

***ABBREVIATED PRELIMINARY ASSESSMENT***

***Pride of Woods, New Discovery, and Pride of Mountains Mines  
in the  
Monte Cristo Mining District***



***Cover Photo: New Discovery Mine as viewed from Mystery Ridge.***

Mount Baker-Snoqualmie National Forest  
Darrington Ranger District  
Snohomish County, WA

September, 2006

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## EXECUTIVE SUMMARY

The Forest Service performed an Abbreviated Preliminary Assessment for the Pride of the Woods, New Discovery, and Pride of the Mountains Mines to determine the need for further site characterization. The Mines are located approximately 40 miles east of Everett, WA on federal lands within the Henry M. Jackson Wilderness on the Mount Baker-Snoqualmie National Forest, Darrington Ranger District. The mines fall within the Glacier Creek drainage which forms the South Fork Sauk River at its confluence with 76 Creek at the town site of Monte Cristo. The Pride of Woods, New Discovery, and Pride of Mountains Mines are located in Glacier Basin at the headwaters of Glacier Creek at elevations of approximately 4,400 to 5,000 feet above mean sea level (MSL). The mines were visited and sampled on August 2, 2006. Numerous cabins and seasonal residences are located within the town site and immediately downstream. The South Fork Sauk River and/or lower reaches of Glacier Creek are known to contain threatened and endangered populations of Bull Trout/Dolly Varden, Steelhead, Pink Salmon, Coho Salmon, and/or Chinook Salmon.

Composite soil samples from mine waste rock dumps were collected in the field, prepared for bench testing in the lab, and analyzed using a Niton X-Ray Fluorescence (XRF) analyzer in accordance with EPA Method 6200. In total, eleven composite soil samples from the three mines were collected and analyzed. Arsenic (4,650-42,982 mg/kg), chromium (<510-2,080 mg/kg), and lead (1,080-7,494 mg/kg), and to a lesser degree antimony (193.2-1,170 mg/kg) and iron (53,800-125,000 mg/kg), concentrations in soil samples from the Pride of Woods, New Discovery, and Pride of Mountains waste rock dumps exceeded Washington's Model Toxics Control Act (MTCA) Method A cleanup levels and/or EPA Region IX Preliminary Remediation Goals (PRGs) for industrial properties. Arsenic, chromium, lead, and zinc (352-1,390 mg/kg) commonly exceeded soil concentrations established under MTCA to be protective of terrestrial ecological receptors at most industrial/commercial sites. However, exceedance of ecological receptor values does not necessarily trigger cleanup actions

Five water quality samples were collected along Glacier Creek above, below, and in between the three aforementioned mines. One sample of adit discharge was collected from the Pride of the Mountains-Northwest Adit. All samples were analyzed for hardness and total antimony, arsenic, cadmium, copper, lead, nickel, and zinc. Four samples were analyzed for sulfate. Only two samples from along Glacier Creek exceeded Washington State chronic aquatic standards: 1) the upstream sample above all 3 mines slightly exceeded for lead; and 2) the downstream sample below all 3 mines exceeded slightly for copper. Some metals concentrations in Glacier Creek, namely antimony, arsenic, copper, and nickel, increased slightly downstream. Lead and zinc concentrations showed some fluctuation downstream but generally decreased. All metals concentrations along Glacier Creek met drinking water standards but not the human health standard for water + organism and/or organism only for arsenic. Adit discharge at the Pride of Mountains-Northwest Adit exceeded state chronic aquatic standards for arsenic, cadmium, copper, lead, and zinc; human health criteria for antimony and arsenic; and drinking water standards for antimony, arsenic, cadmium, copper, and lead. However, the adit effluent infiltrated colluvial material and/or waste rock within 75 feet of the portal. The Southeast Adit at the New Discovery Mine has discharge as well but could not be sampled as part of this investigation because of extremely low flow rate. However, Wolff and others (2003) sampled

the discharge from the southeast adit at the New Discovery and documented that concentrations of arsenic, cadmium, copper, iron, lead, and zinc met state water quality criteria for aquatic life but exceeded the drinking water standard for arsenic. As at the Pride of Mountains mine, the adit discharge infiltrated waste rock within 25 feet of the portal.

Based on the analytical results for soil and water samples; proximity to cabins and seasonal residences downstream at the town site of Monte Cristo; known populations of threatened and endangered Bull Trout/Dolly Varden, Steelhead, and Salmon populations in the lower reaches of Glacier Creek and/or South Fork Sauk River; accessibility of the Site to the public; and EPA's APA Checklist (Appendix A); it is recommended that a Site Inspection (SI) be performed for the Pride of Woods, New Discovery, and Pride of Mountains mines.

## 1.0 INTRODUCTION

An Abbreviated Preliminary Assessment (APA) was performed by the US Forest Service in accordance with the EPA “Guidance for Performing Preliminary Assessments Under CERCLA”, EPA “Improving Site Assessment: Abbreviated Preliminary Assessments” of 1999, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Contingency Plan as outlined in 40 CFR Parts 300.410(c)(1)(i-v).

The purpose of this assessment was to determine whether or not there is a release or potential for a release of contaminants to the environment and/or to human health and to document whether further site characterization is warranted.

## 2.0 SITE DESCRIPTION, OPERATIONAL HISTORY, AND WASTE CHARACTERISTICS

The Pride of Woods, New Discovery, and Pride of Mountains mines are located approximately 40 miles east of Everett, WA within the Henry M. Jackson Wilderness of the Mount Baker-Snoqualmie National Forest, Darrington Ranger District. All of the mines lie within the Glacier Creek drainage which forms the South Fork Sauk River at its confluence with 76 Creek at the town site of Monte Cristo. The South Fork Sauk River and/or lower reaches of Glacier Creek are known to contain threatened and endangered populations of Bull Trout/Dolly Varden, Steelhead, Pink Salmon, Coho Salmon, and/or Chinook Salmon. The Pride of Woods, New Discovery, and Pride of Mountains Mines are located in Glacier Basin at the headwaters of Glacier Creek at elevations of approximately 4,400 to 5,000 feet above mean sea level (MSL).

Access to the Site can be accomplished from either Darrington or Granite Falls via Highway 20, the Mountain Loop Highway, to Barlow Pass. Snohomish County owns and maintains the 5-mile long road (FS road 4710) from Barlow Pass to the town site of Monte Cristo. The road is gated at Barlow Pass. From the town site of Monte Cristo, the Pride of Woods, New Discovery, and Pride of Mountains mines are accessed via a 1.5 mile hike on the Glacier Basin trail (#719). Numerous private cabins and seasonal residences are located at the town site of Monte Cristo as well as immediately downstream.

Location information:

|             |   |                              |
|-------------|---|------------------------------|
| Legal:      | Willamette Meridian, T 29 N, R 11 E, Secs 22 and 23 |                              |
| Lat./Long.: | Pride of Woods                                      | N 47° 58' 53" W 121° 21' 54" |
|             | New Discovery                                       | N 47° 58' 51" W 121° 21' 44" |
|             | Pride of Mountains                                  |                              |
|             | Northwest Adit                                      | N 47° 58' 51" W 121° 21' 33" |
|             | Southeast Adit-Lower                                | N 47° 58' 49" W 121° 21' 30" |
|             | Southeast Adit-Upper                                | N 47° 58' 50" W 121° 21' 29" |

USGS quadrangle: Monte Cristo and Blanca Lake

According to Church and others (1983) and Johnson and others (1985), the first claims in the Monte Cristo mining district were staked on sulfide-bearing quartz veins in 1889. By 1891, a road up the Sauk River valley was under construction and in 1893, the Everett-Monte Cristo Railroad was completed, vastly improving access to the mining district. By 1894 a 300-ton-per-day concentrator and aerial tramways between the mill and the Mystery and Pride of Mountains mines were in place and operating. The mines produced high-grade ore that was trammed to the mill and the mill produced concentrates for shipment to the Everett Smelter until 1897, when flooding along the Sauk River destroyed much of the railroad. The mines were basically shut down until 1899 when John D. Rockefeller gained a controlling interest in the mines and related companies. Railroad service was restored in 1900 and mining resumed in the District. In response to an unfavorable 1901 USGS report on the mineral deposits in the District indicating grade decreased with depth, Rockefeller began selling his holdings. Subsequently, the Guggenheim Smelter Trust, later known as ASARCO, acquired the Monte Cristo Mines and Everett Smelter. Their main interest was the smelter and consequently, the mines were shut down in 1903. The mines were sold in 1905 to the Wilmans brothers who in turn sold to mining speculator Samuel Silverman in 1906 (Wolff and others, 2003). Silverman intended to install a roasting plant at Monte Cristo to produce arsenic trioxide, a pesticide, but the company went into receivership in 1907 (Wolff and others, 2003). Limited production resumed in 1906 only to end again the following year (Johnson and others, 1985). Some mining occurred in 1920 but the District has been generally idle since that time (Johnson and others, 1985).

Among the principal mineral deposits in the Monte Cristo District was a northeast-trending, northwest-dipping shear zone in tonalite host rock exposed for 5,800 feet along strike and ranging from 1 to over 20 feet in width (Johnson and others, 1985). This shear zone contains quartz veins and lenses that pinch and swell horizontally and vertically along the vein. The veins and lenses contain pyrite, pyrrhotite, arsenopyrite, sphalerite, galena, chalcopyrite, stibnite, and lesser amounts of azurite, malachite, boulangerite, realgar, and orpiment (Johnson and others, 1985). This deposit was developed by the Justice, Golden Chord, Mystery, Pride of Woods, New Discovery, and Pride of Mountains mines (Church and others, 1983; Johnson and others, 1985). The principal commodities produced from these mines were gold, silver, copper, lead, and zinc (Broughton, 1942; Derkey and others, 1990). Production records for the District are incomplete but total production is estimated at 280,000 tons of polymetallic ore, mainly produced by the Justice, Golden Chord, Mystery, Pride of Woods, New Discovery, Pride of Mountains, Comet, and Rainy mines (Church and others, 1983; Johnson and others, 1985).

The Pride of Woods Mine comprises one adit 587 feet long driven from Glacier Basin under Mystery Ridge (Johnson and others, 1995). Eventually Adit #2 from the Mystery Mine and the Pride of Woods adit connected under Mystery Ridge and were operated as one mine (Northwest Underground Explorations, 1997). Ore from the Pride of Woods claims was transported underground through the Mystery Mine workings and out the Mystery #3 adit to a low-level aerial tram station. Current observations for the Pride of the Woods Mine are as follows:

- Mine portal is inaccessible; covered by boulders and is assumed to be partially collapsed due to only limited air movement in and out of the portal area (Appendix E-2, photos 1 and 3).

- No mine discharge or evidence of mine discharge from the portal (Appendix E-2, Photo 3).
- Waste rock volume is roughly estimated at 350 loose cubic yards (LCY).
- Waste rock dump is mostly un-vegetated (Appendix E-1, Photos 1 and 2).
- Toe of waste rock dump is located immediately adjacent to Glacier Creek (Appendix E-2, Photo 2).
- No seeps or springs were observed at the base of the waste rock dump.
- Immediately downstream from the Pride of Woods Mine, surface flow in Glacier Creek funnels into talus material and flows downgradient entirely as shallow groundwater (interflow) along talus-bedrock contact (Appendix E-2, Photo 4). Subsurface water re-emerges as surface flow downstream above the bedrock falls.

The New Discovery mine encompasses approximately 2,840 feet of horizontal mine workings on three levels that are connected by raises and stopes (Johnson and others, 1985). Initially, ore from the New Discovery was transported via aerial tram over Mystery Ridge to the concentrator. In 1890, a raise was driven 800 feet from the Mystery #3 adit up to the lower-most level at the New Discovery mine in order to use the low-level aerial tram station at the Mystery (Northwest Underground Exploration, 1997). The New Discovery produced approximately 45,000 tons of ore based on stope volumes (Johnson and others, 1985). Current observations for the New Discovery Mine are as follows:

- There are 3 open adits: herein informally referred to as the southeast adit, northwest adit, and barren adit (Appendix E-3, Photo 5). The northwest adit was the main production drift while the southeast adit was a ventilation tunnel.
- Northwest adit: Unstable but open portal; sill was moist but no mine drainage or evidence of mine drainage (Appendix E-3, Photo 6).
- Southeast adit: Open with mine drainage of 1-2 gallons per minute which infiltrates into waste rock within 25 feet of the mine portal (Appendix E-4, Photo 7) so there is no direct connection to perennial surface waters. Mine drainage of 1-2 gallons per minute was insufficient to sample without significantly disturbing substrate.
- Barren adit: Open portal driven in un-mineralized granodiorite host rock. No mine drainage or evidence of mine drainage (Appendix E-5, Photo 9).
- Waste rock dump un-vegetated and roughly estimated at approximately 850 LCY.
- Waste rock dump located on steep sideslopes well above floodplain of Glacier Creek (Appendix E-4, Photo 8).
- Isolated area of iron oxide and/or hydroxide precipitates along Glacier Creek at base of talus slope below mine waste rock dump (Appendix E-4, Photo 8).

The Pride of Mountains mine comprises 2,314 feet of horizontal mine workings on three main levels connected by a maze of raises, stopes, and intermediate levels (Johnson and others, 1985). One source has reported that the Pride of Mountains workings are also connected to the Mystery Mine (Northwest Underground Explorations, 1997). Production from the Pride of Mountains is estimated at 27,000 tons of ore based on stope volumes. Several additional minor mine workings have been documented but were not visited as part of this investigation. Current observations for the Pride of Mountains mine are as follows:

- Mine workings include 2 partially caved adits, 1 caved adit, and an open incline (Appendix E-5, Photo 10)

- Northwest Adit
  - Portal partially caved (Appendix E-6, Photo 11).
  - Water is ponded behind sloughed material at portal but seeps past sloughed colluvial material and surfaces just outside portal (Appendix E-6, Photos 11 and 12).
  - Mine discharge was estimated at 5 gallons per minute.
  - Mine discharge infiltrated colluvial material and/or waste rock approximately 75 feet downslope from the mine portal (Appendix E-7, Photo 12) so there is no direct connection to any perennial surface waters.
  - Waste rock dump is almost entirely un-vegetated and roughly estimated at approximately 850 LCY (Appendix E-7, Photo 13).
  - Waste rock dump is located on very steep sideslopes well above Glacier Creek floodplain (Appendix E-5, Photo 10).
- Southeast Workings-Upper Adit and Incline
  - Portal partially caved but open, incline open to surface (Appendix E-8, Photos 14-15).
  - Adit and incline were both dry with no mine discharge or evidence of discharge
  - Waste rock dump is largely un-vegetated and roughly estimated at approximately 250 LCY (Appendix E-9, Photo 16).
  - Waste rock dump is located on very steep sideslopes well above Glacier Creek floodplain (Appendix E-5, Photo 10).
- Southeast Workings-Lower Adit
  - Portal completely collapsed (Appendix E-9, Photo 17).
  - No mine drainage or evidence of mine drainage.
  - Waste rock dump is un-vegetated and roughly estimated at 100 LCY (Appendix E-10, Photo 18).
  - Waste rock dump is located on very steep sideslopes well above Glacier Creek floodplain.

The Henry M. Jackson Wilderness is closed to entry and appropriation under the U.S. Mining laws and there are no mining claims with valid existing rights in the area (BLM LR2000 database, accessed 7/13/2006).

### **3.0 SITE SAMPLING AND TEST RESULTS**

#### **3.1 Previous Investigations**

Several previous investigations have looked at possible human health and environmental impacts stemming from historic mining in the Monte Cristo Mining District. Rafterth and others (2002) collected surface water samples along Glacier Creek above the mine workings in Glacier Basin and below the town site of Monte Cristo in August, 2000 (low-flow) and June, 2001 (high-flow). Stream sediment samples were also collected in August, 2000. The results were as follows:

- Field measurements and general chemistry parameters were consistent from the upstream sample to the downstream sample as well as under different flow regimes.



- Iron, zinc, arsenic, and cadmium concentrations in surface waters increased downstream under low- and/or high-flow conditions (Appendix B-2).
- All metals concentrations in surface waters were below aquatic water quality standards (Appendix B-2).
- Aluminum, antimony, chromium, iron and zinc concentrations in stream sediments increased slightly from the upstream sample to the downstream sample.
- Arsenic and copper concentrations in stream sediments showed at least a two-fold increase from upstream to downstream.
- Antimony, arsenic, copper, and zinc concentrations in both upstream and downstream sediment samples exceeded sediment quality guidelines.

Wolff and others (2003) visited the Pride of Woods, New Discovery, and Pride of Mountains Mines on September 27, 2002 and collected a limited number of waste rock soil and adit discharge water samples. The results of their investigation were as follows:

- Concentrations of arsenic, copper and/or lead in waste rock at the Pride of Woods and Pride of Mountains mines exceeded MTCA Method A cleanup levels (Appendix B-1). These soils also exceeded soil concentrations established under MTCA to be protective of terrestrial ecological receptors at most unrestricted land use sites for arsenic, copper, lead, and/or zinc (Appendix B-1).
- Concentrations of arsenic, cadmium, copper, iron, lead, and zinc in adit discharge from the southeast adit at the New Discovery mine met state water quality criteria for aquatic life (Appendix B-2).
- Concentrations of arsenic, cadmium, copper, lead, and zinc in adit discharge from the northwest adit at the Pride of the Mountains mine exceeded state water quality criteria for aquatic life (Appendix B-2).
- Documented that all mines with adit discharge infiltrated colluvium, waste rock, or soil within 100 yards of the portal and that there was no direct discharge to Glacier Creek.

Crofoot and O'Brien (2004) performed rather extensive soil and water sampling in the Glacier Creek and 76 Creek drainages in September of 2003 as part of a Site Hazard Assessment (SHA) performed under MTCA. Soil and surface water samples were analyzed for priority pollutant metals at the Pride of Woods and Pride of Mountains Mines. The results of their investigation for the upper Glacier Creek drainage were as follows:

- Antimony, arsenic, cadmium, lead, and mercury concentrations in waste rock at the Pride of the Woods Mine exceeded MTCA Method A and B cleanup goals (Appendix B-4).
- Arsenic concentrations in waste rock at the Pride of the Mountains mine exceeded MTCA Method A and B cleanup goals (Appendix B-4).
- Arsenic concentrations in surface water samples from the headwater of Glacier Creek and along Glacier Creek above and below the Pride of the Mountains mine exceeded human health criteria but did not exceed aquatic or drinking water standards (Appendix B-5).

### **3.2 Soil Samples**

Composite soil samples were collected from mine waste rock dumps to assess the material for potential contamination. Surface soils were removed to approximately 4 to 6 inches below grade in order to get below highly oxidized surface layers. Samples were collected using stainless steel scoops and placed in Low Density Polyethylene (LDPE) bags for subsequent bench testing. Samples were prepared in the lab and analyzed using a Niton X-Ray Fluorescence (XRF) analyzer in accordance with EPA Method 6200. In total, eleven samples from the three mines were collected and analyzed (Appendix C-1). The analytical results from this effort are provided in Appendix C and summarized below. It is important to note that detection limits for certain elements were higher than the cleanup goals or standards to which they were compared (Appendix C). As a result, there may be additional exceedances of cleanup goals or standards not detectable using this reconnaissance analytical technique.

Two composite soil samples were taken from the Pride of Woods Mine (Samples MC-GC-2A and MC-GC-2B in Appendices C-1 to C-3). Arsenic, chromium, and lead concentrations in both samples and iron and antimony in one sample (MC-GC-2A) exceeded both Washington's Model Toxics Control Act (MTCA) Method A cleanup levels and/or EPA Region IX Preliminary Remediation Goals (PRGs) for industrial properties. Arsenic, chromium, and lead in both samples also exceeded soil concentrations established under MTCA to be protective of terrestrial ecological receptors at most industrial/commercial sites (Appendices C-2 to C-3). However, exceedance of ecological receptor values does not necessarily trigger cleanup actions.

Three composite samples were taken from the New Discovery Mine (Samples MC-GC-4A/B/C in Appendices C-1 and C-4 to C-6). Arsenic and lead concentrations in all 3 samples, antimony and chromium concentrations in 2 samples, and iron in 1 sample exceeded both Washington's Model Toxics Control Act (MTCA) Method A cleanup levels and/or EPA Region IX Preliminary Remediation Goals (PRGs) for industrial properties (Appendices C-4 to C-6). Arsenic (3 samples), chromium (2 samples), lead (3 samples), and zinc (2 samples) exceeded soil concentrations established under MTCA to be protective of terrestrial ecological receptors at most industrial/commercial sites (Appendices C-4 to C-6).

Six composite samples were taken from the mine workings at the Pride of Mountains Mine (Samples MC-GC-6A/B/C, MC-GC-7, and MC-GC-8A/B in Appendices C-1 and C-7 to C-12). Antimony (1 sample), arsenic (all 6 samples), chromium (5 samples), and lead (all 6 samples) concentrations exceeded MTCA Method A cleanup levels and/or EPA Region IX Preliminary Remediation Goals (PRGs) for industrial properties (Appendices C-7 to C-12). Arsenic (all 6 samples), copper (1 sample), chromium (5 samples), lead (6 samples), and zinc (6 samples) exceeded soil concentrations established under MTCA to be protective of terrestrial ecological receptors at most industrial/commercial sites (Appendix C-7 to C-12).

### **3.3 Water Samples**

Water quality sampling at the mines and along Glacier Creek was performed on August 2, 2006. Five water quality samples were collected along Glacier Creek above, below, and in between the three mines (Appendix D-1). One sample of adit discharge was collected from the Pride of the

Mountains Northwest Adit (Appendix D-1). Unfiltered water samples for metals were collected as grab samples and were collected in pre-cleaned, 250-mL High Density Polyethylene (HDPE) bottles and preserved to pH<2 with nitric acid. Metals samples were analyzed for total antimony, arsenic, cadmium, copper, lead, nickel, and zinc by Inductively Coupled Plasma/Mass Spectrometry (ICP/MS) following EPA method SW6020. Unfiltered samples for hardness as CaCO<sub>3</sub> were collected in pre-cleaned 250-mL HDPE bottles and preserved with nitric acid. Samples for hardness were analyzed following EPA method 130.2. Unfiltered samples for sulfate were collected in pre-cleaned 250-mL HDPE bottles and left unpreserved. Samples for sulfate were analyzed by ion chromatography using EPA method 300.0. Field parameters were obtained using a Horiba U-22 meter (Appendix D-2).

All samples were double-bagged in polyethylene and placed on ice for overnight shipment via FedEx to Severn Trent Laboratories, Inc. in Tacoma, Washington. Chain of custody for the samples was maintained. Sample analysis was performed within laboratory holding times. A complete report of the quality assurance/quality control (QA/QC) procedures and results is included in the laboratory analytical report dated August 21, 2006 (Appendix F).

Surface water samples were obtained from Glacier Creek below Pride of Woods Mine, Glacier Creek between Pride of Woods and New Discovery Mines, Glacier Creek between New Discovery and Pride of Woods Mines, Pride of Mountains-Northwest Adit discharge, and Glacier Creek above Pride of Mountains Mine (Appendix D-1). Field parameters obtained for surface water sample sites are located in Appendix D-2. Analytical results and applicable comparison criteria are located in Appendix D-3. The results of the sampling are as follows:

- Antimony, copper, lead, nickel, and zinc were detected in sample MC-GC-9 taken near the headwaters of Glacier Creek above the mines (Appendix D-1 and D-3). Lead concentrations in that sample were slightly above the chronic aquatic water standard (Appendix D-3).
- Metals concentrations along Glacier Creek in between and below the mines were generally consistent with slight downstream increases in antimony, arsenic, copper and nickel (Appendix D-3). Lead and zinc concentrations showed some fluctuation but generally decreased downstream (Appendix D-3). Sulfate concentrations also showed a slight increase downstream but overall sulfate levels are very low (Appendix D-3). Only two samples from along Glacier Creek exceeded Washington State chronic aquatic standards: 1) the upstream background sample above all 3 mines slightly exceeded for lead; and 2) the downstream sample below all 3 mines exceeded slightly for copper (Appendix D-3). All metals concentrations met drinking water standards but not the human health standard for water + organism and/or organism only for arsenic (Appendix C-3).
- One sample of mine effluent discharging from the northwest adit at the Pride of the Mountains Mine was collected. The sample exceeded state chronic aquatic standards for arsenic, cadmium, copper, lead, and zinc (Appendix D-3). The sample also exceeded human health criteria for water+organism and/or organism only for antimony and arsenic and drinking water standards for antimony, arsenic, cadmium, copper, and lead (Appendix D-3). However, the adit influent infiltrated colluvium/waste rock within 75 feet of the portal.

#### 4.0 REMOVAL ACTION JUSTIFICATION

The NCP states that an appropriate removal action may be conducted at a site when a threat to human health or welfare or the environment is identified.

- The removal action is undertaken to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or the threat of a release at a site.
- Section 300.415(b)(2)(i-viii) of the NCP outlines eight factors to be considered when determining the appropriateness of a removal action.
- The applicable factors are outlined below and provide justification for completing the removal action, if required.

| <i>Factor</i>  | <i>Site Condition</i>  | <i>Justification</i> |
|--|--|----------------------|
| 1) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants      | Elevated antimony, arsenic, chromium, lead, and/or zinc concentrations in waste rock dumps (Appendix C); elevated antimony, arsenic, cadmium, copper, lead, and zinc in adit discharge (Appendix D-3). | Yes                  |
| 2) Actual or potential contamination of drinking water supplies or sensitive ecosystems  | Cabins and seasonal residences in and near Monte Cristo. Glacier Creek and South Fork Sauk River.  | Yes                  |
| 3) Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release. | None located at the site.  | No                   |
| 4) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate                        | Elevated antimony, arsenic, chromium, lead, and/or zinc concentrations in waste rock dumps (Appendix C).   | Yes                  |
| 5) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released                                    | Heavy rain or rain on snow events.   | Yes                  |
| 6) Threat of fire or other explosion   | None   | No                   |
| 7) The availability of other appropriate federal or state response mechanisms to respond to the release  | N/A  | No                   |
| 8) Other situations or factors that may pose threats to public health or welfare of the United States or the environment                             | None   | No                   |

#### 5.0 SUMMARY

Composite soil samples from mine waste rock dumps were collected in the field and prepared for bench testing in the lab and analyzed using a Niton XRF unit in accordance with EPA Method 6200. In total, eleven composite soil samples from the three mines were collected and analyzed.

Arsenic, chromium, and lead, and to a lesser degree antimony and iron, concentrations in soil samples from the Pride of Woods, New Discovery, and Pride of Mountains waste rock dumps exceeded Washington's Model Toxics Control Act (MTCA) Method A cleanup levels and/or EPA Region IX Preliminary Remediation Goals (PRGs) for industrial properties. Arsenic, chromium, lead, and zinc commonly exceeded soil concentrations established under MTCA to be protective of terrestrial ecological receptors at most industrial/commercial sites. However, exceedence of ecological receptor values does not necessarily trigger cleanup actions

Five water quality samples were collected along Glacier Creek above, below, and in between the three aforementioned mines. One sample of adit discharge was collected from the Pride of the Mountains-Northwest Adit. All samples were analyzed for hardness and total antimony, arsenic, cadmium, copper, lead, nickel, and zinc. Four samples were analyzed for sulfate. Only two samples from along Glacier Creek exceeded Washington State chronic aquatic standards: 1) the upstream sample above all 3 mines slightly exceeded for lead; and 2) the downstream sample below all 3 mines exceeded slightly for copper. Some metals concentrations in Glacier Creek, namely antimony, arsenic, copper, and nickel, increased slightly downstream. Lead and zinc concentrations showed some fluctuation downstream but generally decreased. All metals concentrations along Glacier Creek met drinking water standards but not the human health standard for water + organism and/or organism for arsenic.

Adit discharge at the Pride of Mountains-Northwest Adit exceeded state chronic aquatic standards for arsenic, cadmium, copper, lead, and zinc; human health criteria for antimony and arsenic; and drinking water standards for antimony, arsenic, cadmium, copper, and lead. However, the adit effluent infiltrated colluvial material and/or waste rock within 75 feet of the portal. The Southeast Adit at the New Discovery Mine has discharge as well but could not be sampled as part of this investigation because of extremely low flow rate. However, Wolff and others (2003) sampled the discharge from the southeast adit at the New Discovery and documented that concentrations of arsenic, cadmium, copper, iron, lead, and zinc met state water quality criteria for aquatic life but exceeded the drinking water standard for arsenic. Here again, the adit discharge infiltrated waste rock within 25 feet of the portal.

## 6.0 **RECOMMENDATION**

Based on the analytical results for soil and water samples; proximity to cabins and seasonal residences downstream at the town site of Monte Cristo, known populations of threatened and endangered Bull Trout/Dolly Varden, Steelhead, and Salmon populations in the lower reaches of Glacier Creek and/or South Fork Sauk River; accessibility of the Site to the public; and EPA's APA Checklist (Appendix A); it is recommended that a Site Inspection (SI) be performed for the Pride of Woods, New Discovery, and Pride of Mountains mines.

Abandoned or inactive mine workings should be closed to limit potential liability associated with the general public recreating at the Site.

## **7.0 DISCLAIMER**

This abandoned mine/mill site was created under the General Mining Law of 1872 and is located solely on National Forest System (NFS) lands administered by the Forest Service. The United States has taken the position and courts have held that the United States is not liable as an “owner” under CERCLA Section 107 for mine contamination left behind on NFS lands by miners operating under the 1872 Mining Law. Therefore, Forest Service believes that this site should not be considered a “federal facility” within the meaning of CERCLA Section 120 and should not be listed on the Federal Agency Hazardous Waste Compliance Docket. Instead, this site should be included on EPA’s CERCLIS database. Consistent with the June 24, 2003 OECA/FFEO “Policy on Listing Mixed Ownership Mine or Mill Sites Created as a Result of the General Mining Law of 1872 on the Federal Agency Hazardous Waste Compliance Docket,” we respectfully request that the EPA Regional Docket Coordinator consult with the Forest Service and EPA Headquarters before making a determination to include this site on the Federal Agency Hazardous Waste Compliance Docket.

## REFERENCES

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## **Appendix A**

### **ABBREVIATED PRELIMINARY ASSESSMENT CHECKLIST**



## ABBREVIATED PRELIMINARY ASSESSMENT CHECKLIST

This checklist can be used to help the site investigator determine if an Abbreviated Preliminary Assessment (APA) is warranted. This checklist should document the rationale for the decision on whether further steps in the site assessment process are required under CERCLA. Use additional sheets, if necessary.

**Checklist Preparer:** Greg Graham, Geologist September 27, 2006  
 (Name/Title) (Date)  
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 (Address) (Phone)  
ggraham@fs.fed.us  
 (E-Mail Address)

**Site Name:** Pride of Woods, New Discovery, and Pride of Mountains Mines

**Previous Names (if any):**

**Site Location:** Near the town site of Monte Cristo, approximately 40 miles east of Everett, WA

**Legal Description:** Willamette Meridian, T 29 N, R 11 E, Secs 22 and 23

**Describe the release (or potential release) and its probable nature:** Arsenic, chromium, and lead, and to a lesser degree antimony and iron, concentrations in soil samples from the Pride of Woods, New Discovery, and Pride of Mountains waste rock dumps exceeded Washington’s Model Toxics Control Act (MTCA) Method A cleanup levels and/or EPA Region IX Preliminary Remediation Goals (PRGs) for industrial properties. Arsenic, chromium, lead, and zinc commonly exceeded soil concentrations established under MTCA to be protective of terrestrial ecological receptors at most industrial/commercial sites. Only two samples from along Glacier Creek exceeded Washington State chronic aquatic water standards: 1) the upstream sample above all 3 mines slightly exceeded for lead; and 2) the downstream sample below all 3 mines exceeded slightly for copper. However, some metals, namely antimony, arsenic, copper, and nickel increased in concentration downstream. Adit discharge at the Pride of Mountains Northwest Adit exceeded state chronic aquatic standards for arsenic, cadmium, copper, lead, and zinc; human health criteria for antimony and arsenic; and drinking water standards for antimony, arsenic, cadmium, copper, and lead.

### Part 1 - Superfund Eligibility Evaluation

| If All answers are “no” go on to Part 2, otherwise proceed to Part 3  | YES | NO       |
|---|-----|----------|
| 1. Is the site currently in CERCLIS or an “alias” of another site?  |     | <b>X</b> |
| 2. Is the site being addressed by some other remedial program (Federal, State, or Tribal)?  |     | <b>X</b> |
| 3. Are the hazardous substances potentially released at the site regulated under a statutory exclusion (i.e., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?   |     | <b>X</b> |
| 4. Are the hazardous substances potentially released at the site excluded by policy considerations (i.e., deferred to RCRA corrective action)?  |     | <b>X</b> |
| 5. Is there sufficient documentation to demonstrate that no potential for a release that could cause adverse environmental or human health impacts exist (i.e., comprehensive remedial investigation equivalent data showing no release above ARAR’s, completed removal action, documentation showing that no hazardous substance release have occurred, or an EPA approved risk assessment completed)? |     | <b>X</b> |

**Part 2 - Initial Site Evaluation**

For Part 2, if information is not available to make a “yes” or “no” response, further investigation may be needed. In these cases, determine whether an APA is appropriate. Exhibit 1 parallels the questions in Part 2. Use Exhibit 1 to make decisions in Part 3.

| <b>If the answer is “no” to any questions 1, 2, or 3, proceed directly to Part 3.</b> | <b>YES</b> | <b>NO</b> |
|---|------------|-----------|
| 1. Does the site have a release or a potential to release?                            | <b>X</b>   |           |
| 2. Does the site have uncontained sources containing CERCLA eligible substances?      | <b>X</b>   |           |
| 3. Does the site have documented on-site, adjacent, or nearby targets?                | <b>X</b>   |           |

| <b>If the answers to questions 1, 2, and 3 above were all “yes” then answer the questions below before proceeding to Part 3.</b>  | <b>YES</b> | <b>NO</b> |
|---|------------|-----------|
| 4. Does documentation indicate that a target (i.e., drinking water wells, drinking surface water intakes, etc.) has been exposed to a hazardous substance released from the site?   |            | <b>X</b>  |
| 5. Is there an apparent release at the site with no documentation of exposed targets, but there are targets on site or immediately adjacent to the site?  |            | <b>X</b>  |
| 6. Is there an apparent release and no documented on-site targets or targets immediately adjacent to the site, but there are nearby targets (i.e., targets within 1 mile)?  | <b>X</b>   |           |
| 7. Is there no indication of a hazardous substance release, and there are uncontained sources containing CERCLA hazardous substances, but there is a potential to release with targets present on site or in proximity to the site? |            | <b>X</b>  |

**Notes:**

Potential targets include cabins and seasonal residence at and downstream of Monte Cristo town site, recreational users using the backcountry for hiking and camping, and a sensitive ecological environment in the lower reaches of Glacier Creek and/or South Fork Sauk Creek which contains threatened and endangered Bull Trout/Dolly Varden, Steelhead, Pink Salmon, Coho Salmon, and Chinook Salmon.

**EXHIBIT 1**  
**SITE ASSESSMENT DECISION GUIDELINES FOR A SITE**

Exhibit 1 identifies different types of site information and provides some possible recommendations for further site assessment activities based on that information. You will use Exhibit 1 in determining the need for further action at the site, based on the answers to the questions in Part 2. Please use your professional judgment when evaluating a site. Your judgment may be different from the general recommendations for a site given below.

| <b>Suspected/Documented Site Conditions</b>   |                     | <b>APA</b> | <b>FULL PA</b> | <b>PA/SI</b> | <b>SI</b> |
|---|---------------------|------------|----------------|--------------|-----------|
| 1. There are no releases or potential to release.   |                     | Yes        | No             | No           | No        |
| 2. No uncontained sources with CERCLA-eligible substances are present on site.  |                     | Yes        | No             | No           | No        |
| 3. There are no on-site, adjacent, or nearby targets  |                     | Yes        | No             | No           | No        |
| 4. There is documentation indicating that a target (i.e., drinking water wells, drinking surface water intakes, etc.) has been exposed to a hazardous substance released from the site  | Option 1:<br>APA SI | Yes        | No             | No           | Yes       |
|   | Option 2:<br>PA/SI  | No         | No             | Yes          | No        |
| 5. There is an apparent release at the site with no documentation of exposed targets, but there are targets on site or immediately adjacent to the site.  | Option 1:<br>APA SI | Yes        | No             | No           | Yes       |
|   | Option 2:<br>PA/SI  | No         | No             | Yes          | N/A       |
| 6. There is an apparent release and no documented on-site targets and no documented immediately adjacent to the site, but there are nearby targets. Nearby targets are those targets that are located within 1 mile of the site and have a relatively high likelihood of exposure to a hazardous substance migrating from the site. |                     | No         | Yes            | No           | No        |
| 7. There is no indication of a hazardous substance release, and there are uncontained sources containing CERCLA hazardous substances, but there is a potential to release with targets present on site or in proximity to the site.   |                     | No         | Yes            | No           | No        |

**Part 3 - EPA Site Assessment Decision**

When completing Part 3, use Part 2 and Exhibit 1 to select the appropriate decision. For example, if the answer to question 1 in Part 2 was “no,” then an APA may be performed and the “NFRAP” box below should be checked. Additionally, if the answer to question 4 in Part 2 is “yes,” then you have two options (as indicated in Exhibit 1): Option 1 -- conduct an APA and check the “Lower Priority SI” or “Higher Priority SI” box below; or Option 2 -- proceed with a combined PA/SI assessment.

|  |  |
|--|--|
| <b>Check the box that applies based on the conclusions of the APA:</b> |  |
| <input type="checkbox"/> NFRAP   | <input type="checkbox"/> Refer to Removal Program – further site assessment needed |
| <input checked="" type="checkbox"/> Higher Priority SI                 | <input type="checkbox"/> Refer to Removal Program – NFRAP                          |
| <input type="checkbox"/> Lower Priority SI                             | <input type="checkbox"/> Site is being addressed as part of another CERCLIS site   |
| <input type="checkbox"/> Defer to RCRA Subtitle C                      | <input type="checkbox"/> Other: _____  |
| <input type="checkbox"/> Defer to NRC                                  |  |
| Regional EPA Reviewer: <u>  N/A  </u>                                  |  |
| Print Name/Signature   | Date   |

**PLEASE EXPLAIN THE RATIONALE FOR YOUR DECISION:**

Arsenic, chromium, and lead, and to a lesser degree antimony and iron, concentrations in soil samples from the Pride of Woods, New Discovery, and Pride of Mountains waste rock dumps exceeded Washington's Model Toxics Control Act (MTCA) Method A cleanup levels and/or EPA Region IX Preliminary Remediation Goals (PRGs) for industrial properties. Arsenic, chromium, lead, and zinc commonly exceeded soil concentrations established under MTCA to be protective of terrestrial ecological receptors at most industrial/commercial sites. However, exceedence of ecological receptor values does not necessarily trigger cleanup actions. Only two samples from along Glacier Creek exceeded Washington State chronic aquatic standards: 1) the upstream sample above all 3 mines slightly exceeded for lead; and 2) the downstream sample below all 3 mines exceeded slightly for copper. However, some metals, namely antimony, arsenic, copper, and nickel increased in concentration downstream. Adit discharge at the Pride of Mountains Northwest Adit exceeded state chronic aquatic standards for arsenic, cadmium, copper, lead, and zinc; human health criteria for antimony and arsenic; and drinking water standards for antimony, arsenic, cadmium, copper, and lead. The Southeast Adit at the New Discovery Mine has discharge as well but could not be sampled as part of this investigation because of low flow rate.

**NOTES:**

Access to the Site can be accomplished from either Darrington or Granite Falls via Highway 20, the Mountain Loop Highway, to Barlow Pass. Snohomish County owns and maintains the 5-mile long road (FS road 4710) from Barlow Pass to the town site of Monte Cristo. The road is gated at Barlow Pass. From the town site of Monte Cristo, the Pride of Woods, New Discovery, and Pride of Mountains miles are accessed via a 1.5 mile hike on the Glacier Basin trail (#719).

## **Appendix B**

### **SUMMARY OF PREVIOUS ANALYTICAL DATA**

**(from Wolff and others, 2003 and Crofoot and O'Brien, 2004)**

**Table 4.** Soil analysis. Metal concentrations are in milligrams per kilogram. Numbers in parentheses indicate the factor by which the analysis exceeds standards shown in Table 5. POW, Pride of the Woods; POM, Pride of the Mountains; ---, no data

| Sample location             | Arsenic       | Cadmium | Copper     | Iron    | Lead       | Mercury | Zinc      | Gold |
|-----------------------------|---------------|---------|------------|---------|------------|---------|-----------|------|
| Mystery adit 3 dump surface | 14,000 (700X) | ---     | 500 (5X)   | 230,000 | 1700 (8X)  | ---     | 1100 (4X) | ---  |
| POW dump surface            | 15,300 (765X) | <1.11   | 195 (2X)   | 55,900  | 1450 (7X)  | ---     | 113       | ---  |
| POM adit 1 dump surface     | 17,300 (865X) | 7.29    | 1010 (10X) | 66,700  | 7040 (32X) | ---     | 941 (3X)  | ---  |

**Table 5.** Model Toxics Cleanup Act, WAC 173-340-900. Table 749-2. Priority contaminants of ecological concern for sites that qualify for the simplified terrestrial ecological evaluation procedure (partial data). Concentrations are in milligrams per kilogram. Levels shown are for unrestricted land use. Levels for silver, gold, and iron are not specified

| Metals       | Arsenic III | Cadmium | Copper | Lead | Mercury | Zinc |
|--------------|-------------|---------|--------|------|---------|------|
| Level, mg/kg | 20          | 25      | 100    | 220  | 9       | 270  |

**Table 9.** Surface water analysis. Metal concentrations are µg/L; Hardness is in mg/L. --- no data; \*, hardness corrected data collected by Robert L. Raforth, Washington Department of Ecology, Water Quality Division (low flow, Aug. 2001; high flow, June 2001). \*\* Standards for these metals are hardness dependent. Conversion formulae are shown in <http://www.ecy.wa.gov/pubs/wac173201a.pdf>. Standards calculated for hardness values specific to Part 1 below, are shown in Appendix B

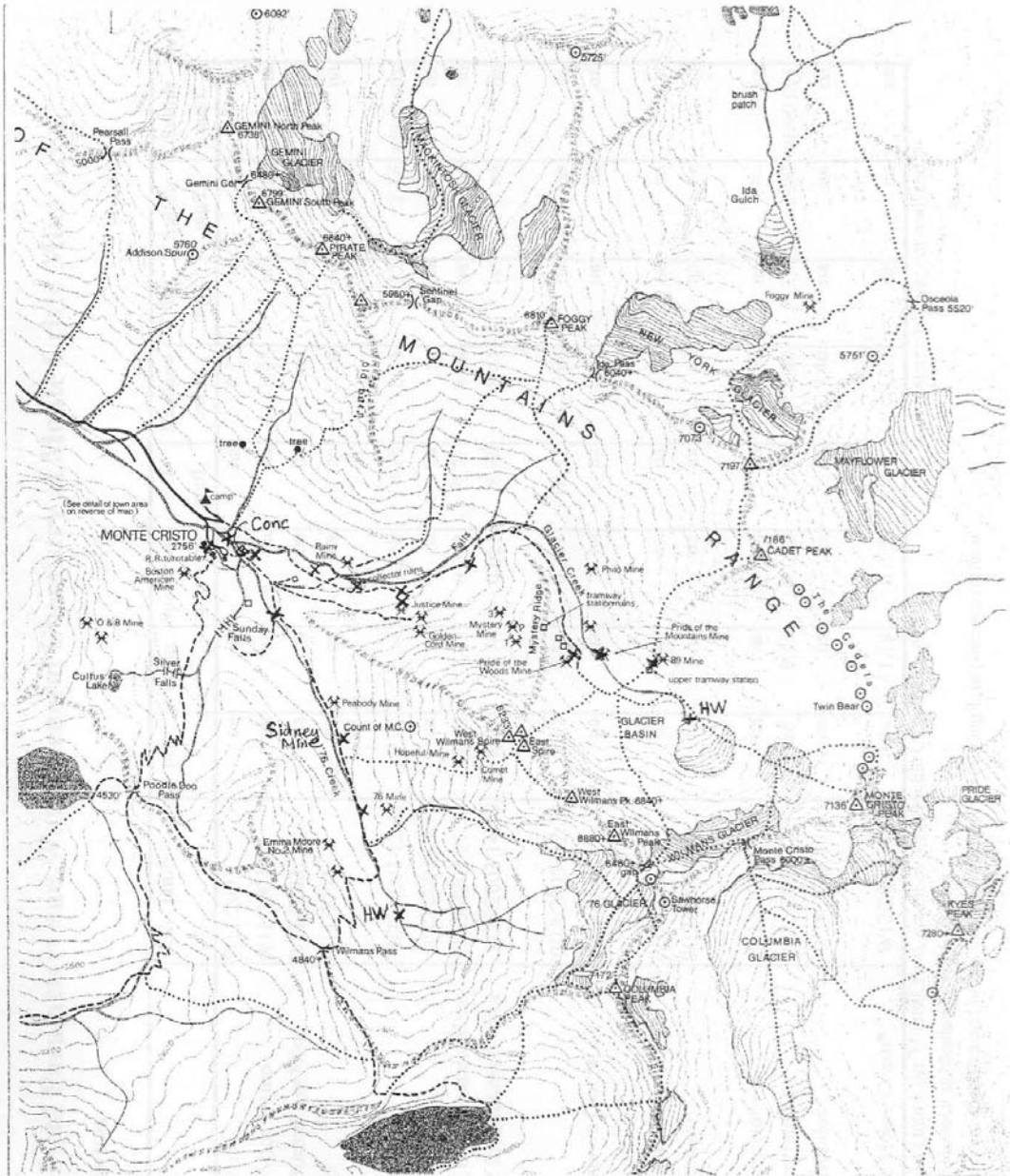
| <b>PART 1: ANALYSIS BY USEPA METHOD 6010, INDUCTIVELY COUPLED PLASMA</b>  |         |         |        |                     |      |         |          |          |
|---|---------|---------|--------|---------------------|------|---------|----------|----------|
| Sample location   | Arsenic | Cadmium | Copper | Iron                | Lead | Mercury | Zinc     | Hardness |
| stream in Justice waste rock dump   | 200     | ---     | <100   | <1000               | <100 | ---     | <100     | 60       |
| stream in Mystery adit3 waste rock dump   | 1100    | ---     | 700    | 12000               | <100 | ---     | 6000     | 250      |
| discharge from Mystery adit 3   | 3300    | ---     | 710    | 48000               | 110  | ---     | 6100     | 240      |
| discharge from New Discovery adit 2   | 30      | <5      | <10    | 729                 | 11   | ---     | 225      | 130      |
| discharge from Pride of the Mountains adit 1  | 6350    | 40      | 2640   | 17700               | 562  | ---     | 5170     | 160      |
| <b>PART 2: ANALYSIS BY USEPA METHOD 6020, INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY*</b>   |         |         |        |                     |      |         |          |          |
| Sample location   | Arsenic | Cadmium | Copper | Iron                | Lead | Mercury | Zinc     | Hardness |
| Glacier Creek upstream, high flow*  | 0.28    | ---     | <.02   | ---                 | <.02 | .0042   | <0.2     | 8.13     |
| Glacier Creek upstream, low flow*   | 4.52    | ---     | 0.264  | ---                 | .032 | <.002   | 1.8 est. | 6.92     |
| Glacier Creek downstream, high flow*  | 7.37    | ---     | 0.31   | ---                 | .02  | .0058   | 5.04     | 7.38     |
| Glacier Creek downstream, low flow*   | 9.24    | ---     | 0.27   | ---                 | <.02 | <.002   | 5.58     | 6.80     |
| <b>PART 3: APPLICABLE WASHINGTON STATE WATER QUALITY STANDARDS</b>  |         |         |        |                     |      |         |          |          |
| Type of standards (applicable Washington Administrative Code)   | Arsenic | Cadmium | Copper | Iron                | Lead | Mercury | Zinc     | Hardness |
| <b>Surface water standards</b> (WAC 173-201A, Standard for aquatic life in surface freshwater, chronic level maximums at 100 mg/L hardness) | 190     | **      | **     | none                | **   | 0.012   | **       | 100      |
| <b>Ground water standards</b> (WAC 246-290, Washington State Department of Health, standards for ground water, domestic consumption)        | 50      | none    | 1300   | 300 (cosmetic only) | 15   | 2.0     | 5000     | ---      |

### **WATER QUALITY STANDARDS FOR HARDNESS DEPENDENT METALS**

WAC 173-201A. Chronic standard (µg/l). \*, hardness data from Raforth and others (2002); ---, no data

| Sample location                              | Hardness (mg/l) | Cd (µg/l) | Cu (µg/l) | Pb (µg/l) | Zn (µg/l) |
|--|-----------------|-----------|-----------|-----------|-----------|
| Stream in Justice waste rock dump            | 60              | ---       | 7.34      | 1.44      | 67.79     |
| Stream in Mystery adit 3 waste rock dump     | 250             | ---       | 24.84     | 6.72      | 227.16    |
| Discharge from Mystery adit 3                | 240             | ---       | 23.98     | 6.43      | 219.43    |
| Discharge from New Discovery adit 2          | 130             | 1.25      | 14.20     | 3.34      | 130.53    |
| Discharge from Pride of the Mountains adit 1 | 160             | 1.46      | 16.96     | 4.18      | 155.63    |
| Glacier Creek upstream, high flow*           | 8               | ---       | 1.31      | 0.14      | 12.30     |
| Glacier Creek upstream, low flow*            | 7               | ---       | 1.17      | 0.13      | 10.98     |
| Glacier Creek downstream, high flow*         | 7               | ---       | 1.17      | 0.13      | 10.98     |
| Glacier Creek downstream, low flow*          | 7               | ---       | 1.17      | 0.13      | 10.98     |

Appendix B-2. Summary of water sample data for adit discharge from New Discovery-Southeast Adit and Pride of Mountains-Northwest Adit (excerpted from Wolff and others, 2003).



**Figure 1. Monte Cristo Mine Area, Snohomish County, Washington**  
 Figure shows mine locations, sample locations (X), creek headwater locations (HW), concentrator (conc) and general topography. Scale is 1 inch = 1750 feet or 0.3 mile.



X = sample location  
 Conc = Concentrator location  
 HW = Headwater of creek sample location



**Table 5. Comparison of SHA Soil Results with Previous Study and Regional Background Metal Concentration Levels for Monte Cristo Mine Area, Snohomish County, Washington**

Results in bold exceed Model Toxics Control Act Cleanup Level or other standard or criterion.

| Soil Analytical Results, mg/kg   |                                      | Arsenic            | Cadmium | Chromium    | Lead  | Mercury | Nickel  | Copper | Silver  | Zinc  | Antimony | Pb:As        |
|--|--------------------------------------|--------------------|---------|-------------|-------|---------|---------|--------|---------|-------|----------|--------------|
| No   | Location                             | As                 | Cd      | Cr          | Pb    | Hg      | Ni      | Cu     | Ag      | Zn    | Sb       | Ratio        |
| 3394095  | Glacier Creek Headwater Sediment     | 122                | 0.65    | 16.4        | 26.3  | 0.874   | 12.1    | 21.7   | 0.18    | 123   | 0.43     | 0.22         |
| 3394096  | Pride of Mountain Mine Soil          | 332                | 1.89    | 9.71        | 130   | 0.528   | 7.9     | 48     | 0.45    | 328   | 0.57 J   | 0.39         |
| 3394097  | Pride of Woods Mine Soil             | 41400              | 2.42    | 12.1        | 2760  | 8.61    | ND>5.0  | 517    | 49.1    | 271   | 416      | 0.07         |
| 10531  | Justice Mine Adit Soil               | 4900               | 6.75    | U>0.232     | 228   | 0.61    | 15.7    | 93.3   | U>0.232 | 312   | 12       | 0.46         |
| 3394098  | Comet Mine Bunker Soil               | 31200              | 9.12    | 11.0        | 7340  | 2.28    | 11.3    | 212    | 17      | 180   | 168      | 0.24         |
| 3374087  | Comet Mine Bunker South Soil         | 14700              | 2.29    | 11.1        | 1950  | 0.368   | 12.1    | 78     | 5.39    | 435   | 719      | 0.13         |
| 10532  | Comet Mystery Tram Terminal Soil     | 8450               | 8.33    | U>0.240     | 20400 | 4.47    | U>0.481 | 1160   | 320     | 882   | 133      | 2.4          |
| 10529  | Concentrator Level 1 West Soil       | 3460               | 4.13    | 2.44        | 9580  | 8.5     | U>0.469 | 378    | 126     | 149   | 1365     | 2.8          |
| 10530  | Concentrator Level 1 East Soil       | 34900              | 11.4    | 5.74        | 7000  | 7.07    | 0.604   | 516    | 115     | 852   | 4582     | 0.2          |
| 3374086  | Concentrator Level 2 West Soil       | 14600              | 1.54    | 1.5         | 16300 | 4.33    | 3.26    | 1340   | 118     | 471   | 3990     | 1.1          |
| 3374088  | So Fork Sauk River-Lake MC* Sediment | 1090               | 3.9     | 36.6        | 278   | 0.0911  | 96.5    | 207    | 6.94    | 806   | 15.7     | 0.25         |
| <b>Previous Study, mg/kg</b>   |                                      |                    |         |             |       |         |         |        |         |       |          | <b>Pb:As</b> |
| Wolff 2003   | Mystery Adit 3 Dump                  | 14000              | na      | na          | 1700  | na      | na      | 500    | na      | 1100  | na       | 0.15         |
|  | Pride of Woods Dump                  | 15300              | ND>1.11 | na          | 1450  | na      | na      | 195    | na      | 113   | na       | 0.09         |
|  | Pride of Mountains Adit 1 Dump       | 17300              | 7.29    | na          | 7040  | na      | na      | 1010   | na      | 941   | na       | 0.40         |
| <b>Natural Background Soil Metal Concentrations** at 90th Percentile Values, mg/kg</b> |                                      |                    |         |             |       |         |         |        |         |       |          | <b>Pb:As</b> |
|  | Puget Sound Lowland n=45             | 22.80              | 0.77    | 48.15       | 16.83 | 0.07    | 38.19   | 36.36  | na      | 85.06 | na       | 0.73         |
|  | Western Washington n=86              | 46.21              | 1.20    | 47.40       | 20.42 | 0.08    | 44.20   | 43.23  | na      | 98.39 | na       | 0.44         |
|  | Washington Statewide n=166           | 41.81              | 0.99    | 41.88       | 17.09 | 0.07    | 38.19   | 36.01  | na      | 85.82 | na       | 0.41         |
| <b>MTCA Cleanup Level, mg/kg</b>   |                                      | Carc/Noncarcinogen |         | CrIII/CrVI  |       |         |         |        |         |       |          |              |
| MTCA method A  |                                      | 20                 | 2       | 2000/19/1   | 250   | 2       | na      | na     | na      | na    | na       |              |
| MTCA method B - Direct Contact   |                                      | 0.667/24.0         | 40      | 120,000/240 | na    | 24      | 1600    | 2960   | 400     | 24000 | 32       |              |

\* South Fork of Sauk River sediment where river flows into Lake Monte Cristo, six miles north of Monte Cristo Mine Area.

na = not available or not analyzed.

ND>0.10 or U>0.10 = Metal not detected above level specified; in this example not above 0.10 mg/kg.

J = metal was positively identified, result is estimated.

\*\* Natural Background Soil Metal Concentrations at 90th Percentile Values in mg/kg from Ecology Publication #94-115, October 1994, page 6-4, table 7.

Appendix B-4. Comparison of SHA soil results with previous study and regional background metals concentration levels for Monte Cristo Mine Area, Snohomish County, Washington (from Crofoot and O'Brien, 2004).

**Table 6. Comparison of SHA Water Results with Previous Study and Cleanup Levels for Monte Cristo Mine Area, Snohomish County, Washington**

Results in bold exceed Model Toxics Control Act Cleanup Level or Washington Water Quality Criterion or other standard.

| Water Analytical Results, ug/L  |   | Hardness | Arsenic<br>As      | Cadmium<br>Cd | Chromium<br>Cr | Lead<br>Pb  | Mercury<br>Hg | Nickel<br>Ni | Copper<br>Cu | Silver<br>Ag | Zinc<br>Zn | Antimony<br>Sb |      |
|---|---|----------|--------------------|---------------|----------------|-------------|---------------|--------------|--------------|--------------|------------|----------------|------|
| 3374080   | 76 Creek Headwater                          | 5        | U>0.50             | U>0.10        | U>0.50         | <b>0.12</b> | U>0.050       | U>0.50       | 0.18         | U>0.10       | U>5.0      | 0.48           |      |
| 3374081   | 76 Creek Sidney Mine Dump                   | 9        | <b>9.64</b>        | U>0.10        | U>0.50         | <b>0.19</b> | U>0.050       | U>0.50       | 0.26         | U>0.10       | U>5.0      | 2.22           |      |
| 3394090   | Glacier Creek Headwater                     | 8        | <b>1.70</b>        | U>0.10        | U>0.50         | U>0.10      | U>0.050       | U>0.50       | U>0.50       | U>0.10       | U>5.0      | 1.8 J          |      |
| 3394091   | Glacier Creek POM Mine                      | 8        | <b>3.80</b>        | U>0.10        | U>0.50         | 0.14        | U>0.050       | U>0.50       | U>0.50       | U>0.10       | U>5.0      | 1.9 J          |      |
| 3394094   | Glacier Creek POM Mine N                    | 8        | <b>3.60</b>        | U>0.10        | U>0.50         | 0.10        | U>0.050       | U>0.50       | U>0.50       | U>0.10       | U>5.0      | 1.9 J          |      |
| 3374082   | Creek at Justice Mine                       | 104      | <b>235</b>         | 0.14          | U>0.50         | 1.26        | U>0.050       | 0.92         | 4.22         | U>0.10       | 21         | 11.3           |      |
| 3374083   | Creek below Justice Mine                    | 99       | <b>264</b>         | <b>0.48</b>   | U>0.50         | 0.74        | U>0.050       | 1.19         | 2.83         | U>0.10       | 56.8       | 11.6           |      |
| 3374084   | Glacier Creek below Concentrator+           | 8        | <b>7.89</b>        | U>0.10        | U>0.50         | 0.13        | U>0.050       | U>0.50       | 0.67         | U>0.10       | U>5.0      | 1.3            |      |
| 3394093   | Glacier Creek Below Concentrator+           | 9        | <b>12.2</b>        | U>0.10        | U>0.50         | <b>0.29</b> | U>0.050       | U>0.50       | 0.55         | U>0.10       | 6.2        | 1.9 J          |      |
| 3374085   | So Fork Sauk River at Lake MC*              | 12       | <b>27.4</b>        | U>0.10        | U>0.50         | <b>0.63</b> | U>0.050       | U>0.50       | 1.41         | U>0.10       | U>5.0      | 5.44           |      |
| <b>Previous Study, ug/L</b>   |   |          |                    |               |                |             |               |              |              |              |            |                |      |
| Ecology 02  | Glacier Creek Upstream-High Flow            | 8        | <b>0.28</b>        | U>0.02        | na             | U>0.02      | 0.0042        | na           | U>0.02       | na           | 0.20       | na             |      |
|   | Glacier Creek Upstream-Low Flow             | 7        | <b>4.52</b>        | U>0.02        | na             | 0.03        | U>0.002       | na           | 0.26         | na           | 1.80 J     | na             |      |
|   | Glacier Creek Downstream-High Flow          | 7        | <b>7.37</b>        | 0.04          | na             | 0.02        | 0.0058        | na           | 0.31         | na           | 5.04       | na             |      |
|   | Glacier Creek Downstream-Low Flow           | 7        | <b>9.24</b>        | 0.04          | na             | U>0.02      | U>0.002       | na           | 0.27         | na           | 5.75       | na             |      |
| <b>MTCA Cleanup Level or Other, ug/L</b>  |   |          |                    |               |                |             |               |              |              |              |            |                |      |
|   |   |          | Carc/Noncarcinogen |               | CrIII/CrVI     |             |               |              |              |              |            |                |      |
|   | MTCA method B Surface Water (Aug 2001)      |          | 0.0982/17.7        |               | 20.3           | 243000/486  | na            | na           | 1100         | 2660         | 25900      | 16500          | 1040 |
|   | Wash Water Quality Criteria-Human Health**  | 8        | 0.018              | na            | na             | na          | 0.14          | 610          | na           | na           | na         | 14             |      |
|   | Wash Water Qual Cri -Aquatic Life Acute**   | 8        | 360                | 2.73          | 435/15         | 47.43       | 2.1           | 1114.65      | 13.04        | 2.12         | 90.1       | na             |      |
|   | Wash Water Qual Cri -Aquatic Life Chronic** | 8        | 190                | 0.83          | 141/10         | 1.85        | 0.012         | 123.79       | 8.92         | na           | 82.27      | na             |      |
| Some Washington Water Quality Criteria are hardness dependent (Cd, Cu, Pb, Ag, Zn) for criteria for other hardness values see Table 3 page 2, Appendix C or formulae below. |   |          |                    |               |                |             |               |              |              |              |            |                |      |

\* South Fork of Sauk River where river flows into Lake Monte Cristo, six miles north of Monte Cristo Mine Area.

na = not available or not analyzed.

U>0.10 = Metal not detected above level specified; in this example not detected above 0.10 ug/L.

J = metal was positively identified, result is estimated.

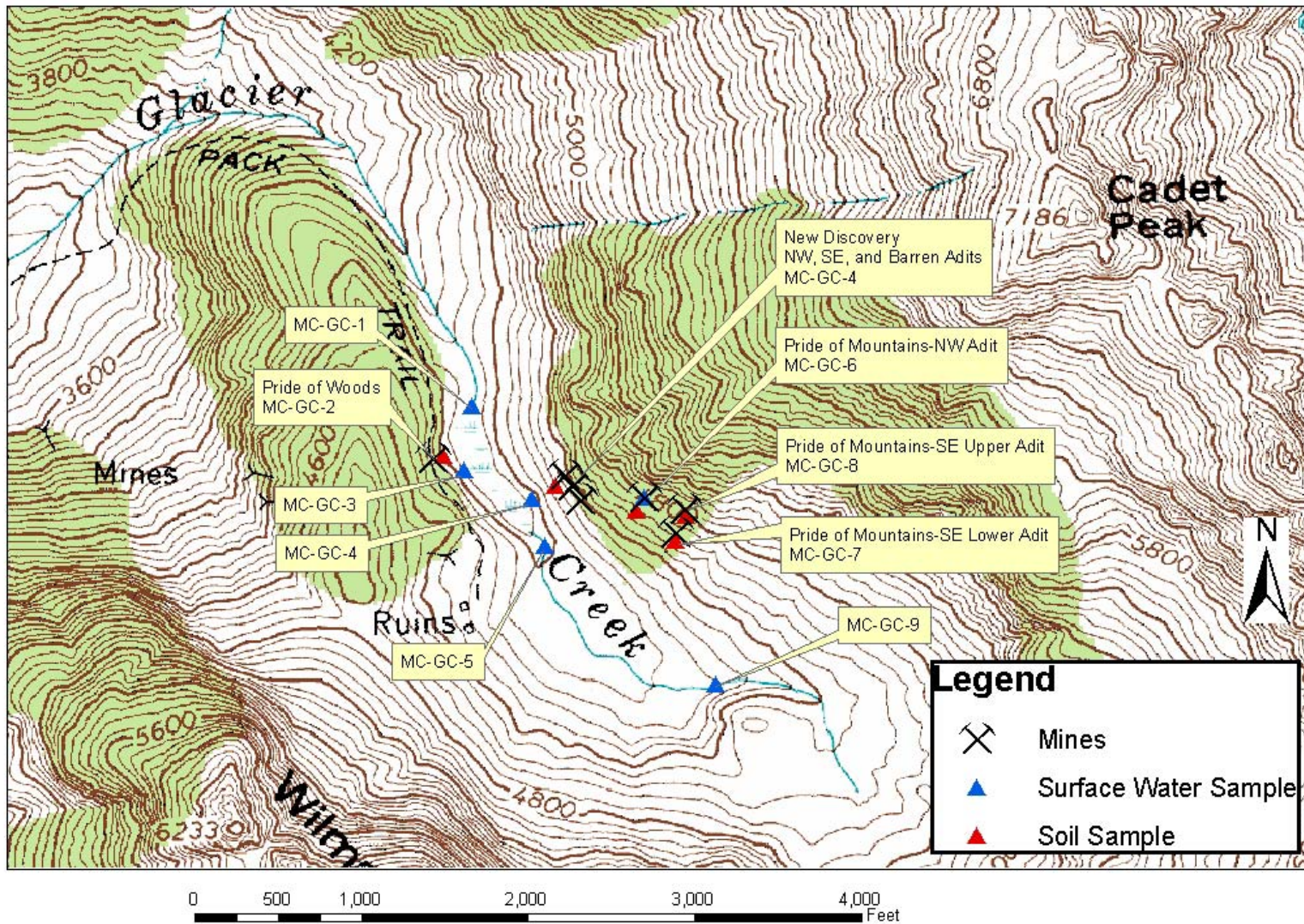
\*\* See Appendix C or formulae are shown in <http://www.ecy.wa.gov/pubs/was17320a.pdf>

## **Appendix C**

### **NITON XRF ANALYTICAL DATA SUMMARY**



Map of Pride of Woods, New Discovery, and Pride of Mountains Mines and Associated Sample Sites



**Table 1.** Analytical results for Pride of Woods Mine waste rock dump; composite sample from northwest half of dump.

**Mine: Pride of Woods  
Sample Number: MC-GC-2A**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | 1,6200                                 |                                    | 410                                    | --  |
|        | Total Arsenic  | 42,982.4                               | 20                                 | 1.6                                    | 20  |
|        | Arsenic III    |  |                                    |  | 260   |
|        | Arsenic V      |  |                                    |  |   |
|        | Cadmium        | BDL (27.45)                            | 2                                  | 450                                    | 36  |
|        | Total Chromium | 1,389.6                                |                                    | 450                                    | 135   |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | 1,560                                  |                                    | 1,900                                  | --  |
|        | Copper         | 323                                    |                                    | 41,000                                 | 550   |
|        | Iron           | 114,000                                |                                    | 100,000                                | --  |
|        | Lead           | 6,428.8                                | 1,000                              | 800                                    | 220   |
|        | Manganese      | BDL (1,800)                            |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (210)                              | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (8.4)                              |                                    | 5,100                                  | 71  |
|        | Nickel         | BDL (345)                              |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (78.6)                             |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (96.75)                            |                                    | 5,100                                  | --  |
|        | Tin            | 166.8                                  |                                    | 100,000                                | (275)   |
|        | Zinc           | 442.8                                  |                                    | 100,000                                | 570   |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.

**Table 2.** Analytical results for Pride of Woods Mine waste rock dump; composite sample from southeast half of dump.

**Mine: Pride of Woods  
Sample Number: MC-GC-2B**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | BDL (37.2)                             |                                    | 410                                    | --  |
|        | Total Arsenic  | 32,588.8                               | <b>20</b>                          | <b>1.6</b>                             |   |
|        | Arsenic III    |  |                                    |  | <b>20</b>   |
|        | Arsenic V      |  |                                    |  | <b>260</b>  |
|        | Cadmium        | BDL (34.65)                            | 2                                  | 450                                    | 36  |
|        | Total Chromium | 1,580                                  |                                    | <b>450</b>                             | <b>135</b>  |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | BDL (885)                              |                                    | 1,900                                  | --  |
|        | Copper         | 183.6                                  |                                    | 41,000                                 | 550   |
|        | Iron           | 97,700                                 |                                    | 100,000                                | --  |
|        | Lead           | 3,539.2                                | <b>1,000</b>                       | <b>800</b>                             | <b>220</b>  |
|        | Manganese      | BDL (1,410)                            |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (165)                              | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (7.95)                             |                                    | 5,100                                  | 71  |
|        | Nickel         | BDL (300)                              |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (61.35)                            |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (123.6)                            |                                    | 5,100                                  | --  |
|        | Tin            | 146.4                                  |                                    | 100,000                                | (275)   |
|        | Zinc           | 351.6                                  |                                    | 100,000                                | 570   |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.

**Table 3.** Analytical results for New Discovery Mine waste rock dump; composite sample from southeast dump.

**Mine: New Discovery  
Sample Number: MC-GC-4A**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | 198.2                                  |                                    | 410                                    | --  |
|        | Total Arsenic  | 7,539.2                                | <b>20</b>                          | <b>1.6</b>                             |   |
|        | Arsenic III    |  |                                    |  | <b>20</b>   |
|        | Arsenic V      |  |                                    |  | <b>260</b>  |
|        | Cadmium        | BDL (36.9)                             | 2                                  | 450                                    | 36  |
|        | Total Chromium | 1,160                                  |                                    | <b>450</b>                             | <b>135</b>  |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | BDL (750)                              |                                    | 1,900                                  | --  |
|        | Copper         | BDL (112.8)                            |                                    | 41,000                                 | 550   |
|        | Iron           | 79,200                                 |                                    | 100,000                                | --  |
|        | Lead           | 1,080                                  | <b>1,000</b>                       | <b>800</b>                             | <b>220</b>  |
|        | Manganese      | 4,428.8                                |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (80.85)                            | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (6.45)                             |                                    | 5,100                                  | 71  |
|        | Nickel         | BDL (240)                              |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (30.9)                             |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (127.8)                            |                                    | 5,100                                  | --  |
|        | Tin            | 208.6                                  |                                    | 100,000                                | (275)   |
|        | Zinc           | 820                                    |                                    | 100,000                                | <b>570</b>  |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.

**Table 4.** Analytical results for New Discovery Mine waste rock dump; composite sample from center dump.

**Mine: New Discovery  
Sample Number: MC-GC-4B**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | 412.4                                  |                                    | 410                                    | --  |
|        | Total Arsenic  | 4,649.6                                | 20                                 | 1.6                                    | 20  |
|        | Arsenic III    |  |                                    |  | 260   |
|        | Arsenic V      |  |                                    |  |   |
|        | Cadmium        | BDL (37.2)                             | 2                                  | 450                                    | 36  |
|        | Total Chromium | BDL (555)                              |                                    | 450                                    | 135   |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | 806.8                                  |                                    | 1,900                                  | --  |
|        | Copper         | 285.4                                  |                                    | 41,000                                 | 550   |
|        | Iron           | 95,100                                 |                                    | 100,000                                | --  |
|        | Lead           | 1,449.6                                | 1,000                              | 800                                    | 220   |
|        | Manganese      | 7,225.6                                |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (58.95)                            | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (5.85)                             |                                    | 5,100                                  | 71  |
|        | Nickel         | BDL (225)                              |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (22.35)                            |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (139.2)                            |                                    | 5,100                                  | --  |
|        | Tin            | 152.8                                  |                                    | 100,000                                | (275)   |
|        | Zinc           | 522.4                                  |                                    | 100,000                                | 570   |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.



**Table 5.** Analytical results for New Discovery Mine waste rock dump; composite sample from northwest dump.

**Mine: New Discovery  
Sample Number: MC-GC-4C**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | 1,060                                  |                                    | 410                                    | --  |
|        | Total Arsenic  | 12,000                                 | 20                                 | 1.6                                    | 20  |
|        | Arsenic III    |  |                                    |  | 260   |
|        | Arsenic V      |  |                                    |  |   |
|        | Cadmium        | BDL (46.05)                            | 2                                  | 450                                    | 36  |
|        | Total Chromium | 2,080                                  |                                    | 450                                    | 135   |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | BDL (855)                              |                                    | 1,900                                  | --  |
|        | Copper         | 403.4                                  |                                    | 41,000                                 | 550   |
|        | Iron           | 125,000                                |                                    | 100,000                                | --  |
|        | Lead           | 3,798.4                                | 1,000                              | 800                                    | 220   |
|        | Manganese      | BDL (1,410)                            |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (87.15)                            | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (5.85)                             |                                    | 5,100                                  | 71  |
|        | Nickel         | BDL (255)                              |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (33.3)                             |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (150)                              |                                    | 5,100                                  | --  |
|        | Tin            | 161.6                                  |                                    | 100,000                                | (275)   |
|        | Zinc           | 1,389.6                                |                                    | 100,000                                | 570   |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.

**Table 6.** Analytical results for Pride of Mountains Mine, main adit waste rock dump; composite sample from lower 1/3 dump.

**Mine: Pride of Mountains, Main Adit  
Sample Number: MC-GC-6A**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | 193.2                                  |                                    | 410                                    | --  |
|        | Total Arsenic  | 5,628.8                                | <b>20</b>                          | <b>1.6</b>                             |   |
|        | Arsenic III    |  |                                    |  | <b>20</b>   |
|        | Arsenic V      |  |                                    |  | <b>260</b>  |
|        | Cadmium        | BDL (37.95)                            | 2                                  | 450                                    | 36  |
|        | Total Chromium | 1,580                                  |                                    | <b>450</b>                             | <b>135</b>  |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | BDL (645)                              |                                    | 1,900                                  | --  |
|        | Copper         | 181.4                                  |                                    | 41,000                                 | 550   |
|        | Iron           | 67,400                                 |                                    | 100,000                                | --  |
|        | Lead           | 2,108.8                                | <b>1,000</b>                       | <b>800</b>                             | <b>220</b>  |
|        | Manganese      | BDL (1,080)                            |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (68.1)                             | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (7.05)                             |                                    | 5,100                                  | 71  |
|        | Nickel         | BDL (210)                              |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (25.8)                             |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (135.45)                           |                                    | 5,100                                  | --  |
|        | Tin            | BDL (92.55)                            |                                    | 100,000                                | (275)   |
|        | Zinc           | 735.6                                  |                                    | 100,000                                | <b>570</b>  |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.

**Table 7.** Analytical results for Pride of Mountains Mine, main adit waste rock dump; composite sample from middle 1/3 dump.

**Mine: Pride of Mountains, Main Adit  
Sample Number: MC-GC-6B**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | 256.2                                  |                                    | 410                                    | --  |
|        | Total Arsenic  | 9,836.8                                | <b>20</b>                          | <b>1.6</b>                             | <b>20</b>   |
|        | Arsenic III    |  |                                    |  | <b>260</b>  |
|        | Arsenic V      |  |                                    |  |   |
|        | Cadmium        | BDL (37.05)                            | 2                                  | 450                                    | 36  |
|        | Total Chromium | 1,096.6                                |                                    | <b>450</b>                             | <b>135</b>  |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | BDL (645)                              |                                    | 1,900                                  | --  |
|        | Copper         | 536.8                                  |                                    | 41,000                                 | 550   |
|        | Iron           | 70,700                                 |                                    | 100,000                                | --  |
|        | Lead           | 3,280                                  | <b>1,000</b>                       | <b>800</b>                             | <b>220</b>  |
|        | Manganese      | 5,977.6                                |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (87.6)                             | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (6.75)                             |                                    | 5,100                                  | 71  |
|        | Nickel         | BDL (225)                              |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (33)                               |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (146.25)                           |                                    | 5,100                                  | --  |
|        | Tin            | BDL (97.8)                             |                                    | 100,000                                | (275)   |
|        | Zinc           | 1,380                                  |                                    | 100,000                                | <b>570</b>  |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.

**Table 8.** Analytical results for Pride of Mountains Mine, Northwest Adit, waste rock dump; composite sample from upper 1/3 dump.

**Mine: Pride of Mountains, Northwest Adit  
Sample Number: MC-GC-6C**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | 225.6                                  |                                    | 410                                    | --  |
|        | Total Arsenic  | 12,800                                 | <b>20</b>                          | <b>1.6</b>                             | <b>20</b>   |
|        | Arsenic III    |  |                                    |  | <b>260</b>  |
|        | Arsenic V      |  |                                    |  |   |
|        | Cadmium        | BDL (35.4)                             | 2                                  | 450                                    | 36  |
|        | Total Chromium | 989.6                                  |                                    | <b>450</b>                             | <b>135</b>  |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | 800.4                                  |                                    | 1,900                                  | --  |
|        | Copper         | 528.8                                  |                                    | 41,000                                 | 550   |
|        | Iron           | 77,200                                 |                                    | 100,000                                | --  |
|        | Lead           | 5,360                                  | <b>1,000</b>                       | <b>800</b>                             | <b>220</b>  |
|        | Manganese      | BDL (1,185)                            |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (103.65)                           | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (6.9)                              |                                    | 5,100                                  | 71  |
|        | Nickel         | BDL (255)                              |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (38.7)                             |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (130.35)                           |                                    | 5,100                                  | --  |
|        | Tin            | 244.2                                  |                                    | 100,000                                | (275)   |
|        | Zinc           | 754                                    |                                    | 100,000                                | <b>570</b>  |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.

**Table 9.** Analytical results for Pride of Mountains Mine, Lower Southeast Adit, waste rock dump; composite sample from upper 1/3 dump.

**Mine: Pride of Mountains, Lower Southeast Adit  
Sample Number: MC-GC-7**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | 240.8                                  |                                    | 410                                    | --  |
|        | Total Arsenic  | 9,024                                  | <b>20</b>                          | <b>1.6</b>                             | <b>20</b>   |
|        | Arsenic III    |  |                                    |  | <b>260</b>  |
|        | Arsenic V      |  |                                    |  |   |
|        | Cadmium        | BDL (25.95)                            | 2                                  | 450                                    | 36  |
|        | Total Chromium | 538                                    |                                    | <b>450</b>                             | <b>135</b>  |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | BDL (705)                              |                                    | 1,900                                  | --  |
|        | Copper         | 1,629.6                                |                                    | 41,000                                 | <b>550</b>  |
|        | Iron           | 70,200                                 |                                    | 100,000                                | --  |
|        | Lead           | 7,494.4                                | <b>1,000</b>                       | <b>800</b>                             | <b>220</b>  |
|        | Manganese      | 2,688.8                                |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (101.25)                           | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (7.65)                             |                                    | 5,100                                  | 71  |
|        | Nickel         | BDL (255)                              |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (36.45)                            |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (93.3)                             |                                    | 5,100                                  | --  |
|        | Tin            | 183.8                                  |                                    | 100,000                                | (275)   |
|        | Zinc           | 1,120                                  |                                    | 100,000                                | <b>570</b>  |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.

**Table 10.** Analytical results for Pride of Mountains Mine, Upper Southeast Adit, waste rock dump; composite sample from upper 1/2 dump.

**Mine: Pride of Mountains, Upper Southeast Adit  
Sample Number: MC-GC-8A**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | 449.6                                  |                                    | 410                                    | --  |
|        | Total Arsenic  | 5,008                                  | 20                                 | 1.6                                    | 20  |
|        | Arsenic III    |  |                                    |  | 260   |
|        | Arsenic V      |  |                                    |  |   |
|        | Cadmium        | BDL (42.45)                            | 2                                  | 450                                    | 36  |
|        | Total Chromium | 862.4                                  |                                    | 450                                    | 135   |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | BDL (570)                              |                                    | 1,900                                  | --  |
|        | Copper         | 277.8                                  |                                    | 41,000                                 | 550   |
|        | Iron           | 53,800                                 |                                    | 100,000                                | --  |
|        | Lead           | 4,508.8                                | 1,000                              | 800                                    | 220   |
|        | Manganese      | 5,747.2                                |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (71.25)                            | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (6.6)                              |                                    | 5,100                                  | 71  |
|        | Nickel         | BDL (210)                              |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (26.4)                             |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (150)                              |                                    | 5,100                                  | --  |
|        | Tin            | BDL (102.45)                           |                                    | 100,000                                | (275)   |
|        | Zinc           | 818                                    |                                    | 100,000                                | 570   |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.

**Table 11.** Analytical results for Pride of Mountains Mine, Upper Southeast Adit, waste rock dump; composite sample from lower 1/2 dump.

**Mine: Pride of Mountains, Upper Southeast Adit  
Sample Number: MC-GC-8B**

| SAMPLE | ANALYTE        | ANALYTICAL RESULT (mg/kg) <sup>1</sup> | MTCA Method A (mg/kg) <sup>2</sup> | EPA REGION IX PRG (mg/kg) <sup>3</sup> | SIMPLIFIED ECOLOGICAL EVALUATION (mg/kg) <sup>4</sup> |
|--------|----------------|--|------------------------------------|--|---|
|        | Antimony       | 258                                    |                                    | 410                                    | --  |
|        | Total Arsenic  | 5,958.4                                | <b>20</b>                          | <b>1.6</b>                             | <b>20</b>   |
|        | Arsenic III    |  |                                    |  | <b>260</b>  |
|        | Arsenic V      |  |                                    |  |   |
|        | Cadmium        | BDL (39.3)                             | 2                                  | 450                                    | 36  |
|        | Total Chromium | BDL (510)                              |                                    | 450                                    | 135   |
|        | Chromium VI    |  | 19                                 | 64                                     |   |
|        | Chromium III   |  | 2,000                              | 100,000                                |   |
|        | Cobalt         | BDL (600)                              |                                    | 1,900                                  | --  |
|        | Copper         | BDL (98.85)                            |                                    | 41,000                                 | 550   |
|        | Iron           | 65,600                                 |                                    | 100,000                                | --  |
|        | Lead           | 1,469.6                                | <b>1,000</b>                       | <b>800</b>                             | <b>220</b>  |
|        | Manganese      | 7,200                                  |                                    | 19,000                                 | 23,500  |
|        | Mercury        | BDL (69.3)                             | 2                                  | 310                                    | Inorganic - 9<br>Organic - .7                         |
|        | Molybdenum     | BDL (6.6)                              |                                    | 5,100                                  | 71  |
|        | Nickel         | 213.2                                  |                                    | 20,000                                 | 1,850   |
|        | Selenium       | BDL (25.95)                            |                                    | 5,100                                  | .8  |
|        | Silver         | BDL (139.2)                            |                                    | 5,100                                  | --  |
|        | Tin            | 135.9                                  |                                    | 100,000                                | (275)   |
|        | Zinc           | 636.8                                  |                                    | 100,000                                | <b>570</b>  |

<sup>1</sup> BDL-Below Detection Limit; detection limit in mg/kg is indicated in parenthesis (e.g. BDL (450))

<sup>2</sup> From WAC 173-340-900, Table 745-1, MTCA Method A Cleanup Levels for Industrial Properties.

<sup>3</sup> From EPA, Region IX, Preliminary Remediation Goals, October, 2004, available at <http://www.epa.gov/region9/waste/sfund/prg/index.html>.

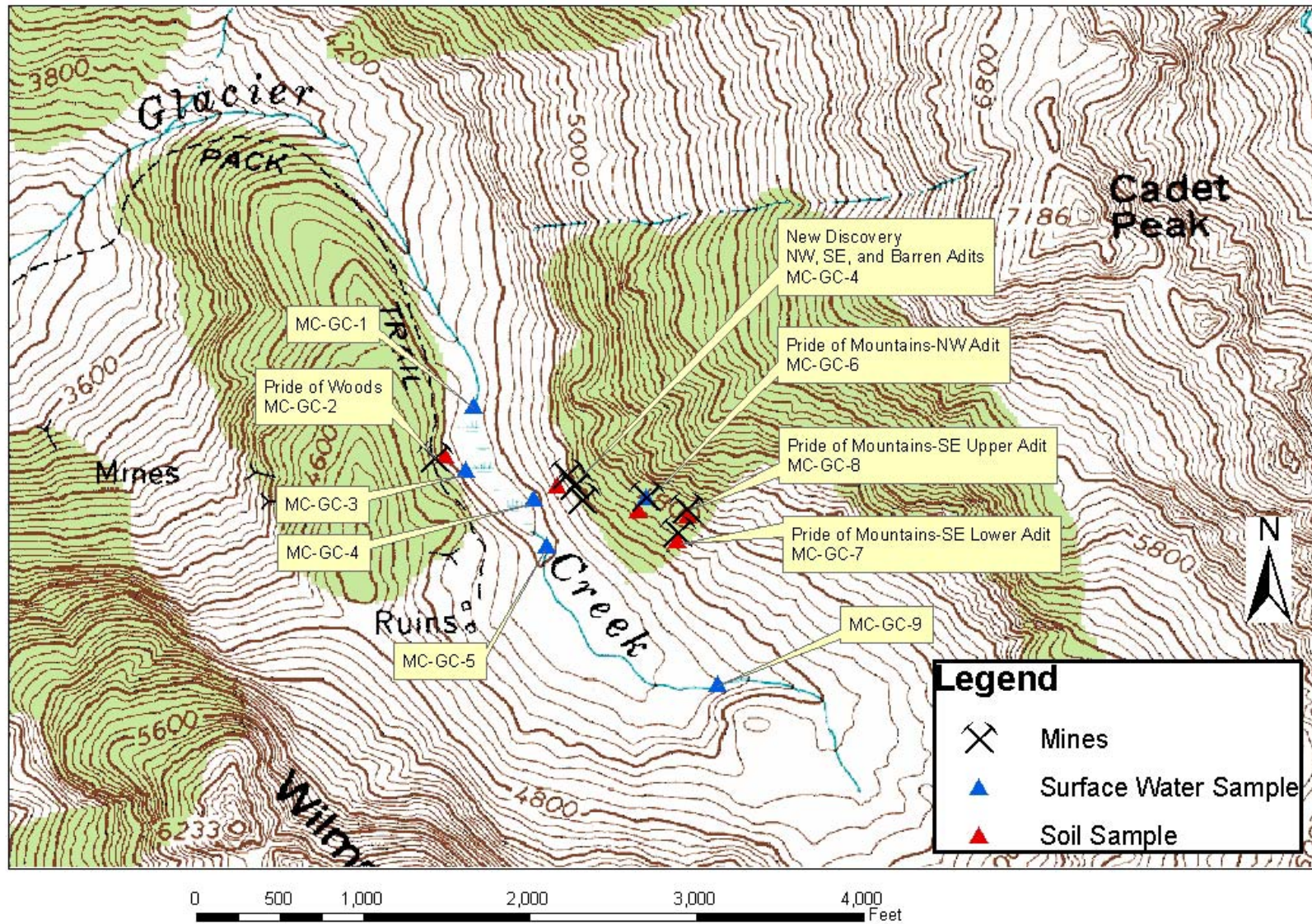
<sup>4</sup> From WAC 173-340-900, Table 749-2, Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. All concentrations are for industrial/commercial sites; if unavailable, unrestricted land use values denoted with parenthesis ( ) were utilized.

## **Appendix D**

### **WATER QUALITY ANALYTICAL DATA**



Map of Pride of Woods, New Discovery, and Pride of Mountains Mines and Associated Sample Sites



**Table D-2. Field parameters for surface water samples along Glacier Creek.**

| Sample I.D.                 | Location                                | Date     | Temperature | pH   | Specific Conductance | Turbidity | Dissolved Oxygen | Total Dissolved Solids | Oxidation-Reduction Potential |
|-----------------------------|---|----------|-------------|------|----------------------|-----------|------------------|------------------------|-------------------------------|
|                             |   |          | (°C)        | (SU) | (mS/cm)              | (NTU)     | (mg/L)           | (g/L)                  | (mV)                          |
| MC-GC-1                     | Glacier Creek downstream POW            | 8/2/2006 | 6.8         | 7.11 | 0.039                | 3         | 12.44            | 0.03                   | 164                           |
| MC-GC-3                     | Glacier Creek above POW and below ND    | 8/2/2006 | 9.6         | 6.44 | 0.045                | 2         | 11.49            | 0.03                   | 213                           |
| MC-GC-4                     | Seep along Glacier Creek below ND       | 8/2/2006 | 6.1         | 6.81 | 0.049                | 3         | 12.94            | 0.03                   | 173                           |
| MC-GC-5                     | Glacier Creek above ND and below POM    | 8/2/2006 | 9.1         | 6.65 | 0.036                | 3         | 10.96            | 0.02                   | 191                           |
| MC-GC-6                     | POM Mine adit effluent                  | 8/2/2006 | 5.2         | 6.60 | 0.316                | 3         | 13.25            | 0.20                   | 208                           |
| MC-GC-9                     | Glacier Creek above POM near headwaters | 8/2/2006 | 7.9         | 6.91 | 0.051                | 5         | 11.49            | 0.03                   | 178                           |
| POW=Pride of Woods Mine     |   |          |             |      |                      |           |                  |                        |                               |
| ND=New Discovery Mine       |   |          |             |      |                      |           |                  |                        |                               |
| POM=Pride of Mountains Mine |   |          |             |      |                      |           |                  |                        |                               |

**Table D-3. Summary of surface water analytical data and applicable standards.**

| Sample I.D.  | Location                                | Date     | Hardness as CaCO <sub>3</sub> | Antimony (Sb)                    | Arsenic (As)    | Cadmium (Cd) | Copper (Cu)   | Lead (Pb)     | Nickel (Ni)   | Zinc (Zn)       | Sulfate (SO <sub>4</sub> <sup>2-</sup> ) |
|--|---|----------|-------------------------------|----------------------------------|-----------------|--------------|---------------|---------------|---------------|-----------------|--|
|  |   |          | mg/L                          | Total Recoverable Metals in µg/L |                 |              |               |               |               |                 |  |
| MC-GC-1  | Glacier Creek downstream POW            | 8/2/2006 | 9.0                           | 4.20                             | 2.00            | ND           | <b>1.6 J</b>  | 0.14 J        | 1.4 J         | 4.6 J           | 1.80                                     |
| MC-GC-3  | Glacier Creek above POW and below ND    | 8/2/2006 | 8.0                           | 5.50                             | 6.00            | ND           | 0.53 J        | 0.14 J        | 0.55 J        | 3.7 J           | 1.70                                     |
| MC-GC-4  | Seep along Glacier Creek below ND       | 8/2/2006 | 9.0                           | 4.90                             | 2.80            | ND           | 0.77 J        | 0.05 J        | 0.51 J        | 7.90            |  |
| MC-GC-5  | Glacier Creek above ND and below POM    | 8/2/2006 | 7.0                           | 4.00                             | 1.6 J           | ND           | 0.44 J        | 0.08 J        | 0.39 J        | 3.1 J           | 1.60                                     |
| MC-GC-6  | POM Mine adit effluent                  | 8/2/2006 | 99.0                          | 30.00                            | <b>1,100.00</b> | <b>11.00</b> | <b>560.00</b> | <b>100.00</b> | 1.3 J         | <b>1,600.00</b> |  |
| MC-GC-9  | Glacier Creek above POM near headwaters | 8/2/2006 | 8.0                           | 3.50                             | ND              | ND           | 1.0 J         | <b>0.21 J</b> | 0.35 J        | 5.20            | 1.30                                     |
| <b>Applicable State Surface Water Standards</b>  |   |          |                               |                                  |                 |              |               |               |               |                 |  |
| Washington State Chronic Surface Water Quality Standards <sup>1</sup>  |   |          | 7.0                           | NS                               | 190             | <i>0.14</i>  | <i>1.17</i>   | <i>0.13</i>   | <i>16.57</i>  | <i>10.98</i>    | NS                                       |
| Washington State Chronic Surface Water Quality Standards <sup>1</sup>  |   |          | 8.0                           | NS                               | 190             | <i>0.16</i>  | <i>1.32</i>   | <i>0.15</i>   | <i>18.55</i>  | <i>12.30</i>    | NS                                       |
| Washington State Chronic Surface Water Quality Standards <sup>1</sup>  |   |          | 9.0                           | NS                               | 190             | <i>0.17</i>  | <i>1.45</i>   | <i>0.17</i>   | <i>20.50</i>  | <i>13.59</i>    | NS                                       |
| Washington State Chronic Surface Water Quality Standards <sup>1</sup>  |   |          | 99.0                          | NS                               | 190             | <i>1.03</i>  | <i>11.25</i>  | <i>2.48</i>   | <i>155.86</i> | <i>103.62</i>   | NS                                       |
| <b>Other Relevant Standards for Reference</b>  |   |          |                               |                                  |                 |              |               |               |               |                 |  |
| EPA Recommended Water Quality Criteria (Aquatic) <sup>2</sup>  |   |          | 8.0                           | NS                               | 150             | <i>0.04</i>  | <i>1.03</i>   | <i>0.15</i>   | <i>6.14</i>   | <i>13.90</i>    | NS                                       |
| EPA Recommended Water Quality Criteria (Human Health-Water+Organism) <sup>2</sup>  |   |          | N/A                           | 5.6                              | 0.018           | NS           | 1300          | NS            | 610           | 7400            | NS                                       |
| EPA Recommended Water Quality Criteria (Human Health-Organism only) <sup>2</sup>   |   |          | N/A                           | 640.0                            | 0.14            | NS           | NS            | NS            | 4600          | 26000           | NS                                       |
| Washington State Primary/Secondary Drinking Water Standards <sup>3</sup>   |   |          | N/A                           | 6                                | 10              | 5            | 1300          | 15            | 100           | 5000            | 250                                      |
| POW=Pride of Woods Mine  |   |          |                               |                                  |                 |              |               |               |               |                 |  |
| ND=New Discovery Mine  |   |          |                               |                                  |                 |              |               |               |               |                 |  |
| POM=Pride of Mountains Mine  |   |          |                               |                                  |                 |              |               |               |               |                 |  |
| NS=Not Specified   |   |          |                               |                                  |                 |              |               |               |               |                 |  |
| U=Analyte not detected at or above reported result   |   |          |                               |                                  |                 |              |               |               |               |                 |  |
| J=Result is less than Reporting Limit but greater than or equal to the Method Detection Limit and the concentration is an approximate value.   |   |          |                               |                                  |                 |              |               |               |               |                 |  |
| <sup>1</sup> Washington Administrative Code, Chapter 173-201A WAC, Water Quality Standards for Surface Waters of the State of Washington. Criteria in <i>italics</i> were corrected for associated hardness value. |   |          |                               |                                  |                 |              |               |               |               |                 |  |
| <sup>2</sup> EPA, 2006, National Recommended Water Quality Criteria. Criteria in <i>italics</i> are hardness dependant and were corrected for the average hardness of Glacier Creek (8mg/L).                       |   |          |                               |                                  |                 |              |               |               |               |                 |  |
| <sup>3</sup> Washington Administrative Code, Chapter 246-290-310, Maximum Contaminant Levels (MCLs) and Maximum Residual Disinfectant Levels (MRDLs)   |   |          |                               |                                  |                 |              |               |               |               |                 |  |

## **Appendix E**

### **Site Photographs**





Photo 1. Pride of Woods Mine as viewed from the New Discovery Mine opposite Glacier Creek, view to the west (photo by G. Graham, 8/2/2006).



Photo 2. Pride of the Woods Mine waste rock dump located along Glacier Creek, view to the southeast (photo by G. Graham, 8/2/2006).





Photo 3. Collapsed portal of Pride of the Woods Mine adit, no mine discharge or evidence of mine discharge was observed, view to the west (photo by G. Graham, 8/2/2006).



Photo 4. View from Pride of Woods Mine down Glacier Creek valley. Surface water flow in Glacier Creek infiltrates talus and flows as shallow groundwater (interflow) along bedrock-talus interface. Surface flow re-emerges downstream above bedrock falls visible from town site, view to the northwest (photo by G. Graham, 8/2/2006).





Photo 5. Overview of 3 adits comprising the New Discovery Mine as viewed from Mystery Ridge, view to the northeast (photo by G. Graham, 8/2/2006).



Photo 6. Portal of northwest adit at the New Discovery Mine. No mine drainage or evidence of mine drainage was observed, view to the east (photo by G. Graham, 8/2/2006).

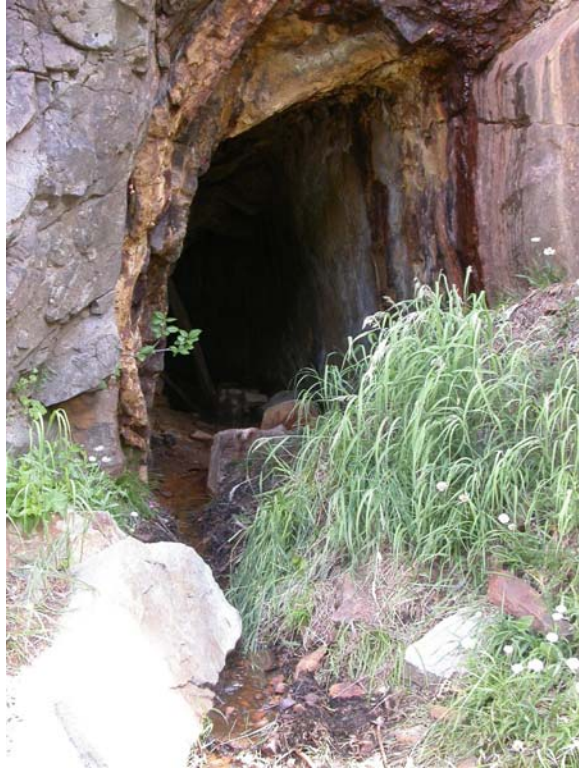


Photo 7. Portal of southeast adit at the New Discovery Mine. Note mine discharge of 1-2 gallons per minute which infiltrated into the waste rock less than 25 feet from portal. View is to the east (photo by G. Graham, 8/2/2006).



Photo 8. View towards Glacier Creek from top of New Discovery waste rock dump. Note iron-oxide and/or hydroxide precipitates at base of talus slope along Glacier Creek which may indicate a seep/spring from shallow groundwater source. Possible seep/spring was sampled as MC-GC-4, view to the southwest (photo by G. Graham, 8/2/2006).





Photo 9. Unmineralized adit driven in barren granodiorite at the New Discovery mine, view to the east (photo by G. Graham, 8/2/2006).



Photo 10. Pride of Mountains Mine as viewed from Glacier Basin, view to the northeast (photo by G. Graham, 8/2/2006).





Photo 11. View of partially collapsed portal of Northwest adit at the Pride of the Mountains Mine, view to the northeast (photo by G. Graham, 8/2/2006).

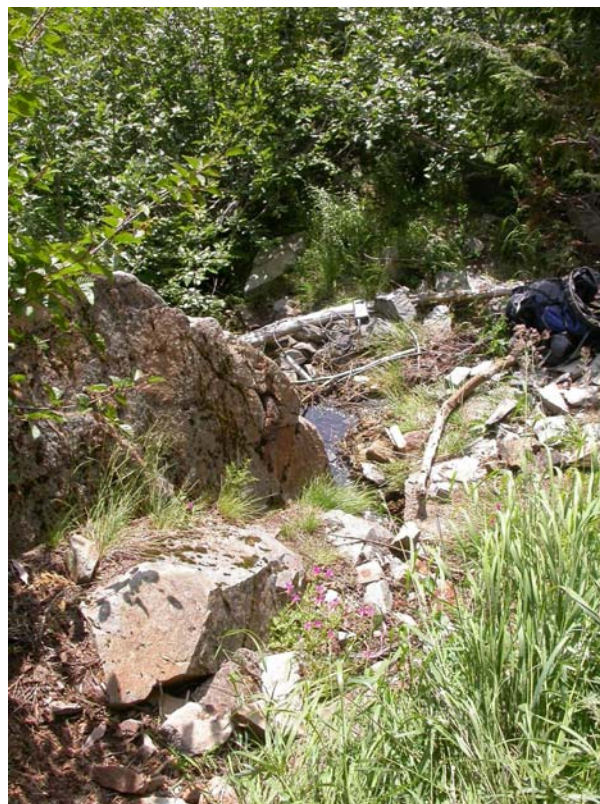


Photo 12. Adit drainage from the Northwest adit at the Pride of the Mountains seeps through colluvial material and resurfaces immediately below the portal, view to the southwest (photo by G. Graham, 8/2/2006).





Photo 12. Mine drainage from the Northwest adit at the Pride of Mountains mine infiltrates into waste rock and colluvial material approximately 75 feet downslope from the mine portal, view to the southwest (photo by G. Graham, 8/2/2006).



Photo 13. Waste rock dump at the northwest adit of the Pride of the Mountains Mine, view to the northeast (photo by G. Graham, 8/2/2006).





Photo 14. Incline adjacent to the upper southeast adit at the Pride of the Mountains mine, view to the northwest (photo by G. Graham, 8/2/2006).



Photo 15. Portal of upper southeast adit at the Pride of the Mountains Mine, there was no discharge or evidence of discharge observed, view to the northwest (photo by G. Graham, 8/2/2006).





Photo 16. Waste rock dump at the upper southeast adit of the Pride of the Mountains Mine, view to the southeast (photo by G. Graham, 8/2/2006).



Photo 17. Collapsed portal of the lower southeast adit at the Pride of the Mountains Mine, there was no discharge or evidence of discharge from the adit, view to the northwest (photo by G. Graham, 8/2/2006).





Photo 18. Waste rock dump for the lower southeast adit at the Pride of Mountains Mine, note that it is comprised of both barren and mineralized granodiorite, view to the southeast (photo by G. Graham, 8/2/2006).

## **Appendix F**

### **Analytical Report from Severn Trent Laboratories**

*Note: Samples for 3 projects were submitted jointly to the lab for analytical analysis. Excerpts of the analytical report relevant only to the Pride of Woods, New Discovery, and Pride of Mountains mines are included here and as a result some pages from the complete report are missing. Analytical data for the other 2 projects are reported in separate documents. A complete copy of the analytical report is available, upon request, from the project file.*



STL

## ANALYTICAL REPORT

Job Number: 580-3244-1

Job Description: MBS Monte Cristo

For:  
USDA Forest Service  
215 Melody Lane  
Wenatchee, WA 98801

Attention: Greg Graham

A handwritten signature in black ink that reads "H Curbow".

---

Heather Curbow  
Project Mgmt. Assistant  
hcurbow@stl-inc.com  
08/21/2006

Project Manager: Heather Curbow

STL Seattle is a part of Severn Trent Laboratories, Inc.

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**Severn Trent Laboratories, Inc.**  
STL Seattle 5755 8th Street East, Tacoma, WA 98424  
Tel (253) 922-2310 Fax (253) 922-5047 www.stl-inc.com

Page 1 of 24





## METHOD SUMMARY

Client: USDA Forest Service

Job Number: 580-3244-1

| Description   | Lab Location | Method       | Preparation Method |
|---|--------------|--------------|--------------------|
| <b>Matrix: Water</b>  |              |              |                    |
| Inductively Coupled Plasma - Mass Spectrometry                  | STL SEA      | SW846 6020   |                    |
| Acid Digestion of Waters for Total Recoverable or               | STL SEA      |              | SW846 3005A        |
| Hardness, Total (mg/l as CaCO <sub>3</sub> ), Titrimetric, EDTA | STL SEA      | MCAWW 130.2  |                    |
| Anions by Ion Chromatography                                    | STL SEA      | EPA-04 300.0 |                    |

### LAB REFERENCES:

STL SEA = STL Seattle

### METHOD REFERENCES:

EPA-04 - "Methods For The Determination Of Inorganic Substances In Environmental Samples", EPA/600/R-93/100, August 1993.

MCAWW - "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

SW846 - "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

STL Seattle

### SAMPLE SUMMARY

Client: USDA Forest Service

Job Number: 580-3244-1

| <b>Lab Sample ID</b> | <b>Client Sample ID</b> | <b>Client Matrix</b> | <b>Date/Time<br/>Sampled</b> | <b>Date/Time<br/>Received</b> |
|----------------------|-------------------------|----------------------|------------------------------|-------------------------------|
| 580-3244-1           | MC-GC-1                 | Water                | 08/02/2006 1030              | 08/08/2006 0815               |
| 580-3244-2           | MC-GC-3                 | Water                | 08/02/2006 1300              | 08/08/2006 0815               |
| 580-3244-3           | MC-GC-4                 | Water                | 08/02/2006 1315              | 08/08/2006 0815               |
| 580-3244-4           | MC-GC-5                 | Water                | 08/02/2006 1715              | 08/08/2006 0815               |
| 580-3244-5           | MC-GC-6                 | Water                | 08/02/2006 1445              | 08/08/2006 0815               |
| 580-3244-6           | MC-GC-9                 | Water                | 08/02/2006 1645              | 08/08/2006 0815               |
| 580-3244-7           | MC-GC-10                | Water                | 08/02/2006 1830              | 08/08/2006 0815               |
| 580-3244-8           | MC-76-1                 | Water                | 08/03/2006 0930              | 08/08/2006 0815               |
| 580-3244-9           | MC-76-2                 | Water                | 08/03/2006 0945              | 08/08/2006 0815               |
| 580-3244-10          | MC-76-3                 | Water                | 08/03/2006 1130              | 08/08/2006 0815               |

STL Seattle

**Analytical Data**

Client: USDA Forest Service

Job Number: 580-3244-1

**Client Sample ID: MC-GC-1**

Lab Sample ID: 580-3244-1  
Client Matrix: Water

Date Sampled: 08/02/2006 1030  
Date Received: 08/08/2006 0815

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**6020 Inductively Coupled Plasma - Mass Spectrometry-Total Recoverable**

Method: 6020                                  Analysis Batch: 580-9897                                  Instrument ID: SEA026  
Preparation: 3005A                              Prep Batch: 580-9855                                  Lab File ID: N/A  
Dilution: 5.0    Initial Weight/Volume: 50 mL  
Date Analyzed: 08/14/2006 1526    Final Weight/Volume: 50 mL  
Date Prepared: 08/14/2006 0957

| Analyte  | Result (mg/L) | Qualifier | MDL      | RL     |
|----------|---------------|-----------|----------|--------|
| Arsenic  | 0.0020        |           | 0.00037  | 0.0020 |
| Lead     | 0.00014       | J B       | 0.000016 | 0.0020 |
| Antimony | 0.0042        | B         | 0.000061 | 0.0020 |
| Cadmium  | ND            |           | 0.000037 | 0.0020 |
| Copper   | 0.0016        | J B       | 0.000075 | 0.0020 |
| Nickel   | 0.0014        | J B       | 0.000052 | 0.0020 |
| Zinc     | 0.0046        | J B       | 0.00026  | 0.0050 |

**Analytical Data**

Client: USDA Forest Service

Job Number: 580-3244-1

Client Sample ID: MC-GC-3

Lab Sample ID: 580-3244-2

Date Sampled: 08/02/2006 1300

Client Matrix: Water

Date Received: 08/08/2006 0815

**6020 Inductively Coupled Plasma - Mass Spectrometry-Total Recoverable**

|                |                 |                 |          |                        |        |
|----------------|-----------------|-----------------|----------|------------------------|--------|
| Method:        | 6020            | Analysis Batch: | 580-9897 | Instrument ID:         | SEA026 |
| Preparation:   | 3005A           | Prep Batch:     | 580-9855 | Lab File ID:           | N/A    |
| Dilution:      | 5.0             |                 |          | Initial Weight/Volume: | 50 mL  |
| Date Analyzed: | 08/14/2006 1611 |                 |          | Final Weight/Volume:   | 50 mL  |
| Date Prepared: | 08/14/2006 0957 |                 |          |                        |        |

| Analyte  | Result (mg/L) | Qualifier | MDL      | RL     |
|----------|---------------|-----------|----------|--------|
| Arsenic  | 0.0060        |           | 0.00037  | 0.0020 |
| Lead     | 0.00014       | J B       | 0.000016 | 0.0020 |
| Antimony | 0.0055        | B         | 0.000061 | 0.0020 |
| Cadmium  | ND            |           | 0.000037 | 0.0020 |
| Copper   | 0.00053       | J B       | 0.000075 | 0.0020 |
| Nickel   | 0.00055       | J B       | 0.000052 | 0.0020 |
| Zinc     | 0.0037        | J B       | 0.00026  | 0.0050 |

**Analytical Data**

Client: USDA Forest Service

Job Number: 580-3244-1

**Client Sample ID: MC-GC-4**

Lab Sample ID: 580-3244-3  
Client Matrix: Water

Date Sampled: 08/02/2006 1315  
Date Received: 08/08/2006 0815

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**6020 Inductively Coupled Plasma - Mass Spectrometry-Total Recoverable**

Method: 6020                      Analysis Batch: 580-9897                      Instrument ID: SEA026  
Preparation: 3005A                  Prep Batch: 580-9855                      Lab File ID: N/A  
Dilution: 5.0                                  Initial Weight/Volume: 50 mL  
Date Analyzed: 08/14/2006 1616                      Final Weight/Volume: 50 mL  
Date Prepared: 08/14/2006 0957

| Analyte  | Result (mg/L) | Qualifier | MDL      | RL     |
|----------|---------------|-----------|----------|--------|
| Arsenic  | 0.0028        |           | 0.00037  | 0.0020 |
| Lead     | 0.000050      | J B       | 0.000016 | 0.0020 |
| Antimony | 0.0049        | B         | 0.000061 | 0.0020 |
| Cadmium  | ND            |           | 0.000037 | 0.0020 |
| Copper   | 0.00077       | J B       | 0.000075 | 0.0020 |
| Nickel   | 0.00051       | J B       | 0.000052 | 0.0020 |
| Zinc     | 0.0079        | B         | 0.00026  | 0.0050 |

**Analytical Data**

Client: USDA Forest Service

Job Number: 580-3244-1

**Client Sample ID: MC-GC-5**

Lab Sample ID: 580-3244-4  
Client Matrix: Water

Date Sampled: 08/02/2006 1715  
Date Received: 08/08/2006 0815

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**6020 Inductively Coupled Plasma - Mass Spectrometry-Total Recoverable**

|                |                 |                 |          |                        |        |
|----------------|-----------------|-----------------|----------|------------------------|--------|
| Method:        | 6020            | Analysis Batch: | 580-9897 | Instrument ID:         | SEA026 |
| Preparation:   | 3005A           | Prep Batch:     | 580-9855 | Lab File ID:           | N/A    |
| Dilution:      | 5.0             |                 |          | Initial Weight/Volume: | 50 mL  |
| Date Analyzed: | 08/14/2006 1621 |                 |          | Final Weight/Volume:   | 50 mL  |
| Date Prepared: | 08/14/2006 0957 |                 |          |                        |        |

| Analyte  | Result (mg/L) | Qualifier | MDL      | RL     |
|----------|---------------|-----------|----------|--------|
| Arsenic  | 0.0016        | J         | 0.00037  | 0.0020 |
| Lead     | 0.000080      | J B       | 0.000016 | 0.0020 |
| Antimony | 0.0040        | B         | 0.000061 | 0.0020 |
| Cadmium  | ND            |           | 0.000037 | 0.0020 |
| Copper   | 0.00044       | J B       | 0.000075 | 0.0020 |
| Nickel   | 0.00039       | J B       | 0.000052 | 0.0020 |
| Zinc     | 0.0031        | J B       | 0.00026  | 0.0050 |

**Analytical Data**

Client: USDA Forest Service

Job Number: 580-3244-1

Client Sample ID: MC-GC-6

Lab Sample ID: 580-3244-5  
Client Matrix: Water

Date Sampled: 08/02/2006 1445  
Date Received: 08/08/2006 0815

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**6020 Inductively Coupled Plasma - Mass Spectrometry-Total Recoverable**

|                |                 |                          |                        |        |
|----------------|-----------------|--------------------------|------------------------|--------|
| Method:        | 6020            | Analysis Batch: 580-9897 | Instrument ID:         | SEA026 |
| Preparation:   | 3005A           | Prep Batch: 580-9855     | Lab File ID:           | N/A    |
| Dilution:      | 5.0             |                          | Initial Weight/Volume: | 50 mL  |
| Date Analyzed: | 08/14/2006 1626 |                          | Final Weight/Volume:   | 50 mL  |
| Date Prepared: | 08/14/2006 0957 |                          |                        |        |

| Analyte  | Result (mg/L) | Qualifier | MDL      | RL     |
|----------|---------------|-----------|----------|--------|
| Arsenic  | 1.1           |           | 0.00037  | 0.0020 |
| Lead     | 0.10          | B         | 0.000016 | 0.0020 |
| Antimony | 0.030         | B         | 0.000061 | 0.0020 |
| Cadmium  | 0.011         |           | 0.000037 | 0.0020 |
| Copper   | 0.56          | B         | 0.000075 | 0.0020 |
| Nickel   | 0.0013        | JB        | 0.000052 | 0.0020 |
| Zinc     | 1.6           | B         | 0.00026  | 0.0050 |

**Analytical Data**

Client: USDA Forest Service

Job Number: 580-3244-1

Client Sample ID: MC-GC-9

Lab Sample ID: 580-3244-6  
Client Matrix: Water

Date Sampled: 08/02/2006 1645  
Date Received: 08/08/2006 0815

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**6020 Inductively Coupled Plasma - Mass Spectrometry-Total Recoverable**

|                |                 |                          |                        |        |
|----------------|-----------------|--------------------------|------------------------|--------|
| Method:        | 6020            | Analysis Batch: 580-9897 | Instrument ID:         | SEA026 |
| Preparation:   | 3005A           | Prep Batch: 580-9855     | Lab File ID:           | N/A    |
| Dilution:      | 5.0             |                          | Initial Weight/Volume: | 50 mL  |
| Date Analyzed: | 08/14/2006 1631 |                          | Final Weight/Volume:   | 50 mL  |
| Date Prepared: | 08/14/2006 0957 |                          |                        |        |

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| Analyte  | Result (mg/L) | Qualifier | MDL      | RL     |
|----------|---------------|-----------|----------|--------|
| Arsenic  | ND            |           | 0.00037  | 0.0020 |
| Lead     | 0.00021       | J B       | 0.000016 | 0.0020 |
| Antimony | 0.0035        | B         | 0.000061 | 0.0020 |
| Cadmium  | ND            |           | 0.000037 | 0.0020 |
| Copper   | 0.0010        | J B       | 0.000075 | 0.0020 |
| Nickel   | 0.00035       | J B       | 0.000052 | 0.0020 |
| Zinc     | 0.0052        | B         | 0.00026  | 0.0050 |



Analytical Data

Client: USDA Forest Service

Job Number: 580-3244-1

General Chemistry

Client Sample ID: MC-GC-1

Lab Sample ID: 580-3244-1  
Client Matrix: Water

Date Sampled: 08/02/2006 1030  
Date Received: 08/08/2006 0815

| Analyte | Result               | Qual          | Units      | MDL   | RL   | Dil | Method |
|---------|----------------------|---------------|------------|-------|------|-----|--------|
| Sulfate | 1.8                  |               | mg/L       | 0.038 | 0.30 | 1.0 | 300.0  |
|         | Anly Batch: 580-9706 | Date Analyzed | 08/08/2006 | 1729  |      |     |        |

| Analyte                       | Result               | Qual          | Units      | RL   | RL  | Dil | Method |
|-------------------------------|----------------------|---------------|------------|------|-----|-----|--------|
| Hardness as calcium carbonate | 9.0                  |               | mg/L       | 2.0  | 2.0 | 1.0 | 130.2  |
|                               | Anly Batch: 580-9756 | Date Analyzed | 08/10/2006 | 0941 |     |     |        |

Client Sample ID: MC-GC-3

Lab Sample ID: 580-3244-2  
Client Matrix: Water

Date Sampled: 08/02/2006 1300  
Date Received: 08/08/2006 0815

| Analyte | Result               | Qual          | Units      | MDL   | RL   | Dil | Method |
|---------|----------------------|---------------|------------|-------|------|-----|--------|
| Sulfate | 1.7                  |               | mg/L       | 0.038 | 0.30 | 1.0 | 300.0  |
|         | Anly Batch: 580-9706 | Date Analyzed | 08/08/2006 | 1747  |      |     |        |

| Analyte                       | Result               | Qual          | Units      | RL   | RL  | Dil | Method |
|-------------------------------|----------------------|---------------|------------|------|-----|-----|--------|
| Hardness as calcium carbonate | 8.0                  |               | mg/L       | 2.0  | 2.0 | 1.0 | 130.2  |
|                               | Anly Batch: 580-9756 | Date Analyzed | 08/10/2006 | 0941 |     |     |        |

Client Sample ID: MC-GC-4

Lab Sample ID: 580-3244-3  
Client Matrix: Water

Date Sampled: 08/02/2006 1315  
Date Received: 08/08/2006 0815

| Analyte                       | Result               | Qual          | Units      | RL   | RL  | Dil | Method |
|-------------------------------|----------------------|---------------|------------|------|-----|-----|--------|
| Hardness as calcium carbonate | 9.0                  |               | mg/L       | 2.0  | 2.0 | 1.0 | 130.2  |
|                               | Anly Batch: 580-9756 | Date Analyzed | 08/10/2006 | 0941 |     |     |        |

**Analytical Data**

Client: USDA Forest Service

Job Number: 580-3244-1

---

**General Chemistry**

**Client Sample ID: MC-GC-5**

Lab Sample ID: 580-3244-4  
Client Matrix: Water

Date Sampled: 08/02/2006 1715  
Date Received: 08/08/2006 0815

| Analyte | Result               | Qual          | Units      | MDL   | RL   | Dil | Method |
|---------|----------------------|---------------|------------|-------|------|-----|--------|
| Sulfate | 1.6                  |               | mg/L       | 0.038 | 0.30 | 1.0 | 300.0  |
|         | Anly Batch: 580-9706 | Date Analyzed | 08/08/2006 | 1805  |      |     |        |

| Analyte                       | Result               | Qual          | Units      | RL   | RL  | Dil | Method |
|-------------------------------|----------------------|---------------|------------|------|-----|-----|--------|
| Hardness as calcium carbonate | 7.0                  |               | mg/L       | 2.0  | 2.0 | 1.0 | 130.2  |
|                               | Anly Batch: 580-9756 | Date Analyzed | 08/10/2006 | 0941 |     |     |        |

**Client Sample ID: MC-GC-6**

Lab Sample ID: 580-3244-5  
Client Matrix: Water

Date Sampled: 08/02/2006 1445  
Date Received: 08/08/2006 0815

| Analyte                       | Result               | Qual          | Units      | RL   | RL  | Dil | Method |
|-------------------------------|----------------------|---------------|------------|------|-----|-----|--------|
| Hardness as calcium carbonate | 99                   |               | mg/L       | 2.0  | 2.0 | 1.0 | 130.2  |
|                               | Anly Batch: 580-9756 | Date Analyzed | 08/10/2006 | 0941 |     |     |        |

**Client Sample ID: MC-GC-9**

Lab Sample ID: 580-3244-6  
Client Matrix: Water

Date Sampled: 08/02/2006 1645  
Date Received: 08/08/2006 0815

| Analyte | Result               | Qual          | Units      | MDL   | RL   | Dil | Method |
|---------|----------------------|---------------|------------|-------|------|-----|--------|
| Sulfate | 1.3                  |               | mg/L       | 0.038 | 0.30 | 1.0 | 300.0  |
|         | Anly Batch: 580-9706 | Date Analyzed | 08/08/2006 | 1846  |      |     |        |

| Analyte                       | Result               | Qual          | Units      | RL   | RL  | Dil | Method |
|-------------------------------|----------------------|---------------|------------|------|-----|-----|--------|
| Hardness as calcium carbonate | 8.0                  |               | mg/L       | 2.0  | 2.0 | 1.0 | 130.2  |
|                               | Anly Batch: 580-9756 | Date Analyzed | 08/10/2006 | 0941 |     |     |        |

**Quality Control Results**

Client: USDA Forest Service

Job Number: 580-3244-1

**Method Blank - Batch: 580-9855**

**Method: 6020  
Preparation: 3005A  
Total Recoverable**

Lab Sample ID: MB 580-9855/15-A  
Client Matrix: Water  
Dilution: 1.0  
Date Analyzed: 08/14/2006 1515  
Date Prepared: 08/14/2006 0957

Analysis Batch: 580-9897  
Prep Batch: 580-9855  
Units: mg/L

Instrument ID: SEA026  
Lab File ID: N/A  
Initial Weight/Volume: 50 mL  
Final Weight/Volume: 50 mL

| Analyte  | Result    | Qual | MDL       | RL      |
|----------|-----------|------|-----------|---------|
| Lead     | 0.0000060 | J    | 0.0000031 | 0.00040 |
| Arsenic  | ND        |      | 0.000073  | 0.00040 |
| Antimony | 0.00026   | J    | 0.000012  | 0.00040 |
| Cadmium  | ND        |      | 0.000074  | 0.00040 |
| Copper   | 0.00020   | J    | 0.000015  | 0.00040 |
| Nickel   | 0.000015  | J    | 0.000010  | 0.00040 |
| Zinc     | 0.00012   | J    | 0.000053  | 0.0010  |

**Lab Control Spike/  
Lab Control Spike Duplicate Recovery Report - Batch: 580-9855**

**Method: 6020  
Preparation: 3005A  
Total Recoverable**

LCS Lab Sample ID: LCS 580-9855/16-A  
Client Matrix: Water  
Dilution: 50  
Date Analyzed: 08/14/2006 1551  
Date Prepared: 08/14/2006 0957

Analysis Batch: 580-9897  
Prep Batch: 580-9855  
Units: mg/L

Instrument ID: SEA026  
Lab File ID: N/A  
Initial Weight/Volume: 50 mL  
Final Weight/Volume: 50 mL

LCSD Lab Sample ID: LCSD 580-9855/17-A  
Client Matrix: Water  
Dilution: 50  
Date Analyzed: 08/14/2006 1556  
Date Prepared: 08/14/2006 0957

Analysis Batch: 580-9897  
Prep Batch: 580-9855  
Units: mg/L

Instrument ID: SEA026  
Lab File ID: N/A  
Initial Weight/Volume: 50 mL  
Final Weight/Volume: 50 mL

| Analyte  | % Rec. |      | Limit    | RPD | RPD Limit | LCS Qual | LCSD Qual |
|----------|--------|------|----------|-----|-----------|----------|-----------|
|          | LCS    | LCSD |          |     |           |          |           |
| Arsenic  | 99     | 100  | 80 - 120 | 1   | 20        |          |           |
| Lead     | 101    | 102  | 80 - 120 | 1   | 20        |          |           |
| Antimony | 104    | 104  | 80 - 120 | 0   | 20        |          |           |
| Cadmium  | 93     | 90   | 80 - 120 | 4   | 20        |          |           |
| Copper   | 101    | 101  | 80 - 120 | 1   | 20        |          |           |
| Nickel   | 100    | 99   | 80 - 120 | 1   | 20        |          |           |
| Zinc     | 100    | 99   | 80 - 120 | 1   | 20        |          |           |

Calculations are performed before rounding to avoid round-off errors in calculated results.

**Quality Control Results**

Client: USDA Forest Service

Job Number: 580-3244-1

**Matrix Spike/  
Matrix Spike Duplicate Recovery Report - Batch: 580-9855**

**Method: 6020  
Preparation: 3005A  
Total Recoverable**

MS Lab Sample ID: 580-3244-1  
Client Matrix: Water  
Dilution: 50  
Date Analyzed: 08/14/2006 1536  
Date Prepared: 08/14/2006 0957

Analysis Batch: 580-9897  
Prep Batch: 580-9855

Instrument ID: SEA026  
Lab File ID: N/A  
Initial Weight/Volume: 50 mL  
Final Weight/Volume: 50 mL

MSD Lab Sample ID: 580-3244-1  
Client Matrix: Water  
Dilution: 50  
Date Analyzed: 08/14/2006 1541  
Date Prepared: 08/14/2006 0957

Analysis Batch: 580-9897  
Prep Batch: 580-9855

Instrument ID: SEA026  
Lab File ID: N/A  
Initial Weight/Volume: 50 mL  
Final Weight/Volume: 50 mL

| Analyte  | % Rec. |     | Limit    | RPD | RPD Limit | MS Qual | MSD Qual |
|----------|--------|-----|----------|-----|-----------|---------|----------|
|          | MS     | MSD |          |     |           |         |          |
| Arsenic  | 103    | 106 | 75 - 125 | 2   | 20        |         |          |
| Lead     | 104    | 107 | 75 - 125 | 3   | 20        | B       | B        |
| Antimony | 80     | 83  | 75 - 125 | 4   | 20        | B       | B        |
| Cadmium  | 103    | 102 | 75 - 125 | 1   | 20        |         |          |
| Copper   | 105    | 106 | 75 - 125 | 0   | 20        | B       | B        |
| Nickel   | 105    | 107 | 75 - 125 | 2   | 20        | B       | B        |
| Zinc     | 103    | 107 | 75 - 125 | 3   | 20        | B       | B        |

**Duplicate - Batch: 580-9855**

**Method: 6020  
Preparation: 3005A  
Total Recoverable**

Lab Sample ID: 580-3244-1  
Client Matrix: Water  
Dilution: 5.0  
Date Analyzed: 08/14/2006 1531  
Date Prepared: 08/14/2006 0957

Analysis Batch: 580-9897  
Prep Batch: 580-9855  
Units: mg/L

Instrument ID: SEA026  
Lab File ID: N/A  
Initial Weight/Volume: 50 mL  
Final Weight/Volume: 50 mL

| Analyte  | Sample Result/Qual | Result    | RPD | Limit | Qual |
|----------|--------------------|-----------|-----|-------|------|
| Arsenic  | 0.00205            | 0.000390  | 136 | 20    | J    |
| Lead     | 0.000135 J         | 0.000150  | 11  | 20    | JB   |
| Antimony | 0.00424            | 0.00371   | 13  | 20    | B    |
| Cadmium  | 0.0000250          | 0.0000100 | NC  | 20    |      |
| Copper   | 0.00157 J          | 0.00155   | 1   | 20    | JB   |
| Nickel   | 0.00143 J          | 0.00119   | 19  | 20    | JB   |
| Zinc     | 0.00462 J          | 0.00951   | 69  | 20    | B    |

Calculations are performed before rounding to avoid round-off errors in calculated results.

**Quality Control Results**

Client: USDA Forest Service

Job Number: 580-3244-1

**Method Blank - Batch: 580-9756**

**Method: 130.2**  
**Preparation: N/A**

Lab Sample ID: MB 580-9756/1  
Client Matrix: Water  
Dilution: 1.0  
Date Analyzed: 08/10/2006 0941  
Date Prepared: N/A

Analysis Batch: 580-9756  
Prep Batch: N/A  
Units: mg/L

Instrument ID: No Equipment Assigned  
Lab File ID: N/A  
Initial Weight/Volume:  
Final Weight/Volume:

| Analyte                       | Result | Qual | RL  | RL  |
|-------------------------------|--------|------|-----|-----|
| Hardness as calcium carbonate | ND     |      | 2.0 | 2.0 |

**Lab Control Spike - Batch: 580-9756**

**Method: 130.2**  
**Preparation: N/A**

Lab Sample ID: LCS 580-9756/2  
Client Matrix: Water  
Dilution: 1.0  
Date Analyzed: 08/10/2006 0941  
Date Prepared: N/A

Analysis Batch: 580-9756  
Prep Batch: N/A  
Units: mg/L

Instrument ID: No Equipment Assigned  
Lab File ID: N/A  
Initial Weight/Volume:  
Final Weight/Volume:

| Analyte                       | Spike Amount | Result | % Rec. | Limit    | Qual |
|-------------------------------|--------------|--------|--------|----------|------|
| Hardness as calcium carbonate | 1000         | 1000   | 100    | 90 - 110 |      |

Calculations are performed before rounding to avoid round-off errors in calculated results.

**Quality Control Results**

Client: USDA Forest Service

Job Number: 580-3244-1

**Method Blank - Batch: 580-9706**

**Method: 300.0**  
**Preparation: N/A**

Lab Sample ID: MB 580-9706/2  
Client Matrix: Water  
Dilution: 1.0  
Date Analyzed: 08/08/2006 1325  
Date Prepared: N/A

Analysis Batch: 580-9706  
Prep Batch: N/A  
Units: mg/L

Instrument ID: SEA025  
Lab File ID: N/A  
Initial Weight/Volume:  
Final Weight/Volume: 5 mL

| Analyte | Result | Qual | MDL   | RL   |
|---------|--------|------|-------|------|
| Sulfate | ND     |      | 0.038 | 0.30 |

**Lab Control Spike - Batch: 580-9706**

**Method: 300.0**  
**Preparation: N/A**

Lab Sample ID: LCS 580-9706/1  
Client Matrix: Water  
Dilution: 1.0  
Date Analyzed: 08/08/2006 1307  
Date Prepared: N/A

Analysis Batch: 580-9706  
Prep Batch: N/A  
Units: mg/L

Instrument ID: SEA025  
Lab File ID: N/A  
Initial Weight/Volume:  
Final Weight/Volume: 5 mL

| Analyte | Spike Amount | Result | % Rec. | Limit    | Qual |
|---------|--------------|--------|--------|----------|------|
| Sulfate | 10.0         | 10.2   | 102    | 90 - 110 |      |

Calculations are performed before rounding to avoid round-off errors in calculated results.

## DATA REPORTING QUALIFIERS

Client: USDA Forest Service

Job Number: 580-3244-1

| <b>Lab Section</b> | <b>Qualifier</b> | <b>Description</b>   |
|--------------------|------------------|--|
| Metals             | B                | Compound was found in the blank and sample.  |
|                    | J                | Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value. |

STL Seattle

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STL Seattle  
5755 8th Street E.  
Tacoma, WA 98424  
Tel. 253-922-2310  
Fax 253-922-5047  
www.stl-inc.com

**Chain of  
Custody Record**



2.9

Client: **USDA FOREST SERVICE** Project Manager: **GREG GRAHAM** Date: **8/4/2006** Chain of Custody Number: **26355**

Address: **D15 MELODY LANE** Telephone Number (Area Code)/Fax Number: **509-664-9285** Lab Number: **3244** Page: **1** of **1**

City: **WENATCHEE** State: **WA** Zip Code: **98801** Site Contact: **TOM COYNER**

Project Name and Location (State): **MBS - MONTE CRISTO** Carrier/Vehicle Number: **FEDEX**

Contract/Purchase Order/Quote No.: **E-MAIL FROM TOM COYNER**

| Sample I.D. and Location/Description<br>(Containers for each sample may be combined on one line) | Date   | Time | Matrix |      |       | Containers & Preservatives   | Analysis (Attach list if more space is needed)   | Special Instructions/<br>Conditions of Receipt            |
|--|--------|------|--------|------|-------|--|--|---|
|  |        |      | Air    | Soil | Water |  |  |   |
| 1 MC-6C-1  | 8/2/06 | 1030 | X      |      |       | MSOX<br>HNO3<br>HNO2<br>HNO4<br>HNO5<br>HNO6<br>HNO7<br>HNO8<br>HNO9<br>HNO10<br>HNO11<br>HNO12<br>HNO13<br>HNO14<br>HNO15<br>HNO16<br>HNO17<br>HNO18<br>HNO19<br>HNO20<br>HNO21<br>HNO22<br>HNO23<br>HNO24<br>HNO25<br>HNO26<br>HNO27<br>HNO28<br>HNO29<br>HNO30<br>HNO31<br>HNO32<br>HNO33<br>HNO34<br>HNO35<br>HNO36<br>HNO37<br>HNO38<br>HNO39<br>HNO40<br>HNO41<br>HNO42<br>HNO43<br>HNO44<br>HNO45<br>HNO46<br>HNO47<br>HNO48<br>HNO49<br>HNO50<br>HNO51<br>HNO52<br>HNO53<br>HNO54<br>HNO55<br>HNO56<br>HNO57<br>HNO58<br>HNO59<br>HNO60<br>HNO61<br>HNO62<br>HNO63<br>HNO64<br>HNO65<br>HNO66<br>HNO67<br>HNO68<br>HNO69<br>HNO70<br>HNO71<br>HNO72<br>HNO73<br>HNO74<br>HNO75<br>HNO76<br>HNO77<br>HNO78<br>HNO79<br>HNO80<br>HNO81<br>HNO82<br>HNO83<br>HNO84<br>HNO85<br>HNO86<br>HNO87<br>HNO88<br>HNO89<br>HNO90<br>HNO91<br>HNO92<br>HNO93<br>HNO94<br>HNO95<br>HNO96<br>HNO97<br>HNO98<br>HNO99<br>HNO100 | TOTAL METALS<br>BY EPA 8210<br>AS LISTED<br>IN 40 CFR<br>PART 136<br>APPENDIX A<br>METHOD 8000<br>SULFATE<br>BY EPA 8000 | ALL SAMPLES FOR METALS<br>+ HARDNESS PRESERVED<br>W/ HAIR |
| 2 MC-6C-3  | 8/2/06 | 1300 |        |      |       |  |  |   |
| 3 MC-6C-4  | 8/2/06 | 1315 |        |      |       |  |  |   |
| 4 MC-6C-5  | 8/2/06 | 1715 |        |      |       |  |  |   |
| 5 MC-6C-6  | 8/2/06 | 1445 |        |      |       |  |  |   |
| 6 MC-6C-9  | 8/2/06 | 1645 |        |      |       |  |  |   |
| 7 MC-6C-10   | 8/2/06 | 1830 |        |      |       |  |  |   |
| 8 MC-76-1  | 8/3/06 | 0930 | X      |      |       |  |  |   |
| 9 MC-76-2  | 8/3/06 | 0945 |        |      |       |  |  |   |
| 10 MC-76-3   | 8/3/06 | 1130 |        |      |       |  |  |   |

Cooler:  Yes  No Cooler Temp: **4°C**

Possible Hazard Identification:  Non-Hazard  Flammable  Skin Irritant  Poison B  Unknown  Poison A

Sample Disposal:  Return To Client  Archive For **1** Months (A fee may be assessed if samples are retained longer than 1 month)

QC Requirements (Specify):

1. Received By: **Shay B. ...** Date: **8/7/06** Time: **0800**

2. Received By: **...** Date: **8/8/06** Time: **0815**

3. Received By: **...** Date: **...** Time: **...**

Comments:

DISTRIBUTION: WHITE - Stays with the Samples; CANARY - Returned to Client with Report; PINK - Field Copy

STL8274-580(12/02)



## LOGIN SAMPLE RECEIPT CHECK LIST

Client: USDA Forest Service

Job Number: 580-3244-1

**Login Number: 3244**

| Question   | T/F/NA | Comment |
|--|--------|---------|
| Radioactivity either was not measured or, if measured, is at or below background | True   |         |
| The cooler's custody seal, if present, is intact.                                | True   |         |
| The cooler or samples do not appear to have been compromised or tampered with.   | True   |         |
| Samples were received on ice.  | True   |         |
| Cooler Temperature is acceptable.  | True   |         |
| Cooler Temperature is recorded.  | True   |         |
| COC is present.  | True   |         |
| COC is filled out in ink and legible.  | True   |         |
| COC is filled out with all pertinent information.                                | True   |         |
| There are no discrepancies between the sample IDs on the containers and the COC. | True   |         |
| Samples are received within Holding Time.  | True   |         |
| Sample containers have legible labels.   | True   |         |
| Containers are not broken or leaking.  | True   |         |
| Sample collection date/times are provided.                                       | True   |         |
| Appropriate sample containers are used.  | True   |         |
| Sample bottles are completely filled.  | True   |         |
| There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs | True   |         |
| VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.     | NA     |         |
| If necessary, staff have been informed of any short hold time or quick TAT needs | True   |         |
| Multiphasic samples are not present.   | True   |         |
| Samples do not require splitting or compositing.                                 | True   |         |