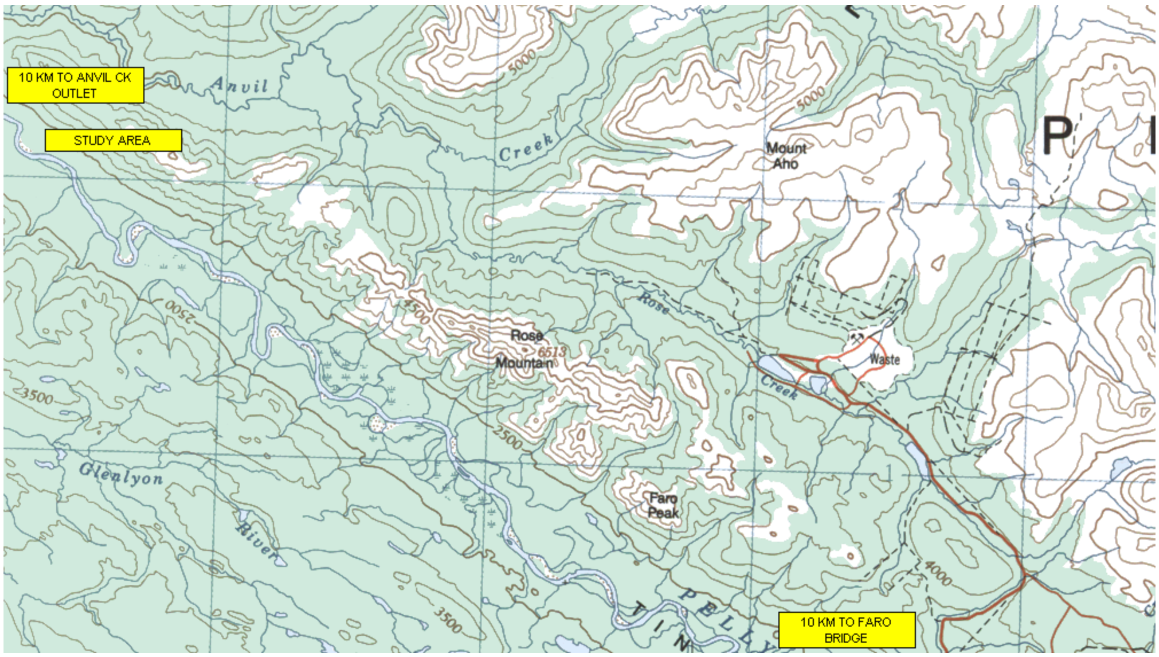


Figure 1: 1:250,000 Topographic map (105K) showing the location of the study area in relation to Faro Yukon. The actual confluence of Anvil Creek with the Pelly River is approximately 10 kilometers downstream (to the left) of the edge of the map. The area shown was all investigated for spawning locations and the area at the extreme left was intensively sampled.

## 4.0 METHODS:

The timing for this project was set to coincide with the anticipated peak of chinook salmon spawning in the Pelly River. The project was conducted between August 18 and 25, 2009.

Unforeseen events, both environmental and personal, caused a change in the original methods identified for this project. A combination of three environmental conditions changed the parameters of the study area, these conditions were;

1) The Pelly River had very low water levels at the time of the investigation making boat travel very difficult and precluded travel below Anvil Creek.

2) The main spawning area upstream of Anvil Creek denoted in 2004 had become alienated from the main flow of the Pelly River in 2007 when the river cut a new channel 2.2 kilometers in length leaving 4.5 kilometers of river channel as an oxbow.

3) The fact that the river channel was shortened by more than 2 kilometers caused flow changes in the reach downstream of the new channel. Evidence of extensive bank movement was noted and bottom substrates were very active and much of the pre-existing bottom was scoured with the result that evidence of historic spawning areas was no longer visible in the surface flow patterns.

The methodology used during this investigation was therefore altered from the original plan to accommodate these environmental factors. A further complication to the original methodology was the sub-bottom scanner became unavailable for the project and therefore the sub-bottom profiling component of the project was not conducted.

The locations of active spawning redds were identified by observing surface flow conditions caused by active chinook spawning, bottom contours (using sonar), the presence of surfacing chinook salmon, the presence of eagles and other scavengers and then suspected redds were confirmed using fish finders. In order to provide a further level of confirmation as to actual spawning activity at identified locations, gillnets were set near suspected spawning areas when it was possible to set a net, and angling with heavy salmon gear was also conducted near the redds. All indications of spawning activity in the reach that extends from the Faro Bridge to 800 meters downstream of Anvil Creek were mapped on actual topographic maps and a GPS waypoint was also created.

A set of six braided nylon gillnets were used. The lengths of the nets varied from 10 to 20 meters, and were either 5” or 5 1/4” stretch mesh. Gillnets were set from shore in suitable eddy lines, suitable net setting locations were uncommon and often required setting of a test net to determine if sub-surface flows were appropriate for netting. The nets were checked at minimum every 12 hours to avoid unnecessary mortalities. All chinook salmon captured by gillnetting were assessed to determine if the fish were actively spawning or migrating through the sample area. From each salmon captured the sex and fork length was recorded and the small processes from both pelvic fins were clipped and stored as 2 separate samples in ethyl alcohol. Live salmon were processed quickly and returned to the water at the area of capture.

Water samples were taken from areas downstream and adjacent to Anvil Creek and then as near to suspected redds as possible. A set of two separate water samples from each site was taken with a hand held sub surface, pole mounted water sampler with a depth capacity of 2.5 meters. The first water sample at each site was taken from the bottom of the river, the second sample was an integrated sample collected equally from the surface to the bottom of the water column. Each sample taken was stored in a labeled 1 liter nalgene bottle; a measure of temperature, pH, and conductivity was recorded for each sample at the time of sampling. Water samples were stored in a cooler during the field investigation and were shipped immediately after the completion of the field component to Maxxam Analytics for assessment of low level total metals.

## 5.0 RESULTS

Spawning habitats in the Pelly River were greatly modified from those observed in 2004. The most extensively utilized spawning reach noted in 2004, 16 kilometers upstream of Anvil Creek, was alienated from the main river in 2007 when the river cut a new main channel through a previously existing small side channel and alienated the spawning area as an oxbow (Figure 2b). The areas downstream of the new channel were also affected as the run of the river was shortened from 4.5 kilometers to 2.2 kilometers with the result that bottom substrates downstream of the new channel became unstable and were observed to be shifting in a dramatic fashion. Most of the evidence of historic spawning areas was washed out by the new flow regime.

### 5.1 Chinook Salmon Spawning Locations

The ability to identify small spawning areas was limited by the non existence or lack of historic evidence of redds and the fact that water levels were rising during the investigation which created high levels of turbidity and turbulence. Redds were small in size and because the historical dunes were wiped out during high flows the surface patterns were small and hard to detect meaning the crew most likely missed identifying some redds. The areas where reds were recorded always had several redds with multiple salmon spawning making them easier to discern.

The location of chinook spawning redds recorded occurred in a variety of habitat areas, however groupings of redds typically occurred in habitats with similar attributes, especially dominant in all locations was laminar flow patterns and surface velocities of slightly less than 1 m/second. The most prolific areas in the main channel were adjacent to freshly eroding gravel banks with water depths of between 2 and 3 meters. Redds were recorded in both the well established (main) channel and the new channel. It was difficult to gauge the extent of spawning activity in the new channel, however gillnet catches would indicate that the utilization of the new channel for spawning was significant. Spawning did not occur in areas were banks were heavily eroding or large amounts of new organic debris had entered the river nor in areas with swirling or turbulent flows.

The spawning areas often had sporadically spaced redds with one area of a river having extensive spawning activity and a nearby similar habitat having none. Three distinct spawning areas were identified within the sample area. Gillnet catches indicated that the new channel was the most active spawning area, however it was difficult to locate redds in the active flows of the new channel and it was impossible to tell how many redds were in the new channel. Occasional redds were also observed in the original channel near the inlet and outlet areas of the new channel. The second most extensive spawning area occurred between 6 and 7 kilometers upstream of Anvil Creek. This spawning area extended around a tight corner and ended upstream of what appears to be the edge of the Anvil Creek alluvial fan or flood plain, approximately 3.5 kilometers upstream of the actual confluence. The third spawning area was a smaller grouping of redds that occurred between the other two areas (Figures 3a and 3b). No spawning areas were observed in the outflow area of Anvil Creek.

Two other spawning areas were recorded between the study area and the Faro Bridge. A large extended area of spawning was recorded at the midway point between Anvil Creek and the bridge, this reach extended for at least 1.5 kilometers and had more Eagles and bears along the shore than any of the other areas. The last spawning area, a small group of redds was recorded 1 kilometer downstream of the Faro Bridge and close to a first nations fish camp.

Unfortunately the areas downstream of Anvil Creek were not assessed for spawning activity due to the low water levels of 2009 that precluded travel back up the river. During the 2004 investigation no spawning in the Pelly River downstream of Anvil Creek was recorded until the confluence with Tay River, a distance of approximately 27 kilometers by river.

### 5.2 Gillnetting and Angling

Angling effort was extended at three different locations, all near areas with redds, for a total of 3.7 hours. Conditions for angling were poor as the water was very turbid and contained a high level of organic debris due to rising water levels. No salmon were captured by angling.

Gillnets were set at 12 different sites (Figures 2a and 2b) and a total of 36 lifts were made with some sites being used more often than others. Gillnets were set for an average soak time of 11.5 hours per set. The duration of gillnet soak times was kept short to avoid excessive mortalities. The total catch from gillnetting consisted of 12 adult chinook salmon, 4 inconnu, 2 lake whitefish and 1 long nose sucker. Of the salmon captured 8 were captured at a single location (net #3, Figure 2b) a site in the upper reaches of the new channel. Gillnets were set near Anvil Creek however the locations were poor and captured no fish. There were no sites downstream of Anvil Creek in the short reach that was accessible where gillnets could be set.

Live salmon were treated with care to allow for live release after sampling when possible. Of the 12 salmon captured 8 were released alive and 4 were net mortalities. The collected fin clips were delivered after the completion of the project to the Department of Fisheries and Oceans for genetic evaluation.

At the time of the investigation the chinook spawn, at this location, was well underway. Most of the salmon captured were in mid spawn. At least three of the males were completely spent, and the others were nearly spent and still ran milt freely. Several of the salmon captured had the visual appearance of pre-spawn condition, however when dead specimens were dissected they were all well involved in the spawn and mostly spent. Three of the females were exuding eggs and the fourth was still tight and not spawning, this fish was considered to be a potential migrant through the area and its genetic materials were stored separately.

### 5.3 Water Sampling

Water samples were taken from 7 different locations on the Pelly River. The first station was approximately 700 meters downstream of Anvil Creek in an area were the mixing of water from Anvil could be visually discerned as it entered the Pelly River. The next 2 sample stations were immediately upstream of Anvil Creek and the other 4 sample stations were spread out from 5 to 15 kilometers upstream of Anvil Creek including the uppermost sample station in the new channel (Figures 2a and 2b ).

It is unlikely that any of the samples collected had significant amounts of ground water. Due to the depth and velocity at the redd locations it was difficult to collect samples from a consistent point on the bottom. Also, water samples were taken downstream of identified redds at a distance far enough away so as not to disturb the eggs. The sample results are very consistent and also suggest that ground water was not sampled.

Conductivity, pH and temperature were consistent among all the samples. There was also consistency in that concentrations of total metals were greater in the bottom samples than in the integrated depth samples. Total metal concentrations from the bottom sample from Site 6 were distinctly higher than any of the other samples. This site is located in the original channel 500 meters downstream of the outlet of the new channel in an area were the bottom substrates were observed to be active. The complete water quality lab report can be found in Appendix 1.

## 6.0 Discussion

Although the original intent of this project, to investigate sites both upstream and downstream of Anvil Creek, was thwarted due to the inaccessibility of the areas downstream several important facts were ascertained during this investigation. The foremost being confirmation of the importance of the area upstream of Anvil Creek to chinook salmon spawning. Spawning salmon remained loyal to the large spawning area regardless of the morphological changes to the river and the new channel was now the main spawning area.

The Anvil Creek flood plain extends a distance of almost 4 kilometers upstream of the actual confluence with the Pelly River. The present outlet of Anvil Creek lies towards the North West corner (the downstream edge) of the flood plain. It would not be surprising to find that ground water from the Anvil drainage enters the Pelly River along the entirety of the flood plain area. There is no data to support this theory; however the fact the active spawning areas end immediately upstream of the flood plain may suggest a preference by the salmon for water other than that from the Anvil drainage. Anvil Creek has never been described as a significant natal creek for chinook salmon spawning, although it is known to be a natal creek with low numbers of spawning salmon. This scenario predates the Faro Mine Complex and may indicate that salmon avoidance of the Anvil Creek drainage may in part or whole be a function of natural mineralization in the area. It should also be noted that increased inputs of dissolved metals from the Faro Mine Complex would increase any avoidance response.

This investigation did confirm the importance of areas upstream of Anvil Creek as chinook spawning habitat and given this confirmation of the data recorded in 2004 it is likely that little spawning activity occurs downstream of Anvil Creek, as was observed in 2004. The reasons salmon use specific habitats may never be known and it would be extremely difficult to understand what influences the Faro Mine Complex may have on salmon activities in the Pelly River.

Table 1: Physical measurements (Conductivity, pH and temperature °C), taken at the time of sampling from water samples collected from the Pelly River, at and upstream of Anvil Creek, August of 2009.

| | Site #1 | Site #2 | Site #3 | Site #4 | Site #5 | Site #6 | Site #7 |
|---|---|---|---|---|---|---|---|
| **integrated** | | | | | | | |
| Conductivity | 310 | 320 | 330 | 320 | 320 | 320 | 320 |
| pH | 8.74 | 8.46 | 8.52 | 8.52 | 8.48 | 8.53 | 8.53 |
| Temp. | 12.1 | 12.5 | 14.8 | 12.5 | 15.0 | 13.5 | 13.5 |
| **Bottom** | | | | | | | |
| Conductivity | 320 | 320 | 340 | 330 | 320 | 320 | 320 |
| pH | 8.6 | 8.57 | 8.57 | 8.51 | 8.51 | 8.52 | 8.53 |
| Temp. °C | 13.0 | 13.0 | 13.0 | 12.5 | 15.0 | 13.5 | 13.5 |

Table 2: A summary of water hardness and the levels of 5 key metals (total metals) from water samples taken from the Pelly River at and Upstream of Anvil Creek, August 22, 2009. INT samples indicate integrated samples collected from the entire water column; B samples indicate samples taken from the bottom.

| | INT1 | INT2 | INT3 | INT4 | INT5 | INT6 | INT7 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TTL HARD** | 155 | 157 | 157 | 141 | 152 | 156 | 141 | 152 | 147 | 122 | 146 | 147 | 167 | 148 |
| **Copper** | 5.19 | 1.57 | 1.57 | 2.57 | 1.69 | 1.51 | 2.30 | 3.15 | 4.15 | 4.23 | 2.90 | 2.53 | 6.02 | 1.78 |
| **Lead** | 0.965 | 0.620 | 1.01 | 1.02 | 0.491 | 0.442 | 0.861 | 1.29 | 1.03 | 1.78 | 1.13 | 1.05 | 4.08 | 0.603 |
| **Zinc** | 40.2 | 14.1 | 14.6 | 29.5 | 17.7 | 17.4 | 32.4 | 40.4 | 110 | 58.2 | 38.6 | 29.5 | 75.1 | 29.8 |
| Magnesium | 13.6 | 13.9 | 13.5 | 12.3 | 13.3 | 13.7 | 12.4 | 13.3 | 12.2 | 10.7 | 12.7 | 12.8 | 14.6 | 12.8 |
| Iron | 225 | 180 | 138 | 212 | 248 | 260 | 211 | 280 | 219 | 143 | 195 | 282 | 2290 | 279 |

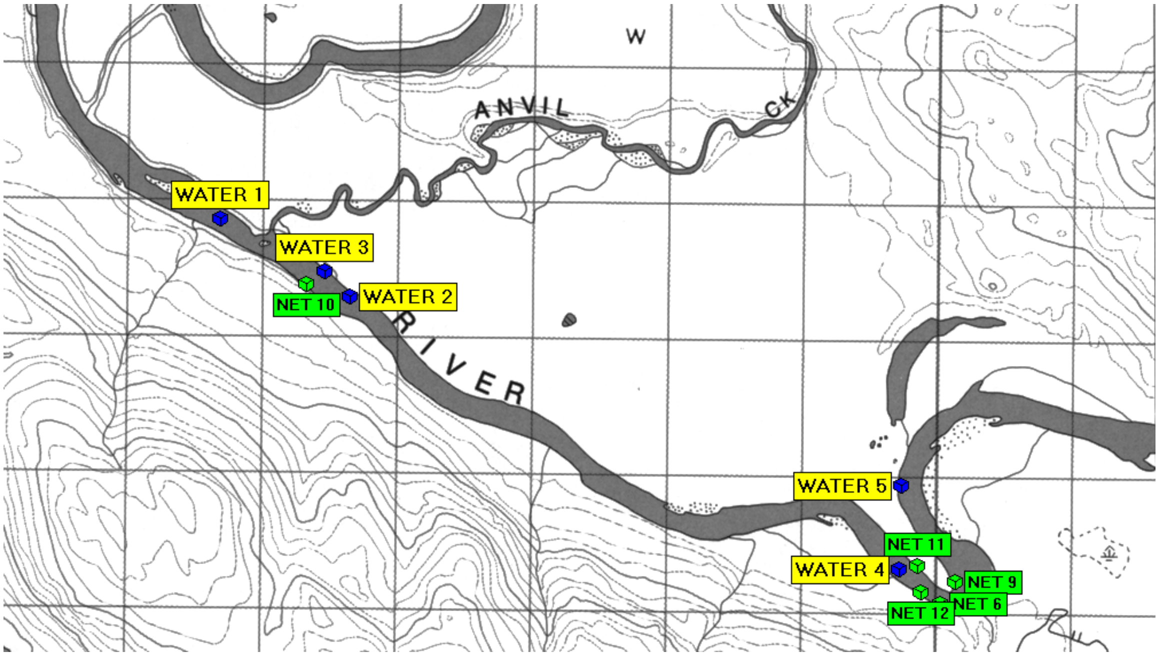

Figure 2a: Water sampling and gillnetting locations used during chinook salmon spawning investigations conducted during August of 2009. The right margin of this figure lines up with the left margin of figure 2b.

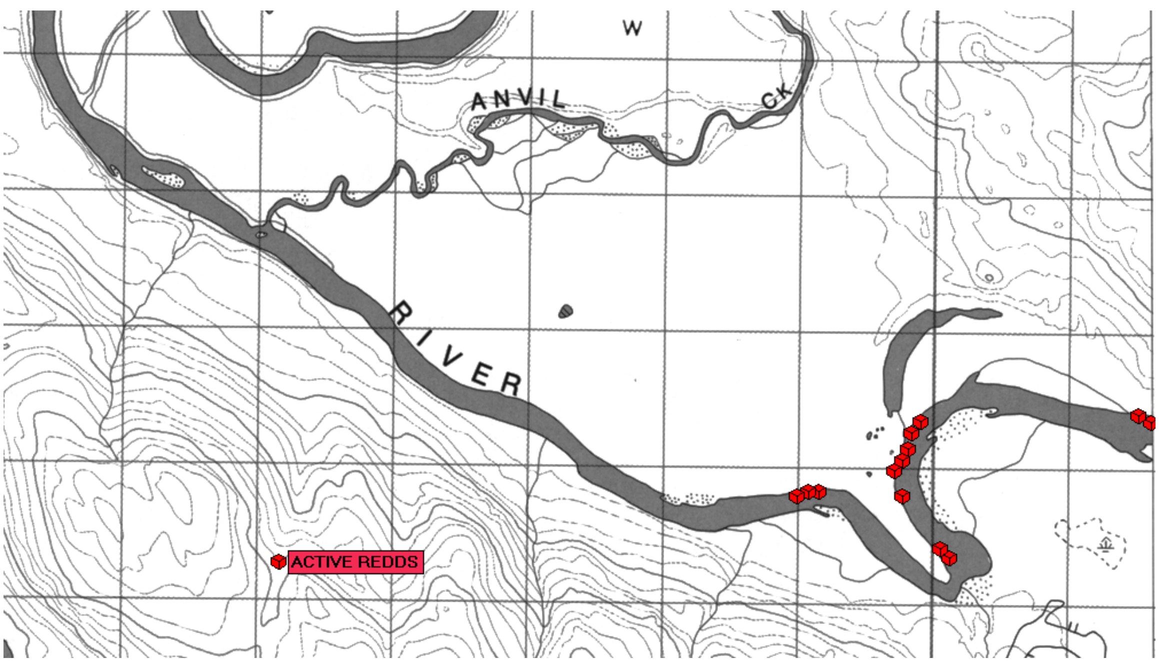

Figure 3a: Locations on the Pelly River that active chinook salmon spawning was recorded during August of 2009. The right margin of this figure aligns with the left margin of figure 3b.

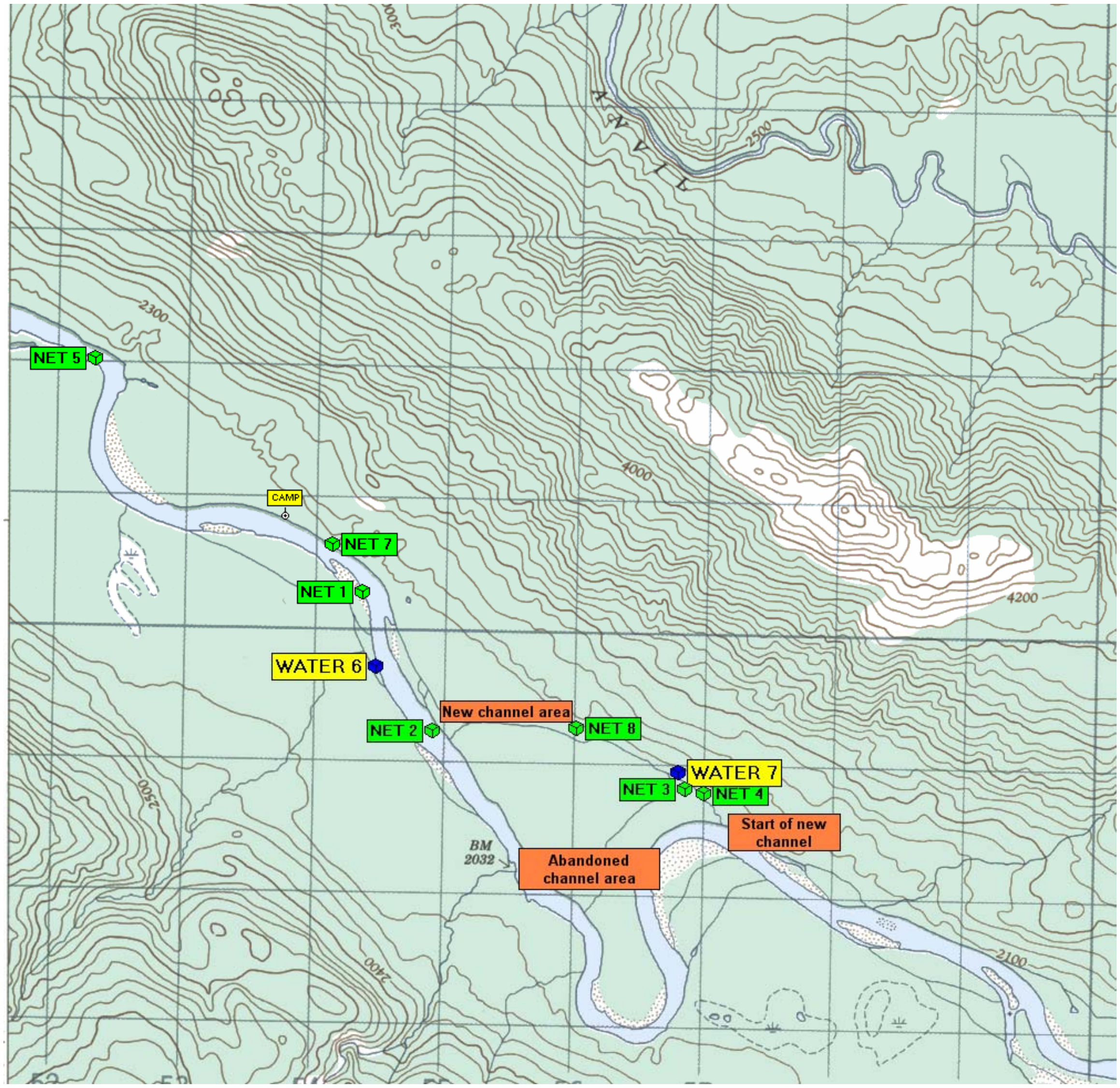

Figure 2b: Water sampling and gillnetting locations used during chinook salmon spawning investigations conducted during August of 2009. The left margin of this figure lines up with the right margin of figure 2a.

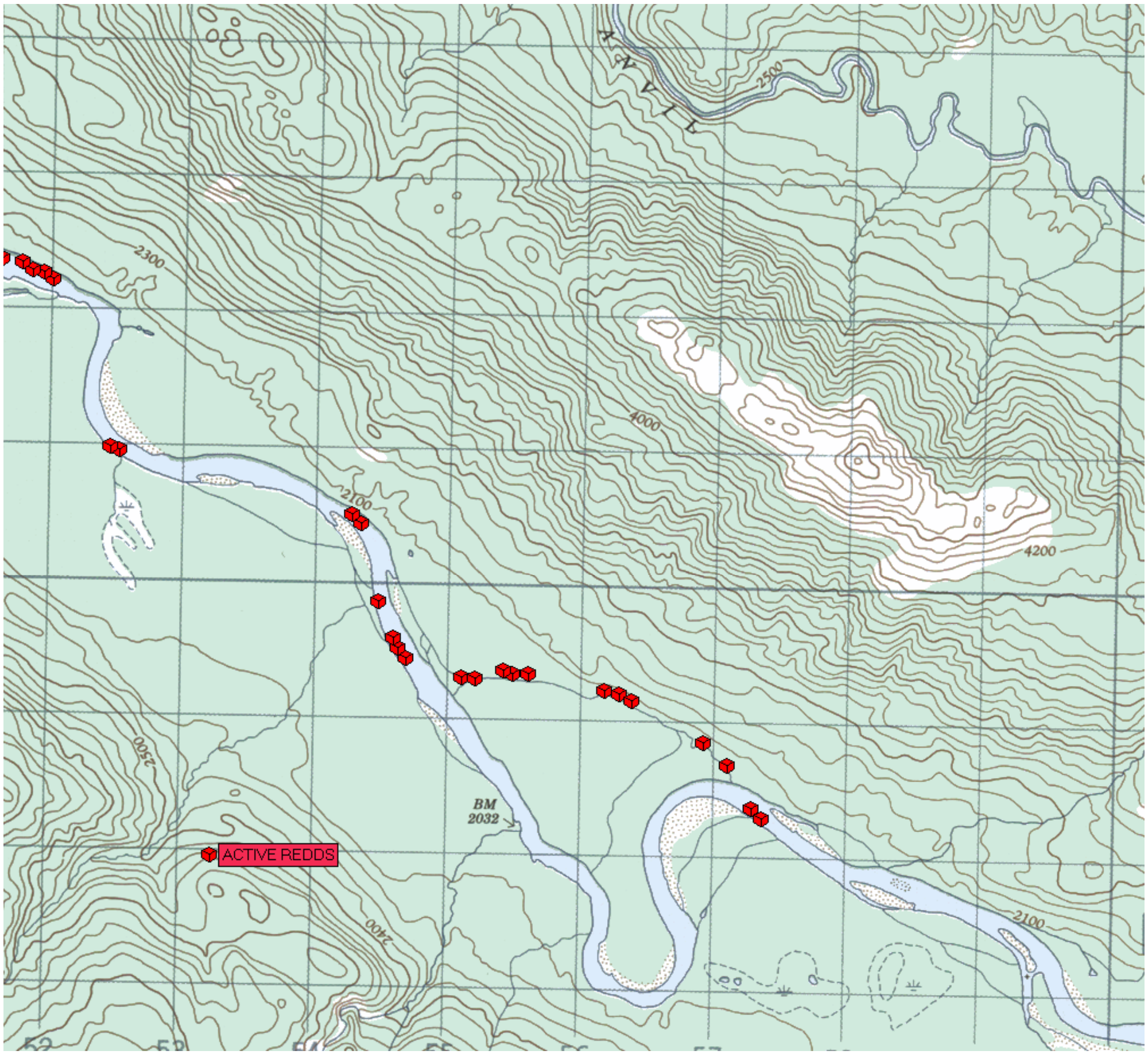


Figure 3b: Locations on the Pelly River that active chinook salmon spawning was recorded during August of 2009. The left margin of this figure aligns with the right margin of figure 3a.

# APPENDIX 1

# WATER QUALITY LAB RESULTS

Your C.O.C. #: F143847, F143913

**Attention: PAUL SPARLING**
WHITE MOUNTAIN CONSULTING
BOX 10140
WHITEHORSE, YT
CANADA Y1A 7A1

**Report Date: 2009/09/29**

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: A952285**
**Received: 2009/09/22, 10:00**

Sample Matrix: Water
# Samples Received: 14

| Analyses | Quantity | Date Extracted | Date Analyzed | Laboratory Method | Analytical Method |
|---|---|---|---|---|---|
| Hardness Total (calculated as CaCO3) | 2 | N/A | 2009/09/26 | | |
| Hardness Total (calculated as CaCO3) | 12 | N/A | 2009/09/28 | | |
| Elements by ICPMS Low Level (total) (1) | 2 | 2009/09/25 | 2009/09/26 | BRN SOP-00206 R7.0 | Based on EPA 200.8 |
| Elements by ICPMS Low Level (total) (1) | 12 | 2009/09/25 | 2009/09/27 | BRN SOP-00206 R7.0 | Based on EPA 200.8 |
| Na, K, Ca, Mg, S by CRC ICPMS (total) | 2 | 2009/09/25 | 2009/09/26 | BRN SOP-00206 R7.0 | Based on EPA 200.8 |
| Na, K, Ca, Mg, S by CRC ICPMS (total) | 12 | 2009/09/25 | 2009/09/27 | BRN SOP-00206 R7.0 | Based on EPA 200.8 |

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) SCC/CAEAL

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

ASHLEY NIVISON, BBY Customer Service
Email: ashley.nivison@maxxamanalytics.com
Phone# (604) 444-4808

==================================================================
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CALA have approved this reporting process and electronic report format.

Total cover pages: 1

Maxxam Job #: A952285
Report Date: 2009/09/29

## LOW LEVEL TOTAL METALS - WATER (WATER)

| Maxxam ID | | Q87145 | Q87146 | | Q87147 | Q87148 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2009/08/23 | 2009/08/23 | | 2009/08/23 | 2009/08/23 | | |
| COC Number | | F143847 | F143847 | | F143847 | F143847 | | |
| | **Units** | **1 INT** | **2 INT** | **QC Batch** | **3 INT** | **4 INT** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | |
| Total Hardness (CaCO3) | mg/L | 155 | 157 | 3435088 | 157 | 141 | 0.5 | 3435088 |
| **Total Metals by ICPMS** | | | | | | | | |
| Total Aluminum (Al) | ug/L | 86.3 | 64.4 | 3445627 | 58.9 | 80.4 | 0.2 | 3447535 |
| Total Antimony (Sb) | ug/L | 0.37 | 0.39 | 3445627 | 0.45 | 0.31 | 0.02 | 3447535 |
| Total Arsenic (As) | ug/L | 0.69 | 0.60 | 3445627 | 0.64 | 0.70 | 0.02 | 3447535 |
| Total Barium (Ba) | ug/L | 76.9 | 80.5 | 3445627 | 78.1 | 74.7 | 0.02 | 3447535 |
| Total Beryllium (Be) | ug/L | 0.01 | <0.01 | 3445627 | <0.01 | <0.01 | 0.01 | 3447535 |
| Total Bismuth (Bi) | ug/L | 0.007 | <0.005 | 3445627 | <0.005 | <0.005 | 0.005 | 3447535 |
| Total Boron (B) | ug/L | <50 | <50 | 3445627 | <50 | <50 | 50 | 3447535 |
| Total Cadmium (Cd) | ug/L | 0.206 | 0.124 | 3445627 | 0.128 | 0.167 | 0.005 | 3447535 |
| Total Chromium (Cr) | ug/L | 0.2 | 0.1 | 3445627 | 0.1 | 0.1 | 0.1 | 3447535 |
| Total Cobalt (Co) | ug/L | 0.163 | 0.125 | 3445627 | 0.092 | 0.165 | 0.005 | 3447535 |
| Total Copper (Cu) | ug/L | 5.19 | 1.57 | 3445627 | 1.57 | 2.57 | 0.05 | 3447535 |
| Total Iron (Fe) | ug/L | 225 | 180 | 3445627 | 138 | 212 | 1 | 3447535 |
| Total Lead (Pb) | ug/L | 0.965 | 0.620 | 3445627 | 1.01 | 1.02 | 0.005 | 3447535 |
| Total Lithium (Li) | ug/L | 4.0 | 3.8 | 3445627 | 3.6 | 3.3 | 0.5 | 3447535 |
| Total Manganese (Mn) | ug/L | 21.8 | 17.8 | 3445627 | 14.8 | 22.9 | 0.05 | 3447535 |
| Total Molybdenum (Mo) | ug/L | 1.19 | 1.25 | 3445627 | 1.30 | 1.12 | 0.05 | 3447535 |
| Total Nickel (Ni) | ug/L | 2.84 | 2.48 | 3445627 | 2.28 | 2.65 | 0.02 | 3447535 |
| Total Selenium (Se) | ug/L | 0.99 | 0.99 | 3445627 | 1.15 | 1.10 | 0.04 | 3447535 |
| Total Silicon (Si) | ug/L | 2810 | 2750 | 3445627 | 2730 | 2500 | 100 | 3447535 |
| Total Silver (Ag) | ug/L | 0.008 | 0.011 | 3445627 | 0.020 | <0.005 | 0.005 | 3447535 |
| Total Strontium (Sr) | ug/L | 175 | 181 | 3445627 | 179 | 162 | 0.05 | 3447535 |
| Total Thallium (Tl) | ug/L | 0.006 | 0.006 | 3445627 | 0.005 | 0.004 | 0.002 | 3447535 |
| Total Tin (Sn) | ug/L | 0.02 | <0.01 | 3445627 | 0.02 | 0.01 | 0.01 | 3447535 |
| Total Titanium (Ti) | ug/L | 2.2 | 0.9 | 3445627 | 1.2 | 1.5 | 0.5 | 3447535 |
| Total Uranium (U) | ug/L | 1.52 | 1.56 | 3445627 | 1.53 | 1.36 | 0.002 | 3447535 |
| Total Vanadium (V) | ug/L | 0.5 | 0.5 | 3445627 | 0.3 | 0.5 | 0.2 | 3447535 |
| Total Zinc (Zn) | ug/L | 40.2 | 14.1 | 3445627 | 14.6 | 29.5 | 0.1 | 3447535 |
| Total Zirconium (Zr) | ug/L | <0.1 | <0.1 | 3445627 | <0.1 | <0.1 | 0.1 | 3447535 |
| Total Calcium (Ca) | mg/L | 39.6 | 39.8 | 3446497 | 40.7 | 36.4 | 0.05 | 3448177 |
| Total Magnesium (Mg) | mg/L | 13.6 | 13.9 | 3446497 | 13.5 | 12.3 | 0.05 | 3448177 |
| Total Potassium (K) | mg/L | 0.83 | 0.76 | 3446497 | 0.80 | 0.77 | 0.05 | 3448177 |

RDL = Reportable Detection Limit

WHITE MOUNTAIN CONSULTING

Maxxam Job #: A952285
Report Date: 2009/09/29

## LOW LEVEL TOTAL METALS - WATER (WATER)

| Maxxam ID | | Q87145 | Q87146 | | Q87147 | Q87148 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2009/08/23 | 2009/08/23 | | 2009/08/23 | 2009/08/23 | | |
| COC Number | | F143847 | F143847 | | F143847 | F143847 | | |
| | **Units** | **1 INT** | **2 INT** | **QC Batch** | **3 INT** | **4 INT** | **RDL** | **QC Batch** |
| Total Sodium (Na) | mg/L | 1.81 | 1.76 | 3446497 | 1.78 | 1.77 | 0.05 | 3448177 |
| Total Sulphur (S) | mg/L | 20 | 21 | 3446497 | 24 | 22 | 3 | 3448177 |

RDL = Reportable Detection Limit

WHITE MOUNTAIN CONSULTING

Maxxam Job #: A952285
Report Date: 2009/09/29

## LOW LEVEL TOTAL METALS - WATER (WATER)

| Maxxam ID | | Q87149 | Q87150 | Q87151 | Q87152 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2009/08/23 | 2009/08/23 | 2009/08/23 | 2009/08/23 | | |
| COC Number | | F143847 | F143847 | F143847 | F143913 | | |
| | **Units** | **5 INT** | **6 INT** | **7 INT** | **1 BOT** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | |
| Total Hardness (CaCO3) | mg/L | 152 | 156 | 141 | 152 | 0.5 | 3435088 |
| **Total Metals by ICPMS** | | | | | | | |
| Total Aluminum (Al) | ug/L | 96.8 | 90.6 | 83.9 | 104 | 0.2 | 3447535 |
| Total Antimony (Sb) | ug/L | 0.28 | 0.26 | 0.37 | 0.42 | 0.02 | 3447535 |
| Total Arsenic (As) | ug/L | 0.67 | 0.66 | 0.70 | 0.76 | 0.02 | 3447535 |
| Total Barium (Ba) | ug/L | 80.2 | 81.1 | 73.8 | 83.8 | 0.02 | 3447535 |
| Total Beryllium (Be) | ug/L | 0.01 | <0.01 | <0.01 | 0.01 | 0.01 | 3447535 |
| Total Bismuth (Bi) | ug/L | <0.005 | <0.005 | <0.005 | 0.006 | 0.005 | 3447535 |
| Total Boron (B) | ug/L | <50 | <50 | <50 | <50 | 50 | 3447535 |
| Total Cadmium (Cd) | ug/L | 0.121 | 0.133 | 0.147 | 0.192 | 0.005 | 3447535 |
| Total Chromium (Cr) | ug/L | 0.1 | 0.1 | 0.2 | 0.3 | 0.1 | 3447535 |
| Total Cobalt (Co) | ug/L | 0.168 | 0.159 | 0.153 | 0.200 | 0.005 | 3447535 |
| Total Copper (Cu) | ug/L | 1.69 | 1.51 | 2.30 | 3.15 | 0.05 | 3447535 |
| Total Iron (Fe) | ug/L | 248 | 260 | 211 | 280 | 1 | 3447535 |
| Total Lead (Pb) | ug/L | 0.491 | 0.442 | 0.861 | 1.29 | 0.005 | 3447535 |
| Total Lithium (Li) | ug/L | 3.5 | 3.5 | 3.3 | 3.6 | 0.5 | 3447535 |
| Total Manganese (Mn) | ug/L | 22.9 | 22.7 | 22.0 | 30.2 | 0.05 | 3447535 |
| Total Molybdenum (Mo) | ug/L | 1.29 | 1.29 | 1.23 | 1.23 | 0.05 | 3447535 |
| Total Nickel (Ni) | ug/L | 2.61 | 2.63 | 2.89 | 3.05 | 0.02 | 3447535 |
| Total Selenium (Se) | ug/L | 1.16 | 1.29 | 1.14 | 1.07 | 0.04 | 3447535 |
| Total Silicon (Si) | ug/L | 2710 | 2960 | 2550 | 2550 | 100 | 3447535 |
| Total Silver (Ag) | ug/L | <0.005 | <0.005 | 0.006 | 0.055 | 0.005 | 3447535 |
| Total Strontium (Sr) | ug/L | 173 | 177 | 160 | 172 | 0.05 | 3447535 |
| Total Thallium (Tl) | ug/L | 0.006 | 0.007 | 0.004 | 0.006 | 0.002 | 3447535 |
| Total Tin (Sn) | ug/L | 0.01 | <0.01 | 0.02 | 0.02 | 0.01 | 3447535 |
| Total Titanium (Ti) | ug/L | 1.7 | 1.6 | 1.3 | 1.9 | 0.5 | 3447535 |
| Total Uranium (U) | ug/L | 1.45 | 1.48 | 1.36 | 1.45 | 0.002 | 3447535 |
| Total Vanadium (V) | ug/L | 0.5 | 0.6 | 0.4 | 0.5 | 0.2 | 3447535 |
| Total Zinc (Zn) | ug/L | 17.7 | 17.4 | 32.4 | 40.4 | 0.1 | 3447535 |
| Total Zirconium (Zr) | ug/L | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 | 3447535 |
| Total Calcium (Ca) | mg/L | 39.0 | 39.9 | 36.0 | 39.0 | 0.05 | 3448177 |
| Total Magnesium (Mg) | mg/L | 13.3 | 13.7 | 12.4 | 13.3 | 0.05 | 3448177 |
| Total Potassium (K) | mg/L | 0.75 | 0.72 | 0.78 | 0.99 | 0.05 | 3448177 |

RDL = Reportable Detection Limit

WHITE MOUNTAIN CONSULTING

Maxxam Job #: A952285
Report Date: 2009/09/29

## LOW LEVEL TOTAL METALS - WATER (WATER)

| Maxxam ID | | Q87149 | Q87150 | Q87151 | Q87152 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2009/08/23 | 2009/08/23 | 2009/08/23 | 2009/08/23 | | |
| COC Number | | F143847 | F143847 | F143847 | F143913 | | |
| | **Units** | **5 INT** | **6 INT** | **7 INT** | **1 BOT** | **RDL** | **QC Batch** |
| Total Sodium (Na) | mg/L | 1.57 | 1.59 | 1.57 | 1.89 | 0.05 | 3448177 |
| Total Sulphur (S) | mg/L | 22 | 23 | 23 | 21 | 3 | 3448177 |

RDL = Reportable Detection Limit

## LOW LEVEL TOTAL METALS - WATER (WATER)

| Maxxam ID | | Q87153 | Q87154 | Q87155 | Q87156 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2009/08/23 | 2009/08/23 | 2009/08/23 | 2009/08/23 | | |
| COC Number | | F143913 | F143913 | F143913 | F143913 | | |
| | **Units** | **2 BOT** | **3 BOT** | **4 BOT** | **5 BOT** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | |
| Total Hardness (CaCO3) | mg/L | 147 | 122 | 146 | 147 | 0.5 | 3435088 |
| **Total Metals by ICPMS** | | | | | | | |
| Total Aluminum (Al) | ug/L | 85.1 | 67.9 | 79.4 | 107 | 0.2 | 3447535 |
| Total Antimony (Sb) | ug/L | 0.26 | 0.36 | 0.29 | 0.30 | 0.02 | 3447535 |
| Total Arsenic (As) | ug/L | 0.70 | 0.65 | 0.69 | 0.74 | 0.02 | 3447535 |
| Total Barium (Ba) | ug/L | 76.2 | 65.6 | 76.3 | 79.8 | 0.02 | 3447535 |
| Total Beryllium (Be) | ug/L | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 | 3447535 |
| Total Bismuth (Bi) | ug/L | 0.007 | <0.005 | <0.005 | 0.005 | 0.005 | 3447535 |
| Total Boron (B) | ug/L | <50 | <50 | <50 | <50 | 50 | 3447535 |
| Total Cadmium (Cd) | ug/L | 0.152 | 0.214 | 0.164 | 0.164 | 0.005 | 3447535 |
| Total Chromium (Cr) | ug/L | 0.8 | 0.2 | 0.1 | 0.2 | 0.1 | 3447535 |
| Total Cobalt (Co) | ug/L | 0.156 | 0.130 | 0.150 | 0.204 | 0.005 | 3447535 |
| Total Copper (Cu) | ug/L | 4.15 | 4.23 | 2.90 | 2.53 | 0.05 | 3447535 |
| Total Iron (Fe) | ug/L | 219 | 143 | 195 | 282 | 1 | 3447535 |
| Total Lead (Pb) | ug/L | 1.03 | 1.78 | 1.13 | 1.05 | 0.005 | 3447535 |
| Total Lithium (Li) | ug/L | 3.4 | 2.8 | 3.3 | 3.3 | 0.5 | 3447535 |
| Total Manganese (Mn) | ug/L | 27.6 | 17.6 | 20.6 | 26.2 | 0.05 | 3447535 |
| Total Molybdenum (Mo) | ug/L | 1.20 | 1.08 | 1.22 | 1.25 | 0.05 | 3447535 |
| Total Nickel (Ni) | ug/L | 3.84 | 2.73 | 2.79 | 2.88 | 0.02 | 3447535 |
| Total Selenium (Se) | ug/L | 1.03 | 0.97 | 1.01 | 1.10 | 0.04 | 3447535 |
| Total Silicon (Si) | ug/L | 3020 | 2110 | 2400 | 2580 | 100 | 3447535 |
| Total Silver (Ag) | ug/L | 0.010 | 0.005 | 0.008 | <0.005 | 0.005 | 3447535 |
| Total Strontium (Sr) | ug/L | 167 | 140 | 165 | 168 | 0.05 | 3447535 |
| Total Thallium (Tl) | ug/L | 0.006 | 0.004 | 0.005 | 0.006 | 0.002 | 3447535 |
| Total Tin (Sn) | ug/L | 0.03 | 0.04 | 0.02 | 0.01 | 0.01 | 3447535 |
| Total Titanium (Ti) | ug/L | 2.0 | 0.9 | 1.4 | 2.2 | 0.5 | 3447535 |
| Total Uranium (U) | ug/L | 1.49 | 1.16 | 1.36 | 1.40 | 0.002 | 3447535 |
| Total Vanadium (V) | ug/L | 0.4 | 0.3 | 0.4 | 0.5 | 0.2 | 3447535 |
| Total Zinc (Zn) | ug/L | 110 | 58.2 | 38.6 | 29.5 | 0.1 | 3447535 |
| Total Zirconium (Zr) | ug/L | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 | 3447535 |
| Total Calcium (Ca) | mg/L | 38.8 | 31.3 | 37.5 | 37.8 | 0.05 | 3448177 |
| Total Magnesium (Mg) | mg/L | 12.2 | 10.7 | 12.7 | 12.8 | 0.05 | 3448177 |
| Total Potassium (K) | mg/L | 0.88 | 0.92 | 0.90 | 0.90 | 0.05 | 3448177 |

RDL = Reportable Detection Limit

Maxxam Job #: A952285
Report Date: 2009/09/29

## LOW LEVEL TOTAL METALS - WATER (WATER)

| Maxxam ID | | Q87153 | Q87154 | Q87155 | Q87156 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2009/08/23 | 2009/08/23 | 2009/08/23 | 2009/08/23 | | |
| COC Number | | F143913 | F143913 | F143913 | F143913 | | |
| | **Units** | **2 BOT** | **3 BOT** | **4 BOT** | **5 BOT** | **RDL** | **QC Batch** |
| Total Sodium (Na) | mg/L | 1.89 | 1.98 | 1.92 | 1.77 | 0.05 | 3448177 |
| Total Sulphur (S) | mg/L | 23 | 19 | 21 | 22 | 3 | 3448177 |

RDL = Reportable Detection Limit

Maxxam Job #: A952285
Report Date: 2009/09/29

## LOW LEVEL TOTAL METALS - WATER (WATER)

| Maxxam ID | | Q87157 | Q87158 | | |
|---|---|---|---|---|---|
| Sampling Date | | 2009/08/23 | 2009/08/23 | | |
| COC Number | | F143913 | F143913 | | |
| | **Units** | **6 BOT** | **7 BOT** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | |
| Total Hardness (CaCO3) | mg/L | 167 | 148 | 0.5 | 3435088 |
| **Total Metals by ICPMS** | | | | | |
| Total Aluminum (Al) | ug/L | 628 | 99.4 | 0.2 | 3447535 |
| Total Antimony (Sb) | ug/L | 0.35 | 0.28 | 0.02 | 3447535 |
| Total Arsenic (As) | ug/L | 2.26 | 0.72 | 0.02 | 3447535 |
| Total Barium (Ba) | ug/L | 124 | 77.7 | 0.02 | 3447535 |
| Total Beryllium (Be) | ug/L | 0.08 | 0.01 | 0.01 | 3447535 |
| Total Bismuth (Bi) | ug/L | 0.008 | <0.005 | 0.005 | 3447535 |
| Total Boron (B) | ug/L | <50 | <50 | 50 | 3447535 |
| Total Cadmium (Cd) | ug/L | 0.517 | 0.164 | 0.005 | 3447535 |
| Total Chromium (Cr) | ug/L | 1.5 | 0.2 | 0.1 | 3447535 |
| Total Cobalt (Co) | ug/L | 1.58 | 0.192 | 0.005 | 3447535 |
| Total Copper (Cu) | ug/L | 6.02 | 1.78 | 0.05 | 3447535 |
| Total Iron (Fe) | ug/L | 2290 | 279 | 1 | 3447535 |
| Total Lead (Pb) | ug/L | 4.08 | 0.603 | 0.005 | 3447535 |
| Total Lithium (Li) | ug/L | 4.0 | 3.3 | 0.5 | 3447535 |
| Total Manganese (Mn) | ug/L | 127 | 26.0 | 0.05 | 3447535 |
| Total Molybdenum (Mo) | ug/L | 0.64 | 1.20 | 0.05 | 3447535 |
| Total Nickel (Ni) | ug/L | 7.90 | 2.76 | 0.02 | 3447535 |
| Total Selenium (Se) | ug/L | 1.07 | 1.17 | 0.04 | 3447535 |
| Total Silicon (Si) | ug/L | 3280 | 2630 | 100 | 3447535 |
| Total Silver (Ag) | ug/L | 0.022 | <0.005 | 0.005 | 3447535 |
| Total Strontium (Sr) | ug/L | 186 | 168 | 0.05 | 3447535 |
| Total Thallium (Tl) | ug/L | 0.023 | 0.006 | 0.002 | 3447535 |
| Total Tin (Sn) | ug/L | <0.01 | <0.01 | 0.01 | 3447535 |
| Total Titanium (Ti) | ug/L | 10.6 | 2.0 | 0.5 | 3447535 |
| Total Uranium (U) | ug/L | 1.60 | 1.41 | 0.002 | 3447535 |
| Total Vanadium (V) | ug/L | 3.3 | 0.6 | 0.2 | 3447535 |
| Total Zinc (Zn) | ug/L | 75.1 | 29.8 | 0.1 | 3447535 |
| Total Zirconium (Zr) | ug/L | 0.2 | <0.1 | 0.1 | 3447535 |
| Total Calcium (Ca) | mg/L | 43.0 | 38.0 | 0.05 | 3448177 |
| Total Magnesium (Mg) | mg/L | 14.6 | 12.8 | 0.05 | 3448177 |
| Total Potassium (K) | mg/L | 0.81 | 0.71 | 0.05 | 3448177 |

RDL = Reportable Detection Limit

WHITE MOUNTAIN CONSULTING

Maxxam Job #: A952285
Report Date: 2009/09/29

## LOW LEVEL TOTAL METALS - WATER (WATER)

| Maxxam ID | | Q87157 | Q87158 | | |
|---|---|---|---|---|---|
| Sampling Date | | 2009/08/23 | 2009/08/23 | | |
| COC Number | | F143913 | F143913 | | |
| | **Units** | **6 BOT** | **7 BOT** | **RDL** | **QC Batch** |
| Total Sodium (Na) | mg/L | 1.53 | 1.48 | 0.05 | 3448177 |
| Total Sulphur (S) | mg/L | 23 | 22 | 3 | 3448177 |

RDL = Reportable Detection Limit

**General Comments**

**Results relate only to the items tested.**

WHITE MOUNTAIN CONSULTING
Attention: PAUL SPARLING
Client Project #:
P.O. #:
Site Reference:

# Quality Assurance Report

Maxxam Job Number: VA952285

| QA/QC Batch Num Init | QC Type | Parameter | Date Analyzed yyyy/mm/dd | Value | Recovery | Units | QC Limits |
|---|---|---|---|---|---|---|---|
| 3445627 AA1 | Matrix Spike | Total Arsenic (As) | 2009/09/26 | | 109 | % | 80 - 120 |
| | | Total Beryllium (Be) | 2009/09/26 | | 120 | % | 80 - 120 |
| | | Total Cadmium (Cd) | 2009/09/26 | | 112 | % | 80 - 120 |
| | | Total Chromium (Cr) | 2009/09/26 | | 115 | % | 80 - 120 |
| | | Total Cobalt (Co) | 2009/09/26 | | 113 | % | 80 - 120 |
| | | Total Copper (Cu) | 2009/09/26 | | NC | % | 80 - 120 |
| | | Total Lead (Pb) | 2009/09/26 | | 113 | % | 80 - 120 |
| | | Total Lithium (Li) | 2009/09/26 | | 115 | % | 80 - 120 |
| | | Total Nickel (Ni) | 2009/09/26 | | 115 | % | 80 - 120 |
| | | Total Selenium (Se) | 2009/09/26 | | 109 | % | 80 - 120 |
| | | Total Uranium (U) | 2009/09/26 | | 120 | % | 80 - 120 |
| | | Total Vanadium (V) | 2009/09/26 | | 114 | % | 80 - 120 |
| | | Total Zinc (Zn) | 2009/09/26 | | NC | % | 80 - 120 |
| | Spiked Blank | Total Arsenic (As) | 2009/09/26 | | 95 | % | 80 - 120 |
| | | Total Beryllium (Be) | 2009/09/26 | | 114 | % | 80 - 120 |
| | | Total Cadmium (Cd) | 2009/09/26 | | 96 | % | 80 - 120 |
| | | Total Chromium (Cr) | 2009/09/26 | | 99 | % | 80 - 120 |
| | | Total Cobalt (Co) | 2009/09/26 | | 99 | % | 80 - 120 |
| | | Total Copper (Cu) | 2009/09/26 | | 103 | % | 80 - 120 |
| | | Total Lead (Pb) | 2009/09/26 | | 103 | % | 80 - 120 |
| | | Total Lithium (Li) | 2009/09/26 | | 107 | % | 80 - 120 |
| | | Total Nickel (Ni) | 2009/09/26 | | 98 | % | 80 - 120 |
| | | Total Selenium (Se) | 2009/09/26 | | 101 | % | 80 - 120 |
| | | Total Uranium (U) | 2009/09/26 | | 108 | % | 80 - 120 |
| | | Total Vanadium (V) | 2009/09/26 | | 97 | % | 80 - 120 |
| | | Total Zinc (Zn) | 2009/09/26 | | 95 | % | 80 - 120 |
| | Method Blank | Total Aluminum (Al) | 2009/09/26 | <0.2 | | ug/L | |
| | | Total Antimony (Sb) | 2009/09/26 | <0.02 | | ug/L | |
| | | Total Arsenic (As) | 2009/09/26 | <0.02 | | ug/L | |
| | | Total Barium (Ba) | 2009/09/26 | <0.02 | | ug/L | |
| | | Total Beryllium (Be) | 2009/09/26 | <0.01 | | ug/L | |
| | | Total Bismuth (Bi) | 2009/09/26 | <0.005 | | ug/L | |
| | | Total Boron (B) | 2009/09/26 | <50 | | ug/L | |
| | | Total Cadmium (Cd) | 2009/09/26 | <0.005 | | ug/L | |
| | | Total Chromium (Cr) | 2009/09/26 | <0.1 | | ug/L | |
| | | Total Cobalt (Co) | 2009/09/26 | <0.005 | | ug/L | |
| | | Total Copper (Cu) | 2009/09/26 | <0.05 | | ug/L | |
| | | Total Iron (Fe) | 2009/09/26 | <1 | | ug/L | |
| | | Total Lead (Pb) | 2009/09/26 | <0.005 | | ug/L | |
| | | Total Lithium (Li) | 2009/09/26 | <0.5 | | ug/L | |
| | | Total Manganese (Mn) | 2009/09/26 | <0.05 | | ug/L | |
| | | Total Molybdenum (Mo) | 2009/09/26 | <0.05 | | ug/L | |
| | | Total Nickel (Ni) | 2009/09/26 | <0.02 | | ug/L | |
| | | Total Selenium (Se) | 2009/09/26 | <0.04 | | ug/L | |
| | | Total Silicon (Si) | 2009/09/26 | <100 | | ug/L | |
| | | Total Silver (Ag) | 2009/09/26 | <0.005 | | ug/L | |
| | | Total Strontium (Sr) | 2009/09/26 | <0.05 | | ug/L | |
| | | Total Thallium (Tl) | 2009/09/26 | <0.002 | | ug/L | |
| | | Total Tin (Sn) | 2009/09/26 | <0.01 | | ug/L | |
| | | Total Titanium (Ti) | 2009/09/26 | <0.5 | | ug/L | |
| | | Total Uranium (U) | 2009/09/26 | <0.002 | | ug/L | |
| | | Total Vanadium (V) | 2009/09/26 | <0.2 | | ug/L | |
| | | Total Zinc (Zn) | 2009/09/26 | <0.1 | | ug/L | |
| | | Total Zirconium (Zr) | 2009/09/26 | <0.1 | | ug/L | |
| | RPD | Total Aluminum (Al) | 2009/09/26 | NC | | % | 20 |

WHITE MOUNTAIN CONSULTING
Attention: PAUL SPARLING
Client Project #:
P.O. #:
Site Reference:

# Quality Assurance Report (Continued)

Maxxam Job Number: VA952285

| QA/QC Batch Num Init | QC Type | Parameter | Date Analyzed yyyy/mm/dd | Value | Recovery | Units | QC Limits |
|---|---|---|---|---|---|---|---|
| 3445627 AA1 | RPD | Total Antimony (Sb) | 2009/09/26 | NC | | % | 20 |
| | | Total Arsenic (As) | 2009/09/26 | 2.0 | | % | 20 |
| | | Total Barium (Ba) | 2009/09/26 | 3.3 | | % | 20 |
| | | Total Beryllium (Be) | 2009/09/26 | NC | | % | 20 |
| | | Total Bismuth (Bi) | 2009/09/26 | NC | | % | 20 |
| | | Total Boron (B) | 2009/09/26 | NC | | % | 20 |
| | | Total Cadmium (Cd) | 2009/09/26 | NC | | % | 20 |
| | | Total Chromium (Cr) | 2009/09/26 | 5.2 | | % | 20 |
| | | Total Cobalt (Co) | 2009/09/26 | NC | | % | 20 |
| | | Total Copper (Cu) | 2009/09/26 | 2.5 | | % | 20 |
| | | Total Iron (Fe) | 2009/09/26 | 2.6 | | % | 20 |
| | | Total Lead (Pb) | 2009/09/26 | 2.4 | | % | 20 |
| | | Total Lithium (Li) | 2009/09/26 | NC | | % | 20 |
| | | Total Manganese (Mn) | 2009/09/26 | 0.9 | | % | 20 |
| | | Total Molybdenum (Mo) | 2009/09/26 | NC | | % | 20 |
| | | Total Nickel (Ni) | 2009/09/26 | 8.6 | | % | 20 |
| | | Total Selenium (Se) | 2009/09/26 | NC | | % | 20 |
| | | Total Silicon (Si) | 2009/09/26 | 3.3 | | % | 20 |
| | | Total Silver (Ag) | 2009/09/26 | NC | | % | 20 |
| | | Total Strontium (Sr) | 2009/09/26 | 1.6 | | % | 20 |
| | | Total Thallium (Tl) | 2009/09/26 | NC | | % | 20 |
| | | Total Tin (Sn) | 2009/09/26 | NC | | % | 20 |
| | | Total Titanium (Ti) | 2009/09/26 | NC | | % | 20 |
| | | Total Uranium (U) | 2009/09/26 | 3.2 | | % | 20 |
| | | Total Vanadium (V) | 2009/09/26 | 4.8 | | % | 20 |
| | | Total Zinc (Zn) | 2009/09/26 | 1.9 | | % | 20 |
| | | Total Zirconium (Zr) | 2009/09/26 | NC | | % | 20 |
| 3446497 AA1 | Method Blank | Total Calcium (Ca) | 2009/09/26 | <0.05 | | mg/L | |
| | | Total Magnesium (Mg) | 2009/09/26 | <0.05 | | mg/L | |
| | | Total Potassium (K) | 2009/09/26 | <0.05 | | mg/L | |
| | | Total Sodium (Na) | 2009/09/26 | <0.05 | | mg/L | |
| | | Total Sulphur (S) | 2009/09/26 | <3 | | mg/L | |
| | RPD | Total Calcium (Ca) | 2009/09/26 | 0.9 | | % | 20 |
| | | Total Magnesium (Mg) | 2009/09/26 | 1.4 | | % | 20 |
| | | Total Potassium (K) | 2009/09/26 | 3.3 | | % | 20 |
| | | Total Sodium (Na) | 2009/09/26 | 2.5 | | % | 20 |
| | | Total Sulphur (S) | 2009/09/26 | NC | | % | 20 |
| 3447535 AA1 | Matrix Spike | | | | | | |
| | [Q87147-02] | Total Arsenic (As) | 2009/09/27 | | 115 | % | 80 - 120 |
| | | Total Beryllium (Be) | 2009/09/27 | | 112 | % | 80 - 120 |
| | | Total Cadmium (Cd) | 2009/09/27 | | 117 | % | 80 - 120 |
| | | Total Chromium (Cr) | 2009/09/27 | | 113 | % | 80 - 120 |
| | | Total Cobalt (Co) | 2009/09/27 | | 109 | % | 80 - 120 |
| | | Total Copper (Cu) | 2009/09/27 | | 109 | % | 80 - 120 |
| | | Total Lead (Pb) | 2009/09/27 | | 108 | % | 80 - 120 |
| | | Total Lithium (Li) | 2009/09/27 | | 108 | % | 80 - 120 |
| | | Total Nickel (Ni) | 2009/09/27 | | 109 | % | 80 - 120 |
| | | Total Selenium (Se) | 2009/09/27 | | 103 | % | 80 - 120 |
| | | Total Uranium (U) | 2009/09/27 | | 116 | % | 80 - 120 |
| | | Total Vanadium (V) | 2009/09/27 | | 114 | % | 80 - 120 |
| | | Total Zinc (Zn) | 2009/09/27 | | NC | % | 80 - 120 |
| | Spiked Blank | Total Arsenic (As) | 2009/09/27 | | 99 | % | 80 - 120 |
| | | Total Beryllium (Be) | 2009/09/27 | | 98 | % | 80 - 120 |
| | | Total Cadmium (Cd) | 2009/09/27 | | 99 | % | 80 - 120 |
| | | Total Chromium (Cr) | 2009/09/27 | | 102 | % | 80 - 120 |

WHITE MOUNTAIN CONSULTING
Attention: PAUL SPARLING
Client Project #:
P.O. #:
Site Reference:

# Quality Assurance Report (Continued)

Maxxam Job Number: VA952285

| QA/QC Batch Num Init | QC Type | Parameter | Date Analyzed yyyy/mm/dd | Value | Recovery | Units | QC Limits |
|---|---|---|---|---|---|---|---|
| 3447535 AA1 | Spiked Blank | Total Cobalt (Co) | 2009/09/27 | | 101 | % | 80 - 120 |
| | | Total Copper (Cu) | 2009/09/27 | | 105 | % | 80 - 120 |
| | | Total Lead (Pb) | 2009/09/27 | | 107 | % | 80 - 120 |
| | | Total Lithium (Li) | 2009/09/27 | | 101 | % | 80 - 120 |
| | | Total Nickel (Ni) | 2009/09/27 | | 102 | % | 80 - 120 |
| | | Total Selenium (Se) | 2009/09/27 | | 106 | % | 80 - 120 |
| | | Total Uranium (U) | 2009/09/27 | | 107 | % | 80 - 120 |
| | | Total Vanadium (V) | 2009/09/27 | | 100 | % | 80 - 120 |
| | | Total Zinc (Zn) | 2009/09/27 | | 105 | % | 80 - 120 |
| | Method Blank | Total Aluminum (Al) | 2009/09/27 | <0.2 | | ug/L | |
| | | Total Antimony (Sb) | 2009/09/27 | <0.02 | | ug/L | |
| | | Total Arsenic (As) | 2009/09/27 | <0.02 | | ug/L | |
| | | Total Barium (Ba) | 2009/09/27 | <0.02 | | ug/L | |
| | | Total Beryllium (Be) | 2009/09/27 | <0.01 | | ug/L | |
| | | Total Bismuth (Bi) | 2009/09/27 | <0.005 | | ug/L | |
| | | Total Boron (B) | 2009/09/27 | <50 | | ug/L | |
| | | Total Cadmium (Cd) | 2009/09/27 | <0.005 | | ug/L | |
| | | Total Chromium (Cr) | 2009/09/27 | <0.1 | | ug/L | |
| | | Total Cobalt (Co) | 2009/09/27 | <0.005 | | ug/L | |
| | | Total Copper (Cu) | 2009/09/27 | <0.05 | | ug/L | |
| | | Total Iron (Fe) | 2009/09/27 | <1 | | ug/L | |
| | | Total Lead (Pb) | 2009/09/27 | <0.005 | | ug/L | |
| | | Total Lithium (Li) | 2009/09/27 | <0.5 | | ug/L | |
| | | Total Manganese (Mn) | 2009/09/27 | <0.05 | | ug/L | |
| | | Total Molybdenum (Mo) | 2009/09/27 | <0.05 | | ug/L | |
| | | Total Nickel (Ni) | 2009/09/27 | <0.02 | | ug/L | |
| | | Total Selenium (Se) | 2009/09/27 | <0.04 | | ug/L | |
| | | Total Silicon (Si) | 2009/09/27 | <100 | | ug/L | |
| | | Total Silver (Ag) | 2009/09/27 | <0.005 | | ug/L | |
| | | Total Strontium (Sr) | 2009/09/27 | <0.05 | | ug/L | |
| | | Total Thallium (Tl) | 2009/09/27 | <0.002 | | ug/L | |
| | | Total Tin (Sn) | 2009/09/27 | <0.01 | | ug/L | |
| | | Total Titanium (Ti) | 2009/09/27 | <0.5 | | ug/L | |
| | | Total Uranium (U) | 2009/09/27 | <0.002 | | ug/L | |
| | | Total Vanadium (V) | 2009/09/27 | <0.2 | | ug/L | |
| | | Total Zinc (Zn) | 2009/09/27 | <0.1 | | ug/L | |
| | | Total Zirconium (Zr) | 2009/09/27 | <0.1 | | ug/L | |
| | RPD [Q87147-02] | Total Aluminum (Al) | 2009/09/27 | 1.3 | | % | 20 |
| | | Total Antimony (Sb) | 2009/09/27 | 2.4 | | % | 20 |
| | | Total Arsenic (As) | 2009/09/27 | 1.1 | | % | 20 |
| | | Total Barium (Ba) | 2009/09/27 | 1.1 | | % | 20 |
| | | Total Beryllium (Be) | 2009/09/27 | NC | | % | 20 |
| | | Total Bismuth (Bi) | 2009/09/27 | NC | | % | 20 |
| | | Total Boron (B) | 2009/09/27 | NC | | % | 20 |
| | | Total Cadmium (Cd) | 2009/09/27 | 2.8 | | % | 20 |
| | | Total Chromium (Cr) | 2009/09/27 | NC | | % | 20 |
| | | Total Cobalt (Co) | 2009/09/27 | 8.0 | | % | 20 |
| | | Total Copper (Cu) | 2009/09/27 | 1.8 | | % | 20 |
| | | Total Iron (Fe) | 2009/09/27 | 0.5 | | % | 20 |
| | | Total Lead (Pb) | 2009/09/27 | 3.1 | | % | 20 |
| | | Total Lithium (Li) | 2009/09/27 | 0.7 | | % | 20 |
| | | Total Manganese (Mn) | 2009/09/27 | 1.4 | | % | 20 |
| | | Total Molybdenum (Mo) | 2009/09/27 | 2.6 | | % | 20 |
| | | Total Nickel (Ni) | 2009/09/27 | 2.1 | | % | 20 |
| | | Total Selenium (Se) | 2009/09/27 | 2.2 | | % | 20 |

WHITE MOUNTAIN CONSULTING
Attention: PAUL SPARLING
Client Project #:
P.O. #:
Site Reference:

# Quality Assurance Report (Continued)

Maxxam Job Number: VA952285

| QA/QC Batch Num Init | QC Type | Parameter | Date Analyzed yyyy/mm/dd | Value | Recovery | Units | QC Limits |
|---|---|---|---|---|---|---|---|
| 3447535 AA1 | RPD [Q87147-02] | Total Silicon (Si) | 2009/09/27 | 3.1 | | % | 20 |
| | | Total Silver (Ag) | 2009/09/27 | NC | | % | 20 |
| | | Total Strontium (Sr) | 2009/09/27 | 2.3 | | % | 20 |
| | | Total Thallium (Tl) | 2009/09/27 | NC | | % | 20 |
| | | Total Tin (Sn) | 2009/09/27 | NC | | % | 20 |
| | | Total Titanium (Ti) | 2009/09/27 | NC | | % | 20 |
| | | Total Uranium (U) | 2009/09/27 | 3.2 | | % | 20 |
| | | Total Vanadium (V) | 2009/09/27 | NC | | % | 20 |
| | | Total Zinc (Zn) | 2009/09/27 | 4.4 | | % | 20 |
| | | Total Zirconium (Zr) | 2009/09/27 | NC | | % | 20 |
| 3448177 AA1 | Method Blank | Total Calcium (Ca) | 2009/09/27 | <0.05 | | mg/L | |
| | | Total Magnesium (Mg) | 2009/09/27 | <0.05 | | mg/L | |
| | | Total Potassium (K) | 2009/09/27 | <0.05 | | mg/L | |
| | | Total Sodium (Na) | 2009/09/27 | <0.05 | | mg/L | |
| | | Total Sulphur (S) | 2009/09/27 | <3 | | mg/L | |
| | RPD [Q87147-02] | Total Calcium (Ca) | 2009/09/27 | 0.8 | | % | 20 |
| | | Total Magnesium (Mg) | 2009/09/27 | 0 | | % | 20 |
| | | Total Potassium (K) | 2009/09/27 | 0.8 | | % | 20 |
| | | Total Sodium (Na) | 2009/09/27 | 1.6 | | % | 20 |
| | | Total Sulphur (S) | 2009/09/27 | 4.2 | | % | 20 |

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Maxxam Analytics

8577 Commerce Court
Burnaby, BC V5A 4N5
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Toll Free: 1-800-440-4808

## CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST



MAXXAM JOB # A-952285 ANALYSIS REQUEST **F 143847**

LAB USE ONLY

| | |
|---|---|
| COMPANY NAME: White mountain | PH. #: <br> E-mail: <br> FAX #: |
| COMPANY ADDRESS: | CLIENT PROJECT ID: (#) |
| SAMPLER NAME (PRINT): | PROJECT MANAGER: |

| # | FIELD SAMPLE ID | MAXXAM LAB # (Lab Use Only) | MATRIX: GROUND WATER | SURFACE WATER | SOIL | DRINKING WATER | OTHER | # CONTAINERS | SAMPLING: DATE DD/MM/YY | TIME | HEADSPACE VAPOUR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 INT | Q87145 | | | | | | | | | |
| 2 | 2 INT | 46 | | | | | | | | | |
| 3 | 3 INT | 47 | | | | | | | | | |
| 4 | 4 INT | 48 | | | | | | | | | |
| 5 | 5 INT | 49 | | | | | | | | | |
| 6 | 6 INT | 50 | | | | | | | | | |
| 7 | 7 INT | 51 | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| 11 | | | | | | | | | | | |
| 12 | | | | | | | | | | | |

| # | BTEX / LH ☐ / BTEX / VPH ☐ / MTBE ☐ | VOC's / VPH ☐ | EPH ☐ / TEH ☐ | PAH ☐ / LEPH/HEPH ☐ | CCME-PHC (FRACTIONS 1-4 PLUS BTEX) | CCME-PHCS (FRACTIONS 2-4) | CCME BTEX (FRACTION 1 PLUS BTEX) | PHENOLS BY 4AAP ☐ / PHENOLS BY GCMS ☐ | TOTAL O&G ☐ / MINERAL O&G ☐ | Dissolved Metals: Field Filtered? YES ☐ NO ☐ | Field Preserved? YES ☐ NO ☐ | Total Metals Field Preserved? YES ☐ NO ☐ | NITRATE ☐ / NITRITE ☐ / AMMONIA ☐ | CHLORIDE ☐ / FLUORIDE ☐ / SULPHATE ☐ | TOTAL SUSPENDED SOLIDS (NFR) | CYANIDE SAD ☐ / WAD ☐ | LEACHABLE LEAD (AA) ☐ (TCLP) ☐ | LEACHABLE BTEX (AA) ☐ (TCLP) ☐ | metals, Used FORO QUOTE in Client | HOLD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | | | | | 4 | |
| 2 | | | | | | | | | | | | | | | | | | | 4 | |
| 3 | | | | | | | | | | | | | | | | | | | 4 | |
| 4 | | | | | | | | | | | | | | | | | | | 4 | |
| 5 | | | | | | | | | | | | | | | | | | | 4 | |
| 6 | | | | | | | | | | | | | | | | | | | 4 | |
| 7 | | | | | | | | | | | | | | | | | | | 4 | |
| 8 | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | |

TAT (Turnaround Time)

**<5 DAY TAT MUST HAVE PRIOR APPROVAL**

*some exceptions apply please contact lab*

| | | |
|---|---|---|
| STANDARD | 5 BUSINESS DAYS | ☐ |
| RUSH | 3 BUSINESS DAYS | ☐ |
| RUSH | 2 BUSINESS DAYS | ☐ |
| URGENT | 1 BUSINESS DAY | ☐ |

OTHER BUSINESS DAYS ____

**CUSTODY RECORD**

P.O. NUMBER / QUOTE NUMBER:

SPECIAL DETECTION LIMITS / CONTAMINANT TYPE:

☐ CCME
☐ CSR
☐ ALBERTA TIER 1
☐ OTHER

ACCOUNTING CONTACT:

SPECIAL REPORTING OR BILLING INSTRUCTIONS:

# SOIL JARS USED AND NOT SUBMITTED:

LAB USE ONLY

| ARRIVAL TEMPERATURE °C: | DUE DATE: | LOG IN CHECK: |
|---|---|---|
| | | |

| | | | |
|---|---|---|---|
| RELINQUISHED BY SAMPLER: | DATE: DD/MM/YY | TIME: | RECEIVED BY: |
| RELINQUISHED BY: | DATE: DD/MM/YY | TIME: | RECEIVED BY: |
| RELINQUISHED BY: | DATE: [illegible] | TIME: [illegible] | RECEIVED BY LABORATORY: [illegible] |

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Toll Free: 1-800-440-4808

**CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST** PAGE 2 OF 2

MAXXAM JOB # ANALYSIS REQUEST F 143913

PANY NAME: White mountain
PH. #:
E-mail:
FAX #:
IPANY ADDRESS:
CLIENT PROJECT ID: (#)
PLER NAME (PRINT):
PROJECT MANAGER:

LAB USE ONLY

| FIELD SAMPLE ID | MAXXAM LAB # (Lab Use Only) | MATRIX: GROUND WATER | SURFACE WATER | SOIL | DRINKING WATER | OTHER | # CONTAINERS | SAMPLING: DATE DD/MM/YY | TIME | HEADSPACE VAPOUR | BTEX / LH / BTEX / VPH / MTBE | VOC's / VPH | EPH / TEH | PAH / LEPH/HEPH | CCME-PHC (FRACTIONS 1-4 PLUS BTEX) | CCME-PHCS (FRACTIONS 2-4) | CCME BTEX (FRACTION 1 PLUS BTEX) | PHENOLS BY 4AAP / PHENOLS BY GCMS | TOTAL O&G / MINERAL O&G | Dissolved Metals: Field Filtered? YES / NO | Field Preserved? YES / NO | Total Metals Field Preserved? YES / NO | NITRATE / NITRITE / AMMONIA | CHLORIDE / FLUORIDE / SULPHATE | TOTAL SUSPENDED SOLIDS (NFR) | CYANIDE SAD / WAD | LEACHABLE LEAD (AA) (TCLP) | LEACHABLE BTEX (AA) (TCLP) | Metals, used Form Quire in client | | | | | | | | | | HOLD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 BOT | 087152 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | |
| 2 BOT | 53 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | |
| 3 BOT | 54 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | |
| 4 BOT | 55 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | |
| 5 BOT | 56 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | |
| 6 BOT | 57 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | |
| 7 BOT | 58 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | |

TAT (Turnaround Time)
**5 DAY TAT MUST HAVE PRIOR APPROVAL**
*some exceptions apply please contact lab*
- NDARD 5 BUSINESS DAYS ☐
- H 3 BUSINESS DAYS ☐
- H 2 BUSINESS DAYS ☐
- ENT 1 BUSINESS DAY ☐
- IER BUSINESS DAYS ____

P.O. NUMBER / QUOTE NUMBER:

SPECIAL DETECTION LIMITS / CONTAMINANT TYPE:
☐ CCME
☐ CSR
☐ ALBERTA TIER 1
☐ OTHER

LAB USE ONLY
ARRIVAL TEMPERATURE °C: | DUE DATE: | LOG IN CHECK:

ACCOUNTING CONTACT:

SPECIAL REPORTING OR BILLING INSTRUCTIONS:

# SOIL JARS USED AND NOT SUBMITTED:

| | | | |
|---|---|---|---|
| RELINQUISHED BY SAMPLER: | DATE: DD/MM/YY | TIME: | RECEIVED BY: |
| RELINQUISHED BY: | DATE: DD/MM/YY | TIME: | RECEIVED BY: |
| RELINQUISHED BY: | DATE: DD/MM/YY 9/22/09 | TIME: 10:00 | RECEIVED BY LABORATORY: Mu |

CUSTODY RECORD