

**2005**

**AQUATIC LIFE SAMPLING AND TESTING PROGRAM  
FOR THE ANVIL RANGE MINE SITE,  
ROSE AND VANGORDA CREEK WATERSHEDS,  
FARO, YUKON**

**TO MEET THE REQUIREMENTS OF WATER LICENSE QZ03-059**

**Conducted: During August, 2005**

**Prepared for Delloite and Touche Inc.**

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## 1.0 Introduction

The following report details the results of the second consecutive year of field investigations conducted under the *Aquatic Life Sampling and Testing Program* for the Anvil Range Mine Site at Faro, Yukon, as required under water license QZ03-059. Field investigations for this project were conducted during August, 2005 under the authority of License to Collect Fish No. 05-18, issued by the Department of Fisheries and Oceans.

The primary goal of this investigation is to annually sample watersheds potentially affected by the Faro and Vangorda Plateau mine sites. Specific sites within the Rose and Vangorda Creek watersheds were investigated to track the presence, relative abundance and condition of fish. From each sampling site, flesh samples from slimy sculpin (*Cottus cognatus*) and Arctic grayling (*Thymallus arcticus*) were taken and analyzed to determine the level of metals in fish tissue.

The investigation also continued the collection of quality data on fish habitats and fish utilization suitable for use in long term monitoring. The sampling methods used in 2005 were as similar as possible to the 2004 investigations to allow comparison between annual data sets.

## 2.0 Study Area

Investigations were conducted within the Rose and Vangorda Creek watersheds in potentially affected waters as well as on control (unaffected) sites on Anvil and Blind Creeks. The following sites were sampled during the investigation:

Sample sites associated with Rose Creek (Figure 1):

- R1 South Fork of Rose Creek immediately upstream of the confluence of North and South Fork of Rose Creek;
- R2 The mixing zone downstream of the intersection of Rose Creek and the tailings pond discharge channel (not flowing at time of investigation);
- R4 Rose Creek just upstream of the confluence with Anvil Creek; and
- R6 Anvil Creek just upstream of the confluence with Rose Creek (control site).

Sampling sites associated with Vangorda Creek (Figure 2):

- V8 Lower Vangorda Creek below the town access road; and
- B1 Blind Creek near the lower bridge (control site)

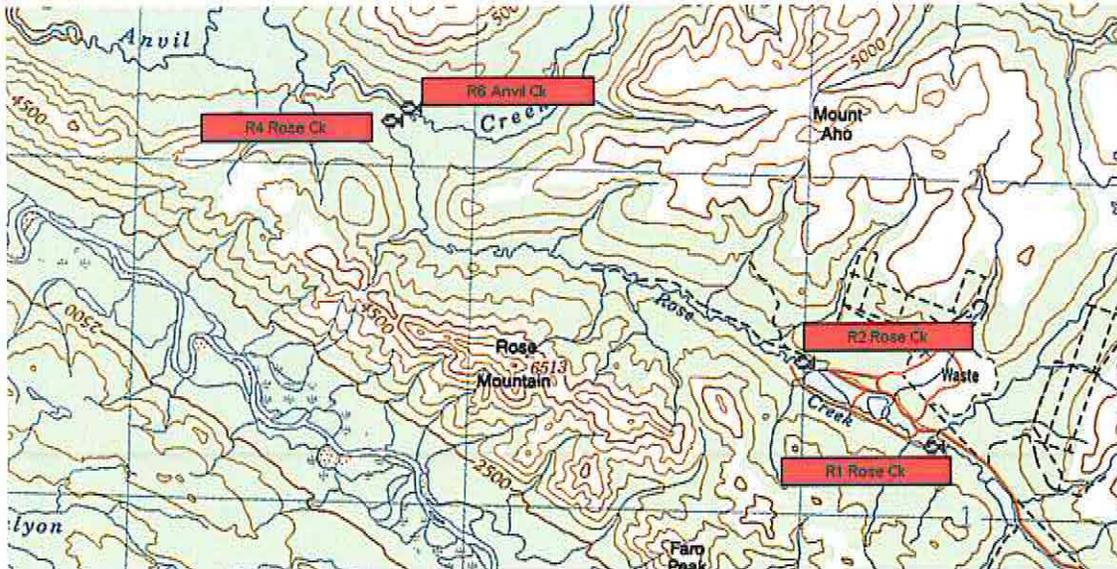


Figure 1: Sample sites associated with Rose Creek from 1:250,000 105K Tay River topographic map.

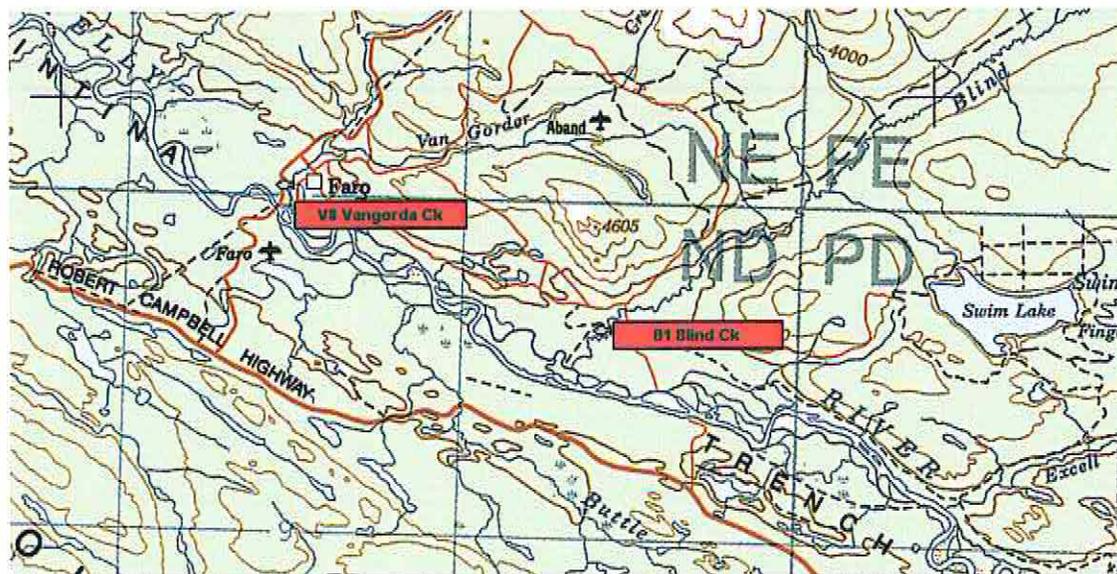


Figure 2: Sampling sites associated with Vangorda Creek from 1:250,000 105K Tay River topographic map.

### 3.0 Methods

Field investigations were conducted between August 15 and 20, 2005 when water levels were low and fish distribution was at its seasonal peak. This timing corresponds with the previous investigations which were conducted from August 9 to 16, 2004.

At each sample location the same 100 meters representative reach as sampled during 2004 was assessed. UTM locations for the downstream end of each sample reach was recorded and referenced with locations recorded during 2004 to ensure re-sampling of the same locations. The two sample sites near the confluence of Rose and Anvil Creeks were accessed with a helicopter; all other sample sites were accessed by road.

The general description of fish habitats compiled in 2004 was re-evaluated for each site, including; the site location, flow parameters consisting of velocities (floating object method), depth, wetted and channel width, substrates, channel configuration, bank stability, water temperature, riparian vegetation and an assessment of available fish cover. Photographs representative of each site showing current year conditions were taken.

The principle fish collection technique used was electro-fishing. Secondary techniques included minnow trapping, angling, and beach seining. Crew members wore polarized glasses at all times to enhance fish viewing abilities and all visual observations of fish were recorded.

Electro-fishing was conducted with a Smith-Route POW type 12A battery powered, back pack electro-fisher. The electro-fisher operator was accompanied by 2 crew members with dip nets. Each site was investigated using a single pass technique with sampling effort similar to that of 2004. Each site was sampled by moving in an upstream direction and sweeping from side to side through each reach; all shoreline areas were fished and attempts at covering all mid-stream habitats were made. Mid channel efforts were difficult and dangerous in flows exceeding 1 meter per second with a depth greater than 0.8 meters, sites with these conditions were not sampled. Effort extended by electro-fishing ranged from 849 to 1,043 seconds of shocking time per site.

Minnow trapping was conducted with "Gee type" minnow traps (¼" mesh), shown to be highly effective for the capture of Yukon River juvenile chinook salmon (jcs). Traps were baited with salmon roe (Yukon River origin) suspended in the trap in a perforated plastic bag, and were set in a variety of habitat types. Traps were set for an overnight period with soak times varying from 13.9 to 26.1 hours.

Beach seining was only conducted to collect metal analysis specimens from Blind Creek. Catch per unit effort from seining was not calculated as the effectiveness of seine pulls varied due to such factors as shoreline configuration, bottom substrates, water depth and velocity. Area seined and seine catches were recorded in a field note book.

Angling was conducted with light spin casting gear and a variety of small lures. Effort was recorded as minutes fished and all fish captured or observed were recorded.

All fish captured were handled delicately to allow for live release after sampling. Anaesthetics were not used. All fish captured or observed were identified as to species and general life stage (fry, juvenile, sub-adult, adult), a sub-sample was measured for fork length ( $\pm 1$  mm) and then released unharmed as near as possible to the location from which they were sampled. All fish captured or observed were recorded into a field book and the information was later entered into computer format.

### **3.1 Metal Sample Collection and Analysis**

Fish samples for metal content analysis were collected during the course of general sampling. A maximum of 5 Arctic grayling and 5 slimy sculpins samples were collected from each site for analysis of metals in tissue. Extra effort by electro-fisher or angling was conducted to collect Arctic grayling from several of the sites and extra seine and minnow trap effort was conducted at Blind Creek to procure slimy sculpin samples.

Arctic Grayling with a fork length  $>200$  mm were selected for tissue sampling and sculpins 80 mm or longer were selected when possible. At sites where less than 5

sculpins over 80 mm in length were caught, a composite sample of 2 or more individual sculpins was utilized.

Specimens collected for metal sample analysis were placed into labeled zip loc baggies immediately after capture. The collected specimens were sampled later in a controlled environment. For sacrificed Arctic grayling, internal and external observations of fish health, sex and maturity, diet, fork length and round weight was recorded. From each grayling a sample of approximately 50 grams for metal content analysis was taken from the caudal area and placed in separate labeled bags. Stomach contents were analyzed at the time of sampling.

For slimy sculpins sacrificed, the total length and round weight for each specimen was recorded, including the individuals from composite samples. Each sculpin sample was bagged and labeled separately; each composite sample was bagged and labeled as a single sample.

Sample data collected from Arctic grayling was entered to a computer format. Stomach content analysis for Arctic grayling was evaluated and coded.

The tissue samples were submitted to Norwest Labs for metals analysis. Metal analysis included microwave acid digest for ICP metals and metals semi trace in tissue. The metal results were expressed as ug/gram. The lab technique used to analyze the 2005 samples was an upgrade from the process used in 2004, resulting in lower detection limits for some metals and higher detection limits for others. Mercury content was not analyzed for in the 2005 samples.

## **4.0 Results**

The sample sites showed little physical variations since 2004 and fish habitats remained stable at all sample locations, all changes observed were noted. In general water levels were greater in 2005 than in 2004. An updated general description of fish habitats and a representative photo from 2005 for each site has been presented in Appendix 1.

Fish distribution and utilization varied between each site; a summary of electro fishing results has been presented in Table 1, a summary of minnow trapping results has been presented in Table 2 and a complete listing of all minnow trapping results has been presented in Appendix 4. Angling records have been presented in Table 3.

Arctic grayling adults were common at most sites, the exceptions being site R6 where they were few and difficult to capture and at site R2 where no adult Arctic grayling were observed. Slimy sculpin were uncommon and difficult to capture at Blind Creek, were uncommon at site V8, and common at the other sites.

Juvenile chinook salmon (jcs) were recorded throughout the study area with the exceptions of R1 and R6. Jcs were far more abundant at B1 and V8 than sites associated with Rose Creek; however numbers of jcs captured at these sites were lower than those recorded during 2004.

A total of 22 Arctic grayling were taken for metal analysis, no adult grayling were captured at site R4 and only 2 were obtained from R6, a complete set of five Arctic grayling were taken from each of the other sites. Lengths ranged from 249 to 362 mm and weight from 150 to 536 grams. A complete listing of sample information for specimens collected has been presented in Appendix 3.

Slimy sculpin taken for metals analysis ranged in length from 52 to 112 mm. The weights of the 18 single fish sculpin samples ranged from 7 to 14 grams. Composite samples of two or more slimy sculpins were prepared from most sites, a total of 12 composite samples were taken.

Stomach content analysis from all Arctic grayling sampled combined consisted of 55% Tricoptera compared with 64% Tricoptera in 2004. In 2004, 23% of the remaining diet consisted of unidentified benthic organisms (mosquitoes or chironomids); the 2005 diet was more varied with 17% consisting of fish remains, including grayling fry, juvenile chinook salmon and slimy sculpins, 9% bees and wasps, 9% ants and 5% chinook salmon eggs. Sample information for stomach content analysis has been presented in Appendix 3 in conjunction with all other sample information for the fish sacrificed for metal sample analysis.

Metal content in fish flesh was generally higher in 2005 than in 2004 although still lower than 2002 and 1997 levels. Vangorda Creek continues to show the highest metal levels of the sample sites and Blind Creek the lowest. Zinc levels were noticeably higher at most sample stations for 2005, however still consistent with the general trend in lower metal concentrations from historical data (Gartner Lee, 2003). A summarized average of 5 key metals from each site for Arctic grayling and slimy sculpin has been presented in Tables 4 and 5 respectively. A complete analytical reporting of all metal content analysis is presented in Appendix 2. The metal analysis procedure conducted during 2005 was more refined than the procedure used in 2004, resulting in lowering of detection limits for several metals, this is especially evident in the manganese content where detection limits were 2.0 ug/g in 2004 and 0.05 ug/g in 2005.

Aluminum levels in slimy sculpin typically ranged between 10 and 40 ug/g. A single sculpin from site R2 (#3) had a content of 273 ug/g, and a multiple fish sample (#1) from Blind Creek had a content of 968 ug/g. The high aluminum levels recorded are likely either an artifact of sampling or a lab error, the samples the high aluminum content were recorded in did not have any other noticeably high metal content values.

## **4.1 Site Summary: R1 Rose Creek**

### **4.1.a Fish Habitat and Utilization**

Arctic grayling adults were present although habitat for large adults was limited, Arctic grayling juveniles were present and common. Slimy sculpin adults continue to be common. Juvenile chinook salmon were not recorded at this site during 2005 investigations. Burbot, sub adults, were captured at this site during both 2004 and 2005.

Electro-fishing consisting of 849 seconds of effort conducted through the 100 meter reach. Fish recorded by electro-fishing consisted of 13 Arctic grayling juveniles, 41 slimy sculpin adults and 2 burbot sub-adults (Table 1).

Minnow trapping at site R1 consisted of 9 traps set for approximately 18.1 hours each. The total catch from minnow trapping consisted of 1 slimy sculpin and 2 arctic grayling juveniles (Table 2).

Angling effort at site R1 for 45 minutes and produced a catch of 4 Arctic grayling adults (Table 3).

#### 4.1.b Metal Samples

Samples taken for metal analysis included 5 Arctic grayling adults and 5 slimy sculpin adults as single fish samples.

The Arctic grayling samples ranged in length from 249 to 282 mm, and in weight from 150 to 229 gms. The sample was comprised of 3 mature males and 2 mature female. Stomach contents consisted of 25% Tricoptera, 25% salmon eggs, 15% slimy sculpin and 35% unidentified.

The salmon eggs observed in the stomach were found in a single adult male and appear to be fertilized and viable eggs (Photo # 1), indicating an adult chinook salmon had spawned nearby. No spawning site was observed however potential sites do exist at the confluence of the North and South Fork of Rose Creek (immediately downstream of site R1) or within the diversion channel downstream of site R1 and the Pump House Pond.

The individual sculpin samples ranged in length from 94 to 102 mm and in weight from 10.2 to 11.0 gms.

Concentrations of most metals in Arctic grayling and slimy sculpin taken from R1 in 2005 (Table 4 and 5) were slightly higher than recorded during 2004, but remain lower than the other sites associated with Rose Creek. Zinc levels in slimy sculpin (Table 5) were substantially higher in 2005 than those recorded during 2004; however Zinc levels in Arctic grayling were lower in 2005 than in 2004.



Figure 3: Photograph of Arctic grayling captured at site R1, showing stomach contents. Note that the chinook salmon eggs are of a bright orange color and are at an eyed stage, indicating the eggs were spawned and fertilized.

## **4.2 Site Summary: R2 Rose Creek**

### **4.2.a Fish Habitat and Utilization**

This site provides a wide variety of habitats, including riffles, rapids, glide areas and deep corner and side pools. Arctic grayling adults were absent from this site during 2005 investigations. Slimy sculpin were abundant; however both electro-fishing and minnow trapping showed a decline in sculpin numbers of approximately 30% from 2004 investigations. Jcs were uncommon at this site during 2005; with no jcs recorded in the minnow traps compared with 21 captured in 2004. A total of 2 jcs were recorded during electro-fishing during 2005 and no jcs were recorded by electro-fishing during 2004. Sub-adult burbot were observed to be more common during 2005 than in 2004.

Electro-fishing consisting of 884 seconds of effort was conducted through the entire 100 meter reach downstream of the tailings pond channel (Table 1). Slimy sculpin were abundant in riffle areas with a total of 76 adults and 7 fry captured. Arctic grayling adults were not recorded by electro-fishing or angling, additional visual inspections and angling effort were conducted and no grayling adults were observed.

Minnow trapping at site R2 consisted of 9 traps set for approximately 15.9 hours each. The total catch from the minnow trapping consisted of 2 adult slimy sculpin and 4 burbot (Table 2). The minnow traps set at R2 during 2005 were all set downstream of the confluence of the tailings pond channel with Rose Creek, in 2005 all traps were set upstream of this point. This may be related to the lack of jcs captured during 2005 in minnow traps.

Angling for a 45 minute period downstream of the tailings pond channel captured no Arctic grayling. Extra effort of 60 minutes angling down stream of the sample site for a distance of a further 800 meters also had no success (Table 3). Extensive visual observations to denote grayling presence was conducted at this time and no adult grayling were observed, visibility was excellent.

### **4.2.b Metal Samples**

Samples taken for metal analysis consisted of 4 single slimy sculpin adults and one composite sample of 2 sculpins, no Arctic grayling were captured. All of the sculpin came from an area of Rose Creek immediately downstream of the confluence with the tailings pond channel.

The four individual sculpin samples ranged in length from 103 to 112 mm and in weight from 13.6 to 15.0 gms. The single composite sample was composed of 2 sculpins 95 and 85 mm in length with a combined weight of 13.4 gms.

Metal content in sculpins from R2 showed the greatest increase of all sites sampled between 2004 and 2005 for both zinc and lead. Zinc levels at R2 from the 2005 sculpin sample are the highest of all sites sampled this year (Table 5), The 2004 samples from R2 had the lowest zinc levels of the sample sites. The levels recorded in 2005 are still lower than those reported from 2002 (Gartner Lee, 2003). A single sculpin sample from site R2 had elevated levels of most metals in comparison with all other fish sampled during 2005.

### **4.3 Site Summary: R4 Rose Creek**

#### **4.3.a Fish Habitat and Utilization**

Fish utilization of site R4 was low. Slimy sculpins were difficult to catch and specimens captured were small, as in 2004. Arctic grayling were occasional, dispersed and difficult to capture except in the area immediately upstream of Anvil creek. Jcs were recorded in the minnow trapping, however were uncommon.

Electro-fishing was conducted through all areas of the 110 meter reach and 1,043 seconds of effort recorded a total of 34 slimy sculpin small adults, 11 sculpin sub-adults, 6 sculpin fry and 6 Arctic grayling juveniles (Table 1).

Minnow trapping at site R4 consisted of 9 traps set for approximately 26.1 hours each. The total catch from minnow trapping consisted of 3 jcs (Table 2).

Angling for 30 minutes near the confluence with Anvil Creek, immediately below the actual sample reach captured 6 Arctic grayling adults (Table 3).

#### **4.3.b Metal Samples**

A complete sample of 5 Arctic grayling adults were taken from R4. The grayling ranged in length from 325 to 358 mm, in weight from 377 to 469 gms and consisted of three adult males and two mature females. The stomach contents from Arctic grayling consisted predominantly of Trichoptera with a small amount of bees and wasps.

The five slimy sculpin samples consisted of; 3 whole fish 92 to 96 mm in length, 7.7 to 10.2 gms and two composite samples; a two fish sample of 85 and 84 mm with a combined weight of 12.0 gms and another two fish sample of 76 and 80 mm with a combined weight of 9.0 gms.

Arctic grayling from 2005 on average showed higher metal levels than from 2004, zinc and manganese the exceptions were both lower. The high manganese average is attributable to a single grayling with a manganese level of 30.1 ug/g of manganese which was lower than a single grayling sampled in the 2004. The levels of manganese at this site, for both species of fish, remain the highest of all sites sampled.

Concentrations of metals in fish tissue at site R4 for both Arctic grayling (Table 4) and slimy sculpin (Table 5) were on average slightly higher than for any others recorded during the 2005 investigation. Manganese levels were considerably higher in slimy sculpins than at any other site.

### **4.4 Site Summary: R6 Anvil Creek**

#### **4.4.a Fish Habitat and Utilization**

Flows in Anvil Creek were only slightly higher than in 2004; however the increase in flows created challenges in sampling for fish that limited the effectiveness of the fish utilization investigation. Fast and deep water precluded sampling in most of the mid channel habitats.

Fish utilization of this reach appeared low. Arctic grayling adults were uncommon and difficult to capture. Slimy sculpin adults were uncommon and slimy sculpin fry were occasional within the sampled habitats.

Electro-fishing, conducted by moving back and forth across the entire width of the creek to cover the entire 100 meter reach was not possible. Shoreline shocking along the left bank and the very lower left bank consisted of 1,021 seconds of effort and recorded 19 slimy sculpin adults, 24 sub adults and 1 fry (Table 1). Slimy sculpin were captured predominantly in areas with significant flows and near the small side channel on the left bank. No other fish were recorded during electro-fishing.

Minnow trapping at site R6 consisted of 9 traps set for approximately 25.4 hours each. The total catch from the minnow trapping was 2 adult slimy sculpin (Table 2).

A single Arctic grayling was captured during 50 minutes of Angling effort at the actual sample reach. An additional 30 minutes of angling at a pool 800 meters upstream of the site captured 1 more Arctic grayling; numerous grayling were observed at this site (Table 3).

#### **4.4.b Metal Samples**

Samples taken for metal analysis at site R6 included 2 adult Arctic grayling, both mature males. The Arctic grayling samples had lengths of 362 and 282 mm, and weights of 536 and 232 gms respectively. Stomach contents consisted of 40% Trichoptera, 40% ants and 20% wasps.

Slimy sculpin samples consisted of 2 individual fish samples both measuring 97 mm and weighing 9.9 and 8.0 grams. The other 3 samples were composites comprised of 2 fish each all in the range of 73 to 89 mm in length with combined weight totals of 10.2, 11.1 and 9.1 grams.

The concentrations of metals in fish tissue from R6 taken in 2005 remained slightly lower than those from sample sites within Rose Creek (Tables 4 and 5). Metal levels were generally lower than in 2004.

### **4.5 Site Summary: V8 Vangorda Creek**

#### **4.5.a Fish Habitat and Utilization**

Fish habitats at the Vangorda Creek sample site were slightly modified at the downstream end of the sample reach by bridge construction. The sample site extends upstream from the location of the Town of Faro sewage force main. Modifications to the bridge adjacent to the sewer line were in progress during the sample period. The active erosion observed during 2004 has begun to stabilize in the upper section of the sample reach; however erosion near the bridge site continues to further expose the sewage force main.

The reach of Vangorda Creek investigated had extensive utilization by several fish species. Notably, jcs were very abundant, Arctic grayling sub- adults were common, Arctic grayling juveniles were occasional and slimy sculpin were uncommon.

Electro-fishing was conducted for a total of 1,015 seconds through the entire 120 meter reach (Table 1). Sampling time for this site was longer than at other sites due to turbid conditions and the large number of fish recorded. Fish recorded included 5 slimy sculpin adults, 189 jcs 2 Arctic grayling adults and 1 sub-adult. Additional electro fishing for 800 seconds for 40 meters above the sample reach and for 100 meters downstream was extended to capture Arctic grayling and slimy sculpin for metal samples. Shocking was

conducted moving downstream at least at the speed of the current and captured 2 slimy sculpin adults, 5 Arctic grayling adults and 2 sub adults.

Minnow trapping at site V8 consisted of 9 traps set for approximately 24.3 hours each. The total catch from the minnow trapping consisted of 164 jcs, for an average of 18 jcs per trap (Table 2) in comparison to 2004 when minnow traps captured 49 jcs per trap. Jcs from V8 had an average length of 73.6 mm and ranged in length from 60 to 91 mm (n=15).

Angling in Vangorda Creek was attempted but the small channel and extensive vegetation limit the angling opportunities. Angling for 15 minutes produced zero fish (Table 3).

#### **4.5.b Metal Samples**

A complete set of 5 Arctic grayling samples were taken. They ranged in length from 262 to 329 mm, and in weight from 172 to 391 gms. The samples consisted of 4 mature males and 1 mature female. Stomach analysis indicated a diet consisting of 31% Tricoptera, 46% fish remains (66% juvenile arctic grayling and 33% jcs), 6% Coleoptera, and 17% unidentified.

Sculpins taken for metal analysis consisted of 3 individual samples and 2 composite samples of 2 fish each. The individual sculpin samples ranged in length from 79 to 92 mm and in weight from 7.0 to 10.5 gms. The 2 composite samples were composed of 2 fish each measuring 71, 74 mm and 70, 65 mm with combined weights of 8.1 and 7.2 grams respectively.

Concentrations of metals in fish tissue for both fish species from V8 increased in 2005 from levels recorded in 2004 (Tables 4 and 5). Zinc levels in grayling from the 2005 sample compared to the 2004 sample were more than twice as high, however zinc levels in sculpins was slightly lower, and both species were still much lower than recorded during 1976 and 2002 (Gartner Lee 2003).

## **4.6 Site Summary: B1**

### **4.6.a Fish Habitat and Utilization**

Electro-fishing was not conducted on Blind Creek at the request of the Department of Fisheries and Oceans due to the presence of spawning adult chinook salmon. A chinook salmon enumeration weir located 50 meters downstream of the bridge was removed just prior to the time of sampling. Adult salmon were observed in the study reach, several redds downstream of the weir site were noted to have less utilization than in 2004, several redds upstream of the bridge that were utilized in 2004 were inactive during 2005 sampling.

Arctic grayling were in groups throughout the study area and slimy sculpin were uncommon except near salmon redds. Grayling were more abundant in deep corner pools 100 to 200 meters above the sample reach. Jcs were abundant throughout the entire study area and in all habitats. The jcs in Blind Creek had an average length of 60.7 mm and ranged in length from 46 to 75 mm (n=49). Also recorded were 6 jcs aged 1+ ranging in length from 98 to 120 mm with an average length of 105 mm and an average weight of 9.0 grams.

Table 1: Summary of electro-fishing results collected during investigations conducted as part of the Aquatic Life Sampling and Testing Program, conducted near Faro, Yukon during August of 2005, 2004 data is presented below for comparison.

Sample Site	Date Sampled	Sample Effort (seconds)	Sample Effort (area)	Arctic Grayling	Slimy Sculpin	Burbot	Juvenile chinook salmon	Round Whitefish
<b>2005</b>								
R1	Aug. 18	849	100 m.	13 juv.	41 ad.	2 sub ad.	0	0
R2	Aug. 19	884	100 m.	16 sub ad. 1 juv.	76 ad. 7 fry	7 sub ad.	2	0
R4	Aug. 17	1,043	110 m.	6 juv.	34 ad, 11 sub.ad. 6 fry	0	0	0
R6	Aug. 17	1,021	100 m.	0	19 ad. 24 sub.ad 1 fry	0	0	0
V8	Aug. 18	1,015	120 m.	2 ad. 1 sub ad.	5 ad	0	189	0
V8 extra	Aug. 18	800	140 m	5 ad. 2 sub ad.	2 ad.	0	not counted	0
<b>2004</b>								
R1	Aug. 14	835	100 m.	3 ad. and 15 fry	29 ad.	2 sub. ad	3	1 ad
R2	Aug. 15	741	100 m.	2 ad.	116 ad. 8 fry	2 sub. ad	0	0
R4	Aug. 13	875	110 m.	1 sub.ad.	25 ad.	0	0	0
R6	Aug. 13	875	100 m.	1 ad	25 ad, 1 fry	0	0	0
V8	Aug. 15	1,012	120 m.	11 sub. ad. 6 juv.	7	0	168	1 ad.

Summary of abbreviations: ad= adult, juv.= juvenile, sub. ad.= sub adult

Table 2: Summary of minnow trapping results (combined) collected during investigations conducted as part of the Aquatic Life Sampling and Testing Program, conducted near Faro, Yukon during August of 2005, 2004 data is presented below for comparison. A complete data set of minnow trapping results has been presented in Appendix 2.

Sample Site	Date Set 2005	Number of traps set	Average Effort in Hours	Arctic Grayling	Slimy Sculpin	Burbot	Juvenile chinook salmon	1+ chinook salmon
<b>2005</b>								
R1	Aug.	9	18.1	2	1	0	0	0
R2	Aug.	9	15.9	0	2	4	5	0
R4	Aug.	9	26.1	0	3	0	0	0
R6	Aug.	9	25.4	0	2	0	0	0
V8	Aug.	9	24.3	0	0	0	164*	0
B1	Aug.	26	17.2	2	6	0	1,045**	6
<b>2004</b>								
R1	Aug. 13	8	18.4	1	3	0	1	0
R2	Aug. 14	14	23.5	0	2	2	21	0
R4	Aug. 12	8	17.6	0	0	0	3	0
R6	Aug. 12	8	17.0	0	4	0	0	0
V8	Aug. 14	8	14.8	0	0	0	391	0
B1	Aug. 14	13	13.9	0	1	0	572	4

\* average catch per trap for site V8= 18.2 jcs per trap

\*\* average catch per trap for site B1= 40.2 jcs per trap

Table 3: Summary of angling effort and catches from effort exerted during investigations conducted as part of the Aquatic Life Sampling and Testing Program, conducted near Faro, Yukon during August of 2005.

Sample site	Date	Effort	Catch	
R1	Aug 18	45 minutes	4 Arctic grayling	
R2	Aug 19	105 minutes	0	observe 0 Ag
R4	Aug 17	30 minutes	5 Arctic grayling	
R6	Aug 17	50 minutes	1 Arctic grayling	
R6 Alternate*	Aug 18	30 minutes	1 Arctic grayling	numerous Ag observed
V8	Aug 18	15 minutes	0	poor angling location
B1	Aug 20	70 minutes	7 Arctic grayling	lost 5 Ag

\*The alternate site R6 is located approximately 800 meters upstream on Anvil Creek from the established R6 sample site.

Table 4: Summary of averages for key metal concentrations (expressed as ug/g) from Arctic grayling tissue collected as part of the Aquatic Life Sampling and Testing Program, conducted near Faro, Yukon during August of 2005, 2004 is presented below for comparison.

Site	R1	R2	R4	R6	V8	B1
<b>Total Metals</b>						
<b>2005</b>						
<i>Samples</i>	<i>avg of 5</i>	<i>no sample</i>	<i>avg of 5</i>	<i>avg of 2</i>	<i>avg of 5</i>	<i>avg of 5</i>
Copper	0.76		0.80	0.71	0.67	0.59
Lead	<0.5		<0.5	<0.5	<0.5	<0.5
Manganese	8.3		10.41	2.76	2.76	1.88
Zinc	13.1		12.63	17.68	17.68	10.60
Cadmium	0.05		0.83	<0.05	0.167	0.09
<b>2004</b>						
<i>Samples</i>	<i>avg of 5</i>	<i>avg of 5</i>	<i>avg of 3</i>	<i>avg of 5</i>	<i>avg of 5</i>	<i>avg of 5</i>
Copper	0.68	0.74	0.96	0.77	0.53	0.50
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese	<2	<2	>2	<2	<2	<2
Zinc	9.37	7.74	9.44	8.29	8.09	6.49
Mercury	0.042	0.030	0.041	0.042	0.051	0.46

Table 5: Summary of averages for key metal concentrations (expressed as ug/g) from slimy sculpin tissue collected as part of the Aquatic Life Sampling and Testing Program, conducted near Faro, Yukon during August of 2005, 2004 data is presented below for comparison.

Site	R1	R2	R4	R6	V8	B1
<b>Total Metals</b>						
<b>2005</b>						
<i>Samples</i>	<i>avg of 5</i>					
Copper	1.12	1.25	0.96	0.98	0.95	1.12
Lead	0.57	1.02	0.56	<.5	<.5	<.5
Manganese	24.96	38.78	47.72	26.42	7.37	8.67
Zinc	30.06	51.76	49.94	39.1	45.66	26.06
Cadmium	0.05	<0.05	<0.05	0.076	0.18	0.085
<b>2004</b>						
<i>Samples</i>	<i>avg of 5</i>	<i>avg of 5</i>	<i>1 sample</i>	<i>avg of 4</i>	<i>avg of 5</i>	<i>avg of 3</i>
Copper	0.57	1.2	0.88	0.93	0.79	0.87
Lead	0.41	0.24	0.22	0.126	0.16	0.075
Manganese	28.1	31.7	66.5	30.8	6.7	9.17
Zinc	53.1	39.3	57.6	41.0	55.14	31.27
Mercury	0.023	0.029	0.022	0.032	0.043	0.036

## 5.0 DISCUSSION

For comparative purposes sites R4 and R6 are physically very close to each other. Fish movements between the 2 sites likely do occur, minimizing the relevance of the comparative metals analysis. Moving these sites further upstream from the confluence zone would provide more distinction between the sites and a more valid (in the case of R6) control. Because the sample locations are described in the Fish Monitoring Plan they are essentially a part of the Water License, relocating these sites will require agreement from the interested parties. A suitable site on Anvil Creek approximately 800 meters upstream of the current station was investigated during the 2005 sampling period. This site provides a much greater opportunity for the capture of fish and a greater potential for distinction between the Rose and Anvil drainages. It is recommended that this site be relocated to the site further up Anvil Creek.

Utilization of Rose Creek by juvenile chinook salmon (jcs) during the 2005 open water season was well below levels recorded during 2004. Utilization of the lower areas of Blind and Vangorda Creeks was again significantly higher than in Rose and Anvil Creeks, but as in Rose utilization was lower than in 2004. Utilization of the outlets of both the Tay and Glenlyon Rivers was very similar to that of Anvil Creek (Sparling 2005). Lower numbers of jcs in the study area was expected as the adult chinook salmon escapement and hence the juvenile recruitment for 2004 was considerably lower than in 2003.

Utilization of Anvil Creek by adult chinook salmon in spawning condition was documented during 2005; however an enumeration survey of Anvil Creek was not conducted during 2005. A total of seven chinook salmon adults were recorded during fisheries investigations in Anvil Creek during 2005 and a single adult salmon was observed within 500 meters of the confluence of Rose and Anvil Creeks (Sparling 2005).

Personnel from the mine site reported having seen adult salmon in Rose Creek approximately 1 km downstream of the tailings discharge channel during early August of 2005. This site was investigated and no fish were observed. The observation of fertilized salmon eggs in an Arctic grayling stomach from site R1 is a clear indication that chinook salmon spawning does occur within the Rose Creek drainage. From the location of the grayling it is likely that the spawning site is above or adjacent to the tailings.

Metal analysis of fish flesh results showed variation between 2004 and 2005, still within the same ranges, the average concentrations taken in 2005 were slightly higher than those from 2004. The average levels of metal concentrations from 2004, '05 remain at a lower level than those reported in 1997 and 2002.

Distinctly higher levels of lead and zinc were found in sculpins from below the tailings outlet at site R2 in 2005 from those of 2004. During the 2004 investigations the tailings channel was not flowing, it was during the 2005 investigation. Sculpin samples were collected from immediately downstream of the discharge channel in both years.

The discharge and water quality may also be related to the absence of Arctic grayling adults at the site. However another factor may also be involved with the absence of Adult arctic grayling; a drilling program was conducted just prior to and during the field investigations at the site. The drilling was such that vibrations would have been significant within the sample reach for several days prior to sampling. A single Arctic grayling was observed upstream of the discharge near the outlet of the diversion channel at the time of sampling site R2. A site approximately 2 km downstream of R2

was investigated after a report of adult salmon. Careful visual observations of the site recorded no Arctic grayling or salmon and the grayling seemed to be avoiding that area as well.

## References

Gartner Lee, 2003. *Fisheries and aquatic Studies at the Anvil Range Mine Complex in 2002 - Technical Memorandum*. Reference GLL 22-943, February 2003.

P.D. Sparling, 2005. *Aquatic Life Sampling and Testing Program For the Pelly River and its main Tributaries between Faro and Earn River*. Prepared for Selkirk First Nation and Type II Mines Office, Whitehorse Yukon, December, 2005

# APPENDIX 1

## GENERAL SITE DESCRIPTIONS

### SITE: R1 Rose Creek

UTM: Down stream end 05 83 739 E, 69 12 390 N

Site Location: reach starts 10 meters upstream of the confluence of the north and south forks of Rose Creek and extends upstream for 110 meters.

Date Sampled: August 17 and 18, 2005, August 13 and 14, 2004

#### CHANNEL CHARACTERISTICS:

Surveyed Length:	110 m
Average Channel Width:	4 meters
Average Wetted Width:	4 meters
Average Depth:	0.3 meters
Average Velocity	1.5 meters per second
% Pool, Riffle, Run / Glide:	65% riffles through boulders, 25% run and 10% small boulder and side pools
Cover	Dominant cover is boulder pools and perched boulders
Overhead vegetation	10% overhanging
Riparian Vegetation	Willow, dwarf birch, cinquefoil, with spruce adjacent

#### BED MATERIAL:

70% boulder, 20% cobble, 5% gravel, 5% sand with occasional bedrock outcrop in lower part of reach

**BANK CHARACTERISTICS:** Well defined channel with bedrock confining the channel on the left bank, the right bank has an open flood plain above an abrupt bank rise of 0.4 meters.

**CHANNEL MORPHOLOGY CHARACTERISTICS:** Uniform channel with a mostly flat bottom, some contour is provided by small pools near submerged bedrock and boulders causing small cascades. A small island exists at the top of the reach. Flows within the South Fork of Rose Creek at site R1 were slightly greater than those of 2004.



Photo 1:, Rose Creek looking upstream at Site R1 from near the bottom of the sample reach.

## **SITE: R2 Rose Creek**

UTM: down stream end 05 79 401 E, 69 14 972 N

Site Location: reach starts at the confluence of the tailings pond discharge channel with Rose Creek and extends downstream for 110 meters through the mix water zone.

Date Sampled: August 18 and 19, 2005, August 15, 2004

### **CHANNEL CHARACTERISTICS:**

Surveyed Length:	110 meters
Average Channel Width:	14 meters
Average Wetted Width:	8 meters
Average Depth:	0.6 meters
Average Velocity	0.8 meters per second
% Pool, Riffle, Run / Glide:	30% pool, 30% riffle, 40% glide
Cover	Large woody debri, undercut banks and deep pools
Overhead vegetation	No overhead vegetation
Riparian Vegetation	Willow, dwarf birch and dead spruce

### **BED MATERIAL:**

30% cobble, 50% gravel, 20% sand with sand and gravel increasing in deeper pools and exposed point bars mostly sand and gravel.

**BANK CHARACTERISTICS:** Sand and gravel point bars opposite of mud cut banks that rise 1.5 to 2.5 meters to an open flood plain.

**CHANNEL MORPHOLOGY CHARACTERISTICS:** Meandering channel with corner pools, small riffles and point bars adjacent to cut banks. Water levels were approximately .3 meters deeper during 2005 investigations than during 2004 investigations.



Photo 3: The tailings pond discharge channel (on left) entering Rose Creek at sample reach site R2.



Photo: The downstream end of the sample reach at site R2.

## **SITE: R4 Rose Creek**

UTM: down stream end 05 67 827 E, 69 21 736 N

Site Location: reach starts 80 meters upstream of the confluence of Rose Creek and Anvil Creek and extends upstream for 110 meters.

Date Sampled: August 17 and 18, 2005, August 12, 2004

### **CHANNEL CHARACTERISTICS:**

Surveyed Length:	110 meters
Average Channel Width:	20 meters
Average Wetted Width:	16 meters
Average Depth:	0.3 meters
Average Velocity	> 1.0 meters per second
% Pool, Riffle, Run / Glide:	60% riffle, 15% boulder pool and 25% run
Cover	Boulder pools and overhead vegetation
Overhead vegetation	20% coverage
Riparian Vegetation	Alder and willow with spruce behind

### **BED MATERIAL:**

5% large boulder, 20% boulder, 30% cobble, 40% gravel, 5% sand.

**BANK CHARACTERISTICS:** Open flood plain with gentle rise adjacent to well defined stepped banks that rise to a maximum of 2 meters to an open flood plain.

**CHANNEL MORPHOLOGY CHARACTERISTICS:** Mostly flat channel with one side typically deeper than the opposite side. Some exposed large boulders and a large side pool exists near the bottom of the reach. Water levels were 0.3 meters deeper during 2005 sampling than during the 2004 investigations.



Photo 5: Boulder habitats in the upper portion of the sample reach at site R4.

## SITE: R6 Anvil Creek

UTM: down stream end 05 67 917 E, 69 21 804 N

Site Location: reach starts 100 meters upstream of the confluence of Anvil Creek with Rose Creek and extends upstream a further 100 meters.

Date Sampled: August 17 and 18, 2005, August 12, 2004

Anvil Creek just upstream of the confluence with Rose Creek (control site).

This reach is located at and begins 150 meters upstream of the confluence and then extends upstream for 100 meters

### CHANNEL CHARACTERISTICS:

Surveyed Length:	100 meters
Average Channel Width:	15 meters
Average Wetted Width:	14 meters
Average Depth:	0.4 meters
Average Velocity	1.5 meters per second
% Pool, Riffle, Run / Glide:	15% rapid, 45% riffle, 20% run, 20% boulder pool
Cover	Turbulence, perched boulders and cobbles, and limited undercut and cut banks.
Overhead vegetation	< 5% cover
Riparian Vegetation	Willow with a sedge fringe and spruce adjacent

**BED MATERIAL:**

5% large boulder, 50% small boulder, 30% cobble, 15% sand

**BANK CHARACTERISTICS:** Well defined and stable banks rise to even 2 meter height on 50% slope.

**CHANNEL MORPHOLOGY CHARACTERISTICS:** Channel mostly flat but the mid channel areas are elevated with deep flows occurring towards the banks. Water levels in Anvil Creek were 0.5 meters deeper during 2005 investigations than those of 2004.



Photo 6: Looking upstream to the top of the sample reach at site R6, from the downstream end.

**SITE: B1 Blind Creek**

UTM: down stream end 05 36 680 E, 68 96 005 N

Site Location: reach starts immediately upstream of the bridge and extends upstream for 100 meters/

Date Sampled: August 19 and 20, 2005, August 14 and 15, 2004

**CHANNEL CHARACTERISTICS:**

Surveyed Length:	100 meters
Average Channel Width:	15.5 meters
Average Wetted Width:	14 meters
Average Depth:	0.7 meters
Average Velocity	0.4 meters per second
% Pool, Riffle, Run / Glide:	100% glide

Cover	Fine organic debris, cut banks (up to 40%), small woody debris against shore and a beaver lodge
Overhead vegetation	10% cover
Riparian Vegetation	Alder, willow with some spruce, with high bush cranberry, raspberry and cinquefoil adjacent

**BED MATERIAL:**

Sand silt and organic debris overlaying 60% cobble, 40% gravel.

**BANK CHARACTERISTICS:** Shallow point bars occur opposite of cut and eroding banks near gentle corners. Cut banks rise between 1 and 2 meters to an open flood plain.

**CHANNEL MORPHOLOGY CHARACTERISTICS:** Uniform channel with a deep side opposite of a side of deposition. Flows in Blind Creek during 2005 sampling were very similar to those encountered during 2004.

**SITE: V8 Vangorda Creek**

UTM: down stream end 05 84 790 E, 69 00 606 N

Site Location: reach starts immediately upstream of a small foot bridge that crosses the creek at the site of the town of Faro sewage discharge pipe crossing and extends upstream for 100 meters

Date Sampled: August 17 and 18, 2005, August 14 and 15, 2004

**CHANNEL CHARACTERISTICS:**

Surveyed Length:	100 meters
Average Channel Width:	6.0 meters
Average Wetted Width:	3.3 meters
Average Depth:	0.5 meters
Average Velocity	1.5 meters per second
% Pool, Riffle, Run / Glide:	80% riffle (almost rapid), 20% eddy and side pools
Cover	Over head vegetation, large and small woody debri, flood washed shrubby vegetation and boulder pools
Overhead vegetation	20% cover
Riparian Vegetation	Alder and willow with occasional spruce and poplar

**BED MATERIAL:**

50% boulder, 20% cobble, 15% gravel, 15% sand with occasional bedrock outcrop in upper part of reach. Most substrates loosely consolidated and highly silted. Creek channel was heavily modified by a high water event this season.

**BANK CHARACTERISTICS:** Well defined channel with newly eroded, but stable, banks that rise gently to a maximum of 2 meters. A small area of bedrock confines the channel on the left bank at the upstream end of the reach.

**CHANNEL MORPHOLOGY CHARACTERISTICS:** Gently meandering with much unconsolidated material forming small islands and limited amounts of instream braiding. The channel has gained some stability since 2004 with most of the unconsolidated materials being swept out. The sample reach does still have a large amount of willow debri and root

wads. This site has had modifications to the lower portion of the reach due to the construction of a new bridge designed to carry the Town of Faro sewage line. The old line was on the creek bed prior to the flooding of 2004, after which it was elevated 0.3 meters above the creek bottom. The removal of the old sewage line had not been completed at the time of sampling.



Photo 7: Looking upstream from the downstream limit of the sample reach under the new bridge at site V8.



Photo 8: The new bridge crossing at site V8.



# NORWEST LABS

## INFORMATION SHEET WATERS

CONTROL NUMBER

W 51468

<b>RESULTS &amp; INVOICE TO:</b> COMPANY: <i>DeBitter-Touche Inc.</i> ADDRESS: <i>79 Wellington St. W.</i> <i>Suite 1900</i> CITY/TOWN: <i>P.O. Box 29 TD Centre</i> PROVINCE: <i>TORONTO ONT.</i> POSTAL CODE: <i>M5K 1B9</i> ATTENTION: <i>Doug Sedgwick</i> PHONE: <i>416 643-8034</i> FAX: CELL:	<b>COPY OF RESULTS TO:</b> COMPANY: <i>White Mtn. Env. Cons.</i> ADDRESS: <i>Box 10140</i> CITY/TOWN: <i>WHITEHORSE, YT</i> PROVINCE: POSTAL CODE: <i>Y1A 7A1</i> ATTENTION: <i>PAUL SPARLING</i> PHONE: <i>867-399-7019</i> FAX: CELL:	WORK ORDER NO. <i>406715</i> DATE STAMP:
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PURCHASE ORDER NO.: <i>FARD AQUATIC EFFECTS STUDY</i>	PROJECT REF.:	REF/QUOTE NO.:
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DATE SAMPLED	<input type="checkbox"/> D <input type="checkbox"/> M <input type="checkbox"/> Y	NUMBER OF SAMPLES	WATER	<input type="checkbox"/>	LIQ WASTE	<input type="checkbox"/>	OTHER (SPECIFY)
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SPECIAL INSTRUCTIONS (SEE OVER FOR IMPORTANT SAMPLE INFORMATION INSTRUCTIONS AND ANALYSIS CODES) <i># 70223</i>	RUSH (UPON FILLING IN THIS SECTION THE CLIENT ACCEPTS THAT SURCHARGES WILL BE ATTACHED TO THE ANALYSIS) NORWEST AUTHORIZATION NAME _____ DATE _____ RUSH DATE REQUIRED <input type="checkbox"/> D <input type="checkbox"/> M <input type="checkbox"/> Y TIME: <input type="checkbox"/> HR <input type="checkbox"/> MIN	CLIENT NO. LP COMPLETION DATE <input type="checkbox"/> D <input type="checkbox"/> M <input type="checkbox"/> Y
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SAMPLE CUSTODY	SAMPLED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
	COMPANY	COMPANY	COMPANY	COMPANY <i>Donna NWLS</i>
	DATE	DATE	DATE	DATE <i>Sept 7/05</i>

SITE I.D.	SAMPLE DESCRIPTION	OTHER	ANALYSIS PACKAGE CODES (USE CODES LISTED ON THE REVERSE OF THIS SHEET)	LAB CODING
1	R-1	ARCTIC GRAYLING	5 samples	
2	R-4		5 samples	
3	R-6		2 samples	ST33T
4	V-8		6 samples	
5	B-1		5 samples	
6	R-1	Slimy sculpin	5 samples	
7	R-2		" - 6	
8	R-4		" - 11	
9	R-6		" - 11	
10	V-8		" - 11	
11	B-1		5 samples (multiple fish/sample)	
12				
13				
14				
15				

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NOTE: Please complete this form in its entirety to ensure correct testing and reporting requirements.

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M5K 1B9  
Attn: Doug Sedgwick  
Sampled By:  
Company:

Project  
ID: Faro Aquatic Effects Study  
Name:  
Location:  
LSD:  
P.O.:  
Acct. Code:

NWL Lot ID: **406715**  
Control Number: W 51468  
Date Received: Sep 07, 2005  
Date Reported: Sep 19, 2005  
Report Number: 743693

Contact	Company	Address						
Doug Sedgwick	Cash Account	Box 29, Suite 1900, 79 Wellington St. W. Toronto, ON M5K 1B9 Phone: (416) 643-8034 Email:						
Web Email Notification		Fax:						
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Id/Format/Reported Date  
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Id/Format/Reported Date

Id/Format/Reported Date

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9/19/05 743693 19-Sep-2005



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### Sample Disposal Date: Oct 19, 2005

All samples will be stored until this date unless other instructions are received. Please indicate other requirements below and return this form to the address or fax number on the upper right of this page.

\_\_\_\_\_ **Extend Sample Storage Until** \_\_\_\_\_ (MM/DD/YY)

The following charges apply to extended sample storage:

Storage for 1 to 5 samples per month	\$ 10.00
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Company: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_  
Phone: \_\_\_\_\_  
Fax: \_\_\_\_\_  
Signature: \_\_\_\_\_

If no other arrangements have been made, samples will be disposed of on Oct 19, 2005.

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# Analytical Report

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 ID: Faro Aquatic Effects Study  
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 Location:  
 LSD:  
 P.O.:  
 Acct. Code:

NWL Lot ID: **406715**  
 Control Number: W 51468  
 Date Received: Sep 07, 2005  
 Date Reported: Sep 19, 2005  
 Report Number: 743693

Analyte	Units	NWL Number	406715-1	406715-2	406715-3	Detection Limit
		Sample Description	R - 1 #1 / Artic Grayling Tissue	R - 1 #2 / Artic Grayling Tissue	R - 1 #3 / Artic Grayling Tissue	
		Matrix	Results	Results	Results	
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	12.2	5.37	5.33	0.5
Antimony	Total (wet weight)	ug/g	<1	<1	<1	1
Arsenic	Total (wet weight)	ug/g	<0.3	<0.4	<0.3	0.4
Barium	Total (wet weight)	ug/g	0.90	0.4	0.5	0.1
Beryllium	Total (wet weight)	ug/g	<0.0050	<0.0050	<0.0050	0.01
Bismuth	Total (wet weight)	ug/g	<1	<1	<1	2
Cadmium	Total (wet weight)	ug/g	<0.05	<0.05	<0.05	0.05
Calcium	Total (wet weight)	ug/g	6540	3330	3590	0.5
Chromium	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g	0.72	0.58	0.92	0.1
Iron	Total (wet weight)	ug/g	18.6	9.61	9.98	0.2
Lead	Total (wet weight)	ug/g	<0.5	<0.5	<0.5	0.5
Lithium	Total (wet weight)	ug/g	0.94	0.82	0.92	0.2
Magnesium	Total (wet weight)	ug/g	346	306	315	1
Manganese	Total (wet weight)	ug/g	8.48	4.2	5.79	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	<0.2	<0.2	<0.2	0.3
Phosphorus	Total (wet weight)	ug/g	6090	4470	4710	1
Potassium	Total (wet weight)	ug/g	4510	4400	4560	2
Selenium	Total (wet weight)	ug/g	1.2	1.5	1.2	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	612	618	638	15
Strontium	Total (wet weight)	ug/g	7.74	3.58	4.01	0.01
Titanium	Total (wet weight)	ug/g	0.2	<0.1	<0.1	0.1
Vanadium	Total (wet weight)	ug/g	<0.2	<0.2	<0.2	0.2
Zinc	Total (wet weight)	ug/g	14.2	11.8	13.7	0.05
Zirconium	Total (wet weight)	ug/g	0.2	0.2	0.2	0.05



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**NWL Lot ID:** 406715  
**Control Number:** W 51468  
**Date Received:** Sep 07, 2005  
**Date Reported:** Sep 19, 2005  
**Report Number:** 743693

Analyte	Units	NWL Number	406715-4	406715-5	406715-6	Detection Limit
		Sample Description	R - 1 #4 / Artic Grayling Tissue	R - 1 #5 / Artic Grayling Tissue	R - 4 #1 / Artic Grayling Tissue	
	Matrix					
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	6.93	7.42	122	0.5
Antimony	Total (wet weight)	ug/g	<1	<1	<1	1
Arsenic	Total (wet weight)	ug/g	<0.3	<0.3	<0.3	0.4
Barium	Total (wet weight)	ug/g	0.86	0.94	2.9	0.1
Beryllium	Total (wet weight)	ug/g	<0.0050	<0.0050	<0.0049	0.01
Bismuth	Total (wet weight)	ug/g	<1	<1	<1	2
Cadmium	Total (wet weight)	ug/g	0.09	<0.05	<0.05	0.05
Calcium	Total (wet weight)	ug/g	4370	4700	5820	0.5
Chromium	Total (wet weight)	ug/g	<0.1	<0.1	1.1	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g	0.64	0.92	1.1	0.1
Iron	Total (wet weight)	ug/g	9.55	16.5	80.3	0.2
Lead	Total (wet weight)	ug/g	<0.5	<0.5	<0.5	0.5
Lithium	Total (wet weight)	ug/g	1.0	0.97	1.2	0.2
Magnesium	Total (wet weight)	ug/g	313	334	335	1
Manganese	Total (wet weight)	ug/g	9.77	14.4	30.1	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	<0.2	<0.2	0.70	0.3
Phosphorus	Total (wet weight)	ug/g	5140	5320	5660	1
Potassium	Total (wet weight)	ug/g	4650	4450	4440	2
Selenium	Total (wet weight)	ug/g	1.6	1.8	1.7	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	673	679	768	15
Strontium	Total (wet weight)	ug/g	4.40	5.31	5.29	0.01
Titanium	Total (wet weight)	ug/g	<0.1	<0.1	1.5	0.1
Vanadium	Total (wet weight)	ug/g	<0.2	<0.2	<0.2	0.2
Zinc	Total (wet weight)	ug/g	14.2	11.6	15.8	0.05
Zirconium	Total (wet weight)	ug/g	0.2	0.2	0.3	0.05



# Analytical Report

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 Suite 1900, 79 Wellington St. W.  
 Toronto, ON, Canada  
 M5K 1B9  
 Attn: Doug Sedgwick  
 Sampled By:  
 Company:

Project  
 ID: Faro Aquatic Effects Study  
 Name:  
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NWL Lot ID: **406715**  
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Analyte	Units	NWL Number	406715-7	406715-8	406715-9	Detection Limit
		Sample Description	R - 4 #2 / Artic Grayling Tissue	R - 4 #3 / Artic Grayling Tissue	R - 4 #4 / Artic Grayling Tissue	
		Matrix				
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	5.17	5.40	7.01	0.5
Antimony	Total (wet weight)	ug/g	<1	<2	<1	1
Arsenic	Total (wet weight)	ug/g	<0.3	<0.4	<0.3	0.4
Barium	Total (wet weight)	ug/g	0.77	0.83	0.91	0.1
Beryllium	Total (wet weight)	ug/g	<0.0049	<0.0050	<0.0050	0.01
Bismuth	Total (wet weight)	ug/g	<1	<2	<1	2
Cadmium	Total (wet weight)	ug/g	0.2	0.08	0.06	0.05
Calcium	Total (wet weight)	ug/g	4400	3830	9630	0.5
Chromium	Total (wet weight)	ug/g	0.1	<0.1	<0.1	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g	0.76	0.55	0.98	0.1
Iron	Total (wet weight)	ug/g	12.8	13.4	13.4	0.2
Lead	Total (wet weight)	ug/g	<0.5	<0.5	<0.5	0.5
Lithium	Total (wet weight)	ug/g	1.0	0.96	1.2	0.2
Magnesium	Total (wet weight)	ug/g	320	294	352	1
Manganese	Total (wet weight)	ug/g	3.1	9.92	6.14	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	<0.2	<0.2	0.3	0.3
Phosphorus	Total (wet weight)	ug/g	5140	4660	7230	1
Potassium	Total (wet weight)	ug/g	4710	4440	4260	2
Selenium	Total (wet weight)	ug/g	2.3	1.7	1.6	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	642	689	725	15
Strontium	Total (wet weight)	ug/g	5.05	3.20	6.70	0.01
Titanium	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Vanadium	Total (wet weight)	ug/g	<0.2	<0.2	<0.2	0.2
Zinc	Total (wet weight)	ug/g	9.90	11.5	16.2	0.05
Zirconium	Total (wet weight)	ug/g	0.2	0.2	0.3	0.05



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NWL Lot ID: **406715**  
 Control Number: W 51468  
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Analyte	Sample Description	Matrix	NWL Number	406715-10	406715-11	406715-12	Detection Limit
			Sample Description	R - 4 #5 / Artic Grayling Tissue	R - 6 #1 / Artic Grayling Tissue	R - 6 #2 / Artic Grayling Tissue	
			Units	Results	Results	Results	
<b>Metals Total</b>							
Aluminum	Total (wet weight)		ug/g	33.3	3.0	6.20	0.5
Antimony	Total (wet weight)		ug/g	<1	<1	<1	1
Arsenic	Total (wet weight)		ug/g	<0.3	<0.3	<0.3	0.4
Barium	Total (wet weight)		ug/g	0.61	0.4	0.84	0.1
Beryllium	Total (wet weight)		ug/g	<0.0050	<0.0050	<0.0050	0.01
Bismuth	Total (wet weight)		ug/g	<1	<1	<1	2
Cadmium	Total (wet weight)		ug/g	<0.05	<0.05	<0.05	0.05
Calcium	Total (wet weight)		ug/g	4080	2580	5900	0.5
Chromium	Total (wet weight)		ug/g	<0.1	<0.1	<0.1	0.1
Cobalt	Total (wet weight)		ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)		ug/g	0.61	0.67	0.75	0.1
Iron	Total (wet weight)		ug/g	50.8	7.13	10.1	0.2
Lead	Total (wet weight)		ug/g	<0.5	<0.5	<0.5	0.5
Lithium	Total (wet weight)		ug/g	1.0	0.90	1.1	0.2
Magnesium	Total (wet weight)		ug/g	318	286	335	1
Manganese	Total (wet weight)		ug/g	2.8	1.6	3.8	0.05
Molybdenum	Total (wet weight)		ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)		ug/g	<0.2	<0.2	<0.2	0.3
Phosphorus	Total (wet weight)		ug/g	4710	4080	5800	1
Potassium	Total (wet weight)		ug/g	4200	4470	4580	2
Selenium	Total (wet weight)		ug/g	1.0	1.5	1.6	0.5
Silver	Total (wet weight)		ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)		ug/g	667	544	623	15
Strontium	Total (wet weight)		ug/g	3.21	2.23	4.57	0.01
Titanium	Total (wet weight)		ug/g	<0.1	<0.1	<0.1	0.1
Vanadium	Total (wet weight)		ug/g	<0.2	<0.2	<0.2	0.2
Zinc	Total (wet weight)		ug/g	9.73	8.37	9.83	0.05
Zirconium	Total (wet weight)		ug/g	0.2	0.2	0.2	0.05



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Analyte		Units	NWL Number	406715-13	406715-14	406715-15	Detection Limit
			Sample Description	V - 8 #1 / Artic Grayling	V - 8 #2 / Artic Grayling	V - 8 #3 / Artic Grayling	
	Matrix		Tissue	Tissue	Tissue		
<b>Metals Total</b>							
Aluminum	Total (wet weight)	ug/g	8.46	8.08	8.01	0.5	
Antimony	Total (wet weight)	ug/g	<2	<1	<1	1	
Arsenic	Total (wet weight)	ug/g	<0.4	<0.3	<0.3	0.4	
Barium	Total (wet weight)	ug/g	1.2	1.1	1.7	0.1	
Beryllium	Total (wet weight)	ug/g	<0.0050	<0.0050	<0.0049	0.01	
Bismuth	Total (wet weight)	ug/g	<2	<1	<1	2	
Cadmium	Total (wet weight)	ug/g	<0.05	0.1	<0.05	0.05	
Calcium	Total (wet weight)	ug/g	9820	8150	15800	0.5	
Chromium	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1	
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1	
Copper	Total (wet weight)	ug/g	0.57	1.0	0.56	0.1	
Iron	Total (wet weight)	ug/g	12.2	15.4	9.29	0.2	
Lead	Total (wet weight)	ug/g	<0.5	<0.5	<0.5	0.5	
Lithium	Total (wet weight)	ug/g	1.3	1.2	1.3	0.2	
Magnesium	Total (wet weight)	ug/g	330	334	391	1	
Manganese	Total (wet weight)	ug/g	3.7	3.7	3.3	0.05	
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1	
Nickel	Total (wet weight)	ug/g	<0.2	<0.2	<0.2	0.3	
Phosphorus	Total (wet weight)	ug/g	7150	6440	9660	1	
Potassium	Total (wet weight)	ug/g	4140	4260	3960	2	
Selenium	Total (wet weight)	ug/g	1.1	2.3	1.4	0.5	
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4	
Sodium	Total (wet weight)	ug/g	742	720	854	15	
Strontium	Total (wet weight)	ug/g	11.1	7.22	12.6	0.01	
Titanium	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1	
Vanadium	Total (wet weight)	ug/g	<0.2	<0.2	<0.2	0.2	
Zinc	Total (wet weight)	ug/g	16.1	12.0	22.9	0.05	
Zirconium	Total (wet weight)	ug/g	0.3	0.2	0.3	0.05	



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Analyte		NWL Number 406715-16		406715-17		406715-18	
		Matrix	Tissue	Tissue	Tissue	Detection Limit	
		Units	Results	Results	Results		
<b>Metals Total</b>							
Aluminum	Total (wet weight)	ug/g	4.3	5.81	17.6	0.5	
Antimony	Total (wet weight)	ug/g	<1	<1	<1	1	
Arsenic	Total (wet weight)	ug/g	<0.3	<0.3	<0.3	0.4	
Barium	Total (wet weight)	ug/g	0.50	0.86	1.8	0.1	
Beryllium	Total (wet weight)	ug/g	<0.0050	<0.0050	<0.0049	0.01	
Bismuth	Total (wet weight)	ug/g	<1	<1	<1	2	
Cadmium	Total (wet weight)	ug/g	0.3	0.1	<0.05	0.05	
Calcium	Total (wet weight)	ug/g	3520	5870	4460	0.5	
Chromium	Total (wet weight)	ug/g	<0.1	<0.1	0.1	0.1	
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1	
Copper	Total (wet weight)	ug/g	0.4	0.82	0.80	0.1	
Iron	Total (wet weight)	ug/g	6.66	9.92	37.6	0.2	
Lead	Total (wet weight)	ug/g	<0.5	<0.5	<0.5	0.5	
Lithium	Total (wet weight)	ug/g	1.0	1.0	0.85	0.2	
Magnesium	Total (wet weight)	ug/g	316	314	285	1	
Manganese	Total (wet weight)	ug/g	1.5	1.6	8.30	0.05	
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1	
Nickel	Total (wet weight)	ug/g	<0.2	<0.2	0.3	0.3	
Phosphorus	Total (wet weight)	ug/g	4560	5520	4680	1	
Potassium	Total (wet weight)	ug/g	4590	4140	4000	2	
Selenium	Total (wet weight)	ug/g	2.0	2.2	1.2	0.5	
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4	
Sodium	Total (wet weight)	ug/g	539	671	690	15	
Strontium	Total (wet weight)	ug/g	3.50	5.31	4.59	0.01	
Titanium	Total (wet weight)	ug/g	<0.1	<0.1	0.5	0.1	
Vanadium	Total (wet weight)	ug/g	<0.2	<0.2	<0.2	0.2	
Zinc	Total (wet weight)	ug/g	16.8	20.6	9.58	0.05	
Zirconium	Total (wet weight)	ug/g	0.2	0.2	0.3	0.05	



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Analyte	Units	NWL Number	406715-19	406715-20	406715-21	Detection Limit
		Sample Description	B - 1 #2 / Artic Grayling Tissue	B - 1 #3 / Artic Grayling Tissue	B - 1 #4 / Artic Grayling Tissue	
	Matrix					
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	7.44	9.43	116	0.5
Antimony	Total (wet weight)	ug/g	<1	<1	<1	1
Arsenic	Total (wet weight)	ug/g	<0.3	<0.3	<0.3	0.4
Barium	Total (wet weight)	ug/g	1.1	1.1	0.84	0.1
Beryllium	Total (wet weight)	ug/g	<0.0049	<0.0050	<0.0049	0.01
Bismuth	Total (wet weight)	ug/g	<1	<1	<1	2
Cadmium	Total (wet weight)	ug/g	0.06	0.2	0.05	0.05
Calcium	Total (wet weight)	ug/g	7810	6760	5760	0.5
Chromium	Total (wet weight)	ug/g	<0.1	<0.1	0.2	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g	0.55	0.50	0.59	0.1
Iron	Total (wet weight)	ug/g	8.51	10.2	7.92	0.2
Lead	Total (wet weight)	ug/g	<0.5	<0.5	<0.5	0.5
Lithium	Total (wet weight)	ug/g	0.99	0.99	0.98	0.2
Magnesium	Total (wet weight)	ug/g	328	342	313	1
Manganese	Total (wet weight)	ug/g	1.9	1.6	1.5	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	<0.2	<0.2	<0.2	0.3
Phosphorus	Total (wet weight)	ug/g	6220	5870	5360	1
Potassium	Total (wet weight)	ug/g	3980	4240	4120	2
Selenium	Total (wet weight)	ug/g	1.4	1.8	1.4	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	609	597	646	15
Strontium	Total (wet weight)	ug/g	6.87	6.50	5.88	0.01
Titanium	Total (wet weight)	ug/g	<0.1	0.2	<0.1	0.1
Vanadium	Total (wet weight)	ug/g	<0.2	<0.2	<0.2	0.2
Zinc	Total (wet weight)	ug/g	9.62	14.3	10.6	0.05
Zirconium	Total (wet weight)	ug/g	0.2	0.2	0.2	0.05



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Analyte	Matrix	Units	NWL Number	406715-22	406715-23	406715-24	Detection Limit
			Sample Description	B - 1 #5 / Artic Grayling Tissue	R - 1 #1 / Slimy Sculpin Tissue	R - 1 #2 / Slimy Sculpin Tissue	
<b>Metals Total</b>							
Aluminum	Total (wet weight)	ug/g		13.4	20.9	23.9	0.5
Antimony	Total (wet weight)	ug/g		<1	<1	<1	1
Arsenic	Total (wet weight)	ug/g		<0.4	<0.3	<0.3	0.4
Barium	Total (wet weight)	ug/g		1.2	2.0	3.2	0.1
Beryllium	Total (wet weight)	ug/g		<0.0050	<0.0050	<0.0049	0.01
Bismuth	Total (wet weight)	ug/g		<1	<1	<1	2
Cadmium	Total (wet weight)	ug/g		0.05	<0.05	0.07	0.05
Calcium	Total (wet weight)	ug/g		6160	9540	16000	0.5
Chromium	Total (wet weight)	ug/g		<0.1	1.1	0.51	0.1
Cobalt	Total (wet weight)	ug/g		<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g		0.52	1.2	1.3	0.1
Iron	Total (wet weight)	ug/g		31.5	48.8	49.4	0.2
Lead	Total (wet weight)	ug/g		<0.5	<0.5	0.50	0.5
Lithium	Total (wet weight)	ug/g		1.1	1.1	1.3	0.2
Magnesium	Total (wet weight)	ug/g		336	271	341	1
Manganese	Total (wet weight)	ug/g		2.8	18.1	34.5	0.05
Molybdenum	Total (wet weight)	ug/g		<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g		<0.2	0.80	0.4	0.3
Phosphorus	Total (wet weight)	ug/g		5740	6520	9360	1
Potassium	Total (wet weight)	ug/g		4320	2550	2790	2
Selenium	Total (wet weight)	ug/g		1.4	0.80	1.0	0.5
Silver	Total (wet weight)	ug/g		<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g		638	808	974	15
Strontium	Total (wet weight)	ug/g		5.48	12.6	18.8	0.01
Titanium	Total (wet weight)	ug/g		<0.1	0.68	0.56	0.1
Vanadium	Total (wet weight)	ug/g		0.3	0.2	0.2	0.2
Zinc	Total (wet weight)	ug/g		8.94	21.0	43.3	0.05
Zirconium	Total (wet weight)	ug/g		0.2	0.3	0.4	0.05



## Analytical Report

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 Attn: Doug Sedgwick  
 Sampled By:  
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Project  
 ID: Faro Aquatic Effects Study  
 Name:  
 Location:  
 LSD:  
 P.O.:  
 Acct. Code:

NWL Lot ID: **406715**  
 Control Number: W 51468  
 Date Received: Sep 07, 2005  
 Date Reported: Sep 19, 2005  
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Analyte	Units	NWL Number	406715-25	406715-26	406715-27	Detection Limit
		Sample Description	R - 1 #3 / Slimy Sculpin Tissue	R - 1 #4 / Slimy Sculpin Tissue	R - 1 #5 / Slimy Sculpin Tissue	
	Matrix					
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	96.2	20.4	218	0.5
Antimony	Total (wet weight)	ug/g	<1	<1	<1	1
Arsenic	Total (wet weight)	ug/g	<0.3	<0.3	<0.3	0.4
Barium	Total (wet weight)	ug/g	2.1	1.6	4.7	0.1
Beryllium	Total (wet weight)	ug/g	<0.0049	<0.0049	<0.0049	0.01
Bismuth	Total (wet weight)	ug/g	<1	<1	<1	2
Cadmium	Total (wet weight)	ug/g	<0.05	<0.05	<0.05	0.05
Calcium	Total (wet weight)	ug/g	9020	6480	11000	0.5
Chromium	Total (wet weight)	ug/g	1.2	0.2	1.3	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	0.2	0.1
Copper	Total (wet weight)	ug/g	1.2	1.0	0.92	0.1
Iron	Total (wet weight)	ug/g	155	45.1	448	0.2
Lead	Total (wet weight)	ug/g	0.64	<0.5	<0.5	0.5
Lithium	Total (wet weight)	ug/g	1.2	0.95	1.4	0.2
Magnesium	Total (wet weight)	ug/g	312	275	425	1
Manganese	Total (wet weight)	ug/g	26.4	13.7	32.1	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	0.79	0.2	0.98	0.3
Phosphorus	Total (wet weight)	ug/g	6320	5430	7420	1
Potassium	Total (wet weight)	ug/g	2700	2930	2740	2
Selenium	Total (wet weight)	ug/g	1.2	1.0	1.1	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	784	755	801	15
Strontium	Total (wet weight)	ug/g	13.0	9.01	14.7	0.01
Titanium	Total (wet weight)	ug/g	0.88	0.54	5.30	0.1
Vanadium	Total (wet weight)	ug/g	0.3	0.3	0.75	0.2
Zinc	Total (wet weight)	ug/g	22.5	33.1	30.4	0.05
Zirconium	Total (wet weight)	ug/g	0.4	0.3	0.4	0.05



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NWL Lot ID: **406715**  
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Analyte	Units	NWL Number	406715-28	406715-29	406715-30	Detection Limit
		Sample Description	R - 2 #1 / Slimy Sculpin Tissue	R - 2 #2 / Slimy Sculpin Tissue	R - 2 #3 / Slimy Sculpin Tissue	
	Matrix					
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	15.2	26.5	273	0.5
Antimony	Total (wet weight)	ug/g	<2	<1	<1	1
Arsenic	Total (wet weight)	ug/g	0.4	<0.3	<0.3	0.4
Barium	Total (wet weight)	ug/g	3.0	3.3	7.24	0.1
Beryllium	Total (wet weight)	ug/g	<0.0050	<0.0050	<0.005	0.01
Bismuth	Total (wet weight)	ug/g	<2	<1	<1	2
Cadmium	Total (wet weight)	ug/g	<0.05	<0.05	0.05	0.05
Calcium	Total (wet weight)	ug/g	12700	8800	10600	0.5
Chromium	Total (wet weight)	ug/g	0.3	0.2	1.1	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	0.3	0.1
Copper	Total (wet weight)	ug/g	1.5	0.87	1.8	0.1
Iron	Total (wet weight)	ug/g	54.4	89.0	650	0.2
Lead	Total (wet weight)	ug/g	0.50	<0.5	2.4	0.5
Lithium	Total (wet weight)	ug/g	1.0	0.99	1.5	0.2
Magnesium	Total (wet weight)	ug/g	354	305	421	1
Manganese	Total (wet weight)	ug/g	30.7	27.4	62.5	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	0.64	0.4	1.4	0.3
Phosphorus	Total (wet weight)	ug/g	7580	6290	6660	1
Potassium	Total (wet weight)	ug/g	2700	2770	2670	2
Selenium	Total (wet weight)	ug/g	0.94	0.98	0.83	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	812	996	804	15
Strontium	Total (wet weight)	ug/g	11.2	7.42	9.54	0.01
Titanium	Total (wet weight)	ug/g	0.2	0.67	8.64	0.1
Vanadium	Total (wet weight)	ug/g	0.2	0.3	0.98	0.2
Zinc	Total (wet weight)	ug/g	39.3	35.2	68.7	0.05
Zirconium	Total (wet weight)	ug/g	0.4	0.4	0.50	0.05



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Analyte	Units	NWL Number	406715-31	406715-32	406715-33	Detection Limit
		Sample Description	R - 2 #4 / Slimy Sculpin Tissue	R - 2 #5 / Slimy Sculpin Tissue	R - 4 #1 / Slimy Sculpin Tissue	
	Matrix					
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	10.4	60.7	13.1	0.5
Antimony	Total (wet weight)	ug/g	<1	<1	<1	1
Arsenic	Total (wet weight)	ug/g	<0.3	<0.3	<0.3	0.4
Barium	Total (wet weight)	ug/g	2.5	2.0	3.5	0.1
Beryllium	Total (wet weight)	ug/g	<0.0049	<0.0050	<0.0050	0.01
Bismuth	Total (wet weight)	ug/g	<1	<1	<1	2
Cadmium	Total (wet weight)	ug/g	<0.05	<0.05	<0.05	0.05
Calcium	Total (wet weight)	ug/g	13800	11000	12800	0.5
Chromium	Total (wet weight)	ug/g	0.3	0.4	0.1	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g	1.1	0.97	0.70	0.1
Iron	Total (wet weight)	ug/g	35.6	155	23.9	0.2
Lead	Total (wet weight)	ug/g	0.58	0.61	<0.5	0.5
Lithium	Total (wet weight)	ug/g	1.0	1.1	0.95	0.2
Magnesium	Total (wet weight)	ug/g	328	338	309	1
Manganese	Total (wet weight)	ug/g	31.9	41.4	58.8	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	0.4	0.50	<0.2	0.3
Phosphorus	Total (wet weight)	ug/g	8090	7020	7760	1
Potassium	Total (wet weight)	ug/g	2680	2810	2610	2
Selenium	Total (wet weight)	ug/g	1.0	1.2	0.73	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	882	794	987	15
Strontium	Total (wet weight)	ug/g	12.7	8.57	11.5	0.01
Titanium	Total (wet weight)	ug/g	<0.1	1.8	0.2	0.1
Vanadium	Total (wet weight)	ug/g	0.2	0.4	0.2	0.2
Zinc	Total (wet weight)	ug/g	56.5	59.1	38.1	0.05
Zirconium	Total (wet weight)	ug/g	0.4	0.4	0.4	0.05



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Analyte	Units	NWL Number	406715-34	406715-35	406715-36	Detection Limit
		Sample Description	R - 4 #2 / Slimy Sculpin Tissue	R - 4 #3 / Slimy Sculpin Tissue	R - 4 #4 / Slimy Sculpin Tissue	
	Matrix					
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	9.98	39.1	9.47	0.5
Antimony	Total (wet weight)	ug/g	<2	<1	<1	1
Arsenic	Total (wet weight)	ug/g	<0.4	<0.3	<0.3	0.4
Barium	Total (wet weight)	ug/g	2.6	4.4	3.1	0.1
Beryllium	Total (wet weight)	ug/g	<0.0050	<0.0049	<0.0050	0.01
Bismuth	Total (wet weight)	ug/g	<2	<1	<1	2
Cadmium	Total (wet weight)	ug/g	<0.05	<0.05	<0.05	0.05
Calcium	Total (wet weight)	ug/g	10300	10400	12200	0.5
Chromium	Total (wet weight)	ug/g	<0.1	0.2	0.2	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g	0.85	1.4	1.1	0.1
Iron	Total (wet weight)	ug/g	27.5	78.7	19.4	0.2
Lead	Total (wet weight)	ug/g	<0.5	0.56	<0.5	0.5
Lithium	Total (wet weight)	ug/g	0.94	0.97	0.89	0.2
Magnesium	Total (wet weight)	ug/g	277	290	311	1
Manganese	Total (wet weight)	ug/g	31.4	60.5	50.0	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	<0.2	0.73	<0.2	0.3
Phosphorus	Total (wet weight)	ug/g	6730	6430	7610	1
Potassium	Total (wet weight)	ug/g	2610	2540	2650	2
Selenium	Total (wet weight)	ug/g	1.1	1.2	1.0	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	811	981	818	15
Strontium	Total (wet weight)	ug/g	9.66	9.59	10.6	0.01
Titanium	Total (wet weight)	ug/g	<0.1	1.1	<0.1	0.1
Vanadium	Total (wet weight)	ug/g	0.2	0.3	0.2	0.2
Zinc	Total (wet weight)	ug/g	47.8	45.4	55.5	0.05
Zirconium	Total (wet weight)	ug/g	0.4	0.4	0.3	0.05



# Analytical Report

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NWL Lot ID: **406715**  
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Analyte	Units	NWL Number	406715-37	406715-38	406715-39	Detection Limit
		Sample Description	R - 4 #5 / Slimy Sculpin Tissue	R - 6 #1 / Slimy Sculpin Tissue	R - 6 #2 / Slimy Sculpin Tissue	
	Matrix					
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	8.52	12.8	15.3	0.5
Antimony	Total (wet weight)	ug/g	<1	<1	<1	1
Arsenic	Total (wet weight)	ug/g	<0.4	<0.3	<0.3	0.4
Barium	Total (wet weight)	ug/g	3.3	3.6	3.3	0.1
Beryllium	Total (wet weight)	ug/g	<0.0050	<0.0049	<0.0050	0.01
Bismuth	Total (wet weight)	ug/g	<1	<1	<1	2
Cadmium	Total (wet weight)	ug/g	<0.05	0.06	0.08	0.05
Calcium	Total (wet weight)	ug/g	14600	17600	12300	0.5
Chromium	Total (wet weight)	ug/g	<0.1	0.1	1.0	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g	0.74	0.82	0.88	0.1
Iron	Total (wet weight)	ug/g	14.6	24.9	38.2	0.2
Lead	Total (wet weight)	ug/g	<0.5	<0.5	<0.5	0.5
Lithium	Total (wet weight)	ug/g	0.96	1.0	0.85	0.2
Magnesium	Total (wet weight)	ug/g	325	346	304	1
Manganese	Total (wet weight)	ug/g	37.9	37.0	25.1	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	<0.2	<0.2	0.55	0.3
Phosphorus	Total (wet weight)	ug/g	8510	9680	7470	1
Potassium	Total (wet weight)	ug/g	2750	2570	2690	2
Selenium	Total (wet weight)	ug/g	1.0	1.2	1.4	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	836	1020	863	15
Strontium	Total (wet weight)	ug/g	13.0	13.4	9.94	0.01
Titanium	Total (wet weight)	ug/g	<0.1	0.1	0.3	0.1
Vanadium	Total (wet weight)	ug/g	0.2	0.2	0.3	0.2
Zinc	Total (wet weight)	ug/g	62.6	60.2	37.0	0.05
Zirconium	Total (wet weight)	ug/g	0.4	0.4	0.3	0.05



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Analyte	Units	NWL Number	406715-40	406715-41	406715-42	Detection Limit
		Sample Description	R - 6 #3 / Slimy Sculpin Tissue	R - 6 #4 / Slimy Sculpin Tissue	R - 6 #5 / Slimy Sculpin Tissue	
	Matrix					
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	19.6	17.4	34.4	0.5
Antimony	Total (wet weight)	ug/g	<1	<1	<1	1
Arsenic	Total (wet weight)	ug/g	<0.3	<0.3	0.5	0.4
Barium	Total (wet weight)	ug/g	3.4	2.5	3.8	0.1
Beryllium	Total (wet weight)	ug/g	<0.0049	<0.0050	<0.005	0.01
Bismuth	Total (wet weight)	ug/g	<1	<1	<1	2
Cadmium	Total (wet weight)	ug/g	0.09	0.08	0.07	0.05
Calcium	Total (wet weight)	ug/g	14800	10200	13100	0.5
Chromium	Total (wet weight)	ug/g	<0.1	0.4	0.3	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g	1.1	0.88	1.2	0.1
Iron	Total (wet weight)	ug/g	35.8	34.8	196	0.2
Lead	Total (wet weight)	ug/g	<0.5	<0.5	<0.5	0.5
Lithium	Total (wet weight)	ug/g	0.98	0.86	0.90	0.2
Magnesium	Total (wet weight)	ug/g	360	291	308	1
Manganese	Total (wet weight)	ug/g	21.7	24.4	23.9	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	0.1	0.1
Nickel	Total (wet weight)	ug/g	<0.2	0.4	0.4	0.3
Phosphorus	Total (wet weight)	ug/g	8760	6790	7520	1
Potassium	Total (wet weight)	ug/g	2810	2580	2700	2
Selenium	Total (wet weight)	ug/g	1.3	1.4	1.3	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	937	982	918	15
Strontium	Total (wet weight)	ug/g	10.7	7.97	10.2	0.01
Titanium	Total (wet weight)	ug/g	0.4	0.4	0.69	0.1
Vanadium	Total (wet weight)	ug/g	0.3	0.2	0.51	0.2
Zinc	Total (wet weight)	ug/g	32.9	29.8	35.5	0.05
Zirconium	Total (wet weight)	ug/g	0.4	0.3	0.4	0.05



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Analyte	Units	NWL Number	406715-43	406715-44	406715-45	Detection Limit
		Sample Description	V - 8 #1 / Slimy Sculpin Tissue	V - 8 #2 / Slimy Sculpin Tissue	V - 8 #3 / Slimy Sculpin Tissue	
	Matrix					
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	37.8	28.7	27.8	0.5
Antimony	Total (wet weight)	ug/g	<1	<1	<1	1
Arsenic	Total (wet weight)	ug/g	<0.3	<0.3	<0.3	0.4
Barium	Total (wet weight)	ug/g	1.8	1.6	1.5	0.1
Beryllium	Total (wet weight)	ug/g	<0.0049	<0.0050	<0.0049	0.01
Bismuth	Total (wet weight)	ug/g	<1	<1	<1	2
Cadmium	Total (wet weight)	ug/g	0.2	0.2	0.1	0.05
Calcium	Total (wet weight)	ug/g	8320	10700	6730	0.5
Chromium	Total (wet weight)	ug/g	0.2	0.1	<0.1	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g	1.0	1.1	0.92	0.1
Iron	Total (wet weight)	ug/g	75.0	50.3	48.9	0.2
Lead	Total (wet weight)	ug/g	<0.5	<0.5	<0.5	0.5
Lithium	Total (wet weight)	ug/g	0.83	0.94	0.80	0.2
Magnesium	Total (wet weight)	ug/g	297	301	272	1
Manganese	Total (wet weight)	ug/g	6.24	5.12	8.03	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	0.3	0.3	<0.2	0.3
Phosphorus	Total (wet weight)	ug/g	5980	7080	5480	1
Potassium	Total (wet weight)	ug/g	2770	2690	2700	2
Selenium	Total (wet weight)	ug/g	3.4	2.4	2.8	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	756	895	986	15
Strontium	Total (wet weight)	ug/g	8.94	10.5	7.79	0.01
Titanium	Total (wet weight)	ug/g	0.79	0.56	0.66	0.1
Vanadium	Total (wet weight)	ug/g	0.3	0.3	0.2	0.2
Zinc	Total (wet weight)	ug/g	48.0	48.0	44.6	0.05
Zirconium	Total (wet weight)	ug/g	0.4	0.4	0.3	0.05



## Analytical Report

Norwest Labs  
 #104, 19575-55 A Ave.  
 Surrey, BC. V3S 8P8  
 Phone: (604) 514-3322  
 Fax: (604) 514-3323

**Bill to:** Deloitte & Touche Inc.  
**Report to:** Deloitte & Touche Inc.  
 Box 29  
 Suite 1900, 79 Wellington St. W.  
 Toronto, ON, Canada  
 M5K 1B9  
 Attn: Doug Sedgwick  
 Sampled By:  
 Company:

**Project**  
**ID:** Faro Aquatic Effects Study  
**Name:**  
**Location:**  
**LSD:**  
**P.O.:**  
**Acct. Code:**

**NWL Lot ID:** 406715  
**Control Number:** W 51468  
**Date Received:** Sep 07, 2005  
**Date Reported:** Sep 19, 2005  
**Report Number:** 743693

Analyte	Units	406715-46		406715-47		406715-48	
		Matrix	Tissue	Matrix	Tissue	Matrix	Tissue
			V - 8 #4 / Slimy Sculpin		V - 8 #5 / Slimy Sculpin		B - 1 #1 / Slimy Sculpin - Multiple Fish / Sample Tissue
<b>Metals Total</b>							
Aluminum	Total (wet weight)	ug/g	35.3		30.4		968
Antimony	Total (wet weight)	ug/g	<1		<1		<1
Arsenic	Total (wet weight)	ug/g	<0.3		<0.3		<0.3
Barium	Total (wet weight)	ug/g	2.6		1.9		3.9
Beryllium	Total (wet weight)	ug/g	<0.0050		<0.0050		<0.0050
Bismuth	Total (wet weight)	ug/g	<1		<1		<1
Cadmium	Total (wet weight)	ug/g	0.2		0.2		0.08
Calcium	Total (wet weight)	ug/g	14400		10400		9040
Chromium	Total (wet weight)	ug/g	<0.1		<0.1		1.6
Cobalt	Total (wet weight)	ug/g	<0.1		<0.1		<0.1
Copper	Total (wet weight)	ug/g	0.82		0.90		2.0
Iron	Total (wet weight)	ug/g	51.0		52.6		54.5
Lead	Total (wet weight)	ug/g	<0.5		<0.5		<0.5
Lithium	Total (wet weight)	ug/g	1.0		0.92		0.82
Magnesium	Total (wet weight)	ug/g	366		302		297
Manganese	Total (wet weight)	ug/g	11.4		6.05		8.53
Molybdenum	Total (wet weight)	ug/g	<0.1		<0.1		<0.1
Nickel	Total (wet weight)	ug/g	<0.2		0.2		0.3
Phosphorus	Total (wet weight)	ug/g	8990		6570		5970
Potassium	Total (wet weight)	ug/g	2810		2680		2560
Selenium	Total (wet weight)	ug/g	2.4		1.9		1.9
Silver	Total (wet weight)	ug/g	<0.4		<0.4		<0.4
Sodium	Total (wet weight)	ug/g	842		1000		889
Strontium	Total (wet weight)	ug/g	14.2		11.4		11.6
Titanium	Total (wet weight)	ug/g	0.66		0.75		1.2
Vanadium	Total (wet weight)	ug/g	0.4		<0.2		0.4
Zinc	Total (wet weight)	ug/g	49.8		37.9		28.1
Zirconium	Total (wet weight)	ug/g	0.4		0.4		0.4



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Project  
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 Name:  
 Location:  
 LSD:  
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 Acct. Code:

NWL Lot ID: 406715  
 Control Number: W 51468  
 Date Received: Sep 07, 2005  
 Date Reported: Sep 19, 2005  
 Report Number: 743693

Analyte	Units	NWL Number	406715-49	406715-50	406715-51	Detection Limit
		Sample Description	B - 1 #2 / Slimy Sculpin - Multiple Fish / Sample Tissue	B - 1 #3 / Slimy Sculpin - Multiple Fish / Sample Tissue	B - 1 #4 / Slimy Sculpin - Multiple Fish / Sample Tissue	
<b>Metals Total</b>						
Aluminum	Total (wet weight)	ug/g	17.6	14.7	19.9	0.5
Antimony	Total (wet weight)	ug/g	<1	<1	<1	1
Arsenic	Total (wet weight)	ug/g	<0.3	<0.3	0.4	0.4
Barium	Total (wet weight)	ug/g	4.4	4.2	2.9	0.1
Beryllium	Total (wet weight)	ug/g	<0.0049	<0.0050	<0.0050	0.01
Bismuth	Total (wet weight)	ug/g	<1	<1	<1	2
Cadmium	Total (wet weight)	ug/g	<0.05	0.1	0.06	0.05
Calcium	Total (wet weight)	ug/g	10400	9810	7580	0.5
Chromium	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Cobalt	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g	0.91	0.74	0.96	0.1
Iron	Total (wet weight)	ug/g	32.3	29.4	33.0	0.2
Lead	Total (wet weight)	ug/g	<0.5	<0.5	<0.5	0.5
Lithium	Total (wet weight)	ug/g	0.84	0.82	0.73	0.2
Magnesium	Total (wet weight)	ug/g	295	296	293	1
Manganese	Total (wet weight)	ug/g	9.85	7.53	7.53	0.05
Molybdenum	Total (wet weight)	ug/g	<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g	<0.2	<0.2	<0.2	0.3
Phosphorus	Total (wet weight)	ug/g	6580	6530	5680	1
Potassium	Total (wet weight)	ug/g	2680	2740	2650	2
Selenium	Total (wet weight)	ug/g	1.6	1.7	1.6	0.5
Silver	Total (wet weight)	ug/g	<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g	774	804	889	15
Strontium	Total (wet weight)	ug/g	13.5	13.8	9.87	0.01
Titanium	Total (wet weight)	ug/g	0.3	0.2	0.73	0.1
Vanadium	Total (wet weight)	ug/g	0.2	0.2	0.2	0.2
Zinc	Total (wet weight)	ug/g	26.1	23.8	20.1	0.05
Zirconium	Total (wet weight)	ug/g	0.3	0.3	0.3	0.05



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 Acct. Code:

NWL Lot ID: **406715**  
 Control Number: W 51468  
 Date Received: Sep 07, 2005  
 Date Reported: Sep 19, 2005  
 Report Number: 743693

Analyte		Units	NWL Number	406715-52	406715-53	406715-54	Detection Limit
			Sample Description	B - 1 #5 / Slimy Sculpin - Multiple Fish / Sample	R6 / Slimy Sculpin	R7 / Slimy Sculpin	
			Matrix	Tissue	Tissue	Tissue	
<b>Metals Total</b>							
Aluminum	Total (wet weight)	ug/g		76.8	11.4	9.41	0.5
Antimony	Total (wet weight)	ug/g		<2	<1	<1	1
Arsenic	Total (wet weight)	ug/g		<0.4	<0.3	<0.3	0.4
Barium	Total (wet weight)	ug/g		6.78	4.1	3.3	0.1
Beryllium	Total (wet weight)	ug/g		<0.0050	<0.0050	<0.0050	0.01
Bismuth	Total (wet weight)	ug/g		<2	<1	<1	2
Cadmium	Total (wet weight)	ug/g		0.1	<0.05	<0.05	0.05
Calcium	Total (wet weight)	ug/g		14500	15300	14000	0.5
Chromium	Total (wet weight)	ug/g		0.2	<0.1	<0.1	0.1
Cobalt	Total (wet weight)	ug/g		<0.1	<0.1	<0.1	0.1
Copper	Total (wet weight)	ug/g		1.0	0.72	0.62	0.1
Iron	Total (wet weight)	ug/g		124	19.6	16.0	0.2
Lead	Total (wet weight)	ug/g		<0.5	<0.5	<0.5	0.5
Lithium	Total (wet weight)	ug/g		1.0	0.94	0.88	0.2
Magnesium	Total (wet weight)	ug/g		353	345	335	1
Manganese	Total (wet weight)	ug/g		9.93	86.1	55.8	0.05
Molybdenum	Total (wet weight)	ug/g		<0.1	<0.1	<0.1	0.1
Nickel	Total (wet weight)	ug/g		0.4	<0.2	<0.2	0.3
Phosphorus	Total (wet weight)	ug/g		8160	9070	8160	1
Potassium	Total (wet weight)	ug/g		2500	2750	2680	2
Selenium	Total (wet weight)	ug/g		1.0	0.92	0.96	0.5
Silver	Total (wet weight)	ug/g		<0.4	<0.4	<0.4	0.4
Sodium	Total (wet weight)	ug/g		842	911	948	15
Strontium	Total (wet weight)	ug/g		16.8	15.9	12.6	0.01
Titanium	Total (wet weight)	ug/g		2.3	<0.1	<0.1	0.1
Vanadium	Total (wet weight)	ug/g		0.5	0.2	<0.2	0.2
Zinc	Total (wet weight)	ug/g		32.2	59.4	57.6	0.05
Zirconium	Total (wet weight)	ug/g		0.4	0.4	0.4	0.05

Approved by:

Bill Warning, B.Sc.  
 Lab Operations Manager



## Methodology and Notes

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### Method of Analysis:

MethodName	Reference	Method	Date Analysis Started	Location
Metals (Total) in tissue (Surrey)	US EPA	Metals & Trace Elements by ICP-AES, 6010B	16-Sep-05	Norwest Labs Surrey

\* Norwest method(s) is based on reference method

### References:

US EPA US Environmental Protection Agency Test Methods

### Comments:

Please direct any inquiries regarding this report to our Client Services group.  
Results relate only to samples as submitted

The test report shall not be reproduced except in full, without the written approval of the laboratory

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