



**NIXON FORK MINE**  
**ANNUAL MONITORING SUMMARY**

**2011**

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## **1.0 INTRODUCTION**

This report presents monitoring and sampling activity results from the Nixon Fork Mine during 2011. The monitoring and sampling activities presented in this report were performed as stipulated in Alaska Department of Environmental Conservation (ADEC) Waste Management Permit 2003-DB0055 and the Reclamation Plan Approval (A20065562). Activities were conducted per the Draft Nixon Fork Monitoring Plan, which is incorporated into the Waste Management Permit by reference.

### **1.1 BACKGROUND**

The Nixon Fork Mine is an underground gold and copper mine located approximately 30 miles northeast of McGrath, Alaska (Figure 1). The mine is currently being operated by Mystery Creek Resources, Inc. (MCRI), a wholly owned subsidiary of Fire River Gold Corporation (FAU), and is located on unpatented federal claims administered by the Bureau of Land Management (BLM). Mine startup activities began in November of 2006. Commercial production officially began on April 1, 2007, and was suspended on October 10, 2007.

On March 22, 2008 MCRI gave notice to the U.S. Bureau of Land Management, Alaska Department of Natural Resources, and Alaska Department of Environmental Conservation that Nixon Fork Mine was being placed on Care and Maintenance status as of April 1, 2008. On February 12, 2009, St. Andrews Goldfield Ltd. sold its 100% interest in MCRI to Pacific North West Capital Corp (PFN) of Vancouver, B.C. who subsequently sold 100% of its interest in MCRI to FAU in September, 2009.

It is the continuing goal of MCRI to maintain the Nixon Fork Mine in a manner that will assure the protection of air, surface, and groundwater quality during the Interim Management period. The project site was being maintained in a temporary closure condition until July 2011. In July 2011, the mill was restarted and reprocessing of ore began through the gravimetric and floatation circuits in the mill. All ore milled in 2011 was “new” ore mined underground and transported to surface. The reprocessing of tailings is anticipated to begin in 2012.

### **2.0 YEAR OF RECORD**

The Year of Record for this report is January 1, 2011 through December 31, 2011.

## **3.0 MONITORING AND SAMPLING RESULTS**

The following sections present the results of monitoring and sampling activities conducted during 2011. Surface water sample stations are shown in Figures 2, 3, and 4.

### **3.1 SURFACE WATER MONITORING**

The monitoring plan calls for sampling surface water once per quarter. Under ice sampling was conducted on March 20, 2011 (Quarter 1) and on December 31, 2011 (Quarter 4).

Open water surface water quality sampling events took place on the following dates:

- One surface water monitoring event took place on May 18, 25, and 27, 2011 (Second Quarter), and
- One surface water sampling event took place on July 18, 2011 (Third Quarter).

Water quality results at each sampling station are discussed in terms of the Alaska Department of Environmental Conservation Water Quality Criteria (Table 1 and Table 2) in terms of:

- Major ion chemistry and water quality;
- Minor ion chemistry; and
- Trace ion chemistry.

Hardness was calculated from concentrations of calcium, magnesium, iron, zinc, and manganese according to the following formula:

$$\text{Hardness} = 2.497 * [\text{Ca}] + 4.116 * [\text{Mg}] + 1.792 * [\text{Fe}] + 1.531 * [\text{Zn}] + 1.822 * [\text{Mn}]$$

Sodium Adsorption Ratio (SAR) was calculated from concentrations of sodium, calcium, and magnesium according to the following formula:

$$\text{SAR} = (\text{Na}^{2+}) / \sqrt{(\text{Ca}^{2+} + \text{Mg}^{2+})/2}$$

Water quality data by station is presented in Appendices A-E. The Alaska water quality standards are listed in Tables 1 and 2.

### **3.1.1 Ruby Creek**

The down gradient baseline sample location (RC-1) for Ruby Creek was the most upstream location with detectable stream flow during the open water period of the year (Figure 4). This sampling location monitors water quality below the proposed mining activities and historic mining impacts as discussed below. A second Ruby Creek station is located farther up the Ruby Creek drainage as shown on Figure 4, just below the spring near the historic stamp mill (RC-2). This sample location, while up gradient of the current mining activities, is within an area of historic mining impacts. Due to historic mining activity and deposition of tailings in Crystal Gulch, there is no continuous stream flow above human influence in this drainage. Even the springs that flow periodically at the head of the drainage contact tailings from pre-1990 mining operations.

#### **3.1.1.1 Ruby Creek Sampling Location RC-1**

During the Year of Record, samples were collected in Quarters 2 and 3 in accordance with the procedures outlined in Appendix A, Section 2.3.2 *Nixon Fork Mine Monitoring Plan* dated June 2005. Station RC-1 has been sampled a total of ten times starting in June 2007. Samples were collected in the Second and Third Quarter 2011 at Station RC-1. A summary of the water quality data for Ruby Creek at Station RC-1 is provided in the following Sections.

**Table 1. ADEC Water Quality Criteria<sup>1</sup>**

<b>Pollutant</b>	<b>Drinking Water Supply</b>	<b>Fresh Water Aquatic Life Acute</b>	<b>Fresh Water Aquatic Life Chronic</b>	<b>Stockwater</b>	<b>Irrigation Water</b>
Alkalinity			20 mg/L as CaCO <sub>3</sub> (minimum except where natural conditions are less)		
Aluminum	-	750 µg/L	87 µg/L	-	5000 µg/L
Antimony	6 µg/L				
Arsenic	10 µg/L	340 µg/L (one-hour average, dissolved)	150 µg/L (four-day average dissolved)	50 µg/L	100 µg/L
Barium	2000 µg/L				
Bismuth	-	-	-	-	-
Beryllium	4 µg/L				100 µg/L
Cadmium	<b>5 µg/L</b>	$e^{1.0166*\ln(\text{hardness}) - 3.924}$ <b>hardness dependent</b>	$e^{1.0166*\ln(\text{hardness}) - 4.719}$ <b>hardness dependent</b>	<b>10 µg/L</b>	<b>10 µg/L</b>
Chloride		860000 µg/L	230000 µg/L		
Chromium	100 µg/L			50 µg/L (hexavalent)	100 µg/L (total)
Copper		$e^{0.9422*\ln(\text{hardness}) - 1.700}$ <b>hardness dependent</b>	$e^{0.8545*\ln(\text{hardness}) - 1.702}$ <b>hardness dependent</b>		200 µg/L
Cyanide	200 µg/L	22 µg/L (free CN)	5.2 µg/L (free CN)		
Fluoride	4000 µg/L				1000 µg/L
Iron			<b>1000</b>		<b>5000 µg/L</b>
Lead		$e^{1.273*\ln(\text{hardness}) - 1.460}$ hardness dependent	$e^{1.273*\ln(\text{hardness}) - 4.705}$ hardness dependent	50 µg/L	5000 µg/L
Manganese					<b>200 µg/L</b>
Mercury	2 µg/L	1.4 µg/L dissolved	0.77 µg/L dissolved		
Nitrate-N	10000 µg/L				
Selenium	50 µg/L	Requires distinction between selenite and selenate.	<b>5.0 µg/L</b>	10 µg/L	20 µg/L
Silver		$e^{1.72*\ln(\text{hardness}) - 6.52}$ hardness dependent <sup>2</sup>			
Zinc		$e^{0.8473*\ln(\text{hardness}) + 0.884}$ <b>hardness dependent</b>	$e^{0.8473*\ln(\text{hardness}) + 0.884}$ <b>hardness dependent</b>		<b>2000 µg/L</b>

<sup>1</sup>ADEC 18 AAC 70 Water Quality Standards (Alaska Department of Environmental Conservation, 2009a).

**Table 2. ADEC Water Quality Standards<sup>1</sup>.**

Parameter	Drinking, culinary, food processing	Agriculture, irrigation, stock water	Aquaculture	Industrial	Contact recreation	Secondary Recreation	Aquatic life
Total Dissolved Solids	<b>500 mg/L</b> ; Cl <sup>-</sup> nor SO <sub>4</sub> <sup>2-</sup> may exceed <b>250 mg/L</b>	<b>1000 mg/L</b> ; SAR < 2.5; Na < 60%; residual carbonate < 1.25 meq/L	<b>1000 mg/L</b> May not cause and adverse effect to aquatic life	No amounts above natural that cause corrosion, scaling, or process problems	N/A	N/A	<b>1000 mg/L</b>
pH	<b>6.0 to 8.5</b>	<b>5.0</b> to 9.0	<b>6.5 to 8.5</b> ; may not vary more than 0.5 from natural conditions	<b>5.0</b> to 9.0	<b>6.5 to 8.5</b> ; if natural condition is outside range, substances may not be added that increase buffering capacity of water	<b>5.0</b> to 9.0	<b>6.5 to 8.5</b> ; may not vary more than 0.5 from natural conditions
Temperature	15°C (maximum)	30°C (maximum)	20°C; 15°C migration and rearing areas; 13°C spawning/ egg and fry incubation areas (maximums)	25°C (maximum)	30°C (maximum)	N/A	20°C; 15°C migration and rearing areas; 13°C spawning/ egg and fry incubation areas (maximums)
Turbidity	5 NTU above natural conditions when natural turbidity is up to 50 NTU; max 10% increase in turbidity (25 NTU max increase)	May not cause detrimental effects on indicated use	May not exceed 25 NTU above natural conditions	May not cause detrimental effects	5 NTU above natural conditions when natural turbidity is up to 50; max 10% increase not to exceed 15 increase NTU when natural turbidity is above 50 NTU	10 NTU above natural conditions when natural turbidity is up to 50; max 20% increase not to exceed 15 NTU increase when natural turbidity is above 50 NTU	May not exceed 25 NTU above natural conditions

Bold text indicates that a standard was naturally violated by one or more measurement or sample.

<sup>1</sup>ADEC 18 AAC 70 Water Quality Standards (Alaska Department of Environmental Conservation, 2009a).

<sup>2</sup>May not reduce the depth of the compensation point by more than 10% from the seasonally established norm for aquatic life.

<sup>3</sup>Several measurements exceeded 110 percent of saturation for dissolved oxygen, but only with the older, non-optical DO meter.

### **Major Ion Chemistry and Water Quality**

#### **Hardness**

Calculated hardness for Station RC-1 was 21 mg/L in May 2011. Calculated hardness for Station RC-1 was 49 mg/L in July 2011. A waterbody with a calculated hardness between 0 and 75 is classified as 'soft' water.

#### **Total Dissolved Solids**

Historically, Station RC-1 had a total dissolved solids (TDS) load between 96.3 mg/L and 7.21 mg/L. Measured TDS at Station RC-1 in May 2011 was 74 mg/L and measured TDS in July 2011 was 88 mg/L.

#### **Alkalinity**

Historically, measured total alkalinity at Station RC-1 was between 28 mg/L and 51.9 mg/L with an average total alkalinity of 45 mg/L. Total alkalinity in May 2011 was 16.3 mg/L. Total alkalinity in July 2011 was 51.3 mg/L. Total alkalinity at Station RC-1 is entirely bicarbonate (HCO<sub>3</sub>) and no carbonate (CO<sub>3</sub>) or hydroxide (OH) alkalinity were measured.

#### **pH**

Historically, Station RC-1 has had a measured pH between 6.6 and 7.9 with a mean pH of 6.9. During 2011 pH measurements were 6.9 in May and 7.3 in July. Measured Station pH is within ADEC water quality standards for all uses (Table 2).

#### **Temperature**

Historically, Station RC-1 has had a measured temperature between 15.1 °C and 0 °C. During 2011 temperature measurements were 2.5°C in May and 9.0 °C in July. Measured stream temperature is within ADEC water quality standards for all uses (Table 2).

#### **Turbidity**

Historically, Station RC-1 has had a measured turbidity level between 1.82 NTU and 19.1 NTU. Mean turbidity level at Station RC-1 historically is 8.5 NTU. Measured turbidity in 2011 was 2.89 NTU in May 2011 and 2.59 NTU in July 2011. Discharges to Ruby Creek above Station RC-1 related to the Nixon Fork Mine are not anticipated but would have to be less than 13.5 NTU to be in compliance with the ADEC water quality standards (Table 2).

### **Minor Ion Chemistry**

Laboratory samples for minor ions were collected from Station RC-1 in both May and July 2011. The minor ions analyzed included:

- Phosphorus;
- Chloride
- Fluoride;
- Sulfate;
- Nitrate-N;
- Nitrite-N;
- Ammonia-N
- Total cyanide; and

- Weak Acid Dissociable (WAD) cyanide.

Of the analyzed minor ions, only chloride and sulfate were detected in both sampling events. Nitrate was only detected in the July 2011 sample. None of the detected minor ions exceed the ADEC water quality standards (Table 2).

### Trace Ion Chemistry

Laboratory samples for trace ions were collected from Station RC-1 in both May and July 2011. The trace ions analyzed included:

- Aluminum;
- Antimony;
- Arsenic;
- Barium;
- Bismuth;
- Cadmium;
- Chromium;
- Copper;
- Lead;
- Manganese;
- Nickel;
- Selenium;
- Silicon;
- Silver;
- Sodium;
- Zinc; and
- Mercury.

No measurable antimony, bismuth, cadmium, chromium, silver, or selenium was present in the samples collected during 2011 from Station RC-1. Trace ions measured in samples collected in either May or July 2011 are discussed below.

#### Aluminum

Historically, measurable aluminum concentrations at Station RC-1 have ranged between 38.3 µg/L and 278 µg/L. The mean measurable aluminum concentration at Station RC-1 is 78 µg/L. Measurable aluminum was present at Station RC-1 in both May 2011 (129 µg/L total and 129 µg/L dissolved) and in July 2011 (278 µg/L dissolved). Water samples indicate that Ruby Creek above Station RC-1 periodically exceeds the allowable aluminum concentrations the ADEC water quality standard has established for chronic effects for aquatic life for fresh water (Table 1). Based upon a review of the historic data it does not appear that the aluminum exceedance in Ruby Creek at Station RC-1 is correlated to season.

#### Antimony

Historically, measurable antimony concentrations at Station RC-1 have ranged between 1.01 µg/L and 2.29 µg/L. The mean measurable antimony concentration at Station RC-1 is 1.29 µg/L.

Measurable antimony was present at Station RC-1 in both May 2011 (1.02 µg/L total and 0.89 µg/L dissolved) and in July 2011 (2.29 µg/L dissolved). Measurable antimony concentrations in 2011 at Station RC-1 did not exceed the most stringent ADEC water quality standard (Table 1).

#### Arsenic

Historically, measurable arsenic concentrations at Station RC-1 have ranged between 5.11 µg/L and 30.3 µg/L. The mean measurable arsenic concentration at Station RC-1 is 23.1 µg/L. Measurable arsenic was present at Station RC-1 in both May 2011 (6.03 µg/L dissolved and 7.44 µg/L total) and in July 2011 (5.11 µg/L total). Water samples indicate that Ruby Creek above Station RC-1 routinely exceeds the allowable arsenic concentrations the ADEC water quality standard has established for drinking water (Table 1). Based upon a review of the historic data it does not appear that the arsenic exceedance in Ruby Creek at Station RC-1 is correlated to season and the mean arsenic concentrations above established water quality criteria are naturally occurring. Arsenic concentrations at Station RC-1 did not exceed applicable water quality criteria.

#### Barium

Historically, measurable barium concentrations at Station RC-1 have ranged between 11.7 µg/L and 27.7 µg/L. The mean measurable barium concentration at Station RC-1 is 21.9 µg/L. Measurable barium was present at Station RC-1 in both May 2011 (11.9 µg/L total and 11.7 µg/L dissolved) and in July 2011 (24.3 µg/L total and 21.5 µg/L dissolved). Measurable barium concentrations in 2011 at Station RC-1 did not exceed the most stringent ADEC water quality standard (Table 1).

#### Bismuth

Historically, no measurable bismuth concentrations have been found at Station RC-1. In May 2011, estimated total bismuth concentrations of 0.438 µg/L dissolved and 0.839 µg/L total were present in the water sample submitted. In July 2011, bismuth concentrations were 6.27 µg/L total. Measurable bismuth concentrations in 2011 at Station RC-1 did not exceed the most stringent ADEC water quality standard (Table 1).

#### Copper

Historically, measurable copper concentrations at Station RC-1 have ranged between 70.4 µg/L and 359 µg/L. The mean measurable copper concentration at Station RC-1 is 149 µg/L. Measurable copper was present at Station RC-1 in both May 2011 (392 µg/L total and 376 µg/L dissolved) and in July 2011 (29.5 µg/L total and 359 µg/L dissolved). Water samples indicate that Ruby Creek above Station RC-1 periodically exceeds the allowable copper concentrations the ADEC water quality standard has established for acute and chronic protection of aquatic life (Table 1). Based upon a review of the historic data it does not appear that the copper exceedance in Ruby Creek at Station RC-1 is correlated to season and the mean copper concentrations above established water quality criteria are naturally occurring or the result of historic mining activity.

#### Lead

Historically, measurable lead concentrations at Station RC-1 have ranged between 0.25 µg/L and 20 µg/L. The mean measurable lead concentration at Station RC-1 is 2.5 µg/L. Measurable lead was present at Station RC-1 in both May 2011 (0.590 µg/L total and 0.101 µg/L dissolved) and in

July 2011 (0.898 µg/L total). Water samples indicate that Ruby Creek above Station RC-1 has historically exceeded the allowable lead concentrations the ADEC water quality standard has established for acute and chronic protection of aquatic life (Table 1). Based upon a review of the historic data it does not appear that the lead exceedance in Ruby Creek at Station RC-1 is correlated to season and the mean lead concentration is below established water quality criteria.

#### Manganese

Historically, measurable manganese concentrations at Station RC-1 have ranged between 18.2 µg/L and 409 µg/L. The mean measurable manganese concentration at Station RC-1 is 198 µg/L. Measurable manganese was present at Station RC-1 in both May 2011 (257 µg/L total and 255 µg/L dissolved) and in July 2011 (13 µg/L total and 0.338 µg/L dissolved). Water samples indicate that Ruby Creek above Station RC-1 routinely exceeds the allowable manganese concentrations the ADEC water quality standard has established for consumption of water and aquatic organisms (Table 1). Based upon a review of the historic data it does not appear that the manganese exceedance in Ruby Creek at Station RC-1 is correlated to season and the mean manganese concentrations above established water quality criteria are naturally occurring.

#### Silicon

Historically, measurable silicon concentrations at Station RC-1 have ranged between 1,710 µg/L and 8,800 µg/L. The mean measurable silicon concentration at Station RC-1 is 4,682 µg/L. Measurable silicon was present at Station RC-1 in both May 2011 (1,740 µg/L total and 1,710 µg/L dissolved) and in July 2011 (7,540 µg/L total and 6,940 µg/L dissolved).

#### Sodium

Historically, measurable sodium concentrations at Station RC-1 have ranged between 1,220 µg/L and 6,410 µg/L. The mean measurable sodium concentration at Station RC-1 is 2,020 µg/L. Measurable sodium was present at Station RC-1 in both May 2011 (545 µg/L total and 546 µg/L dissolved) and in July 2011 (3,380 µg/L total and 3,490 µg/L dissolved).

#### Zinc

Historically, measurable zinc concentrations at Station RC-1 have ranged between 5.1 µg/L and 10.8 µg/L. The mean measurable zinc concentration at Station RC-1 is 8.2 µg/L. Measurable zinc was present at Station RC-1 in both May 2011 (5.8 µg/L total and 5.44 µg/L dissolved) and July 2011 (5.43 µg/L total and 3.01 µg/L dissolved).

#### Mercury

Historically, measurable mercury concentrations at Station RC-1 have ranged between 8.59 ng/L and 118 ng/L. The mean measurable mercury concentration at Station RC-1 is 62 µg/L. Measurable mercury was present at Station RC-1 in both May 2011 (256 ng/L total) and in July 2011 (36.6 µg/L total). Water samples indicate that Ruby Creek above Station RC-1 routinely exceeds the allowable mercury concentrations the ADEC water quality standard (Table 1). Based upon a review of the historic data it does not appear that the mercury exceedance in Ruby Creek at Station RC-1 is correlated to season and the mean mercury concentrations above established water quality criteria are related to the historic stamp mill tailings at the head of the Ruby Creek basin. The historic stamp mill tailings are not part of the Mystery Creek Resources, Inc. facility or mining operation.

### **3.1.1.2 Ruby Creek Sampling Location RC-2**

During the Year of Record, samples were collected in Quarter 2 and Quarter 3 in accordance with the procedures outlined in Appendix A, Section 2.3.2 *Nixon Fork Mine Monitoring Plan* dated June 2010. Water Samples were not collected in Quarter 1 or Quarter 4 2011 because no water was present and the station was frozen to ground. Station RC-2 has been sampled a total of seven times starting in June 2008. A summary of the water quality data for Ruby Creek at Station RC-2 is provided in the following Sections.

#### **Major Ion Chemistry and Water Quality**

##### **Hardness**

Calculated hardness for Station RC-2 was 32 mg/L in May 2011 and 43 mg/L in July 2011. A waterbody with a calculated hardness between 0 and 75 is classified as 'soft' water.

##### **Total Dissolved Solids**

Historically, Station RC-2 had a total dissolved solids (TDS) load between 82 mg/L and 72.5 mg/L. Measured TDS at Station RC-2 in May 2011 was 82 mg/L and 89 mg/L in July 2011.

##### **Alkalinity**

Historically, measured total alkalinity at Station RC-2 was between 40 mg/L and 55.7 mg/L with an average total alkalinity of 45 mg/L. Total alkalinity in May 2011 was 28.5 mg/L and 38.7 mg/L in July 2011. Total alkalinity at Station RC-2 is entirely bicarbonate (HCO<sub>3</sub>) with insignificant carbonate (CO<sub>3</sub>) and no hydroxide (OH) alkalinity was measured.

##### **pH**

Historically, Station RC-2 has had a measured pH between 6.6 and 7.3 with a mean pH of 7.0. During 2011 pH measurements were 7.3 in May 2011 and 7.4 in July 2011. Measured Station pH is within ADEC water quality standards for all uses (Table 1).

##### **Temperature**

Historically, Station RC-2 has had a measured temperature between 15.1 °C and 1.5 °C. During 2011 temperature measurements were 5.1 °C in May 2011 and 1.2 °C in July 2011. Measured stream temperature is within ADEC water quality standards for all uses (Table 2).

##### **Turbidity**

Historically, Station RC-2 has had a measured turbidity level between 0.12 NTU and 6.0 NTU. Mean turbidity level at Station RC-2 historically is 7.7 NTU. Measured turbidity in 2011 was 37 NTU in May 2011 and 8.8 NTU in July 2011. Discharges to Ruby Creek above station RC-2 related to the Nixon Fork Mine are not anticipated but would have to be less than 6.6 NTU to be in compliance with the ADEC water quality standards (Table 2).

#### **Minor Ion Chemistry**

Laboratory sample for minor ions was collected from Station RC-2 in May and July 2011. The minor ions analyzed included:

- Phosphorus;

- Chloride
- Fluoride;
- Sulfate;
- Nitrate-N;
- Nitrite-N;
- Ammonia-N
- Total cyanide; and
- Weak Acid Dissociable (WAD) cyanide.

Of the analyzed minor ions, only chloride, sulfate, chloride, nitrate, and total nitrate were detected in measurable quantities from the August 2010 sampling event. None of the detected minor ions exceed the ADEC water quality standards (Table 2).

### **Trace Ion Chemistry**

Laboratory sample for trace ions were collected from Station RC-2 in August 2011. The trace ions analyzed included:

- Aluminum;
- Antimony;
- Arsenic;
- Barium;
- Bismuth;
- Cadmium;
- Chromium;
- Copper;
- Lead;
- Manganese;
- Nickel;
- Selenium;
- Silicon;
- Silver;
- Sodium;
- Zinc; and
- Mercury.

No measurable cadmium, or selenium was present in the samples collected during 2011 from Station RC-2. Trace ions measured in samples collected in May and July 2011 are discussed below.

### **Aluminum**

Historically, measurable aluminum concentrations at Station RC-2 have ranged between 29.4 µg/L and 1,580 µg/L. The mean measurable aluminum concentration at Station RC-2 is 308 µg/L. Measurable aluminum was present at Station RC-2 in May 2011 (1,580 µg/L total and 295 µg/L dissolved) and in July 2011 (55.9 µg/L total and 67.7 µg/L dissolved). Water samples indicate that Ruby Creek above Station RC-2 periodically exceeds the allowable aluminum

concentrations the ADEC water quality standard has established for chronic effects for aquatic life for fresh water (Table 1). Based upon a review of the historic data it does not appear that the aluminum exceedance in Ruby Creek at Station RC-2 is correlated to season.

#### Antimony

Historically, measurable antimony concentrations at Station RC-2 have ranged between 1.12 µg/L and 4.96 µg/L. The mean measurable antimony concentration at Station RC-2 is 1.96 µg/L. Measurable antimony was present at Station RC-2 in May 2011 (4.96 µg/L total and 1.29 µg/L dissolved) and in July 2011 (1.2 µg/L total and 1.22 µg/L dissolved). Measurable antimony concentrations in 2011 at Station RC-2 did not exceed the most stringent ADEC water quality standard (Table 1).

#### Arsenic

Historically, measurable arsenic concentrations at Station RC-2 have ranged between 19.4 µg/L and 27.7 µg/L. The mean measurable arsenic concentration at Station RC-2 is 23.2 µg/L. Measurable arsenic was present at Station RC-2 in May 2011 (15.2 µg/L total and 4.91 µg/L dissolved) and in July 2011 (27.7 µg/L total and 26.4 µg/L dissolved). Water samples indicate that Ruby Creek above Station RC-2 routinely exceeds the allowable arsenic concentrations the ADEC water quality standard has established for drinking water (Table 1). Based upon a review of the historic data it does not appear that the arsenic exceedance in Ruby Creek at Station RC-2 is correlated to season and the mean arsenic concentrations above established water quality criteria are naturally occurring.

#### Barium

Historically, measurable barium concentrations at Station RC-2 have ranged between 15.9 µg/L and 36.6 µg/L. The mean measurable barium concentration at Station RC-2 is 21.3 µg/L. Measurable barium was present at Station RC-2 in May 2011 (21.5 µg/L total and 19.8 µg/L dissolved) and in July 2011 (17.4 µg/L total and 18.3 µg/L dissolved). Measurable barium concentrations in 2011 at Station RC-2 did not exceed the most stringent ADEC water quality standard (Table 1).

#### Bismuth

Historically, measurable bismuth concentrations at Station RC-2 have ranged between <1.0 µg/L and 14.7 µg/L. The mean measurable bismuth concentration at Station RC-2 is 8.08 µg/L. Measurable barium was present at Station RC-2 in May 2011 (14.5 µg/L total and 0.96 µg/L dissolved) and in July 2011 (0.68 µg/L total and 0.44 µg/L dissolved). Measurable bismuth concentrations in 2011 at Station RC-2 did not exceed the most stringent ADEC water quality standard (Table 1).

#### Chromium

Historically, measurable chromium concentrations at Station RC-2 have ranged between < 2.0 µg/L and 2.54 µg/L. The mean measurable chromium concentration at Station RC-2 is <2.0 µg/L. Measurable chromium was present at Station RC-2 in May 2011 (2.54 µg/L total and 0.82 µg/L dissolved) and was not detected in July 2011. Measurable chromium concentrations in 2011 at Station RC-2 did not exceed the most stringent ADEC water quality standard (Table 1).

### Copper

Historically, measurable copper concentrations at Station RC-2 have ranged between 34.4 µg/L and 805 µg/L. The mean measurable copper concentration at Station RC-2 is 145 µg/L. Measurable copper was present at Station RC-2 in May 2011 (805 µg/L total and 237 µg/L dissolved) and in July 2011 (183 µg/L total and 173 µg/L dissolved). Water samples indicate that Ruby Creek above Station RC-2 periodically exceeds the allowable copper concentrations the ADEC water quality standard has established for acute and chronic protection of aquatic life (Table 1). Based upon a review of the historic data it does not appear that the copper exceedance in Ruby Creek at Station RC-2 is correlated to season and the mean copper concentrations above established water quality criteria are naturally occurring.

### Lead

Historically, measurable lead concentrations at Station RC-2 have ranged between 0.329 µg/L and 2.88 µg/L. The mean measurable lead concentration at Station RC-2 is 0.970 µg/L. Measurable lead was present at Station RC-2 in May 2011 (2.54 µg/L total and 0.247 µg/L dissolved) and in July 2011 (0.37 µg/L total and 0.384 µg/L dissolved). Although laboratory results indicate that Ruby Creek above Station RC-1 has historically exceeded the allowable lead concentrations the ADEC water quality standard has established for acute and chronic protection of aquatic life (Table 1) but that lead has not exceeded applicable water quality standards at Station RC-2. Based upon a review of the historic data it does not appear that the lead exceedance in Ruby Creek at Station RC-2 is correlated to season and the mean lead concentration is below established water quality criteria.

### Manganese

Historically, measurable manganese concentrations at Station RC-2 have ranged between 2.04 µg/L and 213 µg/L. The mean measurable manganese concentration at Station RC-2 is 120 µg/L. Measurable manganese was present at Station RC-2 in May 2011 (158 µg/L total and 99.7 µg/L dissolved) and in July 2011 (159 µg/L total and 159 µg/L dissolved). Water samples indicate that Ruby Creek above Station RC-2 routinely exceeds the allowable manganese concentrations the ADEC water quality standard has established for consumption of water and aquatic organisms (Table 1). Based upon a review of the historic data it does not appear that the manganese exceedance in Ruby Creek at Station RC-2 is correlated to season and the mean manganese concentrations above established water quality criteria are naturally occurring.

### Nickel

Historically, measurable nickel concentrations at Station RC-2 have been below detection limits (< 2.0 µg/L). Measurable nickel was present at Station RC-2 in May 2011 (3.72 µg/L total).

### Silicon

Historically, measurable silicon concentrations at Station RC-2 have ranged between 3,050 µg/L and 7,470 µg/L. The mean measurable silicon concentration at Station RC-2 is 5,798 µg/L. Measurable silicon was present at Station RC-2 in May 2011 (4,840 µg/L total and 3,050 µg/L dissolved) and in July 2011 (3,430 µg/L total and 3,480 µg/L dissolved).

### Sodium

Historically, measurable sodium concentrations at Station RC-2 have ranged between 1,080 µg/L and 3,590 µg/L. The mean measurable sodium concentration at Station RC-2 is 2,471 µg/L. Measurable sodium was present at Station RC-2 in May 2011 (1,160 µg/L total and 1,080 µg/L dissolved) and in July 2011 (1,100 µg/L total and 1,170 µg/L dissolved).

### Zinc

Historically, measurable zinc concentrations at Station RC-2 have ranged from below detection limits (< 5.0 µg/L) to 9.29 µg/L. Measurable zinc was present at Station RC-2 in May 2011 (20.2 µg/L total and 6.94 µg/L dissolved) and in July 2011 (5.85 µg/L total and 6.06 µg/L dissolved). Zinc concentrations did not exceed applicable water quality standards (Table 1).

### Mercury

Historically, measurable mercury concentrations at Station RC-2 have ranged between 9.18 ng/L and 106 ng/L. The mean measurable mercury concentration at Station RC-2 is 35.4 ng/L. Measurable mercury was present at Station RC-2 in July 2011 (86.1 µg/L total). Water samples indicate that Ruby Creek above Station RC-2 periodically exceeds the allowable mercury concentrations in the ADEC water quality standard (Table 1). Based upon a review of the historic data it does not appear that the mercury exceedance in Ruby Creek at Station RC-2 is correlated to season and the mean mercury concentrations above established water quality criteria are related to the historic stamp mill tailings at the head of the Ruby Creek basin. The historic stamp mill tailings are not part of the Mystery Creek Resources, Inc. facility or mining operation.

## **3.1.2 Mystery Creek**

There are two sampling locations on Mystery Creek: one (MC-1) approximately 250 meters downstream, and one (MC-2) approximately 200 meters upstream of the mine drinking water intake structure location shown on Figure 4.

### **3.1.2.1 Mystery Creek Sampling Location MC-1**

During the Year of Record, samples were collected in Quarter 2 and Quarter 3 in accordance with the procedures outlined in Appendix A, Section 2.3.2 *Nixon Fork Mine Monitoring Plan* dated June 2010. Water samples were not collected in Quarter 1 or Quarter 4 2011 because no water was present and the station was frozen to ground. Station MC-1 has been sampled a total of ten times starting in June 2008. A summary of the water quality data for Mystery Creek at Station MC-1 is provided in the following Sections.

### **Major Ion Chemistry and Water Quality**

#### Hardness

Calculated hardness for Station MC-1 in May 2011 was 32 mg/L and 31 mg/L in July 2011. A waterbody with a calculated hardness between 0 and 75 is classified as 'soft' water.

### Total Dissolved Solids

Historically, Station MC-1 had a total dissolved solids (TDS) load between 18.8 mg/L and 72 mg/L. Measured TDS at Station MC-1 in May 2011 was 51 mg/L and was 72 mg/L in July 2011.

### Alkalinity

Historically, measured total alkalinity at Station MC-1 was between 20 mg/L and 38 mg/L with an average total alkalinity of 31 mg/L. Total alkalinity in May 2011 was 19.8 mg/L and was 30 mg/L in July 2011.. Total alkalinity at Station MC-1 is entirely bicarbonate (HCO<sub>3</sub>) and no carbonate (CO<sub>3</sub>) and hydroxide (OH) alkalinity was measured.

### pH

Historically, Station MC-1 has had a measured pH between 6.7 and 7.6 with a mean pH of 7.2. During 2011 pH measurements were 7.3 in May and 7.4 in July. Measured Station pH is within ADEC water quality standards for all uses (Table 1).

### Temperature

Historically, Station MC-1 has had a measured temperature between 0.4 °C and 10.3 °C. During 2011 temperature measurements were 0.4 °C in May and 2.8 °C in July.. Measured stream temperature is within ADEC water quality standards for all uses (Table 2).

### Turbidity

Historically, Station MC-1 has had a measured turbidity level between 0.1 NTU and 3.16 NTU. Mean turbidity level at Station MC-1 historically is 1.82 NTU. Measured turbidity in 2011 was 3.16\ NTU in May 2011 and 2.45 NTU in July 2011. Discharges to Mystery Creek above station MC-1 related to the Nixon Fork Mine are not anticipated.

### Minor Ion Chemistry

Laboratory sample for minor ions were collected from Station MC-1 in Quarter 2 and Quarter 3 2011. The minor ions analyzed included:

- Phosphorus;
- Chloride
- Fluoride;
- Sulfate;
- Nitrate-N;
- Nitrite-N;
- Ammonia-N
- Total cyanide; and
- Weak Acid Dissociable (WAD) cyanide.

Of the analyzed minor ions, only sulfate, chloride, and nitrate, and total nitrate were detected in measurable quantities from the August 2011 sampling event. None of the detected minor ions exceed the ADEC water quality standards (Table 2).

### Trace Ion Chemistry

Laboratory sample for trace ions were collected from Station MC-1 in July 2011. The trace ions analyzed included:

- Aluminum;
- Antimony;
- Arsenic;
- Barium;
- Bismuth;
- Cadmium;
- Chromium;
- Copper;
- Lead;
- Manganese;
- Nickel;
- Selenium;
- Silicon;
- Silver;
- Sodium;
- Zinc; and
- Mercury.

No measurable antimony, bismuth, cadmium, chromium, nickel, selenium, silver, or zinc was present in the samples collected during 2011 from Station MC-1. Trace ions measured in samples collected in May and July 2011 are discussed below.

#### Aluminum

Historically, measurable aluminum concentrations at Station MC-1 have ranged between 23.7 µg/L and 816 µg/L. The mean measurable aluminum concentration at Station MC-1 is 155 µg/L. Measurable aluminum was present at Station MC-1 in May 2011 (816 µg/L total and 31.2 µg/L dissolved) and in July 2011 (238 µg/L total and 24.7 µg/L dissolved). Measured aluminum at station MC-1 indicates that Mystery Creek exceeded the ADEC water quality chronic effect on aquatic life criteria for aluminum in surface waters.

#### Arsenic

Historically, measurable arsenic concentrations at Station MC-1 have ranged between 32.5 µg/L and 64.9 µg/L. The mean measurable arsenic concentration at Station MC-1 is 49 µg/L. Measurable arsenic was present at Station MC-1 in May 2011 (63.3 µg/L total and 38.3 µg/L dissolved) and in July 2011 (53.7 µg/L total and 49.2 µg/L dissolved). Water samples indicate that Mystery Creek above Station MC-1 routinely exceeds the allowable arsenic concentrations the ADEC water quality standard has established for drinking water (Table 1). Based upon a review of the historic data it does not appear that the arsenic exceedance in Mystery Creek at Station MC-1 is correlated to season and the mean arsenic concentrations above established water quality criteria are naturally occurring.

### Barium

Historically, measurable barium concentrations at Station MC-1 have ranged between 5.58 µg/L and 11.4 µg/L. The mean measurable arsenic concentration at Station MC-1 is 7.03 µg/L. Measurable barium was present at Station MC-1 in May 2011 (11.4 µg/L total and 5.81 µg/L dissolved) and in July 2011 (8.03 µg/L total and 5.99 µg/L dissolved). Measurable barium concentrations in 2011 at Station MC-1 did not exceed the most stringent ADEC water quality standard (Table 1).

### Copper

Historically, measurable copper concentrations at Station MC-1 have been below 1 µg/L total. Measurable copper was present at Station MC-1 in May 2011 (2.89 µg/L total ) and in July 2011 (1.19 µg/L total). Measurable copper concentrations in 2011 at Station MC-1 did not exceed the most stringent ADEC water quality standard (Table 1).

### Lead

Historically, measurable lead concentrations at Station MC-1 have ranged from below 0.2 µg/L to 1.41 µg/L . Measurable lead was present at Station MC-1 in May 2011 (1.04 µg/L total ) and in July 2011 (.826 µg/L total). Measurable copper concentrations in 2011 at Station MC-1 did not exceed the most stringent ADEC water quality standard (Table 1).

### Manganese

Historically, measurable manganese concentrations at Station MC-1 have ranged between 2.79 µg/L and 25.3 µg/L. The mean measurable manganese concentration at Station MC-1 is 14.5 µg/L. Measurable manganese was present at Station MC-1 in May 2011 (2.89 µg/L total ) and in July 2011 (1.19 µg/L total). Water samples indicate that Mystery Creek above Station MC-1 does not exceed the allowable manganese concentrations the ADEC water quality standard has established (Table 1).

### Silicon

Historically, measurable silicon concentrations at Station MC-1 have ranged between 4,740 µg/L and 5,760 µg/L. The mean measurable silicon concentration at Station MC-1 May 2011 (4,580 µg/L total and 3,920 µg/L dissolved) and in July 2011 (5,340 µg/L total and 5,070 µg/L dissolved).

### Sodium

Historically, measurable sodium concentrations at Station MC-1 have ranged between 1,810 µg/L and 2,120 µg/L. The mean measurable sodium concentration at Station MC-1 is 1,650 µg/L. Measurable sodium was present at Station MC-1 in May 2011 (1,460 µg/L total and 1,440 µg/L dissolved) and in July 2011 (2,030 µg/L total and 2,150 µg/L dissolved).

### Mercury

Historically, measurable mercury concentrations at Station MC-1 have ranged between 1.12 ng/L and 12.1 ng/L. The mean measurable mercury concentration at Station MC-1 is 3.34 ng/L. Measurable mercury was present at Station MC-1 in May 2011 (4.81 ng/L total) and in July 2011

(2.78 ng/L total). Water samples indicate that Mystery Creek above Station MC-1 does not exceed the ADEC water quality standard for allowable mercury concentrations (Table 1).

### **3.1.2.2 Mystery Creek Sampling Location MC-2**

During the Year of Record, samples were collected in Quarters 1, 2, 3, and 4 in accordance with the procedures outlined in Appendix A, Section 2.3.2 *Nixon Fork Mine Monitoring Plan* dated June 2010. Station MC-2 has been sampled a total of thirteen times starting in June 2007. A summary of the water quality data for Mystery Creek at Station MC-2 is provided in the following Sections. Samples were collected through the ice at station MC-2 in accordance with the procedures outlined in Appendix A, Section 2.3.2 *Nixon Fork Mine Monitoring Plan* dated June 2005.

#### **Major Ion Chemistry and Water Quality**

##### **Hardness**

Calculated hardness for Station MC-2 was:

- March 2011 - 32 mg/L;
- May 2011 – 22 mg/L;
- July 2011 – 31 mg/L; and
- December 2011 – 34 mg/L.

A waterbody with a calculated hardness between 0 and 75 is classified as ‘soft’ water.

##### **Total Dissolved Solids**

Historically, Station MC-2 had a total dissolved solids (TDS) load between 0.13 mg/L and 87.5 mg/L. Measured TDS was:

- March 2011 – Not Measured;
- May 2011 – 45 mg/L;
- July 2011 – 71 mg/L; and
- December 2011 – 48 mg/L.

##### **Alkalinity**

Historically, measured total alkalinity at Station MC-2 was between 28 mg/L and 49 mg/L with an average total alkalinity of 33mg/L. Total alkalinity was:

- March 2011 - 34 mg/L;
- May 2011 – 22 mg/L;
- July 2011 – 31 mg/L; and
- December 2011 – 32 mg/L.

##### **pH**

Historically, Station MC-2 has had a measured pH between 6.7 and 7.8 with a mean pH of 7.2. During 2011 pH measurements were:

- March 2011 – 7.1;

- May 2011 – 7.2;
- July 2011 – 7.4; and
- December 2011 – 7.3.

Measured Station pH is within ADEC water quality standards for all uses (Table 2).

#### Temperature

Historically, Station MC-2 has had a measured temperature between 9.3 °C and 0 °C. During 2011 temperature measurements were:

- March 2011 – 0 °C;
- May 2011 – 0.4 °C;
- July 2011 – 2.2 °C; and
- December 2011 – 0 °C.

Measured stream temperature is within ADEC water quality standards for all uses (Table 2).

#### Turbidity

Historically, Station MC-2 has had a measured turbidity level between 0.13 NTU and 3.24 NTU. Mean turbidity level at Station MC-2 historically is 1.21 NTU. Measured turbidity was

- March 2011 – 2.04 NTU;
- May 2011 – 1.89 NTU;
- July 2011 – 1.7 NTU; and
- December 2011 – 1.1 NTU.

Discharges to Mystery Creek above station MC-2 related to the Nixon Fork Mine are not anticipated but would have to be less than 5.9 NTU to be in compliance with the ADEC water quality standards (Table 2).

#### Minor Ion Chemistry

Laboratory sample for minor ions were collected from Station MC-2 in all four quarters of 2011. The minor ions analyzed for included:

- Phosphorus;
- Chloride
- Fluoride;
- Sulfate;
- Nitrate-N;
- Nitrite-N;
- Ammonia-N
- Total cyanide; and
- Weak Acid Dissociable (WAD) cyanide.

Of the analyzed minor ions, only chloride, sulfate, nitrate were detected in sampling events. Ammonia was only detected in the July 2011 sample. None of the detected minor ions exceed the ADEC water quality standards (Table 2).

### Trace Ion Chemistry

Laboratory sample for trace ions were collected from Station MC-2 in all four quarters of 2011. The trace ions analyzed included:

- Aluminum;
- Antimony;
- Arsenic;
- Barium;
- Bismuth;
- Cadmium;
- Chromium;
- Copper;
- Lead;
- Manganese;
- Nickel;
- Selenium;
- Silicon;
- Silver;
- Sodium;
- Zinc; and
- Mercury.

No measurable bismuth cadmium, chromium, nickel, selenium, or silver was present in the samples collected during 2011 from Station MC-2. Trace ions measured in samples collected in either March or August 2011 are discussed below.

### Aluminum

Historically, measurable aluminum concentrations at Station MC-2 have ranged between 21 µg/L and 294 µg/L. The mean measurable aluminum concentration at Station MC-2 is 140 µg/L. Measurable aluminum was present at Station MC-2 was:

- March 2011 – 514 µg/L total and 294 µg/L dissolved;
- May 2011 – 306 µg/L total and 34.2 µg/L dissolved;
- July 2011 – 120 µg/L total and 25.6 µg/L dissolved; and
- December 2011 – 406 µg/L total and 9.28 µg/L dissolved.

Water samples indicate that Mystery Creek above Station MC-2 periodically exceeds the allowable aluminum concentrations the ADEC water quality standard has established for chronic effects for aquatic life for fresh water (Table 1). Based upon a review of the historic data it does not appear that the aluminum exceedance in Mystery Creek at Station MC-2 is correlated to season.

### Arsenic

Historically, measurable arsenic concentrations at Station MC-2 have ranged between 34.7 µg/L and 79.2 µg/L. The mean measurable arsenic concentration at Station MC-2 is 59 µg/L. Measurable arsenic was present at Station MC-2 during all four quarters:

- March 2011 – 76.8 µg/L total and 63.6 µg/L dissolved;
- May 2011 – 52 µg/L total and 35.5 µg/L dissolved;
- July 2011 – 44.1 µg/L total and 30.8 µg/L dissolved; and
- December 2011 – 62 µg/L total and 56.7 µg/L dissolved.

Water samples indicate that Mystery Creek above Station MC-2 routinely exceeds the allowable arsenic concentrations the ADEC water quality standard has established for drinking water and stock water (Table 1). Based upon a review of the historic data it does not appear that the arsenic exceedance in Mystery Creek at Station MC-2 is correlated to season and the mean arsenic concentrations above established water quality criteria are naturally occurring.

### Barium

Historically, measurable barium concentrations at Station MC-2 have ranged between 5.0 µg/L and 11.7 µg/L. The mean measurable barium concentration at Station MC-21 is 6.9 µg/L. Measurable barium was present at Station MC-2 in all four quarters:

- March 2011 – 11.7 µg/L total and 9.76 µg/L dissolved;
- May 2011 – 7.64 µg/L total and 5.53 µg/L dissolved;
- July 2011 – 7.29 µg/L total and 6.31 µg/L dissolved; and
- December 2011 – 7.01 µg/L total and 6.84 µg/L dissolved.

Measurable barium concentrations in 2011 at Station MC-2 did not exceed the most stringent ADEC water quality standard (Table 1).

### Copper

Historically, measurable copper concentrations at Station MC-2 have ranged between 1.03 µg/L and 1.93 µg/L. The mean measurable copper concentration at Station MC-2 is 1.48 µg/L. Measurable copper was present at Station MC-2 in all four quarters 2011:

- March 2011 – 1.56 µg/L total and 1.33 µg/L dissolved;
- May 2011 – 1.83 µg/L total and 0.991 µg/L dissolved;
- July 2011 – 1.06 µg/L total and 0.790 µg/L dissolved; and
- December 2011 – 1.18 µg/L total and 1.88 µg/L dissolved.

Water samples indicate that Mystery Creek above Station MC-2 does not exceed the allowable copper concentrations the ADEC water quality standard has established for acute and chronic protection of aquatic life (Table 1).

### Lead

Historically, measurable lead concentrations at Station MC-2 have ranged between 0.222 µg/L and 1.4 µg/L. The mean measurable lead concentration at Station MC-2 is 0.61 µg/L. Measurable lead was present at Station MC-2 in all four quarters of 2011:

- March 2011 – 1.13 µg/L total and 0.787 µg/L dissolved;
- May 2011 – 1.4 µg/L total and 0.098 µg/L dissolved;
- July 2011 – 0.274 µg/L total; and
- December 2011 – 0.248 µg/L total and 0.0997 µg/L dissolved.

Water samples indicate that Mystery Creek above Station MC-2 does not exceed the allowable lead concentrations the ADEC water quality standard has established for acute and chronic protection of aquatic life (Table 1).

### Manganese

Historically, measurable manganese concentrations at Station MC-2 have ranged between 1.35 µg/L and 30.9 µg/L. The mean measurable manganese concentration at Station MC-2 is 12 µg/L. Measurable manganese was present at Station MC-2 in all four quarters of 2011:

- March 2011 – 22.9 µg/L total and 11.1 µg/L dissolved;
- May 2011 – 29.2 µg/L total and 2.6 µg/L dissolved;
- July 2011 – 26.3 µg/L total and 15.8 µg/L dissolved; and
- December 2011 – 7.19 µg/L total and 2.84 µg/L dissolved.

Water samples indicate that Mystery Creek above Station MC-2 does not exceed the allowable manganese concentrations the ADEC water quality standard has established for consumption of water and aquatic organisms (Table 1).

### Silicon

Historically, measurable silicon concentrations at Station MC-2 have ranged between 4,550 µg/L and 7,260 µg/L. The mean measurable silicon concentration at Station MC-2 is 5,407 µg/L. Measurable silicon was present at Station MC-2 in all four quarters of 2011:

- March 2011 – 5,290 µg/L total and 4,990 µg/L dissolved;
- May 2011 – 4,070 µg/L total and 3,650 µg/L dissolved;
- July 2011 – 5,110 µg/L total and 4,840 µg/L dissolved; and
- December 2011 – 5,770 µg/L total and 5,660 µg/L dissolved.

### Sodium

Historically, measurable sodium concentrations at Station MC-2 have ranged between 1,800 µg/L and 3,400 µg/L. The mean measurable sodium concentration at Station MC-2 is 1,985 µg/L. Measurable sodium was present at Station MC-2 all four quarters of 2011:

- March 2011 –1,830 µg/L total and 1,750 µg/L dissolved;
- May 2011 – 1,480 µg/L total;
- July 2011 – 2,050 µg/L total and 2,010 µg/L dissolved; and
- December 2011 – 1,970 µg/L total and 2,000 µg/L dissolved.

### Zinc

Historically, measurable zinc concentrations at Station MC-2 have ranged between 5.66 µg/L and 13.6 µg/L. The mean measurable zinc concentration at Station MC-2 is 9.22 µg/L. Measurable zinc was present at Station MC-2 in Quarter 4 of 2011 (12 µg/L total and 8.91 µg/L dissolved).

### Mercury

Historically, measurable mercury concentrations at Station MC-2 have ranged between 5.97 ng/L and 1.1 ng/L. The mean measurable mercury concentration at Station MC-2 is 2.65 ng/L. Measurable mercury was present at Station MC-2 all four quarters of 2011:

- March 2011 –4.8 ng/L total;
- May 2011 – 5.3 ng/L total;
- July 2011 – 1.75 ng/L total; and
- December 2011 – 1.79 ng/L total.

Water samples indicate that Mystery Creek above Station MC-2 does not exceed the ADEC water quality standard for allowable mercury concentrations (Table 1).

## **3.1.3 Nixon Fork**

The Nixon Fork of the Takotna River located approximately 4.5 miles downstream receives flow from both Ruby and Mystery Creek. In order to assess the baseline water quality of the first significant receiving water body, samples were to be collected from the Nixon Fork of the Takotna River upstream (NF-1) and downstream (NF-2) of the confluence with Ruby Creek. The approximate sampling locations are shown on Figure 2.

### **3.1.3.1 Nixon Fork Sampling Location NF-1**

During the Year of Record, a sample was not collected at this location because snow depths would not allow snow machine travel to the sample station from the mine nor was an alternative means of transportation available.

### **3.1.3.2 Nixon Fork Sampling Location NF-2**

During the Year of Record, a sample was not collected at this location because snow depths would not allow snow machine travel to the sample station from the mine nor was an alternative means of transportation available.

## **3.1.4 Intermittent Spring at Encino Gulch**

An intermittent spring in Encino Gulch located below the FTDS will be sampled if flowing water is present at the time other baseline samples are collected. During the Year of Record, samples

were collected in Quarter 2 and 3 in accordance with the procedures outlined in Appendix A, Section 2.3.2 *Nixon Fork Mine Monitoring Plan* dated June 2010. Water Samples were not collected in Quarters 1 and 4 2011 because no water was present and the station was frozen to ground. August 2010 was the first time that water samples were collected at Station EC-1. A summary of the water quality data for Mystery Creek at Station EC-1 is provided in the following Sections.

### **Major Ion Chemistry and Water Quality**

#### **Hardness**

Calculated hardness for Station EC-1 was 31 mg/L in May 2011 and 32 mg/L in July 2011. A waterbody with a calculated hardness between 0 and 75 is classified as 'soft' water.

#### **Total Dissolved Solids**

Measured TDS at Station EC-1 in May 2011 was 60 mg/L and 66 mg/L in July 2011.

#### **Alkalinity**

Total alkalinity at Station EC-1 in May 2011 was 31.5 mg/L and 33.4 in July 2011. Total alkalinity at Station EC-1 is entirely bicarbonate (HCO<sub>3</sub>) and no carbonate (CO<sub>3</sub>) and hydroxide (OH) alkalinity was measured.

#### **pH**

Water pH at Station EC-1 was 7.6 in May 2011 and 7.5 in July 2011. Measured Station pH is within ADEC water quality standards for all uses (Table 1).

#### **Temperature**

During 2011 temperature at Station EC-1 was 1.4 °C in May and 4.1 °C in July. Measured stream temperature is within ADEC water quality standards for all uses (Table 2).

#### **Turbidity**

Measured turbidity in 2011 was 0.44 NTU in May 2011 and 28 NTU in July 2011. Discharges to Encino Gulch above station EC-1 related to the Nixon Fork Mine are not anticipated .

### **Minor Ion Chemistry**

A laboratory sample for minor ions was collected from Station EC-1 in July 2011. The minor ions analyzed for included:

- Phosphorus;
- Chloride
- Fluoride;
- Sulfate;
- Nitrate-N;
- Nitrate-N;
- Ammonia-N
- Total cyanide; and
- Weak Acid Dissociable (WAD) cyanide.

Of the analyzed minor ions, only sulfate, chloride, and nitrate were detected in measurable quantities from the 2011 sampling events. None of the detected minor ions exceed the ADEC water quality standards (Table 2).

### **Trace Ion Chemistry**

Laboratory sample for trace ions were collected from Station EC-1 in Quarter 2 and Quarter 3 of 2011. The trace ions analyzed included:

- Aluminum;
- Antimony;
- Arsenic;
- Barium;
- Bismuth;
- Cadmium;
- Chromium;
- Copper;
- Lead;
- Manganese;
- Nickel;
- Selenium;
- Silicon;
- Silver;
- Sodium;
- Zinc; and
- Mercury.

No measurable antimony, barium, bismuth, cadmium, chromium, nickel, selenium, silver, or zinc was present in the samples collected during 2011 from Station EC-1. Trace ions measured in samples collected in 2011 are discussed below.

#### **Aluminum**

Measurable aluminum was present at Station EC-1 in May 2011 (43.7 µg/L total and 6.28 µg/L dissolved) and in July 2011 (167 µg/L total). Measured aluminum at station EC-1 indicates that Encino Gulch periodically exceeds the most stringent ADEC water quality criteria for aluminum in surface waters.

#### **Arsenic**

Measurable arsenic was present at Station EC-1 in May 2011 (89.5 µg/L total and 85.1 µg/L dissolved) and in July 2011 (93.5 µg/L total and 87.7 µg/L dissolved). Water samples indicate that Encino Gulch above Station EC-1 exceeds the allowable arsenic concentrations the ADEC water quality standard has established for drinking water (Table 1).

### Copper

Measurable copper was present at Station EC-1 in May 2011 (1.03 µg/L total). Water samples indicate that Encino Gulch above Station EC-1 does not exceed the allowable copper concentrations the ADEC water quality standard (Table 1).

### Manganese

Measurable manganese was present at Station EC-1 in May 2011 (3.1 µg/L total) and in July 2011 (8.32 µg/L total). Water samples indicate that Encino Gulch above Station EC-1 does not exceed the allowable manganese concentrations the ADEC water quality standard has established (Table 1).

### Silicon

Measurable silicon was present at Station EC-1 in May 2011 (5,510 µg/L total and 5,390 µg/L dissolved) and in July 2011 (5,350 µg/L total and 5,270 µg/L dissolved).

### Sodium

Measurable sodium was present at Station EC-1 May 2011 (1,740 µg/L total and 1,690 µg/L dissolved) and in July 2011 (1,800 µg/L total and 1,830 µg/L dissolved).

### Mercury

Measurable mercury was present at Station EC-1 in May 2011 (1.26 ng/L total) and in July 2011 (2.39 ng/L total and 87.7 µg/L dissolved). . Water samples indicate that Mystery Creek above Station EC-1 does not exceed the ADEC water quality standard for allowable mercury concentrations (Table 1).

## **3.2 GROUNDWATER MONITORING**

Groundwater monitoring activities are discussed in Section 4.2.2.

## **4.0 OPERATION AND CLOSURE MONITORING**

### **4.1 PERMIT MANAGEMENT**

No change in permit status has occurred during the Year of Record described in this report. MCRI reapplied for all permits in Quarter 3, 2011 and all permits have been administratively extended until June 2012.

### **4.2 VISUAL MONITORING PROGRAM**

Facilities operating under the solid waste and/or dam safety permits that will have formally scheduled visual monitoring include: the FTDS, tailings impoundment, development rock dump and solid waste landfill. The following sections described the results of visual monitoring by site feature.

#### **4.2.1 Filtered Tailings Disposal Site**

During 2011, there was no processing of ore performed through the CIL circuit at the Nixon Fork Gold Mine. Construction and lining of the FTDS was completed during the summer/fall 2011 but no material was placed in the FTDS Pursuant to Note 1, Table 4-2, daily visual monitoring of the FTDS was not required to be performed because the facility is inactive. A Facility Safety Audit has not been scheduled for the FTDS because there has been no processing of ore and no additional deposition of tailings since 2007. No slumps or failures were noted by mine site personnel.

#### **4.2.2 Tailings Storage Facility**

During 2011, approximately 22,723 tons of material was generated as a result of milling activity. Approximately 16,765 tons of mill waste was sent to the Tailings Storage Facility (TSF). Visual monitoring records for the TSF are provided in the quarterly reports. Visual monitoring of the TSF dam, liner, ditch, and water level were performed on a regular basis. Monitoring of water levels in the TSF indicated that gauge had become icebound and that the required freeboard in the TSF had not been maintained. MCRI notified the applicable Federal and State agencies of this condition in November 2011 and undertook remedial actions to reestablish the permit mandated freeboard.

Groundwater wells MW-1 and MW-2, located near the foot of the tailings dam (Figure 4), were checked for water. As is normally the case, due to the very deep groundwater level (at least 400 feet below surface), both wells were dry.

#### **4.2.3 Development Rock Dump**

During the 2011, mining activity occurred and approximately 8,576 tons of development rock was generated. Visual reports for development waste rock can be found in the quarterly reports for 2011. Geochemical sampling of the waste rock for acid generating potential (ABA) and leachate quality was performed in accordance with applicable permits (Section

#### **4.2.4 Solid Waste Landfill**

The solid waste landfill visual monitoring was performed by operation personnel each time waste is placed and covered in the landfill. Operation personnel were instructed to look for unusual signs of settlement, seeps, or erosion, as well as any unusual water color or sheens. Visual monitoring records for the Solid Waste Landfill are in the Quarterly Reports.

#### **4.2.5 Wildlife**

Operations personnel are required to report any wildlife mortality observed at any of the mine waste and solid waste facilities at the mine. A log was maintained of wildlife sightings in the project area that include bear, moose, caribou and larger furbearers such as wolves. However, operations personnel did not log birds and other smaller wildlife typically observed in the project

area. A nuisance bears and cub had to be put down. Appropriate reporting and paperwork was submitted to ADF&G regarding the IDL&P shooting.

### **4.3 GEOTECHNICAL MONITORING**

Nixon Fork Mine is in temporary closure and active geotechnical monitoring in addition to the visual monitoring described in Section 4.2 of this report is generally only required when the Nixon Fork Mine is in operation. Ongoing geotechnical monitoring performed during the temporary closure is described in the following sections.

#### **4.3.1 Filtered Tailings Disposal Site**

During 2011, no milling of ore through the CIL circuit occurred and no material was placed in the FTDS. There is no requirement for additional monitoring aside from the visual monitoring described in Section 4.2.1.

#### **4.3.2 Tailings Storage Facility**

During 2011, milling of ore occurred and material was placed in the TSF. The thermistors installed in boreholes G04-1 and G04-2 were monitored monthly. The monthly themistor readings for 2011 were recorded and included in Quarterly Reports.

During 2011, no signs of instability or erosion were reported to a qualified engineer for consideration of further testing and solutions for stabilizing the tailings impoundment.

#### **4.3.3 Development Rock Dump**

In addition to the visual monitoring described in Section 4.2.3, two groundwater monitoring wells (DRMW-1 and DRMW-2) will be installed down slope of the Crystal Portal development rock dump. Once installed, these wells will be monitored for water presence. These wells will continue to be monitored for the presence of water on a quarterly schedule; if any water is present, samples will be collected and analyzed using the same parameters noted in Section 3.0, Tables 3-1 and 3-2 of the monitoring plan.

#### **4.3.4 Solid Waste Landfill**

No geotechnical testing or inspection is anticipated for the landfill, except the visual monitoring described in Section 4.2.4. During 2011, no signs of instability or erosion were observed.

### **4.4 GEOCHEMICAL MONITORING**

MCRI did operate the mill and added material to the TSF and waste rock dumps. The results of geochemical testing performed during 2011 are presented in Appendix F. The results of geochemical testing indicate that:

- No residual cyanide is contained in the mill process waters or tailings;

- Anticipated runoff meets from the tailings and waste rock dumps is anticipated to meet the water quality criteria contained in 18 AAC 70; and
- Neither the ore nor the waste rock had a net neutralization potential less than 3.0 and is therefore non-acid generating materials.

#### **4.5 FLUID MANAGEMENT**

Land application of wastewater from the TSF was performed in July 2011. The July 2011 land application of wastewater was authorized by the ADEC. Approximately 227,628 gallons of water were land applied to an area of approximately 1.8 acre.

#### **4.6 LAND APPLICATION**

In 2008, ADEC determined the maximum allowable water volume per acre and the specified concentration limits that are intended to limit the mass loading of the specified parameters to the land application area. Land application is regulated based on the mass loading of each parameter, rather than the water volume and concentrations separately. Based on the number of gallons applied, area of application, and the most recent parameter concentrations in the TSF, the current land disposal site of 1.8 acres can accommodate approximately 98,942 gallons before reaching saturation. The number of gallons until saturation is limited by the high concentration of nitrates in the tailings pond water. Saturation for the other parameters would not be reached with the 98,942 gallons.

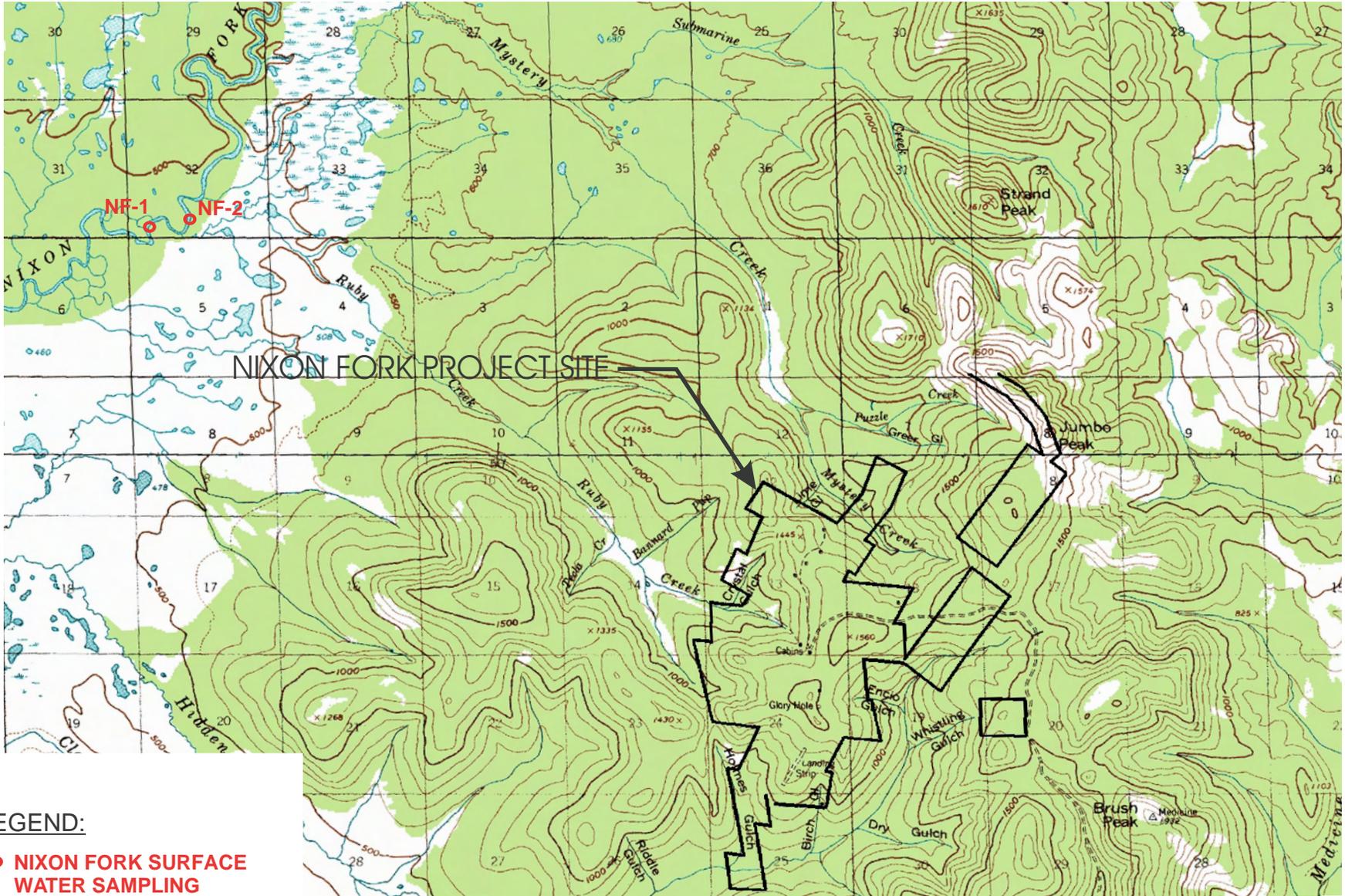
#### **4.8 Reclamation and Closure**

MCRI sought and received permission from BLM to reclaim the existing sand borrow pit and open a new sand borrow pit near the landfill road. The purpose of the request was to move operations away from wetlands located near the old sand borrow pit. Since the footprint of the old sand borrow area and the new sand borrow area were the same, no change in surface disturbance occurred.

MCRI completed an update of the reclamation and closure bond amount in the fourth quarter of 2011.

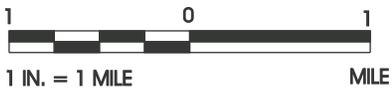


 <p><b>Golder Associates</b> Anchorage, Alaska</p>	SCALE	1 IN. = 300 MI.	<p><b>VICINITY MAP NIXON FORK MINE NEAR MCGRATH, ALASKA</b></p>
	CADD	CAV	
	DATE	06/28/05	
	CHECK	JFD	
FILE No.	0335632A003	DATE	06/28/05
PROJECT No.	033-5632x002.004	REV.	0
MYSTERY CRK / MONITORING PLAN / AK			FIGURE <b>1</b>



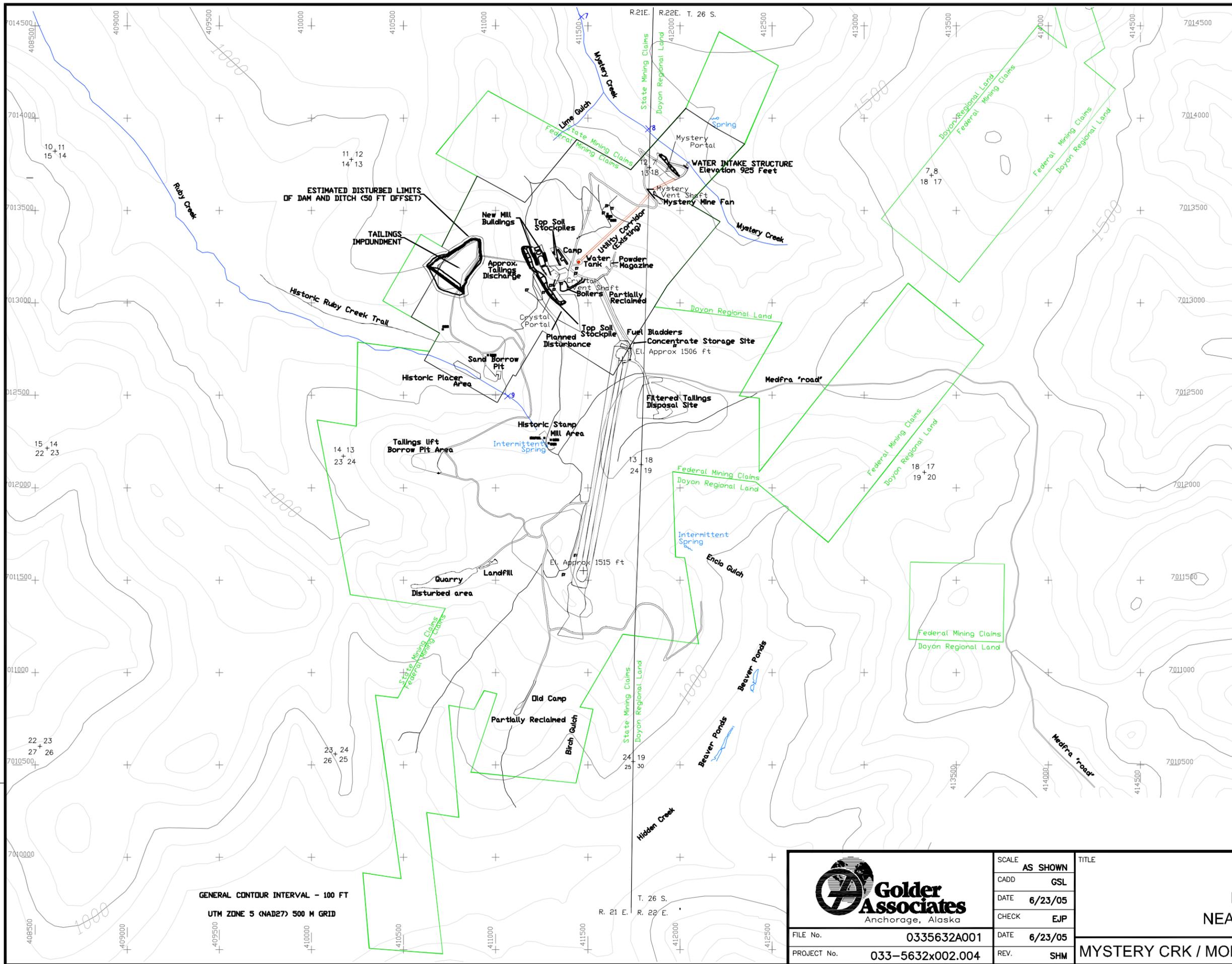
**LEGEND:**

- NIXON FORK SURFACE WATER SAMPLING POINTS



REFERENCES: USGS QUADRANGLE MAPS  
MEDFRA A(4) & B(4)

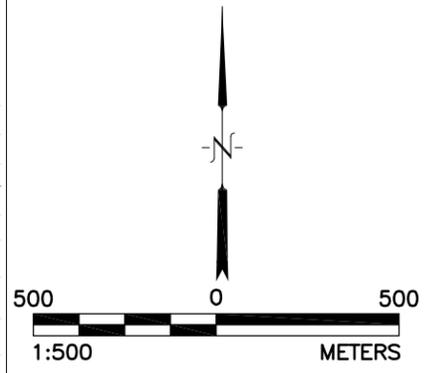
 <b>Golder Associates</b> Anchorage, Alaska	SCALE	AS SHOWN	TITLE  <b>PROJECT LOCATION</b> NIXON FORK MINE NEAR MCGRATH, ALASKA
	CADD	CAV	
	DATE	3/30/05	
	CHECK	JFD	
FILE No.	0335632A004	DATE	6/28/05
PROJECT No.	033-5632x002.004	REV.	0
<b>MYSTERY CRK / MONITORING PLAN / AK</b>			FIGURE <b>2</b>



GENERAL CONTOUR INTERVAL - 100 FT  
 UTM ZONE 5 (NAD27) 500 M GRID

### LEGEND

- Former stream gauge approximate location and number from 1990 project
- Approximate location of spring
- Active Mine Portal
- Active Ventilation Shaft
- Existing Shaft
- Existing Building
- Existing Disturbance
- Planned Disturbance
- Federal Claims Surveyed
- Federal Claims Unsurveyed

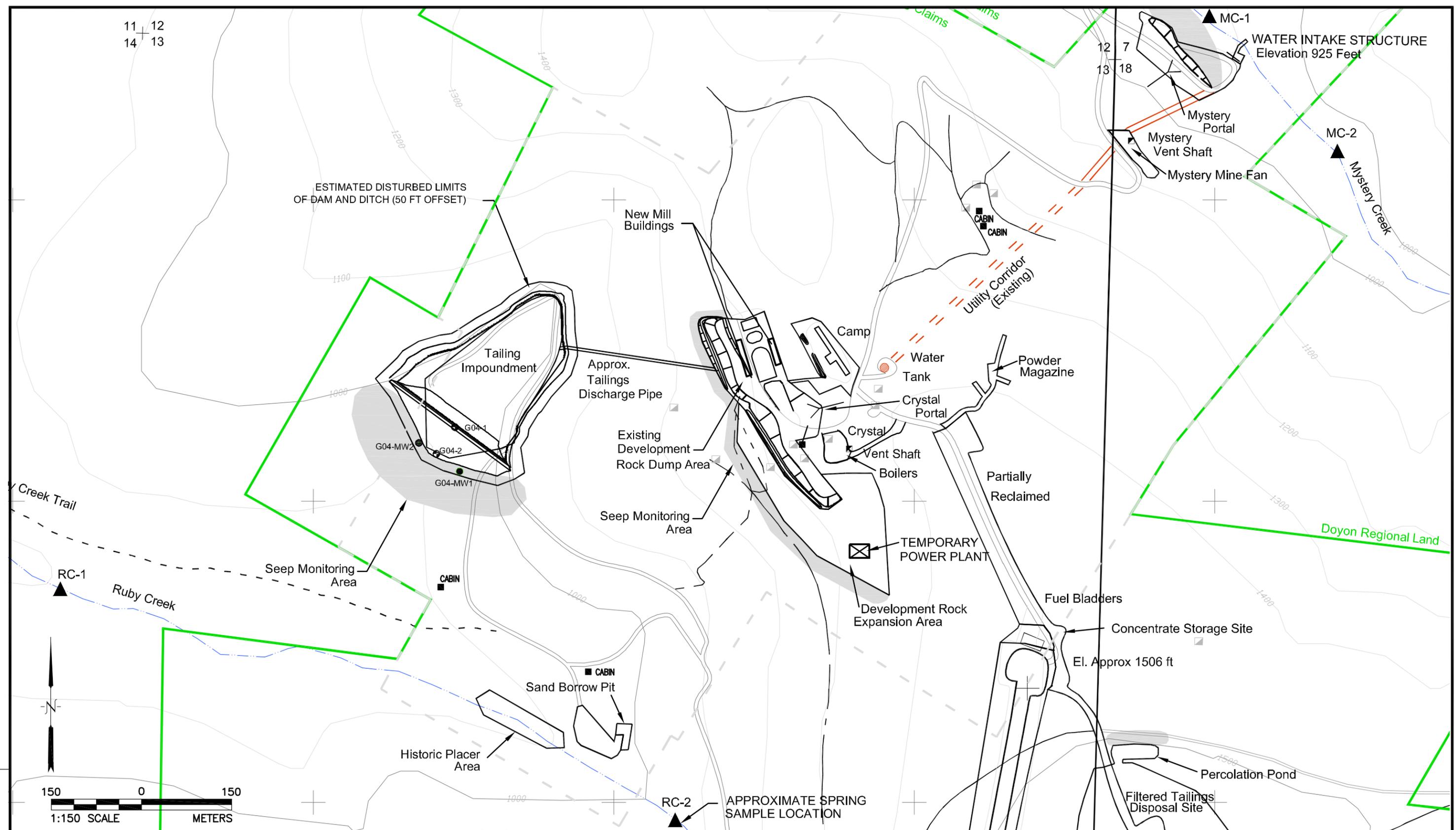


### REFERENCES

1.) FIGURE PROVIDED BY MYSTERY CREEK RESOURCES INC.

 <b>Golder Associates</b> Anchorage, Alaska	SCALE	AS SHOWN	TITLE
	CADD	GSL	
FILE No.	0335632A001	DATE	6/23/05
PROJECT No.	033-5632x002.004	CHECK	EJP
		DATE	6/23/05
		REV.	SHM
<b>SITE PLAN</b> NIXON FORK MINE NEAR MCGRATH, ALASKA			FIGURE
			<b>3</b>

11 12  
14 13



**LEGEND**

G04-1	BOREHOLES WITH THERMISTERS	-1100-	GROUND SURFACE CONTOURS IN FEET
G04-MW2	MONITORING WELLS	☒	TEMPORARY POWER PLANT LOCATION
◻	SHAFT	●	SEEP MONITORING AREA
▲	SURFACE WATER SAMPLE LOCATION		

**NOTES**

1. LOCATION OF 2004 BOREHOLES AND WELLS ARE BASED ON MEASUREMENTS FROM KNOWN FEATURES AND SHOULD BE CONSIDERED APPROXIMATE.

**REFERENCES**

1. BASEMAP PROVIDED BY MYSTERY CREEK RESOURCES INC.

**Golder Associates**  
Anchorage, Alaska

FILE No.	0335632A002	SCALE	AS SHOWN
PROJECT No.	033-5632x002.004	CADD	ACM
		DATE	06/20/05
		CHECK	EJP
		DATE	6/23/05
		REV.	SHM

**TITLE**

**WATER MONITORING LOCATIONS**  
NIXON FORK MINE  
NEAR MCGRATH, ALASKA

MYSTERY CRK/ MONITORING PLAN/ AK

FIGURE **4**



**APPENDIX A**

**RC-1 BASELINE WATER QUALITY SUMMARY TABLE**

Analyte	Units	RC1		RC 1		RC1		RC1		RC-1		RC-1
		6/29/2007		6/2/2008		8/8/2008		9/27/2008		7/1/2009		8/26/2009
		Downstream										
		Total	Dissolved	Total								
<b>Major Ion Chemistry</b>												
pH (lab)	pH units	6.98	N/A	6.76	N/A	6.73	N/A	6.65	N/A	6.6	N/A	6.8
pH (field)	pH units	N/A	N/A			7.11	N/A	7.13	N/A	6.8	N/A	7.2
Temperature (field)	Degrees C	N/A	N/A	11.4	N/A	12.1	N/A	2.3	N/A	14.3	N/A	8.1
Conductivity (lab)	umhos/cm	100	N/A	85.2	N/A	103	N/A	106	N/A	95.2	N/A	127
Conductivity (field)	umhos/cm	N/A	N/A			98.8	N/A	43.1	N/A	95.5	N/A	128.2
Total Suspended Solids	mg/L	3.2	N/A	1.14	N/A	1.1	N/A	0.693	N/A	2.27	N/A	1
Total Dissolved Solids	mg/L	83.8	N/A	82.5	N/A	70	N/A	96.3	N/A	78.8	N/A	91.3
Turbidity	NTU	1.82	N/A	19.7	N/A	8.18	N/A	5.71	N/A	11.8	N/A	4.16
Calculated Hardness	mg/L	N/A	59	58	47	51	51	54	52	44	N/A	55
Total Settleable Solids (field)	mg/L	N/A	N/A	N/A								
Total Settleable Solids (lab)	mg/L	N/A	N/A	N/A								
Alkalinity	mg/L	49	N/A	42.4	N/A	51.8	N/A	51.9	N/A	44	N/A	28
HCO3 Alkalinity	mg/L	49	N/A	42.4	N/A	51.8	N/A	51.9	N/A	44	N/A	28
CO3 Alkalinity	mg/L	<10	N/A	<10								
OH Alkalinity	mg/L	<10	N/A	<10								
Calcium	mg/L	N/A	15.1	15.2	12.8	13	13.1	13.5	13.2	13	13.5	17.2
Iron	mg/L	N/A	3.76	3.96	2.15	3.35	2.93	3.3	2.84	3.06	2.71	1.75
Magnesium	mg/L	N/A	3.65	3.25	2.83	3.16	3.21	3.5	3.42	2.8	2.86	3.02
Potassium	ug/L	<500	<500	595	539	500 U	500 U	500 U	500 U	<0.5	<0.5	<0.5
<b>Minor Ion Chemistry</b>												
Chloride	mg/L	N/A	0.104	0.259	N/A	0.107	N/A	0.503	N/A			N/A
Fluoride	mg/L	N/A	<0.1	<0.1	N/A	<0.1	N/A	<0.1	N/A			N/A
Sulfate	mg/L	N/A	0.157	0.895	N/A	0.155	N/A	0.261	N/A			N/A
Nitrate-N	mg/L	N/A	0.223	N/A	N/A	N/A	N/A	N/A	N/A			<0.1
Nitrite-N	mg/L	N/A	<0.4	N/A	N/A	N/A	N/A	N/A	N/A			<0.1
Total Nitrate/Nitrite N	mg/L	N/A	N/A	0.503	N/A	0.3	N/A	0.319	N/A			N/A
Ammonia-N	mg/L	0.299	N/A	0.53	N/A	0.4	N/A	0.33	N/A			0.162
Cyanide	mg/L	<0.005	N/A	<0.005	N/A	<0.005	N/A	N/A	<0.005	N/A		<0.005
Weak Acid Dissociable CN	mg/L	<0.005	N/A	<0.005	N/A	<0.005	N/A	N/A	<0.005	N/A		<0.005
<b>Trace Ion Chemistry</b>												
Aluminum	ug/L	N/A	110	59.5	43	52.8	41.3	47.9	39.2	108	71.8	65.5
Antimony	ug/L	N/A	1.53	1.29	1.01	1.16	1.14	1.02	<1	1.45	1.53	<1
Arsenic	ug/L	N/A	25	28.6	18.5	30.3	27.8	25.3	23.1	26	24.8	15.3
Barium	ug/L	N/A	24.1	27.7	24.2	23.8	23.9	18.8	18.4	24.4	25.4	15.9
Bismuth	ug/L	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium	ug/L	N/A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	ug/L	<2	N/A	<2	<2	<2	N/A	<2	N/A	<2	<2	<2
Copper	ug/L	N/A	189	254	191	138	132	113	107	190	193	83.2
Lead	ug/L	N/A	20.3	0.482	0.257	<0.2	<0.2	0.251	<0.2	0.412	0.32	<0.2
Manganese	ug/L	N/A	225	409	369	226	230	196	196	221	241	114
Nickel	ug/L	N/A	3.15	<2	<2	<2	<2	<2	<2	<2	<2	<2
Phosphorous	ug/L	<200	N/A	<200								
Selenium	ug/L	N/A	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Silicon	ug/L	N/A	4030	3960	3540	4260	4360	4000	3950	4110	4260	3090
Silver	ug/L	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sodium	ug/L	N/A	1610	1340	1220	1480	1580	1360	1320	1.43	1.5	1.62
Zinc	ug/L	N/A	9.62	7.65	6.69	<5	<5	5.11	<5	<5	<5	<5
Mercury	ng/L	78.9	N/A	N/A	118	N/A	61.4	45.1	N/A	8.59	N/A	36.6

**APPENDIX B**

**RC-2 BASELINE WATER QUALITY SUMMARY TABLE**

Analyte	Units	RC2		RC2		RC2		RC2		RC2	
		6/3/2008		8/8/2008		8/8/2008		9/27/2009		10/14/2009	
		Upstream		Upstream		Upstream		Upstream		Upstream	
		Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
<b>Major Ion Chemistry</b>											
pH (lab)	pH units	6.92	N/A	6.72	N/A	6.89	N/A	6.63	N/A	7	N/A
pH (field)	pH units			7.13	N/A	N/A	N/A	m	N/A	N/A	N/A
Temperature (field)	Degrees C	1.5	N/A	1.61	N/A	N/A	N/A	M	N/A	N/A	N/A
Conductivity (lab)	umhos/cm	111	N/A	112	N/A	113	N/A	122	N/A	94.6	N/A
Conductivity (field)	umhos/cm			120.1	N/A	N/A	N/A	m	N/A	N/A	N/A
Total Suspended Solids	mg/L	<1.14	N/A	<1.14	N/A	<1.14	N/A	<1.14	N/A	<0.508	N/A
Total Dissolved Solids	mg/L	73.8	N/A	80	N/A	72.5	N/A	83.8	N/A	77.5	N/A
Turbidity	NTU	1.27	N/A	0.16	N/A	0.12	N/A	0.2	N/A	6.03	N/A
Hardness	mg/L	59	N/A	N/A	N/A	N/A	N/A	N/A	N/A	58	44
Total Settleable Solids (field)	mg/L										
Total Settleable Solids (lab)	mg/L										
Alkalinity	mg/L	<10	N/A	54.2	N/A	54.2	N/A	55.7	N/A	40	N/A
HCO3 Alkalinity	mg/L	<10	N/A	54.2	N/A	54.2	N/A	55.7	N/A	40	N/A
CO3 Alkalinity	mg/L	<10	N/A	<10	N/A	<10	N/A	<10	N/A	<10	N/A
OH Alkalinity	mg/L	<10	N/A	<10	N/A	<10	N/A	<10	N/A	<10	N/A
Calcium	mg/L	18.1	16.3	13.6	13.7	13.7	13.3	14	14.1	14.7	11.5
Iron	mg/L	0.0982	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	3.55	2.44
Magnesium	mg/L	3.24	3.01	2.7	2.75	2.71	2.67	2.8	2.83	3.54	2.77
Potassium	ug/L	1140	1140	1030	1050	1050	1030	1070	1010	<500	<500
<b>Minor Ion Chemistry</b>											
Chloride	mg/L	0.294	N/A	0.289	N/A	0.301	N/A	0.302	N/A	N/A	N/A
Fluoride	mg/L	<0.1	N/A	0.1 U	N/A	0.1 U	N/A	0.1 U	N/A	N/A	N/A
Sulfate	mg/L	2.07	N/A	1.98	N/A	2	N/A	1.79	N/A	N/A	N/A
Nitrate-N	mg/L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.127	N/A
Nitrite-N	mg/L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<0.1	N/A
Total Nitrate/Nitrite N	mg/L	1.05	N/A	1.15	N/A	1.09	N/A	1.3	N/A	N/A	N/A
Ammonia-N	mg/L	0.336	N/A	<0.1	N/A	<0.1	N/A	0.1 U	N/A	0.286	N/A
Cyanide	mg/L	<0.005	N/A	<0.005	N/A	<0.005	N/A	N/A	<0.005	<0.005	N/A
Weak Acid Dissociable CN	mg/L	<0.005	N/A	<0.005	N/A	<0.005	N/A	N/A	<0.005	<0.005	N/A
<b>Trace Ion Chemistry</b>											
Aluminum	ug/L	29.4	<20	<20	<20	<20	<20	<20	<20	76	53.3
Antimony	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	1.12	<1
Arsenic	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	27.4	19.5
Barium	ug/L	20.7	20.8	20.6	21.1	20.3	20.2	21.9	20.7	19.4	15.1
Bismuth	ug/L	1.46	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	ug/L	<2	N/A	<2	N/A	<2	N/A	<2	N/A	<2	<2
Copper	ug/L	110	37.2	44.9	33.3	50.4	32.7	38.7	31.4	147	107
Lead	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	ug/L	4.22	2.04	<1	<1	<1	<1	<1	<1	213	167
Nickel	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Phosphorous	ug/L	<200	N/A	200 U	N/A	200 U	N/A	200 U	N/A	<200	N/A
Selenium	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Silicon	ug/L	7310	7210	7200	7470	7300	7290	7220	6740	4860	3780
Silver	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sodium	ug/L	3290	3290	3410	3590	3450	3430	3370	3390	1620	1250
Zinc	ug/L	<5	<5	<5	17	<5	<5	<5	<5	9.29	<5
Mercury	ng/L	N/A	17.7	N/A	12.4	N/A	12.5	9.18	N/A	74.7	N/A

**APPENDIX C**

**MC-1 BASELINE WATER QUALITY SUMMARY TABLE**

Analyte	Units	MCI		MC-1		MC-1		MC-1		MC-X (dup)		MC-1		MC-A (dup)													
		6/29/2007		10/15/2007		3/11/2008		6/2/2008		8/7/2008		9/26/2008		8/26/2009		8/5/2010		5/18/2011		5/18/2011		7/18/2011		7/18/2011			
		Downstream		Downstream		Downstream		Downstream		Downstream		Downstream															
		Total	Dissolved	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total												
<b>Major Ion Chemistry</b>																											
pH (lab)	pH units	7.28	N/A	7.56	N/A	7.13	N/A	7.01	N/A	6.78	N/A	6.73	N/A	7.2	N/A	-	7.3	-	7.2	-	7.2	-	7.4	-	7.4		
pH (field)	pH units	N/A	N/A	N/A	N/A	-	N/A	-	-	7.05	N/A	-	N/A	7.4	N/A	-	6.12	-	7	-	7	-	6.98	-	6.98		
Temperature (field)	Degrees C	N/A	N/A	N/A	N/A	-	N/A	5.2	N/A	4.6	N/A	-	N/A	4.2	N/A	-	10.3	-	0.4	-	0.4	-	2.8	-	2.8		
Conductivity (lab)	umhos/cm	100	N/A	70	N/A	57.5	N/A	48.8	N/A	46.3	N/A	63.8	N/A	82.6	N/A	-	77.9	-	48.1	-	48.2	-	71.4	-	71.9		
Conductivity (field)	umhos/cm	N/A	N/A	N/A	N/A	-	N/A	-	-	38.5	N/A	-	N/A	86.5	N/A	-	65.2	-	18.4	-	18.4	-	40.8	-	40.8		
Total Suspended Solids	mg/L	15.6	N/A	1.3	N/A	1.8	N/A	1.4	N/A	1.4	N/A	1.2	N/A	1	N/A	-	1.55	-	41.8	-	61.3	-	19.6	-	17.6		
Total Dissolved Solids	mg/L	18.8	N/A	47.5	N/A	57.5	N/A	48.8	N/A	46.3	N/A	63.8	N/A	46.3	N/A	-	-	-	51	-	55	-	72	-	62		
Turbidity	NTU	<0.1	N/A	1.57	N/A	0.15	N/A	0.65	N/A	2.63	N/A	1.24	N/A	2.05	N/A	-	1	-	3.16	-	3.06	-	2.45	-	2.09		
Total Settleable Solids (field)	mg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No Sample	-	No Sample			
Settleable Matter (lab)	mg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.500 U	-	0.500 U	-	0.100 U	-	0.100 U		
Calculated Hardness	mg/L	N/A	39	32	32	40	N/A	32	32	30	29	32	N/A	36	N/A	33.234	-	20.319	-	20.717	-	31.884	-	30.601	-		
Alkalinity	mg/L	37.1	N/A	30.8	N/A	37.9	N/A	29.7	N/A	33.4	N/A	34.6	N/A	35	N/A	-	33.6	-	19.8	-	19.7	-	30.1	-	30		
HCO3 Alkalinity	mg/L	37.1	N/A	N/A	N/A	NR	N/A	29.7	N/A	33.4	N/A	34.6	N/A	35	N/A	-	33.6	-	6.20U	-	6.20 U	-	30.1	-	30		
CO3 Alkalinity	mg/L	<10	N/A	N/A	N/A	NR	N/A	<10	N/A	<10	N/A	<10	N/A	<10	N/A	-	10.0 U	-	6.20 U	-	6.20 U	-	6.20 U	-	6.20 U		
OH Alkalinity	mg/L	<10	N/A	N/A	N/A	NR	N/A	<10	N/A	<10	N/A	<10	N/A	<10	N/A	-	10.0 U	-	6.20 U	-	6.20 U	-	6.20 U	-	6.20 U		
Calcium	mg/L	N/A	11.1	9.29	9.26	11.5	11	9.5	9.56	8.66	8.2	8.95	9.79	10.8	10.6	9.62	10.3	5.93	6.05	6.04	5.97	9.08	9.09	8.78	8.76		
Iron	mg/L	N/A	0.0896	0.238	0.154	0.114	<0.02	0.278	0.132	0.225	0.101	0.238	84.1	315	97.7	0.250 U	0.319	0.132 J	1.05	0.139 J	1.33	0.156 U	0.383	0.156 U	0.248 J		
Magnesium	mg/L	N/A	2.76	2.04	2.03	2.58	2.53	1.96	2.02	2	1.93	2.17	2	2.16	2.02	2.24	2.39	1.34	1.52	1.37	1.57	2.24	2.2	2.11	2.18		
Potassium	ug/L	N/A	640	662	664	739	725	676	753	600	577	664	0.556	0.695	0.668	695	696	1100	1120	1110	1130	588	613	567	588		
<b>Minor Ion Chemistry</b>																											
Chloride	mg/L	N/A	0.161	0.265	N/A	0.223	N/A	0.222	N/A	0.168	N/A	0.274	N/A	-	N/A	-	0.252	-	0.297	-	0.338	-	0.263	-	0.224		
Fluoride	mg/L	N/A	<0.1	<0.1	N/A	-	N/A	-	0.100 U	-	0.0640 J	-	0.0710 J	-	0.0810 J	-	0.0800 J										
Sulfate	mg/L	N/A	3.54	2.9	N/A	3.78	N/A	3.01	N/A	3.06	N/A	3.18	N/A	-	N/A	-	3.28	-	2.06	-	2.07	-	3.54	-	3.49		
Nitrate-N	mg/L	N/A	0.19	0.394	N/A	NR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.272	N/A	-	0.194	-	0.0620 U	-	0.0620 U	-	0.297	-	0.311		
Nitrite-N	mg/L	N/A	<0.4	<0.4	N/A	NR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<0.1	N/A	-	0.100 U	-	0.226	-	0.231	-	0.0620 U	-	0.0620 U		
Total Nitrate/Nitrite N	mg/L	N/A	N/A	0.512	N/A		N/A	0.477	N/A	0.348	N/A	0.435	N/A	N/A	N/A	-	0.194	-	0.226	-	0.231	-	0.297	-	0.311		
Ammonia-N	mg/L	<0.1	N/A	<0.1	N/A	<0.1	N/A	0.347	N/A	<0.1	N/A	<0.1	N/A	<0.1	N/A	-	0.100 U	-	0.0358 J	-	0.0537 J	-	0.0620 U	-	0.0620 U		
Cyanide	mg/L	<0.005	N/A	N/A	<0.005	N/A	<0.005	-	0.0050 U	-	0.00300 U																
Weak Acid Dissociable CN	mg/L	<0.005	N/A	N/A	<0.005	N/A	<0.005	-	0.0050 U	-	0.00300U	-	0.00300 U	-	0.00300 U	-	0.00300 U										
<b>Trace Ion Chemistry</b>																											
Aluminum	ug/L	N/A	<20	44.6	24.9	44.8	<20	53.1	21.7	38.3	<20	27.9	<20	28.9	<20	20.0 U	37.5	31.2	816	31	1020	24.7	238	21.5	126		
Antimony	ug/L	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.00 U	1.00 U	0.642 J	0.328 J	0.462 J	0.620 U	0.475 J	0.604J	0.534 J	0.530 J		
Arsenic	ug/L	N/A	45.8	45.2	37.1	63.4	55.2	50.8	45.8	49.2	39.2	45.9	40.7	48.8	32.5	64.9	47.6	38.3	63.3	39.2	68.8	49.2	53.7	48	53.1		
Barium	ug/L	N/A	5.58	6.44	6.39	6.82	6.91	6.42	6.31	6.61	6.29	6.7	6.23	6.94	6.36	6.6	7.72	5.81	11.4	5.78	13.4	5.99	8.03	6.06	6.89		
Bismuth	ug/L	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.00 U	1.00 U	0.620 U	0.620 U								
Cadmium	ug/L	N/A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.500 U	0.500 U	0.300 U	0.300 U	0.300 U	0.300 U	0.300 U	0.300 U	0.300 U	0.300 U		
Chromium	ug/L	<2	N/A	<2	N/A	<2	NA	<2	NA	<2	N/A	<2	<2	<2	<2	2.00 U	2.00 U	1.24 U	1.04 J	1.24 U	1.22 J	1.24 U	1.24 U	1.24 U	1.24 U		
Copper	ug/L	N/A	<1	1.12	<1	<1	<1	1.28	1.06	<1	<1	<1	<1	1.21	<1	1.00 U	1.00 U	0.873 J	2.89	0.514 J	2.35	0.648 J	1.19	0.771 J	0.961 J		
Lead	ug/L	N/A	<0.2	<0.2	<0.2	<0.2	<0.2	0.241	<0.2	0.272	<0.2	<0.2	<0.2	0.2	<0.2	0.200 U	0.200 U	0.286	1.04	0.124 U	1.41	0.153 J	0.826	0.137 J	0.23		
Manganese	ug/L	N/A	17.9	17.6	15.8	6.74	2.79	15.4	11.9	15.3	13.7	18.7	11.9	23.7	18	3.18	25.3	0.724 J	29.9	0.578 J	36.7	2.05	9.69	2.18	8.33		
Nickel	ug/L	N/A	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2.00 U	2.00 U	1.24 U	1.11 J	1.24 U	1.27 J	1.24 U	0.805 J	0.687 J	1.24 U		
Phosphorous	ug/L	<200	N/A	200 U	200 U	124 U	124 U	124 U	124 U	66.7 J	124 U	124 U	124 U														
Selenium	ug/L	N/A	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5.00 U	5.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U		
Silicon	ug/L	N/A	4740	5230	5140	5580	5280	4740	5270	5510	5440	5760	5100	5530	5400	5520	5340	3920	4580	3910	4790	5070	5340	4790	5220		
Silver	ug/L	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.00 U	1.00 U	0.620 U	0.620 U								
Sodium	ug/L	N/A	1990	2010	2030	1980	2010	1810	1940	1960	1970	2070	1.99	2.12	2.06	2090	2120	1440	1460	1460	1470	2150	2030	1950	2050		
Zinc	ug/L	N/A	<5	<5	<5	9.8	<5	<5	<5	<5	<5	<5	<5	<5	<5	5.00 U	5.00 U	2.97 J	4.26 J	5.00 U	4.20 J	2.79 J	4.38 J	4.70 J	5.00 U		
Mercury	ng/L	<1	N/A	1.12	N/A	1.42	N/A	N/A	1.64	N/A	12.1	2.01	N/A	1.21	N/A	-	3.05	-	4.81	-	4.06	-	2.58	-	2.78		

**APPENDIX D**

**MC-2 BASELINE WATER QUALITY SUMMARY TABLE**



**APPENDIX E**

**EC-1 BASELINE WATER QUALITY SUMMARY TABLE**

Analyte	Analytical Method	DL	LOQ	Units	Encino		Encino Spring		Encino Spring	
					8/5/2010		5/18/2011		7/18/2011	
					Dissolved	Total	Dissolved	Total	Dissolved	Total
<b>Major Ion Chemistry</b>										
pH (lab)	SM20 4500-H B	0.1	0.1	pH units	-	7.4	-	7.6	-	7.5
pH (field)	YSI 63 Meter	-	-	pH units	-	6.16	-	7.51	-	7.44
Temperature (field)	YSI 63 Meter	-	-	Degrees C	-	8.8	-	1.4	-	4.1
Conductivity (lab)	SM20 2510B	0.477	1	umhos/cm	-	72.2	-	70.7	-	74
Conductivity (field)	YSI 63 Meter	-	-	µS/cm	-	58.7	-	25.9	-	41.9
Total Suspended Solids	SM20 2540D	0.5	1.67	mg/L	-	4.3	-	12.5	-	33.1
Total Dissolved Solids		3.1	10	mg/L			-	60	-	66
Turbidity	SM20 2130B	0.05	0.1	NTU	-	0.24	-	0.44	-	28.4
Total Settleable Solids (field)	SM2540 F	-	-	mg/L	-	U	-	No Sample	-	No Sample
Settleable Matter (lab)	SM2540 F	0.5	0.5	mg/L	-	0.500 U	-	0.500 U	-	0.100 U
Calculated Hardness	-	-	-	mg/L	32.4	-	30.579	-	31.978	-
Alkalinity	SM2320 B	3.1	10	mg/L	-	32.4	-	31.5	-	33.4
HCO3 Alkalinity	SM2320 B	3.1	10	mg/L	-	32.4	-	31.5	-	33.4
CO3 Alkalinity	SM2320 B	3.1	10	mg/L	-	10.0 U	-	6.20 U	-	6.20 U
OH Alkalinity	SM2320 B	3.1	10	mg/L	-	10.0 U	-	6.20 U	-	6.20 U
Calcium	EPA 200.8	150	500	mg/L	9.68	9.88	9.05	9.45	9.38	9.61
Iron	EPA 200.8	78	250	mg/L	0.250 U	0.250 U	0.156 U	0.0794 J	0.156 U	0.256
Magnesium	EPA 200.8	15	50	mg/L	2	2.14	1.94	2.01	2.08	2.05
Potassium	EPA 200.8	150	500	ug/L	841	821	833	864	0.745	761
<b>Minor Ion Chemistry</b>										
Chloride	EPA 300.0	0.031	0.1	mg/L	-	0.298	-	0.309	-	0.309
Fluoride	EPA 300.0	0.031	0.1	mg/L	-	0.100 U	-	0.0680 J	-	0.0820 J
Sulfate	EPA 300.0	0.031	0.1	mg/L	-	1.88	-	1.8	-	1.77
Total Nitrate/Nitrite-N	SM20 4500NO3-F	0.031	0.1	mg/L		1.88		1.8	-	0.188
Nitrite-N	SM20 4500NO3-F	0.031	0.1	mg/L		0.0620 U		0.0620 U	-	0.0620 U
Nitrate-N	SM20 4500NO3-F	0.031	0.1	mg/L	-	0.198	-	0.285	-	0.188
Ammonia-N	SM20 4500NH3-G	0.031	0.1	mg/L	-	0.100 U	-	0.0620 U	-	0.0620 U
Cyanide	SM20 4500-CN C, E	0.0015	0.005	mg/L	-	0.0050 U	-	0.00300 U	-	0.00300 U
Weak Acid Dissociable CN	SM20 4500-CN I	0.0015	0.005	mg/L	-	0.0050 U	-	0.00300U	-	0.00300 U
<b>Trace Ion Chemistry</b>										
Aluminum	EPA 200.8	6.2	20.0	ug/L	20.0 U	37.1	6.28 J	43.7	12.4 U	167
Antimony	EPA 200.8	0.31	1	ug/L	1.00 U	1.00 U	0.499 J	0.620 U	0.620 U	0.620 U
Arsenic	EPA 200.8	2.5	5	ug/L	96.2	91.2	85.1	89.5	87.7	93.5
Barium	EPA 200.8	0.94	3	ug/L	3.00 U	3.00 U	1.78 J	1.97 J	1.58 J	2.83 J
Bismuth	EPA 200.8	0.31	1	ug/L	1.00 U	1.00 U	0.620 U	0.620 U	0.620 U	0.620 U
Cadmium	EPA 200.8	0.15	0.5	ug/L	0.500 U	0.500 U	0.300 U	0.300 U	0.300 U	0.300 U
Chromium	EPA 200.8	0.62	2	ug/L	2.00 U	2.00 U	1.24 U	1.24 U	1.24 U	1.24 U
Copper	EPA 200.8	0.31	1	ug/L	1.00 U	1.00 U	0.429 J	1.03	0.620 U	0.465 J
Lead	EPA 200.8	0.062	0.2	ug/L	0.200 U	0.200 U	0.37	0.346	0.124 U	0.264
Manganese	EPA 200.8	0.31	1	ug/L	1.00 U	3.74	0.620 U	3.1	0.620 U	8.32
Nickel	EPA 200.8	0.62	2	ug/L	2.00 U	2.00 U	1.24 U	0.635 J	1.24 U	1.24 U
Phosphorous	EPA 200.8	62	200	ug/L	200 U	200 U	124 U	124 U	124 U	124 U
Selenium	EPA 200.8	1.5	5	ug/L	5.00 U	5.00 U	3.00 U	3.00 U	3.00 U	3.00 U
Silicon	EPA 200.8	100	200	ug/L	5850	5820	5390	5510	5270	5350
Silver	EPA 200.8	0.31	1	ug/L	1.00 U	1.00 U	0.620 U	0.620 U	0.620 U	0.620 U
Sodium	EPA 200.8	150	500	ug/L	1890	1950	1690	1740	1830	1800
Zinc	EPA 200.8	2.5	5	ug/L	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Mercury	EPA 1631 E	0.5	1	ng/L	-	2.88	-	1.26	-	2.39

**APPENDIX F**  
**GEOCHEMICAL DATA FOR 2011**

		Meteoric Water Mobility Procedure TSF Mill Tails									
Potential Regulatory Criteria		TSF Mill Tails 1 12/6/2011	TSF Mill Tails 2 12/6/2011	TSF Mill Tails 1 12/17/2011	TSF Mill Tails 2 12/17/2011	TSF Mill Tails 1 12/24/2011	TSF Mill Tails 2 12/24/2011	TSF Mill Tails 1 12/29/2011	TSF Mill Tails 2 12/29/2011	TSF Mill Tails 1 1/12/2012	TSF Mill Tails 2 1/12/2012
Sample Weight [g]		1000	1000	1000	1000	950	850	700	700		
Volume D.I. Water [mL]		1000	1000	1000	1000	950	850	700	700		
Initial pH [units]		8.02	8.07	7.94	7.9	7.99	7.96	8.01	8.07		
Final pH [units]		7.86	7.75	7.66	7.72	7.72	7.75	7.85	7.89		
Volume Leachate [mL]		396	402	507	544	480	416	341	341		
pH [units]	6.5-8.5	8.05	8.02	8.11	8.1	8.03	8.06	8.1	8.07		
Alkalinity [mg/L as CaCO <sub>3</sub> ]		157	174	148	141	137	140	137	131		
Bicarbonate [mg/L as CaCO <sub>3</sub> ]		157	174	148	141	137	140	137	131		
Conductivity [µS/cm]		628	693	746	716	632	637	578	540		
Total Dissolved Solids [mg/L]		331	366	469	449	337	323	271	274		
Fluoride [mg/L]	1 mg/L	0.39	0.33	0.52	0.51	0.4	0.4	0.31	0.29		
Sulphate [mg/L]	chloride and sulfate cannot	55	55	57	54	44	45	43	40		
Chloride [mg/L]	exceed 250 mg/L	5.1	5	5	4.6	4.2	4.2	4.1	3.6		
Nitrite (as N) [mg/L]	1 mg/L	<b>1.05</b>	<b>1.56</b>	0.51	0.74	0.28	0.22	<b>3.11</b>	<b>2.79</b>		
Nitrate (as N) [mg/L]	10 mg/L	<b>24.6</b>	<b>30.3</b>	<b>43.9</b>	<b>42</b>	<b>33.1</b>	<b>32.6</b>	<b>22.1</b>	<b>20.2</b>		
Cyanide (WAD) [mg/L]	0.0052 mg/L	<b>0.02</b>	<b>0.02</b>	<0.01	<0.01	<0.01	<0.01	<b>0.02</b>	<b>0.03</b>		
Mercury [mg/L]	0.00005 mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001		
Silver [mg/L]	0.00087 mg/L*	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001		
Aluminum [mg/L]	0.087 mg/L*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
Arsenic [mg/L]		0.011	0.0103	0.0075	0.0085	0.0088	0.0087	0.0091	0.0093		
Boron [mg/L]		1.02	0.996	0.8	0.783	0.4	0.398	0.398	0.378		
Beryllium [mg/L]		<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002		
Bismuth [mg/L]		<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00003	0.00003		
Calcium [mg/L]		46.3	53	60.9	59.7	52.3	53.8	44.3	44		
Cadmium [mg/L]	0.00014 mg/L*	0.00002	0.000028	0.000023	0.000012	0.000014	0.000007	0.000014	<0.000003		
Chromium [mg/L]	0.1 mg/L	<0.0005	<0.0005	<0.0005	<0.0005	0.0008	<0.0005	<0.0005	<0.0005		
Copper [mg/L]	0.00451 mg/L*	<b>0.0153</b>	<b>0.013</b>	<b>0.0057</b>	<b>0.0073</b>	<b>0.015</b>	<b>0.0166</b>	<b>0.0135</b>	<b>0.0108</b>		
Iron [mg/L]	1 mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.005	0.006		
Potassium [mg/L]		12.8	13.3	12.9	12.3	12.5	12.8	9.4	9.16		
Magnesium [mg/L]		27.6	31.4	38.3	37.4	25.4	25	19.5	18.9		
Manganese [mg/L]	0.05 mg/L*	<b>0.138</b>	<b>0.173</b>	<b>0.0755</b>	<b>0.0741</b>	<b>0.0673</b>	<b>0.0662</b>	<b>0.0779</b>	<b>0.0634</b>		
Sodium [mg/L]		11.9	12.1	9.78	9.12	7.27	7.49	6.66	6.23		
Nickel [mg/L]	0.02639 mg/L*	0.0013	0.0011	0.0035	0.0031	0.0025	0.0025	0.001	0.0014		
Lead [mg/L]	0.00104 mg/L*	0.00007	0.00005	0.00003	0.00005	0.00003	0.00003	0.00002	<0.00002		
Antimony [mg/L]	0.006 mg/L	0.0045	0.0043	0.0047	0.0047	0.003	0.0031	0.0046	0.0047		
Selenium [mg/L]	0.0046 mg/L*	0.002	0.002	0.002	0.001	0.003	0.002	0.002	0.002		
Thallium [mg/L]		0.0017	0.00183	0.00172	0.00175	0.00177	0.00179	0.00161	0.00152		
Zinc [mg/L]	0.05989 mg/L*	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.001		

Sample ID	Date	Cyanide mg/Kg	Weak Acid Dissociable CN mg/Kg	Total Solids %
TSF Mill Tails	12/7/2011	0.0600 U	0.100 U	12.4
TSF Mill Tails	12/8/2011	0.0600 U	0.100 U	15.1
TSF Mill Tails A	12/8/2011	0.0600 U	0.100 U	15.5
TSF Mill Tails	12/9/2011	0.0600 U	0.100 U	14.8
TSF Mill Tails	12/14/2011	0.0600 U	0.100 U	27.5
TSF Mill Tails	12/15/2011	0.0600 U	0.100 U	10.5
TSF Mill Tails	12/16/2011	0.0600 U	0.099 U	11.5
TSF Mill Tails A	12/16/2011	0.0600 U	0.100 U	15.3
TSF Mill Tails	12/17/2011	0.0600 U	0.100 U	17.1
TSF Mill Tails	12/18/2011	0.0600 U	0.100 U	22
TSF Mill Tails	12/19/2011	0.0600 U	0.100 U	20.1
TSF Mill Tails	12/20/2011	0.0600 U	0.100 U	15
TSF Mill Tails	12/21/2011	0.0600 U	0.100 U	17.7
TSF Mill Tails	12/22/2011	0.0600 U	0.100 U	15.5
TSF Mill Tails	12/23/2011	0.0600 U	0.100 U	13
TSF Mill Tails	12/24/2011	0.0600 U	0.100 U	12.9
TSF Mill Tails A	12/24/2011	0.0600 U	0.100 U	12.9
TSF Mill Tails	12/29/2011	0.0600 U	0.100 U	10.6
TSF Mill Tails	12/30/2011	0.0600 U	0.100 U	10.7
TSF Mill Tails	1/4/2012	0.0600 U	0.100 U	11.8
TSF Mill Tails	1/5/2012	0.0600 U	0.100 U	18.2
TSF Mill Tails A	1/5/2012	0.0600 U	0.100 U	12.4

Modified Acid-base Accounting for Mill Tails

	TSF Mill Tails 1 12/6/2011	TSF Mill Tails 2 12/6/2011	TSF Mill Tails 1 12/17/2011	TSF Mill Tails 2 12/17/2011	TSF Mill Tails 1 12/24/2011	TSF Mill Tails 2 12/24/2011	TSF Mill Tails 1 12/29/2011	TSF Mill Tails 2 12/29/2011
Paste pH [s.u.]	8.3	8.24	8.23	8.23	8.29	8.07	8.19	8.14
Fizz Rate	4	4	4	4	4	4	4	4
Sample Weight [g]	2.02	2	2	1.99	1.98	1.98	2.01	2.03
HCl added [mL]	202.8	202.2	290	287.7	259.3	261	253.1	258.1
HCl [Normality]	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NaOH [Normality]	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NaOH to pH= 8.3 [mL]	55	54.73	91.17	87.49	79.03	78.12	77.91	79.57
Final pH [s.u.]	1.68	1.69	1.61	1.63	1.64	1.63	1.63	1.64
Neutralizing Potential [t CaCO <sub>3</sub> /1000 t]	366	369	497	503	455	462	436	440
Acid Generating Potential [t CaCO <sub>3</sub> /1000 t]	0.31	0.36	0.31	0.31	0.31	0.31	0.31	0.31
Net NP [t CaCO <sub>3</sub> /1000 t]	365	368	497	503	455	461	436	439
NP/AP [ratio]	1180	1040	1600	1620	1470	1490	1410	1420
Sulphur (total) [%]	0.007	0.009	0.005	<0.005	<0.005	<0.005	0.015	0.015
Acid Leachable SO <sub>4</sub> -S [%]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.01
Sulphide [%]	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Carbon (total) [%]	4.23	4.05	5.86	5.49	5.15	5.25	5.08	5.06
Carbonate [%]	19.9	21.4	27.6	28.4	22.8	24.2	23.9	24

Meteoritic Water Mobility Procedure for Development Waste Rock												
Sample Weight [g]	Potential Regulatory Criteria	Development Waste Rock 1	Development Waste Rock 2	Development Waste Rock 1	Development Waste Rock 2	Development Waste Rock 1	Development Waste Rock 2	Development Waste Rock 1	Development Waste Rock 2	Development Waste Rock 1	Development Waste Rock 2	Development Waste Rock 2
		11/12/2011	11/12/2011	11/19/2011	11/19/2011	11/24/2011	11/24/2011	11/24/2011	12/16/2011	12/16/2011	1/12/2012	1/12/2012
5000		5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
5000		5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
5.8		5.8	5.8	5.53	5.72	5.94	5.93	5.8	5.58	5.52	5.39	5.39
7.86		7.7	7.7	8.37	7.62	7.95	7.84	7.28	7.21	6.62	6.58	6.58
4437		4727	4727	4576	4708	4538	4798	3881	3738	4101	4308	4308
6.5-8.5		7.69	7.5	7.66	7.62	7.66	7.51	7.38	7.33	6.99	6.76	6.76
52		27	27	31	30	31	32	33	29	12	8	8
52		27	27	31	30	31	32	33	29	12	8	8
178		101	101	136	172	86	100	70	62	62	40	40
97		60	60	106	109	<30	60	94	108	94	80	80
1 mg/L		0.16	0.03	0.1	0.08	0.06	0.19	0.1	0.14	0.06	0.06	0.06
5.5	chloride and sulfate cannot	2.72	2.72	2.2	1.6	4.8	3.4	1.4	1.5	2.9	1.5	1.5
<0.2	exceed 250 mg/L	<0.2	<0.2	0.2	0.2	1	0.7	0.6	0.6	7.2	3.4	3.4
<0.3	1 mg/L	<0.6	<0.6	0.09	0.1	0.37	0.72	<0.06	<0.06	0.08	0.13	0.13
10 mg/L		6.86	5.14	8.61	13	1.87	2.68	<0.05	<0.05	0.16	0.13	0.13
<0.01	0.0052 mg/L	<0.01	<0.01	<0.01	<0.001	<0.001	<0.001	<0.004	<0.004	<0.001	<0.001	<0.001
0.0005 mg/L	0.002	0.0037	0.0037	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
0.00087 mg/L*	0.0002	0.00014	0.00014	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
0.087 mg/L*	<0.01	0.03	0.03	0.03	0.03	0.04	0.07	0.32	0.55	0.1	0.15	0.15
0.0385	0.0047	0.0103	0.0103	0.0064	0.0064	0.0124	0.0069	0.006	0.0087	0.0056	0.0058	0.0058
0.0054	0.0023	0.0177	0.0177	0.0184	0.0184	0.0095	0.0165	0.0071	0.0059	0.0106	0.0103	0.0103
<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	0.00004	0.00004	0.00004	0.0008	0.0008
<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00002	0.00001	0.00001
26.2	0.0014 mg/L*	15.3	15.3	18.1	20.3	11.6	12.3	8.3	7.52	5.51	3.87	3.87
0.000003	0.000003	<0.000003	<0.000003	0.00001	0.000007	<0.000003	<0.000003	0.000396	0.000293	0.000341	0.000297	0.000297
0.0008	0.1 mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0012	<0.0005	<0.0005	<0.0005	0.0011	0.0011
0.00451 mg/L*	0.0016	0.0009	0.0009	0.0016	0.0012	0.0009	0.001	0.0023	0.0022	0.0025	0.0034	0.0034
<0.003	<0.003	<0.003	<0.003	0.003	0.003	<0.003	<0.003	0.395	0.639	0.094	0.102	0.102
2.57	1 mg/L	0.291	0.291	0.875	0.738	0.603	0.485	1.93	1.89	1.46	1.24	1.24
1.68		0.383	0.383	2.83	3.26	1.74	2.67	1.53	1.52	1.01	0.628	0.628
0.05 mg/L*	0.00352	0.00147	0.00147	0.00282	0.00291	0.00089	0.00184	0.03238	0.02651	0.0279	0.0211	0.0211
0.61		0.26	0.26	0.81	1.03	0.4	0.9	3.05	3.44	3.74	2.58	2.58
0.0008	0.02639 mg/L*	0.0004	0.0004	0.0002	<0.0001	0.005	0.0006	0.0006	0.0008	0.001	0.0011	0.0011
0.00104 mg/L*	0.00005	0.00022	0.00022	<0.00002	<0.00002	0.0001	0.00006	0.00071	0.00089	0.0003	0.00042	0.00042
0.006 mg/L	0.0077	0.0008	0.0008	0.002	0.0011	0.0012	0.0012	0.0023	0.0029	0.0043	0.0046	0.0046
0.0046 mg/L*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
0.00029	0.00014	0.00014	0.00014	0.00018	0.00005	0.0002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
0.05989 mg/L*	0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.007	0.007	0.014	0.013		

Modified Acid-base Accounting for Development Waste Rock

	Development Waste Rock 1	Development Waste Rock 1	Development Waste Rock 2	Development Waste Rock 1	Development Waste Rock 2	Development Waste Rock 1	Development Waste Rock 2	Development Waste Rock 1	Development Waste Rock 2	Development Waste Rock 1	Development Waste Rock 2
	7/25/2011	11/12/2011	11/12/2011	11/19/2011	11/19/2011	11-24-2011	11/24/2011	12/16/2011	12/16/2011	01-12-2012	1/12/2012
Paste pH [s.u.]	8.77	7.76	7.92	8.02	8.16	8.38	8.28	7.55	7.49	7.31	7.24
Fizz Rate	4	4	3	4	4	4	4	1	1	1	1
Sample Weight [g]	1.99	2.01	2.01	2.05	2.01	2	1.97	1.96	1.97	2.04	2.07
HCl added [mL]	371.6	144	364.1	488.9	497.4	502.7	421	20	20	20	20
HCl [Normality]	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NaOH [Normality]	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NaOH to pH= 8.3 [mL]	58.72	43.56	98.04	126	138	140	99.42	16.71	16.59	18.24	18.12
Final pH [s.u.]	1.98	1.65	1.65	1.64	1.61	1.57	1.67	1.72	1.67	1.43	1.45
Neutralizing Potential [t CaCO3/1000 t]	786	250	662	886	893	907	816	8.4	8.7	4.3	4.5
Acid Generating Potential [t CaCO3/1000 t]	1.25	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Net NP [t CaCO3/1000 t]	785	250	661	885	893	906	816	8.09	8.39	3.99	4.19
NP/AP [ratio]	629	806	2130	2860	2880	2920	2630	27.1	28.1	13.9	14.5
Sulphur (total) [%]	0.235	0.007	<0.005	0.03	0.018	0.016	0.011	0.006	<0.005	0.008	<0.005
Acid Leachable SO4-S [%]	0.19	<0.01	<0.01	0.03	0.02	0.03	0.01	<0.01	<0.01	<0.01	<0.01
Sulphide [%]	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Carbon (total) [%]	9.3	3.04	8.04	10.3	10.2	9.96	9.2	0.176	0.137	0.188	0.143
Carbonate [%]	43.4	14.2	37.5	49.8	51.2	49	43.5	0.149	0.042	0.007	0.02