DRAFT
ENGINEERING EVALUATION / COST ANALYSIS

BLACK PINE MINE

Prepared for
Montana Department
of Environmental Quality
Abandoned Mine Lands Bureau

Prepared by
Herrera Environmental Consultants, Inc.

In association with

Trihydro Corporation

HERRERA

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Abandoned Mine Lands Bureau
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ACRONYMS AND ABBREVIATIONS

A	area
AALS	acute aquatic life standard
ABA	acid base accounting
ACM	asbestos-containing material
AOC	Area of Concern
AHERA	Asbestos Hazard Emergency Response Act
ARARs	Applicable or Relevant and Appropriate Requirements
ASA	American Society of Agronomy
ASARCO	American Smelting and Refining Company
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
bgs	below ground surface
BPM	Black Pine Mine
BW	body weight
CALEPA	California Environmental Protection Agency
CEC	cation exchange capacity
CFC	chlorofluorocarbons
cfs	cubic feet per second
CLP	contract laboratory program
cm/s	centimeters per second
COC	contaminant of concern
COPC	contaminant of potential concern
cy	cubic yard
DEQ/AMLB	Montana Department of Environmental Quality/Abandoned Mine Lands Bureau
DQO	data quality objective
EE/CA	expanded engineering evaluation and cost analysis
ELCR	Estimated Lifetime Cancer Risk
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EQ	ecological impact quotient
FSP	Field Sampling Plan
ft	foot or feet
GI ABS %	Gastrointestinal Absorption percentage
GPS	global positioning system
HBM	Hazardous Building Materials
HEAST	Health Effects Assessment Summary Tables
HHS	human health standards
HID	high-intensity discharge
HMI	hazardous materials inventory
HQ	Hazard Quotient
HR	home range

HUC	Hydrologic Unit Code
in	inch
IR	ingestion rate
IRIS	integrated risk information system
kg	kilogram
kg/day	kilogram per day
LAP	laboratory analytical plan
lb	pound
L/d	liters per day
MBMG	Montana Bureau of Mines and Geology
MCL	maximum contaminant level
meq/100 g	milliequivalents per 100 grams
MF	modifying factor
µg/L	micrograms per liter
mg/m^3	milligrams per cubic meter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mm	millimeters
mmhos/cm	millimhos per centimeter
MT	Montana
NCP	National Oil and Hazardous Substances Contingency Plan
NOAA	National Oceanographic and Atmospheric Administration
NOAEL	no observed adverse effects level
oz	ounce
PCB	polychlorinated biphenyl
pcf	pounds per cubic foot
PCM	point count method
ppm	parts per million
PPRTV	Provisional Peer Reviewed Toxicity Values
PRG	preliminary reclamation goal
QA	quality assurance
QC	quality control
RA	risk assessment
RAGS	Risk Assessment Guidance for Superfund
RBCG	risk-based cleanup guidelines
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RI	reclamation investigation
RPD	relative percent difference
RSL	regional screening levels
RWP	Reclamation Work Plan
SCR	soil consumption rate
SF	slope factor
SRAD	South Removal Area drainage
s.u.	standard units

TAL	target analyte level
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TRL	target reporting level
TRV	toxic reference values
TSCA	Toxic Substance Control Act
TSI	thermal system insulation
UCL	upper confidence limit
UF	uncertainty factor
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey
WIR	water ingestion rate
XRF	x-ray fluorescence

EXECUTIVE SUMMARY

The Black Pine Mine (BPM) is located approximately 12 miles from Philipsburg, Montana in Granite County. The site consists of approximately 1,055 acres of patented mining claims and 157 unpatented lode claims on lands administered by the United States Forest Service (USFS). Mining began at the BPM around 1885 and continued, intermittently, into the 1990s. The mine site encompasses several historic and modern mining areas, including the Combination Mine Area of Concern (AOC), the Tim Smith Mine AOC, the Historic Mine AOC, and the Combination Mill AOC. Physical and environmental hazards resulting from mining operations remain at the site, such as remnant structures, adits, and shafts. In addition to these hazards, numerous areas are located throughout the site that contain contaminated materials heavily impacted by metals. Contaminated material at BPM includes mine tailings and waste rock, as well as sediments and soils impacted by metals leaching from mine wastes or from metals-laden seeps. These contaminated materials create risks for both site users and ecological receptors.

Investigations and environmental monitoring began at BPM in 1981 and have continued through this Engineering Evaluating and Cost Analysis (EE/CA). Based on historical sampling results, reclamation activities were previously undertaken in the Combination Mill AOC and Combination Mine AOC. Reclamation activities in these areas consisted of partial reclamation of the Combination Mill tailings impoundment in the mid-1990s, installation of the Combination Mine seepage collection and pumpback system in 2001, and excavation of impacted soils from the Combination Mine Soils Removal Areas. These impacted soils were combined with the Combination Mine waste rock pile and grading and capping of the Combination Mine waste rock pile occurred between 2004 and 2006. While these reclamation activities consolidated large portions of the mining-impacted materials at BPM, exposure pathways for these materials to human and ecological receptors remain, as do other areas of impacted materials.

This EE/CA was undertaken by the Montana Department of Environmental Quality, Abandoned Mine Lands Bureau (DEQ/AMLB) to identify reclamation alternatives that effectively address the reclamation of the contaminated materials and physical hazards at BPM. Alternative analysis was conducted to determine if the proposed alternatives would meet the evaluation criteria of effectiveness, implementability, and cost. A preferred alternative was then selected for reclamation at BPM based on its performance level and ability to meet targeted cleanup goals and reclamation objectives. This EE/CA considers source removal and does not specifically address the treatment of surface water or groundwater. It is presumed that the removal of contaminated material will provide protection against surface water and groundwater degradation by minimizing adverse effects due to contamination. Surface water and groundwater will be evaluated in detail at a later date.

Contaminated Material at BPM

Approximately 400,000 cubic yards (cy) of contaminated materials are estimated to be present at, and downgradient of BPM and are summarized in the table below. The estimated waste volumes are based on review of analytical results, test pit observations, review of boring logs, and interpretation of topographic mapping.

Table E-1. Estimated Impacted Waste Volumes at Black Pine Mine

Impacted Location	Estimated Volume (cy)[1]
Combination Mine Waste Rock Pile	203,200[2]
Combination Mine Soils Removal Areas	5,000
Tim Smith Waste Rock Piles at Tim Smith No. 1 and No. 2 Adits	22,650
Historic Mine Area Waste Rock Areas	13,350
Combination Mill Sediments, Soils, and Tailings Impoundments	128,300
Dispersed Locations along South Fork Lower Willow Creek on USFS Administered Lands	19,700
Total	392,200

[1]Quantities are preliminary; estimates and will be refined based on further evaluation and design.

[2]The Combination Mine waste rock pile contains approximately 232,000 cy of material, including 29,000 cy of cover material. The clean cover material will be salvaged and replaced following removal of contaminated materials. The volume of contaminated materials to be removed is 203,200 cy.

Characteristics of Contaminated Material in the AOCs

Metals concentrations exceeded DEQ risk based cleanup guidelines (RBCG) in each of the AOCs for one or more of the following: waste rock, soil, and surface water. Metals concentrations in groundwater exceeded Montana's Circular DEQ-7 human health standards in the Combination Mine AOC. The Reclamation Investigation (RI) report contains detailed information regarding the data obtained from collected samples. The following provides a brief synopsis of contaminated material characteristics within each AOC.

Combination Mine AOC - Elevated metals concentrations at the Combination Mine AOC appear to be limited to waste rock in the Combination Mine waste rock pile and one isolated area near the lower extent of the South Soils Removal Area. Metals concentrations in samples from surface soils on the waste rock pile and in the Soils Removal Area, as well as soils underlying the waste rock samples, were approximately one to two orders of magnitude less than concentrations detected in the waste rock samples.

Tim Smith Mine AOC - The highest metals concentrations were detected in samples collected from the Tim Smith No. 1 Adit waste rock pile. Metals concentrations were notably higher in waste rock samples collected from the Tim Smith No. 1 Adit waste rock pile as compared to

metals concentrations in the one waste rock sample collected from the Tim Smith No. 2 Adit waste rock pile. Detected metals concentrations were substantially lower in soil samples collected below the waste rock and in the surface soil samples, as compared with waste rock samples. Metals concentrations detected in downslope sediment samples were approximately an order of magnitude lower than detected concentrations in waste rock samples.

Historic Mine AOC - Metals impacts appear to be limited to the visually apparent waste rock areas. The lowest metals concentrations were detected in the subsurface soil samples excavated along the upslope edge of the Harrison Shaft waste rock area, and the surface soil samples collected along the northern fringe of the Harrison Shaft waste rock area.

Combination Mill AOC – Metals concentrations were generally higher in tailings samples than in soil or sediment samples. Average concentrations of metals in sediment samples along South Fork Lower Willow Creek (SFLWC) downstream of the tailings impoundment showed higher than average concentrations than for subsurface soil samples collected from the tailings impoundment test pits or in sediment grid samples collected west of the tailings impoundment. Total recoverable metals concentrations and metals loading rates in surface water generally increase from upstream to downstream, where the largest increase in both metals concentrations and metals loading rates begin at the Combination Mill. Surface water flowing through the Combination Mill tailings impoundment and fluvially deposited tailings in the downstream floodplain are likely responsible for increased metals concentrations and loading rates in SFLWC.

Risk Assessments Conducted from Contaminated Material Sample Results

Human health and ecological risk assessments were performed following the RI to identify contaminants of concern (COCs) at BPM based on sample results from each AOC. The human health risk assessment identified COCs present in solid media as antimony, arsenic, and lead, while COCs present in surface water were identified as antimony, arsenic, lead, and mercury. Arsenic and lead were also identified as carcinogen COCs for recreational users.

The ecological risk assessment identified multiple COCs that affect the health of the ecosystem. COCs present in the surface water and sediments in South Fork Lower Willow Creek that pose a significant risk to the health of aquatic life include arsenic, cadmium, copper, lead, mercury, silver, and zinc. The COCs for terrestrial wildlife present at the BPM include antimony, arsenic, and lead. COCs for terrestrial plant communities include arsenic, cadmium, copper, lead, mercury, and zinc.

Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements (ARARs) are standards, requirements, criteria, or limitations promulgated under federal or state laws that specifically address a hazardous substance, pollutant, or contaminant at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. Requirements that are either "Applicable" or "Relevant and Appropriate" for BPM address a specific hazardous substance, pollutant, or contaminant; location; remedial action; problem; and/or situation similar to those encountered at a CERCLA site. Thus, any onsite removal actions completed at BPM must comply with and attain the more stringent federal or state ARARs.

ARARs are categorized as contaminant-specific, location-specific, or action-specific requirements. Each of these requirements assist in the development and selection of reclamation actions. The DEQ/AMLB has developed a summary of federal and state ARARs for reclamation projects that apply to BPM. These ARARs were referenced during the formulation of site-wide alternatives at BPM to ensure that reclamation activities would abide by and meet the contaminant-, location-, or action-specific requirements identified.

Reclamation Goals and Objectives

The overall objectives of reclamation at BPM are to reduce the current and/or threatened release of potentially hazardous substances to the environment, protect human health and the environment by minimizing direct contact with contaminants, and prevent degradation of adjacent lands. Attainment of these objections will be based on goals developed through regulatory and technical guidance (ARAR-based goals) and through risk-based goals developed for the site.

ARAR-based cleanup goals do not exist for soils or mine wastes and therefore apply to surface water and groundwater only. ARAR-based cleanup goals for surface water are derived from Montana's Circular DEQ-7 Water Quality Standards and ARAR-based goals for groundwater are the State of Montana Human Health Standards. Although the reclamation actions addressed in this EE/CA do not specifically address surface water or groundwater, the actions would likely improve surface water and groundwater quality through removal of potential sources of contamination.

Human and ecological health risk-based clean-up levels were developed in the RI using the DEQ RBCG for soil, sediment, and surface water. The risk-based cleanup goals are based on the most conservative thresholds between the aquatic life, ecological receptors, and human health communities.

Reclamation Options and Alternatives

Prior to identifying site-wide reclamation alternatives for BPM, process options were identified and evaluated in an initial screening process to pinpoint viable options to pursue for reclamation. The screening process involved the evaluation of three criteria: effectiveness, implementability, and cost. Process options were identified within the general response actions of no action, institutional controls, engineering controls, and treatment. Within those actions, process options were further segregated into reclamation technologies. Institutional controls cover access controls; engineering controls cover removal and containment, surface restoration, stream restoration, and physical hazard removal; and treatment covers soil media treatment. Numerous process options are contained within each of the reclamation technologies. Process options were either retained or discarded if the options showed poor results against the evaluation criteria or would be unable to attain the specified reclamation goals and objectives.

Process options that were retained were then assembled into site-wide alternatives. Those process options retained include 1.) no action; 2.) removal and containment: the removal of contaminated material with placement in either on onsite repository or offsite disposal

facility, select in-place capping of contaminated material, and removal of dispersed contaminated material on USFS administered lands; 3.) surface restoration: revegetation and rock cover; 4.) stream restoration: relocation and reconstruction of SFLWC and Mill Creek; 5.) physical hazard removal: adit closure and stabilization, building demolition, and building maintenance and protection.

Five site-wide reclamation alternatives were then assembled from these process options. A no-action alternative (Alternative 1) was retained for use as a baseline in which to compare the other alternatives. Excluding the no-action alternative, each alternative includes the restoration of SFLWC and Mill Creek, revegetation or rock cover, adit closure and stabilization, building maintenance and repair, and building demolition. The main removal mechanisms for each alternative are as follows:

- Alternative 2: select in-place capping and select removal of contaminated material with placement in an onsite repository,
- Alternative 3: select in-place capping and select removal of contaminated material with placement in an offsite disposal facility,
- Alternative 4: site-wide removal of contaminated material with placement in an onsite repository, and
- Alternative 5: site-wide removal of contaminated material with placement in an offsite disposal facility.

Similar to the evaluation of the process options, the same criteria of effectiveness, implementability, and cost were used to conduct a more thorough evaluation for each alternative. A comparative analysis was then done to assess each alternative's performance relative to the others based on effectiveness, implementability, and cost. From the results of the comparative analysis, Alternative 4 was selected as the preferred site-wide alternative.

Future Activities

To reduce human health and ecological risks due to the levels of toxic substances at BPM, reclamation will focus on removing antimony, arsenic, and lead from human exposure pathways associated with soil, tailings, waste rock, and sediments, and removing antimony, arsenic, lead, and mercury from exposure pathways associated with surface waters. A reclamation alternative for implementation at BPM will be selected following feedback received from DEQ/AMLB review and public comment regarding this EE/CA.

1.0 INTRODUCTION

This Engineering Evaluation/Cost Analysis (EE/CA) was conducted in accordance with Montana Department of Environmental Quality, Abandoned Mine Lands Bureau (DEQ/AMLB) Contract No. 407032 Task Order No. 19 and Contract No. 414036 Task Order No. 4. Under previous task orders, Herrera Environmental Consultants (Herrera) and Trihydro Corporation (Trihydro) prepared a Reclamation Work Plan (RWP), collected onsite field and laboratory data, and prepared a Reclamation Investigation (RI) report for the Black Pine Mine (BPM).

Work conducted as part of the RI identified the nature and extent of impacted wastes and physical hazards at BPM, and estimated the risks these hazards pose to human health and the environment. The primary conclusion of the RI Report was that site users and ecological receptors are at risk due to elevated metals concentrations in impacted surface water, mine wastes, soils, and sediments at the site. This EE/CA has been prepared in order to identify and evaluate source-control alternatives to address the risks posed by solid media. Site characterization results from the RI are used in this EE/CA to identify potential reclamation technology processes, assemble reclamation alternatives, and develop a preferred alternative for reclamation of BPM.

1.1. Purpose and Objectives

The purpose of an EE/CA is to propose an approach for substantial, prioritized risk reduction in a short time frame. The EE/CA is based on requirements of Section 300.415(b)(4)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), outlining non-time-critical removal actions, and the Montana Comprehensive Environmental Cleanup and Responsibility Act (CECRA). It is intended to: (1) satisfy environmental review requirements for removal actions; (2) satisfy administrative record requirements for unproved documentation of removal action selection; and (3) provide a framework for evaluating and selecting alternative technologies (EPA 1993a). In doing so, the EE/CA identifies objectives of the removal action and analyzes the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives (EPA 1993a).

The objective of this EE/CA is to screen process options and to develop and evaluate potential response alternatives appropriate for reclamation of mining wastes associated with BPM. This EE/CA focuses solely on source control, where contaminant sources are addressed through removal alternatives or other means. Sources of contaminated material at BPM consist of solid wastes such as tailings, sediments, soils, and waste rock piles. An adaptive management approach for surface water and groundwater is not addressed in depth in this EE/CA, and will be implemented following source reclamation activities. Surface water and groundwater will be monitored following reclamation activities and additional actions will be evaluated and implemented as necessary to meet water quality standards.

The alternatives are evaluated based on effectiveness, implementability, and cost. Effectiveness is evaluated in terms of protectiveness and ability to achieve the removal goals. Protectiveness of the alternatives is assessed in terms of how well they protect public health, the community, workers during implementation, and the environment, in addition to how well they comply with applicable or relevant and appropriate requirements (ARARs). Implementability of the alternatives is based on their technical feasibility, the availability of necessary resources to support the alternatives, and their administrative feasibility. Cost of the alternatives is determined by evaluating capital costs, as well as costs for post-removal site control, based on present worth (EPA 1993a).

Once the alternatives have been described and individually assessed against the criteria, a comparative analysis is conducted to evaluate the relative performance of each alternative in relation to each criterion. This process identifies key trade-offs affecting remedy selection, resulting in a preferred alternative recommendation (EPA 1993a).

1.2. Report Organization

This report is organized according to the standard DEQ format, with Sections 2 through 5 summarizing information compiled and generated through the RI process and Sections 6 through 10 identifying and screening candidate reclamation technologies, assembling alternatives, comparing alternatives, and selecting a preferred approach for site reclamation.

2.0 Site Background

This section discusses the site characteristics and background information at BPM relevant to this EE/CA.

BPM is located in the Flint-Rock drainage basin in Granite County, Montana (Figure 2-1). BPM consists of approximately 1,055 acres of patented mining claims and 157 unpatented lode claims on lands administered by the United States Forest Service (USFS). Due to the large size of the site, BPM was divided into four general areas of concern (AOCs) (Figure 2-2):

- Combination Mine AOC
- Tim Smith Mine AOC
- Historic Mine AOC
- Combination Mill AOC

2.1. Mining History

Mining began at BPM circa 1885, continuing with some interruptions until the early 1990s. Silver and copper were the primary metals mined. In 1887, the 10-stamp Combination Mill was constructed on the South Fork of Lower Willow Creek (SFLWC), which operated from 1887 to 1897 to extract silver from the ore mined in the area (DEQ 2009). Approximately 100,000 tons of ore were mined from BPM prior to 1897.

Little to no mining was performed at BPM from 1897 through 1928 due to a depressed metals market (Hydrometrics 2010). Production resumed in 1928 and roughly 39,000 tons of ore was mined from 1928 through 1947. Historic mining resulted in at least 20 levels and 14,000 feet of drifts, crosscuts, and shafts (Volin et al. 1952).

Following the end of the Second World War, mining was largely idle until 1974 when more modern mining was resumed by the Black Pine Mining Company, continuing sporadically through the early 1990s (Hydrometrics 2010). Ore mined during this period was transported to the Anaconda smelter for use as siliceous flux and for recovery of silver and copper. Mining activities were last conducted by ASARCO, Inc., which placed the mine on temporary shutdown status in the early 1990s (Hydrometrics 2010).

2.2. Site Setting

BPM is accessible by traveling south on Highway 1 (MT-1) approximately 24 miles from Exit 153 on Interstate 90, then traveling west and north via the Black Pine Road (County Road 178, and USFS Roads 448 and 678) approximately 8.5 miles. The site is located in Sections 7, 8, 9, 16, 17, 18, 20, and 21 in Township 8 North, Range 14 West, in Granite County, Montana. Site

elevations range from approximately 5,600 feet above mean sea level at the historic Combination Mill area to approximately 6,500 feet near the modern day Combination Mine.

BPM is comprised of a variety of mining impacted lands that include contaminated material accumulations and mine infrastructure such as adits, shafts, and buildings (Figure 2-3). Contaminated materials at BPM are potentially present in four types of media: surface water, soil (including tailings and waste rock), sediment, and groundwater. Elevated levels of metals are those that exceed the Montana statewide risk-based cleanup guidelines (RBCGs), 95th upper confidence limit (UCL), the "Montana Numeric Water Quality Standards" Circular DEQ-7 (Circular DEQ-7) human health standard (HHS), and the Circular DEQ-7 acute and chronic aquatic life standards (AALS and CALS, respectively)(DEQ 2012). Elevated levels of antimony, arsenic, cadmium, copper, lead, mercury, and manganese were found in tailings and waste rock samples. Surface water and groundwater samples showed elevated levels of antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc. Sediment samples showed elevated levels of antimony, arsenic, cadmium, lead, and manganese.

2.2.1. Geology and Soils

The geology near BPM consists of folded and faulted Precambrian sedimentary rocks that have been intruded by Cretaceous batholiths. The area is underlain by sedimentary rocks of Beltian age, including extensive areas of Newland and Spokane formations that are steeply tilted and faulted (DEQ 2009). Sedimentary rocks have been metamorphosed from contact with the intrusive igneous rocks. Diopside, epidote, and magnetite were formed in impure Newland limestone.

At BPM, the Spokane Formation (the oldest of the Precambrian units), consists of thin-bedded siltstone, sandstone and shale, and massive quartzite (Wollenberg et al. 1980). The rocks at the mine strike N 10˚ to 30˚ W and dip from 10˚ to 30˚ SW.

Ores are found only in the sedimentary formations, including fissure veins in quartzite and replacement veins along fissures in limestone and calcareous shales (DEQ 2009). Four mineral veins have been identified in BPM: Upper, Tim Smith, Combination, and Onyx. The Combination vein has been the primary focus of mining at the site, which contains elevated silver concentrations (DEQ 2009). This vein is a fissure-filling located along a single bedding plane that has been displaced by normal faulting (Hydrometrics 2010).

2.2.2. Hydrogeology

Groundwater flow through contaminated material, interaction with abandoned mine workings, and recharge from naturally mineralized bedrock are potential sources of metals loading to surface water and groundwater at BPM. Review of historic groundwater sample results indicates elevated metals concentrations in groundwater in and downgradient from the Combination Mine waste rock pile (Hydrometrics 2010). Monitoring wells have been installed to collect data for evaluation of groundwater and surface water interactions evidenced by seeps noted below the toe of the Combination Mine waste rock pile (Figure 2-4).

As part of post-mining assessment of environmental conditions and reclamation needs at BPM, ASARCO installed monitoring wells in the Combination Mine AOC in 2001. Four monitoring

wells were installed, and are located in and downslope of the Combination Mine waste rock pile; One well (CMMW-2) was installed along the crest of the waste rock pile, a second well (CMMW-1) was installed at the toe of the waste rock pile, and two other wells (CMMW-3 and CMMW-4) were installed downgradient in the North Soils Removal Area. In 2007, shallow piezometers were installed at three locations (CMPZ-3S, CMPZ-3D, and CMPZ-4) near CMMW-3 and CMMW-4; only CMPZ-4 yielded sufficient water for sampling in May 2007. Additional monitoring wells were installed in 2008 to evaluate flow through the Combination Mine waste rock pile and to monitor downgradient groundwater quality. Two wells (CMMW-5 and CMMW-6) were installed in the crest of the waste rock pile and three wells (CMMW-7, CMMW-8, and CMMW-9) were installed along the toe of the waste rock pile.

2.2.3. Hydrology

Drainage along the western, southern, and northern portions of BPM, including the Combination Mill, Tim Smith Mine, and Historic Mine Areas, flows to the SFLWC, which is part of the Flint-Rock Basin (hydrologic unit code [HUC] 17010202). Drainage from these areas includes the ephemeral Mill Creek and the Tim Smith drainages.

Tailings from the Combination Mill area have been transported and deposited throughout the downstream reaches of SFLWC (MCS 2004). A large magnitude flood in 1989, which followed a forest fire in the upper reaches of the watershed, mobilized a large volume of tailings from the Combination Mill site that were fluvially deposited in floodplain areas and behind several beaver dams located along SFLWC (MCS 2004).

Drainage along the eastern portion of BPM, which includes the Combination Mine Area, flows to Smart Creek, which also is part of the Flint-Rock Basin (Figure 2-5). Several seeps emanate from or downslope of the Combination Mine waste rock pile. Efforts to reduce and/or control metals-bearing seeps and runoff were undertaken beginning in 2001 with the construction of a seepage collection and pumpback system. The seepage collection and pumpback system consists of a series of French drains that drain to a wet vault downgradient of the waste rock pile. The pumpback system pumps the collected surface water into the Combination Mine Auxiliary Adit, where it collects in the underground mine workings, adding to the existing Combination Mine pool (mine pool). The Combination Mine waste rock pile was regraded and capped between 2004 and 2006. Surface soils from the Combination Mine Soils Removal Areas were excavated and incorporated with the waste rock as part of the waste rock regrading and capping. Review of sample and analytical results since installation of these measures indicates a reduction in seep metals concentrations, although elevated concentrations, as compared to background conditions, still exist in both the downslope soils and water collected from seeps (Hydrometrics 2010).

Installation of the seepage collection/pumpback system appears to be influencing the mine pool elevation. The water level in the mine pool has increased since installation of the seepage collection/pumpback system. Prior to the installation of the system, the mine pool was measured at approximately 6,000 feet. The mine pool was measured at a high in July of 2011 at approximately 6,100 feet or a 100 foot increase over the 10 years since the system was installed. The increase in the mine pool may be affecting the quantity and chemistry of

the downgradient seeps. This connection will be investigated further during future investigations.

2.2.4. Vegetation and Wildlife

BPM is characterized by native and introduced vegetation species. These plants are mainly growing on undisturbed areas around the site, since little or no vegetation is able to grow on tailings piles, waste rock piles, and the Combination Mine Soils Removal Areas downslope from the Combination Mine.

Dominant trees include lodgepole pine (Pinus contorta), Engelmann spruce (Picea engelmannii), Douglas fir (Pseudotsuga menziesii), and Ponderosa pine (Pinus ponderosa) (MCS 2004). Shrubs and other vegetative species include grouse whortleberry (Vaccinium scoparium), snowberry (Symphoricarpos alba), and blue huckleberry (Vaccinium globurlare) (MNHP 2010).

The habitat supports a variety of large mammals (deer, elk, moose, black bear, bobcat, and beaver), small mammals (rabbit, squirrel, mouse, and vole), and birds (owls, eagles, and raptors) (MNHP 2010).

2.2.5. Land Use and Population

BPM is located on private land surrounded by the Beaverhead-Deerlodge National Forest. The primary land use in the vicinity of the site is recreational. The population in Granite County is 3,079 people, with an average of 1.8 persons per square mile (USCB 2013).

2.2.6. Climate

Average monthly temperatures range from a high of 66°F to a low of 42°F in July and a high of 39°F to a low of 3°F in January. Average annual precipitation is 24 inches, with May and June being the wettest months of the year. Precipitation is mostly in the form of snow during the winter months, snow and rain during the spring and fall, and rain during the summer. Climate information was obtained from measurements at the Black Pine Snotel (#349) (NWCC 2011).

2.2.7. Land Ownership

The current owner of BPM is the Montana Environmental Trust Group, LLC (Trust). The site was previously owned by the American Smelting and Refining Company (ASARCO). The surrounding land is administered by the USFS.

2.3. Areas of Concern

Due to the large size of the site, BPM was divided into four AOCs. The following sections describe the AOCs, including Combination Mine, Tim Smith Mine, Historic Mine, and Combination Mill.

2.3.1. Combination Mine AOC

The Combination Mine AOC is located along the eastern edge of BPM (Figure 2-6). The Combination Mine AOC is upstream of Smart Creek, which is a tributary to Flint Creek, and is bounded to the east and south by USFS administered lands. The Combination Mine AOC is approximately 165 acres, including the Combination Mine Auxiliary Adit, Combination Mine Adit, mine facilities, Combination Mine waste rock pile, seepage collection/pumpback system, and Combination Mine Soils Removal Areas. The Combination Mine waste rock pile contains an estimated 232,200 cubic yards (cy) of material, including 29,000 cy of clean cover material over the consolidated waste rock. The volume of contaminated material in the Combination Mine waste rock pile is approximately 203,200 cy. An additional 5,000 cy of material is located downslope in the Combination Mine Soils Removal Areas, specifically within the South Soils Removal Area. Figure 2-7 shows an approximate profile of contaminated material used to obtain the volume estimate for the Combination Mine waste rock pile.

2.3.2. Tim Smith Mine AOC

The Tim Smith Mine AOC contains approximately 22,650 cy of contaminated material and includes the Tim Smith No. 1 Adit and waste rock dump, the Tim Smith No. 2 Adit and waste rock dump, and related mine facilities (Figure 2-8). The Tim Smith Mine AOC is approximately 430 acres located in the central and southern portions of the site, upstream of SFLWC. The Tim Smith No. 1 Adit, Tim Smith No. 2 Adit, and associated waste rock dumps are among the most recent mining disturbances at BPM, originating from mining which began in 1992 (McCulloch 1993).

2.3.3. Historic Mine AOC

The Historic Mine AOC contains approximately 13,350 cy of contaminated material and is approximately 240 acres located along the northern edge of the site, upstream of and along Mill Gulch. The Historic Mine AOC includes the Lewis Shaft, Harrison Shaft, Harper Shaft, Barret Shaft, Williams No. 1 Shaft, Williams No. 2 Shaft, Williams No. 3 Shaft, Combination No. 1 Adit, Combination No. 2 Adit, and Buenaventura Adit (Figure 2-9).

2.3.4. Combination Mill AOC

The Combination Mill AOC is 220 acres located on the western edge of BPM, along SFLWC. The Combination Mill AOC includes the historic Combination Mill and tailings impoundment, the "Old Mill", and impacted tailings and sediments downstream along SFLWC (Figure 2-10). Contaminated material identified in the Combination Mill AOC includes 128,300 cy associated with the Combination Mill tailings impoundments and adjacent soils and sediments, and 19,700 cy associated with dispersed sediments and tailings downstream along SFLWC on USFS administered lands.

3.0 CONTAMINATED MATERIAL CHARACTERISTICS AND SUMMARY OF EXISTING DATA

This section provides an overview of past sampling and associated reclamation activities at BPM. The results from prior sampling activities were used to identify sample locations in the 2011 RI and to fill in any missing data gaps for the EE/CA development. Soil/sediment and water sample data collected from 2011 are presented in Tables 3-1 through 3-14, with sample locations shown in Figures 3-1 through 3-6. Soil/sediment and water sample data collected from 1981 to 2010, along with corresponding sample locations, are presented in Appendix A on Figures A-1 through A-5.

3.1. Previous Investigations

3.1.1. 1981 Baseline Hydrologic Data Collection

In 1981, Hydrometrics, Inc. (Hydrometrics) completed a baseline hydrologic study that reviewed existing information and collected additional data from the Smart Creek, SFLWC, and Marshall Creek drainages. Data collection consisted of eight surface water samples and an inventory of springs/seeps. The samples were submitted to the laboratory for analysis of specific conductance, turbidity, total suspended solids, total dissolved solids, pH, common ions, nutrients, and metals (total and dissolved) (Hydrometrics, 2010). Sample locations are shown on Figure 2-4 and in Appendix A on Figures A-1 and A-2.

3.1.2. 1988-1990 Surface Water and Sediment Sampling

USFS completed surface water and sediment sampling in the SFLWC drainage from 1988 through 1990. The sample locations were described in relation to the Combination Mill ('above' or 'below'); therefore, exact sample locations are unknown. Surface water samples were collected in 1988 and 1990. These samples were analyzed for metals, nutrients, and common ions. Sediment samples were collected in 1988, 1989, and 1990, and were analyzed for metals.

In 1990, ASARCO collected surface water and soil/tailings samples near the Combination Mill to compare with USFS data. Six surface water samples and four soil/tailings samples were collected and submitted for laboratory analysis. Surface water samples were analyzed for metals, total dissolved solids, and total suspended solids. The soil/tailings samples were analyzed for total metals (Hydrometrics, 2010).

3.1.3. 1991 Combination Mill Surface Water and Solids Sampling

USFS sought further site characterization due to concerns that USFS administered lands adjacent to the Combination Mill were being impacted by the upstream tailings impoundment. The concern was that mine-related contamination from tailings and soil piles located within the floodplain of SFLWC had been transported into the creek through erosion

and surface water runoff, and deposited on USFS administered lands. The USFS contracted Schafer and Associates to complete the investigation (Hydrometrics, 2010).

In 1991, Schafer and Associates collected soils, tailings, surface water and sediment samples. Four water samples, 15 soil/tailings samples, and 10 sediment samples were submitted for laboratory analysis. Additionally, 80 pH measurements were taken from the 52 test pits excavated within the contaminated floodplain (Hydrometrics, 2010). Sample locations are shown in Appendix A on Figures A-2 and A-3.

3.1.4. 1993-1995 Combination Mill Inventory Site Investigations

Sampling conducted from 1993 through 1995 was performed by Pioneer Technical Services Inc. (Pioneer), on behalf of the Department of State Lands, Abandoned Mines Reclamation Bureau. The purpose of this investigation was to create an inventory of contamination present at the Combination Mill.

Pioneer conducted two sampling events over the two-year period. The first sampling event was conducted in 1993 and included seven surface water samples, one shallow groundwater sample, five sediment samples, and soil/tailings samples from four excavation test pits. Water samples were analyzed for common ions and metals, while sediment samples were analyzed for metals only. The soil/tailings samples were individually analyzed in the field for total metals using x-ray fluorescence (XRF). Subsequently, the soil/tailings samples were combined into a composite sample that was submitted for laboratory analysis of total metals and acid-base accounting (ABA).

The second sampling event was conducted in 1995 and specifically targeted the downstream area of the Combination Mill and tailings impoundment. Pioneer collected four surface water samples, four sediment samples, and soil/tailings samples from 12 test pits. Water and sediment samples were analyzed for the same constituents as the 1993 samples. Soil/tailings samples were field screened for total metals by XRF and then combined into a composite sample that was submitted for laboratory analysis of total metals, ABA, and cyanide (Hydrometrics, 2010). Sample locations are shown in Appendix A on Figures A-2 and A-3.

3.1.5. 1995-2010 BPM Permit Sampling

DEQ Hard Rock Mining Program began conducting periodic sampling events in 1995 to comply with the BPM operating permit. Between 1995 and 2010, eight sampling events were conducted that consisted of surface water, spring/seep, and soil samples. Documented compliance inspections included 16 surface water samples, three water samples from the mine pool, nine groundwater samples, and eight soil samples. Sample locations varied throughout these compliance inspections, with some locations selected based on surface water runoff patterns and the location of ephemeral streams.

Site characterization and reclamation activities completed by ASARCO at BPM during this time were done in coordination with the DEQ Hard Rock Mining Program and the USFS (Hydrometrics, 2010).

3.1.6. 2000-2010 Environmental Assessment and Reclamation Planning – Combination Mine

From 2000 to 2010, Hydrometrics worked with ASARCO and DEQ to evaluate environmental conditions and reclamation needs at BPM.

In 2000, Hydrometrics performed a site reconnaissance and spring/seep inventory. Samples were collected from surface water, water in the mine pool, and spring/seep water downgradient of the Combination Mine waste rock pile. Additionally, Hydrometrics collected and submitted soil and waste rock samples from locations downgradient of the Combination Mine main adit and began excavating soil test pits to characterize potential borrow locations in anticipation of future reclamation activities.

To account for seasonal variability, site characterization continued throughout 2001. Supplementary samples of impacted soil and waste rock, potential borrow soil, and surface/seep/spring water were collected. In addition, four groundwater monitoring wells (CMMW-1, CMMW-2, CMMW-3, and CMMW-4) were installed.

During the 2001 investigation work, ASARCO constructed a water collection system at the Combination Mine, the purpose of which is to minimize transport of metals-bearing surface runoff and shallow groundwater. This system gathers seep/spring water from two discrete locations downgradient of the Combination Mine and pumps the water directly to the mine pool, or, during high flow periods, to an interim lined containment pond for storage. The containment pond also collects seasonal flows from seepage collection pipes beneath the Combination Mine waste rock pile. Stored water from the containment pond is pumped uphill to the mine pool through the Combination Mine auxiliary adit.

Following a report of the data collected in 2000 and 2001 by Hydrometrics, ASARCO began reclamation activities associated with the Combination Mine waste rock in 2004. The reclamation activities were completed in 2006 and included:

- Relocation of a portion of USFS Road 448,
- Re-grading the waste rock pile from its original 2:1 slope to a more stable 3.5:1 slope,
- Capping the top of the waste rock pile with a PVC liner and drain layer, and placing approximately three feet of clean earthen material over the top and side slopes of the waste rock pile,
- Diversion of storm water run-on and collection of storm water run-off surrounding the waste rock pile, and
- Excavation of contaminated material from the drainage below the Combination Mine waste rock pile and relocation of contaminated material to the waste rock pile.

During the two-year reclamation construction period, Hydrometrics performed additional water sampling for ASARCO at the request of the DEQ Hard Rock Mine Permitting Bureau. Samples were taken from previously established groundwater, surface water, and spring/seep locations, in addition to the lined containment pond, surface water inflow to the containment pond, and surface water runoff below the Combination Mine waste rock pile.

Water quality monitoring continued from 2006 through 2010, and the results were presented in the Interim Status Report for the Black Pine Mine (Hydrometrics, 2007). Sampling dates and locations throughout this time period were as follows:

- 2006 – Two water sampling events conducted at previously established groundwater, surface water, and/or spring/seep locations.
- 2007 – Four water sampling events conducted at previously established groundwater, surface water, and/or spring/seep locations. Installation of four shallow piezometers, of which only one contained sufficient water to obtain a sample.
- 2008 – Four water sampling events conducted at previously established groundwater, surface water, spring/seep, and/or piezometer locations. Installation of five additional groundwater monitoring wells.
- 2009 – One water sampling event conducted at previously established groundwater, surface water, spring/seep, and piezometer locations.
- 2010 – Two water sampling events conducted at previously established groundwater, surface water, and/or spring/seep locations.

Sample locations are shown on Figure 2-4 and in Appendix A on Figure A-4.

3.1.7. 2000-2010 Environmental Assessment and Reclamation Planning – Tim Smith Mine

In conjunction with site reconnaissance at the Combination Mine, ASARCO worked with Hydrometrics and DEQ to perform environmental assessment and reclamation planning at the Tim Smith Mine beginning in 2000. Initial sampling included water pooled within the Tim Smith mine workings and surface/spring/seep water downgradient of the Tim Smith Mine. Water sampling continued throughout 2001 to establish a baseline for water quality in the area and to account for seasonal variability. Additionally, four composite waste rock samples were collected in 2001.

Hydrometrics continued surface/spring/seep water sampling events downgradient of the Tim Smith Mine throughout ASARCO's reclamation activities at the Combination Mine. Sampling events were conducted in 2004 and 2005. After completion of the Combination Mine reclamation activities, sampling events temporarily ceased at the Tim Smith Mine. No samples were collected in 2006, 2007, 2008, or 2010, although one surface water sample (TSP-9) from the Tim Smith Mine was collected in 2009.

Although no reclamation took place at the Tim Smith Mine from 2000 to 2010, Hydrometrics calculated that approximately 23,500 cy and 9,200 cy of waste rock existed within the Tim Smith No. 1 and Tim Smith No. 2 waste rock piles, respectively.

Sample locations are shown in Appendix A on Figure A-1.

3.1.8. 2005-2009 Total Maximum Daily Load (TMDL) Sampling

In 2005, DEQ initiated a TMDL program to monitor the local watershed. The TMDL program sought to characterize the surface water throughout the watershed and define the extent of mine-related impacts. Streams in close proximity to historical mine infrastructure and areas with contaminated materials, as well as areas upstream and downstream from directly impacted areas, were periodically sampled.

Sample locations are shown in Appendix A on Figures A-2 and A-3.

3.2. 2011-2012 Reclamation Investigation

In 2011, DEQ/AMLB contracted Herrera, under Contract No. 407032, to conduct a RI. Herrera prepared a RWP, collected field and laboratory data, and prepared a RI report. The RI report delineates the nature and extent of contaminated material at the site, estimates the risk that these materials may pose to human health and the environment, and analyzes data pertinent to potential reclamation alternatives.

3.2.1. Background Samples

In order to evaluate preexisting conditions, quantify site-specific background concentrations, and determine the applicable RBCGs, background samples were collected for soil (Table 3-1) and surface water during the RI. Analytical results from the background samples were compared to the statewide DEQ RBCGs for each corresponding contaminant of concern (COC). Where the background sample results were less than the statewide RBCG, the statewide RBCG became the applicable guideline. Where the background concentrations exceeded the RBCG, the site-specific RBCG was determined using the 95th UCL of the arithmetic mean for all background samples taken at BPM. For example, the statewide DEQ RBCG for arsenic in soil is 0.7 mg/kg, whereas the site-specific RBCG for arsenic was determined to be 40.4 mg/kg, indicating a relatively high naturally occurring concentration of arsenic in the vicinity. Arsenic was the only COC for which there was a site-specific RBCG.

Background sampling during the RI consisted of two surface water samples and eight soil samples. Initially, the RWP detailed four background soil samples, BG-SS-01 through BG-SS-04; however, the risk assessment determined that soil samples taken as part of the repository investigation doubled as background samples. The two surface water background samples, TSP-9 and TSP-10, were taken in the Tim Smith drainage upgradient of the Tim Smith Mine.

To formulate reclamation recommendations, site-specific RBCGs were compared to analytical results to identify hazards at BPM.

3.2.2. Solid-Matrix Samples

Solid-matrix samples of waste rock, tailings, soil, and sediment were collected during the RI. Sampling methodology was described in the RWP, with deviations presented in section 2.3 of the RI report. Total recoverable metal concentrations for waste rock, tailings, soil, and sediment were compared to the site-specific RBCGs. A summary of the contaminated material characterization and solid-matrix sampling conducted at each AOC is described below.

Combination Mine AOC

Solid-matrix sampling at the Combination Mine AOC included collection of four waste rock samples and 27 soil samples. Figures 3-1 and 3-2 show the waste rock and soil sampling locations. All of the samples were analyzed for total recoverable metals and moisture content (Table 3-2). Twenty-one of the samples, including both waste rock and soil, were also analyzed for ABA (Table 3-3).

Elevated metals concentrations were observed in all of the waste rock samples, one surface soil sample collected near the lower extent of the South Soils Removal Area, and one composite soil sample collected from the northwestern soil stockpile in the Central Processing building.

Metals concentrations of antimony, arsenic, cadmium, copper, lead, iron, silver, and zinc in the four waste rock samples increased with sample depth. Concentrations of antimony, arsenic, and lead exceeded RBCGs in all waste rock samples, and elevated concentrations of copper and manganese were observed.

Surface and subsurface soil samples were taken from three waste rock test pits and eight test pits in and downgradient of the Combination Mine Soils Removal Area. Additionally, surface soil samples were collected north of the Combination Mine waste rock and Soils Removal Areas on USFS administered lands. Concentrations of antimony, arsenic, cadmium, copper, lead, and manganese exceeded RBCGs in these samples.

The acid base potential, or net neutralization potential, falls within the -20 t/kt to +20 t/kt, which is considered to have uncertainty and the potential to generate acid exists (EPA 1994). Lime amendments, if necessary, are low and would require a maximum of 13 tons of lime for every 1,000 tons of contaminated material.

Tim Smith Mine AOC

Eleven solid-matrix samples were collected from the Tim Smith Mine AOC, including three waste rock samples, five soil samples, and three sediment samples. Figure 3-3 shows the waste rock, soil, and sediment sampling locations. All of the samples were analyzed for total recoverable metals and moisture content (Table 3-4), while only the three waste rock samples were analyzed for ABA (Table 3-5).

The highest metals concentrations were detected in samples collected from the Tim Smith No. 1 Adit waste rock dump. Detected concentrations of antimony, arsenic, copper, lead, mercury, iron, and silver were significantly higher in these samples than concentrations in samples from underlying soils (overlying soils showed similarly high metals concentrations). The waste rock samples had RBCG exceedances for antimony (locations TS-RS-01 and TS-RS-03), arsenic (all three locations), and lead (locations TS-RS-01 and TS-RS-03). Concentrations in the waste rock samples for other metals did not exceed the RBCGs, although elevated concentrations of copper and zinc were observed at locations TS-RS-01 and TS-RS-03.

The five soil samples collected at the Tim Smith Mine AOC were taken from soils above or below the waste rock in the five excavated test pits. Three of the test pits were located in the Tim Smith No. 1 Adit waste rock dump while the remaining two were located within Tim Smith No. 2 Adit. Metals concentrations, excluding arsenic, were below the DEQ RBCGs; arsenic exceeded the 95th UCL in three of the five soil samples.

Sediment samples were collected downgradient of the Tim Smith No. 1 Adit waste rock dump. Elevated concentrations of manganese, mercury, nickel, and zinc were observed in the sediment samples. Other metals concentrations were approximately an order of magnitude less than those observed in the waste rock dump at Tim Smith No. 1 Adit. With the exception of manganese, mercury, and nickel, metals concentrations decreased downgradient.

The three waste rock samples from the Tim Smith Mine AOC were analyzed for ABA. The acid base potential, or net neutralization potential, falls within the -20 t/kt to +20 t/kt, which is considered to have uncertainty and the potential to generate acid exists (EPA 1994). Lime amendments, if necessary, are low and would require a maximum of 5.4 tons of lime for every 1,000 tons of contaminated material.

Historic Mine AOC

At the Historic Mine AOC, solid-matrix sampling consisted of twelve waste rock samples, eight surface and three subsurface soil samples, and one sediment sample. Figure 3-4 shows the waste rock, soil, and sediment sampling locations. All of the samples were analyzed for total recoverable metals and moisture content (Table 3-6). Eight of the twelve waste rock samples were analyzed for ABA (Table 3-7).

The twelve waste rock samples were collected from eight test pit locations. Four test pits were located downgradient of the Harrison Shaft, three test pits were located downgradient of the Harper Shaft, and the remaining test pit was located northwest of the Lewis Shaft. Elevated metals concentrations were detected in most of the waste rock samples and are highest along the downslope edge of the Harper Shaft waste rock area and lowest in the test pit near Lewis Shaft. Concentrations of antimony, arsenic, cadmium, lead, and manganese exceeded RBCGs in waste rock samples.

Three subsurface soil samples were collected from beneath waste rock material; one of the three samples, located beneath the Harper Shaft waste rock pile, contained lead at a concentration exceeding the RBCG. Out of the eight surface soil samples: four were taken downgradient of the Harrison Shaft, two downgradient of the Harper Shaft, and two

downgradient of the Lewis Shaft. Concentrations of antimony, arsenic, lead, and manganese exceeded RBCGs in surface soil samples.

The sediment sample was collected from the Mill Creek drainage downslope of the waste rock areas. Metals concentrations in the sediment sample were similar to those seen in upgradient soil samples. Concentrations of manganese exceeded RBCGs and elevated concentrations of copper and mercury were observed.

Eight waste rock and eight surface soil samples were collected at the Historic Mine AOC and analyzed for ABA. The acid base potential, or net neutralization potential, falls within the -20 t/kt to +20 t/kt, which is considered to have uncertainty and the potential to generate acid exists (EPA 1994). Lime amendments, if necessary, are low and would require a maximum of 16.9 tons of lime for every 1,000 tons of contaminated material. The results for HM-SS-16, located near the Lewis Shaft, indicate this material has the largest potential for generating acid.

Combination Mill AOC

Sampling performed at the Combination Mill AOC included nine subsurface soil samples, 52 sediment samples, and 22 tailings samples. Figures 3-5 and 3-6 show the soil, sediment, and tailings sampling locations. All of the samples were analyzed for total recoverable metals and moisture content (Table 3-8), while ABA analysis was only performed on nine of the tailings samples (Table 3-9).

The 22 tailings samples were collected from 10 test pits at the Combination Mill AOC. Eight of the test pits were excavated in the tailings impoundment, one was excavated near the foundation of the Combination Mill, and the remaining test pit was located near the "Old Mill". Concentrations of antimony, arsenic, cadmium, lead, manganese, and mercury exceeded RBCGs.

The nine subsurface soil samples were taken from beneath the tailings. Eight of the soil samples were taken from the eight test pits dug in the tailings impoundment. The remaining soil sample was taken from the test pit dug near the "Old Mill". Concentrations of antimony, arsenic, cadmium, lead, and manganese exceeded RBCGs. Elevated concentrations of mercury and copper were also observed in the soil samples.

Fifty-two sediment samples were collected from 45 sample locations within the SFLWC floodplain. Four samples (CML-SD-01 through CML-SD-04) were collected from four TMDL sites; two samples were collected from ponds located on the tailings impoundment (CML-SD-06 and CML-SD-07); one sample was collected from near the confluence of the Tim Smith drainage and SFLWC (CML-SD-05); nine samples were taken downstream of the Combination Mill and tailings impoundment; and the remaining samples were collected in a grid located west of the tailings impoundment. Metals concentrations decreased the further downstream from the Combination Mill and tailings impoundment that the sample was taken, but were dependent on the location of individual samples. Samples that were located based on visual observation of apparent tailings or impacted sediments exhibited higher metals concentrations. Five sediment sample locations (CML-SD-17, CML-SD-16, CML-SD-15, CML-SD-14, and CML-SD-13)

were identified in the field to target suspected tailings depositional areas downstream of the tailings impoundment along SFLWC. Samples collected at three of these locations (CML-SD-17, CML-SD-16, and CMLSD-15) contained the highest metals concentrations of the sediment samples collected during the RI. Results for these samples more closely match the results for tailings samples. CML-SD-14, which contained elevated metals concentrations as compared to other sediment samples, was collected in an area devoid of vegetation and associated with a former tailings reprocessing area on USFS administered lands. Concentrations of antimony, arsenic, cadmium, lead, and manganese exceeded RBCGs. Elevated concentrations of mercury and copper were observed in a number of sediment samples.

Nine tailings samples were collected and analyzed for ABA from the Combination Mill AOC. The acid base potential, or net neutralization potential, falls within the -20 t/kt to +20 t/kt, which is considered to have uncertainty and the potential to generate acid exists (EPA 1994). Lime amendments, if necessary, are low and would require a maximum of 8.1 tons of lime for every 1,000 tons of contaminated material. CML-TS-05, located centrally in the north tailings impoundment, has the only negative net neutralization potential observed, indicating that acid potential is larger than the neutralization potential.

3.2.3. Water-Matrix Samples

Water-matrix sampling at the four AOCs included surface water (grab and synoptic) and groundwater sampling. A summary of the water-matrix sampling, including contaminated material characterization, conducted at each AOC during the RI is included below. Field duplicates are not included in the sample collection totals.

Combination Mine AOC

Water-matrix sampling at the Combination Mine AOC consisted of 10 surface water/seep samples and nine groundwater samples (Figures 3-1 and 3-2). Water quality parameters were taken in the field at each sample location. Samples were submitted to Pace Analytical for analysis of total recoverable metals (surface water), total dissolved metals (groundwater), and laboratory parameters (Tables 3-10 and 3-11). Analytical results were compared to the DEQ RBCGs and/or the DEQ-7.

While metals concentrations in a number of surface water samples exceeded either the DEQ RBCGs or DEQ-7 standards, the highest metals concentrations were detected in the samples collected four locations: CPS-1, a seep located in the lower portion of the North Soils Removal Area; CPS-7A , a seep located on the northern/midslope border of the South Soils Removal Area; CPS-10B, a seep located mid-slope in the North Soils Removal Area; and DTRD, located along the toe of the Combination Mine waste rock pile. Cadmium, copper, lead (except CPS-1), manganese, and zinc concentrations detected in samples from these locations were roughly one order of magnitude higher than concentrations detected in samples from other locations. Concentrations of arsenic, cadmium, copper, iron, manganese, and zinc exceeded both the DEQ RBCGs and the DEQ-7 standards, while the only lead exceeded the DEQ-7 standard.

Review of the historical surface water data indicates that metals concentrations have declined substantially since grading and capping of the waste rock and installation of the seepage collection pumpback system were completed. While metals concentrations declined following the 2003 to 2006 reclamation work, the reduction trend appears to have slowed.

Dissolved metals analytical results for the nine groundwater samples collected from the Combination Mine groundwater monitoring wells were compared to DEQ-7 groundwater standards. The concentration of at least one metal exceeded the applicable DEQ-7 standard in each of the samples. The highest metals concentrations were detected in samples from CMMW-3, located in the upper portion of the North Soils Removal Area; CMMW-5, located in the crest of the Combination Mine waste rock pile; and CMMW-7, located at the top of the North Soils Removal Area. The lowest concentrations were detected in CMMW-1, located in the upper portion of the South Soils Removal Area, and CMMW-6, located along the northern crest of the Combination Mine waste rock pile.

Review of the groundwater analytical results did not reveal notable differences in metals concentrations between monitoring wells screened in bedrock (CMMW-1, CMMW-3, CMMW-6, CMMW-7, and CMMW-8) and monitoring wells screened in soil (CMMW-2, CMMW-4, CMMW-5, and CMMW-9 [interface between bedrock and overburden]). Additionally, there were no notable differences in samples collected from wells screened shallow compared to those screened deeper. Metals concentrations do not exhibit notable trends through the groundwater samples.

Based on a limited number of sampling events, the 2011 RI data does not vary remarkably from historical data. However, detected metals concentrations in groundwater samples are approximately an order of magnitude lower than concentrations detected in surface water/seep samples.

Tim Smith Mine AOC

During the 2011 RI, five surface water samples were collected from springs/drainages associated with the Tim Smith Mine AOC (Figure 3-3). Field parameters were collected for each water sample and the samples were submitted for laboratory analysis of total recoverable metals and laboratory parameters (Table 3-12).

The detected metals concentrations in surface water samples collected at the Tim Smith Mine AOC were one to two orders of magnitude lower than concentrations in surface water/seep samples collected at the Combination Mine AOC. Metals concentrations did not vary significantly from upstream to downstream locations and there was not one sample that had significantly higher concentrations than other samples. Copper concentrations increased moving downstream; 8.9 µg/L at TSP-9 compared to 22.5 µg/L at TSP-6. Conversely, manganese concentrations were higher in upstream samples (18.8 µg/L in TSP-9 and 52.6 µg/L in TSP-10) than in downstream samples (8.9 µg/L in TSP-6). Metals concentrations detected in TSP-10, located upgradient form the Tim Smith Adit No. 1, were higher than downstream samples for arsenic, iron, lead, and manganese.

Historic Mine AOC

Two surface water samples were collected at the Historic Mine AOC (Figure 3-4). One sample location coincided with the routine surface water monitoring location, MCSP-1. The second location (Road Cut) was identified in the field during the sampling event and was located adjacent to the south side of the road from the Lewis Shaft to the Combination Mill. This sample location may collect surface runoff from the Tim Smith No. 2 Adit waste rock dump and from portions of the Lewis Shaft area. Field parameters were collected for each water sample and the samples were submitted to Pace Analytical for analysis of total recoverable metals and laboratory parameters (Table 3-13). Analytical results were compared to DEQ RBCGs and DEQ-7 standards.

The detected metals concentrations in surface water samples collected at the Historic Mine AOC were similar to, but lower than, concentrations in surface water/seep samples collected at the Combination Mine AOC. Higher metals concentrations were detected in the Road Cut sample than MCSP-1, with the exception of cadmium, copper, and zinc. Arsenic and zinc concentrations exceeded RBCGs in some samples, with elevated non-exceedance levels observed for iron. Concentrations of cadmium, copper, iron, and lead exceeded the DEQ-7 standards in one or both of the samples, while the reporting limit was not low enough to determine if silver exceedances had occurred.

Combination Mill AOC

There were 18 surface water samples taken in association with the Combination Mill AOC (Figures 3-5 and 3-6). Sixteen of the surface water samples were taken in conjunction with the 2011 synoptic sampling event along SFLWC, while the remaining two samples were collected from the north sediment pond located near the Trust property boundary and the south sediment pond adjacent to Mill Creek. Analytical results for the surface water samples (Table 3-14) were compared to DEQ RBCGs and DEQ-7 water quality standards. A brief summary of the comparison is included below, while a more detailed summary can be found in the RI report.

Concentrations of antimony, arsenic, lead, manganese, mercury, and/or zinc exceeded RBCGs in some samples. Concentrations of antimony, arsenic, cadmium, copper, iron, lead, mercury, silver, and zinc exceeded DEQ-7 standards. The RI report includes a series of graphs that plot metals loading concentrations versus distance downstream along SFLWC and its tributaries using the 2011 synoptic sampling data.

3.2.4. Synoptic Sampling

Synoptic sampling on SFLWC was conducted in spring 2011 and late summer 2012. Sediment and surface water samples were collected during both events. 2011 synoptic sampling locations are shown in Figures B-1 and B-2 and 2012 synoptic sampling locations are shown in Figure B-3 in Appendix B. Detailed 2012 synoptic sampling locations are presented in the Synoptic Sampling Data Summary and Analysis Report (Herrera 2012b).

Synoptic sampling conducted in 2011 during spring snowmelt conditions indicated increasing mercury and other heavy metals concentrations and loading rates moving from upstream to downstream in SFLWC (Herrera 2012a). The highest metals concentrations and loading rates in SFLWC were observed downstream of Trust Property on USFS administered land. Tables B-1 through B-5 in Appendix B present the analytical results for the surface water and sediment samples.

Synoptic sampling conducted during late summer 2012 represented base flow conditions (low flow) for comparison with the high flow results from 2011. Results from the 2012 sampling event correlated with data from the 2011 sampling event, and significantly lower metals concentrations were observed in samples from Trust Property compared to USFS administered land. Samples collected from USFS administered land exhibited increasing metals concentrations from upstream to downstream. Fluvially deposited tailings dispersed throughout the floodplain in this section of SFLWC interact with shallow groundwater releasing metals to the creek, even during base flow conditions. Tables B-6 through B-10 present the analytical results for the surface water and sediment samples.

Figures B-4 through B-15 in Appendix B provide a visual comparison between discharge, metals concentrations, and metals loading rates during high and low flow in SFLWC.

3.2.5. Hazardous Materials Inventory

A hazardous building materials survey was performed during the RI to identify and document potential hazardous building materials at BPM. The survey included asbestos and other potential hazardous building materials, such as chlorofluorocarbons in refrigerators, polychlorinated biphenyl in light ballasts and transformers, and mercury containing fluorescent tubes and thermostats. The survey consisted of a visual inspection, photo documentation, and sample collection with analysis. As-built drawings for structures were not available. A summary of items identified for recycling and/or disposal is presented below for each AOC. Table 3-15 shows the results of materials tested for asbestos within each AOC.

Combination Mine AOC

Infrastructure cataloging was completed at four buildings and two adits within the Combination Mine AOC, including the Northern and Southern buildings, the Central Processing building, the Mechanical building, and the Combination and Combination Auxiliary Adits (Figure 3-1). All infrastructure associated with the Combination Mine AOC is located upgradient of the waste rock pile.

Asbestos was not detected in any of the 30 samples taken from 12 unique suspect building materials. Within the three metal shop buildings, a number of items were identified as requiring recycling, management, and/or disposal, including:

- 151 - fluorescent light and high intensity discharge light fixtures
- 245 - ballasts
- 2 - one-gallon containers of antifreeze

- 1 - one-gallon container of engine oil
- 1 - 55-gallon drum marked “calcium pellets”
- 2 - 55-gallon metal drums with unknown fluid (possibly used for oil)
- 6 - refrigerators (removed and disposed of on 12/12/11)
- 3 – vehicles
- 2 - metal containers with an unknown fluid (possibly fuel or solvent)
- 1 - five-gallon bucket of grout
- 4 - automobile tires (removed and disposed of on 12/12/11)
- 1 - one-gallon container of brake fluid
- 1 - ABC fire extinguisher
- 2 - pressurized gas containers
- 2 - two-gallon Safety Can containers with unknown product
- 7 - five-gallon buckets of unknown product (possibly motor oil)
- 2 - ABC dry chemical extinguishers
- 3 - empty 500-gallon metal aboveground storage tanks (ASTs)
- 1 - empty 200-gallon metal AST
- Approximately 350 boxes of rock core samples
- Paint spray cans
- Empty motor oil containers (quart and gallon size)

Tim Smith Mine AOC

Infrastructure cataloging was completed at two buildings, one structure, and two adits within the Tim Smith Mine AOC, including the Tim Smith No. 1 Adit North and South buildings, the Spring House, and the Tim Smith No. 1 and No. 2 Adits (Figure 3-3).

Asbestos was not detected in any of the three samples taken from two unique suspect materials. Other potentially hazardous materials or items identified at the Tim Smith Mine AOC include:

- 1 – fluorescent light fixture
- 2 – ballasts

- 2 - one-quart containers of transmission fluid
- 2 - empty gasoline tanks (1 five-gallon and 1 ten-gallon)
- 1 - 55-gallon drum (contents unknown)
- 1 - empty fuel above ground storage tank
- 1 - large fan/blower
- 2 - discharged fire extinguishers
- Tubing covered with oily product

Historic Mine AOC

Infrastructure cataloging was completed at five buildings/structures within the Historic Mine AOC, including: the Lewis Shaft Garage, the Lewis Shaft Building, the Harper Shaft, the remains of the Harrison Shaft, and the Harper Shaft Shack (Figure 3-4).

A total of eight asbestos samples were collected from five unique suspect building materials. Asbestos was detected (60% Chrysotile) in the grout sample collected from the collapsed Harrison Shaft rubble. Asbestos was not detected in any of the other suspect materials. Other potentially hazardous materials or items that require recycling and/or disposal include:

- 1 - small drum with unknown contents
- 1 - large conveyor drive unit
- 1 - large fan/blower
- Numerous boxes of rock core samples

Combination Mill AOC

Infrastructure cataloging was completed at three buildings within the Combination Mill AOC, including two mill sites housing the "Old Mill" and the Combination Mill, and the Pump House next to South Fork Lower Willow Creek (Figure 3-5).

Four asbestos samples were collected from four unique suspect building materials identified in the three buildings. Asbestos was not detected in any of the samples. Examination of other potentially hazardous building materials included wood and brick samples. Samples were obtained by drilling into multiple bricks and scraps of wood at each mill location and harvesting the cuttings. The drill cuttings were composited based on location and submitted for laboratory analysis of the eight RCRA metals. The results indicated that significant quantities of arsenic, lead, and mercury exist within the materials (Table 3-16). The Toxicity Characteristic Leaching Procedure (TCLP) was conducted to give a final determination of the toxicity characteristics of the building materials within the Combination Mill AOC.

3.3. 2012-2013 Repository Investigation

In 2012, Herrera collected geotechnical samples to supplement the initial repository siting performed as part of the RI. A Repository Investigation report provides detail on the samples collected, geotechnical properties of the proposed repository location, and a preliminary layout of the repository based on the geotechnical findings (Herrera 2013).

4.0 SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Applicable or Relevant and Appropriate Requirements (ARARs) are standards, requirements, criteria, or limitations promulgated under federal or state laws that specifically address a hazardous substance, pollutant, or contaminant at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. CERCLA requires that on-site removal actions attain or waive Federal environmental ARARs, or more stringent State environmental ARARs, upon completion of the removal action. The NCP also requires compliance with ARARs during removal actions to the extent practicable.

ARARs are identified on a site-by-site basis, and assist in the development and selection of reclamation remedies. ARARs are categorized as 1) contaminant-specific requirements that establish acceptable concentrations of chemicals that may be found in or discharged to the ambient environment; 2) location-specific requirements that place restrictions on concentrations of hazardous substances or on the conduct of cleanup activities based on geographical or physical positions of sites; or 3) action-specific requirements that define how cleanup methods should be performed based on technology or activity limitations.

ARARs are either "Applicable" or "Relevant and Appropriate," both of which are mandatory under the NCP. Requirements that are "Applicable" for BPM address a specific hazardous substance, pollutant, or contaminant, location, removal action, or other circumstance found at a CERCLA site. Requirements that are "Relevant and appropriate" address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to BPM.

The DEQ/AMLB has developed a summary of federal and state ARARs for reclamation projects that apply to BPM. Appendix C presents a table listing these ARARs. Each ARAR identified in the table includes a citation to a specific statutory or regulatory requirement, a description that summarizes the requirement, and a classification of whether the ARAR is Applicable, Relevant and Appropriate, or Not Applicable to the reclamation project.

Many requirements are identical or nearly identical in both federal and state law, usually pursuant to environmental programs administered by both the Environmental Protection Agency (EPA) and the State of Montana, such as the requirements for the federal Clean Water Act (CWA) and the Montana Water Quality Act. The NCP states that such a situation results in a citation to the state provision as the appropriate standard, but treatment of the provisions is a federal requirement. ARARs and other laws which are unique to state law are identified as state ARARs.

5.0 RISK ASSESSMENT SUMMARY

This section summarizes the findings of both the human health and ecological risk assessments through hazard identification, exposure assessment, toxicity assessment, and risk characterization. The human health and ecological risk assessments are detailed in Appendices D and E, respectively. The results of the risk assessments are used to develop risk-based clean-up goals. Details on exposure parameters and risk calculations, and the complete results are provided in the RI Report (Herrera 2012a).

The risk assessment conducted for BPM utilized site-specific environmental data to determine which hazardous elements are contaminants of concern (COCs), identified exposure routes to COCs, and assessed potential adverse human health and ecological effects of such exposure. This information is used by risk managers to evaluate whether removal (cleanup) actions may be required. The information is also used as the basis for conducting a removal action, to define potential exposure pathways that need to be addressed, and to identify appropriate clean-up goals. Attainment of the recommended clean-up goals after the reclamation process suggests successful remedy for human and ecological health.

5.1. Human Health Risk Assessment

5.1.1. Hazard Identification

Hazards at BPM were identified first by determining the contaminants of potential concern (COPCs) to human and ecological receptors. COPCs were established by comparing each potentially hazardous element (metals) identified at BPM to criteria set by EPA in their Risk Assessment Guidance for Superfund (RAGS) document (EPA 2004a). If the following criteria were met, the element became a COPC for BPM:

- The contaminant is present at the site,
- The contaminant has a concentration significantly above background levels (generally 3 times higher),
- The measured concentration of the contaminant is at least 20 percent greater than the laboratory analytical detection limit, and
- Analytical methods have acceptable quality assurance/quality control (QA/QC) results.

5.1.1.1. Solid Matrix Samples

Analytical results for the solid matrix samples (soil, tailings, waste rock, and sediment) collected from BPM AOCs were evaluated and compared to the EPA criteria. If those criteria were met, the results were then compared to DEQ RBCG for soils (listed in Table 7-10 of DEQ RBCG) (DEQ 1996 and EPA 2004b). Based on this comparison, 10 COPCs were identified; COPCs exceeding soil cleanup guidelines from DEQ RBCG are in **bold**:

- **Antimony**
- **Arsenic**
- **Cadmium**
- **Copper**
- Iron
- **Lead**
- **Manganese**
- Mercury
- Silver
- Zinc

5.1.1.2. Water Matrix Samples

BPM water samples were collected from SFLWC, Tim Smith Drainage, and Mill Creek. There are several seeps present at BPM; however, water quality results for these are not incorporated in the human health risk assessment calculations per DEQ guidelines (DEQ 1996). Analytical results from water samples collected at BPM were evaluated and compared to the EPA's COPC criteria, the DEQ RBCG for water (listed in Table 7-11 of DEQ RBCG), and DEQ-7 water quality standards (DEQ 1996 and 2012 and EPA 2004b). Twelve COPCs were identified; COPCs exceeding DEQ's water clean-up guidelines are in **bold**:

- **Antimony**
- **Arsenic**
- Cadmium
- Chromium III
- Copper
- Iron
- **Lead**
- **Manganese**
- **Mercury**
- Nickel
- Silver
- **Zinc**

5.1.2. Exposure Assessment

The exposure assessment identifies the potential human receptors and how contaminants are transported through the environment at BPM through different exposure scenarios. The assessment also characterizes the parameters used to quantify human exposures to the COPCs previously identified.

DEQ RBCG identifies potential uses at remote mine sites and those uses that may contribute the most potential exposure and risk (DEQ 1996). The gold panner/rock hound was selected as the primary exposure scenario for recreational use at BPM. SFLWC flows through the Combination Mill AOC, exposing native fish and ultimately anglers to COPCs present at BPM; therefore, fish consumption was added as a potential recreational exposure to the gold panner/rock hound scenario to account for COPCs exposure through ingestion. Although hunting and all-terrain vehicle recreational use are probable at BPM, the gold panner/rock hound scenario was chosen because it is the most conservative in the DEQ RBCG and consequently the most protective of human health (DEQ 1996).

The exposure routes and associated exposure parameters used in the risk assessment include:

- Incidental soil ingestion (gold panner/rock hound – adult and child)
- Dermal exposure to soil (gold panner/rock hound – adult and child)
- Inhalation of particulate matter (gold panner/rock hound – adult and child)
- Incidental water ingestion (gold panner/rock hound – adult and child)
- Dermal contact with water (gold panner/rock hound – adult and child)
- Incidental sediment ingestion (gold panner/rock hound – adult and child)
- Fish ingestion (fisherman – adult)

Conservative exposure parameters from the DEQ RBCG were used in the risk assessment as the actual exposure parameters and time spent at the site by recreational users is unknown. This decision was due to the potential of SFLWC to serve as trout habitat. The conservative fish consumption exposure pathway option listed in the DEQ RBCG (DEQ 1996) of 42 meals per year was used in the exposure calculations. For the gold panner/rock hound scenario, the exposure frequency of 50 days per year was used in the associated exposure calculations (DEQ 1996).

Exposure assessments require an estimate of the concentration of a chemical that is expected to be contacted by a receptor over the exposure period at the location of potential contact. This concentration is known as the exposure point concentration (EPC). Both EPA RAGS (2004a) and the DEQ RBCG (DEQ 1996) guidance recommend utilizing the 95th UCL of the arithmetic mean concentration for each COPC as the EPC for that COPC within a media. However, if this statistic cannot be calculated based on sample size (i.e., the distribution is not normalized, $n < 30$), the arithmetic mean of the COPC concentrations found at the site should be used. The maximum concentration is only to be used if the sample size is limited. A

total of 26 solid matrix surface samples, which are appropriate for risk calculations using the chosen exposure scenarios were collected from BPM and used in this risk assessment, including 13 soil, 3 waste rock, and 10 tailings samples. In addition, 19 water samples, 11 seep samples, and 47 sediment samples were collected from locations at BPM and deemed practical for use in the risk assessment.

In accordance with guidance for gold panner/rock hound and fish consumption exposures associated with water (ingestion and dermal exposure to water, ingestion of sediments, and ingestion of fish), the maximum COPC concentration was used for the specific COPC exposure point concentrations (EPCs) in the calculations (DEQ 1996). The arithmetic mean of the soil COPC concentrations from the area with the highest magnitude of tailings (sample results from the Combination Mill AOC) were used for the specific COPC EPC in exposure calculations related to soils exposures (DEQ 1996). For one case, the arithmetic mean of manganese in waste rock at the Combination Mine AOC was greater than the arithmetic mean for manganese in tailings at the Combination Mill AOC; therefore, the greater concentration was used in exposure calculations. Media-specific EPCs for each COPC used in exposure calculations are provided in Table 5-1. Uncertainties associated with using the maximum/median concentration versus the 95th UCL of the COPC arithmetic mean are outlined in Section 5.1.7.

A total of 26 solid matrix samples were collected from BPM and were determined to be suitable for risk calculations, including 13 soil, 3 waste rock, and 10 tailings samples. In addition, 19 water samples, 11 seep discharge samples, and 47 sediment samples were collected and deemed suitable for risk calculations. Exposure point concentrations (EPCs) for each media (solids, sediments, and water) and COPC were calculated using the analytical results for total recoverable metals. In accordance with the guidance for gold panner/rock hound and fish consumption exposures associated with water, the maximum surface water COPC concentration was used for calculation of the specific COPC EPCs. Table 5-1 provides the media-specific EPCs for each COPC used in the exposure calculations for the risk assessment.

Table 5-1. Exposure Point Concentrations (EPCs) for Contaminants of Potential Concern (COPCs) by Media, Black Pine Mine.

COPCs	Solids[a] (mg/kg)	Surface Water[b] (µg/L)	Sediment[c] (mg/kg)
Antimony	876	117	891
Arsenic	786	36.0	642
Cadmium	17.0	1.20	32.5
Chromium III	NA	2.90	NA
Copper	2,553	221	5,320
Iron	23,933	2,990	37,400
Lead	3,573	49.0	4,240
Manganese	773	52.6	2,780
Mercury	26.4	2.52	57.9
Nickel	NA	4.20	NA

Table 5-1. Exposure Point Concentrations (EPCs) for Contaminants of Potential Concern (COPCs) by Media, Black Pine Mine.			
COPCs	Solids[a] (mg/kg)	Surface Water[b] (µg/L)	Sediment[c] (mg/kg)
Silver	67.8	0.64	213
Zinc	406	63.1	768

[a] EPCs in solids are based on the arithmetic mean from tailings concentrations associated with the most concentrated tailings area at BPM (the Combination Mill AOC) or the arithmetic mean from waste rock concentrations from the most concentrated waste rock area (the Combination Mine AOC); whichever was higher

[b] Water EPCs include the maximum surface water concentrations for Trust property and USFS administered lands, excluding seep discharge

[c] Sediment EPCs include the maximum sediment concentrations for Trust property and USFS administered lands

mg/kg – milligram per kilogram

µg/L – microgram per liter

COPC – contaminant of potential concern

NA – not applicable; the element is not a COPC for the associated medium

Guidance for COPC exposure calculations, pathways, and parameters used in the risk calculations was obtained from Tables 4-1 and 4-2, and Figure 4-2 in the DEQ RBCG (DEQ 1996). The RI Report provides details on how the EPCs were established and the risk assessment calculations (Herrera 2012a). Calculation tables for the risk assessment can also be found in Appendix D.

5.1.3. Toxicity Assessment

The purpose of a toxicity assessment is to evaluate available evidence regarding the potential for particular contaminants to cause adverse effects in exposed individuals. Toxicity assessments use toxicity thresholds, which are an estimate of a daily exposure that is not likely to cause appreciable risk of harmful effects during a lifetime. The risk assessment used the toxicity thresholds of chronic oral reference doses (RfD) for systemic toxins and cancer slope factors (SF) for carcinogens. RfDs were obtained from EPA's Integrated Risk Information System (IRIS), EPA's Health Effects Assessment Summary Tables (HEAST), and EPA's Provisional Peer Reviewed Toxicity Values (PPRTV) for antimony, arsenic, cadmium, chromium (trivalent), manganese, mercury, nickel, silver, and zinc. Toxic threshold values can be found in the Appendix D. The chronic oral RfD for a specific substance is determined using the equation:

$$RfD = NOAEL \div (UF \times MF)$$

Where: NOAEL is the no observed adverse effects level;

UF is an uncertainty factor, ranging from 1 to 1,000; and

MF is a modifying factor, determined by EPA professional judgment (EPA 1993b).

Chronic inhalation reference concentration (RfC) values were obtained from the IRIS. The RfD and RfC for lead were obtained by back-calculation methods from DEQ RBCG (DEQ 1996).

Dermal toxic thresholds were calculated using oral RfD values for each COPC by incorporating the Gastrointestinal Absorption percentages (GI ABS %) from EPA's RAGS (EPA 2004a). The following equation was used to determine the dermal RfD:

Dermal RfD = Oral RfD x GI ABS %.

If no GI ABS % was available, the oral RfD was extrapolated to the dermal RfD.

SF values were obtained from EPA's IRIS and from the California Environmental Protection Agency (CALEPA 2005).

5.1.4. Risk Characterization

Risk characterization combines exposure and toxicity evaluations to calculate quantitative carcinogenic risk and non-carcinogenic hazards for an exposure scenario. The following sections present the results from the BPM quantitative human health risk assessment.

5.1.4.1. Risk Calculations

A hazard quotient (HQ) was calculated to compare exposure to toxic thresholds (oral or dermal RfD or RfC) for each COPC and specific exposure route. This HQ quantifies non-carcinogenic human health hazards for each COPC present onsite. The equation used was:

HQ = Exposure ÷ Toxic Threshold

The EPA HQ benchmark of 1.0 has been established to protect human health from contaminants. An HQ greater than 1.0 indicates the need for an exposure reduction. More specifically, it denotes an exposure value higher than the given threshold value and designates that specific COPC as a COC for BPM. HQs for adult and child receptors were calculated for each COPC in each media (solids, sediment, and water), with an exposure duration of 30 years for the gold panner/rock hound recreational scenario (adult exposure duration of 24 years and child exposure duration of 6 years). A HQ for adult fish consumption was also calculated by comparing fish ingestion exposure to the oral RfD for specific COPCs.

A combined COPC HQ was determined by summing all hazard quotients (oral, dermal, and inhalation) for each COPC in each media (solids, water, sediments, and fish). The combined HQ represents the total HQ for each COPC present in solids, sediment, water, and fish for an adult (Table 5-2) and child (Table 5-3). A total COPC HQ was also determined for each media and for all media combined as shown in Table 5 -2 and Table 5-3. The relative contribution of each individual COPC HQ to the total COPC HQ is also calculated to determine which COPCs are of greater concern. Only the COCs are presented in Tables 5-2 and 5-3. For all the COPCs risk assessment results see the RI Report (Herrera 2012a).

Table 5-2. Summary of Adult Non-Carcinogenic Hazards Through Exposures as a Recreational Gold Panner/Rock Hound, Black Pine Mine.

COCs	Solids HQ[a]	Surface Water HQ[b]	Sediment HQ[c]	Fish Consumption HQ[b, d]	Combined HQ[e]	Percent Contribution
Antimony	2.69E+00	6.30E-01	1.05E+00	5.43E-02	4.42E+00	15.38%

Table 5-2. Summary of Adult Non-Carcinogenic Hazards Through Exposures as a Recreational Gold Panner/Rock Hound, Black Pine Mine.						
COCs	Solids HQ[a]	Surface Water HQ[b]	Sediment HQ[c]	Fish Consumption HQ[b, d]	Combined HQ[e]	Percent Contribution
Arsenic	2.12E+00	2.38E-01	1.01E+00	9.81E-01	4.35E+00	15.12%
Lead	1.39E+00	6.40E-02	1.33E+00	2.97E-01	3.08E+00	10.71%
Mercury	8.76E-02	3.11E-02	1.70E-01	1.61E+01	1.64E+01	56.96%
TOTAL COPC HQ	6.42E+00	9.91E-01	3.68E+00	1.77E+01	2.88E+01	

[a] Maximum concentration from the arithmetic mean of the COC concentration in tailings from the Combination Mill AOC or waste rock from the Combination Mine AOC used as the EPC in the exposure calculation

[b] Maximum sample point concentration for surface waters, excluding seep discharge used as the EPC in the exposure calculation

[c] Maximum sample point concentration for sediments used as the EPC in the exposure calculation

[d] The more conservative exposure frequency of 42 meals per year used in the fisherman exposure scenario for this exposure pathway

[e] Sum of all exposure routes at BPM

COC – contaminant of concern

HQ – hazard quotient

Table 5-3. Summary of Child Non-Carcinogenic Hazards Through Exposures as a Recreational Gold Panner/Rock Hound, Black Pine Mine.					
COCs	Solids HQ[a]	Surface Water HQ[b]	Sediment HQ[c]	Combined HQ[e]	Percent Contribution
Antimony	4.40E+00	2.75E+00	2.03E+00	9.19E+00	40.60%
Arsenic	3.68E+00	1.10E+00	1.95E+00	6.74E+00	29.79%
Lead	2.57E+00	2.98E-01	2.58E+00	5.45E+00	24.08%
TOTAL COPC HQ	1.10E+01	4.42E+00	7.16E+00	2.26E+01	

[a] Maximum concentration from the arithmetic mean of the COC concentration in tailings from the Combination Mill AOC or waste rock from the Combination Mine AOC used as the EPC in the exposure calculation

[b] Maximum sample point concentration for surface waters, excluding seep discharge used as the EPC in the exposure calculation

[c] Maximum sample point concentration for sediments used as the EPC in the exposure calculation

[d] The more conservative exposure frequency of 42 meals per year used in the fisherman exposure scenario for this exposure pathway

[e] Sum of all exposure routes at BPM

COC – contaminant of concern

HQ – hazard quotient

Antimony, arsenic, and lead are COCs at BPM with a potential risk to create non-carcinogenic health effects for the recreational gold panner/rock hound recreationalist. Mercury is a COC for the recreational fisherman consuming fish from SFLWC. The majority of the antimony, arsenic, and lead adult exposure are from accidental ingestion and contact with tailings, waste rock, and soil, in addition to accidental ingestion of sediments. The majority of the antimony, arsenic, and lead child exposure results from accidental ingestion and contact with

tailings, waste rock, and soil, accidental ingestion of sediments, and accidental ingestion of surface water for antimony and arsenic.

Carcinogenic exposures for arsenic, cadmium, and lead were calculated in the same manner as the non-carcinogenic exposure, except the average time of the pathway-specific exposure period was adjusted to 365 days for 70 years (lifetime). Exposures for the estimated lifetime cancer risk (ELCR) incorporate the child and adult exposures to obtain a lifetime exposure for the given exposure pathway. Guidance for these calculations was obtained from the DEQ RBCG (DEQ 1996). The ELCR was calculated for arsenic, cadmium, and lead using the following equation:

$$ELCR = Slope\ Factor \times Lifetime\ Exposure$$

EPA considers an ELCR greater than 1.0 E-06 as unacceptable exposure (EPA 2004b). This benchmark indicates that one person in a population of 1,000,000 will be at risk for developing cancer from the given COPC. A COPC ELCR greater than 1.0 E-06 signifies a COC at BPM.

ELCRs were determined for both adult and child, and were then combined for a true lifetime estimated cancer risk. Combined adult and child ELCRs for each COPC in each media are summed across exposure pathways for a combined media ELCR. A total ELCR was also determined for each media and for all media combined as shown in Table 5-4. ELCRs for fish consumption only consider adult exposure, and not child exposure. Only the risk assessment results for the BPM COCs are presented. For all of the COPC risk assessment results, see the RI Report (Herrera 2012a).

Table 5-4. Summary of Combined Adult and Child Carcinogenic Risk From Exposures as a Recreational Gold Panner/Rock Hound, Black Pine Mine.

Carcinogen COCs	Solids ELCR[a, d]	Surface Water ELCR[b, d]	Sediment ELCR[c, d]	Fish Consumption ELCR[b, e]	Combined ELCR[f]	Percentage of ELCR
Arsenic	4.70E-04	7.92E-05	2.30E-04	6.15E-04	1.39E-03	92.26%
Lead	8.88E-06	3.26E-07	8.62E-06	9.91E-05	1.17E-04	7.74%
TOTAL ELCR	4.79E-04	7.96E-05	2.39E-04	7.14E-04	1.51E-03	

[a] Maximum concentration from the arithmetic mean of the COC concentration in tailings from the Combination Mill AOC or waste rock from the Combination Mine AOC used as the EPC in the exposure calculation

[b] Maximum sample point concentration for surface waters, excluding seep discharge, used as the EPC in the exposure calculation

[c] Maximum sample point concentration for sediments used as the EPC in the exposure calculation

[d] Combined adult and child estimated lifetime cancer risk across all specific media exposure pathways

[e] Adult exposure only used in the fish ingestion ELCR

[f] The sum of all exposure pathways at BPM

COC – contaminant of concern

ELCR - Estimated lifetime cancer risk

Human exposures to arsenic and lead at BPM create potential cancer risks to recreational users. Both contaminants are present at concentrations that pose potential non-carcinogenic and carcinogenic human health risks.

The COCs for soils and sediments at BPM are antimony, arsenic, and lead. The COCs for water, excluding seeps, at BPM are antimony, arsenic, and lead. Mercury is a COC for the recreational fisherman consuming fish from SFLWC. Arsenic and lead are COCs which have the potential to cause non-carcinogenic and carcinogenic health risks.

5.1.5. Human Health Risks for Individual AOCs

The risk assessment previously described focuses on BPM as a whole and does not consider the four AOCs individually. In order to compare the contamination levels and human health risks across AOCs, Herrera completed risk assessments using the maximum COPC concentration in each media at each AOC. The risk assessments by AOC were performed to identify COCs and assist with prioritization of reclamation activities per AOC.

Adult and children exposures were considered for comparison purposes. The results for non-carcinogenic health hazards for solid and surface water exposures are shown in Tables 5-5 and 5-6; the results for carcinogenic health hazards for solid and surface water exposures are shown in Tables 5-7 and 5-8. Only the risk assessment results for the BPM COCs are presented. For the entire risk assessment results see the RI Report (Herrera 2012a).

Table 5-5. Adult Non-Carcinogenic Risks Through Solid Media Exposures as a Recreational Gold Panner/Rock Hound by AOC, Black Pine Mine.

COCs	Combination Mill AOC HQs[a]	Combination Mine AOC HQs[a]	Historic Mine AOC HQs[a]	Tim Smith Mine AOC HQs[a]
Antimony	9.84E+00	3.10E+00	3.56E+00	NA
Arsenic	6.59E+00	1.45E+00	3.08E+00	NA
Lead	3.70E+00	7.35E-01	1.91E+00	NA
Total HQ	2.12E+01	6.28E+00	8.80E+00	NA

[a] Maximum sample point concentration for soils, waste rock, or tailings used as the EPC in the exposure calculation

AOC – area of concern

COC – contaminant of concern

HQ – hazard quotient

NA - not applicable (no surface soil samples were collected at Tim Smith Mine AOC)

Table 5-6. Adult Non-Carcinogenic Risks Through Surface Water Exposures as a Recreational Gold Panner/Rock Hound by AOC, Black Pine Mine.

COCs	Combination Mill AOC HQs[a, b]	Combination Mine AOC HQs[a, b]	Historic Mine AOC HQs[a]	Tim Smith Mine AOC HQs[a]

Cadmium	6.11E-03	1.09E+00	1.32E-03	1.42E-03
Copper	1.10E-02	1.04E+00	5.31E-03	1.51E-03
Total HQ	9.86E-01	3.38E+00	4.23E-02	4.87E-02

[a] Maximum sample point concentration for surface waters, excluding seep discharge as the EPC in the exposure calculation

[b] Combination Mill AOC includes the samples collected downstream of the mill, the only surface waters present at the Combination Mine AOC are seeps

AOC – area of concern

COC – contaminant of concern

HQ – hazard quotient

Table 5-7. Summary of Combined Adult and Child Carcinogenic Risk Through Solid Media Exposures as a Recreational Gold Panner/Rock Hound by AOC, Black Pine Mine.

COCs	Combination Mill AOC ELCRs[a]	Combination Mine AOC ELCRs[a]	Historic Mine AOC ELCRs[a]	Tim Smith Mine AOC ELCRs[a]
Arsenic	1.46E-03	2.24E-04	6.81E-04	NA
Lead	2.37E-05	3.21E-06	1.22E-05	NA

[a] Maximum sample point concentration for soils, waste rock, or tailings used as the EPC in the exposure calculation

AOC – area of concern

COC – contaminant of concern

ELCR - estimated lifetime cancer risk

NA - not applicable (no surface soil samples collected at Tim Smith Mine AOC)

Table 5-8. Summary of Combined Adult and Child Carcinogenic Risk Through Surface Water Exposures as a Recreational Gold Panner/Rock Hound by AOC, Black Pine Mine.

COC	Combination Mill AOC ELCRs[a]	Combination Mine AOC ELCRs[a,]	Historic Mine AOC ELCRs[a]	Tim Smith Mine AOC ELCRs[a]
Arsenic	7.92E-05	1.20E-04	5.06E-06	7.26E-06
Lead	3.26E-07	2.42E-06	1.93E-08	3.53E-08

The only surface water present at the Combination Mine AOC is seeps.

[a] Maximum sample point concentration for surface waters, excluding seep discharge as the EPC in the exposure calculation

AOC – area of concern

COC – contaminant of concern

ELCR - estimated lifetime cancer risk

5.1.6. Risk-Based Clean-up Goals

Risk-based clean-up goals were developed for COCs that exceeded the non-carcinogenic HQ or ELCR benchmarks developed by EPA, which are 1.0 and 1.0 E-06, respectively. The risk-based clean-up goals for BPM were derived from Tables 7-10 and 7-11 in the DEQ RBCG (DEQ 1996).

The proposed cleanup goals attempt to reduce the non-carcinogenic HQ to less than one and the risk of cancer to less than 1.0 E-6.

The soil and water cleanup guidelines for antimony, arsenic, lead, and mercury are summarized in Table 5-9. Soil and water background samples were collected from the potential repository locations and from upstream of the confluence of the Tim Smith Drainage and SFLWC. Because the background samples for antimony, lead, and mercury are less than the RBCGs, the RBCG was used for each COC.

DEQ RBCGs for arsenic are 0.7 mg/kg for soil and 0.06 µg/L for surface water. At BPM, the arithmetic mean background soil concentration is 32 times the soil cleanup guideline level, indicating a relatively high naturally occurring concentration of arsenic in the vicinity. DEQ RBCG allows for use of the 95th UCL on the mean concentration from background soil as an alternative cleanup concentration (DEQ 1996). DEQ RBCG states that health protective levels may be assumed if the maximum contaminant level (MCL) for arsenic is set as the water reclamation goal.

Table 5-9.Risk-Based Clean-Up Guidelines for Recreational Users at BPM, Black Pine Mine.

COCs	Soil Cleanup Guideline (mg/kg)	Surface Water Cleanup Guideline (µg/L)
Antimony	293	91.1
Arsenic	40.4[a]	10[b]
Lead	1,100	47.1
Mercury	NA	0.15

[a] UCL = 95th upper confidence limit on the arithmetic mean from background samples

[b] MCL = State of Montana Circular DEQ-7 drinking water standard, maximum contaminant level (DEQ 2012)

COC – contaminant of concern

mg/kg – milligram per kilogram

µg/L – microgram per liter

NA - not applicable; not a COC for that medium

5.1.7. Uncertainty Assessment

Uncertainty in this human health risk assessment is potentially associated with the use of mean concentrations in a given media, based on the small number of water samples collected. In addition, EPA indicates that using the maximum concentration can result in an over-estimate of the human health recreational risk. A conservative approach was used in this case to protect human and ecological health and to account for recreational users on-site and downstream of BPM.

Uncertainty also can be attributed to the dermal toxic thresholds extrapolated from the oral RfD, as this is not an accurate representation of the exposure route. However, this represents the best available option for calculating risk. In addition, back calculations are not a reliable method for determining toxic thresholds for lead, as the concentration of lead considered to be "safe" has not yet been determined (EPA 2004a).

There is also uncertainty associated with inhalation exposures calculated from soil concentrations instead of actual air particulate concentrations (no air monitoring was performed).

5.1.8. Risk Characterization Summary

The risk assessment for BPM resulted in total HQs of 28.8 for adults (includes fish consumption) and 22.6 for children, indicating the potential for adverse health effects among recreational users. COCs include antimony, arsenic, and lead present in tailings, waste rock, soils, and sediments. COCs include antimony, arsenic, lead, and mercury present in surface waters at or affected by BPM. Arsenic is a COC with the potential to cause non-carcinogenic and carcinogenic health risks associated with all exposure pathways and media analyzed in this risk assessment for recreational users exposed to soil, tailings, waste rock, surface waters, sediment, and fish. Lead is a COC with the potential to cause non-carcinogenic and carcinogenic health risks associated with exposure pathways and media analyzed in this risk assessment for recreational users exposed to soil, tailings, waste rock, sediments, and fish. Due to the level of these toxic substances present at BPM, corrective measures to reduce human health risks and hazards are recommended. Reclamation should focus on reducing the COC concentrations in human exposure pathways associated with soil, tailings, waste rock, sediments, and surface waters.

5.2. Ecological Risk Assessment

The ecological risk assessment identified COCs and presented estimated risks to groups of ecological receptors. The risk assessment identified hazards and ecological threats, determined exposure assessments and ecological effects assessments (toxicity assessments), and characterized risk. Risks were determined for receptors in aquatic life, terrestrial wildlife, and terrestrial plant communities. Several documents written by federal and state regulatory agencies provided guidance for the ecological risk assessment.

The ecological risk assessment was a preliminary, qualitative screening-level assessment. RBCGs are based on both the human health and ecological risk assessments, as well as other supporting factors. This assessment presents both the risk for the entire BPM as well as risks for the individual AOCs for comparison purposes.

5.2.1. Hazard Identification for Ecological Effects and Habitats

Analytical results from samples collected at BPM during the summer of 2011 were used in the risk assessment. The COPCs listed in the human health risk were also evaluated in the ecological risk assessment: COPCs for soil include antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc. COPCs for water include antimony, arsenic, cadmium, chromium (trivalent), copper, iron, lead, manganese, mercury, nickel, silver, and zinc.

5.2.1.1. Ecological Receptors of Concern and Habitat

Three ecological communities are evaluated as ecological receptors in the risk assessment, including aquatic, terrestrial, and plant communities. SFLWC provides habitat to fish and other forms of aquatic life that are ecological receptors and part of the local wildlife and the

human food chain. The whitetail deer is a common wildlife species in Montana and represents the terrestrial community at BPM in this risk assessment. Vegetation is exposed to COPCs through root-to-soil contact, resulting in the uptake of COPCs.

Contaminated tailings, waste rock, soil, and surface water at BPM are hazards to these receptors. These contaminants are biologically available to terrestrial wildlife through consumption of vegetation, seep discharges, salt precipitates, and exposed tailings, waste rock, and soils. In addition, contaminated material has eroded into SFLWC, potentially affecting aquatic life.

5.2.2. Exposure Assessment

An exposure scenario for each ecological community is presented below. Table 5-10 lists the EPCs for each COPC and exposure pathway at BPM. The arithmetic mean was calculated for each set of solid media samples for each COPC. The maximum of the COPC concentration means from tailings, soil and waste rock were used as the EPCs for the deer and plant community exposures. The maximum surface water and sediment concentrations for each COPC were used as the EPC for aquatic and deer exposure pathways. Calculation tables are provided in Appendix E. Per DEQ RBCGs, seep drainage COPC concentrations were only incorporated as part of the whitetail deer exposure scenario and not part of the aquatic life exposure scenario (the potential exists for wildlife to drink from a seep, but it is less likely that aquatic life would exist in mine seeps). Detailed information on toxic thresholds, the full ecological risk calculations, and more information on the ecological risk assessment are included in the RI Report (Herrera 2012a).

Table 5-10. Contaminants of Potential Concern (COPCs) Exposure Point Concentrations (EPCs) for Ecological Exposure Scenarios, Black Pine Mine.

COPCs	Aquatic Life Surface Water Concentration[a] (µg/L)	Associated Water Hardness[b] (mg/L $CaCO_3$)	Sediment Concentration[c] (mg/kg)	Deer Ingestion Water Concentration[d] (µg/L)	Deer Ingestion/ Phytotoxicity Soil, Tailings, or Waste Rock Surface Concentration[e] (mg/kg)
Antimony	117	25	891	117	876
Arsenic	36.0	25	642	54.7	786
Cadmium	1.20	25	32.5	215	16.99
Chromium III	2.90	25	25.8	2.90	5.60
Copper	221	25	5,320	20,900	2,553
Iron	2,990	25	37,400	41,400	23,933
Lead	49.0	25	4,240	363	3,573
Manganese	52.6	25	2,780	6,640	773
Mercury	2.52	25	57.9	2.52	26.5
Nickel	4.20	25	31.2	4.20	5.08
Silver	0.64	25	213	0.64	67.8
Zinc	63.1	25	768	20,400	406

[a] Aquatic life surface water EPCs include maximum surface water concentrations for the entire BPM, excluding seep discharge

[b] Hardness results for surface water were < 25 mg/kg $CaCO_3$ with the exception of seeps; therefore, a minimum hardness value of 25 was used
[c] Sediment EPCs include the maximum sediment concentrations for the entire BPM
[d] Deer ingestion water EPCs include maximum surface water concentrations for the entire BPM, including seep discharge.
[e] Maximum concentration of the arithmetic mean concentrations from tailings concentrations associated with the most concentrated tailings area at BPM (the Combination Mill AOC), or from waste rock concentrations from the most concentrated waste rock area (the Combination Mine AOC)
mg/kg – milligram per kilogram
mg/L $CaCO_3$ – milligram per liter as calcium carbonate
µg/L – microgram per liter
COPC – contaminant of potential concern

5.2.2.1. Exposures to Aquatic Life Communities and Toxic Thresholds

The aquatic life exposure scenario evaluated the health threat to fish and other aquatic life from COPCs in SFLWC water and sediment. Contaminated material from the Tim Smith Mine AOC, Historic Mine AOC, and Combination Mill AOC drain into SFLWC and contaminated the creek. Run-off during precipitation events contaminates the soil surface in the mining area and transports contaminants into SFLWC. This contaminant transport poses a health threat to fish and other aquatic life through sediments and water in the creek. Seeps at the Combination Mine AOC were not included in the aquatic life exposure scenario because seep discharge is not considered suitable habitat for aquatic life.

The aquatic life scenario uses water hardness to adjust aquatic life standards for certain metals. If water hardness results are greater than 25 mg/L, aquatic life standards are adjusted using a specific calculation relevant to each COPC, which is available in the Montana DEQ-7 (DEQ 2012). The aquatic life standards for specific COPCs (cadmium, copper, lead, and zinc) did not need to be adjusted for water hardness, as all hardness measurements were less than 25 mg/L.

Acute aquatic life standards for surface water were used as toxic thresholds for the aquatic life community (DEQ 2012). Long-term water sampling has not taken place at BPM; therefore chronic effects to aquatic life could not be evaluated. National Oceanographic and Atmospheric Administration's (NOAA) sediment quality guidelines were applied as toxic thresholds for exposures through sediment (NOAA 1999).

5.2.2.2. Exposures to Terrestrial Wildlife Communities and Toxic Thresholds

The terrestrial wildlife exposure scenario evaluated the threat to wildlife health from COPCs for those species that use BPM as part of their home range. BPM is surrounded by the Beaverhead-Deerlodge National Forest, which allows terrestrial wildlife to migrate through BPM. The whitetail deer represents the terrestrial community in this risk assessment based on the availability of exposure parameters and toxic thresholds in toxicology literature. It was assumed that deer using the site as part of their home range would be exposed to contaminants by ingesting surface water and soil or salt precipitates associated with the contaminated material. Exposure through vegetation consumption was not considered based on a lack of vegetation growing on impacted areas of BPM. Dermal or inhalation exposures were not considered, due to lack of exposure data. *Estimating Exposure of Terrestrial Wildlife to Contaminants* was used as a guidance document and source for exposure parameters in this ecological assessment (Sample and Suter II 1994).

Conservative estimates were used for all exposure parameters (body weight, soil consumption rate, water intake rate, and home range for a representative whitetail deer) since this was a screening-level risk assessment. The whitetail deer no observed adverse effect levels (NOAELs) from the *Toxicological Benchmarks for Wildlife* were used as toxic thresholds for terrestrial wildlife (Sample et al. 1996).

5.2.2.3. Exposures to Terrestrial Plant Communities and Toxic Thresholds

The terrestrial plant exposure scenario evaluated threats to the health of terrestrial plants at BMP, as well as investigating soil chemistry related to the lack of vegetation on disturbed areas and possible phytotoxic effects to plants. The exposure pathway to terrestrial plant communities is through root-to-soil contact and results in the uptake of COPCs. Vegetation is sparse at BPM due to the lack of organic material and the presence of biologically available contaminants in soil.

General phytotoxic thresholds listed in the *Clark Fork River Ecological Risk Assessment* were used as toxic thresholds for the terrestrial plant community at BPM (ISSI Consulting Group 1999). This document contains literature-based toxic reference values (TRVs) determined by summarizing results from several terrestrial plant toxicology studies related to soil COPC concentrations. These values are not specific to vegetation species or to BPM native species because no vegetation exists on the majority of impacted BPM land.

5.2.3. Risk Characterization

The ecological impact quotient (EQ) is a ratio of exposure to toxic threshold. EQs were calculated for each COPC at BPM specific to each ecological community exposure scenario. An EQ greater than 1.0 signifies a COPC exposure that potentially threatens the health of the ecological receptor. If the EQ exceeds this benchmark, the COPC becomes a COC at BPM for the specific ecological community.

5.2.3.1. Aquatic Life Communities

Exposures associated with water were compared to freshwater AALS to obtain the EQ for each COPC. Because long-term water quality sampling was not part of this investigation, only the acute EQ is incorporated into the total EQ. Table 5-11 shows the water and sediment EPCs, toxic thresholds, and the EQs estimated for the aquatic community at BPM (calculations are provided in Appendix E).

Table 5-11. Aquatic Life Community Risk Characterization for Contaminants of Concern (COCs), Black Pine Mine.

COCs	Surface Water Concentration [a] (µg/L)	Sediment Concentration [b] (mg/kg)	AALS (µg/L)[c]	Sediment Quality Guidelines[d] (mg/kg)	Acute Aquatic Life Surface Water EQ[e]	Aquatic Life Sediment EQ[e]
Arsenic[f]	36.0	642	340	70.0	0.11	9.17
Cadmium[f]	1.20	32.5	0.52	906	2.30	0.04
Copper[f]	221	5,320	3.79	270	58.3	19.7
Lead[f]	49.0	4,240	13.98	218	3.51	19.5

Mercury[f]	2.52	57.9	1.70	0.71	1.48	81.6
Silver[f]	0.64	213	0.374	3.70	1.71	57.6
Zinc[f]	63.1	768	37.02	410	1.70	1.87
TOTAL					69.1	190

[a] Maximum surface water concentrations for the entire BPM, excluding seep discharge
[b] Maximum sediment concentrations for the entire BPM
[c] Freshwater acute aquatic life standards (AALS), DEQ-7 Montana Numeric Water Quality Standards (DEQ 2012)
[d] Sediment quality guidelines (NOAA 1999); medium affects range for biological effects
[e] Ratio of exposure to toxic threshold (ecological impact quotient)
[f] Priority Pollutant, DEQ-7 Montana Numeric Water Quality Standards (DEQ 2012)
EQ - ecological impact quotient
mg/kg – milligram per kilogram
µg/L – microgram per liter
COC – contaminant of concern

Ecological COCs in the surface water at BPM are cadmium, copper, lead, mercury, silver, and zinc. Ecological COCs in sediment are arsenic, copper, lead, mercury, silver, and zinc. These COCs effect the health of aquatic life in SFLWC within or downstream of the Combination Mill AOC. Contaminants in these sediments and surface water originate primarily from erosion of mine tailings. This risk assessment analyzes the total recoverable portion of the contaminants in surface water; the non-recoverable, or dissolved, portion is more mobile and bioavailable, and is not considered in this assessment.

5.2.3.2. Terrestrial Wildlife Communities

EQ values for whitetail deer are determined by summing the exposure values from soil and water ingestion for each COPC, and then comparing this sum to the COPC toxic thresholds. The ratio compares the deer ingestion toxic thresholds to contaminants in surface water, soil, tailings, and waste rock at BPM. Table 5-12 provides the resulting COCs for whitetail deer, which can be extrapolated to the wildlife community.

Table 5-12. Terrestrial Wildlife Community Risk Characterization for Contaminants of Concern (COCs). Black Pine Mine.

COCs	Surface Water Concentration[a] (µg/L)	Solid Concentration[b] (mg/kg)	Total Deer Exposure[c] (mg/kg-day)	NOAELs/ Toxic Thresholds[d] (mg/kg-day)	Deer Ingestion Soil and Water EQ[e]	Toxic Endpoint Source
Antimony	117	876	1.01	0.02	53.0	Sample et. al 1996
Arsenic	54.7	786	0.90	0.02	47.3	Sample et. al 1996
Lead	363	3,573	4.10	0.01	819	ATSDR 1993
TOTAL					921	

[a] Maximum surface water concentrations for the entire BPM, including seep discharge
[b] Maximum concentration of the arithmetic mean concentrations from tailings concentrations associated with the most concentrated tailings area at BPM (the Combination Mill AOC), or from waste rock concentrations from the most concentrated waste rock area (the Combination Mine AOC)
[c] Combined soil and water exposures (Sample and Suter II 1994)
[d] The most recent and most conservative estimated NOAELs (Sample, Opresko, and Suter II 1996) used for toxic threshold values
[e] Ratio of exposure to toxic threshold (ecological impact quotient)

EQ - ecological impact quotient
mg/kg – milligram per kilogram
µg/L – microgram per liter
COC – contaminant of concern

Antimony, arsenic, and lead are the COCs for the terrestrial wildlife community at BPM. Each of these COCs originates through exposures to contaminated surface water from SFLWC at or downstream of the Combination Mill AOC, seeps, and/or tailings or waste rock at the Combination Mill AOC or Combination Mine AOC.

5.2.3.3. Terrestrial Plant Communities

Terrestrial plant exposures were compared to TRVs to obtain a ratio of the exposure value to phytotoxic threshold value for each COPC. Table 5-13 provides the phytotoxic EQs for each COC for the plant community at BPM.

Table 5-13. Terrestrial Plant Community Risk Characterization for Contaminants of Concern (COCs), Black Pine Mine.

COCs	Solid Concentration (mg/kg)[a]	Phytotoxic Soil Concentration (mg/kg)[b]	Terrestrial Plant Phytotoxicity EQ[c]	Toxic Threshold Source
Arsenic	786.02	10.00	78.6	Efroymson et al. 1997
Cadmium	16.99	3.00	5.66	Kabata-Pendias and Pendias 1992
Copper	2553.30	60.00	42.6	Kabata-Pendias and Pendias 1992
Lead	3572.93	50.00	71.5	Efroymson et al. 1997
Mercury	26.45	5.00	5.29	CH2M Hill 1987
Zinc	405.66	50.00	8.11	Efroymson et al. 1997
TOTAL			212	

[a] Maximum concentration of the arithmetic mean concentrations from tailings concentrations associated with the most concentrated tailings area at BPM (the Combination Mill AOC)
[b] Most conservative estimated toxic reference value for vegetation from several toxicology studies
[c] Ratio of exposure to toxic threshold (ecological impact quotient)
EQ - ecological impact quotient
mg/kg – milligram per kilogram
COC – contaminant of concern

Arsenic, cadmium, copper, lead, mercury, and zinc are the COCs for terrestrial plant communities at BPM. Contaminants are in tailings at the Combination Mill AOC. These COCs are inhibiting vegetation growth on the impacted areas at BPM.

5.2.4. Individual AOC Risk Characterization

Ecological risk calculations were completed for each AOC to compare contaminants present at each location. The maximum concentrations were used for each COPC in each media, solids (tailings, waste rock, and soil) or surface water from each site. Individual AOC results were incorporated into the whitetail deer exposure calculations. Seeps are the only surface water at the Combination Mine AOC; therefore, the associated EQ results for terrestrial wildlife

water ingestion reflect exposures to seep water. Tables 5-14 to 5-16 compare the EQs representing the risk to the three ecological communities at the individual AOCs.

Table 5-14. Comparison of Aquatic Life Ecological Impact Quotients (EQs) at Each AOC, Black Pine Mine.

	Combination Mill AOC		Combination Mine AOC		Historic Mine AOC		Tim Smith Mine AOC	
COCs	Surface Water EQ[a]	Sediment EQ[a]	Surface Water EQ[a, b]	Sediment EQ[b]	Surface Water EQ[a]	Sediment EQ[a]	Surface Water EQ[a]	Sediment EQ[a]
Arsenic	0.11	9.17	0.16	NA	0.01	0.35	0.01	0.44
Cadmium	2.30	0.04	413	NA	0.50	0.01	0.54	0.01
Copper	58.3	19.7	5,512	NA	28.2	10.3	8.04	2.37
Lead	3.51	19.5	26.0	NA	0.21	1.40	0.38	0.50
Mercury	1.48	81.6	ND	NA	0.07	38.6	0.02	34.4
Silver	1.71	57.6	ND	NA	0.00	0.92	ND	1.65
Zinc	1.70	1.87	551	NA	0.85	0.66	0.60	0.58
TOTAL	69.1	189.9	6,502	NA	29.9	52.8	9.63	40.6

EQs reflect the aquatic life exposures to COCs present in surface water (excluding seep discharge) and sediments
[a] The maximum COC concentration per media was used as the exposure point concentration in exposure calculations
[b] The only surface water present at the Combination Mine AOC is seep discharge; no sediment samples were collected at the Combination Mine AOC
EQ - ecological impact quotient
COC - contaminant of concern
NA - indicates no aquatic threshold available for this COPC or no sample was taken
ND - indicates no COC was detected in sample analysis

Table 5-15. Comparison of Terrestrial Wildlife Ecological Impact Quotients (EQs) at Each AOC, Black Pine Mine.

COCs	Combination Mill AOC Deer Ingestion- Soil and Water EQ[a]	Combination Mine AOC Deer Ingestion- Soil and Water EQ[a]	Historic Mine AOC Deer Ingestion- Soil and Water EQ[a]	Tim Smith Mine AOC Deer Ingestion- Water EQ[a]
Antimony	40.1	9.32	16.0	0.004
Arsenic	30.3	5.14	15.7	0.011
Lead	448	70.0	257	0.069
TOTAL	519	85.2	289	0.089

EQs reflect the terrestrial wildlife (whitetail deer) exposures to COCs present in surface water (including seep discharge) and tailings, waste rock, or soil present at each AOC.
[a] The maximum COC concentration per media was used as the exposure point concentration in exposure calculations
EQ - ecological impact quotient
COC – contaminant of concern

Table 5-16. Comparison of Terrestrial Plant Ecological Impact Quotients (EQs) at Each AOC, Black Pine Mine.				
	Combination Mill AOC	Combination Mine AOC	Historic Mine AOC	Tim Smith Mine AOC
COCs	Plant Phytotoxicity EQ	Plant Phytotoxicity EQ	Plant Phytotoxicity EQ	Plant Phytotoxicity EQ
Arsenic	244.00	53.70	114.00	NA
Cadmium	16.40	22.33	3.80	NA
Copper	110.50	946.67	34.67	NA
Lead	190.40	37.20	98.00	NA
Mercury	43.00	0.22	2.60	NA
Zinc	22.20	87.60	6.52	NA
TOTAL	626.50	1147.72	259.59	NA

EQs reflect terrestrial plant exposures to COCs present in tailings, waste rock, or soil
The maximum COC concentration for tailings, waste rock, or soil was used as the exposure point concentration in exposure calculations.
EQ - ecological impact quotient
COC – contaminant of concern
NA - indicates no phytotoxic threshold available for this COPC or no sample was taken

5.2.4.1. Risk Characterization Summary

Table 5-17 summarizes the EQs for ecological receptor communities at BPM. The total EQ by COC is the sum of EQs for each media and ecological community. The total EQ listed in the last row and last column (1,392) is the sum of the EQs for all the different media and ecological communities for all COCs evaluated. This total EQ represents the total ecological impact quotient for all COCs at BPM.

Table 5-17. Summary of Ecological Impact Quotients (EQs) for Ecological Receptors, Exposure Pathways, and Contaminants of Concern (COCs), Black Pine Mine.					
COCs	Acute Aquatic Life Surface Water EQ	Aquatic Life Sediment EQ	Deer Ingestion-Soil and Water EQ	Terrestrial Plant Phytotoxicity EQ	Total EQ by COC
Antimony	NA	NA	53.0	NA	53.0
Arsenic	0.11	9.17	47.3	78.6	135
Cadmium	2.30	0.04	0.12	5.66	8.13
Copper	58.3	19.7	0.995	42.6	122
Lead	3.51	19.5	819	71.5	914
Mercury	1.48	81.6	0.08	5.29	88.4
Silver	1.71	57.6	NA	NA	59.3
Zinc	1.70	1.87	0.04	8.11	11.7
TOTAL	69.1	190	921	212	1,392

EQ - ecological impact quotient
COC – contaminant of concern
NA - indicates no EQ could be calculated for the COC as a toxic threshold was not available

This risk assessment presents potential threats to the health of terrestrial plants, wildlife, and aquatic life communities that may use BPM for habitat. This ecological risk assessment is a conservative screening-level assessment and provides conservative EQs. Results indicate that several contaminants present at the site threaten the health of the BPM ecosystem. Arsenic, cadmium, copper, lead, mercury, silver, and zinc are contaminants in SFLWC surface water and sediments that pose a significant health risk to aquatic life. Antimony, arsenic, and lead pose health risks to the terrestrial wildlife community native to BPM. All contaminants analyzed for risks to the terrestrial plant community at BPM resulted in concentrations that were harmful to the livelihood of plants; these contaminants include arsenic, cadmium, copper, lead, mercury, and zinc. Concentrations of these contaminants are a contributing factor to the lack of vegetation on mine disturbed areas at the site.

5.3. Physical Hazards

Potential physical hazards remnant of BPM mining operation still exist on the site. Hazards include, but are not limited to, falling, tripping, punctures and gouges (from broken glass, nails, scrap metal and lumber), falling debris, biological hazards (rodent infestations and droppings, bird droppings, biting insects), and dust. Fluorescent and HID lights and ballasts were identified in the structures at the Combination Mine AOC and the Time Smith Mine AOC. A summary of the physical hazards are described below by AOC.

There are two buildings in the Combination Mill AOC that present physical hazards (Figure 5-1). The "Old Mill" and the Combination Mill are in deteriorating condition. Samples of brick and wood building materials were collected from these buildings and analyzed for total recoverable metals. Concentrations of arsenic, lead, and/or mercury are more than 20 times the screening-level toxicity characteristic regulatory limit (5.0 mg/L for arsenic and lead, 0.2 mg/L for mercury) indicating these building materials may be potentially hazardous. The TCLP was completed on the brick and wood samples to obtain a conclusive toxicity characteristic for each material. Although the arsenic, lead, and mercury results from the TCLP were under the regulatory limits (under 2.0 mg/L for arsenic and lead, under 0.02 mg/L for mercury), the brick and wood will continue to provide contaminant exposure to human and ecological visitors.

Two adits and one building at the Combination Mine AOC present physical hazards (Figure 5-2). The opening to the Combination Auxiliary Adit had begun to cave in, so it has been boarded up with plywood and timber. However, due to the temporary nature of this fix, the adit still presents a physical hazard to recreational users and wildlife. The Combination Adit has been blocked with wood doors, however the doors have been vandalized, and continued use of wood as a barrier could present an ongoing safety issue. Three of the four buildings do not pose physical hazards to recreational users or wildlife, as their windows and doors have been boarded up to limit access. However, the Central Processing Building is not secure, because there are no boards on the doors or windows and there is a large opening in the side of the building. This building contains a large transformer containing dielectric fluid and a scrap vehicle, which present additional hazards at the site.

There are three buildings and two adit structures in the Tim Smith Mine AOC (Figure 5-3). The No. 1 and No. 2 Adits and the Spring House and Adit No. 1 South Building at the Tim Smith

Mine AOC are physical hazards, while the Tim Smith Adit No. 1 North building is in operable condition. Although the entrances to the adits are boarded closed, the Tim Smith Adit No. 1 is caving in and presents a physical hazard to humans and wildlife. The Spring House is located behind a locked gate, and the Tim Smith Adit No. 1 South Building is locked, these structures continue to pose risk to human and ecological health due to the deteriorating conditions of the structures. Other potentially hazardous materials include a fluorescent light fixture, two ballasts, mechanic fluids, fire extinguishers, and a 55-gallon drum of unknown materials.

The Historic Mine AOC has three buildings, three adits, and seven shafts at the site that are in varying condition (Figure 5-4). The Lewis Shaft Garage is boarded up and a fence was installed surrounding the entrance to the building. In addition, a small drum was identified with unknown contents that could potentially be hazardous inside the Lewis Shaft Garage. The Lewis Shaft is fenced off and padlocked. A new hasp and lock was installed on the door to the Lewis Shaft during maintenance activities completed in late fall 2011. The Harrison Shaft has collapsed and asbestos was detected (60% Chrysotile) in a grout sample collected from the Harrison Shaft rubble. The Harper Shaft is sealed with a concrete cover and the small structure next to the Harper Shaft is empty.

In summary, six buildings, four adits, and one shaft, and various items and building materials contained within buildings present physical hazards to humans and wildlife. Five of the adits and shafts have potential of subsiding and three have already begun to cave in. The asbestos present in the Harrison Shaft rubble and the arsenic and lead present in the brick and wood in the "Old Mill" and Combination Mill are potential sources of exposure to human and ecological receptors. Lastly, the deteriorating conditions of the buildings remaining at the site could be hazardous to human and wildlife.

6.0 RECLAMATION OBJECTIVES AND GOALS

The overall objectives of reclamation at BPM are to reduce the current and/or threatened release of potentially hazardous substances to the environment, protect human health and the environment by minimizing direct contact with contaminants, and prevent degradation of adjacent lands. Actions will be taken to meet the following objectives:

- Minimize human and wildlife contact with contaminated material (e.g. tailings, waste rock, soils, sediment, and surface water);
- Reduce the potential for contaminant migration from mine waste (waste rock/tailings), soils, and sediments to surface water, groundwater, and air;
- Reduce the potential for risk to human health through ingestion of contaminated material and/or inhalation of dust;
- Improve water quality in SFLWC to the extent possible, accounting for the presence of upgradient and downgradient sources;
- Limit impacts to human and ecological receptors associated with historic contaminant releases;
- Stabilize soil in disturbed areas to reduce erosion;
- Improve watershed functionality to promote a more stable, natural hydrologic system;
- Leave the site in a condition that supports sustainable ecological communities (terrestrial and aquatic); and
- Minimize post-reclamation visual contrasts between the site and adjacent land.

These objectives can be attained based on goals developed through regulatory requirements (ARAR-based goals), which include numeric or technical criteria, and through risk-based goals developed for the site. The more conservative of the ARAR or risk-based goals is listed as the removal reclamation goal in Section 6.3.

6.1. ARAR-based Removal Reclamation Goals

ARAR-based cleanup goals for BPM are based on the ARARs summarized and evaluated in Section 4. These goals are limited to surface water and groundwater since no contaminant-specific ARARs exist for soils and contaminated material. The scope of this EE/CA and contemplated removal actions are restricted to source control and solid media, including soil, waste rock, tailings, and sediment. Reclamation actions to address risk posed by solid media are expected to improve surface water and/or groundwater quality, and therefore ARARs pertinent to those media are identified and discussed. Historically, improvements in surface water quality have been realized through reclamation actions on solid media, such as those

conducted at the South Soils Removal Area and North Soils Removal Area. However, it is currently premature to predict the extent and nature of the changes in water quality as a result of source control actions. If surface water and groundwater ARAR numeric standards are not met through source control actions, then future additional water reclamation evaluations and actions may be required.

Surface water ARARs include established aquatic life and human health water quality standards which specify concentrations of a specific constituent deemed protective of human health and the environment.

For certain constituents, the aquatic life standards include both acute and chronic criteria. The acute criteria are applicable for short-term exposure and the chronic criteria are applicable for long-term exposure. The BPM risk assessments did not evaluate chronic effects to aquatic life, as consistent long-term water sampling has not occurred at BPM. Therefore, the acute criteria were selected for this evaluation. ARAR-based cleanup goals for surface water are derived from DEQ-7 Water Quality Standards applied for protection of human health and aquatic life (Table 6-1). The numeric value for the goal listed in the ARAR-Based Concentration column is the more conservative of the HHS and the AALS.

Table 6-1. ARAR-Based Removal Action Goals for Surface Water, Black Pine Mine.

Contaminant	Applicable Standard	ARAR-Based Concentration (µg/L)	Existing Concentration at BPM (µg/L)
Antimony	HHS	5.6 PP	ND(0.5) - 117
Arsenic	HHS	10 MCL	ND(0.5) – 54.7
Barium	HHS	1,000 NPP	8.7 – 86.7
Cadmium	AALS	0.52[1] PP	ND(0.08) - 215
Chromium	HHS	100 MCL	ND(0.50) – 2.9
Copper	AALS	3.79[1] PP	1 – 20,900 J
Iron	HHS	300 SMCL	ND (50.0) – 41,400 J
Lead	HHS	15 MCL	0.12/ND(0.12) U - 363
Manganese	HHS	50 SMCL	1.0 – 3,680
Mercury	HHS	0.05 PP	0.0042 – 2.52
Nickel	HHS	100 HA	ND(0.50) – 4.2
Silver	AALS	0.374[1] PP	ND(0.5) – 0.64
Zinc	AALS	37[1] PP	ND(5) – 20,400 J

[1] - At 25 mg/L hardness, CaCO3.
MCL – Maximum Contaminant Level (40 CFR 141)
PP – Priority Pollutant (Section 304(a) of the CWA)
NPP – Non-Priority Pollutant
HA – Health Advisory developed from EPA's "Drinking Water Standards and Health Advisories" (October 1996) guidance, using recent scientific evidence and verified by EPA Region VIII toxicologist
SMCL – Secondary Maximum Contaminant Level

J – Estimated Concentration
U – Evaluated to be undetected at the reporting limit
µg/L – Microgram per liter
HHS – Human Health Standard from October 2012 Circular DEQ-7
AALS – Acute Aquatic Life Standard from October 2012 Circular DEQ-7
ND () Analyte was not detected (reporting limit)

Groundwater at the site is not currently used as a drinking water source, nor is it likely to be used as such in the future based on the undeveloped nature of the site and historic use of the area. Although the removal actions addressed through this EE/CA do not specifically address groundwater (groundwater will be addressed in a future evaluation), the removal actions have the potential to improve groundwater quality through removal of potential sources of contamination.

ARAR-based goals for groundwater are the State of Montana Human Health Standards (HHS) and are listed in Table 6-2. As in Table 6-1, the numeric value for the goal listed in the ARAR-Based Concentration column is the more conservative of the HHS and the AALS.

Table 6-2. ARAR-Based Removal Action Goals for Groundwater, Black Pine Mine.

Contaminant	Applicable Standard	ARAR-Based Concentration (µg/L)	Existing Concentration at BPM (µg/L)
Arsenic	HHS	10 MCL	ND(0.5) - 108
Cadmium	HHS	5 MCL	0.1 - 305
Copper	HHS	1,300 PP	0.93 J – 22,200
Iron	HHS	300 SMCL	ND(50) UJ – 2050 J
Lead	HHS	15 MCL	0.12 J – 23.2 J
Manganese	HHS	50 SMCL	3.6 J - 7740
Zinc	HHS	2,000 HA	ND(5) – 22,300

MCL – Maximum Contaminant Level (40 CFR 141)
PP – Priority Pollutant (Section 304(a) of the CWA)
SMCL – Secondary Maximum Contaminant Level
J – Estimated Concentration
UJ – Estimated Reporting Limit
ND() – Analyte was not detected (reporting limit)
µg/L – microgram per liter
HHS – Human Health Standard from October 2012 Circular DEQ-7

6.2. Risk-based Removal Reclamation Goals

The human health and ecological risk assessments conducted for BPM are summarized in Section 5. The risk assessments identified contaminants of concern (COCs) at BPM resulting from entrainment of mining- and mill-related metals.

6.2.1. Soil, Waste Rock, and Tailings

The human health risk assessment indicates that contaminated material exceed an HQ of 1 for antimony, arsenic and lead, identifying them as COCs for soil, waste rock, and tailings. Additionally, the Estimated Lifetime Cancer Risk for arsenic exceeds EPA guidelines for soil COCs antimony and lead. Background arsenic soil concentrations are naturally high in the BPM area; therefore, the 95th UCL of the arithmetic mean of arsenic concentrations in background samples was used per DEQ guidelines. The human health BPM solid media RBCG are listed in Table 6-3.

Concentrations of contaminated material at BPM are a contributing factor in the lack of vegetation growth on impacted areas of the mine site. RBCG for the protection of ecological receptors are derived from the most conservative toxic reference values for ecological receptors, the terrestrial plant community. The phytotoxicity thresholds are lower than those for human health. The most conservative soil cleanup guidelines for ecological health are presented in Table 6-3.

Table 6-3. Risk-Based Soil[a] Reclamation Goals for the Most Susceptible Ecological Receptors and Human Receptors, Black Pine Mine.

Contaminant of Concern	Receptors most at Risk	Terrestrial Plant Risk-based Reclamation Goal (mg/kg)	Human Health Risked-based Reclamation Goal (mg/kg)	Background Concentrations[b] (mg/kg)
Antimony	Human Health	-	293	61.5
Arsenic	Plant community/ Human Health	10	40.4[a]	40.4
Cadmium	Plant Community	3	-	1.17
Copper	Plant Community	60	-	103.4
Lead	Plant community/ Human Health	50	1,100	416.3
Mercury	Plant Community	5	-	0.083
Zinc	Plant Community	50	-	100.0

[a] Soil also includes waste rock and tailings

[b] UCL = 95th Upper Confidence Limit on the arithmetic mean from background samples

mg/kg – milligram per kilogram

- indicates not applicable as a COC

6.2.2. Sediment

The COCs in sediments at BPM are antimony, arsenic, and lead. The sediment RBCGs for human health are listed in Table 6-4. The ecological risk assessment indicated exposures to arsenic, copper, lead, mercury, silver, and zinc in sediments at BPM present health risks to ecological communities. Exposures to mercury in sediments are 82 times greater than the aquatic life threshold, indicating a significant risk to the aquatic community at BPM. The risk-based reclamation goals to protect ecological receptors at BPM should be based on the most

conservative thresholds between the aquatic life and human health communities. Table 6-4 lists the sediment reclamation goals for BPM.

Table 6-4. Risk-Based Sediment Reclamation Goals for the Most Susceptible Ecological Receptors and Human Receptors, Black Pine Mine.

Contaminant of Concern	Receptors most at Risk	Aquatic Life Risk-based Goal (mg/kg)[a]	Human Health Risk-based Goal (mg/kg)	Background Concentration (mg/kg)[b]
Antimony	Aquatic Life/ Human Health	NS	293	ND
Arsenic	Aquatic Life/ Human Health	70.0	40.4[c]	12.0
Copper	Aquatic Life	270	-	26.8
Lead	Aquatic Life/ Human Health	218	1,100	16.3
Mercury	Aquatic Life	0.71	-	0.38
Silver	Aquatic Life	3.70	-	ND
Zinc	Aquatic Life	410	-	96.8

[a] Sediment quality guidelines (NOAA 1999); medium affects range for biological effects
[b] Based on upstream sediment sample (only one sample upstream of BPM)
[c] UCL = 95th Upper Confidence Limit on the arithmetic mean from background samples
mg/kg – milligram per kilogram
– indicates not applicable
NS – a standard has not been developed
ND – Analyte not detected

6.2.3. Surface Water

The surface water human health COCs at BPM are antimony, arsenic, lead, and mercury. The human health RBCGs are listed in Table 6-5. Risks to ecological receptors at BPM exist from exposures to arsenic, cadmium, copper, lead, mercury, silver, and zinc in surface waters. Exposures to copper in surface water are 58 times greater than the DEQ acute aquatic life threshold, indicating a significant risk to the aquatic community. Surface water reclamation goals for BPM should be based on the most conservative thresholds between the aquatic life and human health communities. Table 6-5 lists the surface water reclamation goals for BPM.

Table 6-5. Risk-Based Surface Water Reclamation Goals for the Most Susceptible Ecological Receptors and Human Receptors, Black Pine Mine.

Contaminant of Concern	Receptors most at Risk	Aquatic Life Risk-based Reclamation Goal (µg/L)[a, b]	Human Health Risk-based Reclamation Goal (µg/L)[b]	Background Concentrations (µg/L)[c]
Antimony	Aquatic Life/ Human Health	NS	91.1	0.24
Arsenic	Aquatic Life/ Human Health	340	10[d]	0.57
Cadmium	Aquatic Life	0.52	-	0.06
Copper	Aquatic Life	3.79	-	6.9
Lead	Aquatic Life/ Human Health	13.98	47.1	1.06

Mercury	Aquatic Life/ Human Health	1.70	0.15	0.006
Silver	Aquatic Life	0.374	-	ND
Zinc	Aquatic Life	37	-	3.96

[a] Freshwater acute aquatic life standards (AALS), DEQ-7 Montana Numeric Water Quality Standards (DEQ 2012)
[b] Hardness adjusted thresholds (hardness measured was less than 25 mg/L).
[c] UCL = 95th Upper Confidence Limit on the arithmetic mean from background samples.
[d] MCL = State of Montana Circular DEQ-7 drinking water standard, Maximum Contaminant Level (DEQ 2012)
µg/L – microgram per liter
– indicates not applicable
NS – a standard has not been developed
ND – Analyte not detected

6.3. Removal Reclamation Goals

Removal reclamation goals at BMP are based first on the 95th UCL of the arithmetic mean concentration from background samples. However, if an ARAR or risk-based concentration is higher than the background concentration, the more conservative value of the ARAR or risk-based guidelines is listed as the removal reclamation goal. Table 6-6 presents the site wide contaminants and associated reclamation goals.

Table 6-6. Removal Reclamation Goals, Black Pine Mine.

Contaminant of Concern	Surface Water (µg/L)	Sediment (mg/kg)	Soil (mg/kg)	Groundwater (µg/L)
Antimony	5.6[a]	293[c]	293[c]	-
Arsenic	10[a]	40.4[b]	40.4[b]	10[a]
Barium	1,000[a]	-	-	-
Cadmium	0.52[a]	-	3[c]	5[a]
Chromium	100[a]	-	-	-
Copper	3.79[a]	270[c]	103.4[b]	1,300[a]
Iron	300[a]	-	-	300[a]
Lead	13.98[a]	218[c]	416.3[b]	15[a]
Manganese	50[a]	-	-	50[a]
Mercury	0.05[a]	0.71[c]	5[c]	-
Nickel	100[a]	-	-	-
Silver	0.374[a]	3.7[c]	-	-
Zinc	37[a]	410[c]	100[b]	2,000[a]

[a] ARAR based concentration based
[b] background concentration based
[c] risk-based concentration
mg/kg – milligram per kilogram
µg/L – microgram per liter
- Indicates metal is not considered a contaminant for that media

7.0 PRESENTATION OF PROCESS OPTIONS

This section presents the general response actions associated with the reclamation objectives identified in Section 6.0, and the process options and technologies associated with those response actions. The reclamation options and technologies were evaluated and screened based on effectiveness, implementability, and cost. The retained process options are developed in Section 8.0 into site-wide reclamation alternatives.

This section focuses on options that met the screening criteria and were retained for further evaluation. The screening criteria for evaluation of the technology process options are discussed in Section 7.2. Options that were eliminated through the screening process are presented and discussed in Appendix F.

The objectives presented in Section 6.0 primarily relate to solid media, but also include surface water and groundwater media. As discussed in Section 6.0, the scope of this EE/CA and contemplated removal actions are restricted to source control and solid media, including soil, waste rock, tailings, and sediment. Therefore, GRAs and technology process options to specifically address surface water and groundwater are not included.

7.1. General Response Actions and Reclamation Technologies

General response actions and reclamation technologies have been organized into four categories in order to provide a basis for relative comparison of process options based on effectiveness, implementability, and cost. The following categories represent the technologies identified for site reclamation:

- No action
- Institutional controls
- Engineering controls
- Treatment

For each reclamation technology, site specific process options are identified and compared.

7.1.1. Category Descriptions

7.1.1.1. No Action

Under this general response action, no reclamation technology would be implemented and reclamation would rely strictly on natural processes. No additional reclamation, treatment technologies, controls, or assessment would be required. The contaminated material would remain within each AOC.

7.1.1.2. Institutional Controls

Institutional controls include reclamation technologies for access control, such as physical barriers and fencing to restrict access to the site, detailed signage to warn the general public of existing hazards, and administrative actions such as land use restrictions. These controls do not reduce the volume, toxicity, or mobility of contaminants. Institutional controls are frequently used in combination with other actions to educate and warn the public, and minimize access and/or restrict use to control potential exposure to contaminants.

7.1.1.3. Engineering Controls

Since this EE/CA focuses solely on source control, proposed engineering controls include reclamation of solid media only; reclamation of groundwater and surface water will be evaluated at a later date. Engineering controls include reclamation technologies for removal and containment, surface restoration, SFLWC and Mill Creek restoration, and physical hazard removal. Engineering controls can reduce the volume and/or mobility of contaminants onsite.

Since this EE/CA focuses solely on source control, the process options and technologies do not include reclamation of surface water or groundwater.

7.1.1.4. Treatment

This EE/CA focuses solely on source control; therefore, proposed treatment technologies are for reclamation of solid media only. Water treatment at the BPM was evaluated in the 2014 Site Reclamation and Water Treatment Technical Memorandum, included in Appendix G.

Solid media treatment involves destruction or detoxification of contaminated material, separation or volume reduction followed by reuse, recycling, destruction or detoxification of the residual contaminated material, or immobilization of the contaminated material.

Treatment technologies can be categorized as physical, thermal, chemical, or biological. Some technologies may combine these basic processes where, for instance, both chemical reactions and physical treatment take place. Treatment processes may produce residuals that can be hazardous substances, and may require disposal or further treatment.

7.1.2. Identification of Process Options

Process options were developed based on appropriate and all known, available, and reasonable technologies (AKART), previous reclamation project work, and industry standard practices. Table 7-1 presents process options organized by general response actions and reclamation technologies.

Table 7-1. Process Options, Black Pine Mine.

General Response Action	Reclamation Technology	Process Option
No Action	None	No Action
Institutional Controls	Access and Use Control	Fencing and Signage
		Land Use Restrictions

Engineering Controls	Removal and/or Containment	Removal of Contaminated Material and Placement in Repository on Trust Property
		Removal of Contaminated Material and Placement in Offsite Disposal Facility
		In Place Capping
		Removal of Dispersed Contaminated Material
	Surface Restoration	Revegetation
		Rock Cover
	Stream Restoration	Relocation and Reconstruction of SFLWC and Mill Creek
		No Restoration of SFLWC and Mill Creek
	Physical Hazard Removal	Adit Closure and Stabilization
		Building Demolition
		Building Maintenance and Protection
Treatment	Solid Media Treatment	Waste Rock Reprocessing
		Soil Binding with Enzymes
		Lime Solidification
		Cement Solidification

7.2. Process Options Screening

This section describes the screening criteria used to compare and evaluate the general response and reclamation technology process options. The screening criteria are as follows:

- Effectiveness. Effectiveness is evaluated based on how completely the option achieves the reclamation objective and cleanup goals in both the short and long term. In addition, the reclamation option is evaluated based on its ability to protect human health and the environment, comply with ARARs, and reduce contaminant toxicity, mobility, and volume. Considerations used in determining effectiveness include site-specific factors and characteristics of the reclamation option.

- Implementability. Implementability is evaluated based on the technical and administrative feasibility of an option and on the availability of services and materials. Technical feasibility considerations include the ability to construct, install, operate, and maintain the system to be used, the possibility of technical difficulties, and the potential need to monitor and review performance. Administrative feasibility considerations include logistics, land ownership, the ability to implement institutional controls, the ease of acquisition of normal legal approvals (i.e., permits), community involvement, public acceptability, and coordination of government regulatory agencies. Implementability also takes into account integration with existing facility operations, as well as other current or potential reclamation.

- Cost. Cost evaluates the estimated capital cost for each reclamation option. This evaluation is done through the development of order-of-magnitude cost estimates for

the purpose of comparing reclamation options. The estimates are based on previous similar projects performed for DEQ, unit cost data from RS Means, and quotes from local suppliers and contractors. The cost estimates do not reflect actual project financing.

Process options were assigned a rating of high, moderate, or low for effectiveness and implementability, and costs were developed for each option. Options were then ranked within each reclamation technology category from most suitable to least suitable based on effectiveness, then implementability, and lastly cost. Options are presented in ranked order in the screening table (Appendix H).

Options that were known or found to be ineffective, difficult to implement, and/or cost prohibitive based on the screening process were not retained for inclusion in site-wide alternatives. These options and the rationale for elimination are described in Appendix F.

Process options that were deemed to be effective, applicable, and feasible are described below. These options will be combined to create site-wide alternatives that are developed and evaluated in Section 8.

7.2.1. No Action

Under the no action option, no reclamation activities would be performed at the site to control contaminant mobility or reduce toxicity or volume, including no institutional or engineering controls.

The no action option is implementable but not effective; however, it is retained and used as a baseline for comparative purposes in Section 8.

7.2.2. Institutional Controls

Although institutional control options are implementable and low in cost, they are not effective at meeting reclamation goals or at providing protection of human and ecological health. Institutional control options are not effective as stand-alone options, but will be combined with other options during the development of alternatives. Information on these options is included in Appendix F.

7.2.3. Engineering Controls

Engineering control process options that met screening criteria are described below. The option for stream restoration, No Restoration of SFLWC and Mill Creek, is not protective of ecological health; therefore, this option was not retained for further evaluation. Information on this option is included in Appendix F.

Removal and/or Containment

7.2.3.1. Removal of Contaminated Material and Placement in a Repository on Trust Property Option

This option includes removal of contaminated material and disposal in an engineered repository on Trust property. Contaminated material would be excavated from the AOCs and

hauled to one main repository. Over-excavation of the contaminated material would be performed to ensure that the removal reclamation goals presented in Section 6 are met.

Total recoverable metals analyses from the 2011 site investigation indicate the contaminated material left from mining activities poses an unacceptable risk to human health and the environment. However, mine waste solids at BPM are not considered hazardous waste according to the Bevill exemption, which excludes "solid waste from the extraction, beneficiation, and processing of ores and minerals" from regulation as hazardous waste under Subtitle C of RCRA [40 CFR 261.4(b)(7)]. Material not covered under the Bevill exemption, such as building debris and roaster brick, would have to be hauled offsite and disposed of in the proper classification of landfill. A repository, with an adequate cover system, would achieve the removal reclamation goals for contaminated material, including waste rock and tailings, presented in Section 6. Removal of contaminated material from the environs and placement in a repository is expected to improve surface water and groundwater quality. If water-related ARAR numeric standards are not met through source removal actions, then future additional water reclamation evaluations and actions may be required.

A detailed repository investigation assessing specific suitable repository locations was performed in 2012 and the results are presented in the Repository Investigation Report (Herrera 2013). The repository would be located in a topographic bowl north of the access road to the Lewis Shaft and would include approximately 15 acres, as shown on Figure 7-1. This location is high in the drainage, which reduces the likelihood of groundwater influx to the bottom of the repository. The existing topography would allow repository grading to blend with the surrounding terrain. The area is accessible by existing roads. There are two overhead power lines above the repository location that may need to be relocated.

The cap design would consist of a low-permeability synthetic liner (geomembrane) designed to prevent stormwater from percolating into the underlying contaminated material. A composite drainage net would be installed over the liner to help convey water away from the repository. A minimum three-foot thick soil cover would be placed above the liner/drainage net to protect the liner from punctures. An additional six inches of topsoil, or a six-inch thick rock cover would then be placed over the soil cover for protection. The topsoil would be vegetated with native species. Information regarding the conceptual repository design is presented in the Conceptual Repository Design Technical Memorandum (Herrera 2014). Conceptual repository design figures from this report are included in Appendix I.

The areas in each AOC where contaminated material was removed would be reclaimed. Surface restoration options for the removal area and repository cover are included in Section 7.2.3.5 and 7.2.3.6.

Removal and placement of contaminated material in a repository is an effective option for protection of human and ecological health. It is implementable and cost effective, and will be retained for further evaluation in Section 8.

7.2.3.2. Removal of Contaminated Material and Placement in Offsite Disposal Facility Option

This option includes excavating contaminated materials from the AOCs and SFLWC and hauling them to an offsite permitted facility. Over-excavation of the contaminated material would be

performed to ensure that the soil and sediment removal goals presented in Section 6 are met. Contaminated material would be loaded into trucks and hauled to a nearby permitted disposal facility. Evaluation and costs in this EE/CA are based on disposal at a Class II municipal landfill, which consist of municipal solid waste landfills (RCRA D). The closest Class II municipal landfills are approximately 70 miles from BPM. Material would be disposed according to the appropriate state and federal regulations. If the material would have to be hauled to a hazardous waste landfill (RCRA C) the closest landfills would be Grandview, ID or Lake Point, UT. This would greatly increase costs for hauling and disposal.

All disturbed areas would be reclaimed and restored following reclamation activities. Surface restoration options for the removal area are included in Section 7.2.3.5.

Although the removal and offsite disposal option is cost prohibitive, it is an effective option for protection of human and ecological health and could be readily implemented. Therefore, it will be retained for further evaluation in Section 8.

7.2.3.3. In Place Capping Option

In-place capping of contaminated material would include regrading the existing tailings and waste rock to provide a level surface and placing a 3-foot soil cap over the entire area. The soil cap would consist of low permeability soil to reduce contact between stormwater run-on and contaminated material. To reduce erosion and minimize infiltration of stormwater, a surface cover would be placed over the cap, which would consist of either six inches of topsoil to provide a growth medium for vegetation or six inches of onsite rock. Surface restoration options for the cover are included in Sections 7.2.3.5 and 7.2.3.6.

Select in-place capping would be completed in AOCs where there is no potential for interaction between the contaminated material and groundwater. One of the groundwater monitoring wells located in the Combination Mine AOC showed a depth to water of less than one foot and groundwater was encountered in a test pit at the Combination Mill AOC at approximately three feet bgs. Groundwater influx in these AOCs could mobilize contaminants and compromise the integrity of the capping system. Therefore, this option was not retained in the development of site-wide alternatives involving the Combination Mine or Combination Mill wastes.

Although the in-place capping option is not as effective as the other removal options for the Combination Mine and Combination Mill wastes, it is an effective option for protection of human and ecological health in the Tim Smith Mine and Historic Mine AOCs. It could be readily implemented and is cost effective. Therefore, in-place capping in the Tim Smith Mine and Historic Mine AOCs will be retained for further evaluation in Section 8.

7.2.3.4. Removal of Dispersed Contaminated Material Option

The removal of dispersed contaminated material consists of the excavation and removal of approximately 19,700 cy of contaminated material along SFLWC on USFS administered lands (Figure 7-2). The contaminated materials are deposited in pockets along SFLWC and selective clearing and grubbing would be required to access the contaminated material from USFS

roads. The contaminated material would be hauled and disposed of in a repository or at an offsite disposal facility as identified in Sections 7.2.3.1 through 7.2.3.2. The removal areas would then be restored with surface restoration options discussed in Section 7.2.3.5.

The removal of dispersed contaminated material option is an effective option for protection of human and ecological health. It is implementable and cost effective, and will be retained for further evaluation in Section 8.

Surface Restoration

Revegetation and rock cover are two options identified for surface restoration. Surface restoration will be performed on areas within each AOC where contaminated material has been removed, disturbed borrow areas, and areas necessitating a cover system. One or more of the surface restoration options may be appropriate within each AOC.

7.2.3.5. Revegetation Option

Revegetation would occur in areas where contaminated material has been removed, borrow areas, and in-place capping areas. Revegetation at each of these areas would require site-specific planting and seeding approaches.

Areas disturbed by removal of contaminated material would be restored with vegetation appropriate to the hydrology of the area. Stream banks and immediate flood plains would be planted with riparian grasses and shrubs to provide stabilization. Drier disturbed sites would be seeded with upland grasses and planted with lodgepole pine, which is the dominant "pioneer" species in the area. These areas would require less topsoil, with four inches on the riparian areas and two inches on more arid areas.

Borrow areas would be excavated with the goal of retaining at least two inches of topsoil to support revegetation efforts in capped areas and in disturbed areas within each AOC. The borrow areas would be reseeded with upland grasses and planted with lodge pole pine.

The cover system used for in-place capping would be stabilized to maintain the integrity of the cap. A dense grass cover would be planted to provide stabilization and reduce erosion. A grass seed mix would be chosen to provide a dense cover, which would reduce the natural invasion of woody plants that could compromise the integrity of the cap through root intrusion. Successful grass establishment would require the placement of at least six inches of topsoil.

Topsoil borrow locations at or near BPM are limited to three locations at BPM (onsite) and two locations in close proximity to BPM (offsite), as shown in Figure 7-3. These areas may not provide the entire amount of required borrow material, so additional topsoil may need to be generated from amending subsoil, or new topsoil may need to be purchased and imported.

The following sections provide descriptions of the choices involved with obtaining topsoil for revegetation purposes.

a. Onsite Borrow and Amendments

This choice would consist of excavating material on Trust property and hauling and placing it on disturbed areas. Three onsite borrow areas have been identified as topsoil sources. Amendments, such as organic matter and micro/macro nutrients, may need to be added to the borrow material in order to provide an effective growth medium for the establishment of grasses and plants. For instance, based on the 2012 Repository Investigation Report (Herrera, 2013), the soils within the onsite borrow areas show adequate levels of potassium and phosphorus, but have low organic matter content and nitrogen levels. Amendments will be added according to soil properties at the specific borrow locations. Following the regrading of disturbed areas, borrow material would be placed over the entire area and then revegetated.

b. Offsite Borrow and Amendments

This choice involves excavating material from adjacent lands administered by USFS, and hauling and placing it on disturbed areas. Two offsite borrow sites have been identified, with distances ranging from approximately 4.8-5.6 miles. Soil amendments would likely be necessary for material originating from an offsite borrow source, as nitrate levels from select borrow areas are below those needed to support revegetation efforts. A visual assessment for noxious and invasive plants present on borrow areas, in addition to the transport route, would be performed prior to transporting the material to BPM. If an excessive number of noxious and invasive plants are found, treatment would be implemented prior to harvesting the soil in order to prevent the spread of noxious and invasive species at BPM. Following the regrading of disturbed areas, borrow material would be placed over the entire area and then revegetated.

c. Import Topsoil

Importing topsoil would involve purchasing topsoil and hauling to BPM. A material analysis would be obtained to verify soil properties. In the event that the imported soil had inadequate nutrient levels to promote successful revegetation, amendments would be added. The topsoil would be spread to the specified thickness and revegatated.

The revegetation option is an effective option for remediation of disturbed areas. Onsite and offsite borrow and amendments are readily implementable and cost effective, and are retained for further evaluation in Section 8. Importing topsoil would be effective and implementable; however, it is cost prohibitive due to the unit price and hauling costs between BPM and potential vendors and is not retained for further evaluation.

7.2.3.6. Rock Cover Option

Rock would be used to provide cover on the repository. Soil processing for a rock cover option consists of using a vibratory screen plant to separate coarse fragments (rock) from soil particles. Material excavated to construct the repository would be screened using various sized screens to obtain six-inch minus rock, and the material would be stockpiled for use as cover. Rock would be placed in a six-inch lift over the three-foot thick soil cover.

The rock cover is an effective option for protection of the repository cover system and is readily implementable. Although the revegetation option is more cost effective, there is

limited borrow material available onsite to use as planting media. Therefore, the soil processing for rock cover option will be retained for further evaluation in Section 8.

Stream Restoration

7.2.3.7. Relocation and Reconstruction of SFLWC and Mill Creek Option

SFLWC is currently constricted by berms along the tailings impoundments at the Combination Mill AOC to separate the creek from the tailings. Additionally, Mill Creek bisects the tailings impoundment and connects with SFLWC following flowing past the impoundments. This option describes the process involved with relocating and reconstructing SFLWC.

There are long-term risks associated with leaving the existing tailings impoundments in place and the creeks in their current channels. Hydraulic modeling has shown that the impoundment berms are adequate to confine peak flows up to and including expected 500-year recurrence interval flows on both SFLWC and Mill Creek (hydrologic and hydraulic analyses are presented in Appendix J). However, there are side channels on the floodplain that are known to have conveyed water and sediment during peak flows in 1989, and hydraulic modeling of the existing channel indicates that these side channels and floodplain channels engage at and above the 2-year recurrence interval peak flow. Previously mobilized sediments are currently stored on the floodplain and are subject to remobilization by peak flows that – while insufficient to overtop the impoundment berms – do overtop the banks of SFLWC and activate floodplain channels. Furthermore, the possibility of a debris flow from the right-bank tributary to Mill Creek just upstream of the impoundments cannot be dismissed. During intense local thunderstorms in 2000-2001 similar small steep drainages in the Bitterroots produced debris torrents with estimated peak flows in excess of 7,000 cfs (Parrett et al. 2003); such a flow would overtop and likely breach the impoundment berms, mobilizing some if not all of the impounded tailings, and could return the Mill Creek – SFLWC confluence to its historic location on the north side of the Mill Creek fan, rerouting the Mill Creek channel through the northern tailings impoundment.

Relocation and reconstruction of SFLWC and Mill Creek would include realignment and restoration of the SFLWC channel from where it crosses USFS 678 to the downstream Trust property boundary (Figure 7-4). The proposed channel shown in Figure 7-4 is a concept-level plan that would return the channel to its approximate historical location while minimizing disturbance of the existing SFLWC channel during construction. Channel cross-sections and profiles will be developed during design to ensure adequate conveyance of expected peak flows (Appendix J). Reclamation work at the site would consist of reconstructing approximately 3,000 feet of SFLWC, reconstructing approximately 400 feet of Mill Creek, establishing riparian vegetation along the constructed creek, implementing BMPs to reduce erosion on reclaimed areas, and installing temporary fencing.

The stream channel design will be a collaborative effort between DEQ and the USFS. The SFLWC channel would be realigned to its approximate historic location, with a plan and gradient that is consistent with the upstream and downstream portions of the creek not directly impacted by tailings deposits. Mill Creek would be realigned to its approximate historic location. Regraded areas and the banks of SFLWC and Mill Creek would be revegetated following construction.

The relocation and reconstruction of SFLWC and Mill Creek option is an effective option for restoration of the creek channel. It is readily implementable and cost effective, and will be retained for further evaluation in Section 8.

Physical Hazard Removal

Physical hazards at BPM consist of mine infrastructure, including adits, shafts, and buildings. The adits, shafts, and buildings located in the AOCs at BPM are in varying conditions. In order to address the physical hazards that these structures present, various options have been identified in the sections below. One or more of the options may be appropriate within each AOC. Table 7-2 lists the buildings and adits from each AOC and includes actions for addressing the condition of structures that have been identified as physical hazards.

Table 7-2. Actions to Address Conditions of Buildings, Adits, and Shafts at Black Pine Mine.

AOC	Structure	Action
Combination Mine	Northern Building	None
	Southern Building	None
	Central Processing Building	Remove material and vehicle within
	Mechanical Building	Maintain locks
	Combination Adit	Secure entrance
	Combination Auxiliary Adit	Stabilize and secure entrance
Tim Smith Mine	Adit No. 1 North Building	Remove material within
	Adit No. 1 South Building	Demolish
	Spring House	Demolish
	No. 1 Adit	Permanently close entrance
	No. 2 Adit	Permanently close entrance
Historic Mine	Lewis Shaft Garage	Relocate core samples and demolish
	Lewis Shaft Building	Maintain perimeter fence
	Lewis Shaft	Maintain perimeter fence
	Harrison Shaft	Remove rubble
Combination Mill	Combination Mill	Demolish
	"Old Mill"	Demolish
	Pump House	Maintain locks

7.2.3.8. Adit Closure and Stabilization Option

There are numerous adits at BPM and the stability of each adit varies; some of the adits have collapsed and the structural integrity of others is unknown. Further degradation of the adit

structures could result in an unpredictable collapse and thereby cause harm to nearby individuals or wildlife.

Adit closure would be conducted for unstable adits that are no longer required, and would involve backfilling the adit entrance to ensure that future access to the mine workings is not possible. The Combination Mine and Combination Auxiliary Adits will remain accessible in order to access the pumpback system and mine workings. The Combination Mine Adit entrance would be secured, and the Combination Auxiliary Adit entrance would be stabilized and repaired. Any adit entrance that does not meet structural requirements would need to be reinforced and stabilized.

The adit closure and stabilization option is an effective option for protection of human and ecological health. It is readily implementable and cost effective, and will be retained for further evaluation in Section 8.

7.2.3.9. Building Demolition Option

Multiple structures at BPM have not been maintained and are in deteriorating condition, which may present risks to human health, including structure collapse or rodent infestation. Removal of these structures would prevent a possible collapse that could cause damage or injury. Removal would also restore natural habitat and help meet the objective to leave the site in a condition that supports sustainable ecological communities. The building demolition option would include tearing down the existing structures and transporting the debris offsite. All construction debris removed from the existing structures would be properly disposed of in accordance with state and federal waste regulations.

The building demolition option is an effective option for protection of human and ecological health. It is readily implementable and cost effective for buildings that are currently in various states of disrepair. It will be retained for further evaluation in Section 8.

7.2.3.10. Building Maintenance and Protection Option

Some structures located at BPM are in operable condition, but in need of maintenance and protection. Maintaining perimeter fencing and locks on buildings would prevent access to recreational users of BPM and provide site safety. Various mining material and objects, such as core samples, equipment, and scrap vehicles, would be removed from buildings that are to be left intact; Objects would be relocated or disposed of to minimize hazards. Structures that are left onsite would require periodic inspection and maintenance in the future.

The building maintenance and protection option is an effective option for protection of human and ecological health. It is readily implementable and cost effective for buildings that are currently in working condition. It will be retained for further evaluation in Section 8.

7.2.4. Treatment

Although some solid media treatment options are effective at meeting reclamation goals and protecting human and ecological health, most are difficult to implement or cost prohibitive. Therefore, treatment options were not retained for further evaluation. Information on these options is included in Appendix F.

7.3. Process Option Screening Summary

This section summarizes the results of the process option screening process. Table 7-3 shows the rankings for effectiveness, implementability, and cost, and whether or not the option was retained for further evaluation. Process options that are not retained for further analysis because they are ineffective, difficult to implement, or do not achieve the project reclamation goals are highlighted in grey.

Table 7-3. Process Option Screening Summary, Black Pine Mine.

General Response Action	Reclamation Technology	Process Option	Effectiveness	Implement-ability	Cost	Retained for Further Analysis?
No Action	None	No Action	NA	NA	$0	Yes
Institutional Controls	Access and Use Control	Fencing and Signage	Low	High	$123,900	No, but will be combined with other options
		Land Use Restrictions	Low	Moderate	$200	No, but will be combined with other options
Engineering Controls	Removal and/or Containment	Removal of Contaminated Material and Placement in Repository on Trust Property	High	High	$8,537,700	Yes
		Removal of Contaminated Material and Placement in Offsite Disposal Facility	High	High	$20,106,100	Yes
		In Place Capping	Moderate	High	$2,404,400	Yes
		Removal of Dispersed Contaminated Material	High	High	$424,700	Yes
	Surface Restoration	Reveg-etation / Onsite Borrow / Removal Areas	High	High	$1,024,300	Yes
		Reveg-etation / Onsite Borrow / Repo-sitory	High	High	$106,200	Yes
		Reveg-etation / Offsite Borrow / Removal Areas	High	High	$1,191,300	Yes
		Reveg-etation / Offsite Borrow / Repo-sitory	High	High	$135,000	Yes
		Reveg-etation / Import Topsoil / Removal Areas	High	High	$2,709,200	Yes
		Reveg-etation / Import Topsoil / Repo-sitory	High	High	$396,900	Yes
		Rock Cover: Native Material Screening (Repository)	High	High	$728,200	Yes
		Rock Cover: Import Rock (Repository)	High	High	$1,381,400	No
	Stream Restoration	Relocation and Reconstruction of SFLWC and Mill Creek	High	Moderate	$462,500	Yes

		No Restoration of SFLWC and Mill Creek	Low	Moderate	$0	No
	Physical Hazard Removal	Adit Closure and Stabilization	High	High	$37,600	Yes
		Building Demolition	High	High	$21,400	Yes
		Building Maintenance and Protection	Moderate	High	$7,900	Yes
Treatment	Solid Media Treatment	Waste Rock Reprocessing	High	Low	$54,675,900	No
		Soil Binding with Enzymes	Low	Moderate	$6,278,900	No
		Lime Solidification	Low	Low	$9,914,600	No
		Cement Solidification	Low	Low	$10,396,400	No

NA = Not Applicable

As a result of the screening process, 14 process options have been retained for detailed analysis in Section 8. The 14 process options will be combined into alternatives for each AOC. The preferred AOC alternatives will then be combined into a site-wide preferred alternative.

8.0 Detailed Analysis of Reclamation Alternatives

This section provides descriptions and a detailed analysis of removal action reclamation alternatives, which are assembled from the process options presented in Section 7. The 14 site-wide process options that were retained for further analysis were revised and refined to create five site-wide alternatives. Table 8-1 presents the site-wide alternatives and shows the process options that compose each alternative.

Table 8-1. Presentation of Reclamation Alternatives, Black Pine Mine.

Alternative	Process Options
1	No Action
2	Select Removal of Contaminated Material and Placement in Repository on Trust Property
	Removal of Dispersed Contaminated Material
	Select In-Place Capping
	Relocation and Reconstruction of SFLWC and Mill Creek
	Revegetation
	Rock Cover
	Adit Closure and Stabilization
	Building Demolition
	Building Maintenance and Protection
3	Select Removal of Contaminated Material and Placement in Offsite Disposal Facility
	Removal of Dispersed Contaminated Material
	Select In-Place Capping
	Relocation and Reconstruction of SFLWC and Mill Creek
	Revegetation
	Adit Closure and Stabilization
	Building Demolition
	Building Maintenance and Protection
4	Site-Wide Removal of Contaminated Material and Placement in Repository on Trust Property
	Removal of Dispersed Contaminated Material
	Relocation and Reconstruction of SFLWC and Mill Creek
	Revegetation

	Rock Cover
	Adit Closure and Stabilization
	Building Demolition
	Building Maintenance and Protection
5	Site-Wide Removal of Contaminated Material and Placement in Offsite Disposal Facility
	Removal of Dispersed Contaminated Material
	Relocation and Reconstruction of SFLWC and Mill Creek
	Revegetation
	Adit Closure and Stabilization
	Building Demolition
	Building Maintenance and Protection

Alternative 1, No Action, is required by the NCP. The other alternatives comprise various containment actions to address the solid contaminated material as well as other actions to address adit stabilization, adit closure, building maintenance and protection, building demolition, and reconstruction of SFLWC and Mill Creek. The containment alternatives primarily differ in whether contaminated materials are excavated and placed in a repository on Trust property, capped in-place, excavated and disposed of offsite, or a combination of those options. As discussed in Section 7, treatment options of contaminated solid materials were either not as effective as or more expensive than containment options, and therefore, a site-wide treatment alternative was not developed.

Because this EE/CA addresses source removal only, the alternatives presented address solid contaminated material and do not include groundwater or surface water reclamation alternatives. In addition, the impact of source control options on surface water and groundwater are not evaluated in detail. Based on past actions, it is anticipated that removing solid contaminated material from the SFLWC floodplain area will reduce human and ecological risks associated with surface water and groundwater.

8.1. Alternatives Analysis Criteria

A detailed analysis for each alternative was performed by evaluating the following criteria, in accordance with the NCP:

- Effectiveness
  - Overall protection of human health and the environment
  - Compliance with ARARs
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume through treatment

- Short-term effectiveness

- Implementability
- Cost

Descriptions of the evaluation criteria that were used to assess the site-wide alternatives are as follows:

Effectiveness –

The scope of this EE/CA and contemplated removal actions are restricted to source control actions on solid media, including soil, waste rock, tailings, and sediment. Reclamation actions to address risk posed by solid media are expected to improve surface water and/or groundwater quality; however, it is currently premature to predict the extent and nature of the changes in water quality as a result of source control actions. It is acknowledged that surface water and groundwater ARAR numeric standards may not be fully met through source control actions, and future additional water reclamation evaluations and actions may be required. The evaluation of effectiveness for each alternative identified in this EE/CA is restricted to how well each alternative is able to achieve the specified criteria for addressing solid contaminated media. The ability of an alternative to achieve anti-degradation water-related ARARs is also included within the evaluation, but the ability of an alternative to achieve specific ARAR-based numeric water quality standards is not included in the evaluation.

The five main elements comprising effectiveness are described below. *Overall Protection of Human Health and the Environment* – The overall assessment of protection draws on the assessments conducted under other evaluation criteria, particularly long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. Adequate protection must be demonstrated by elimination, reduction, or control for each exposure pathway. Short-term or cross-media impacts also must be acceptable.

Compliance with ARARs – This criterion is assessed on how each alternative complies with applicable or relevant and appropriate standards, criteria, advisories, or other guidelines. Waivers are identified if necessary. A comprehensive list of federal and state ARARs has been developed for BPM and is presented in detail in Section 4. The ARARs are divided into contaminant-specific, location-specific, and action-specific requirements.

Long-term Effectiveness and Permanence – This criterion is evaluated based on the effectiveness of each alternative in protecting human health and the environment after the reclamation objectives have been achieved. The assessment considers the degree of certainty that the alternative will be successful, its long-term reliability, the magnitude of residual risk, and effectiveness of controls required to manage treatment residues of remaining contaminants.

Reduction of Toxicity, Mobility, or Volume through Treatment – This criterion is evaluated with respect to the statutory preference for selecting actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substance as its principle element. This preference is satisfied when treatment is used to reduce the principle threats at a site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.

Short-term Effectiveness – This criterion includes the effectiveness of each alternative in protecting human health and the environment during construction and implementation of a remedy until removal actions have been completed. The length of time to reach removal action objectives is also considered.

Implementability - This criterion includes the technical and administrative feasibility of an alternative including the availability of services and materials. Technical feasibility considerations include the ability to construct, install, operate, and maintain the system to be used, the possibility of technical difficulties, and the potential need to monitor and review for effective performance. Administrative feasibility considerations include logistics, land ownership, the ability to implement institutional controls, the ease of acquisition of normal legal approvals (i.e., permits), community involvement, public acceptance, and coordination with government regulatory agencies. Implementability also takes into account integration with existing facility operations, as well as other current or potential reclamation activities.

Cost – This criterion includes the estimated capital cost, operation, and maintenance costs for each reclamation alternative. The cost estimates do not reflect actual project financing. A removal action is not considered practical if the cost of the removal action is substantial and disproportionate to the degree of protection it would achieve over a lower preference cleanup action.

Following the detailed analysis of the site-wide alternatives, a comparative analysis (see Section 9.0) will be conducted, including a discussion of each reclamation alternative's relative strengths and weaknesses with respect to each evaluation criterion and how reasonable key uncertainties could change expectations of their relative performance.

8.2. Quantitative Evaluation of Threshold Criteria

Each reclamation alternative, with the exception of the no-action alternative, is designed to achieve risk reduction necessary to meet the reclamation objectives and removal goals. All of the reclamation alternatives include actions on all known solid sources of contamination that pose risk. Therefore, no additional calculation or modeling of relative risk reduction between the reclamation alternatives will be performed in this evaluation.

8.3. Site-Wide Alternatives

Contaminated material at BPM consists of waste rock, contaminated soils, sediments, and tailings. Table 8-2 lists the contaminated material present at BPM, and the associated

volume. The dispersed contaminated material located on USFS administered lands has been deposited in eight main locations along a two-mile reach of SFLWC.

Table 8-2. Contaminated Material Quantities, Black Pine Mine.

Location	Contaminated Material	Volume (cy)
Combination Mine AOC	Waste Rock	203,200[a]
	Contaminated Soils	5,000
Tim Smith Mine AOC	Waste Rock	22,650
Historic Mine AOC	Waste Rock	13,350
Combination Mill AOC	Tailings	128,300
Dispersed Locations on USFS Administered Lands	Tailings	19,700

[a] The Combination Mine waste rock pile contains approximately 232,000 cy of material, including 29,000 cy of cover material. The clean cover material will be salvaged and replaced following removal of contaminated materials. The volume of contaminated materials to be removed is 203,200 cy.

In order to address elevated metals concentrations of the contaminated material, five site-wide reclamation alternatives were assembled for BPM. Each alternative includes actions for reducing the risks presented by elevated metals concentrations and physical hazards present at the site. The following sections provide a detailed analysis of the site-wide alternatives at BPM including the cost analysis for implementation of each alternative. Detailed cost estimates for each alternative are provided in Appendix K.

8.4. Alternative 1: No Action

Evaluation of the no-action alternative is required by the NCP and is used as the baseline against which the other alternatives are compared. No reclamation would be performed under the no-action alternative and reclamation would rely on natural processes. It is assumed that BPM conditions would remain virtually unchanged and significant contaminant reduction or containment would not occur.

8.4.1. Effectiveness:

The no-action alternative is not expected to result in attainment of the reclamation objectives and cleanup goals outlined in Section 6. Site contamination would continue to pose an unacceptable risk to human health and the environment.

a. Overall Protection of Human Health and the Environment

The no-action alternative provides no control of contaminated material and no reduction in risk to human health or the environment. Under the no-action alternative, the recreational user and terrestrial wildlife would continue to be exposed to contamination through oral and dermal exposure pathways, and plants would continue to be exposed through direct contact. Natural

attenuation processes are not expected to occur to any measurable degree that would reduce the risks posed by the contaminated material.

b. **Compliance with ARARs**

No contaminated materials would be treated, removed, or actively managed under the no-action alternative. The no-action alternative would not meet federal or state contaminant-specific ARARs.

c. **Long-term Effectiveness and Permanence**

No administrative or engineering controls would be implemented as a result of the no-action alternative. Protection of human health and the environment would not be achieved, and risks would remain for human recreational users and ecological receptors. Alternative 1 does not offer long-term effectiveness or permanence.

d. **Reduction of Toxicity, Mobility, or Volume through Treatment**

The no-action alternative does not achieve any reduction of toxicity, mobility, or volume of contaminants through treatment.

e. **Short-term Effectiveness**

No administrative or engineering controls would be implemented as a result of the no-action alternative. Protection of human health and the environment would not be achieved, and site risks would remain for human recreational users and ecological receptors. Alternative 1 does not provide a short-term effective solution.

8.4.2. Implementability

No action is performed under Alternative 1; thus, the majority of the technical and administrative feasibility criteria do not apply. Public acceptance, one of the considerations included within administrative feasibility, is expected to be low. The public is not expected to accept a no action alternative at this site that poses risks to humans and ecological receptors.

8.4.3. Costs

No capital or operating costs are incurred as part of the no-action alternative. However, annual monitoring costs of approximately $7,100, or a total of $139,200 over a 30-year project life, would be incurred as part of the current permit requirements (Table K-1 in Appendix K). The future consequences of no action (human health and ecological impacts) are unknown.

8.5. Alternative 2: Select In-Place Capping with Select Removal of Contaminated Material and Placement in Repository on Trust Property

Alternative 2 would consist of removing and disposing of contaminated material from the Combination Mine AOC, Combination Mill AOC, and dispersed locations on USFS administered lands in an engineered repository on Trust property. Contaminated material at the Tim Smith Mine and Historic Mine AOCs would be left in place, regraded, and capped with a low permeability cover and topsoil to provide a medium for a vegetative cover. Contaminated material from the Combination Mine and Combination Mill AOCs would be removed and placed in an engineered repository on Trust property. The repository would be capped with a geomembrane liner, drainage layer, and cover soil to prevent infiltration of precipitation into the waste. Alternative 2 also includes relocation and reconstruction of SFLWC and Mill Creek, adit stabilization, adit closure, building maintenance and protection, and building demolition.

Reclamation work at the site would involve:

- Removal of contaminated material from Combination Mine AOC, Combination Mill AOC, and dispersed tailings areas and placement in repository on Trust property
    - Constructing an engineered repository,
    - Widening and improving approximately 2.1 miles of road to access dispersed material,
    - Clearing and grubbing along SFLWC at dispersed locations on USFS administered lands,
    - Over-excavating contaminated material,
    - Stabilizing slimes in the Combination Mill tailings with lime or other material as necessary,
    - Placing contaminated material in the repository,
    - Installing cap and cover system on the repository,
    - Placing rock over the repository cap,
    - Regrading and recountouring removal and repository areas,
    - Constructing surface water diversion ditches around the repository,
- In-Place Capping at Tim Smith Mine AOC and Historic Mine AOC
    - Widening and improving approximately 1 mile of road to access Tim Smith Mine waste rock dumps and adits,

    - Regrading the contaminated material areas,
    - Installing a soil cap over the contaminated material,
    - Placing topsoil over the cap, and
    - Constructing surface water diversion ditches around the capped areas,
- Revegetating in-place cap and removal areas,
- Installing temporary fencing around the repository and capped areas,
- Relocation and Reconstruction of SFLWC and Mill Creek
    - Removing berms located along SFLWC,
    - Realigning the streambeds,
    - Installing boulder and/or log weirs,
- Implementing BMPs,
- Addressing physical hazards
    - Stabilizing the Combination Auxiliary Adit and securing the Combination Adit,
    - Closing the Tim Smith No. 1 and Tim Smith No. 2 Adits,
    - Removing the Harrison Shaft rubble,
    - Removing materials from the Central Processing building, securing the Mechanical building, removing materials from the Tim Smith No. 1 North building, relocating core samples from the Lewis Shaft Garage to the Combination Mine Southern building, and securing the Pump House,
    - Demolishing the Lewis Shaft Garage, Combination Mill, "Old Mill", Tim Smith No. 1 South building, and the Spring House, and
    - Securing the Lewis Shaft perimeter fence.

For select removal of contaminated material, waste rock, contaminated soils, sediments, and tailings would be removed from the Combination Mine AOC, Combination Mill AOC, and in dispersed locations on USFS administered lands and placed in the repository. In order to access the dispersed tailings and sediments from USFS administered lands, approximately 2.1 miles of road on the east side of SFLWC would be widened and improved. Widening of the road would require clearing and grubbing.

Contaminated material would be placed in the repository and compacted in lifts as applicable to the material being placed. Once all the material is placed, the repository would be graded to provide a uniform surface on which to place a geomembrane liner and drainage net. A

three-foot soil cover would then be placed over the drainage net, with 18 inches of rock placed over the soil cover.

After removal of the contaminated material from the Combination Mill AOC, SFLWC and Mill Creek would be restored and relocated to their approximate historic locations. Flow would be diverted in order to provide a dry working area during channel realignment and reconstruction. The berms located on the west side of the impoundment would be removed and the creek channels would be realigned as close to their historic locations as possible. The channels would be reconstructed with log and boulder weirs. Riparian grasses and willows would be planted approximately eight feet on each side of the creek banks to provide stabilization and habitat. Detailed hydrologic and hydraulic analyses are presented in Appendix J.

Removal areas would be regraded to match existing site topography following the placement of contaminated material in the repository. Upland areas would be planted with upland grasses and lodgepole pine to provide stabilization and reduce erosion. Drainage in the North Soils Removal Area and the South Soils Removal Area would be improved to reduce erosion and sediment transport to Smart Creek. Areas approximately eight feet on each side of the bank along SFLWC on USFS administered lands would be planted with riparian grasses and willows to provide stabilization and habitat.

For select in-place capping, the waste rock areas at the Tim Smith Mine and Historic Mine AOCs would be graded to lessen steep grades and provide a uniform surface on which to place a soil cap. Once the cap is installed, cover soil would be placed over the cap and planted with upland grasses to provide stabilization, reduce erosion, and minimize infiltration of stormwater. Surface water diversion ditches would be excavated upslope of the containment areas to eliminate surface run-on and downslope to prevent sediment mobilization offsite. Fencing would then be installed around the perimeter of the containment area to prevent access and disturbance.

Adit stabilization at the Combination Auxiliary Adit would involve installing rock anchor bolts, steel support beams, or other type of support system to prevent collapse. The timber and plywood currently blocking the entrance would be replaced or reset to prohibit people or animals from entering the adit. Securing the Combination Adit would consist of replacing the damaged entrance doors with new doors that would prohibit people or animals from entering the adit. Adit closure would involve backfilling the adit entrance to prevent access.

Demolishing the Tim Smith No. 1 South building, the Spring House, the Lewis Shaft Garage, the Combination Mill, and the "Old Mill" would involve tearing down the existing structures and transporting the debris offsite. The Harrison Shaft rubble and materials removed from the Tim Smith No. 1 North building and the Central Processing building would also be hauled and disposed of offsite. Offsite hauling and disposal would be done in accordance with state and federal regulations. Prior to demolishing the Lewis Shaft Garage, all core samples would be relocated to the Southern building at the Combination Mine AOC.

8.5.1. Effectiveness:

Alternative 2 is expected to result in attainment of the reclamation objectives and soil and sediment cleanup goals outlined in Section 6. Risks to human health and the environment from site contamination would be reduced.

a. **Overall Protection of Human Health and the Environment**

Alternative 2 provides control of contaminated material and contaminant transport by capping material in place and by removal and containment in a repository. It also reduces the contaminant loadings to exposure pathways and surface area available for exposure. The human recreational user would be protected from arsenic and lead exposure through the breaking of the ingestion and dermal contact pathways. Terrestrial wildlife would also be protected from contaminant exposure through the breaking of the solid media ingestion pathway. Plant phytotoxicity would be mitigated by removing the contaminated material.

Alternative 2 also provides protection from the physical hazards associated with the present condition of the adits, shafts, and buildings.

b. Alternative 2 is expected to achieve overall protection of human health and the environment. **Compliance with ARARs**

Alternative 2 would meet the contaminant-specific ARARs, location-specific ARARs, and action-specific ARARs identified in Appendix C. No contaminant-specific ARARs were identified for the solid media. Alternative 2 is expected to meet those contaminant-specific surface water and groundwater ARARs related to antidegradation.

Groundwater was not characterized during the RI as it was not part of the project scope. However, capping the waste rock in the Tim Smith Mine and Historic Mine AOCs and removing the waste rock, contaminated soils, and tailings in the Combination Mine and Combination Mill AOCs and placing the material in a repository would reduce direct contaminant loadings via surface water runoff and contaminant leaching to groundwater due to infiltration, thereby meeting nondegradation rules listed in ARM.

Alternative 2 reclamation activities conducted to meet federal and state requirements regarding contaminant levels, location restrictions, and actions include:

- Containment of contaminated material with a cap and cover to prevent exposure,
- Removal of contaminated material from locations susceptible to surface water or groundwater contact and containment in a repository to prevent exposure,

- Placing silt fence downslope of the contaminated material removal areas to reduce erosion of material into the Smart Creek drainage or SFLWC drainage, and
- Diverting SFLWC and Mill Creek during realignment and reconstruction, and
- Controlling dust at excavation areas and along transport routes.

c. Long-term Effectiveness and Permanence

Long-term effectiveness and permanence would likely be attained through containment of the contaminated material in a permanent repository. However, the soil cap used for in-place capping at the Tim Smith Mine and Historic Mine AOCs would still be susceptible to wind and water erosion over time. Erosion could expose the waste rock and tailings, potentially exposing the contaminated material to human and ecological receptors.

To counteract this potential and promote the long term effectiveness of in-place capped areas, removal areas, and the repository, several design considerations would be implemented, including:

- The in-place capped areas and repository will be shaped to promote surface water run-off and eliminate surface water run-on in order to minimize erosion,
- Contaminated material placed in the repository will be compacted to the extent practicable to minimize settlement over time,
- The in-place cap and repository cap will be designed to minimize surface water infiltration and degradation of the cap by root penetration or burrowing animals,
- Where revegetation is implemented for cap protection/stabilization, the cover soil would promote vegetation of native plant species, which would provide stabilization through root cohesion and minimize infiltration through evapotranspiration. Once vegetation is established, minimal long-term site monitoring and maintenance would be required, and
- Where rock is installed for surfacing, coarsely fragmented rock will allow interlocking of rock pieces to provide stabilization, with minimal long-term site monitoring and maintenance required.

Limited monitoring and maintenance would be required for capped areas to ensure maintenance of functional integrity. Monitoring would include periodic inspections of the caps and covers, and periodic groundwater and surface water monitoring. Maintenance would consist of addressing any areas of the

caps and covers subject to erosion, maintaining building and adit protections, and maintaining fencing.

Protection of stable buildings and demolition of unstable buildings would provide a long-term effective solution to physical hazards. Stabilizing and securing or closing the adits and shafts would promote the continuing safety of humans and wildlife by making the entrances inaccessible.

d. Reduction of Toxicity, Mobility, or Volume through Treatment

Contaminant mobility would likely be reduced by capping and covering contaminated material, since it would have low susceptibility to mobilization through surface water erosion, surface water leaching, groundwater interaction, wind erosion, or human disturbance. The volume of contaminated material would not be significantly reduced and no treatment (destruction) would occur to lessen the toxicity of the contaminated material. Contaminated material would be effectively isolated from humans and the environment.

e. Short-term Effectiveness

Alternative 2 would be implemented in multiple construction seasons. The design would be finalized and a construction bid package prepared in the spring. Construction bidding and contracting would be performed in the summer with construction beginning at the end of summer.

Short-term environmental and human impacts that result from implementation of Alternative 2 include dust and surface water contaminant mobilization. To mitigate these impacts, dust would be controlled at excavation areas and along transport routes to reduce air-borne contaminant migration. BMPs would be implemented to prevent transportation of contaminated material offsite, including placement of silt fence downslope of the contaminated material removal areas. Other BMPs, such as straw wattles, would be used for erosion control on revegetated areas.

BPM is located in a remote location; however, implementation of Alternative 2 would present short-term impacts to the public during construction. These impacts may include restricting traffic on nearby access roads, haul truck traffic on state and federal highways, increased local business activity, and increased demand for housing by construction workers.

8.5.2. Implementability

Alternative 2 is both technically and administratively feasible; however, state and federal permits may be required in order to conduct work in the creeks and riparian areas. The techniques used for removal of contaminated material, construction of the repository, in-place capping, creek channel restoration, reclamation of disturbed areas, stabilizing and securing or closing of the adits and shafts, and protecting or demolishing buildings are considered standard in the construction field and are reliable. Material and equipment are

available to implement this alternative, and designs, methods, and specifications for construction have been implemented at similar sites.

On-going monitoring and maintenance would be required for capped areas to ensure functional integrity, which is considered a standard procedure for this design type.

8.5.3. Costs

The total present worth cost of implementing Alternative 2 is estimated to be $13,628,600 (Table K-2 in Appendix K). The present worth value of 30 years of annual maintenance and monitoring costs are included in addition to the capital costs. The major cost components of this alternative include: contractor mobilization and demobilization; repository construction; excavation, haul, placement, and compaction of contaminated material; in-place cap and liner system; cover system; seeding, mulching, and planting of removal and capped areas and the repository; creek diversion; channel restoration; stabilizing and securing or closing adits and shafts, protecting or demolishing buildings; and annual inspection and maintenance.

8.6 Alternative 3: Select In-Place Capping with Select Removal of Contaminated Material and Placement in Offsite Disposal Facility

Alternative 3 would consist of removing and disposing of contaminated material from the Combination Mine AOC, Combination Mill AOC, and in dispersed locations on USFS administered lands at an offsite permitted disposal facility. The primary difference between Alternative 3 and Alternative 2 is with respect to whether disposal is on Trust property (Alternative 2) or offsite (Alternative 3). Contaminated material at the Tim Smith Mine and Historic Mine AOCs would be left in place, regraded, capped with a low permeability soil, with topsoil placed over the soil cap to provide a medium for the vegetative cover. Alternative 3 also includes the relocation and reconstruction of SFLWC and Mill Creek, adit stabilization, adit closure, building maintenance and protection, and building demolition.

Reclamation work at the site would involve:

- Removal of contaminated material from Combination Mine AOC, Combination Mill AOC, and dispersed tailings areas and disposal offsite
    - Widening and improving approximately 2.1 miles of road to access dispersed material,
    - Clearing and grubbing along SFLWC at dispersed locations on USFS administered lands,
    - Over-excavating contaminated material,
    - Stabilizing slimes in the Combination Mill tailings with lime or other material as necessary,

    - Hauling contaminated material to an offsite disposal facility,
    - Regrading and recountouring removal areas,
- In-place capping at Tim Smith Mine AOC and Historic Mine AOC
    - Widening and improving approximately 1 mile of road to access Tim Smith Mine waste rock dumps and adits,
    - Regrading the contaminated material areas,
    - Installing a soil cap over the contaminated material,
    - Placing topsoil over the cap,
    - Constructing surface water diversion ditches around the capped areas,
- Revegetating in-place cap and removal areas,
- Relocation and Reconstruction of SFLWC and Mill Creek
    - Removing berms located along SFLWC,
    - Realigning the streambeds,
    - Installing boulder and/or log weirs,
- Implementing BMPs,
- Addressing physical hazards
    - Stabilizing the Combination Auxiliary Adit and securing the Combination Adit,
    - Closing the Tim Smith No. 1 and Tim Smith No. 2 Adits, ,
    - Removing the Harrison Shaft rubble,
    - Removing materials from the Central Processing building, securing the Mechanical building, removing materials from the Tim Smith No. 1 North building, relocating core samples from the Lewis Shaft Garage to the Combination Mine Southern building, and securing the Pump House,
    - Demolishing the Lewis Shaft Garage, Combination Mill, "Old Mill", Tim Smith No. 1 South building, and the Spring House, and
    - Securing the Lewis Shaft perimeter fence.

For select removal of contaminated material, the waste rock, contaminated soils, sediments, and tailings would be removed from the Combination Mine AOC, Combination Mill AOC, and in dispersed locations on USFS administered lands and transported to a permitted offsite disposal facility. In order to access the dispersed tailings and sediments from USFS

administered lands, approximately 2.1 miles of road on the east side of SFLWC would be widened and improved. Widening of the road would require clearing and grubbing.

After removal of contaminated material from the Combination Mill AOC, SFLWC and Mill Creek would be restored and relocated to their approximate historic locations. Flow would be diverted in order to provide a dry working area during channel realignment and reconstruction. The berms located on the west side of the impoundment would be removed and the creek channels would be realigned as close to their historic locations as possible. The channels would be reconstructed with log and boulder weirs. Riparian grasses and willows would be planted approximately eight feet on each side of the creek banks to provide stabilization and habitat. Detailed hydrologic and hydraulic analyses are presented in Appendix J.

Removal areas would be regraded to match existing site topography once the contaminated material has been removed and hauled offsite. Upland areas would be planted with upland grasses and lodgepole pine to provide stabilization and reduce erosion. Drainage in the North Soils Removal Area and the South Soils Removal Area would be improved to reduce erosion and sediment transport to Smart Creek. Areas approximately eight feet on each side of the bank along SFLWC on USFS administered lands would be planted with riparian grasses and willows to provide stabilization and habitat.

For select in-place capping, the waste rock areas at the Tim Smith Mine and Historic Mine AOCs would be graded to shallower slopes and provide a uniform surface on which to place a soil cap. Once the cap is installed, cover soil would be placed over the cap and planted with upland grasses to provide stabilization, reduce erosion, and minimize infiltration of stormwater. Surface water diversion ditches would be excavated upslope of the containment areas to eliminate surface run-on and downslope to prevent sediment mobilization offsite. Fencing would then be installed around the perimeter of the containment area to prevent access and disturbance.

Adit stabilization at the Combination Auxiliary Adit would involve installing rock anchor bolts, steel support beams, or other type of support system to prevent collapse. The timber and plywood currently blocking the entrance would be replaced or reset to prohibit people or animals from entering the adit. Securing the Combination Adit would consist of replacing the damaged entrance doors with new doors that would prohibit people or animals from entering the adit. Adit closure would involve backfilling the adit entrance to prevent access.

Demolishing the Tim Smith No. 1 South building, the Spring House, the Lewis Shaft Garage, the Combination Mill, and the "Old Mill" would involve tearing down the existing structures and transporting the debris offsite. The Harrison Shaft rubble and materials removed from the Tim Smith No. 1 North building and the Central Processing building would also be hauled and disposed of offsite. Offsite hauling and disposal would be done in accordance with state and federal regulations. Prior to demolishing the Lewis Shaft Garage, all core samples would be relocated to the Southern building at the Combination Mine AOC.

8.6.1 Effectiveness:

Alternative 3 is expected to result in attainment of the reclamation objectives and soil and sediment cleanup goals outlined in Section 6. Risks to human health and the environment from site contamination would be reduced.

a. Overall Protection of Human Health and the Environment

Alternative 3 provides control of contaminated material and contaminant transport by capping material in place and by removal and offsite disposal. It also reduces the contaminant loadings to exposure pathways and surface area available for exposure. The human recreational user and terrestrial wildlife would be protected from contaminant exposure through breaking of the pathways for solid media ingestion and dermal contact. Plant phytotoxicity would be mitigated by removing the contaminated material.

Alternative 3 also provides protection from the physical hazards associated with the present condition of the adits, shafts, and buildings.

b. Compliance with ARARs, as identified by DEQ

Alternative 3 would meet the contaminant-specific ARARs, location-specific ARARs, and action-specific ARARs identified in Appendix C. No contaminant-specific ARARs were identified for the solid media. Alternative 3 is expected to meet those contaminant-specific surface water and groundwater ARARs related to antidegradation. Evaluation of whether Alternative 3 is able to meet surface water and groundwater numeric standard ARARs is not within the scope of this EE/CA.

Groundwater was not characterized during the RI as it was not part of the project scope. However, capping the waste rock in the Tim Smith Mine and Historic Mine AOCs and removing the waste rock, contaminated soils, and tailings in the Combination Mine and Combination Mill AOCs and transporting it to an offsite disposal facility would reduce direct contaminant loadings via surface water runoff and contaminant leaching to groundwater due to infiltration, thereby meeting nondegradation rules listed in ARM.

Alternative 3 reclamation activities conducted to meet federal and state requirements regarding contaminant levels, location restrictions, and actions include:

- Containment of contaminated material with a cap and cover to prevent exposure,
- Removal of contaminated material from locations susceptible to surface water or groundwater contact and offsite disposal,

- Placing silt fence downslope of the contaminated material removal areas to reduce erosion of material into the Smart Creek drainage or SFLWC drainage, and
- Diverting SFLWC and Mill Creek during realignment and reconstruction, and
- Controlling dust at excavation areas and along transport routes.

c. Long-term Effectiveness and Permanence

Long-term effectiveness and permanence would likely be attained through the containment of the contaminated material from the AOCs. However, the soil cap used for in-place capping at the Tim Smith Mine and Historic Mine AOCs would still be susceptible to wind and water erosion over time. Although the ABA results (Tables 3-5 and 3-7) from these AOCs show low acid potential, erosion could potentially expose the waste rock to oxygen and water, leading to acid rock drainage.

To counteract this potential, several design considerations would be implemented to aid in the long-term effectiveness of this alternative, including:

- The in-place capped areas will be constructed to promote surface water run-off and eliminate surface water run-on in order to minimize erosion,
- The cap will be designed to minimize surface water infiltration and degradation of the cap by root penetration or burrowing animals, and
- Where revegetation is implemented for cap protection/stabilization, the cover soil would promote vegetation of native plant species, which would provide stabilization through root cohesion and minimize infiltration through evapotranspiration. Once vegetation is established, minimal long-term site monitoring and maintenance would be required.
- Where rock is installed for cap protection/stabilization, coarsely fragmented rock will allow interlocking of rock pieces to provide stabilization, with minimal long-term site monitoring and maintenance required.

Limited monitoring and maintenance would be required for capped areas to ensure maintenance of functional integrity. Monitoring would include periodic inspections of the caps and covers, and periodic groundwater and surface water monitoring. Maintenance would consist of addressing any areas of the caps and covers subject to erosion, maintaining building and adit protections, and maintaining fencing.

Protection of stable buildings and demolition of unstable buildings would provide a long-term effective solution to physical hazards. Stabilizing and securing or closing the adits and shafts would promote the continuing safety of humans and wildlife by making the entrances inaccessible.

d. Reduction of Toxicity, Mobility, or Volume through Treatment

Contaminant mobility would likely be reduced by placement of a portion of the contaminated material to an offsite disposal facility and capping and covering the remaining contaminated material. The volume of contaminated material on site would be significantly reduced with offsite disposal; however, there is no overall reduction in volume with this alternative. The toxicity of the contaminated material would not be reduced by removal and containment in an offsite facility. Contaminated material would likely be isolated from humans and the environment.

e. Short-term Effectiveness

Alternative 3 would be implemented in multiple construction seasons. The design would be finalized and a construction bid package prepared in the spring. Construction bidding and contracting would be performed in the summer with construction beginning at the end of summer.

Short-term environmental and human impacts that result from implementation of Alternative 3 include dust and surface water contaminant mobilization. To mitigate these impacts, dust control would be implemented to reduce air-borne contaminant migration. BMPs would be implemented to prevent transportation of contaminated material offsite, including placement of silt fence downslope of the contaminated material removal areas. Other BMPs, such as straw wattles, would be used for erosion control on revegetated areas.

BPM is located in a remote location; however, implementation of Alternative 3 would present short-term impacts to the public during construction. These impacts may include haul truck traffic on state and federal highways, disruption of tourism and/or recreation, increased local business activity, and increased housing demand by temporary construction workers.

8.6.2 Implementability

Alternative 3 is both technically and administratively feasible; however, state and/or federal permits may be required in order to conduct work in the creeks, and associated riparian areas that are outside the Trust boundary. The techniques used for removal of contaminated material, offsite disposal, in-place capping, creek channel restoration, reclamation of disturbed areas, stabilizing and securing or closing of the adits and shafts, and protecting or demolishing buildings are considered standard in the construction field and are reliable. Material and equipment are available to implement this alternative, and designs, methods, and specifications for construction have been implemented at similar sites.

On-going monitoring and maintenance would be required for capped areas to ensure functional integrity, which is considered a standard procedure for this design type.

8.6.3 Costs

The total present worth cost of implementing Alternative 3 is estimated to be $23,231,200 (Table K-3 in Appendix K). The present worth value of 30 years of annual maintenance and monitoring costs are included in addition to the capital costs. The major cost components of this alternative include: contractor mobilization and demobilization; excavation and offsite haul of contaminated material; landfill disposal fee; in-place cap and liner system; cover system; seeding, mulching, and planting of removal and capped areas; creek diversion; channel restoration; stabilizing and securing or closing adits and shafts, protecting or demolishing buildings; and annual inspection and maintenance.

8.7. Alternative 4: Site-Wide Removal of Contaminated Material and Placement in Repository on Trust Property

Alternative 4 would involve removal of contaminated material from all four AOCs and dispersed locations on USFS administered lands, and disposal of the material in an engineered repository on Trust Property. The primary difference between Alternative 4 and Alternatives 2 and 3 is that Alternative 4 would involve removal of contaminated material at the Tim Smith Mine and Historic Mine AOCs and placement in a repository on Trust property, rather than in-place capping of these materials. The repository cap includes a geomembrane liner, drainage layer, and cover soil as means to prevent infiltration of precipitation into the waste. Alternative 4 also includes relocation and reconstruction of SFLWC and Mill Creek, adit stabilization, adit closure, building maintenance and protection, and building demolition.

Reclamation work at the site would consist of:

- Removal of contaminated material and placement in repository on Trust property
    - Constructing an engineered repository,
    - Widening and improving approximately 3.1 miles of road to access dispersed material and Tim Smith Mine waste rock dumps and adits,
    - Clearing and grubbing along SFLWC at dispersed locations on USFS administered lands,
    - Over-excavating contaminated material at the four AOCs and in dispersed tailings locations,
    - Stabilizing slimes in the Combination Mill tailings with lime or other material as necessary,
    - Placing contaminated material the repository,
    - Installing cap and cover system on the repository,

    - Placing rock over the repository cap,
    - Regrading and recountouring removal and repository areas,
    - Revegetating removal areas,
    - Constructing surface water diversion ditches around the repository,
    - Installing temporary fencing around the repository,
- Realignment and Reconstruction of SFLWC and Mill Creek
    - Removing berms located along SFLWC,
    - Realigning the streambeds,
    - Installing boulder and/or log weirs,
- Implementing BMPs,
- Addressing physical hazards
    - Stabilizing the Combination Auxiliary Adit and securing the Combination Adit,
    - Closing the Tim Smith No. 1 and Tim Smith No. 2,
    - Removing the Harrison Shaft rubble,
    - Removing materials from the Central Processing building, securing the Mechanical building, removing materials from the Tim Smith No. 1 North building, relocating core samples from the Lewis Shaft Garage to the Combination Mine Southern building, and securing the Pump House,
    - Demolishing the Lewis Shaft Garage, Combination Mill, "Old Mill", Tim Smith No. 1 South building, and the Spring House, and
    - Securing the Lewis Shaft perimeter fence.

For removal of contaminated material, the waste rock, contaminated soils, sediments, and tailings would be removed from the four AOCs and in dispersed locations on USFS administered lands and placed in the repository. In order to access the dispersed tailings and sediments from USFS administered lands, approximately 2.1 miles of road on the east side of SFLWC would be widened and improved. Widening of the road would require clearing and grubbing.

Contaminated material would be placed in the repository and compacted in lifts as applicable to the material being placed. Once all the material is placed, the repository would be graded to provide a uniform surface on which to place a geomembrane liner and drainage net. A three-foot soil cover would then be placed over the drainage net, with 18 inches of rock placed over the soil cover.

After removal of contaminated material from the Combination Mill AOC, SFLWC and Mill Creek would be restored and relocated to their approximate historic locations. Flow would be diverted in order to provide a dry work area during channel realignment and reconstruction. The berms located on the west side of the impoundment would be removed and the creek channels would be realigned as close to their historic locations as possible. The channels would then be reconstructed with log and boulder weirs. Riparian grasses and willows would be planted approximately eight feet on each side of the creek banks to provide stabilization and habitat. Detailed hydrologic and hydraulic analyses are presented in Appendix J.

Removal areas would be regraded to match existing site topography following the placement of contaminated material in the repository. Upland areas would be planted with upland grasses and lodgepole pine to provide stabilization and reduce erosion. Drainage in the North Soils Removal Area and the South Soils Removal Area would be improved to reduce erosion and sediment transport to Smart Creek. Areas approximately eight feet on each side of the bank along SFLWC on USFS administered lands would be planted with riparian grasses and willows to provide stabilization and habitat.

Adit stabilization at the Combination Auxiliary Adit would involve installing rock anchor bolts, steel support beams, or other type of support system to prevent collapse. The timber and plywood currently blocking the entrance would be replaced or reset to prohibit people or animals from entering the adit. Securing the Combination Adit would consist of replacing the damaged entrance doors with new doors that would prohibit people or animals from entering the adit. Adit closure would involve backfilling the adit entrance to prevent access.

Demolishing the Tim Smith No. 1 South building, the Spring House, the Lewis Shaft Garage, the Combination Mill, and the "Old Mill" would involve tearing down the existing structures and transporting the debris offsite. The Harrison Shaft rubble and materials removed from the Tim Smith No. 1 North building and the Central Processing building would also be hauled and disposed of offsite. Offsite hauling and disposal would be done in accordance with state and federal regulations. Prior to demolishing the Lewis Shaft Garage, all core samples would be relocated to the Southern building at the Combination Mine AOC.

8.7.1 Effectiveness:

Alternative 4 is expected to result in attainment of the reclamation objectives and soil and sediment cleanup goals outlined in Section 6. Risks to human health and the environment from site contamination would be reduced.

a. Overall Protection of Human Health and the Environment

Alternative 4 provides control of contaminated material and contaminant transport by complete removal and containment in a repository. It also reduces the contaminant loadings to exposure pathways and surface area available for exposure. The human recreational user would be protected from arsenic and lead exposure in solids (soil, sediment, tailings, and waste rock) through breaking of the pathways for ingestion and dermal contact. Terrestrial wildlife would be protected from contaminant exposure through breaking of

the pathway for incidental ingestion of contaminated material. Plant phytotoxicity would be mitigated by removing and containing the contaminated material.

Alternative 4 also provides protection from the physical hazards associated with the present condition of the adits, shafts, and buildings at BPM.

b. Compliance with ARARs, as identified by DEQ

Alternative 4 would meet the contaminant-specific ARARs, location-specific ARARs, and action-specific ARARs identified in Appendix C. No contaminant-specific ARARs were identified for the solid media. Alternative 4 is expected to meet those contaminant-specific surface water and groundwater ARARs related to antidegradation. Evaluation of whether Alternative 4 is able to meet surface water and groundwater numeric standard ARARs is not within the scope of this EE/CA.

Groundwater was not characterized during the RI as it was not part of the project scope. However, removing contaminated material and capping it in a repository would reduce the direct contaminant loadings via surface water runoff and contaminant leaching to groundwater due to infiltration, thereby meeting nondegradation rules listed in ARM.

Alternative 4 reclamation activities conducted to meet federal and state requirements regarding contaminant levels, location restrictions, and actions include:

- Removal of the contaminated material from locations susceptible to surface water or groundwater contact,
- Containment of material in a repository to prevent exposure,
- Placing silt fence downslope of the contaminated material removal areas to reduce erosion of material into the Smart Creek and SFLWC drainages,
- Diverting SFLWC and Mill Creek during realignment and reconstruction, and
- Controlling dust at excavation areas and along transport routes.

c. Long-term Effectiveness and Permanence

Long-term effectiveness and permanence would be attained through the complete removal of the contaminated material from the AOCs. Source removal of the solid media will also likely contribute to future reduction of contaminants in surface water and groundwater.

Several design considerations would contribute to long-term effectiveness of the alternative, including:

- Contaminated material would be placed and compacted to minimize settlement over time,
- The repository would be shaped to promote surface water run-off and eliminate surface water run-on in order to minimize erosion,
- The cap would be designed to minimize surface water infiltration and degradation of the cap by root penetration or burrowing animals,
- Where revegetation is implemented for surfacing, the cover soil would promote vegetation of native plant species, which would provide stabilization through root cohesion and minimize infiltration through evapotranspiration. Once vegetation is established, minimal long-term site monitoring and maintenance would be required, and
- Where rock is installed for surfacing, coarsely fragmented rock will allow interlocking of rock pieces to provide stabilization, with minimal long-term site monitoring and maintenance required.

Limited monitoring and maintenance would be required at the repository to ensure maintenance of functional integrity of the cap. Monitoring would include periodic inspections of the cap and cover, and periodic groundwater and surface water monitoring. Maintenance would consist of addressing any areas of the cap and cover subject to erosion, maintaining building and adit protections, and maintaining fencing.

Protection of stable buildings and demolition of unstable buildings would provide a long-term effective solution to physical hazards. Stabilizing and securing or closing the adits and shafts would promote the continuing safety of humans and wildlife by making the entrances inaccessible.

d. Reduction of Toxicity, Mobility, or Volume through Treatment

Contaminant mobility would be reduced by placing contaminated material in a repository, since it would no longer be susceptible to mobilization through surface water erosion, surface water leaching, groundwater interaction, wind erosion, or human disturbance. The volume of contaminated material would not be significantly reduced and no treatment (destruction) would occur to lessen the toxicity of the contaminated material. Contaminated material would be effectively isolated from humans and the environment.

e. Short-term Effectiveness

Alternative 4 would be implemented in multiple construction seasons. The design would be finalized and a construction bid package prepared in the

spring. Construction bidding and contracting would be performed in the summer with construction beginning at the end of summer.

Short-term environmental and human impacts that result from implementation of Alternative 4 include dust and surface water contaminant mobilization. To mitigate these impacts, dust would be controlled at excavation areas and along transport routes to reduce air-borne contaminant migration. BMPs would be implemented to prevent transportation of contaminated material offsite, including placement of silt fence downslope of the contaminated material removal areas, Other BMPs, such as straw wattles, would be used for erosion control on revegetated areas.

BPM is located in a remote location; however, implementation of Alternative 4 would present short-term impacts to the public during construction. These impacts may include haul truck traffic on state and federal highways, increased local business activity, and increased housing demand by temporary construction workers.

8.7.2 Implementability

Alternative 4 is both technically and administratively feasible; however, state and/or federal permits may be required in order to conduct work in the creeks and associated riparian areas that are outside the Trust boundary. The techniques used in the removal of contaminated material, construction of the repository, creek channel restoration, reclamation of disturbed areas, stabilizing and securing or closing the adits and shafts, and protecting or demolishing buildings are considered standard in the construction field and are reliable. Material and equipment are available to implement this alternative, and designs, methods, and specifications for construction have been implemented at similar sites.

On-going monitoring and maintenance would be required for the repository to ensure its integrity, which is considered a standard procedure for this design type.

8.7.3 Costs

The total present worth cost of implementing Alternative 4 is estimated to be $13,880,500 (Table K-4 in Appendix K). The present worth value of 30 years of annual maintenance and monitoring costs are included in addition to the capital costs. The major cost components of this alternative include: contractor mobilization and demobilization; repository construction; excavation, haul, placement, and compaction of contaminated material; seeding, mulching, and planting of removal areas and the repository; creek diversion; channel restoration; stabilizing and securing or closing adits and shafts; protecting or demolishing buildings; and annual inspection and maintenance.

8.8 Alternative 5: Site-Wide Removal of Contaminated Material and Placement in Offsite Disposal Facility

Alternative 5 would consist of complete removal of contaminated material from all four AOCs and dispersed locations on USFS administered lands, and disposal of the material at an offsite permitted disposal facility. Alternative 5 also includes relocation and reconstruction of SFLWC and Mill Creek, adit stabilization, adit closure, building maintenance and protection, and building demolition.

Reclamation work at the site would involve:

- Removal of contaminated material and transport to permitted offsite disposal facility
    - Widening and improving approximately 3.1 miles of road to access dispersed material and Tim Smith Mine waste rock dumps and adits,
    - Clearing and grubbing along SFLWC at dispersed locations on USFS administered lands,
    - Over-excavating contaminated material at the four AOCs and in dispersed tailings locations,
    - Stabilizing slimes in the Combination Mill tailings with lime or other material as necessary, Hauling contaminated material to an offsite disposal facility,
    - Regrading and recountouring removal areas,
    - Revegetating removal areas,
- Realignment and Reconstruction of SFLWC and Mill Creek
    - Removing berms located along SFLWC,
    - Realigning the streambeds,
    - Installing boulder and/or log weirs,
- Implementing BMPs,
- Addressing physical hazards
    - Stabilizing the Combination Auxiliary Adit and securing the Combination Adit,
    - Closing the Tim Smith No. 1 and Tim Smith No. 2 Adits,
    - Removing the Harrison Shaft rubble,
    - Removing materials from the Central Processing building, securing the Mechanical building, removing materials from the Tim Smith No. 1 North

building, relocating core samples from the Lewis Shaft Garage to the Combination Mine Southern building, and securing the Pump House,

- Demolishing the Lewis Shaft Garage, Combination Mill, "Old Mill", Tim Smith No. 1 South building, and the Spring House, and
- Securing the Lewis Shaft perimeter fence.

For removal of contaminated material, the waste rock, contaminated soils, sediments, and tailings would be removed from the four AOCs and in dispersed locations on USFS administered lands and transported to an offsite permitted disposal facility. In order to access the dispersed tailings and sediments from USFS administered lands, approximately 2.1 miles of road on the east side of SFLWC would be widened and improved. Widening of the road would require clearing and grubbing.

After removal of contaminated material from the Combination Mill AOC, SFLWC and Mill Creek would be restored and relocated to their approximate historic locations. Flow would be diverted in order to provide a dry work area during channel realignment and reconstruction. The berms located on the west side of the impoundment would be removed and the creek channels would be realigned as close to their historic locations as possible. The channels would then be reconstructed with log and boulder weirs. Riparian grasses and willows would be planted approximately eight feet on each side of the creek banks to provide stabilization and habitat. Detailed hydrologic and hydraulic analyses are presented in Appendix J.

Removal areas would be regraded to match existing site topography once the contaminated material has been removed and transported offsite. Upland areas would be planted with upland grasses and lodgepole pine to provide stabilization and reduce erosion. Drainage in the North Soils Removal Area and the South Soils Removal Area would be improved to reduce erosion and sediment transport to Smart Creek. Areas approximately eight feet on each side of the bank along SFLWC on USFS administered lands would be planted with riparian grasses and willows to provide stabilization and habitat.

Adit stabilization at the Combination Auxiliary Adit would involve installing rock anchor bolts, steel support beams, or other type of support system to prevent collapse. The timber and plywood currently blocking the entrance would be replaced or reset to prohibit people or animals from entering the adit. Securing the Combination Adit would consist of replacing the damaged entrance doors with new doors that would prohibit people or animals from entering the adit. Adit closure would involve backfilling the adit entrance to prevent access.

Demolishing the Tim Smith No. 1 South building, the Spring House, the Lewis Shaft Garage, the Combination Mill, and the "Old Mill" would involve tearing down the existing structures and transporting the debris offsite. The Harrison Shaft rubble and materials removed from the Tim Smith No. 1 North building and the Central Processing building would also be hauled and disposed of offsite. Offsite hauling and disposal would be done in accordance with state and federal regulations. Prior to demolishing the Lewis Shaft Garage, all core samples would be relocated to the Southern building at the Combination Mine AOC.

8.8.1 Effectiveness:

Alternative 5 is expected to result in the attainment of the reclamation objectives and cleanup goals outlined in Section 6. Risks to human health and the environment from site contamination will be reduced.

c. Overall Protection of Human Health and the Environment

Alternative 5 provides control of contaminated material and contaminant transport by removal and offsite disposal. It also reduces the contaminant loadings to exposure pathways and surface area available for exposure. The human recreational user, terrestrial, and aquatic life would be protected from contaminant exposure through ingestion and dermal contact. Plant phytotoxicity would be mitigated by removing the contaminated material.

Alternative 5 also provides protection from the physical hazards associated with the present condition of the adits, shafts, and buildings.

d. Compliance with ARARs, as identified by DEQ

Alternative 5 will meet the contaminant-specific ARARs, location-specific ARARs, and action-specific ARARs identified in Appendix C-. No contaminant-specific ARARs were identified for the solid media. Alternative 5 is expected to meet those contaminant-specific surface water and groundwater ARARs related to antidegradation. Evaluation of whether Alternative 5 is able to meet surface water and groundwater numeric standard ARARs is not within the scope of this EE/CA.

Groundwater was not characterized during the RI as it was not part of the project scope; however, the complete removal and offsite disposal of contaminated material would reduce the direct contaminant loadings via surface water runoff and contaminant leaching to groundwater due to infiltration, thereby meeting nondegradation rules listed in ARM.

Alternative 5 reclamation activities conducted to meet federal and state requirements regarding contaminant levels, location restrictions, and actions include:

- Removal of the contaminated material from locations susceptible to surface water or groundwater contact,
- Offsite disposal of contaminated material to prevent exposure,
- Placing silt fence downslope of the contaminated material removal areas to reduce erosion of material into the Smart Creek and SFLWC drainages,
- Diverting SFLWC and Mill Creek during realignment and reconstruction, and

- Controlling dust at excavation areas and along transport routes.

e. Long-term Effectiveness and Permanence

Long-term effectiveness and permanence would be attained through the complete removal of the contaminated material from BPM. Source removal of the solid media will also likely contribute to future reduction of contaminants in surface water and groundwater.

Where revegetation is implemented for protection/stabilization, the cover soil would promote vegetation of native plant species, which would provide stabilization through root cohesion and minimize infiltration through evapotranspiration. Once vegetation is established, minimal long-term site monitoring and maintenance would be required.

Where rock is installed for protection/stabilization, coarsely fragmented rock will allow interlocking of rock pieces to provide stabilization, with minimal long-term site monitoring and maintenance required.

Protection of stable buildings and demolition of unstable buildings would provide a long-term effective solution. Stabilizing and securing or closing the adits and shafts would promote the continuing safety of humans and wildlife by making the entrances inaccessible.

f. Reduction of Toxicity, Mobility, or Volume through Treatment

Contaminant mobility and volume would be eliminated by transporting contaminated material offsite; however, no treatment (destruction) would occur to lessen the toxicity of the contaminated material. Contaminated material would be effectively isolated from humans and the environment.

g. Short-term Effectiveness

Alternative 5 would be implemented in multiple construction seasons. The design would be finalized and a construction bid package prepared in the spring. Construction bidding and contracting would be performed in the summer with construction beginning at the end of summer.

Short-term environmental and human impacts that result from implementation of Alternative 5 include dust and surface water contaminant mobilization. To mitigate these impacts, dust would be controlled at excavation areas and along transport routes to reduce air-borne contaminant migration. BMPs would be implemented to prevent transportation of contaminated material offsite, including placement of silt fence downslope of the contaminated material removal areas. Other BMPs, such as straw wattles, would be used for erosion control on revegetated areas.

BPM is located in a remote location; however, implementation of Alternative 5 would present short-term impacts to the public during construction. These

impacts may include haul truck traffic on state and federal highways, disruption of tourism and/or recreation, increased local business activity, and increased housing demand by temporary construction workers.

8.8.2 Implementability

Alternative 5 is both technically and administratively feasible; however, state and/or federal permits may be required in order to conduct work in the creek. The techniques used in the removal of contaminated material, offsite disposal, reclamation of site disturbances, creek channel restoration, stabilizing and securing or closing the adits and shafts, and protecting and demolishing buildings are considered standard in the construction field and are reliable. Material and equipment are available to implement this alternative, and designs, methods, and specifications for construction have been implemented at similar sites.

8.8.3 Costs

The total present worth cost of implementing Alternative 5 is estimated to be $24,926,000 (Table K-5 in Appendix K). The present worth value of 30 years of annual maintenance and monitoring costs are included in addition to the capital costs. The major cost components of this alternative include: contractor mobilization and demobilization; excavation and offsite haul of contaminated material; landfill disposal fee; seeding, mulching, and planting of removal areas; creek diversion; channel restoration; stabilizing and securing or closing adits and shafts; protecting or demolishing buildings; and annual inspection and maintenance.

9.0 COMPARATIVE ANALYSIS OF RECLAMATION ALTERNATIVES

This section summarizes results of the detailed analysis performed on the five proposed reclamation alternatives, and provides a comparison of the alternatives to threshold and primary balancing criteria. The relative strengths and weaknesses of the alternatives with respect to each evaluation criterion are discussed. In addition, the effects of key uncertainties on the expected performance are presented.

This evaluation will be used as the basis for identification of the preferred alternative for BPM. A public meeting will be held to present the preferred alternative, along with other reclamation alternatives, evaluated by this EE/CA. A 30-day public comment period will allow the public to submit, in writing, any comments on the EE/CA, which will be addressed in writing by DEQ before finalizing the EE/CA and issuing the Action Memorandum (AM). The selection of the preferred alternative will be documented in the AM.

9.1 Effectiveness Comparative Analysis

The effectiveness criteria include: overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. These criteria are explained in Section 8.

9.1.1 Alternative 1: No Action

Alternative 1 has low effectiveness since no contaminated materials would be treated, removed, or actively managed. This alternative would not protect human health and the environment nor would it comply with state or federal ARARs. The human health and ecological risk-based cleanup goals would not be met. No administrative or engineering controls would be implemented as a result of the no-action alternative and no short or long-term effectiveness would be achieved.

9.1.2 Alternative 2

Alternative 2 has moderate effectiveness in the long term. The contaminated material at BPM would either be contained by in-place capping or by placement in a capped repository. In-place capping of the contaminated material would isolate the contaminants and protect human health and the environment by limiting exposure; however, it may be prone to erosion and potential leaching. Placement of the material in a capped repository would provide contaminant isolation and protection for human health and the environment. Contaminant-, location– and action-specific ARARs would be met subject to the considerations described for the alternative. Toxicity and volume of the contaminated material would not be reduced. However, contaminant mobility would likely be reduced by capping the contaminated material either in-place or in a repository. Short-term effectiveness would be high, as BMPs

and water control would be implemented during construction and the surrounding local communities would experience a rise in economic activity through the duration of construction.

9.1.3 Alternative 3

Alternative 3 has moderate effectiveness in the long term. Approximately 90 percent of contaminated material present at BPM would be removed from the site. Capping the contaminated material at the Tim Smith Mine and Historic Mine AOCs would isolate the contaminants and protect human health and the environment by limiting exposure; however, it may be prone to erosion and potential leaching. Alternatively, there would be permanent protection for human health and the environment in the Combination Mine and Combination Mill AOCs since the contaminated material would be completely removed. Contaminant-, location– and action-specific ARARs would be met subject to the considerations described for the alternative. Toxicity of the contaminated material would not be reduced. However, contaminant mobility would be significantly reduced by capping the waste rock in the Tim Smith Mine and Historic Mine AOCs and completely removing and transporting the contaminated material from the Combination Mine and Mill AOCs to a permitted facility offsite, where a cover and stormwater drainage system, bottom liner, and groundwater monitoring system meeting RCRA Subtitle D design requirements would be utilized. Since the majority of contaminated material would be removed from BPM, there would be a substantial reduction in contaminant volume. Short-term effectiveness would be high, as BMPs and water control would be implemented during construction and the surrounding local communities would experience a rise in economic activity through the duration of construction.

9.1.4 Alternative 4

Alternative 4 has high effectiveness in the long term since the entire volume of contaminated material present at BPM would be contained through one cap and cover system. This containment would provide contaminant isolation and protection for human health and the environment. Contaminant -, location – and action-specific ARARs would be fully met. Although toxicity and volume would not be reduced, contaminant mobility would be reduced by the capping the contaminated material at the repository. Short-term effectiveness would be high, as BMPs and water control would be implemented during construction and the surrounding local communities would experience a rise in economic activity through the duration of construction.

9.1.5 Alternative 5

Alternative 5 has high effectiveness in the long term since the entire volume of contaminated material present at BPM would be removed, providing permanent protection for human health and the environment. Contaminant -, location – and action-specific ARARs would be fully met. Although toxicity would not be reduced, contaminant mobility and volume would be reduced by the complete removal of contaminated material and placement in a permitted facility offsite, where a cover and stormwater drainage system, bottom liner, and groundwater monitoring system meeting RCRA Subtitle D design requirements would be utilized. Short-term effectiveness would be high, as BMPs and water control would be

implemented during construction and the surrounding local communities would experience a rise in economic activity through the duration of construction.

9.2 Implementability Comparative Analysis

The implementability criterion evaluates administrative and technical feasibility in addition to the availability of services and materials. Alternatives 2 through 5 share the administrative actions of obtaining permits and coordinating with agencies in order to conduct work during the SFLWC and Mill Creek restoration. These actions would require identical procedures and have therefore not been discussed.

9.2.1 Alternative 1

Alternative 1 has low administrative feasibility because of the unlikely acceptance by the public and community for an alternative that does not address the risks posed by contaminated material at the site. It has high technical feasibility since no reclamation would be performed and work would consist only of stormwater monitoring. Services and materials associated with stormwater monitoring would be readily available.

9.2.2 Alternative 2

Alternative 2 has moderate administrative feasibility since it would require preventing future site development and/or use in the in-place capped areas and repository area at BPM. Technical feasibility would be high, as the installation of in-place cap and cover systems can both be implemented using standard construction techniques.

9.2.3 Alternative 3

Alternative 3 has moderate administrative feasibility since it would require preventing future site development and/or use in the in-place capped areas at BPM, abiding by regulatory requirements associated with hauling on federal and state highways, and addressing potential public concerns regarding hauling of contaminated material. Technical feasibility would be moderate, as the installation of in-place cap and cover systems would be implemented using standard construction techniques and equipment. Properly hauling contaminated material to prevent exposure to the public can be accomplished. However, the required offsite hauling of approximately 356,200 cy of contaminated material on Highway 1 and Interstate 90 lowers the technical feasibility from high to moderate due to the additional effort that may be required to reduce potential impacts to the public, improve haul roads and stream crossings, manage haul road traffic, and coordinate hauling logistics and schedule.

9.2.4 Alternative 4

Alternative 4 has moderate administrative feasibility since it would require preventing future site development and/or use in the repository area. Technical feasibility would be high, as repository construction and reclamation can be implemented using standard construction techniques and equipment.

9.2.5 Alternative 5

Alternative 5 has moderate administrative feasibility since it would require abiding by regulatory requirements associated with hauling on federal and state highways and properly hauling contaminated material to prevent exposure to the public. Technical feasibility would be moderate since the removal and haul of contaminated material offsite requires only standard construction techniques and equipment. However, the required offsite hauling of approximately 392,200 cy of contaminated material on Highway 1 and Interstate 90 lowers the technical feasibility from high to moderate due as explained for Alternative 3.

9.3 Cost Comparative Analysis

The site-wide alternative cost estimates include direct construction costs and annual operation and maintenance costs for 30 years. A three percent inflation rate was used to obtain the present worth of the operation and maintenance costs (Office of Management and Budget, 2013).

Alternatives 2 through 5 share the reclamation actions for the removal and disposal of dispersed contaminated material on USFS administered lands, realignment and reconstruction of SFLWC and Mill Creek, securing and stabilizing or closing adits, and protecting or demolishing buildings. These reclamation actions are equal in cost for each alternative; therefore, the main components of each alternative that differentiate it from one another are identified below.

9.3.1 Alternative 1

The present value of implementing Alternative 1 is $139,200, which includes stormwater monitoring for 30 years. Costs associated with Alternative 1 are minimal since no reclamation would be performed at BPM and no treatment technologies or controls would be implemented.

9.3.2 Alternative 2

The present value of implementing Alternative 2 is $13,628,600. This cost includes constructing the repository and in-place capping systems at BPM. The majority of the contaminated material would be placed in the repository, which accounts for over one-half of the total cost. On-going maintenance would be required for the capped areas to ensure the integrity of the in-place and repository capping systems, which accounts for roughly over one quarter of the total cost for this alternative.

9.3.3 Alternative 3

The present value of implementing Alternative 3 is $23,231,200. In-place capping at the Tim Smith Mine and Historic Mine AOCs would be performed; however, the majority of the contaminated material would be disposed of offsite. The offsite haul costs and the disposal costs at a permitted disposal facility would account for more than one-third of the total cost. On-going maintenance would involve monitoring the capped areas; however, this accounts for a fairly insignificant portion of the total cost for this alternative.

9.3.4 Alternative 4

The present value of implementing Alternative 4 is $13,880,500. Since contaminated material would be consolidated in one repository, the majority of the cost originates from the construction of the repository, which accounts for approximately three-quarters of the total cost.

9.3.5 Alternative 5

The present value of implementing Alternative 5 is $24,926,000. The removal and disposal of contaminated material site-wide contributes to the majority of this alternative's cost. Offsite haul costs and the disposal costs at a permitted disposal facility account for nearly three-quarters of the total cost; however, minimal maintenance is required since there would be no contaminated material remaining onsite.

9.4 Comparative Analysis Summary

Table 9-1 provides a summary for each of the five site-wide alternative's ability to meet the evaluation criteria. The preferred alternative for reclamation of BPM is discussed in Section 10.

Table 9-1 Comparative Analysis for Site-Wide Alternatives at Black Pine Mine

Criterion		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Effectiveness						
Overall Protection of Human Health and the Environment		Low	Moderate	Moderate	High	High
Compliance with ARARs		Low	High	High	High	High
Long-term Effectiveness and Permanence		Low	Moderate	Moderate	High	High
Reduction of:	Toxicity	Low	Low	Low	Low	Low
	Mobility	Low	Moderate	High	High	High
	Volume	Low	Low	Low	Low	Low
Short-term Effectiveness		Low	High	High	High	High
Implementability						
Administrative Feasibility		Low	Moderate	Moderate	Moderate	Moderate
Technical Feasibility		High	High	Moderate	High	Moderate
Availability of Services and Materials		High	High	High	High	High
Cost						
Capital		$0	$13,365,900	$22,980,300	$13,629,600	$24,675,100
O&M (Present Worth 2013)		$139,200	$262,700	$250,900	$250,900	$250,900
Total Cost		$139,200	$13,628,600	$23,231,200	$13,880,500	$24,926,000

10 PREFERRED ALTERNATIVE

Alternative 4 is selected as the preferred site-wide alternative since it would most effectively achieve the reclamation objectives and cleanup goals presented in Section 6. In contrast with Alternatives 2 and 3, contaminated material would be consolidated in one area of BPM, which would minimize annual maintenance costs and the administrative controls necessary to prevent access into reclaimed areas. Additionally, Alternative 4 includes a geomembrane liner in addition to a soil cap, which would reduce the possibility of leaching contaminants into the environment through cap erosion. Although Alternative 4 provides a similar level of protection as Alternative 5, it is significantly less costly, would have less impacts to the public, including haul traffic impacts on USFS/county roads, and state and federal highways.

Alternative 4 could be implemented with standard techniques and materials readily available for construction. Projects of similar magnitude involving onsite containment have been shown to be successful at containing contaminated material while providing long-term permanence. Alternative 4 would provide lasting human health and ecological protection by minimizing contaminant exposure and reducing the mobility of contaminants at BPM.

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TABLES

TABLE 3-1. SOLID-MATRIX ANALYTICAL RESULTS - TOTAL RECOVERABLE

METALS BACKGROUND SOILS

BLACK PINE MINE

Location	Date Sampled	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Zinc	Iron	Silver
Risk Based Cleanup Guidelines[a] (mg/kg)					**293**	**40.4[bd]**	**4,975**	**19.5[b]**	**735,000**	**30,500**	**27,100**	**1,100**	**665**	**220**	**14,650**	**220,000**	**NS**	**NS**
RY-SS-01	7/12/2011	0	1	mg/kg	0.48	4.0	284	0.093	6.8	4.3	5.1	6.8	327	0.025 J	13.6	36.8	11800	ND(0.37)
RY-SS-02	7/12/2011	0	1	mg/kg	0.6	7.2	248	0.31	4.4	3.3	5.7	5.4	**782**	0.14 J	8.5	42.7	6090	ND(0.45)
RY-SS-03	7/12/2011	0	1	mg/kg	2.4	8.4	202	0.14	10.1	8.7	12.9	20.4	399	0.062 J	12	37.2	17900	ND(0.55)
RY-SS-04	7/12/2011	0	1	mg/kg	158	**74.7**	247	2.4	3.4	4.0	82.5	1030	**1300**	ND(0.021) UJ	8.3	141	16000	2.7
RY-SS-05	7/12/2011	0	1	mg/kg	2.0	11.1	285	1.0	6.2	5.1	12.6	27.9	**1040**	ND(0.019) UJ	12.2	85.3	11800	ND(0.49)
MW-RY-06	8/16/2011	0	0.5	mg/kg	5.5	13.1	122	0.58	13.2	7.8 J	219	45.6	384	0.026	12.3	53.9	13300	1.5
MW-RY-07	8/17/2011	0	0.5	mg/kg	0.98	7.2	216	0.2	7.6	8.1 J	6.4	13.7	**1840**	0.037	9.6	32	9880	ND(0.48)
MW-RY-08	8/17/2011	0	0.5	mg/kg	19.3	**52.1**	90.2	0.35	3.6	1.7 J	70.7	217	146	0.02	4.4	129	9240	0.83
Mean Concentration[c]					23.7	22.2	212	0.63	6.9	5.4	51.9	171	**777**	0.04	10.1	69.7	12001	3.1

[a] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Soil Cleanup Guidelines for Recreational Visitors Table 7-10 (DEQ 1996)

[b] Carcinogenic risk of 5E-07

[c] For non detect results, one half of the reporting limit was used in the calculation of the mean concentration

[d] UCL = 95th upper confidence limit on the arithmetic mean background concentration, from background samples

Bold, highlighted values exceed DEQ RBCG values

J – Estimated

concentration UJ –

Estimated reporting limit ft -

feet

mg/kg - milligrams per kilogram.

ND() - Analyte was not detected (reporting

limit) NS - A standard has not been adopted

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-RS-04	CMN-RS-04 (2-4 ft)	BP-CMN-RS-04-02	10163634	10163634002	7/14/2011	Soil	995701.2516	823155.6623	2	4	MOISTURE	Soil Moisture	35.4		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	0.132		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	0.223		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.415		%
											SB_T_	Antimony, Total Recoverable	424		mg/kg
											AS_T_	Arsenic, Total Recoverable	216		mg/kg
											BA_T_	Barium, Total Recoverable	92.2		mg/kg
											CD_T_	Cadmium, Total Recoverable	3.7		mg/kg
											CR_T_	Chromium, Total Recoverable	1.3		mg/kg
											CO_T_	Cobalt, Total Recoverable	ND(0.76)		mg/kg
											CU_T_	Copper, Total Recoverable	309		mg/kg
											FE_T_	Iron, Total Recoverable	9400		mg/kg
											PB_T_	Lead, Total Recoverable	1910		mg/kg
											MN_T_R	Manganese, Total Recoverable	110		mg/kg
											HG_T_	Mercury, Total Recoverable	0.28 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	1.5		mg/kg
											AG_T_	Silver, Total Recoverable	50.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	423		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.8		Std Units
											ACIDBASE_POT	Acid Base Potential	-5		t/1000t
											ACIDITY_POT	Acid Potential	5		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)	UJ	t/1000t
											01305-78-8_REC	Recommended Lime	7.5		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	1		t/1000t
CMN-RS-04	CMN-RS-04 (5-7 ft)	BP-CMN-RS-04-05	10163634	10163634003	7/14/2011	Soil	995701.2516	823155.6623	5	7	MOISTURE	Soil Moisture	34.4		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	0.127		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	0.108		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	0.276		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.512		%
											SB_T_	Antimony, Total Recoverable	986		mg/kg
											AS_T_	Arsenic, Total Recoverable	439		mg/kg
											BA_T_	Barium, Total Recoverable	114		mg/kg
											CD_T_	Cadmium, Total Recoverable	10.2		mg/kg
											CR_T_	Chromium, Total Recoverable	0.9		mg/kg
											CO_T_	Cobalt, Total Recoverable	ND(0.73)		mg/kg
											CU_T_	Copper, Total Recoverable	464		mg/kg
											FE_T_	Iron, Total Recoverable	19400		mg/kg
											PB_T_	Lead, Total Recoverable	2750		mg/kg
											MN_T_R	Manganese, Total Recoverable	36.8		mg/kg
											HG_T_	Mercury, Total Recoverable	0.13 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	1.1		mg/kg
											AG_T_	Silver, Total Recoverable	155		mg/kg
											ZN_T_	Zinc, Total Recoverable	1040		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.8		Std Units
											ACIDBASE_POT	Acid Base Potential	-6.4		t/1000t
											ACIDITY_POT	Acid Potential	6.4		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)	UJ	t/1000t
											01305-78-8_REC	Recommended Lime	9.2		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	1		t/1000t

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-RS-05	CMN-RS-05 (5-7 ft)	BP-CMN-RS-05-05	10163633	10163633008	7/14/2011	Soil	995520.7678	822481.2171	5	7	MOISTURE	Soil Moisture	7.9		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	0.134		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	0.237		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.369		%
											SB_T_	Antimony, Total Recoverable	678		mg/kg
											AS_T_	Arsenic, Total Recoverable	467		mg/kg
											BA_T_	Barium, Total Recoverable	244		mg/kg
											CD_T_	Cadmium, Total Recoverable	13.7		mg/kg
											CR_T_	Chromium, Total Recoverable	3		mg/kg
											CO_T_	Cobalt, Total Recoverable	4.1 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	1950		mg/kg
											FE_T_	Iron, Total Recoverable	12500		mg/kg
											PB_T_	Lead, Total Recoverable	3050		mg/kg
											MN_T_R	Manganese, Total Recoverable	850		mg/kg
											HG_T_	Mercury, Total Recoverable	0.27 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	4.4		mg/kg
											AG_T_	Silver, Total Recoverable	69		mg/kg
											ZN_T_	Zinc, Total Recoverable	923		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.4		Std Units
											ACIDBASE_POT	Acid Base Potential	1.6		t/1000t
											ACIDITY_POT	Acid Potential	4.4		t/1000t
											NEUT_POT	Neutralization Potential	6.1		t/1000t
											01305-78-8_REC	Recommended Lime	5.6		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CMN-RS-06	CMN-RS-06 (2-4 ft)	BP-CMN-RS-06-02	10163633	10163633011	7/14/2011	Soil	995669.1155	822435.624	2	4	MOISTURE	Soil Moisture	7.5		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	0.0778		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	0.144		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	0.169		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.396		%
											SB_T_	Antimony, Total Recoverable	765		mg/kg
											AS_T_	Arsenic, Total Recoverable	515		mg/kg
											BA_T_	Barium, Total Recoverable	168		mg/kg
											CD_T_	Cadmium, Total Recoverable	14.9		mg/kg
											CR_T_	Chromium, Total Recoverable	4.1		mg/kg
											CO_T_	Cobalt, Total Recoverable	2.5 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	1690		mg/kg
											FE_T_	Iron, Total Recoverable	14400		mg/kg
											PB_T_	Lead, Total Recoverable	3820		mg/kg
											MN_T_R	Manganese, Total Recoverable	652		mg/kg
											HG_T_	Mercury, Total Recoverable	0.26 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	3.9		mg/kg
											AG_T_	Silver, Total Recoverable	87.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	1150		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.4		Std Units
											ACIDBASE_POT	Acid Base Potential	4.2		t/1000t
											ACIDITY_POT	Acid Potential	6.5		t/1000t
											NEUT_POT	Neutralization Potential	11		t/1000t
											01305-78-8_REC	Recommended Lime	8.1		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-04	CMN-SS-04 (0-1 ft)	BP-CMN-SS-04-00	10163634	10163634001	7/14/2011	Soil	995701.2516	823155.6623	0	1	MOISTURE	Soil Moisture	10.8		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	26.2		mg/kg
											AS_T_	Arsenic, Total Recoverable	35		mg/kg
											BA_T_	Barium, Total Recoverable	180		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.39		mg/kg
											CR_T_	Chromium, Total Recoverable	4.1		mg/kg
											CO_T_	Cobalt, Total Recoverable	3.7 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	57.8		mg/kg
											FE_T_	Iron, Total Recoverable	8820		mg/kg
											PB_T_	Lead, Total Recoverable	261		mg/kg
											MN_T_R	Manganese, Total Recoverable	480		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.02)	UJ	mg/kg
											NI_T_R	Nickel, Total Recoverable	4.8		mg/kg
											AG_T_	Silver, Total Recoverable	1		mg/kg
											ZN_T_	Zinc, Total Recoverable	81.5		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.3		Std Units
											ACIDBASE_POT	Acid Base Potential	3		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	0.73 J	J	t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CMN-SS-04	CMN-SS-04 (8-10 ft)	BP-CMN-SS-04-08	10163634	10163634004	7/14/2011	Soil	995701.2516	823155.6623	8	10	MOISTURE	Soil Moisture	12.6		%
											SB_T_	Antimony, Total Recoverable	0.74		mg/kg
											AS_T_	Arsenic, Total Recoverable	7.9		mg/kg
											BA_T_	Barium, Total Recoverable	63		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.11		mg/kg
											CR_T_	Chromium, Total Recoverable	3.7		mg/kg
											CO_T_	Cobalt, Total Recoverable	1.4 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	26.8		mg/kg
											FE_T_	Iron, Total Recoverable	5680		mg/kg
											PB_T_	Lead, Total Recoverable	5.3		mg/kg
											MN_T_R	Manganese, Total Recoverable	56.9		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.023)	UJ	mg/kg
											NI_T_R	Nickel, Total Recoverable	2.5		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.56)		mg/kg
											ZN_T_	Zinc, Total Recoverable	17.7		mg/kg

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-05	CMN-SS-05 (0-1 ft)	BP-CMN-SS-05-00	10163633	10163633009	7/14/2011	Soil	995520.7678	822481.2171	0	1	MOISTURE	Soil Moisture	11.5		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	20.2		mg/kg
											AS_T_	Arsenic, Total Recoverable	26.1		mg/kg
											BA_T_	Barium, Total Recoverable	298		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.37		mg/kg
											CR_T_	Chromium, Total Recoverable	4.8		mg/kg
											CO_T_	Cobalt, Total Recoverable	6.1 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	73.6		mg/kg
											FE_T_	Iron, Total Recoverable	8450		mg/kg
											PB_T_	Lead, Total Recoverable	282		mg/kg
											MN_T_R	Manganese, Total Recoverable	928		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.021)	UJ	mg/kg
											NI_T_R	Nickel, Total Recoverable	4.9		mg/kg
											AG_T_	Silver, Total Recoverable	1		mg/kg
											ZN_T_	Zinc, Total Recoverable	88		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.3		Std Units
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CMN-SS-05	CMN-SS-05 (8-10 ft)	BP-CMN-SS-05-08	10163633	10163633007	7/14/2011	Soil	995520.7678	822481.2171	8	10	MOISTURE	Soil Moisture	11.8		%
											SB_T_	Antimony, Total Recoverable	1.4		mg/kg
											AS_T_	Arsenic, Total Recoverable	7.7		mg/kg
											BA_T_	Barium, Total Recoverable	97		mg/kg
											CD_T_	Cadmium, Total Recoverable	ND(0.08)		mg/kg
											CR_T_	Chromium, Total Recoverable	6.7		mg/kg
											CO_T_	Cobalt, Total Recoverable	5.4 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	8.7		mg/kg
											FE_T_	Iron, Total Recoverable	7960		mg/kg
											PB_T_	Lead, Total Recoverable	14.9		mg/kg
											MN_T_R	Manganese, Total Recoverable	137		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.022)	UJ	mg/kg
											NI_T_R	Nickel, Total Recoverable	5.8		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.5)		mg/kg
											ZN_T_	Zinc, Total Recoverable	25.7		mg/kg

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-06	CMN-SS-06 (0-1 ft)	BP-CMN-SS-06-00	10163633	10163633012	7/14/2011	Soil	995669.1155	822435.624	0	1	MOISTURE	Soil Moisture	10.7		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	15.4		mg/kg
											AS_T_	Arsenic, Total Recoverable	22.3		mg/kg
											BA_T_	Barium, Total Recoverable	177		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.54		mg/kg
											CR_T_	Chromium, Total Recoverable	4.1		mg/kg
											CO_T_	Cobalt, Total Recoverable	7.8 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	57.5		mg/kg
											FE_T_	Iron, Total Recoverable	6670		mg/kg
											PB_T_	Lead, Total Recoverable	217		mg/kg
											MN_T_R	Manganese, Total Recoverable	910		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.022)	UJ	mg/kg
											NI_T_R	Nickel, Total Recoverable	ND(8.7)		mg/kg
											AG_T_	Silver, Total Recoverable	1.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	321		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.3		Std Units
											ACIDBASE_POT	Acid Base Potential	0.9		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	0.94		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CMN-SS-06	CMN-SS-06 (6-8 ft)	BP-CMN-SS-06-06	10163633	10163633010	7/14/2011	Soil	995669.1155	822435.624	6	8	MOISTURE	Soil Moisture	10.9		%
											SB_T_	Antimony, Total Recoverable	2.1		mg/kg
											AS_T_	Arsenic, Total Recoverable	7		mg/kg
											BA_T_	Barium, Total Recoverable	67.9		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.25		mg/kg
											CR_T_	Chromium, Total Recoverable	5.9		mg/kg
											CO_T_	Cobalt, Total Recoverable	7 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	8.8		mg/kg
											FE_T_	Iron, Total Recoverable	6890		mg/kg
											PB_T_	Lead, Total Recoverable	19		mg/kg
											MN_T_R	Manganese, Total Recoverable	342		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.02)	UJ	mg/kg
											NI_T_R	Nickel, Total Recoverable	8		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.48)		mg/kg
											ZN_T_	Zinc, Total Recoverable	37.9		mg/kg

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-07	CMN-SS-07 (0-1 ft)	BP-CMN-SS-07-00	10163634	10163634005	7/14/2011	Soil	996112.58	822825.573	0	1	MOISTURE	Soil Moisture	8.6		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	1.5		mg/kg
											AS_T_	Arsenic, Total Recoverable	12.2		mg/kg
											BA_T_	Barium, Total Recoverable	85.4		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.41		mg/kg
											CR_T_	Chromium, Total Recoverable	12.2		mg/kg
											CO_T_	Cobalt, Total Recoverable	6.6 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	30.9		mg/kg
											FE_T_	Iron, Total Recoverable	15300		mg/kg
											PB_T_	Lead, Total Recoverable	19.7		mg/kg
											MN_T_R	Manganese, Total Recoverable	252		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.021)	UJ	mg/kg
											NI_T_R	Nickel, Total Recoverable	8.2		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.55)		mg/kg
											ZN_T_	Zinc, Total Recoverable	57		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.1		Std Units
											ACIDBASE_POT	Acid Base Potential	1.2		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	1.2 J	J	t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CMN-SS-07	CMN-SS-07 (6-7 ft)	BP-CMN-SS-07-06	10163634	10163634006	7/14/2011	Soil	996112.58	822825.573	6	7	FRAG_COARSE	Coarse Fragments	19.3		%
											OM	Organic Matter	ND(0.1)		%
											MOISTURE	Soil Moisture	10.3		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											CEC	Cation Exchange Capacity	22.1		meq/100g
											SB_T_	Antimony, Total Recoverable	1.3		mg/kg
											AS_T_	Arsenic, Total Recoverable	12.4		mg/kg
											BA_T_	Barium, Total Recoverable	111		mg/kg
											CD_T_	Cadmium, Total Recoverable	ND(0.088)		mg/kg
											CR_T_	Chromium, Total Recoverable	11.9		mg/kg
											CO_T_	Cobalt, Total Recoverable	10.3 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	14.9		mg/kg
											FE_T_	Iron, Total Recoverable	14000		mg/kg
											PB_T_	Lead, Total Recoverable	24.8		mg/kg
											MN_T_R	Manganese, Total Recoverable	393		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.02)	UJ	mg/kg
											NI_T_R	Nickel, Total Recoverable	9.7		mg/kg
											N_NO3	Nitrogen, Nitrate	ND(5)		mg/kg
											P_AVAI	Phosphorous, Available	ND(1)		mg/kg
											K	Potassium, Total	ND(122)		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.55)		mg/kg
											ZN_T_	Zinc, Total Recoverable	30.5		mg/kg
											PH_SATPASTE	pH, Saturated Paste	7.2		Std Units
											PH_SMPBUFFER	pH, SMP Buffer	6.8		Std Units
											ACIDBASE_POT	Acid Base Potential	2		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	2 J	J	t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0.3		t/1000t

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-08	CMN-SS-08 (0-1 ft)	BP-CMN-SS-08-00	10163634	10163634007	7/14/2011	Soil	996341.4152	822740.7253	0	1	MOISTURE	Soil Moisture	16.4		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	3.3		mg/kg
											AS_T_	Arsenic, Total Recoverable	14.4		mg/kg
											BA_T_	Barium, Total Recoverable	64.7		mg/kg
											CD_T_	Cadmium, Total Recoverable	1.6		mg/kg
											CR_T_	Chromium, Total Recoverable	7.6		mg/kg
											CO_T_	Cobalt, Total Recoverable	8.2 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	220		mg/kg
											FE_T_	Iron, Total Recoverable	11000		mg/kg
											PB_T_	Lead, Total Recoverable	24.4		mg/kg
											MN_T_R	Manganese, Total Recoverable	419		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.022)	UJ	mg/kg
											NI_T_R	Nickel, Total Recoverable	4.8		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.6)		mg/kg
											ZN_T_	Zinc, Total Recoverable	101		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7		Std Units
											ACIDBASE_POT	Acid Base Potential	1.7		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	1.7 J	J	t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CMN-SS-08	CMN-SS-08 (3-5 ft)	BP-CMN-SS-08-03	10163634	10163634008	7/14/2011	Soil	996341.4152	822740.7253	3	5	FRAG_COARSE	Coarse Fragments	19.3		%
											OM	Organic Matter	0.13		%
											MOISTURE	Soil Moisture	22.9		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											CEC	Cation Exchange Capacity	22.1		meq/100g
											SB_T_	Antimony, Total Recoverable	1.1		mg/kg
											AS_T_	Arsenic, Total Recoverable	7.6		mg/kg
											BA_T_	Barium, Total Recoverable	136		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.71		mg/kg
											CR_T_	Chromium, Total Recoverable	8.4		mg/kg
											CO_T_	Cobalt, Total Recoverable	5.2 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	124		mg/kg
											FE_T_	Iron, Total Recoverable	10300		mg/kg
											PB_T_	Lead, Total Recoverable	14.8		mg/kg
											MN_T_R	Manganese, Total Recoverable	193		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.021)	R	mg/kg
											NI_T_R	Nickel, Total Recoverable	5.6		mg/kg
											N_NO3	Nitrogen, Nitrate	ND(5)		mg/kg
											P_AVAI	Phosphorous, Available	1.6		mg/kg
											K	Potassium, Total	ND(116)		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.62)		mg/kg
											ZN_T_	Zinc, Total Recoverable	62.7		mg/kg
											SPCON_SATPASTE	Specific Conductance, Saturated	323 J	J	mmhos/cm
											PH_SATPASTE	pH, Saturated Paste	6.8		Std Units
											PH_SMPBUFFER	pH, SMP Buffer	6.8		Std Units
											ACIDBASE_POT	Acid Base Potential	1.7		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	1.7 J	J	t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	1		t/1000t

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-09	CMN-SS-09 (0-1 ft)	BP-CMN-SS-09-00	10163634	10163634009	7/14/2011	Soil	996496.0929	822603.4628	0	1	MOISTURE	Soil Moisture	16.4		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	1.4		mg/kg
											AS_T_	Arsenic, Total Recoverable	9.7		mg/kg
											BA_T_	Barium, Total Recoverable	250		mg/kg
											CD_T_	Cadmium, Total Recoverable	2.7		mg/kg
											CR_T_	Chromium, Total Recoverable	7.8		mg/kg
											CO_T_	Cobalt, Total Recoverable	6 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	489		mg/kg
											FE_T_	Iron, Total Recoverable	8270		mg/kg
											PB_T_	Lead, Total Recoverable	21		mg/kg
											MN_T_R	Manganese, Total Recoverable	460		mg/kg
											HG_T_	Mercury, Total Recoverable	0.12 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	5.3		mg/kg
											AG_T_	Silver, Total Recoverable	0.66		mg/kg
											ZN_T_	Zinc, Total Recoverable	131		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.4		Std Units
											ACIDBASE_POT	Acid Base Potential	1.2		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	1.2 J	J	t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	3.9		t/1000t
CMN-SS-09	CMN-SS-09 (4-6 ft)	BP-CMN-SS-09-04	10163634	10163634010	7/14/2011	Soil	996496.0929	822603.4628	4	6	FRAG_COARSE	Coarse Fragments	22.1		%
											OM	Organic Matter	ND(0.1)		%
											MOISTURE	Soil Moisture	11.6		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											CEC	Cation Exchange Capacity	16.3		meq/100g
											SB_T_	Antimony, Total Recoverable	0.67		mg/kg
											AS_T_	Arsenic, Total Recoverable	8.1		mg/kg
											BA_T_	Barium, Total Recoverable	185		mg/kg
											CD_T_	Cadmium, Total Recoverable	1.7		mg/kg
											CR_T_	Chromium, Total Recoverable	12.1		mg/kg
											CO_T_	Cobalt, Total Recoverable	11.2 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	58.4		mg/kg
											FE_T_	Iron, Total Recoverable	14400		mg/kg
											PB_T_	Lead, Total Recoverable	20.4		mg/kg
											MN_T_R	Manganese, Total Recoverable	243		mg/kg
											HG_T_	Mercury, Total Recoverable	61.3 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	7.1		mg/kg
											N_NO3	Nitrogen, Nitrate	ND(5)		mg/kg
											P_AVAI	Phosphorous, Available	3.2		mg/kg
											K	Potassium, Total	ND(125)		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.57)		mg/kg
											ZN_T_	Zinc, Total Recoverable	129		mg/kg
											SPCON_SATPASTE	Specific Conductance, Saturated	1 J	J	mmhos/cm
											PH_SATPASTE	pH, Saturated Paste	6.1		Std Units
											PH_SMPBUFFER	pH, SMP Buffer	6.9		Std Units
											ACIDBASE_POT	Acid Base Potential	3.7		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	3.7 J	J	t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0.3		t/1000t

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-10	CMN-SS-10 (0-1 ft)	BP-CMN-SS-10-00	10163644	10163644001	7/14/2011	Soil	996694.5628	822516.1362	0	1	MOISTURE	Soil Moisture	15		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	15		mg/kg
											AS_T_	Arsenic, Total Recoverable	8.6		mg/kg
											BA_T_	Barium, Total Recoverable	237		mg/kg
											CD_T_	Cadmium, Total Recoverable	1.4 J	J	mg/kg
											CR_T_	Chromium, Total Recoverable	3.3 J	J	mg/kg
											CO_T_	Cobalt, Total Recoverable	4.7 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	139		mg/kg
											FE_T_	Iron, Total Recoverable	6800		mg/kg
											PB_T_	Lead, Total Recoverable	15.8		mg/kg
											MN_T_R	Manganese, Total Recoverable	1170		mg/kg
											HG_T_	Mercury, Total Recoverable	0.044 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	6.1		mg/kg
											AG_T_	Silver, Total Recoverable	1		mg/kg
											ZN_T_	Zinc, Total Recoverable	93.2		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.6		Std Units
											ACIDBASE_POT	Acid Base Potential	2.4		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	2.4		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	2.4		t/1000t
CMN-SS-10	CMN-SS-10 (4-5 ft)	BP-CMN-SS-10-04	10163644	10163644002	7/14/2011	Soil	996694.5628	822516.1362	4	5	MOISTURE	Soil Moisture	20.1		%
											SB_T_	Antimony, Total Recoverable	5.4		mg/kg
											AS_T_	Arsenic, Total Recoverable	14.1		mg/kg
											BA_T_	Barium, Total Recoverable	136		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.32 J	J	mg/kg
											CR_T_	Chromium, Total Recoverable	4.8 J	J	mg/kg
											CO_T_	Cobalt, Total Recoverable	12.7 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	38.1		mg/kg
											FE_T_	Iron, Total Recoverable	17100		mg/kg
											PB_T_	Lead, Total Recoverable	24.9		mg/kg
											MN_T_R	Manganese, Total Recoverable	510		mg/kg
											HG_T_	Mercury, Total Recoverable	0.043 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	7.8		mg/kg
											AG_T_	Silver, Total Recoverable	ND(1.5)		mg/kg
											ZN_T_	Zinc, Total Recoverable	44.8		mg/kg

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-11	CMN-SS-11 (0-1 ft)	BP-CMN-SS-11-00	10163644	10163644009	7/14/2011	Soil	995997.1798	822541.4686	0	1	MOISTURE	Soil Moisture	9.2		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	16.2		mg/kg
											AS_T_	Arsenic, Total Recoverable	22.5		mg/kg
											BA_T_	Barium, Total Recoverable	130		mg/kg
											CD_T_	Cadmium, Total Recoverable	1.2 J	J	mg/kg
											CR_T_	Chromium, Total Recoverable	4.8 J	J	mg/kg
											CO_T_	Cobalt, Total Recoverable	4.3 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	64.2		mg/kg
											FE_T_	Iron, Total Recoverable	8570		mg/kg
											PB_T_	Lead, Total Recoverable	110		mg/kg
											MN_T_R	Manganese, Total Recoverable	311		mg/kg
											HG_T_	Mercury, Total Recoverable	0.07 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	5.5		mg/kg
											AG_T_	Silver, Total Recoverable	2.3		mg/kg
											ZN_T_	Zinc, Total Recoverable	133		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.2		Std Units
											ACIDBASE_POT	Acid Base Potential	1.5		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	1.5		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CMN-SS-11	CMN-SS-11 (4-5 ft)	BP-CMN-SS-11-04	10163644	10163644010	7/14/2011	Soil	995997.1798	822541.4686	4	5	FRAG_COARSE	Coarse Fragments	10.9		%
											OM	Organic Matter	ND(0.1)		%
											MOISTURE	Soil Moisture	9.8		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											CEC	Cation Exchange Capacity	21.7		meq/100g
											SB_T_	Antimony, Total Recoverable	4.1		mg/kg
											AS_T_	Arsenic, Total Recoverable	29.5		mg/kg
											BA_T_	Barium, Total Recoverable	116		mg/kg
											CD_T_	Cadmium, Total Recoverable	ND(0.079)	UJ	mg/kg
											CR_T_	Chromium, Total Recoverable	6.2 J	J	mg/kg
											CO_T_	Cobalt, Total Recoverable	12.6 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	18.4		mg/kg
											FE_T_	Iron, Total Recoverable	27500		mg/kg
											PB_T_	Lead, Total Recoverable	55.4		mg/kg
											MN_T_R	Manganese, Total Recoverable	610		mg/kg
											HG_T_	Mercury, Total Recoverable	0.03 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	7.2		mg/kg
											N_NO3	Nitrogen, Nitrate	ND(5)		mg/kg
											P_AVAI	Phosphorous, Available	ND(1)		mg/kg
											K	Potassium, Total	ND(123)		mg/kg
											AG_T_	Silver, Total Recoverable	0.59		mg/kg
											ZN_T_	Zinc, Total Recoverable	43.1		mg/kg
											SPCON_SATPASTE	Specific Conductance, Saturated	0.37 J	J	mmhos/cm
											PH_SATPASTE	pH, Saturated Paste	7.2		Std Units
											PH_SMPBUFFER	pH, SMP Buffer	6.9		Std Units
											ACIDBASE_POT	Acid Base Potential	3.2		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	3.2		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0.3		t/1000t

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-12	CMN-SS-12 (0-1 ft)	BP-CMN-SS-12-00	10163644	10163644007	7/14/2011	Soil	996196.3849	822453.6733	0	1	MOISTURE	Soil Moisture	20.3		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	9.1		mg/kg
											AS_T_	Arsenic, Total Recoverable	12.3		mg/kg
											BA_T_	Barium, Total Recoverable	160		mg/kg
											CD_T_	Cadmium, Total Recoverable	1.1 J	J	mg/kg
											CR_T_	Chromium, Total Recoverable	4.3 J	J	mg/kg
											CO_T_	Cobalt, Total Recoverable	2.5 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	105		mg/kg
											FE_T_	Iron, Total Recoverable	6400		mg/kg
											PB_T_	Lead, Total Recoverable	59		mg/kg
											MN_T_R	Manganese, Total Recoverable	316		mg/kg
											HG_T_	Mercury, Total Recoverable	0.062 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	14.8		mg/kg
											AG_T_	Silver, Total Recoverable	2		mg/kg
											ZN_T_	Zinc, Total Recoverable	127		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.8		Std Units
											ACIDBASE_POT	Acid Base Potential	2.2		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	2.2		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	1		t/1000t
CMN-SS-12	CMN-SS-12 (4-5 ft)	BP-CMN-SS-12-04	10163644	10163644008	7/14/2011	Soil	996196.3849	822453.6733	4	5	FRAG_COARSE	Coarse Fragments	11.7		%
											OM	Organic Matter	ND(0.1)		%
											MOISTURE	Soil Moisture	20.2		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											CEC	Cation Exchange Capacity	23		meq/100g
											SB_T_	Antimony, Total Recoverable	2.1		mg/kg
											AS_T_	Arsenic, Total Recoverable	10.4		mg/kg
											BA_T_	Barium, Total Recoverable	222		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.19 J	J	mg/kg
											CR_T_	Chromium, Total Recoverable	8.2 J	J	mg/kg
											CO_T_	Cobalt, Total Recoverable	7.5 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	22.3		mg/kg
											FE_T_	Iron, Total Recoverable	13300		mg/kg
											PB_T_	Lead, Total Recoverable	23.3		mg/kg
											MN_T_R	Manganese, Total Recoverable	239		mg/kg
											HG_T_	Mercury, Total Recoverable	0.029 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	8.9		mg/kg
											N_NO3	Nitrogen, Nitrate	ND(5)		mg/kg
											P_AVAI	Phosphorous, Available	ND(1)		mg/kg
											K	Potassium, Total	ND(120)		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.5)		mg/kg
											ZN_T_	Zinc, Total Recoverable	54		mg/kg
											SPCON_SATPASTE	Specific Conductance, Saturated	0.91 J	J	mmhos/cm
											PH_SATPASTE	pH, Saturated Paste	6.8		Std Units
											PH_SMPBUFFER	pH, SMP Buffer	7		Std Units
											ACIDBASE_POT	Acid Base Potential	3.5		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	3.5		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-13	CMN-SS-13 (0-1 ft)	BP-CMN-SS-13-00	10163644	10163644005	7/14/2011	Soil	996457.377	822387.2326	0	1	MOISTURE	Soil Moisture	33.9		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.0751		%
											SB_T_	Antimony, Total Recoverable	396		mg/kg
											AS_T_	Arsenic, Total Recoverable	250		mg/kg
											BA_T_	Barium, Total Recoverable	254		mg/kg
											CD_T_	Cadmium, Total Recoverable	11.2 J	J	mg/kg
											CR_T_	Chromium, Total Recoverable	ND(3)	UJ	mg/kg
											CO_T_	Cobalt, Total Recoverable	4.2 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	885		mg/kg
											FE_T_	Iron, Total Recoverable	11700		mg/kg
											PB_T_	Lead, Total Recoverable	1890		mg/kg
											MN_T_R	Manganese, Total Recoverable	540		mg/kg
											HG_T_	Mercury, Total Recoverable	1.4 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	5.8		mg/kg
											AG_T_	Silver, Total Recoverable	70.8		mg/kg
											ZN_T_	Zinc, Total Recoverable	877		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	5.7		Std Units
											ACIDBASE_POT	Acid Base Potential	1.5		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	1.5		t/1000t
											01305-78-8_REC	Recommended Lime	13		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	8.9		t/1000t
CMN-SS-13	CMN-SS-13 (4-5 ft)	BP-CMN-SS-13-04	10163644	10163644006	7/14/2011	Soil	996457.377	822387.2326	4	5	FRAG_COARSE	Coarse Fragments	33.4		%
											OM	Organic Matter	ND(0.1)		%
											MOISTURE	Soil Moisture	20.2		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											CEC	Cation Exchange Capacity	24.6		meq/100g
											SB_T_	Antimony, Total Recoverable	2.4		mg/kg
											AS_T_	Arsenic, Total Recoverable	8.3		mg/kg
											BA_T_	Barium, Total Recoverable	173		mg/kg
											CD_T_	Cadmium, Total Recoverable	ND(0.093)	UJ	mg/kg
											CR_T_	Chromium, Total Recoverable	9.4 J	J	mg/kg
											CO_T_	Cobalt, Total Recoverable	4.3 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	14.5		mg/kg
											FE_T_	Iron, Total Recoverable	13400		mg/kg
											PB_T_	Lead, Total Recoverable	24.4		mg/kg
											MN_T_R	Manganese, Total Recoverable	170		mg/kg
											HG_T_	Mercury, Total Recoverable	0.026 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	8		mg/kg
											N_NO3	Nitrogen, Nitrate	ND(5)		mg/kg
											P_AVAI	Phosphorous, Available	1.4		mg/kg
											K	Potassium, Total	ND(121)		mg/kg
											AG_T_	Silver, Total Recoverable	0.91		mg/kg
											ZN_T_	Zinc, Total Recoverable	41.4		mg/kg
											SPCON_SATPASTE	Specific Conductance, Saturated	204 J	J	mmhos/cm
											PH_SATPASTE	pH, Saturated Paste	7.2		Std Units
											PH_SMPBUFFER	pH, SMP Buffer	6.9		Std Units
											ACIDBASE_POT	Acid Base Potential	3.3		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	3.3		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0.3		t/1000t

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-14	CMN-SS-14 (0-1 ft)	BP-CMN-SS-14-00	10163644	10163644003	7/14/2011	Soil	997186.0727	822362.1939	0	1	MOISTURE	Soil Moisture	30.4		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	3.1		mg/kg
											AS_T_	Arsenic, Total Recoverable	19.1		mg/kg
											BA_T_	Barium, Total Recoverable	177		mg/kg
											CD_T_	Cadmium, Total Recoverable	2.8 J	J	mg/kg
											CR_T_	Chromium, Total Recoverable	6.8 J	J	mg/kg
											CO_T_	Cobalt, Total Recoverable	5.6 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	321		mg/kg
											FE_T_	Iron, Total Recoverable	15700		mg/kg
											PB_T_	Lead, Total Recoverable	19.3		mg/kg
											MN_T_R	Manganese, Total Recoverable	298		mg/kg
											HG_T_	Mercury, Total Recoverable	0.13 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	6.7		mg/kg
											AG_T_	Silver, Total Recoverable	ND(1.2)		mg/kg
											ZN_T_	Zinc, Total Recoverable	163		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6		Std Units
											ACIDBASE_POT	Acid Base Potential	1.5		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	1.5		t/1000t
											01305-78-8_REC	Recommended Lime	8.3		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	6		t/1000t
CMN-SS-14	CMN-SS-14 (4-5 ft)	BP-CMN-SS-14-04	10163644	10163644004	7/14/2011	Soil	997186.0727	822362.1939	4	5	MOISTURE	Soil Moisture	15.6		%
											SB_T_	Antimony, Total Recoverable	17.4		mg/kg
											AS_T_	Arsenic, Total Recoverable	19.9		mg/kg
											BA_T_	Barium, Total Recoverable	312		mg/kg
											CD_T_	Cadmium, Total Recoverable	6.9 J	J	mg/kg
											CR_T_	Chromium, Total Recoverable	4.3 J	J	mg/kg
											CO_T_	Cobalt, Total Recoverable	5.1 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	917		mg/kg
											FE_T_	Iron, Total Recoverable	7080		mg/kg
											PB_T_	Lead, Total Recoverable	108		mg/kg
											MN_T_R	Manganese, Total Recoverable	602		mg/kg
											HG_T_	Mercury, Total Recoverable	0.022 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	7.3		mg/kg
											AG_T_	Silver, Total Recoverable	3.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	279		mg/kg
CMN-SS-15	CMN-SS-15 (0-0.5 ft)	CMN-SS-15	10163635	10163635001	7/13/2011	Soil	996253.9382	823521.0975	0	0.5	MOISTURE	Soil Moisture	21.6		%
											SB_T_	Antimony, Total Recoverable	6.6		mg/kg
											AS_T_	Arsenic, Total Recoverable	11.5		mg/kg
											BA_T_	Barium, Total Recoverable	63.6		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.6		mg/kg
											CR_T_	Chromium, Total Recoverable	3.2		mg/kg
											CO_T_	Cobalt, Total Recoverable	2.5		mg/kg
											CU_T_	Copper, Total Recoverable	88.5		mg/kg
											FE_T_	Iron, Total Recoverable	4490		mg/kg
											PB_T_	Lead, Total Recoverable	62.1		mg/kg
											MN_T_R	Manganese, Total Recoverable	226		mg/kg
											HG_T_	Mercury, Total Recoverable	0.093 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	2.6		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.53)		mg/kg
											ZN_T_	Zinc, Total Recoverable	55.4		mg/kg

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-16	CMN-SS-16 (0-0.5 ft)	CMN-SS-16	10163635	10163635002	7/13/2011	Soil	996817.0426	824261.1	0	0.5	MOISTURE	Soil Moisture	20.2		%
											SB_T_	Antimony, Total Recoverable	36.7		mg/kg
											AS_T_	Arsenic, Total Recoverable	31.7		mg/kg
											BA_T_	Barium, Total Recoverable	89.9		mg/kg
											CD_T_	Cadmium, Total Recoverable	2.9		mg/kg
											CR_T_	Chromium, Total Recoverable	5		mg/kg
											CO_T_	Cobalt, Total Recoverable	5.4		mg/kg
											CU_T_	Copper, Total Recoverable	295		mg/kg
											FE_T_	Iron, Total Recoverable	7450		mg/kg
											PB_T_	Lead, Total Recoverable	182		mg/kg
											MN_T_R	Manganese, Total Recoverable	556		mg/kg
											HG_T_	Mercury, Total Recoverable	0.25 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	4.9		mg/kg
											AG_T_	Silver, Total Recoverable	3.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	148		mg/kg
CMN-SS-17	CMN-SS-17 (0-0.5 ft)	BP-CMN-SS-17	10167132	10167132001	8/18/2011	Soil	995357.433	822766.8568	0	0.5	MOISTURE	Soil Moisture	13.1		%
											SB	Antimony, Total	12.6		mg/kg
											AS	Arsenic, Total	14.5		mg/kg
											BA	Barium, Total	120		mg/kg
											CD	Cadmium, Total	0.86		mg/kg
											CR	Chromium, Total	2.4		mg/kg
											CO_T_	Cobalt, Total Recoverable	4.2 J	J	mg/kg
											CU	Copper, Total	89.8		mg/kg
											FE	Iron, Total	5160		mg/kg
											PB	Lead, Total	90.4		mg/kg
											MN	Manganese, Total	285		mg/kg
											HG_T_	Mercury, Total Recoverable	0.041		mg/kg
											NI	Nickel, Total	3.2		mg/kg
											SE	Selenium, Total	ND(0.38)		mg/kg
											AG	Silver, Total	1.6		mg/kg
											ZN	Zinc, Total	79.4		mg/kg
CMN-SS-18	CMN-SS-18 (0-0.5 ft)	BP-CMN-SS-18	10167132	10167132002	8/18/2011	Soil	995338.4658	822701.472	0	0.5	MOISTURE	Soil Moisture	9.4		%
											SB	Antimony, Total	3.6		mg/kg
											AS	Arsenic, Total	9.1		mg/kg
											BA	Barium, Total	70.1		mg/kg
											CD	Cadmium, Total	1.3		mg/kg
											CR	Chromium, Total	1.2		mg/kg
											CO_T_	Cobalt, Total Recoverable	2.9 J	J	mg/kg
											CU	Copper, Total	62.8		mg/kg
											FE	Iron, Total	6770		mg/kg
											PB	Lead, Total	23		mg/kg
											MN	Manganese, Total	202		mg/kg
											HG_T_	Mercury, Total Recoverable	0.022		mg/kg
											NI	Nickel, Total	4		mg/kg
											AG	Silver, Total	0.5		mg/kg
											ZN	Zinc, Total	75.5		mg/kg

TABLE 3-2. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CMN-SS-19	CMN-SS-19 (0-0.5 ft)	BP-CMN-SS-19	10167132	10167132003	8/18/2011	Soil	995327.0854	822769.6997	0	0.5	MOISTURE	Soil Moisture	8.5		%
											SB	Antimony, Total	1010		mg/kg
											AS	Arsenic, Total	537		mg/kg
											BA	Barium, Total	87.7		mg/kg
											CD	Cadmium, Total	67		mg/kg
											CR	Chromium, Total	ND(0.38)		mg/kg
											CO_T_	Cobalt, Total Recoverable	4.1 J	J	mg/kg
											CU	Copper, Total	56800		mg/kg
											FE	Iron, Total	13600		mg/kg
											PB	Lead, Total	1860		mg/kg
											MN	Manganese, Total	989		mg/kg
											HG_T_	Mercury, Total Recoverable	1.1		mg/kg
											NI	Nickel, Total	6.8		mg/kg
											AG	Silver, Total	105		mg/kg
											ZN	Zinc, Total	4380		mg/kg

[a] Silver was included in original laboratory analytical reports, but was removed in revised reports by the laboratory

J – Estimated concentration
R - Rejected, data not
usable UJ – Estimated
reporting limit ft - feet
meq/100g - milliequivalents per hundred
grams mg/kg - milligrams per kilogram
mmhos/cm - micromhos per centimeter
% - percent
ND() - Analyte was not detected (reporting
limit) Std Units - Standard Units
t/1000t - tons per thousand tons

TABLE 3-3. ACID BASE ACCOUNTING RESULTS
COMBINTION MINE AOC
BLACK PINE MINE

Location	Date Sampled	Sample Start Depth (ft)	Sample End Depth (ft)	Acid Base Potential** (t/1000t)	Acid Potential (t/1000t)	Neutralization Potential (t/1000t)	pH, SMP Buffer (Standard Units)	Recommended Lime (t/1000t)	SMP Lime Requirement (t/1000t)	Sulfur (HCL Extraction) (%)	Sulfur (HNO3 Extraction) (%)	Sulfur (Hot Water Extraction) (%)	Sulfur, Residual (%)	Sulfur, Total (%)
CMN-SS-04	7/14/2011	0	1	0.73	ND(4.3)	0.73 J	7.3	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-RS-04	7/14/2011	2	4	-5	5	ND(0.5) UJ	6.8	7.5	1	0.132	ND(0.05)	0.223	ND(0.05)	0.415
CMN-RS-04	7/14/2011	5	7	-6.4	6.4	ND(0.5) UJ	6.8	9.2	1	0.127	0.108	0.276	ND(0.05)	0.512
CMN-SS-05	7/14/2011	0	1	0	ND(4.3)	ND(0.5) UJ	7.3	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-RS-05	7/14/2011	5	7	1.6	4.4	6.1	7.4	5.6	0	ND(0.05)	0.134	0.237	ND(0.05)	0.369
CMN-SS-06	7/14/2011	0	1	0.9	ND(4.3)	0.94	7.3	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-RS-06	7/14/2011	2	4	4.2	6.5	11	7.4	8.1	0	0.0778	0.144	0.169	ND(0.05)	0.396
CMN-SS-07	7/14/2011	0	1	1.2	ND(4.3)	1.2 J	7.1	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-07	7/14/2011	6	7	2	ND(4.3)	2 J	6.8	ND(5.4)	0.3	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-08	7/14/2011	0	1	1.7	ND(4.3)	1.7 J	7	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-08	7/14/2011	3	5	1.7	ND(4.3)	1.7 J	6.8	ND(5.4)	1	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-09	7/14/2011	0	1	1.2	ND(4.3)	1.2 J	6.4	ND(5.4)	3.9	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-09	7/14/2011	4	6	3.7	ND(4.3)	3.7 J	6.9	ND(5.4)	0.3	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-10	7/14/2011	0	1	2.4	ND(4.3)	2.4	6.6	ND(5.4)	2.4	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-11	7/14/2011	0	1	1.5	ND(4.3)	1.5	7.2	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-11	7/14/2011	4	5	3.2	ND(4.3)	3.2	6.9	ND(5.4)	0.3	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-12	7/14/2011	0	1	2.2	ND(4.3)	2.2	6.8	ND(5.4)	1	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-12	7/14/2011	4	5	3.5	ND(4.3)	3.5	7	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-13	7/14/2011	0	1	1.5	ND(4.3)	1.5	5.7	13	8.9	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	0.0751
CMN-SS-13	7/14/2011	4	5	3.3	ND(4.3)	3.3	6.9	ND(5.4)	0.3	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CMN-SS-14	7/14/2011	0	1	1.5	ND(4.3)	1.5	6	8.3	6	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)

J – Estimated concentration
UJ – Estimated reporting limit
ft - feet
t/1000t = tons of Calcium Carbonate ($CaCO_3$) per 1,000 tons waste
ND() - Analyte was not detected (reporting limit)

** Acid/Base Potential = NP - AP
Potentially Acid Generating:
Uncertain Acid Generation Potential:
Unlikely to Generate Acid:

NP = Neutralization Potential
AP = Acid Potential
NNP = Net Neutralizing Potential = Base - Acid Potential

NP:AP < 1 and NNP < -20 tons/kton
NP:AP between 1 and 3 and/or NNP between -20 and +20 tons/kton
NNP < +20 tons/kton

TABLE 3-4 SOLID MATRIX ANALYTICAL RESULTS
TIM SMITH MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte a	Value	Reviewer Qualifier	Units
TS-RS-01	TS-RS-01 (4-6 ft)	BP-TS-RS-01-04	10163483	10163483001	7/12/2011	Soil	991334.57	824297.71	4	6	MOISTURE	Soil Moisture	5.2		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	0.0546		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	0.0639		%
											SULFUR_RES	Sulfur, Residual	ND(0.05		%
											SULFU	Sulfur, Total	0.141		%
											SB_T_	Antimony, Total	508		mg/kg
											AS_T_	Arsenic, Total	629		mg/kg
											BA_T_	Barium, Total	241		mg/kg
											CD_T_	Cadmium, Total	3.9		mg/kg
											CR_T_	Chromium, Total	1.8		mg/kg
											CO_T_	Cobalt, Total	0.94 J	J	mg/kg
											CU_T_	Copper, Total	1510		mg/kg
											FE_T_	Iron, Total Recoverable	26500		mg/kg
											PB_T_	Lead, Total Recoverable	1880		mg/kg
											MN_T_	Manganese, Total	248		mg/kg
											HG_T_	Mercury, Total	2.3 J	J	mg/kg
											NI_T_	Nickel, Total	ND(2.2)		mg/kg
											AG_T_	Silver, Total Recoverable	63.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	149		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.1		Std
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
TS-RS-03	TS-RS-03 (2-4 ft)	BP-TS-RS-03-02	10163483	10163483004	7/12/2011	Soil	991327.96	824180.93	2	4	MOISTURE	Soil Moisture	3.6		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	0.0625		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	0.0695		%
											SULFUR_RES	Sulfur, Residual	ND(0.05		%
											SULFU	Sulfur, Total	0.161		%
											SB_T_	Antimony, Total	712		mg/kg
											AS_T_	Arsenic, Total	868		mg/kg
											BA_T_	Barium, Total	186		mg/kg
											CD_T_	Cadmium, Total	6		mg/kg
											CR_T_	Chromium, Total	1.7		mg/kg
											CO_T_	Cobalt, Total	1.3 J	J	mg/kg
											CU_T_	Copper, Total	794		mg/kg
											FE_T_	Iron, Total Recoverable	28100		mg/kg
											PB_T_	Lead, Total Recoverable	3060		mg/kg
											MN_T_	Manganese, Total	125		mg/kg
											HG_T_	Mercury, Total	2.1 J	J	mg/kg
											NI_T_	Nickel, Total	2.7		mg/kg
											AG_T_	Silver, Total Recoverable	201		mg/kg
											ZN_T_	Zinc, Total Recoverable	144		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.8		Std
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	1		t/1000t

TABLE 3-4 SOLID MATRIX ANALYTICAL RESULTS
TIM SMITH MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
TS-RS-07	TS-RS-07 (4-6 ft)	BP-TS-RS-07-04	10163483	10163483007	7/13/2011	Soil	992112.32	826172.09	4	6	MOISTURE	Soil Moisture	9.8		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	ND(0.05		%
											SULFUR_RES	Sulfur, Residual	ND(0.05		%
											SULFU	Sulfur, Total	0.092		%
											SB_T_	Antimony, Total	219		mg/kg
											AS_T_	Arsenic, Total	118		mg/kg
											BA_T_	Barium, Total	49.3		mg/kg
											CD_T_	Cadmium, Total	0.12		mg/kg
											CR_T_	Chromium, Total	5.4		mg/kg
											CO_T_	Cobalt, Total	2.5 J	J	mg/kg
											CU_T_	Copper, Total	31.3		mg/kg
											FE_T_	Iron, Total Recoverable	17000		mg/kg
											PB_T_	Lead, Total Recoverable	162		mg/kg
											MN_T_	Manganese, Total	67.6		mg/kg
											HG_T_	Mercury, Total	1.1 J	J	mg/kg
											NI_T_	Nickel, Total	4.9		mg/kg
											AG_T_	Silver, Total Recoverable	13.5		mg/kg
											ZN_T_	Zinc, Total Recoverable	18.6		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.3		Std
											ACIDBASE_POT	Acid Base Potential	0.7		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	0.72		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
TS-SD-01	TS-SD-01 (0-0.5 ft)	BP-TS-SD-01-00	10160707	10160707002	6/13/2011	Sediment	990839.04	824292.65	0	0.5	MOISTURE	Soil Moisture	65.9		%
											SB_T_	Antimony, Total	37.2		mg/kg
											AS_T_	Arsenic, Total	31.1		mg/kg
											BA_T_	Barium, Total	266		mg/kg
											CD_T_	Cadmium, Total	9.1 J	J	mg/kg
											CR_T_	Chromium, Total	10.7		mg/kg
											CO_T_	Cobalt, Total	6.5 J	J	mg/kg
											CU_T_	Copper, Total	639		mg/kg
											FE_T_	Iron, Total Recoverable	10100		mg/kg
											PB_T_	Lead, Total Recoverable	110		mg/kg
											MN_T_	Manganese, Total	1140		mg/kg
											HG_T_	Mercury, Total	0.23		mg/kg
											NI_T_	Nickel, Total	24.5		mg/kg
											AG_T_	Silver, Total Recoverable	6.1 J	J	mg/kg
											ZN_T_	Zinc, Total Recoverable	236		mg/kg
TS-SD-02	TS-SD-02 (0-0.5 ft)	BP-TS-SD-02-00	10160707	10160707006	6/13/2011	Sediment	989432.59	823797.61	0	0.5	MOISTURE	Soil Moisture	68.9		%
											SB_T_	Antimony, Total	3.2		mg/kg
											AS_T_	Arsenic, Total	22.4		mg/kg
											BA_T_	Barium, Total	635		mg/kg
											CD_T_	Cadmium, Total	1.1 J	J	mg/kg
											CR_T_	Chromium, Total	16		mg/kg
											CO_T_	Cobalt, Total	11.6 J	J	mg/kg
											CU_T_	Copper, Total	50.9		mg/kg
											FE_T_	Iron, Total Recoverable	24700		mg/kg
											PB_T_	Lead, Total Recoverable	65.2		mg/kg
											MN_T_	Manganese, Total	947		mg/kg
											HG_T_	Mercury, Total	24.4		mg/kg
											NI_T_	Nickel, Total	20		mg/kg
											AG_T_	Silver, Total Recoverable	ND(1.5)	UJ	mg/kg
											ZN_T_	Zinc, Total Recoverable	117		mg/kg

TABLE 3-4 SOLID MATRIX ANALYTICAL RESULTS
TIM SMITH MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
TS-SD-03	TS-SD-03 (0-0.5 ft)	BP-CML-SD-03-00	10160673	10160673003	6/14/2011	Sediment	987859.71	825256.19	0	0.5	MOISTURE	Soil Moisture	71.6		%
											SB_T_	Antimony, Total	3.3		mg/kg
											AS_T_	Arsenic, Total	20.2		mg/kg
											BA_T_	Barium, Total	800		mg/kg
											CD_T_	Cadmium, Total	1.8		mg/kg
											CR_T_	Chromium, Total	23.5		mg/kg
											CO_T_	Cobalt, Total	10.7 J	J	mg/kg
											CU_T_	Copper, Total	87.7		mg/kg
											FE_T_	Iron, Total Recoverable	20600		mg/kg
											PB_T_	Lead, Total Recoverable	39.2		mg/kg
											MN_T_	Manganese, Total	1150		mg/kg
											HG_T_	Mercury, Total	0.76		mg/kg
											NI_T_	Nickel, Total	31.2		mg/kg
											AG_T_	Silver, Total Recoverable	ND(1.4)		mg/kg
											ZN_T_	Zinc, Total Recoverable	136		mg/kg
TS-SS-01	TS-SS-01 (6-8 ft)	BP-TS-SS-01-06	10163483	10163483002	7/12/2011	Soil	991334.57	824297.71	6	8	MOISTURE	Soil Moisture	10.3		%
											SB_T_	Antimony, Total	7.5		mg/kg
											AS_T_	Arsenic, Total	11.5		mg/kg
											BA_T_	Barium, Total	130		mg/kg
											CD_T_	Cadmium, Total	0.31		mg/kg
											CR_T_	Chromium, Total	4.8		mg/kg
											CO_T_	Cobalt, Total	3.1 J	J	mg/kg
											CU_T_	Copper, Total	19		mg/kg
											FE_T_	Iron, Total Recoverable	6920		mg/kg
											PB_T_	Lead, Total Recoverable	28.6		mg/kg
											MN_T_	Manganese, Total	660		mg/kg
											HG_T_	Mercury, Total	0.047 J	J	mg/kg
											NI_T_	Nickel, Total	5.1		mg/kg
											AG_T_	Silver, Total Recoverable	1.5		mg/kg
											ZN_T_	Zinc, Total Recoverable	32.3		mg/kg
TS-SS-02	TS-SS-02 (2-4 ft)	BP-TS-SS-02-02	10163483	10163483005	7/12/2011	Soil			2	4	MOISTURE	Soil Moisture	8.6		%
											SB_T_	Antimony, Total	109		mg/kg
											AS_T_	Arsenic, Total	79.8		mg/kg
											BA_T_	Barium, Total	146		mg/kg
											CD_T_	Cadmium, Total	3		mg/kg
											CR_T_	Chromium, Total	4.1		mg/kg
											CO_T_	Cobalt, Total	3 J	J	mg/kg
											CU_T_	Copper, Total	189		mg/kg
											FE_T_	Iron, Total Recoverable	7240		mg/kg
											PB_T_	Lead, Total Recoverable	328		mg/kg
											MN_T_	Manganese, Total	325		mg/kg
											HG_T_	Mercury, Total	1 J	J	mg/kg
											NI_T_	Nickel, Total	4.8		mg/kg
											AG_T_	Silver, Total Recoverable	17.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	56.6		mg/kg

TABLE 3-4 SOLID MATRIX ANALYTICAL RESULTS
TIM SMITH MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte a	Value	Reviewer Qualifier	Units
TS-SS-03	TS-SS-03 (3-5 ft)	BP-TS-SS-03-03	10163483	10163483003	7/12/2011	Soil	991327.96	824180.93	3	5	MOISTURE	Soil Moisture	14.5		%
											SB_T_	Antimony, Total	5.7		mg/kg
											AS_T_	Arsenic, Total	11.5		mg/kg
											BA_T_	Barium, Total	154		mg/kg
											CD_T_	Cadmium, Total	0.87		mg/kg
											CR_T_	Chromium, Total	7.5		mg/kg
											CO_T_	Cobalt, Total	3.5 J	J	mg/kg
											CU_T_	Copper, Total	730		mg/kg
											FE_T_	Iron, Total Recoverable	11400		mg/kg
											PB_T_	Lead, Total Recoverable	65.7		mg/kg
											MN_T_	Manganese, Total	457		mg/kg
											HG_T_	Mercury, Total	0.029 J	J	mg/kg
											NI_T_	Nickel, Total	6.5		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.58		mg/kg
											ZN_T_	Zinc, Total Recoverable	72.4		mg/kg
TS-SS-07	TS-SS-07 (1-3 ft)	BP-TS-SS-07-01	10163483	10163483008	7/13/2011	Soil	992112.32	826172.09	1	3	MOISTURE	Soil Moisture	10		%
											SB_T_	Antimony, Total	64.2		mg/kg
											AS_T_	Arsenic, Total	73.6		mg/kg
											BA_T_	Barium, Total	84.1		mg/kg
											CD_T_	Cadmium, Total	0.14		mg/kg
											CR_T_	Chromium, Total	10.1		mg/kg
											CO_T_	Cobalt, Total	3.6 J	J	mg/kg
											CU_T_	Copper, Total	28.2		mg/kg
											FE_T_	Iron, Total Recoverable	14600		mg/kg
											PB_T_	Lead, Total Recoverable	200		mg/kg
											MN_T_	Manganese, Total	217		mg/kg
											HG_T_	Mercury, Total	0.69 J	J	mg/kg
											NI_T_	Nickel, Total	6		mg/kg
											AG_T_	Silver, Total Recoverable	12.8		mg/kg
											ZN_T_	Zinc, Total Recoverable	36.3		mg/kg
TS-SS-08	TS-SS-08 (1-3 ft)	BP-TS-SS-08-01	10163483	10163483006	7/13/2011	Soil	992041.28	826111.05	1	3	MOISTURE	Soil Moisture	14		%
											SB_T_	Antimony, Total	23		mg/kg
											AS_T_	Arsenic, Total	47.4		mg/kg
											BA_T_	Barium, Total	92.5		mg/kg
											CD_T_	Cadmium, Total	0.15		mg/kg
											CR_T_	Chromium, Total	17.8		mg/kg
											CO_T_	Cobalt, Total	9.3 J	J	mg/kg
											CU_T_	Copper, Total	63		mg/kg
											FE_T_	Iron, Total Recoverable	21000		mg/kg
											PB_T_	Lead, Total Recoverable	147		mg/kg
											MN_T_	Manganese, Total	109		mg/kg
											HG_T_	Mercury, Total	0.15 J	J	mg/kg
											NI_T_	Nickel, Total	9		mg/kg
											AG_T_	Silver, Total Recoverable	2.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	62.1		mg/kg

[a] Silver was included in original laboratory analytical reports, but was removed in revised reports by the laboratory
J – Estimated concentration
UJ – Estimated reporting
limit ft - feet
meq/100g - milliequivalents per hundred
grams mg/kg - milligrams per kilogram
mmhos/cm - micromhos per centimeter
% - percent
ND() - Analyte was not detected (reporting
limit) Std Units - Standard Units
t/1000t - tons per thousand tons

TABLE 3-5. ACID BASE ACCOUNTING RESULTS
TIM SMITH MINE AOC
BLACK PINE MINE

Location	Date Sampled	Sample Start Depth (ft)	Sample End Depth (ft)	Acid Base Potential** (t/1000t)	Acid Potential (t/1000t)	Neutralization Potential (t/1000t)	pH, SMP Buffer (Standard Units)	Recommended Lime (t/1000t)	SMP Lime Requirement (t/1000t)	Sulfur (HCL Extraction) (%)	Sulfur (HNO3 Extraction) (%)	Sulfur (Hot Water Extraction) (%)	Sulfur, Residual (%)	Sulfur, Total (%)
TS-RS-01	7/12/2011	4	6	0	ND(4.3)	ND(0.5)	7.1	ND(5.4)	0	ND(0.05)	0.0546	0.0639	ND(0.05)	0.141
TS-RS-03	7/12/2011	2	4	0	ND(4.3)	ND(0.5)	6.8	ND(5.4)	1	ND(0.05)	0.0625	0.0695	ND(0.05)	0.161
TS-RS-07	7/13/2011	4	6	0.7	ND(4.3)	0.72	7.3	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	0.092

ft - feet

t/1000t = tons of Calcium Carbonate ($CaCO_3$) per 1,000 tons waste

ND() - Analyte was not detected (reporting limit)

** Acid/Base Potential = NP - AP

Potentially Acid Generating: NP:AP < 1 and NNP < -20 tons/kton

Uncertain Acid Generation Potential: NP:AP between 1 and 3 and/or NNP between -20 and +20 tons/kton

Unlikely to Generate Acid: NNP < +20 tons/kton

NP = Neutralization Potential

AP = Acid Potential

NNP = Net Neutralizing Potential = Base - Acid Potential

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-RS-01	HM-RS-01 (8-10 ft)	BP-HM-RS-01-08	10163606	10163606007	7/13/2011	Soil	994023.10	825570.24	8	10	MOISTURE	Soil Moisture	14.1		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	1.2		mg/kg
											AS_T_	Arsenic, Total Recoverable	7.9		mg/kg
											BA_T_	Barium, Total Recoverable	126		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.36		mg/kg
											CR_T_	Chromium, Total	9.9		mg/kg
											CO_T_	Cobalt, Total Recoverable	7		mg/kg
											CU_T_	Copper, Total Recoverable	71.5		mg/kg
											FE_T_	Iron, Total Recoverable	19800		mg/kg
											PB_T_	Lead, Total Recoverable	8.6		mg/kg
											MN_T_R	Manganese, Total	119		mg/kg
											HG_T_	Mercury, Total Recoverable	0.077 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	13.6		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.48)		mg/kg
											ZN_T_	Zinc, Total Recoverable	47.9		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.7		Std Units
											ACIDBASE_POT	Acid Base Potential	0.74		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	0.74		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	1.8		t/1000t
HM-RS-01	HM-RS-01 (16-17 ft)	BP-HM-RS-01-16.5	10163606	10163606006	7/13/2011	Soil	994023.10	825570.24	16	17	MOISTURE	Soil Moisture	19.6		%
											SB_T_	Antimony, Total Recoverable	1.1		mg/kg
											AS_T_	Arsenic, Total Recoverable	6.1		mg/kg
											BA_T_	Barium, Total Recoverable	127		mg/kg
											CD_T_	Cadmium, Total Recoverable	ND(0.073)		mg/kg
											CR_T_	Chromium, Total	13.1		mg/kg
											CO_T_	Cobalt, Total Recoverable	9.5		mg/kg
											CU_T_	Copper, Total Recoverable	12.1		mg/kg
											FE_T_	Iron, Total Recoverable	21100		mg/kg
											PB_T_	Lead, Total Recoverable	9.6		mg/kg
											MN_T_R	Manganese, Total	211		mg/kg
											HG_T_	Mercury, Total Recoverable	0.046		mg/kg
											NI_T_R	Nickel, Total Recoverable	15.3		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.45)		mg/kg
											ZN_T_	Zinc, Total Recoverable	31.4		mg/kg

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-RS-02	HM-RS-02 (1-3 ft)	BP-HM-RS-02-01	10163606	10163606008	7/13/2011	Soil	993889.40	825460.07	1	3	MOISTURE	Soil Moisture	15.3		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.0529		%
											SB_T_	Antimony, Total Recoverable	421		mg/kg
											AS_T_	Arsenic, Total Recoverable	376		mg/kg
											BA_T_	Barium, Total Recoverable	149		mg/kg
											CD_T_	Cadmium, Total Recoverable	7.1		mg/kg
											CR_T_	Chromium, Total	2.7		mg/kg
											CO_T_	Cobalt, Total Recoverable	4.7		mg/kg
											CU_T_	Copper, Total Recoverable	1010		mg/kg
											FE_T_	Iron, Total Recoverable	15900		mg/kg
											PB_T_	Lead, Total Recoverable	1820		mg/kg
											MN_T_R	Manganese, Total	740		mg/kg
											HG_T_	Mercury, Total Recoverable	ND(0.021)	UJ	mg/kg
											NI_T_R	Nickel, Total Recoverable	6.7		mg/kg
											AG_T_	Silver, Total Recoverable	104		mg/kg
											ZN_T_	Zinc, Total Recoverable	71.2		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.2		Std Units
											ACIDBASE_POT	Acid Base Potential	1.7		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	1.7		t/1000t
											01305-78-8_REC	Recommended Lime	7.3		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	5.3		t/1000t
HM-RS-02	HM-RS-02 (3-5 ft)	BP-HM-RS-02-03	10163606	10163606009	7/13/2011	Soil	993889.40	825460.07	3	5	MOISTURE	Soil Moisture	14.2		%
											SB_T_	Antimony, Total Recoverable	2.7		mg/kg
											AS_T_	Arsenic, Total Recoverable	11		mg/kg
											BA_T_	Barium, Total Recoverable	147		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.23		mg/kg
											CR_T_	Chromium, Total	8.5		mg/kg
											CO_T_	Cobalt, Total Recoverable	9.6		mg/kg
											CU_T_	Copper, Total Recoverable	23.2		mg/kg
											FE_T_	Iron, Total Recoverable	16500		mg/kg
											PB_T_	Lead, Total Recoverable	34.8		mg/kg
											MN_T_R	Manganese, Total	620		mg/kg
											HG_T_	Mercury, Total Recoverable	3.5 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	11.2		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.42)		mg/kg
											ZN_T_	Zinc, Total Recoverable	46.6		mg/kg

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-RS-03	HM-RS-03 (1-3 ft)	BP-HM-RS-03-01	10163606	10163606002	7/13/2011	Soil	993995.64	825383.53	1	3	MOISTURE	Soil Moisture	8.4		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	0.131		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.228		%
											SB_T_	Antimony, Total Recoverable	1140		mg/kg
											AS_T_	Arsenic, Total Recoverable	894		mg/kg
											BA_T_	Barium, Total Recoverable	364		mg/kg
											CD_T_	Cadmium, Total Recoverable	10.8		mg/kg
											CR_T_	Chromium, Total	ND(0.45)		mg/kg
											CO_T_	Cobalt, Total Recoverable	0.77		mg/kg
											CU_T_	Copper, Total Recoverable	925		mg/kg
											FE_T_	Iron, Total Recoverable	24000		mg/kg
											PB_T_	Lead, Total Recoverable	2800		mg/kg
											MN_T_R	Manganese, Total	219		mg/kg
											HG_T_	Mercury, Total Recoverable	1.2 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	1.5		mg/kg
											AG_T_	Silver, Total Recoverable	82.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	140		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.6		Std Units
											ACIDBASE_POT	Acid Base Potential	1.5		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	1.5		t/1000t
											01305-78-8_REC	Recommended Lime	6.3		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	2.4		t/1000t
HM-RS-04	HM-RS-04 (7-9 ft)	BP-HM-RS-04-07	10163606	10163606004	7/13/2011	Soil	994084.38	825434.94	7	9	MOISTURE	Soil Moisture	15		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	39.1		mg/kg
											AS_T_	Arsenic, Total Recoverable	43.9		mg/kg
											BA_T_	Barium, Total Recoverable	160		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.88		mg/kg
											CR_T_	Chromium, Total	8.7		mg/kg
											CO_T_	Cobalt, Total Recoverable	16.4		mg/kg
											CU_T_	Copper, Total Recoverable	358		mg/kg
											FE_T_	Iron, Total Recoverable	19600		mg/kg
											PB_T_	Lead, Total Recoverable	216		mg/kg
											MN_T_R	Manganese, Total	497		mg/kg
											HG_T_	Mercury, Total Recoverable	0.34 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	14.1		mg/kg
											AG_T_	Silver, Total Recoverable	6.5		mg/kg
											ZN_T_	Zinc, Total Recoverable	50.6		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.6		Std Units
											ACIDBASE_POT	Acid Base Potential	3.2		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	3.2		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	2.4		t/1000t

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-RS-05	HM-RS-05 (2-4 ft)	BP-HM-RS-05-02	10163633	10163633003	7/13/2011	Soil	994651.73	825459.93	2	4	MOISTURE	Soil Moisture	11.9		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	50.3		mg/kg
											AS_T_	Arsenic, Total Recoverable	61.3		mg/kg
											BA_T_	Barium, Total Recoverable	153		mg/kg
											CD_T_	Cadmium, Total Recoverable	1.2		mg/kg
											CR_T_	Chromium, Total	8.9		mg/kg
											CO_T_	Cobalt, Total Recoverable	9.9 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	193		mg/kg
											FE_T_	Iron, Total Recoverable	11700		mg/kg
											PB_T_	Lead, Total Recoverable	401		mg/kg
											MN_T_R	Manganese, Total	465		mg/kg
											HG_T_	Mercury, Total Recoverable	0.094 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	13.7		mg/kg
											AG_T_	Silver, Total Recoverable	7.8		mg/kg
											ZN_T_	Zinc, Total Recoverable	ND(104)		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.9		Std Units
											ACIDBASE_POT	Acid Base Potential	0.73		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	0.73		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0.3		t/1000t
HM-RS-05	HM-RS-05 (5-7 ft)	BP-HM-RS-05-05	10163633	10163633004	7/13/2011	Soil	994651.73	825459.93	5	7	MOISTURE	Soil Moisture	9.2		%
											SB_T_	Antimony, Total Recoverable	18.1		mg/kg
											AS_T_	Arsenic, Total Recoverable	22.4		mg/kg
											BA_T_	Barium, Total Recoverable	77.8		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.91		mg/kg
											CR_T_	Chromium, Total	7.7		mg/kg
											CO_T_	Cobalt, Total Recoverable	5.3 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	57.9		mg/kg
											FE_T_	Iron, Total Recoverable	9340		mg/kg
											PB_T_	Lead, Total Recoverable	149		mg/kg
											MN_T_R	Manganese, Total	197		mg/kg
											HG_T_	Mercury, Total Recoverable	0.059 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	8.5		mg/kg
											AG_T_	Silver, Total Recoverable	3.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	26.2		mg/kg

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-RS-06	HM-RS-06 (1-3 ft)	BP-HM-RS-06-01	10163633	10163633002	7/13/2011	Soil	994713.21	825391.57	1	3	MOISTURE	Soil Moisture	7.8		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	0.0542		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.0912		%
											SB_T_	Antimony, Total Recoverable	1020		mg/kg
											AS_T_	Arsenic, Total Recoverable	1190		mg/kg
											BA_T_	Barium, Total Recoverable	261		mg/kg
											CD_T_	Cadmium, Total Recoverable	22.8		mg/kg
											CR_T_	Chromium, Total	4.1		mg/kg
											CO_T_	Cobalt, Total Recoverable	2.8 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	3310		mg/kg
											FE_T_	Iron, Total Recoverable	28900		mg/kg
											PB_T_	Lead, Total Recoverable	4980		mg/kg
											MN_T_R	Manganese, Total	682		mg/kg
											HG_T_	Mercury, Total Recoverable	0.56 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	ND(9.9)		mg/kg
											AG_T_	Silver, Total Recoverable	175		mg/kg
											ZN_T_	Zinc, Total Recoverable	395		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.9		Std Units
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0.3		t/1000t
HM-RS-06	HM-RS-06 (8-10 ft)	BP-HM-RS-06-08	10163633	10163633006	7/13/2011	Soil	994713.21	825391.57	8	10	MOISTURE	Soil Moisture	9.9		%
											SB_T_	Antimony, Total Recoverable	188		mg/kg
											AS_T_	Arsenic, Total Recoverable	209		mg/kg
											BA_T_	Barium, Total Recoverable	155		mg/kg
											CD_T_	Cadmium, Total Recoverable	4		mg/kg
											CR_T_	Chromium, Total	12.2		mg/kg
											CO_T_	Cobalt, Total Recoverable	9.8 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	441		mg/kg
											FE_T_	Iron, Total Recoverable	21000		mg/kg
											PB_T_	Lead, Total Recoverable	1500		mg/kg
											MN_T_R	Manganese, Total	282		mg/kg
											HG_T_	Mercury, Total Recoverable	0.04 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	14.9		mg/kg
											AG_T_	Silver, Total Recoverable	22.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	ND(100)		mg/kg

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-RS-07	HM-RS-07 (1-3 ft)	BP-HM-RS-07-01	10163633	10163633001	7/13/2011	Soil	994666.57	825303.47	1	3	MOISTURE	Soil Moisture	11		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	0.0937		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	0.0559		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	0.183		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.339		%
											SB_T_	Antimony, Total Recoverable	1380		mg/kg
											AS_T_	Arsenic, Total Recoverable	1380		mg/kg
											BA_T_	Barium, Total Recoverable	247		mg/kg
											CD_T_	Cadmium, Total Recoverable	20.6		mg/kg
											CR_T_	Chromium, Total	2.7		mg/kg
											CO_T_	Cobalt, Total Recoverable	1.1 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	1280		mg/kg
											FE_T_	Iron, Total Recoverable	23100		mg/kg
											PB_T_	Lead, Total Recoverable	6960		mg/kg
											MN_T_R	Manganese, Total	270		mg/kg
											HG_T_	Mercury, Total Recoverable	7 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	ND(2.8)		mg/kg
											AG_T_	Silver, Total Recoverable	319		mg/kg
											ZN_T_	Zinc, Total Recoverable	332		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.3		Std Units
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	11		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	4.6		t/1000t
HM-RS-08	HM-RS-08 (2-4 ft)	BP-HM-RS-08-02	10163483	10163483009	7/13/2011	Soil	993149.44	825455.09	2	4	MOISTURE	Soil Moisture	7.6		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	27.6		mg/kg
											AS_T_	Arsenic, Total Recoverable	41.5		mg/kg
											BA_T_	Barium, Total Recoverable	92.9		mg/kg
											CD_T_	Cadmium, Total Recoverable	1.7		mg/kg
											CR_T_	Chromium, Total	12.3		mg/kg
											CO_T_	Cobalt, Total Recoverable	8.5 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	329		mg/kg
											FE_T_	Iron, Total Recoverable	12500		mg/kg
											PB_T_	Lead, Total Recoverable	614		mg/kg
											MN_T_R	Manganese, Total	412		mg/kg
											HG_T_	Mercury, Total Recoverable	0.57 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	9.9		mg/kg
											AG_T_	Silver, Total Recoverable	3.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	191		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.8		Std Units
											ACIDBASE_POT	Acid Base Potential	6		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	6		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	1		t/1000t

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-SD-01	HM-SD-01 (0-0.5 ft)	HM-SD-01	10160707	10160707009	6/13/2011	Sediment	992849.33	826967.21	0	0.5	MOISTURE	Soil Moisture	65.2		%
											SB_T_	Antimony, Total Recoverable	20		mg/kg
											AS_T_	Arsenic, Total Recoverable	24.8		mg/kg
											BA_T_	Barium, Total Recoverable	752		mg/kg
											CD_T_	Cadmium, Total Recoverable	4.9 J	J	mg/kg
											CR_T_	Chromium, Total	20.7		mg/kg
											CO_T_	Cobalt, Total Recoverable	9.8 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	2780		mg/kg
											FE_T_	Iron, Total Recoverable	21400		mg/kg
											PB_T_	Lead, Total Recoverable	305		mg/kg
											MN_T_R	Manganese, Total	2780		mg/kg
											HG_T_	Mercury, Total Recoverable	27.4		mg/kg
											NI_T_R	Nickel, Total Recoverable	26.8		mg/kg
											AG_T_	Silver, Total Recoverable	3.4 J	J	mg/kg
											ZN_T_	Zinc, Total Recoverable	272		mg/kg
HM-SS-03	HM-SS-03 (3-5 ft)	BP-HM-SS-03-03	10163606	10163606001	7/13/2011	Soil	993995.64	825383.53	3	5	MOISTURE	Soil Moisture	12.2		%
											SB_T_	Antimony, Total Recoverable	25.8		mg/kg
											AS_T_	Arsenic, Total Recoverable	143		mg/kg
											BA_T_	Barium, Total Recoverable	132		mg/kg
											CD_T_	Cadmium, Total Recoverable	1.3		mg/kg
											CR_T_	Chromium, Total	8.1		mg/kg
											CO_T_	Cobalt, Total Recoverable	7.2		mg/kg
											CU_T_	Copper, Total Recoverable	547		mg/kg
											FE_T_	Iron, Total Recoverable	15000		mg/kg
											PB_T_	Lead, Total Recoverable	339		mg/kg
											MN_T_R	Manganese, Total	352		mg/kg
											HG_T_	Mercury, Total Recoverable	0.86 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	9.4		mg/kg
											AG_T_	Silver, Total Recoverable	3.3		mg/kg
											ZN_T_	Zinc, Total Recoverable	85.6		mg/kg
HM-SS-04	HM-SS-04 (10-12 ft)	BP-HM-SS-04-10	10163606	10163606003	7/13/2011	Soil	994084.38	825434.94	10	12	MOISTURE	Soil Moisture	15.4		%
											SB_T_	Antimony, Total Recoverable	2.2		mg/kg
											AS_T_	Arsenic, Total Recoverable	7.2		mg/kg
											BA_T_	Barium, Total Recoverable	182		mg/kg
											CD_T_	Cadmium, Total Recoverable	ND(0.073)		mg/kg
											CR_T_	Chromium, Total	21.4		mg/kg
											CO_T_	Cobalt, Total Recoverable	8.9		mg/kg
											CU_T_	Copper, Total Recoverable	12.9		mg/kg
											FE_T_	Iron, Total Recoverable	23700		mg/kg
											PB_T_	Lead, Total Recoverable	13.5		mg/kg
											MN_T_R	Manganese, Total	400		mg/kg
											HG_T_	Mercury, Total Recoverable	0.04 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	18.3		mg/kg
											AG_T_	Silver, Total Recoverable	0.57		mg/kg
											ZN_T_	Zinc, Total Recoverable	36.1		mg/kg

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-SS-07	HM-SS-07 (3-5 ft)	BP-HM-SS-07-03	10163633	10163633005	7/13/2011	Soil	994666.57	825303.47	3	5	MOISTURE	Soil Moisture	21.5		%
											SB_T_	Antimony, Total Recoverable	142		mg/kg
											AS_T_	Arsenic, Total Recoverable	154		mg/kg
											BA_T_	Barium, Total Recoverable	433		mg/kg
											CD_T_	Cadmium, Total Recoverable	5.9		mg/kg
											CR_T_	Chromium, Total	7		mg/kg
											CO_T_	Cobalt, Total Recoverable	6.8 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	3440		mg/kg
											FE_T_	Iron, Total Recoverable	12300		mg/kg
											PB_T_	Lead, Total Recoverable	1020		mg/kg
											MN_T_R	Manganese, Total	2320		mg/kg
											HG_T_	Mercury, Total Recoverable	8.5 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	10.9		mg/kg
											AG_T_	Silver, Total Recoverable	26.5		mg/kg
											ZN_T_	Zinc, Total Recoverable	124		mg/kg
HM-SS-09	HM-SS-09 (0-0.5 ft)	HM-SS-09	10163635	10163635004	7/13/2011	Soil	993822.10	825698.29	0	0.5	MOISTURE	Soil Moisture	17.2		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	20.6		mg/kg
											AS_T_	Arsenic, Total Recoverable	33.8		mg/kg
											BA_T_	Barium, Total Recoverable	179		mg/kg
											CD_T_	Cadmium, Total Recoverable	2.2		mg/kg
											CR_T_	Chromium, Total	9.5		mg/kg
											CO_T_	Cobalt, Total Recoverable	7.2		mg/kg
											CU_T_	Copper, Total Recoverable	1390		mg/kg
											FE_T_	Iron, Total Recoverable	13000		mg/kg
											PB_T_	Lead, Total Recoverable	375		mg/kg
											MN_T_R	Manganese, Total	782		mg/kg
											HG_T_	Mercury, Total Recoverable	0.57 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	10.4		mg/kg
											AG_T_	Silver, Total Recoverable	5		mg/kg
											ZN_T_	Zinc, Total Recoverable	136		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6		Std Units
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	7.9		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	6		t/1000t

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-SS-10	HM-SS-10 (0-0.5 ft)	HM-SS-10	10163635	10163635003	7/13/2011	Soil	993852.87	825609.15	0	0.5	MOISTURE	Soil Moisture	17.7		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	5		mg/kg
											AS_T_	Arsenic, Total Recoverable	8.6		mg/kg
											BA_T_	Barium, Total Recoverable	241		mg/kg
											CD_T_	Cadmium, Total Recoverable	1.6		mg/kg
											CR_T_	Chromium, Total	10.9		mg/kg
											CO_T_	Cobalt, Total Recoverable	10.9		mg/kg
											CU_T_	Copper, Total Recoverable	2080		mg/kg
											FE_T_	Iron, Total Recoverable	13800		mg/kg
											PB_T_	Lead, Total Recoverable	99.6		mg/kg
											MN_T_R	Manganese, Total	1400		mg/kg
											HG_T_	Mercury, Total Recoverable	0.029 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	10.7		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.58)		mg/kg
											ZN_T_	Zinc, Total Recoverable	122		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.4		Std Units
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	3.9		t/1000t
HM-SS-11	HM-SS-11 (0-0.5 ft)	HM-SS-11	10163635	10163635006	7/13/2011	Soil	994103.17	825558.82	0	0.5	MOISTURE	Soil Moisture	13.3		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	31.4		mg/kg
											AS_T_	Arsenic, Total Recoverable	57.8		mg/kg
											BA_T_	Barium, Total Recoverable	93.9		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.7		mg/kg
											CR_T_	Chromium, Total	4.6		mg/kg
											CO_T_	Cobalt, Total Recoverable	2		mg/kg
											CU_T_	Copper, Total Recoverable	283		mg/kg
											FE_T_	Iron, Total Recoverable	6140		mg/kg
											PB_T_	Lead, Total Recoverable	267		mg/kg
											MN_T_R	Manganese, Total	254		mg/kg
											HG_T_	Mercury, Total Recoverable	0.89 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	3.9		mg/kg
											AG_T_	Silver, Total Recoverable	6.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	32		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.2		Std Units
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	7.7		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	5.3		t/1000t

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-SS-12	HM-SS-12 (0-0.5 ft)	HM-SS-12	10163635	10163635005	7/13/2011	Soil	993999.89	825658.74	0	0.5	MOISTURE	Soil Moisture	16.7		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	8.1		mg/kg
											AS_T_	Arsenic, Total Recoverable	14.9		mg/kg
											BA_T_	Barium, Total Recoverable	178		mg/kg
											CD_T_	Cadmium, Total Recoverable	0.92		mg/kg
											CR_T_	Chromium, Total	7.4		mg/kg
											CO_T_	Cobalt, Total Recoverable	4.6		mg/kg
											CU_T_	Copper, Total Recoverable	389		mg/kg
											FE_T_	Iron, Total Recoverable	9390		mg/kg
											PB_T_	Lead, Total Recoverable	62.9		mg/kg
											MN_T_R	Manganese, Total	463		mg/kg
											HG_T_	Mercury, Total Recoverable	0.024 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	8.8		mg/kg
											AG_T_	Silver, Total Recoverable	1.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	69.3		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.5		Std Units
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	3.1		t/1000t
HM-SS-13	HM-SS-13 (0-0.5 ft)	HM-SS-13	10163635	10163635007	7/14/2011	Soil	994753.99	825558.64	0	0.5	MOISTURE	Soil Moisture	14		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	254		mg/kg
											AS_T_	Arsenic, Total Recoverable	316		mg/kg
											BA_T_	Barium, Total Recoverable	305		mg/kg
											CD_T_	Cadmium, Total Recoverable	6.6		mg/kg
											CR_T_	Chromium, Total	7.2		mg/kg
											CO_T_	Cobalt, Total Recoverable	4.3		mg/kg
											CU_T_	Copper, Total Recoverable	1420		mg/kg
											FE_T_	Iron, Total Recoverable	15700		mg/kg
											PB_T_	Lead, Total Recoverable	2210		mg/kg
											MN_T_R	Manganese, Total	1240		mg/kg
											HG_T_	Mercury, Total Recoverable	1 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	9.2		mg/kg
											AG_T_	Silver, Total Recoverable	42.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	181		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.6		Std Units
											ACIDBASE_POT	Acid Base Potential	2.9		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	2.9		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	2.4		t/1000t

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-SS-14	HM-SS-14 (0-0.5 ft)	HM-SS-14	10163635	10163635008	7/14/2011	Soil	994692.82	825567.79	0	0.5	MOISTURE	Soil Moisture	14.7		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total Recoverable	149		mg/kg
											AS_T_	Arsenic, Total Recoverable	141		mg/kg
											BA_T_	Barium, Total Recoverable	254		mg/kg
											CD_T_	Cadmium, Total Recoverable	2.3		mg/kg
											CR_T_	Chromium, Total	6.5		mg/kg
											CO_T_	Cobalt, Total Recoverable	2.8		mg/kg
											CU_T_	Copper, Total Recoverable	662		mg/kg
											FE_T_	Iron, Total Recoverable	12800		mg/kg
											PB_T_	Lead, Total Recoverable	857		mg/kg
											MN_T_R	Manganese, Total	461		mg/kg
											HG_T_	Mercury, Total Recoverable	0.26 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	10.4		mg/kg
											AG_T_	Silver, Total Recoverable	30.5		mg/kg
											ZN_T_	Zinc, Total Recoverable	135		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.5		Std Units
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	3.1		t/1000t
HM-SS-15	HM-SS-15 (0-0.5 ft)	BP-HM-SS-15-00	10163483	10163483010	7/13/2011	Soil	993212.56	825536.16	0	0.5	MOISTURE	Soil Moisture	8.5		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	0.0746		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	0.175		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.183		%
											SB_T_	Antimony, Total Recoverable	594		mg/kg
											AS_T_	Arsenic, Total Recoverable	501		mg/kg
											BA_T_	Barium, Total Recoverable	218		mg/kg
											CD_T_	Cadmium, Total Recoverable	7.3		mg/kg
											CR_T_	Chromium, Total	3.1		mg/kg
											CO_T_	Cobalt, Total Recoverable	0.63 J	J	mg/kg
											CU_T_	Copper, Total Recoverable	505		mg/kg
											FE_T_	Iron, Total Recoverable	27400		mg/kg
											PB_T_	Lead, Total Recoverable	2050		mg/kg
											MN_T_R	Manganese, Total	46.5		mg/kg
											HG_T_	Mercury, Total Recoverable	3.6 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	2		mg/kg
											AG_T_	Silver, Total Recoverable	144		mg/kg
											ZN_T_	Zinc, Total Recoverable	326		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.5		Std Units
											ACIDBASE_POT	Acid Base Potential	-7.5		t/1000t
											ACIDITY_POT	Acid Potential	7.5		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	13		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	3.1		t/1000t

Table 3-6. SOLID-MATRIX ANALYTICAL RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Sample Start Depth (ft)	Sample End Depth (ft)	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
HM-SS-16	HM-SS-16 (0-0.5 ft)	HM-SS-16	10163635	10163635009	7/14/2011	Soil	993290.94	825396.09	0	0.5	MOISTURE	Soil Moisture	6.9		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	0.255		%
											SULFUR_HOTWATER_H	Sulfur (Hot Water Extraction)	0.312		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.452		%
											SB_T_	Antimony, Total Recoverable	1160		mg/kg
											AS_T_	Arsenic, Total Recoverable	1140		mg/kg
											BA_T_	Barium, Total Recoverable	228		mg/kg
											CD_T_	Cadmium, Total Recoverable	11.4		mg/kg
											CR_T_	Chromium, Total	2.3		mg/kg
											CO_T_	Cobalt, Total Recoverable	0.43		mg/kg
											CU_T_	Copper, Total Recoverable	1530		mg/kg
											FE_T_	Iron, Total Recoverable	53600		mg/kg
											PB_T_	Lead, Total Recoverable	4900		mg/kg
											MN_T_R	Manganese, Total	64.8		mg/kg
											HG_T_	Mercury, Total Recoverable	13 J	J	mg/kg
											NI_T_R	Nickel, Total Recoverable	1.1		mg/kg
											AG_T_	Silver, Total Recoverable	140		mg/kg
											ZN_T_	Zinc, Total Recoverable	297		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.2		Std Units
											ACIDBASE_POT	Acid Base Potential	-8.2		t/1000t
											ACIDITY_POT	Acid Potential	8.2		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	16.9		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	5.3		t/1000t

[a] Silver was included in original laboratory analytical reports, but was removed in revised reports by the laboratory

J – Estimated concentration
UJ – Estimated reporting limit
ft - feet
meq/100g - milliequivalents per hundred grams
mg/kg - milligrams per kilogram
mmhos/cm - micromhos per centimeter
% - percent
ND() - Analyte was not detected (reporting limit)
Std Units - Standard Units
t/1000t - tons per thousand tons

TABLE 3-7. ACID BASE ACCOUNTING RESULTS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Date Sampled	Sample Start Depth (ft)	Sample End Depth (ft)	Acid Base Potential** (t/1000t)	Acid Potential (t/1000t)	Neutralization Potential (t/1000t)	pH, SMP Buffer (Standard Units)	Recommended Lime (t/1000t)	SMP Lime Requirement (t/1000t)	Sulfur (HCL Extraction) (%)	Sulfur (HNO3 Extraction) (%)	Sulfur (Hot Water Extraction) (%)	Sulfur, Residual (%)	Sulfur, Total (%)
HM-RS-01	7/13/2011	8	10	0.74	ND(4.3)	0.74	6.7	ND(5.4)	1.8	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
HM-RS-02	7/13/2011	1	3	1.7	ND(4.3)	1.7	6.2	7.3	5.3	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	0.0529
HM-RS-03	7/13/2011	1	3	1.5	ND(4.3)	1.5	6.6	6.3	2.4	ND(0.05)	ND(0.05)	0.131	ND(0.05)	0.228
HM-RS-04	7/13/2011	7	9	3.2	ND(4.3)	3.2	6.6	ND(5.4)	2.4	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
HM-RS-05	7/13/2011	2	4	0.73	ND(4.3)	0.73	6.9	ND(5.4)	0.3	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
HM-RS-06	7/13/2011	1	3	0	ND(4.3)	ND(0.5)	6.9	ND(5.4)	0.3	ND(0.05)	ND(0.05)	0.0542	ND(0.05)	0.0912
HM-RS-07	7/13/2011	1	3	0	ND(4.3)	ND(0.5)	6.3	11	4.6	0.0937	0.0559	0.183	ND(0.05)	0.339
HM-RS-08	7/13/2011	2	4	6	ND(4.3)	6	6.8	ND(5.4)	1	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
HM-SS-09	7/13/2011	0	0.5	0	ND(4.3)	ND(0.5)	6	7.9	6	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
HM-SS-10	7/13/2011	0	0.5	0	ND(4.3)	ND(0.5)	6.4	ND(5.4)	3.9	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
HM-SS-11	7/13/2011	0	0.5	0	ND(4.3)	ND(0.5)	6.2	7.7	5.3	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
HM-SS-12	7/13/2011	0	0.5	0	ND(4.3)	ND(0.5)	6.5	ND(5.4)	3.1	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
HM-SS-13	7/14/2011	0	0.5	2.9	ND(4.3)	2.9	6.6	ND(5.4)	2.4	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
HM-SS-14	7/14/2011	0	0.5	0	ND(4.3)	ND(0.5)	6.5	ND(5.4)	3.1	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
HM-SS-15	7/13/2011	0	0.5	-7.5	7.5	ND(0.5)	6.5	13	3.1	0.0746	0.175	ND(0.05)	ND(0.05)	0.183
HM-SS-16	7/14/2011	0	0.5	-8.2	8.2	ND(0.5)	6.2	16.9	5.3	ND(0.05)	0.255	0.312	ND(0.05)	0.452

ft - feet

t/1000t = tons of Calcium Carbonate ($CaCO_3$) per 1,000 tons waste

ND() - Analyte was not detected (reporting limit)

** Acid/Base Potential = NP - AP

Potentially Acid Generating: NP:AP < 1 and NNP < -20 tons/kton

Uncertain Acid Generation Potential: NP:AP between 1 and 3 and/or NNP between -20 and +20 tons/kton

Unlikely to Generate Acid: NNP < +20 tons/kton

NP = Neutralization Potential

AP = Acid Potential

NNP = Net Neutralizing Potential = Base - Acid Potential

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-01	CML-SD-01 (0-0.5 ft)	CML-SD-01	10160673	10160673012	6/14/2011	Sediment	989313.06	838754.65	0	0.5	MOISTURE	Soil Moisture	15.2		%
											SB_T_	Antimony, Total	317		mg/kg
											AS_T_	Arsenic, Total	223		mg/kg
											BA_T_	Barium, Total	74.5		mg/kg
											CD_T_	Cadmium, Total	4.8		mg/kg
											CR_T_	Chromium, Total	6.2		mg/kg
											CO_T_	Cobalt, Total	7.6 J	J	mg/kg
											CU_T_	Copper, Total	378		mg/kg
											FE_T_	Iron, Total Recoverable	14400		mg/kg
											PB_T_	Lead, Total Recoverable	826		mg/kg
											MN_T_	Manganese, Total	413		mg/kg
											HG_T_	Mercury, Total	17.6		mg/kg
											NI_T_	Nickel, Total	3.9		mg/kg
											AG_T_	Silver, Total Recoverable	11.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	188		mg/kg
CML-SD-02	CML-SD-02 (0-0.5 ft)	CML-SD-02	10160673	10160673013	6/15/2011	Sediment	988686.08	831557.87	0	0.5	MOISTURE	Soil Moisture	29.6		%
											SB_T_	Antimony, Total	461		mg/kg
											AS_T_	Arsenic, Total	417		mg/kg
											BA_T_	Barium, Total	308		mg/kg
											CD_T_	Cadmium, Total	8.9		mg/kg
											CR_T_	Chromium, Total	8.4		mg/kg
											CO_T_	Cobalt, Total	10.9 J	J	mg/kg
											CU_T_	Copper, Total	1430		mg/kg
											FE_T_	Iron, Total Recoverable	22700		mg/kg
											PB_T_	Lead, Total Recoverable	1970		mg/kg
											MN_T_	Manganese, Total	744		mg/kg
											HG_T_	Mercury, Total	13.6		mg/kg
											NI_T_	Nickel, Total	6.9		mg/kg
											AG_T_	Silver, Total Recoverable	25.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	317		mg/kg
CML-SD-03	CML-SD-03 (0-0.5 ft)	BP-CML-SD-03-00	10160673	10160673014	6/15/2011	Sediment	988786.48	829207.60	0	0.5	MOISTURE	Soil Moisture	43.8		%
											SB_T_	Antimony, Total	16.8		mg/kg
											AS_T_	Arsenic, Total	19.4		mg/kg
											BA_T_	Barium, Total	143		mg/kg
											CD_T_	Cadmium, Total	0.43		mg/kg
											CR_T_	Chromium, Total	20.7		mg/kg
											CO_T_	Cobalt, Total	7.6 J	J	mg/kg
											CU_T_	Copper, Total	57.9		mg/kg
											FE_T_	Iron, Total Recoverable	22300		mg/kg
											PB_T_	Lead, Total Recoverable	207		mg/kg
											MN_T_	Manganese, Total	404		mg/kg
											HG_T_	Mercury, Total	4.1		mg/kg
											NI_T_	Nickel, Total	9.1		mg/kg
											AG_T_	Silver, Total Recoverable	1.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	40.5		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-04	CML-SD-04 (0-0.5 ft)	BP-CML-SD-04-00	10160673	10160673001	6/14/2011	Sediment	988269.43	828557.35	0	0.5	MOISTURE	Soil Moisture	67.7		%
											SB_T_	Antimony, Total	16.7		mg/kg
											AS_T_	Arsenic, Total	27.9		mg/kg
											BA_T_	Barium, Total	335		mg/kg
											CD_T_	Cadmium, Total	1.4		mg/kg
											CR_T_	Chromium, Total	8.3		mg/kg
											CO_T_	Cobalt, Total	19.3 J	J	mg/kg
											CU_T_	Copper, Total	109		mg/kg
											FE_T_	Iron, Total Recoverable	12400		mg/kg
											PB_T_	Lead, Total Recoverable	74.2		mg/kg
											MN_T_	Manganese, Total	1980		mg/kg
											HG_T_	Mercury, Total	14.4		mg/kg
											NI_T_	Nickel, Total	11.4		mg/kg
											AG_T_	Silver, Total Recoverable	2.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	144		mg/kg
CML-SD-05	CML-SD-05 (0-0.5 ft)	BP-CML-SD-05-00	10160673	10160673002	6/14/2011	Sediment	987789.32	825202.77	0	0.5	MOISTURE	Soil Moisture	43.7		%
											SB_T_	Antimony, Total	ND(0.64)		mg/kg
											AS_T_	Arsenic, Total	12		mg/kg
											BA_T_	Barium, Total	452		mg/kg
											CD_T_	Cadmium, Total	1.2		mg/kg
											CR_T_	Chromium, Total	11.8		mg/kg
											CO_T_	Cobalt, Total	8.1 J	J	mg/kg
											CU_T_	Copper, Total	26.8		mg/kg
											FE_T_	Iron, Total Recoverable	14500		mg/kg
											PB_T_	Lead, Total Recoverable	16.3		mg/kg
											MN_T_	Manganese, Total	1160		mg/kg
											HG_T_	Mercury, Total	0.38		mg/kg
											NI_T_	Nickel, Total	13.4		mg/kg
											AG_T_	Silver, Total Recoverable	ND(0.64)		mg/kg
											ZN_T_	Zinc, Total Recoverable	96.8		mg/kg
CML-SD-06	CML-SD-06 (0-0.5 ft)	CML-SD-06-00	10160707	10160707004	6/13/2011	Sediment	988475.47	829216.35	0	0.5	MOISTURE	Soil Moisture	55.8		%
											SB_T_	Antimony, Total	891		mg/kg
											AS_T_	Arsenic, Total	642		mg/kg
											BA_T_	Barium, Total	353		mg/kg
											CD_T_	Cadmium, Total	28.6 J	J	mg/kg
											CR_T_	Chromium, Total	8.2		mg/kg
											CO_T_	Cobalt, Total	7.6 J	J	mg/kg
											CU_T_	Copper, Total	3620		mg/kg
											FE_T_	Iron, Total Recoverable	21200		mg/kg
											PB_T_	Lead, Total Recoverable	3760		mg/kg
											MN_T_	Manganese, Total	602		mg/kg
											HG_T_	Mercury, Total	32.8		mg/kg
											NI_T_	Nickel, Total	14.6		mg/kg
											AG_T_	Silver, Total Recoverable	64.6 J	J	mg/kg
											ZN_T_	Zinc, Total Recoverable	768		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-07	CML-SD-07 (0-0.5 ft)	CML-SD-07	10160673	10160673009	6/14/2011	Sediment	988475.47	830441.94	0	0.5	MOISTURE	Soil Moisture	35.8		%
											SB_T_	Antimony, Total	817		mg/kg
											AS_T_	Arsenic, Total	596		mg/kg
											BA_T_	Barium, Total	340		mg/kg
											CD_T_	Cadmium, Total	15.4		mg/kg
											CR_T_	Chromium, Total	8.3		mg/kg
											CO_T_	Cobalt, Total	10.4 J	J	mg/kg
											CU_T_	Copper, Total	5320		mg/kg
											FE_T_	Iron, Total Recoverable	21800		mg/kg
											PB_T_	Lead, Total Recoverable	4240		mg/kg
											MN_T_	Manganese, Total	1180		mg/kg
											HG_T_	Mercury, Total	10.1		mg/kg
											NI_T_	Nickel, Total	6.1		mg/kg
											AG_T_	Silver, Total Recoverable	37.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	393		mg/kg
CML-SD-08	CML-SD-08 (0-0.5 ft)	CML-SD-08	10160673	10160673010	6/14/2011	Sediment	987914.93	836670.88	0	0.5	MOISTURE	Soil Moisture	36.5		%
											SB_T_	Antimony, Total	613		mg/kg
											AS_T_	Arsenic, Total	553		mg/kg
											BA_T_	Barium, Total	244		mg/kg
											CD_T_	Cadmium, Total	11.5		mg/kg
											CR_T_	Chromium, Total	5.6		mg/kg
											CO_T_	Cobalt, Total	6.7 J	J	mg/kg
											CU_T_	Copper, Total	1390		mg/kg
											FE_T_	Iron, Total Recoverable	20100		mg/kg
											PB_T_	Lead, Total Recoverable	2960		mg/kg
											MN_T_	Manganese, Total	443		mg/kg
											HG_T_	Mercury, Total	12.1		mg/kg
											NI_T_	Nickel, Total	5.8		mg/kg
											AG_T_	Silver, Total Recoverable	34.8		mg/kg
											ZN_T_	Zinc, Total Recoverable	430		mg/kg
CML-SD-09	CML-SD-09 (0-0.5 ft)	CML-SD-09	10160673	10160673007	6/14/2011	Sediment	987927.78	836610.15	0	0.5	MOISTURE	Soil Moisture	26.1		%
											SB_T_	Antimony, Total	465		mg/kg
											AS_T_	Arsenic, Total	377		mg/kg
											BA_T_	Barium, Total	163		mg/kg
											CD_T_	Cadmium, Total	7.8		mg/kg
											CR_T_	Chromium, Total	5.4		mg/kg
											CO_T_	Cobalt, Total	7.8 J	J	mg/kg
											CU_T_	Copper, Total	920		mg/kg
											FE_T_	Iron, Total Recoverable	15400		mg/kg
											PB_T_	Lead, Total Recoverable	2070		mg/kg
											MN_T_	Manganese, Total	452		mg/kg
											HG_T_	Mercury, Total	5.4		mg/kg
											NI_T_	Nickel, Total	5.2		mg/kg
											AG_T_	Silver, Total Recoverable	23.9		mg/kg
											ZN_T_	Zinc, Total Recoverable	287		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-10	CML-SD-10 (0-0.5 ft)	CML-SD-10	10160673	10160673008	6/14/2011	Sediment	988519.66	834758.14	0	0.5	MOISTURE	Soil Moisture	30.1		%
											SB_T_	Antimony, Total	596		mg/kg
											AS_T_	Arsenic, Total	492		mg/kg
											BA_T_	Barium, Total	185		mg/kg
											CD_T_	Cadmium, Total	10.3		mg/kg
											CR_T_	Chromium, Total	5.2		mg/kg
											CO_T_	Cobalt, Total	6.2 J	J	mg/kg
											CU_T_	Copper, Total	1160		mg/kg
											FE_T_	Iron, Total Recoverable	19700		mg/kg
											PB_T_	Lead, Total Recoverable	2460		mg/kg
											MN_T_	Manganese, Total	419		mg/kg
											HG_T_	Mercury, Total	7		mg/kg
											NI_T_	Nickel, Total	4.9		mg/kg
											AG_T_	Silver, Total Recoverable	38.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	401		mg/kg
CML-SD-11	CML-SD-11 (0-0.5 ft)	CML-SD-11	10160673	10160673011	6/14/2011	Sediment	989035.55	832376.49	0	0.5	MOISTURE	Soil Moisture	21		%
											SB_T_	Antimony, Total	307		mg/kg
											AS_T_	Arsenic, Total	219		mg/kg
											BA_T_	Barium, Total	145		mg/kg
											CD_T_	Cadmium, Total	4.6		mg/kg
											CR_T_	Chromium, Total	6.1		mg/kg
											CO_T_	Cobalt, Total	11.5 J	J	mg/kg
											CU_T_	Copper, Total	623		mg/kg
											FE_T_	Iron, Total Recoverable	16300		mg/kg
											PB_T_	Lead, Total Recoverable	1170		mg/kg
											MN_T_	Manganese, Total	1210		mg/kg
											HG_T_	Mercury, Total	21.1		mg/kg
											NI_T_	Nickel, Total	6.5		mg/kg
											AG_T_	Silver, Total Recoverable	14.8		mg/kg
											ZN_T_	Zinc, Total Recoverable	248		mg/kg
CML-SD-13	CML-SD-13 (0-0.5 ft)	CML-SD-13-00	10160756	10160756008	6/16/2011	Sediment	987973.86	836622.85	0	0.5	MOISTURE	Soil Moisture	38.2		%
											SB_T_	Antimony, Total	440		mg/kg
											AS_T_	Arsenic, Total	339		mg/kg
											BA_T_	Barium, Total	229		mg/kg
											CD_T_	Cadmium, Total	7.7		mg/kg
											CR_T_	Chromium, Total	7.5		mg/kg
											CO_T_	Cobalt, Total	12.7		mg/kg
											CU_T_	Copper, Total	1210		mg/kg
											FE_T_	Iron, Total Recoverable	17300		mg/kg
											PB_T_	Lead, Total Recoverable	1690		mg/kg
											MN_T_	Manganese, Total	741		mg/kg
											HG_T_	Mercury, Total	17.4		mg/kg
											NI_T_	Nickel, Total	6.9		mg/kg
											AG_T_	Silver, Total Recoverable	23.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	257		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-14	CML-SD-14 (0-0.5 ft)	CML-SD-14-00	10160756	10160756010	6/16/2011	Sediment	988683.60	836351.89	0	0.5	MOISTURE	Soil Moisture	37.8		%
											SB_T_	Antimony, Total	1010		mg/kg
											AS_T_	Arsenic, Total	668		mg/kg
											BA_T_	Barium, Total	304		mg/kg
											CD_T_	Cadmium, Total	14.7		mg/kg
											CR_T_	Chromium, Total	4.9		mg/kg
											CO_T_	Cobalt, Total	3.6		mg/kg
											CU_T_	Copper, Total	2230		mg/kg
											FE_T_	Iron, Total Recoverable	21700		mg/kg
											PB_T_	Lead, Total Recoverable	3270		mg/kg
											MN_T_	Manganese, Total	257		mg/kg
											HG_T_	Mercury, Total	7.7		mg/kg
											NI_T_	Nickel, Total	3.2		mg/kg
											AG_T_	Silver, Total Recoverable	51.5		mg/kg
											ZN_T_	Zinc, Total Recoverable	403		mg/kg
CML-SD-15	CML-SD-15 (0-0.5 ft)	CML-SD-15-00	10160756	10160756007	6/16/2011	Sediment	988585.66	834660.72	0	0.5	MOISTURE	Soil Moisture	35.1		%
											SB_T_	Antimony, Total	1300		mg/kg
											AS_T_	Arsenic, Total	1250		mg/kg
											BA_T_	Barium, Total	1030		mg/kg
											CD_T_	Cadmium, Total	32.5		mg/kg
											CR_T_	Chromium, Total	6.5		mg/kg
											CO_T_	Cobalt, Total	1.9		mg/kg
											CU_T_	Copper, Total	4810		mg/kg
											FE_T_	Iron, Total Recoverable	35900		mg/kg
											PB_T_	Lead, Total Recoverable	8050		mg/kg
											MN_T_	Manganese, Total	342		mg/kg
											HG_T_	Mercury, Total	9.2		mg/kg
											NI_T_	Nickel, Total	4.1		mg/kg
											AG_T_	Silver, Total Recoverable	213		mg/kg
											ZN_T_	Zinc, Total Recoverable	1300		mg/kg
CML-SD-16	CML-SD-16 (0-0.5 ft)	CML-SD-16-00	10160756	10160756011	6/16/2011	Sediment	988876.52	831915.39	0	0.5	MOISTURE	Soil Moisture	31		%
											SB_T_	Antimony, Total	2130		mg/kg
											AS_T_	Arsenic, Total	1670		mg/kg
											BA_T_	Barium, Total	492		mg/kg
											CD_T_	Cadmium, Total	26.6		mg/kg
											CR_T_	Chromium, Total	2		mg/kg
											CO_T_	Cobalt, Total	0.66		mg/kg
											CU_T_	Copper, Total	5170		mg/kg
											FE_T_	Iron, Total Recoverable	27700		mg/kg
											PB_T_	Lead, Total Recoverable	7330		mg/kg
											MN_T_	Manganese, Total	171		mg/kg
											HG_T_	Mercury, Total	8		mg/kg
											NI_T_	Nickel, Total	0.69		mg/kg
											AG_T_	Silver, Total Recoverable	73.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	313		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-17	CML-SD-17 (0-0.5 ft)	CML-SD-17-00	10160756	10160756009	6/16/2011	Sediment	988659.81	831282.58	0	0.5	MOISTURE	Soil Moisture	38.6		%
											SB_T_	Antimony, Total	1090		mg/kg
											AS_T_	Arsenic, Total	745		mg/kg
											BA_T_	Barium, Total	317		mg/kg
											CD_T_	Cadmium, Total	17.1		mg/kg
											CR_T_	Chromium, Total	3.8		mg/kg
											CO_T_	Cobalt, Total	3.1		mg/kg
											CU_T_	Copper, Total	1910		mg/kg
											FE_T_	Iron, Total Recoverable	23800		mg/kg
											PB_T_	Lead, Total Recoverable	3880		mg/kg
											MN_T_	Manganese, Total	325		mg/kg
											HG_T_	Mercury, Total	10.5		mg/kg
											NI_T_	Nickel, Total	2.5		mg/kg
											AG_T_	Silver, Total Recoverable	56.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	496		mg/kg
CML-SD-18	CML-SD-18 (0-0.5 ft)	CML-SD-18-00	10163437	10163437036	7/13/2011	Soil	988624.20	830688.17	0	0.5	MOISTURE	Soil Moisture	53.2		%
											SB_T_	Antimony, Total	76.1 J	J	mg/kg
											AS_T_	Arsenic, Total	211 J	J	mg/kg
											BA_T_	Barium, Total	793 J	J	mg/kg
											CD_T_	Cadmium, Total	14.8		mg/kg
											CR_T_	Chromium, Total	18.5		mg/kg
											CO_T_	Cobalt, Total	16.3		mg/kg
											CU_T_	Copper, Total	1070 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	29700		mg/kg
											PB_T_	Lead, Total Recoverable	663 J	J	mg/kg
											MN_T_	Manganese, Total	1640		mg/kg
											HG_T_	Mercury, Total	11.6		mg/kg
											NI_T_	Nickel, Total	24.1		mg/kg
											AG_T_	Silver, Total Recoverable	16.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	479 J	J	mg/kg
CML-SD-19	CML-SD-19 (0-0.5 ft)	CML-SD-19-00	10163437	10163437034	7/13/2011	Soil	988574.13	830739.22	0	0.5	MOISTURE	Soil Moisture	9.2		%
											SB_T_	Antimony, Total	614 J	J	mg/kg
											AS_T_	Arsenic, Total	442 J	J	mg/kg
											BA_T_	Barium, Total	238 J	J	mg/kg
											CD_T_	Cadmium, Total	15.4		mg/kg
											CR_T_	Chromium, Total	ND(2.8)		mg/kg
											CO_T_	Cobalt, Total	ND(2.8)		mg/kg
											CU_T_	Copper, Total	727 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	11900		mg/kg
											PB_T_	Lead, Total Recoverable	2560 J	J	mg/kg
											MN_T_	Manganese, Total	264		mg/kg
											HG_T_	Mercury, Total	2.8		mg/kg
											NI_T_	Nickel, Total	ND(5.5)		mg/kg
											AG_T_	Silver, Total Recoverable	47		mg/kg
											ZN_T_	Zinc, Total Recoverable	238 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-19	CML-SD-19 (2-3 ft)	CML-SD-19-02	10163437	10163437035	7/13/2011	Soil	988574.13	830739.22	2	3	MOISTURE	Soil Moisture	25.4		%
											SB_T_	Antimony, Total	21.1 J	J	mg/kg
											AS_T_	Arsenic, Total	43.6 J	J	mg/kg
											BA_T_	Barium, Total	317 J	J	mg/kg
											CD_T_	Cadmium, Total	6.8		mg/kg
											CR_T_	Chromium, Total	16.8		mg/kg
											CO_T_	Cobalt, Total	19.6		mg/kg
											CU_T_	Copper, Total	361 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	26900		mg/kg
											PB_T_	Lead, Total Recoverable	197 J	J	mg/kg
											MN_T_	Manganese, Total	920		mg/kg
											HG_T_	Mercury, Total	3.4		mg/kg
											NI_T_	Nickel, Total	19.5		mg/kg
											AG_T_	Silver, Total Recoverable	2.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	339 J	J	mg/kg
CML-SD-20	CML-SD-20 (0-0.5 ft)	CML-SD-20-00	10163437	10163437025	7/12/2011	Soil	988474.13	830739.22	0	0.5	MOISTURE	Soil Moisture	36.4		%
											SB_T_	Antimony, Total	528 J	J	mg/kg
											AS_T_	Arsenic, Total	617 J	J	mg/kg
											BA_T_	Barium, Total	430 J	J	mg/kg
											CD_T_	Cadmium, Total	25.9		mg/kg
											CR_T_	Chromium, Total	7.8		mg/kg
											CO_T_	Cobalt, Total	8.6		mg/kg
											CU_T_	Copper, Total	2430 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	19400		mg/kg
											PB_T_	Lead, Total Recoverable	3720 J	J	mg/kg
											MN_T_	Manganese, Total	1280		mg/kg
											HG_T_	Mercury, Total	8.6		mg/kg
											NI_T_	Nickel, Total	ND(6.8)		mg/kg
											AG_T_	Silver, Total Recoverable	50.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	335 J	J	mg/kg
CML-SD-20	CML-SD-20 (2-3 ft)	CML-SD-20-02	10163437	10163437026	7/12/2011	Soil	988474.13	830739.22	2	3	MOISTURE	Soil Moisture	27.5		%
											SB_T_	Antimony, Total	6.3 J	J	mg/kg
											AS_T_	Arsenic, Total	29.7 J	J	mg/kg
											BA_T_	Barium, Total	396 J	J	mg/kg
											CD_T_	Cadmium, Total	6.6		mg/kg
											CR_T_	Chromium, Total	15.5		mg/kg
											CO_T_	Cobalt, Total	21.3		mg/kg
											CU_T_	Copper, Total	136 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	27800		mg/kg
											PB_T_	Lead, Total Recoverable	86.1 J	J	mg/kg
											MN_T_	Manganese, Total	1040		mg/kg
											HG_T_	Mercury, Total	7		mg/kg
											NI_T_	Nickel, Total	23.2		mg/kg
											AG_T_	Silver, Total Recoverable	ND(2.8)		mg/kg
											ZN_T_	Zinc, Total Recoverable	231 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-21	CML-SD-21 (0-0.5 ft)	CML-SD-21-00	10163437	10163437024	7/12/2011	Soil	988374.13	830739.22	0	0.5	MOISTURE	Soil Moisture	24.3		%
											SB_T_	Antimony, Total	475 J	J	mg/kg
											AS_T_	Arsenic, Total	507 J	J	mg/kg
											BA_T_	Barium, Total	292 J	J	mg/kg
											CD_T_	Cadmium, Total	22.5		mg/kg
											CR_T_	Chromium, Total	5.6		mg/kg
											CO_T_	Cobalt, Total	5		mg/kg
											CU_T_	Copper, Total	1630 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	19200		mg/kg
											PB_T_	Lead, Total Recoverable	2940 J	J	mg/kg
											MN_T_	Manganese, Total	474		mg/kg
											HG_T_	Mercury, Total	6.3		mg/kg
											NI_T_	Nickel, Total	6.3		mg/kg
											AG_T_	Silver, Total Recoverable	43.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	413 J	J	mg/kg
CML-SD-22	CML-SD-22 (0-0.5 ft)	CML-SD-22-00	10163437	10163437031	7/13/2011	Soil	988647.45	830538.21	0	0.5	MOISTURE	Soil Moisture	21.9		%
											SB_T_	Antimony, Total	28.5 J	J	mg/kg
											AS_T_	Arsenic, Total	58.2 J	J	mg/kg
											BA_T_	Barium, Total	153 J	J	mg/kg
											CD_T_	Cadmium, Total	2.1		mg/kg
											CR_T_	Chromium, Total	12.2		mg/kg
											CO_T_	Cobalt, Total	9.9		mg/kg
											CU_T_	Copper, Total	154 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	22800		mg/kg
											PB_T_	Lead, Total Recoverable	186 J	J	mg/kg
											MN_T_	Manganese, Total	610		mg/kg
											HG_T_	Mercury, Total	1.6		mg/kg
											NI_T_	Nickel, Total	7.7		mg/kg
											AG_T_	Silver, Total Recoverable	ND(2.6)		mg/kg
											ZN_T_	Zinc, Total Recoverable	118 J	J	mg/kg
CML-SD-23	CML-SD-23 (0-0.5 ft)	CML-SD-23-00	10163437	10163437032	7/13/2011	Soil	988574.13	830539.22	0	0.5	MOISTURE	Soil Moisture	21.5		%
											SB_T_	Antimony, Total	40.9 J	J	mg/kg
											AS_T_	Arsenic, Total	61.6 J	J	mg/kg
											BA_T_	Barium, Total	190 J	J	mg/kg
											CD_T_	Cadmium, Total	2.4		mg/kg
											CR_T_	Chromium, Total	22.1		mg/kg
											CO_T_	Cobalt, Total	11.6		mg/kg
											CU_T_	Copper, Total	249 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	31600		mg/kg
											PB_T_	Lead, Total Recoverable	282 J	J	mg/kg
											MN_T_	Manganese, Total	568		mg/kg
											HG_T_	Mercury, Total	5.8		mg/kg
											NI_T_	Nickel, Total	10.5		mg/kg
											AG_T_	Silver, Total Recoverable	ND(2.3)		mg/kg
											ZN_T_	Zinc, Total Recoverable	92.4 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-23	CML-SD-23 (2-3 ft)	CML-SD-23-02	10163437	10163437033	7/13/2011	Soil	988574.13	830539.22	2	3	MOISTURE	Soil Moisture	18.4		%
											SB_T_	Antimony, Total	38 J	J	mg/kg
											AS_T_	Arsenic, Total	48.4 J	J	mg/kg
											BA_T_	Barium, Total	218 J	J	mg/kg
											CD_T_	Cadmium, Total	3.1		mg/kg
											CR_T_	Chromium, Total	21.6		mg/kg
											CO_T_	Cobalt, Total	13		mg/kg
											CU_T_	Copper, Total	661 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	30800		mg/kg
											PB_T_	Lead, Total Recoverable	300 J	J	mg/kg
											MN_T_	Manganese, Total	789		mg/kg
											HG_T_	Mercury, Total	2.9		mg/kg
											NI_T_	Nickel, Total	10.5		mg/kg
											AG_T_	Silver, Total Recoverable	ND(2.2)		mg/kg
											ZN_T_	Zinc, Total Recoverable	108 J	J	mg/kg
CML-SD-24	CML-SD-24 (0-0.5 ft)	CML-SD-24-00	10163437	10163437020	7/12/2011	Soil	988474.13	830539.22	0	0.5	MOISTURE	Soil Moisture	9.6		%
											SB_T_	Antimony, Total	95 J	J	mg/kg
											AS_T_	Arsenic, Total	109		mg/kg
											BA_T_	Barium, Total	371		mg/kg
											CD_T_	Cadmium, Total	6.5		mg/kg
											CR_T_	Chromium, Total	10		mg/kg
											CO_T_	Cobalt, Total	15.3		mg/kg
											CU_T_	Copper, Total	500		mg/kg
											FE_T_	Iron, Total Recoverable	16500		mg/kg
											PB_T_	Lead, Total Recoverable	617 J	J	mg/kg
											MN_T_	Manganese, Total	1190		mg/kg
											HG_T_	Mercury, Total	4.9		mg/kg
											NI_T_	Nickel, Total	10.4		mg/kg
											AG_T_	Silver, Total Recoverable	7.3		mg/kg
											ZN_T_	Zinc, Total Recoverable	269 J	J	mg/kg
CML-SD-24	CML-SD-24 (1-2 ft)	CML-SD-24-01	10163437	10163437021	7/12/2011	Soil	988474.13	830539.22	1	2	MOISTURE	Soil Moisture	22.6		%
											SB_T_	Antimony, Total	24 J	J	mg/kg
											AS_T_	Arsenic, Total	30.5 J	J	mg/kg
											BA_T_	Barium, Total	425 J	J	mg/kg
											CD_T_	Cadmium, Total	13.8		mg/kg
											CR_T_	Chromium, Total	16.3		mg/kg
											CO_T_	Cobalt, Total	25.8		mg/kg
											CU_T_	Copper, Total	1390 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	23200		mg/kg
											PB_T_	Lead, Total Recoverable	182 J	J	mg/kg
											MN_T_	Manganese, Total	2050		mg/kg
											HG_T_	Mercury, Total	5.6		mg/kg
											NI_T_	Nickel, Total	22.5		mg/kg
											AG_T_	Silver, Total Recoverable	ND(2.9)		mg/kg
											ZN_T_	Zinc, Total Recoverable	328 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-25	CML-SD-25 (0-0.5 ft)	CML-SD-25-00	10163437	10163437022	7/12/2011	Soil	988374.13	830539.22	0	0.5	MOISTURE	Soil Moisture	8.6		%
											SB_T_	Antimony, Total	184 J	J	mg/kg
											AS_T_	Arsenic, Total	232 J	J	mg/kg
											BA_T_	Barium, Total	515 J	J	mg/kg
											CD_T_	Cadmium, Total	12.6		mg/kg
											CR_T_	Chromium, Total	12.1		mg/kg
											CO_T_	Cobalt, Total	12.9		mg/kg
											CU_T_	Copper, Total	837 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	19900		mg/kg
											PB_T_	Lead, Total Recoverable	1210 J	J	mg/kg
											MN_T_	Manganese, Total	1210		mg/kg
											HG_T_	Mercury, Total	3.5		mg/kg
											NI_T_	Nickel, Total	13.3		mg/kg
											AG_T_	Silver, Total Recoverable	12.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	326 J	J	mg/kg
CML-SD-26	CML-SD-26 (0-0.5 ft)	CML-SD-26-00	10163437	10163437023	7/12/2011	Soil	988274.13	830539.22	0	0.5	MOISTURE	Soil Moisture	20.7		%
											SB_T_	Antimony, Total	312 J	J	mg/kg
											AS_T_	Arsenic, Total	291 J	J	mg/kg
											BA_T_	Barium, Total	185 J	J	mg/kg
											CD_T_	Cadmium, Total	12.3		mg/kg
											CR_T_	Chromium, Total	5		mg/kg
											CO_T_	Cobalt, Total	6.5		mg/kg
											CU_T_	Copper, Total	654 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	13600		mg/kg
											PB_T_	Lead, Total Recoverable	1870 J	J	mg/kg
											MN_T_	Manganese, Total	598		mg/kg
											HG_T_	Mercury, Total	4.5		mg/kg
											NI_T_	Nickel, Total	ND(5.7)		mg/kg
											AG_T_	Silver, Total Recoverable	22.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	235 J	J	mg/kg
CML-SD-27	CML-SD-27 (0-0.5 ft)	CML-SD-27-00	10163437	10163437019	7/12/2011	Soil	988474.13	830339.22	0	0.5	MOISTURE	Soil Moisture	7.3		%
											SB_T_	Antimony, Total	172 J	J	mg/kg
											AS_T_	Arsenic, Total	176		mg/kg
											BA_T_	Barium, Total	185		mg/kg
											CD_T_	Cadmium, Total	8		mg/kg
											CR_T_	Chromium, Total	6.6		mg/kg
											CO_T_	Cobalt, Total	8		mg/kg
											CU_T_	Copper, Total	1130		mg/kg
											FE_T_	Iron, Total Recoverable	14100		mg/kg
											PB_T_	Lead, Total Recoverable	1050 J	J	mg/kg
											MN_T_	Manganese, Total	790		mg/kg
											HG_T_	Mercury, Total	10.4		mg/kg
											NI_T_	Nickel, Total	6.2		mg/kg
											AG_T_	Silver, Total Recoverable	14.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	175 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-28	CML-SD-28 (0-0.5 ft)	CML-SD-28-00	10163437	10163437018	7/12/2011	Soil	988374.13	830339.22	0	0.5	MOISTURE	Soil Moisture	18		%
											SB_T_	Antimony, Total	248 J	J	mg/kg
											AS_T_	Arsenic, Total	265		mg/kg
											BA_T_	Barium, Total	647		mg/kg
											CD_T_	Cadmium, Total	15.9		mg/kg
											CR_T_	Chromium, Total	14.8		mg/kg
											CO_T_	Cobalt, Total	17.2		mg/kg
											CU_T_	Copper, Total	1690		mg/kg
											FE_T_	Iron, Total Recoverable	23500		mg/kg
											PB_T_	Lead, Total Recoverable	1440 J	J	mg/kg
											MN_T_	Manganese, Total	1070		mg/kg
											HG_T_	Mercury, Total	22.1		mg/kg
											NI_T_	Nickel, Total	18.3		mg/kg
											AG_T_	Silver, Total Recoverable	14.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	343 J	J	mg/kg
CML-SD-29	CML-SD-29 (0-0.5 ft)	CML-SD-29-00	10163437	10163437017	7/12/2011	Soil	988274.13	830339.22	0	0.5	MOISTURE	Soil Moisture	6		%
											SB_T_	Antimony, Total	706 J	J	mg/kg
											AS_T_	Arsenic, Total	630		mg/kg
											BA_T_	Barium, Total	359		mg/kg
											CD_T_	Cadmium, Total	27.6		mg/kg
											CR_T_	Chromium, Total	3.7		mg/kg
											CO_T_	Cobalt, Total	3.1		mg/kg
											CU_T_	Copper, Total	2060		mg/kg
											FE_T_	Iron, Total Recoverable	17300		mg/kg
											PB_T_	Lead, Total Recoverable	3890 J	J	mg/kg
											MN_T_	Manganese, Total	352		mg/kg
											HG_T_	Mercury, Total	4.1		mg/kg
											NI_T_	Nickel, Total	ND(4.9)		mg/kg
											AG_T_	Silver, Total Recoverable	58.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	359 J	J	mg/kg
CML-SD-30	CML-SD-30 (0-0.5 ft)	CML-SD-30-00	10163437	10163437030	7/13/2011	Soil	988415.52	830223.41	0	0.5	MOISTURE	Soil Moisture	23.7		%
											SB_T_	Antimony, Total	5.6 J	J	mg/kg
											AS_T_	Arsenic, Total	24.9 J	J	mg/kg
											BA_T_	Barium, Total	294 J	J	mg/kg
											CD_T_	Cadmium, Total	6.6		mg/kg
											CR_T_	Chromium, Total	15.1		mg/kg
											CO_T_	Cobalt, Total	23.7		mg/kg
											CU_T_	Copper, Total	1550 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	26500		mg/kg
											PB_T_	Lead, Total Recoverable	81.8 J	J	mg/kg
											MN_T_	Manganese, Total	974		mg/kg
											HG_T_	Mercury, Total	9.6		mg/kg
											NI_T_	Nickel, Total	12.9		mg/kg
											AG_T_	Silver, Total Recoverable	ND(2.5)		mg/kg
											ZN_T_	Zinc, Total Recoverable	232 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-31	CML-SD-31 (0-0.5 ft)	CML-SD-31-00	10163437	10163437015	7/12/2011	Soil	988274.13	830139.22	0	0.5	MOISTURE	Soil Moisture	14.2		%
											SB_T_	Antimony, Total	272 J	J	mg/kg
											AS_T_	Arsenic, Total	301		mg/kg
											BA_T_	Barium, Total	451		mg/kg
											CD_T_	Cadmium, Total	13.5		mg/kg
											CR_T_	Chromium, Total	11.7		mg/kg
											CO_T_	Cobalt, Total	15.5		mg/kg
											CU_T_	Copper, Total	2950		mg/kg
											FE_T_	Iron, Total Recoverable	22600		mg/kg
											PB_T_	Lead, Total Recoverable	1350 J	J	mg/kg
											MN_T_	Manganese, Total	1040		mg/kg
											HG_T_	Mercury, Total	2.1		mg/kg
											NI_T_	Nickel, Total	9.5		mg/kg
											AG_T_	Silver, Total Recoverable	19.3		mg/kg
											ZN_T_	Zinc, Total Recoverable	370 J	J	mg/kg
CML-SD-31	CML-SD-31 (2-3 ft)	CML-SD-31-02	10163437	10163437016	7/12/2011	Soil	988274.13	830139.22	2	3	MOISTURE	Soil Moisture	22.2		%
											SB_T_	Antimony, Total	406 J	J	mg/kg
											AS_T_	Arsenic, Total	382		mg/kg
											BA_T_	Barium, Total	296		mg/kg
											CD_T_	Cadmium, Total	17.9		mg/kg
											CR_T_	Chromium, Total	8.3		mg/kg
											CO_T_	Cobalt, Total	18.8		mg/kg
											CU_T_	Copper, Total	1950		mg/kg
											FE_T_	Iron, Total Recoverable	18900		mg/kg
											PB_T_	Lead, Total Recoverable	2350 J	J	mg/kg
											MN_T_	Manganese, Total	1190		mg/kg
											HG_T_	Mercury, Total	3.8		mg/kg
											NI_T_	Nickel, Total	10.4		mg/kg
											AG_T_	Silver, Total Recoverable	39.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	246 J	J	mg/kg
CML-SD-32	CML-SD-32 (0-0.5 ft)	CML-SD-32-00	10163437	10163437014	7/12/2011	Soil	988274.13	829939.22	0	0.5	MOISTURE	Soil Moisture	29.7		%
											SB_T_	Antimony, Total	463 J	J	mg/kg
											AS_T_	Arsenic, Total	449		mg/kg
											BA_T_	Barium, Total	421		mg/kg
											CD_T_	Cadmium, Total	16		mg/kg
											CR_T_	Chromium, Total	7.9		mg/kg
											CO_T_	Cobalt, Total	5.2		mg/kg
											CU_T_	Copper, Total	921		mg/kg
											FE_T_	Iron, Total Recoverable	19300		mg/kg
											PB_T_	Lead, Total Recoverable	2470 J	J	mg/kg
											MN_T_	Manganese, Total	558		mg/kg
											HG_T_	Mercury, Total	10.9		mg/kg
											NI_T_	Nickel, Total	7.2		mg/kg
											AG_T_	Silver, Total Recoverable	21.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	387 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-33	CML-SD-33 (0-0.5 ft)	CML-SD-33-00	10163437	10163437012	7/12/2011	Soil	988274.13	829739.22	0	0.5	MOISTURE	Soil Moisture	15.9		%
											SB_T_	Antimony, Total	159 J	J	mg/kg
											AS_T_	Arsenic, Total	155		mg/kg
											BA_T_	Barium, Total	448		mg/kg
											CD_T_	Cadmium, Total	9		mg/kg
											CR_T_	Chromium, Total	11.4		mg/kg
											CO_T_	Cobalt, Total	3.5		mg/kg
											CU_T_	Copper, Total	1260		mg/kg
											FE_T_	Iron, Total Recoverable	13400		mg/kg
											PB_T_	Lead, Total Recoverable	925 J	J	mg/kg
											MN_T_	Manganese, Total	127		mg/kg
											HG_T_	Mercury, Total	4.3		mg/kg
											NI_T_	Nickel, Total	7.2		mg/kg
											AG_T_	Silver, Total Recoverable	11.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	200 J	J	mg/kg
CML-SD-33	CML-SD-33 (1-2 ft)	CML-SD-33-01	10163437	10163437013	7/12/2011	Soil	988274.13	829739.22	1	2	MOISTURE	Soil Moisture	10.1		%
											SB_T_	Antimony, Total	511 J	J	mg/kg
											AS_T_	Arsenic, Total	527		mg/kg
											BA_T_	Barium, Total	210		mg/kg
											CD_T_	Cadmium, Total	20.6		mg/kg
											CR_T_	Chromium, Total	3.1		mg/kg
											CO_T_	Cobalt, Total	ND(2.3)		mg/kg
											CU_T_	Copper, Total	1420		mg/kg
											FE_T_	Iron, Total Recoverable	14200		mg/kg
											PB_T_	Lead, Total Recoverable	2940 J	J	mg/kg
											MN_T_	Manganese, Total	163		mg/kg
											HG_T_	Mercury, Total	1.1		mg/kg
											NI_T_	Nickel, Total	ND(4.7)		mg/kg
											AG_T_	Silver, Total Recoverable	46.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	260 J	J	mg/kg
CML-SD-34	CML-SD-34 (0-0.5 ft)	CML-SD-34	10163437	10163437006	7/12/2011	Soil	988274.13	829539.22	0	0.5	MOISTURE	Soil Moisture	62.7		%
											SB_T_	Antimony, Total	683 J	J	mg/kg
											AS_T_	Arsenic, Total	315		mg/kg
											BA_T_	Barium, Total	269		mg/kg
											CD_T_	Cadmium, Total	15.6		mg/kg
											CR_T_	Chromium, Total	13.6		mg/kg
											CO_T_	Cobalt, Total	6.9		mg/kg
											CU_T_	Copper, Total	2240		mg/kg
											FE_T_	Iron, Total Recoverable	18800		mg/kg
											PB_T_	Lead, Total Recoverable	2840 J	J	mg/kg
											MN_T_	Manganese, Total	165		mg/kg
											HG_T_	Mercury, Total	55.4		mg/kg
											NI_T_	Nickel, Total	ND(11.9)		mg/kg
											AG_T_	Silver, Total Recoverable	29.6		mg/kg
											ZN_T_	Zinc, Total Recoverable	333 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-35	CML-SD-35 (0-0.5 ft)	CML-SD-35	10163437	10163437007	7/12/2011	Soil	988174.13	829538.22	0	0.5	MOISTURE	Soil Moisture	27		%
											SB_T_	Antimony, Total	293 J	J	mg/kg
											AS_T_	Arsenic, Total	305		mg/kg
											BA_T_	Barium, Total	271		mg/kg
											CD_T_	Cadmium, Total	12.9		mg/kg
											CR_T_	Chromium, Total	9.8		mg/kg
											CO_T_	Cobalt, Total	5.4		mg/kg
											CU_T_	Copper, Total	1740		mg/kg
											FE_T_	Iron, Total Recoverable	22100		mg/kg
											PB_T_	Lead, Total Recoverable	2200 J	J	mg/kg
											MN_T_	Manganese, Total	666		mg/kg
											HG_T_	Mercury, Total	57.9		mg/kg
											NI_T_	Nickel, Total	7.5		mg/kg
											AG_T_	Silver, Total Recoverable	31.3		mg/kg
											ZN_T_	Zinc, Total Recoverable	344 J	J	mg/kg
CML-SD-36	CML-SD-36 (0-0.5 ft)	CML-SD-36	10163437	10163437005	7/12/2011	Soil	988374.13	829339.22	0	0.5	MOISTURE	Soil Moisture	20.5		%
											SB_T_	Antimony, Total	105 J	J	mg/kg
											AS_T_	Arsenic, Total	125		mg/kg
											BA_T_	Barium, Total	259		mg/kg
											CD_T_	Cadmium, Total	6.2		mg/kg
											CR_T_	Chromium, Total	5.5		mg/kg
											CO_T_	Cobalt, Total	4.2		mg/kg
											CU_T_	Copper, Total	479		mg/kg
											FE_T_	Iron, Total Recoverable	9620		mg/kg
											PB_T_	Lead, Total Recoverable	769 J	J	mg/kg
											MN_T_	Manganese, Total	788		mg/kg
											HG_T_	Mercury, Total	9.3		mg/kg
											NI_T_	Nickel, Total	6.5		mg/kg
											AG_T_	Silver, Total Recoverable	18.8		mg/kg
											ZN_T_	Zinc, Total Recoverable	107 J	J	mg/kg
CML-SD-37	CML-SD-37 (0-0.5 ft)	CML-SD-37	10163437	10163437004	7/12/2011	Soil	988274.13	829339.22	0	0.5	MOISTURE	Soil Moisture	3.8		%
											SB_T_	Antimony, Total	88.9 J	J	mg/kg
											AS_T_	Arsenic, Total	118		mg/kg
											BA_T_	Barium, Total	249		mg/kg
											CD_T_	Cadmium, Total	4.4		mg/kg
											CR_T_	Chromium, Total	25.8		mg/kg
											CO_T_	Cobalt, Total	9.9		mg/kg
											CU_T_	Copper, Total	276		mg/kg
											FE_T_	Iron, Total Recoverable	36900		mg/kg
											PB_T_	Lead, Total Recoverable	693 J	J	mg/kg
											MN_T_	Manganese, Total	569		mg/kg
											HG_T_	Mercury, Total	8.1		mg/kg
											NI_T_	Nickel, Total	4.7		mg/kg
											AG_T_	Silver, Total Recoverable	10.8		mg/kg
											ZN_T_	Zinc, Total Recoverable	164 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-38	CML-SD-38 (0-0.5 ft)	CML-SD-38	10163437	10163437008	7/12/2011	Soil	988174.13	829337.61	0	0.5	MOISTURE	Soil Moisture	15.8		%
											SB_T_	Antimony, Total	69.3 J	J	mg/kg
											AS_T_	Arsenic, Total	101		mg/kg
											BA_T_	Barium, Total	284		mg/kg
											CD_T_	Cadmium, Total	4.4		mg/kg
											CR_T_	Chromium, Total	10.3		mg/kg
											CO_T_	Cobalt, Total	6.2		mg/kg
											CU_T_	Copper, Total	375		mg/kg
											FE_T_	Iron, Total Recoverable	16400		mg/kg
											PB_T_	Lead, Total Recoverable	518 J	J	mg/kg
											MN_T_	Manganese, Total	1300		mg/kg
											HG_T_	Mercury, Total	9.7		mg/kg
											NI_T_	Nickel, Total	7.1		mg/kg
											AG_T_	Silver, Total Recoverable	8.3		mg/kg
											ZN_T_	Zinc, Total Recoverable	134 J	J	mg/kg
CML-SD-39	CML-SD-39 (0-0.5 ft)	CML-SD-39-00	10163437	10163437029	7/13/2011	Soil	988374.13	829139.22	0	0.5	MOISTURE	Soil Moisture	18.1		%
											SB_T_	Antimony, Total	23 J	J	mg/kg
											AS_T_	Arsenic, Total	27.2 J	J	mg/kg
											BA_T_	Barium, Total	414 J	J	mg/kg
											CD_T_	Cadmium, Total	2.2		mg/kg
											CR_T_	Chromium, Total	10.2		mg/kg
											CO_T_	Cobalt, Total	6.6		mg/kg
											CU_T_	Copper, Total	180 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	11900		mg/kg
											PB_T_	Lead, Total Recoverable	238 J	J	mg/kg
											MN_T_	Manganese, Total	415		mg/kg
											HG_T_	Mercury, Total	5.3		mg/kg
											NI_T_	Nickel, Total	12.1		mg/kg
											AG_T_	Silver, Total Recoverable	ND(2.2)		mg/kg
											ZN_T_	Zinc, Total Recoverable	101 J	J	mg/kg
CML-SD-40	CML-SD-40 (0-0.5 ft)	CML-SD-40	10163437	10163437003	7/12/2011	Soil	988274.13	829139.22	0	0.5	MOISTURE	Soil Moisture	44.3		%
											SB_T_	Antimony, Total	11.1 J	J	mg/kg
											AS_T_	Arsenic, Total	16.5		mg/kg
											BA_T_	Barium, Total	437		mg/kg
											CD_T_	Cadmium, Total	1.6		mg/kg
											CR_T_	Chromium, Total	10.3		mg/kg
											CO_T_	Cobalt, Total	7.6		mg/kg
											CU_T_	Copper, Total	75.5		mg/kg
											FE_T_	Iron, Total Recoverable	11300		mg/kg
											PB_T_	Lead, Total Recoverable	88 J	J	mg/kg
											MN_T_	Manganese, Total	781		mg/kg
											HG_T_	Mercury, Total	2.1		mg/kg
											NI_T_	Nickel, Total	13.9		mg/kg
											AG_T_	Silver, Total Recoverable	ND(3)		mg/kg
											ZN_T_	Zinc, Total Recoverable	127 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-41	CML-SD-41 (0-0.5 ft)	CML-SD-41	10163437	10163437009	7/12/2011	Soil	988174.13	829139.22	0	0.5	MOISTURE	Soil Moisture	9.3		%
											SB_T_	Antimony, Total	239 J	J	mg/kg
											AS_T_	Arsenic, Total	270		mg/kg
											BA_T_	Barium, Total	191		mg/kg
											CD_T_	Cadmium, Total	13.1		mg/kg
											CR_T_	Chromium, Total	8.9		mg/kg
											CO_T_	Cobalt, Total	3.4		mg/kg
											CU_T_	Copper, Total	653		mg/kg
											FE_T_	Iron, Total Recoverable	24900		mg/kg
											PB_T_	Lead, Total Recoverable	1570 J	J	mg/kg
											MN_T_	Manganese, Total	485		mg/kg
											HG_T_	Mercury, Total	5.4		mg/kg
											NI_T_	Nickel, Total	ND(5)		mg/kg
											AG_T_	Silver, Total Recoverable	46.3		mg/kg
											ZN_T_	Zinc, Total Recoverable	170 J	J	mg/kg
CML-SD-42	CML-SD-42 (0-0.5 ft)	CML-SD-42-00	10163437	10163437027	7/13/2011	Soil	988374.13	828939.22	0	0.5	MOISTURE	Soil Moisture	15		%
											SB_T_	Antimony, Total	26.2 J	J	mg/kg
											AS_T_	Arsenic, Total	37.4 J	J	mg/kg
											BA_T_	Barium, Total	63.2 J	J	mg/kg
											CD_T_	Cadmium, Total	1.1		mg/kg
											CR_T_	Chromium, Total	9.5		mg/kg
											CO_T_	Cobalt, Total	3.5		mg/kg
											CU_T_	Copper, Total	123 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	14800		mg/kg
											PB_T_	Lead, Total Recoverable	174 J	J	mg/kg
											MN_T_	Manganese, Total	88.4		mg/kg
											HG_T_	Mercury, Total	3.9		mg/kg
											NI_T_	Nickel, Total	ND(4.4)		mg/kg
											AG_T_	Silver, Total Recoverable	ND(2.2)		mg/kg
											ZN_T_	Zinc, Total Recoverable	32.6 J	J	mg/kg
CML-SD-42	CML-SD-42 (2-3 ft)	CML-SD-42-02	10163437	10163437028	7/13/2011	Soil	988374.13	828939.22	2	3	MOISTURE	Soil Moisture	16.6		%
											SB_T_	Antimony, Total	40.5 J	J	mg/kg
											AS_T_	Arsenic, Total	48.7 J	J	mg/kg
											BA_T_	Barium, Total	171 J	J	mg/kg
											CD_T_	Cadmium, Total	2.4		mg/kg
											CR_T_	Chromium, Total	11.6		mg/kg
											CO_T_	Cobalt, Total	5.7		mg/kg
											CU_T_	Copper, Total	309 J	J	mg/kg
											FE_T_	Iron, Total Recoverable	15400		mg/kg
											PB_T_	Lead, Total Recoverable	240 J	J	mg/kg
											MN_T_	Manganese, Total	323		mg/kg
											HG_T_	Mercury, Total	5		mg/kg
											NI_T_	Nickel, Total	9		mg/kg
											AG_T_	Silver, Total Recoverable	2.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	71.9 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-43	CML-SD-43 (0-0.5 ft)	CML-SD-43	10163437	10163437002	7/12/2011	Soil	988274.13	828939.22	0	0.5	MOISTURE	Soil Moisture	30.5		%
											SB_T_	Antimony, Total	20 J	J	mg/kg
											AS_T_	Arsenic, Total	32.9		mg/kg
											BA_T_	Barium, Total	485		mg/kg
											CD_T_	Cadmium, Total	4.2		mg/kg
											CR_T_	Chromium, Total	10.9		mg/kg
											CO_T_	Cobalt, Total	8.3		mg/kg
											CU_T_	Copper, Total	131		mg/kg
											FE_T_	Iron, Total Recoverable	13100		mg/kg
											PB_T_	Lead, Total Recoverable	136 J	J	mg/kg
											MN_T_	Manganese, Total	936		mg/kg
											HG_T_	Mercury, Total	3.3		mg/kg
											NI_T_	Nickel, Total	12.7		mg/kg
											AG_T_	Silver, Total Recoverable	ND(3.1)		mg/kg
											ZN_T_	Zinc, Total Recoverable	211 J	J	mg/kg
CML-SD-44	CML-SD-44 (0-0.5 ft)	CML-SD-44	10163437	10163437010	7/12/2011	Soil	988174.13	828939.22	0	0.5	MOISTURE	Soil Moisture	38.4		%
											SB_T_	Antimony, Total	7.9 J	J	mg/kg
											AS_T_	Arsenic, Total	29.5		mg/kg
											BA_T_	Barium, Total	437		mg/kg
											CD_T_	Cadmium, Total	1.3		mg/kg
											CR_T_	Chromium, Total	23.9		mg/kg
											CO_T_	Cobalt, Total	7.8		mg/kg
											CU_T_	Copper, Total	97.9		mg/kg
											FE_T_	Iron, Total Recoverable	37400		mg/kg
											PB_T_	Lead, Total Recoverable	168 J	J	mg/kg
											MN_T_	Manganese, Total	160		mg/kg
											HG_T_	Mercury, Total	6.9		mg/kg
											NI_T_	Nickel, Total	19.2		mg/kg
											AG_T_	Silver, Total Recoverable	ND(3.3)		mg/kg
											ZN_T_	Zinc, Total Recoverable	202 J	J	mg/kg
CML-SD-45	CML-SD-45 (0-0.5 ft)	CML-SD-45	10163437	10163437001	7/12/2011	Soil	988274.13	828739.22	0	0.5	MOISTURE	Soil Moisture	25.4		%
											SB_T_	Antimony, Total	2.8 J	J	mg/kg
											AS_T_	Arsenic, Total	7.8		mg/kg
											BA_T_	Barium, Total	285		mg/kg
											CD_T_	Cadmium, Total	1.1		mg/kg
											CR_T_	Chromium, Total	8.4		mg/kg
											CO_T_	Cobalt, Total	7.7		mg/kg
											CU_T_	Copper, Total	42.5		mg/kg
											FE_T_	Iron, Total Recoverable	9690		mg/kg
											PB_T_	Lead, Total Recoverable	37.5 J	J	mg/kg
											MN_T_	Manganese, Total	739		mg/kg
											HG_T_	Mercury, Total	1.1		mg/kg
											NI_T_	Nickel, Total	11		mg/kg
											AG_T_	Silver, Total Recoverable	ND(2.5)		mg/kg
											ZN_T_	Zinc, Total Recoverable	78.3 J	J	mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SD-46	CML-SD-46 (0-0.5 ft)	CML-SD-46	10163437	10163437011	7/12/2011	Soil	988174.13	828739.22	0	0.5	MOISTURE	Soil Moisture	60.7		%
											SB_T_	Antimony, Total	8 J	J	mg/kg
											AS_T_	Arsenic, Total	10.5		mg/kg
											BA_T_	Barium, Total	489		mg/kg
											CD_T_	Cadmium, Total	1.5		mg/kg
											CR_T_	Chromium, Total	24.2		mg/kg
											CO_T_	Cobalt, Total	6.4		mg/kg
											CU_T_	Copper, Total	68.9		mg/kg
											FE_T_	Iron, Total Recoverable	25900		mg/kg
											PB_T_	Lead, Total Recoverable	55 J	J	mg/kg
											MN_T_	Manganese, Total	183		mg/kg
											HG_T_	Mercury, Total	12.7		mg/kg
											NI_T_	Nickel, Total	25.4		mg/kg
											AG_T_	Silver, Total Recoverable	ND(4.9)		mg/kg
											ZN_T_	Zinc, Total Recoverable	227 J	J	mg/kg
CML-SS-01	CML-SS-01 (6-7 ft)	BP-CML-SS-01-06	10163645	10163645008	7/15/2011	Soil	988616.41	830303.97	6	7	MOISTURE	Soil Moisture	37.2		%
											SB_T_	Antimony, Total	167		mg/kg
											AS_T_	Arsenic, Total	123		mg/kg
											BA_T_	Barium, Total	229		mg/kg
											CD_T_	Cadmium, Total	8.3		mg/kg
											CR_T_	Chromium, Total	5.7		mg/kg
											CO_T_	Cobalt, Total	15.3		mg/kg
											CU_T_	Copper, Total	2570		mg/kg
											FE_T_	Iron, Total Recoverable	12800		mg/kg
											PB_T_	Lead, Total Recoverable	1120		mg/kg
											MN_T_	Manganese, Total	1300		mg/kg
											HG_T_	Mercury, Total	0.35 J	J	mg/kg
											NI_T_	Nickel, Total	6.8		mg/kg
											AG_T_	Silver, Total Recoverable	14.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	163		mg/kg
CML-SS-02	CML-SS-02 (6-7 ft)	BP-CML-SS-02-06	10163645	10163645011	7/15/2011	Soil	988486.50	830048.85	6	7	MOISTURE	Soil Moisture	17.9		%
											SB_T_	Antimony, Total	10		mg/kg
											AS_T_	Arsenic, Total	11.9		mg/kg
											BA_T_	Barium, Total	178		mg/kg
											CD_T_	Cadmium, Total	3.1		mg/kg
											CR_T_	Chromium, Total	6.1		mg/kg
											CO_T_	Cobalt, Total	2.1		mg/kg
											CU_T_	Copper, Total	2360		mg/kg
											FE_T_	Iron, Total Recoverable	5640		mg/kg
											PB_T_	Lead, Total Recoverable	67.7		mg/kg
											MN_T_	Manganese, Total	67.2		mg/kg
											HG_T_	Mercury, Total	9.1		mg/kg
											NI_T_	Nickel, Total	5.3		mg/kg
											AG_T_	Silver, Total Recoverable	1		mg/kg
											ZN_T_	Zinc, Total Recoverable	108		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SS-03	CML-SS-03 (6-7 ft)	BP-CML-SS-03-06	10163645	10163645014	7/15/2011	Soil	988666.65	829989.19	6	7	MOISTURE	Soil Moisture	28.9		%
											SB_T_	Antimony, Total	750		mg/kg
											AS_T_	Arsenic, Total	777		mg/kg
											BA_T_	Barium, Total	370		mg/kg
											CD_T_	Cadmium, Total	15		mg/kg
											CR_T_	Chromium, Total	ND(0.5)		mg/kg
											CO_T_	Cobalt, Total	2.5		mg/kg
											CU_T_	Copper, Total	3840		mg/kg
											FE_T_	Iron, Total Recoverable	16200		mg/kg
											PB_T_	Lead, Total Recoverable	5310		mg/kg
											MN_T_	Manganese, Total	136		mg/kg
											HG_T_	Mercury, Total	12.6		mg/kg
											NI_T_	Nickel, Total	4.1		mg/kg
											AG_T_	Silver, Total Recoverable	70.8		mg/kg
											ZN_T_	Zinc, Total Recoverable	384		mg/kg
CML-SS-04	CML-SS-04 (6-8 ft)	BP-CML-SS-04-06	10163640	10163640003	7/15/2011	Soil	988406.32	829694.92	6	8	MOISTURE	Soil Moisture	24.6		%
											SB_T_	Antimony, Total	164		mg/kg
											AS_T_	Arsenic, Total	121		mg/kg
											BA_T_	Barium, Total	286		mg/kg
											CD_T_	Cadmium, Total	9.6		mg/kg
											CR_T_	Chromium, Total	9.5		mg/kg
											CO_T_	Cobalt, Total	11.4 J	J	mg/kg
											CU_T_	Copper, Total	1230		mg/kg
											FE_T_	Iron, Total Recoverable	10700		mg/kg
											PB_T_	Lead, Total Recoverable	393		mg/kg
											MN_T_	Manganese, Total	359		mg/kg
											HG_T_	Mercury, Total	81.1 J	J	mg/kg
											NI_T_	Nickel, Total	9.2		mg/kg
											AG_T_	Silver, Total Recoverable	10.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	208		mg/kg
CML-SS-05	CML-SS-05 (4-6 ft)	BP-CML-SS-05-04	10163640	10163640006	7/15/2011	Soil	988516.20	829612.88	4	6	MOISTURE	Soil Moisture	36.7		%
											SB_T_	Antimony, Total	1260		mg/kg
											AS_T_	Arsenic, Total	1030		mg/kg
											BA_T_	Barium, Total	495		mg/kg
											CD_T_	Cadmium, Total	23.1		mg/kg
											CR_T_	Chromium, Total	4.8		mg/kg
											CO_T_	Cobalt, Total	1.3 J	J	mg/kg
											CU_T_	Copper, Total	5600		mg/kg
											FE_T_	Iron, Total Recoverable	18900		mg/kg
											PB_T_	Lead, Total Recoverable	8010		mg/kg
											MN_T_	Manganese, Total	155		mg/kg
											HG_T_	Mercury, Total	24.7 J	J	mg/kg
											NI_T_	Nickel, Total	3		mg/kg
											AG_T_	Silver, Total Recoverable	101		mg/kg
											ZN_T_	Zinc, Total Recoverable	371		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SS-06	CML-SS-06 (5-7 ft)	BP-CML-SS-06-05	10163640	10163640009	7/15/2011	Soil	988459.01	829346.48	5	7	MOISTURE	Soil Moisture	42.4		%
											SB_T_	Antimony, Total	19.2		mg/kg
											AS_T_	Arsenic, Total	176		mg/kg
											BA_T_	Barium, Total	427		mg/kg
											CD_T_	Cadmium, Total	63.1		mg/kg
											CR_T_	Chromium, Total	22.6		mg/kg
											CO_T_	Cobalt, Total	4.4 J	J	mg/kg
											CU_T_	Copper, Total	367		mg/kg
											FE_T_	Iron, Total Recoverable	14600		mg/kg
											PB_T_	Lead, Total Recoverable	77.1		mg/kg
											MN_T_	Manganese, Total	165		mg/kg
											HG_T_	Mercury, Total	79.3 J	J	mg/kg
											NI_T_	Nickel, Total	19.9		mg/kg
											AG_T_	Silver, Total Recoverable	3.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	576		mg/kg
CML-SS-07	CML-SS-07 (5-7 ft)	BP-CML-SS-07-05	10163643	10163643003	7/15/2011	Soil	988722.44	829153.27	5	7	MOISTURE	Soil Moisture	13.1		%
											SB_T_	Antimony, Total	30.3		mg/kg
											AS_T_	Arsenic, Total	39.5		mg/kg
											BA_T_	Barium, Total	151		mg/kg
											CD_T_	Cadmium, Total	1.5 J	J	mg/kg
											CR_T_	Chromium, Total	5.2 J	J	mg/kg
											CO_T_	Cobalt, Total	43.1 J	J	mg/kg
											CU_T_	Copper, Total	231		mg/kg
											FE_T_	Iron, Total Recoverable	22400		mg/kg
											PB_T_	Lead, Total Recoverable	167		mg/kg
											MN_T_	Manganese, Total	1600		mg/kg
											HG_T_	Mercury, Total	67.5 J	J	mg/kg
											NI_T_	Nickel, Total	8		mg/kg
											AG_T_	Silver, Total Recoverable	2.4		mg/kg
											ZN_T_	Zinc, Total Recoverable	80.7		mg/kg
CML-SS-08	CML-SS-08 (7-9 ft)	BP-CML-SS-08-07	10163643	10163643006	7/15/2011	Soil	988475.16	828988.49	7	9	MOISTURE	Soil Moisture	23.7		%
											SB_T_	Antimony, Total	1.9		mg/kg
											AS_T_	Arsenic, Total	8.3		mg/kg
											BA_T_	Barium, Total	156		mg/kg
											CD_T_	Cadmium, Total	0.12 J	J	mg/kg
											CR_T_	Chromium, Total	5.4 J	J	mg/kg
											CO_T_	Cobalt, Total	14.4 J	J	mg/kg
											CU_T_	Copper, Total	35.1		mg/kg
											FE_T_	Iron, Total Recoverable	18800		mg/kg
											PB_T_	Lead, Total Recoverable	20.1		mg/kg
											MN_T_	Manganese, Total	457		mg/kg
											HG_T_	Mercury, Total	130 J	J	mg/kg
											NI_T_	Nickel, Total	7		mg/kg
											AG_T_	Silver, Total Recoverable	7.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	178		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-SS-10	CML-SS-10 (6-7 ft)	BP-CML-SS-10-06	10163645	10163645005	7/15/2011	Soil	988236.27	829715.05	6	7	MOISTURE	Soil Moisture	17.2		%
											SB_T_	Antimony, Total	162		mg/kg
											AS_T_	Arsenic, Total	173		mg/kg
											BA_T_	Barium, Total	178		mg/kg
											CD_T_	Cadmium, Total	1.7		mg/kg
											CR_T_	Chromium, Total	ND(0.45)		mg/kg
											CO_T_	Cobalt, Total	14.7		mg/kg
											CU_T_	Copper, Total	606		mg/kg
											FE_T_	Iron, Total Recoverable	49500		mg/kg
											PB_T_	Lead, Total Recoverable	1830		mg/kg
											MN_T_	Manganese, Total	1050		mg/kg
											HG_T_	Mercury, Total	0.77 J	J	mg/kg
											NI_T_	Nickel, Total	7.9		mg/kg
											AG_T_	Silver, Total Recoverable	9.5		mg/kg
											ZN_T_	Zinc, Total Recoverable	251		mg/kg
CML-TS-01	CML-TS-01 (0-1 ft)	BP-CML-TS-01-00	10163645	10163645006	7/15/2011	Soil/Tailings	988616.41	830303.97	0	1	MOISTURE	Soil Moisture	10.7		%
											SB_T_	Antimony, Total	324		mg/kg
											AS_T_	Arsenic, Total	262		mg/kg
											BA_T_	Barium, Total	240		mg/kg
											CD_T_	Cadmium, Total	8.9		mg/kg
											CR_T_	Chromium, Total	3.3		mg/kg
											CO_T_	Cobalt, Total	7.6		mg/kg
											CU_T_	Copper, Total	1680		mg/kg
											FE_T_	Iron, Total Recoverable	16900		mg/kg
											PB_T_	Lead, Total Recoverable	2300		mg/kg
											MN_T_	Manganese, Total	620		mg/kg
											HG_T_	Mercury, Total	0.24 J	J	mg/kg
											NI_T_	Nickel, Total	5.7		mg/kg
											AG_T_	Silver, Total Recoverable	26.5		mg/kg
											ZN_T_	Zinc, Total Recoverable	198		mg/kg
CML-TS-01	CML-TS-01 (2-4 ft)	BP-CML-TS-01-02	10163645	10163645007	7/15/2011	Soil/Tailings	988616.41	830303.97	2	4	MOISTURE	Soil Moisture	40.1		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total	23.3		mg/kg
											AS_T_	Arsenic, Total	24.2		mg/kg
											BA_T_	Barium, Total	483		mg/kg
											CD_T_	Cadmium, Total	8.7		mg/kg
											CR_T_	Chromium, Total	15		mg/kg
											CO_T_	Cobalt, Total	8		mg/kg
											CU_T_	Copper, Total	2140		mg/kg
											FE_T_	Iron, Total Recoverable	13300		mg/kg
											PB_T_	Lead, Total Recoverable	144		mg/kg
											MN_T_	Manganese, Total	269		mg/kg
											HG_T_	Mercury, Total	1 J	J	mg/kg
											NI_T_	Nickel, Total	13.3		mg/kg
											AG_T_	Silver, Total Recoverable	1.3		mg/kg
											ZN_T_	Zinc, Total Recoverable	213		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	5.9		Std
											ACIDBASE_POT	Acid Base Potential	2.2		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	2.2		t/1000t
											01305-78-8_REC	Recommended Lime	8.1		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	5.9		t/1000t

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-TS-02	CML-TS-02 (0-1 ft)	BP-CML-TS-02-00	10163645	10163645009	7/15/2011	Soil/Tailings	988486.50	830048.85	0	1	MOISTURE	Soil Moisture	14.3		%
											SB_T_	Antimony, Total	6.9		mg/kg
											AS_T_	Arsenic, Total	11.2		mg/kg
											BA_T_	Barium, Total	34.7		mg/kg
											CD_T_	Cadmium, Total	0.84		mg/kg
											CR_T_	Chromium, Total	2.3		mg/kg
											CO_T_	Cobalt, Total	7.5		mg/kg
											CU_T_	Copper, Total	846		mg/kg
											FE_T_	Iron, Total Recoverable	7930		mg/kg
											PB_T_	Lead, Total Recoverable	32.3		mg/kg
											MN_T_	Manganese, Total	147		mg/kg
											HG_T_	Mercury, Total	0.3 J	J	mg/kg
											NI_T_	Nickel, Total	4.5		mg/kg
											AG_T_	Silver, Total Recoverable	0.52		mg/kg
											ZN_T_	Zinc, Total Recoverable	60.6		mg/kg
CML-TS-02	CML-TS-02 (2-4 ft)	BP-CML-TS-02-02	10163645	10163645010	7/15/2011	Soil/Tailings	988486.50	830048.85	2	4	MOISTURE	Soil Moisture	38.4		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	0.0754		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	0.0697		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.174		%
											SB_T_	Antimony, Total	7.5		mg/kg
											AS_T_	Arsenic, Total	11.3		mg/kg
											BA_T_	Barium, Total	365		mg/kg
											CD_T_	Cadmium, Total	2.3		mg/kg
											CR_T_	Chromium, Total	10.1		mg/kg
											CO_T_	Cobalt, Total	12.8		mg/kg
											CU_T_	Copper, Total	92		mg/kg
											FE_T_	Iron, Total Recoverable	9680		mg/kg
											PB_T_	Lead, Total Recoverable	44.9		mg/kg
											MN_T_	Manganese, Total	297		mg/kg
											HG_T_	Mercury, Total	1.9		mg/kg
											NI_T_	Nickel, Total	13.9		mg/kg
											AG_T_	Silver, Total Recoverable	1.1		mg/kg
											ZN_T_	Zinc, Total Recoverable	159		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	5.9		Std
											ACIDBASE_POT	Acid Base Potential	3.2		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	3.2		t/1000t
											01305-78-8_REC	Recommended Lime	11		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	5.9		t/1000t
CML-TS-03	CML-TS-03 (0-1 ft)	BP-CML-TS-03-00	10163645	10163645012	7/15/2011	Soil/Tailings	988666.65	829989.19	0	1	MOISTURE	Soil Moisture	38.2		%
											SB_T_	Antimony, Total	1370		mg/kg
											AS_T_	Arsenic, Total	1640		mg/kg
											BA_T_	Barium, Total	514		mg/kg
											CD_T_	Cadmium, Total	31.8		mg/kg
											CR_T_	Chromium, Total	ND(0.6)		mg/kg
											CO_T_	Cobalt, Total	1.9		mg/kg
											CU_T_	Copper, Total	5420		mg/kg
											FE_T_	Iron, Total Recoverable	25100		mg/kg
											PB_T_	Lead, Total Recoverable	837		mg/kg
											MN_T_	Manganese, Total	327		mg/kg
											HG_T_	Mercury, Total	9.9		mg/kg
											NI_T_	Nickel, Total	1.6		mg/kg
											AG_T_	Silver, Total Recoverable	142		mg/kg
											ZN_T_	Zinc, Total Recoverable	522		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-TS-03	CML-TS-03 (2-4 ft)	BP-CML-TS-03-02	10163645	10163645013	7/15/2011	Soil/Tailings	988666.65	829989.19	2	4	MOISTURE	Soil Moisture	25.5		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	0.0702		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	0.126		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.201		%
											SB_T_	Antimony, Total	1730		mg/kg
											AS_T_	Arsenic, Total	1610		mg/kg
											BA_T_	Barium, Total	471		mg/kg
											CD_T_	Cadmium, Total	23.7		mg/kg
											CR_T_	Chromium, Total	ND(0.55)		mg/kg
											CO_T_	Cobalt, Total	ND(0.55)		mg/kg
											CU_T_	Copper, Total	6240		mg/kg
											FE_T_	Iron, Total Recoverable	29300		mg/kg
											PB_T_	Lead, Total Recoverable	9390		mg/kg
											MN_T_	Manganese, Total	167		mg/kg
											HG_T_	Mercury, Total	5.5		mg/kg
											NI_T_	Nickel, Total	0.69		mg/kg
											AG_T_	Silver, Total Recoverable	110		mg/kg
											ZN_T_	Zinc, Total Recoverable	735		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7		Std
											ACIDBASE_POT	Acid Base Potential	0.74		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	0.74		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CML-TS-04	CML-TS-04 (0-1 ft)	BP-CML-TS-04-00	10163640	10163640001	7/15/2011	Soil/Tailings	988406.32	829694.92	0	1	MOISTURE	Soil Moisture	21.2		%
											SB_T_	Antimony, Total	548		mg/kg
											AS_T_	Arsenic, Total	390		mg/kg
											BA_T_	Barium, Total	434		mg/kg
											CD_T_	Cadmium, Total	17.3		mg/kg
											CR_T_	Chromium, Total	9.8		mg/kg
											CO_T_	Cobalt, Total	2.2 J	J	mg/kg
											CU_T_	Copper, Total	3240		mg/kg
											FE_T_	Iron, Total Recoverable	17500		mg/kg
											PB_T_	Lead, Total Recoverable	2460		mg/kg
											MN_T_	Manganese, Total	143		mg/kg
											HG_T_	Mercury, Total	0.24 J	J	mg/kg
											NI_T_	Nickel, Total	6		mg/kg
											AG_T_	Silver, Total Recoverable	48.7		mg/kg
											ZN_T_	Zinc, Total Recoverable	278		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-TS-04	CML-TS-04 (2-4 ft)	BP-CML-TS-04-02	10163640	10163640002	7/15/2011	Soil/Tailings	988406.32	829694.92	2	4	MOISTURE	Soil Moisture	20.8		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	ND(0.05)		%
											SB_T_	Antimony, Total	52.2		mg/kg
											AS_T_	Arsenic, Total	50.6		mg/kg
											BA_T_	Barium, Total	289		mg/kg
											CD_T_	Cadmium, Total	7.1		mg/kg
											CR_T_	Chromium, Total	11.8		mg/kg
											CO_T_	Cobalt, Total	8.4 J	J	mg/kg
											CU_T_	Copper, Total	846		mg/kg
											FE_T_	Iron, Total Recoverable	19000		mg/kg
											PB_T_	Lead, Total Recoverable	181		mg/kg
											MN_T_	Manganese, Total	298		mg/kg
											HG_T_	Mercury, Total	13.1 J	J	mg/kg
											NI_T_	Nickel, Total	8.5		mg/kg
											AG_T_	Silver, Total Recoverable	4.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	139		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	5.8		Std
											ACIDBASE_POT	Acid Base Potential	1.2		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	1.2 J	J	t/1000t
											01305-78-8_REC	Recommended Lime	11		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	8.1		t/1000t
CML-TS-05	CML-TS-05 (0-1 ft)	BP-CML-TS-05-00	10163640	10163640004	7/15/2011	Soil/Tailings	988516.20	829612.88	0	1	MOISTURE	Soil Moisture	23.3		%
											SB_T_	Antimony, Total	409		mg/kg
											AS_T_	Arsenic, Total	353		mg/kg
											BA_T_	Barium, Total	421		mg/kg
											CD_T_	Cadmium, Total	13.6		mg/kg
											CR_T_	Chromium, Total	11.5		mg/kg
											CO_T_	Cobalt, Total	7.8 J	J	mg/kg
											CU_T_	Copper, Total	2020		mg/kg
											FE_T_	Iron, Total Recoverable	17300		mg/kg
											PB_T_	Lead, Total Recoverable	1840		mg/kg
											MN_T_	Manganese, Total	418		mg/kg
											HG_T_	Mercury, Total	0.8 J	J	mg/kg
											NI_T_	Nickel, Total	8.2		mg/kg
											AG_T_	Silver, Total Recoverable	28.4		mg/kg
											ZN_T_	Zinc, Total Recoverable	311		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-TS-05	CML-TS-05 (2-4 ft)	BP-CML-TS-05-02	10163640	10163640005	7/15/2011	Soil/Tailings	988516.20	829612.88	2	4	MOISTURE	Soil Moisture	23.3		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	0.0507		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	0.106		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.155		%
											SB_T_	Antimony, Total	1190		mg/kg
											AS_T_	Arsenic, Total	1020		mg/kg
											BA_T_	Barium, Total	615		mg/kg
											CD_T_	Cadmium, Total	21		mg/kg
											CR_T_	Chromium, Total	4.9		mg/kg
											CO_T_	Cobalt, Total	1.1 J	J	mg/kg
											CU_T_	Copper, Total	3690		mg/kg
											FE_T_	Iron, Total Recoverable	20600		mg/kg
											PB_T_	Lead, Total Recoverable	10000		mg/kg
											MN_T_	Manganese, Total	172		mg/kg
											HG_T_	Mercury, Total	2.5 J	J	mg/kg
											NI_T_	Nickel, Total	2.7		mg/kg
											AG_T_	Silver, Total Recoverable	79.9		mg/kg
											ZN_T_	Zinc, Total Recoverable	654		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.6		Std
											ACIDBASE_POT	Acid Base Potential	-1.6		t/1000t
											ACIDITY_POT	Acid Potential	1.6		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)	UJ	t/1000t
											01305-78-8_REC	Recommended Lime	5		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	2.4		t/1000t
CML-TS-06	CML-TS-06 (0-1 ft)	BP-CML-TS-06-00	10163640	10163640007	7/15/2011	Soil/Tailings	988459.01	829346.48	0	1	MOISTURE	Soil Moisture	19.8		%
											SB_T_	Antimony, Total	1040		mg/kg
											AS_T_	Arsenic, Total	830		mg/kg
											BA_T_	Barium, Total	463		mg/kg
											CD_T_	Cadmium, Total	30.7		mg/kg
											CR_T_	Chromium, Total	5.8		mg/kg
											CO_T_	Cobalt, Total	2 J	J	mg/kg
											CU_T_	Copper, Total	1740		mg/kg
											FE_T_	Iron, Total Recoverable	15600		mg/kg
											PB_T_	Lead, Total Recoverable	6790		mg/kg
											MN_T_	Manganese, Total	190		mg/kg
											HG_T_	Mercury, Total	0.4 J	J	mg/kg
											NI_T_	Nickel, Total	4.1		mg/kg
											AG_T_	Silver, Total Recoverable	128		mg/kg
											ZN_T_	Zinc, Total Recoverable	220		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-TS-06	CML-TS-06 (2-4 ft)	BP-CML-TS-06-02	10163640	10163640008	7/15/2011	Soil/Tailings	988459.01	829346.48	2	4	MOISTURE	Soil Moisture	16.4		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.097		%
											SB_T_	Antimony, Total	1410		mg/kg
											AS_T_	Arsenic, Total	1070		mg/kg
											BA_T_	Barium, Total	397		mg/kg
											CD_T_	Cadmium, Total	22		mg/kg
											CR_T_	Chromium, Total	4.1		mg/kg
											CO_T_	Cobalt, Total	1.3 J	J	mg/kg
											CU_T_	Copper, Total	4040		mg/kg
											FE_T_	Iron, Total Recoverable	22600		mg/kg
											PB_T_	Lead, Total Recoverable	6960		mg/kg
											MN_T_	Manganese, Total	246		mg/kg
											HG_T_	Mercury, Total	46.1 J	J	mg/kg
											NI_T_	Nickel, Total	2.4		mg/kg
											AG_T_	Silver, Total Recoverable	99.9		mg/kg
											ZN_T_	Zinc, Total Recoverable	334		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.3		Std
											ACIDBASE_POT	Acid Base Potential	2.4		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	2.4 J	J	t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CML-TS-07	CML-TS-07 (0-1 ft)	BP-CML-TS-07-00	10163643	10163643001	7/15/2011	Soil/Tailings	988722.44	829153.27	0	1	MOISTURE	Soil Moisture	20.4		%
											SB_T_	Antimony, Total	529		mg/kg
											AS_T_	Arsenic, Total	496		mg/kg
											BA_T_	Barium, Total	289		mg/kg
											CD_T_	Cadmium, Total	7.5 J	J	mg/kg
											CR_T_	Chromium, Total	3.7 J	J	mg/kg
											CO_T_	Cobalt, Total	4.3 J	J	mg/kg
											CU_T_	Copper, Total	1110		mg/kg
											FE_T_	Iron, Total Recoverable	27600		mg/kg
											PB_T_	Lead, Total Recoverable	2650		mg/kg
											MN_T_	Manganese, Total	315		mg/kg
											HG_T_	Mercury, Total	215 J	J	mg/kg
											NI_T_	Nickel, Total	9.3		mg/kg
											AG_T_	Silver, Total Recoverable	52.5		mg/kg
											ZN_T_	Zinc, Total Recoverable	250		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-TS-07	CML-TS-07 (2-4 ft)	BP-CML-TS-07-02	10163643	10163643002	7/15/2011	Soil/Tailings	988722.44	829153.27	2	4	MOISTURE	Soil Moisture	8.2		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.053		%
											SB_T_	Antimony, Total	690		mg/kg
											AS_T_	Arsenic, Total	633		mg/kg
											BA_T_	Barium, Total	207		mg/kg
											CD_T_	Cadmium, Total	12.5 J	J	mg/kg
											CR_T_	Chromium, Total	ND(0.52)	UJ	mg/kg
											CO_T_	Cobalt, Total	0.93 J	J	mg/kg
											CU_T_	Copper, Total	941		mg/kg
											FE_T_	Iron, Total Recoverable	15500		mg/kg
											PB_T_	Lead, Total Recoverable	3290		mg/kg
											MN_T_	Manganese, Total	289		mg/kg
											HG_T_	Mercury, Total	221 J	J	mg/kg
											NI_T_	Nickel, Total	1.6		mg/kg
											AG_T_	Silver, Total Recoverable	96.2		mg/kg
											ZN_T_	Zinc, Total Recoverable	334		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.3		Std
											ACIDBASE_POT	Acid Base Potential	0.73		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	0.73		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CML-TS-08	CML-TS-08 (0-1 ft)	BP-CML-TS-08-00	10163643	10163643004	7/15/2011	Soil/Tailings	988475.16	828988.49	0	1	MOISTURE	Soil Moisture	25.4		%
											SB_T_	Antimony, Total	233		mg/kg
											AS_T_	Arsenic, Total	188		mg/kg
											BA_T_	Barium, Total	146		mg/kg
											CD_T_	Cadmium, Total	4.3 J	J	mg/kg
											CR_T_	Chromium, Total	2.8 J	J	mg/kg
											CO_T_	Cobalt, Total	2.3 J	J	mg/kg
											CU_T_	Copper, Total	687		mg/kg
											FE_T_	Iron, Total Recoverable	16000		mg/kg
											PB_T_	Lead, Total Recoverable	1290		mg/kg
											MN_T_	Manganese, Total	183		mg/kg
											HG_T_	Mercury, Total	10.8 J	J	mg/kg
											NI_T_	Nickel, Total	3.4		mg/kg
											AG_T_	Silver, Total Recoverable	20.8		mg/kg
											ZN_T_	Zinc, Total Recoverable	118		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-TS-08	CML-TS-08 (5-7 ft)	BP-CML-TS-08-05	10163643	10163643005	7/15/2011	Soil/Tailings	988475.16	828988.49	5	7	MOISTURE	Soil Moisture	34.5		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	ND(0.05)		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	ND(0.05)		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.0605		%
											SB_T_	Antimony, Total	360		mg/kg
											AS_T_	Arsenic, Total	340		mg/kg
											BA_T_	Barium, Total	337		mg/kg
											CD_T_	Cadmium, Total	8.2 J	J	mg/kg
											CR_T_	Chromium, Total	ND(0.52)	UJ	mg/kg
											CO_T_	Cobalt, Total	4.2 J	J	mg/kg
											CU_T_	Copper, Total	1610		mg/kg
											FE_T_	Iron, Total Recoverable	26600		mg/kg
											PB_T_	Lead, Total Recoverable	2990		mg/kg
											MN_T_	Manganese, Total	1120		mg/kg
											HG_T_	Mercury, Total	7.4 J	J	mg/kg
											NI_T_	Nickel, Total	3.7		mg/kg
											AG_T_	Silver, Total Recoverable	113		mg/kg
											ZN_T_	Zinc, Total Recoverable	194		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	7.1		Std
											ACIDBASE_POT	Acid Base Potential	8.3		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	8.3		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0		t/1000t
CML-TS-09	CML-TS-09 (0-1 ft)	BP-CML-TS-09-00	10163643	10163643007	7/15/2011	Soil/Tailings	988657.50	828897.92	0	1	MOISTURE	Soil Moisture	34.5		%
											SB_T_	Antimony, Total	3210		mg/kg
											AS_T_	Arsenic, Total	2440		mg/kg
											BA_T_	Barium, Total	424		mg/kg
											CD_T_	Cadmium, Total	49.2 J	J	mg/kg
											CR_T_	Chromium, Total	ND(0.64)	UJ	mg/kg
											CO_T_	Cobalt, Total	4.8 J	J	mg/kg
											CU_T_	Copper, Total	6630		mg/kg
											FE_T_	Iron, Total Recoverable	52500		mg/kg
											PB_T_	Lead, Total Recoverable	9520		mg/kg
											MN_T_	Manganese, Total	439		mg/kg
											HG_T_	Mercury, Total	ND(0.024	UJ	mg/kg
											NI_T_	Nickel, Total	6.2		mg/kg
											AG_T_	Silver, Total Recoverable	168		mg/kg
											ZN_T_	Zinc, Total Recoverable	1110		mg/kg
CML-TS-09	CML-TS-09 (2-4 ft)	BP-CML-TS-09-02	10163643	10163643008	7/15/2011	Soil/Tailings	988657.50	828897.92	2	4	MOISTURE	Soil Moisture	18.6		%
											SB_T_	Antimony, Total	1280		mg/kg
											AS_T_	Arsenic, Total	5140		mg/kg
											BA_T_	Barium, Total	464		mg/kg
											CD_T_	Cadmium, Total	13.2 J	J	mg/kg
											CR_T_	Chromium, Total	ND(0.49)	UJ	mg/kg
											CO_T_	Cobalt, Total	2.5 J	J	mg/kg
											CU_T_	Copper, Total	3120		mg/kg
											FE_T_	Iron, Total Recoverable	60700		mg/kg
											PB_T_	Lead, Total Recoverable	23600		mg/kg
											MN_T_	Manganese, Total	84.4		mg/kg
											HG_T_	Mercury, Total	0.64 J	J	mg/kg
											NI_T_	Nickel, Total	3.6		mg/kg
											AG_T_	Silver, Total Recoverable	119		mg/kg
											ZN_T_	Zinc, Total Recoverable	122		mg/kg

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-TS-09	CML-TS-09 (4-6 ft)	BP-CML-TS-09-04	10163643	10163643009	7/15/2011	Soil/Tailings	988657.50	828897.92	4	6	MOISTURE	Soil Moisture	16.2		%
											SB_T_	Antimony, Total	2540		mg/kg
											AS_T_	Arsenic, Total	4980		mg/kg
											BA_T_	Barium, Total	315		mg/kg
											CD_T_	Cadmium, Total	35.2 J	J	mg/kg
											CR_T_	Chromium, Total	ND(0.54)	UJ	mg/kg
											CO_T_	Cobalt, Total	1.7 J	J	mg/kg
											CU_T_	Copper, Total	5580		mg/kg
											FE_T_	Iron, Total Recoverable	67700		mg/kg
											PB_T_	Lead, Total Recoverable	15100		mg/kg
											MN_T_	Manganese, Total	234		mg/kg
											HG_T_	Mercury, Total	137 J	J	mg/kg
											NI_T_	Nickel, Total	2.2		mg/kg
											AG_T_	Silver, Total Recoverable	108		mg/kg
											ZN_T_	Zinc, Total Recoverable	273		mg/kg
CML-TS-09	CML-TS-09 (6-8 ft)	BP-CML-TS-09-06	10163643	10163643010	7/15/2011	Soil/Tailings	988657.50	828897.92	6	8	MOISTURE	Soil Moisture	22.6		%
											SB_T_	Antimony, Total	15700		mg/kg
											AS_T_	Arsenic, Total	4200		mg/kg
											BA_T_	Barium, Total	390		mg/kg
											CD_T_	Cadmium, Total	99.9 J	J	mg/kg
											CR_T_	Chromium, Total	ND(0.56)	UJ	mg/kg
											CO_T_	Cobalt, Total	14.6 J	J	mg/kg
											CU_T_	Copper, Total	22700		mg/kg
											FE_T_	Iron, Total Recoverable	50700		mg/kg
											PB_T_	Lead, Total Recoverable	12600		mg/kg
											MN_T_	Manganese, Total	815		mg/kg
											HG_T_	Mercury, Total	4.1 J	J	mg/kg
											NI_T_	Nickel, Total	20.7		mg/kg
											AG_T_	Silver, Total Recoverable	159		mg/kg
											ZN_T_	Zinc, Total Recoverable	1570		mg/kg
CML-TS-10	CML-TS-10 (0-1 ft)	BP-CML-TS-10-00	10163645	10163645003	7/15/2011	Soil/Tailings	988249.08	829777.32	0	1	MOISTURE	Soil Moisture	12		%
											SULFUR_EX_HCL	Sulfur (HCL Extraction)	0.0825		%
											SULFUR_EX_HNO3	Sulfur (HNO3 Extraction)	ND(0.05)		%
											SULFUR_HOTWATER_	Sulfur (Hot Water	0.144		%
											SULFUR_RES	Sulfur, Residual	ND(0.05)		%
											SULFU	Sulfur, Total	0.227		%
											SB_T_	Antimony, Total	1090		mg/kg
											AS_T_	Arsenic, Total	1250		mg/kg
											BA_T_	Barium, Total	378		mg/kg
											CD_T_	Cadmium, Total	5.8		mg/kg
											CR_T_	Chromium, Total	ND(0.5)		mg/kg
											CO_T_	Cobalt, Total	0.98		mg/kg
											CU_T_	Copper, Total	2160		mg/kg
											FE_T_	Iron, Total Recoverable	42900		mg/kg
											PB_T_	Lead, Total Recoverable	8010		mg/kg
											MN_T_	Manganese, Total	254		mg/kg
											HG_T_	Mercury, Total	0.33 J	J	mg/kg
											NI_T_	Nickel, Total	1.8		mg/kg
											AG_T_	Silver, Total Recoverable	62.3		mg/kg
											ZN_T_	Zinc, Total Recoverable	989		mg/kg
											PH_SMPBUFFER	pH, SMP Buffer	6.9		Std
											ACIDBASE_POT	Acid Base Potential	0		t/1000t
											ACIDITY_POT	Acid Potential	ND(4.3)		t/1000t
											NEUT_POT	Neutralization Potential	ND(0.5)		t/1000t
											01305-78-8_REC	Recommended Lime	ND(5.4)		t/1000t
											SMPLIME_REQ	SMP Lime Requirement	0.3		t/1000t

TABLE 3-8. SOLID-MATRIX ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sample	Matrix	X	Y	Sample Start	Sample End	Tri Cas	Analyte	Value	Reviewer	Units
CML-TS-10	CML-TS-10 (2-4 ft)	BP-CML-TS-10-02	10163645	10163645004	7/15/2011	Soil/Tailings	988249.08	829777.32	2	4	MOISTURE	Soil Moisture	25		%
											SB_T_	Antimony, Total	1110		mg/kg
											AS_T_	Arsenic, Total	1400		mg/kg
											BA_T_	Barium, Total	616		mg/kg
											CD_T_	Cadmium, Total	4.4		mg/kg
											CR_T_	Chromium, Total	ND(0.48)		mg/kg
											CO_T_	Cobalt, Total	ND(0.48)		mg/kg
											CU_T_	Copper, Total	1340		mg/kg
											FE_T_	Iron, Total Recoverable	21600		mg/kg
											PB_T_	Lead, Total Recoverable	2490		mg/kg
											MN_T_	Manganese, Total	169		mg/kg
											HG_T_	Mercury, Total	0.59 J	J	mg/kg
											NI_T_	Nickel, Total	ND(0.48)		mg/kg
											AG_T_	Silver, Total Recoverable	10.5		mg/kg
											ZN_T_	Zinc, Total Recoverable	419		mg/kg

[a] Silver was included in original laboratory analytical reports, but was removed in revised reports by the laboratory
J – Estimated concentration
UJ – Estimated reporting
limit ft - feet
meq/100g - milliequivalents per hundred
grams mg/kg - milligrams per kilogram
mmhos/cm - micromhos per centimeter
% - percent
ND() - Analyte was not detected (reporting
limit) Std Units - Standard Units
t/1000t - tons per thousand tons

TABLE 3-9. ACID BASE ACCOUNTING RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Date Sampled	Sample Start Depth (ft)	Sample End Depth (ft)	Acid Base Potential** (t/1000t)	Acid Potential (t/1000t)	Neutralization Potential (t/1000t)	pH, SMP Buffer (Standard Units)	Recommended Lime (t/1000t)	SMP Lime Requirement (t/1000t)	Sulfur (HCL Extraction) (%)	Sulfur (HNO3 Extraction) (%)	Sulfur (Hot Water Extraction) (%)	Sulfur, Residual (%)	Sulfur, Total (%)
CML-TS-01	7/15/2011	2	4	2.2	ND(4.3)	2.2	5.9	8.1	5.9	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CML-TS-02	7/15/2011	2	4	3.2	ND(4.3)	3.2	5.9	11	5.9	ND(0.05)	0.0754	0.0697	ND(0.05)	0.174
CML-TS-03	7/15/2011	2	4	0.74	ND(4.3)	0.74	7	ND(5.4)	0	0.0702	ND(0.05)	0.126	ND(0.05)	0.201
CML-TS-04	7/15/2011	2	4	1.2	ND(4.3)	1.2 J	5.8	11	8.1	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)
CML-TS-05	7/15/2011	2	4	-1.6	1.6	ND(0.5) UJ	6.6	5	2.4	ND(0.05)	0.0507	0.106	ND(0.05)	0.155
CML-TS-06	7/15/2011	2	4	2.4	ND(4.3)	2.4 J	7.3	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	0.097
CML-TS-07	7/15/2011	2	4	0.73	ND(4.3)	0.73	7.3	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	0.053
CML-TS-08	7/15/2011	5	7	8.3	ND(4.3)	8.3	7.1	ND(5.4)	0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	0.0605
CML-TS-10	7/15/2011	0	1	0	ND(4.3)	ND(0.5) UJ	6.9	ND(5.4)	0.3	0.0825	ND(0.05)	0.144	ND(0.05)	0.227

J - Estimated concentration

UJ - Estimated reporting limit

ft - feet

t/1000t = tons of Calcium Carbonate ($CaCO_3$) per 1,000 tons waste

ND() - Analyte was not detected (reporting limit)

** Acid/Base Potential = NP - AP

Potentially Acid Generating:

Uncertain Acid Generation Potential:

Unlikely to Generate Acid:

NP = Neutralization Potential

AP = Acid Potential

NNP = Net Neutralizing Potential = Base - Acid Potential

NP:AP between 1 and 3 and/or NNP between -20 and +20 tons/kton

NNP < -20 tons/kton

NNP < +20 tons/kton

TABLE 3-10. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MINE AOC BLACK PINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
CPS-1	CPS-1	CPS-1	10158290	10158290001	5/19/2011	Water	996465.254	822724.587	FLOW	Flow	24		gpm
									TEMP	Temperature	8.24		oC
									PH	pH	4.15		Std Units
									ACIDITY	Acidity	84,800 J	J	ug/L
									ALKLNT	Alkalinity	ND(5,000)		ug/L
									AS_T_R	Arsenic, Total Recoverable	ND(0.5)		ug/L
									CD_T_R	Cadmium, Total Recoverable	173		ug/L
									CA	Calcium, Total	65,400		ug/L
									CU_T_R	Copper, Total Recoverable	11,100 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	ND(50)		ug/L
									PB_T_R	Lead, Total Recoverable	0.3		ug/L
									MG	Magnesium, Total	27,300 J	J	ug/L
									MN_T_R	Manganese, Total	3,680		ug/L
									O2_DIS	Oxygen, Dissolved	16,680		ug/L
									K	Potassium, Total	3,690 J	J	ug/L
									NA	Sodium, Total	6,450 J	J	ug/L
									TDS	Solids, Total Dissolved	584,000		ug/L
									TS	Solids, Total Suspended	1,200 J	J	ug/L
									SULFAT	Sulfate	294,000		ug/L
									ZN_T_R	Zinc, Total Recoverable	12,600 J	J	ug/L
									SPCON_	Conductance Field	573		umhos/cm
CPS-2	CPS-2	CPS-2	10158290	10158290003	5/19/2011	Water	997503.80	822824.78	FLOW	Flow	60		gpm
									TEMP	Temperature	7.47		oC
									PH	pH	5.81		Std Units
									ACIDITY	Acidity	17,900 J	J	ug/L
									ALKLNT	Alkalinity	16,400		ug/L
									AS_T_R	Arsenic, Total Recoverable	3.5		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.17		ug/L
									CA	Calcium, Total	5,160		ug/L
									CU_T_R	Copper, Total Recoverable	21.2 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	1,580 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	6.6		ug/L
									MG	Magnesium, Total	1,760 J	J	ug/L
									MN_T_R	Manganese, Total	13.9		ug/L
									O2_DIS	Oxygen, Dissolved	12,500		ug/L
									K	Potassium, Total	1,660 J	J	ug/L
									NA	Sodium, Total	3,000 J	J	ug/L
									TDS	Solids, Total Dissolved	98,000		ug/L
									TS	Solids, Total Suspended	2,200 J	J	ug/L
									SULFAT	Sulfate	6,100		ug/L
									ZN_T_R	Zinc, Total Recoverable	20.2 J	J	ug/L
									SPCON_	Conductance Field	55		umhos/cm

TABLE 3-10. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MINE AOC BLACK PINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
CPS-7A	CPS-7A	CPS-7A	10158290	10158290004	5/19/2011	Water	996036.82	822506.99	FLOW	Flow	0.18		gpm
									TEMP	Temperature	14.04		oC
									PH	pH	5.65		Std Units
									ACIDITY	Acidity	37,300 J	J	ug/L
									ALKLNT	Alkalinity	ND(5,000)		ug/L
									AS_T_R	Arsenic, Total Recoverable	54.7		ug/L
									CD_T_R	Cadmium, Total Recoverable	52.9		ug/L
									CA	Calcium, Total	28,200		ug/L
									CU_T_R	Copper, Total Recoverable	4,320 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	41,400 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	363		ug/L
									MG	Magnesium, Total	16,700 J	J	ug/L
									MN_T_R	Manganese, Total	938		ug/L
									O2_DIS	Oxygen, Dissolved	10,420		ug/L
									K	Potassium, Total	7,140 J	J	ug/L
									NA	Sodium, Total	3,720 J	J	ug/L
									TDS	Solids, Total Dissolved	320,000		ug/L
									TS	Solids, Total Suspended	2,670,000 J	J	ug/L
									SULFAT	Sulfate	75,600		ug/L
									ZN_T_R	Zinc, Total Recoverable	4,650 J	J	ug/L
									SPCON_	Conductance Field	200		umhos/cm
CPS-8	CPS-8	CPS-8	10158290	10158290005	5/19/2011	Water	995879.43	822216.83	FLOW	Flow	0.066		gpm
									TEMP	Temperature	14		oC
									PH	pH	6.4		Std Units
									ACIDITY	Acidity	23,700 J	J	ug/L
									ALKLNT	Alkalinity	22,500		ug/L
									AS_T_R	Arsenic, Total Recoverable	3.8		ug/L
									CD_T_R	Cadmium, Total Recoverable	7.8		ug/L
									CA	Calcium, Total	10,300		ug/L
									CU_T_R	Copper, Total Recoverable	339 J	J	ug/L
									HARDNE	Hardness, Total	41,500		ug/L
									FE_T_R	Iron, Total Recoverable	1,950 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	7.7		ug/L
									MG	Magnesium, Total	3,820 J	J	ug/L
									MN_T_R	Manganese, Total	31.9		ug/L
									O2_DIS	Oxygen, Dissolved	10,640		ug/L
									K	Potassium, Total	1,770 J	J	ug/L
									NA	Sodium, Total	3,900 J	J	ug/L
									TDS	Solids, Total Dissolved	122,000		ug/L
									TS	Solids, Total Suspended	258,000 J	J	ug/L
									SULFAT	Sulfate	19,600		ug/L
									ZN_T_R	Zinc, Total Recoverable	361 J	J	ug/L
									SPCON_	Conductance Field	49		umhos/cm

TABLE 3-10. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MINE AOC
BLACK PINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
CPS-10B	CPS-10	CPS-10	10158290	10158290011	5/19/2011	Water	996249.08	822739.37	FLOW	Flow	0.5		gpm
					5/16/2011				TEMP	Temperature	8.51		oC
									PH	pH	4.51		Std Units
									O2_DIS	Oxygen, Dissolved	14,700		ug/L
									SPCON_	Conductance Field	528		umhos/cm
	CPS-10B	CPS-10B			5/19/2011				ACIDITY	Acidity	40,200 J	J	ug/L
									ALKLNT	Alkalinity	ND(5,000)		ug/L
									AS_T_R	Arsenic, Total Recoverable	4.5		ug/L
									CD_T_R	Cadmium, Total Recoverable	132		ug/L
									CA	Calcium, Total	58,600		ug/L
									CU_T_R	Copper, Total Recoverable	8,600 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	4,700 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	9.2		ug/L
									MG	Magnesium, Total	24,300 J	J	ug/L
									MN_T_R	Manganese, Total	2,590		ug/L
									K	Potassium, Total	4,630 J	J	ug/L
									NA	Sodium, Total	6,680 J	J	ug/L
									TDS	Solids, Total Dissolved	462,000		ug/L
									TS	Solids, Total Suspended	644,000 J	J	ug/L
									SULFAT	Sulfate	266,000		ug/L
									ZN_T_R	Zinc, Total Recoverable	9,720 J	J	ug/L
CPSW-1	CPSW-1	CPSW-1	10158290	10158290006	5/19/2011	Water	998058.96	822260.26	FLOW	Flow	70		gpm
									TEMP	Temperature	13.67		oC
									PH	pH	6.57		Std Units
									ACIDITY	Acidity	26,600 J	J	ug/L
									ALKLNT	Alkalinity	12,800		ug/L
									AS_T_R	Arsenic, Total Recoverable	3.1		ug/L
									CD_T_R	Cadmium, Total Recoverable	2.2		ug/L
									CA	Calcium, Total	6,200		ug/L
									CU_T_R	Copper, Total Recoverable	89.9 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	1,380 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	4.6		ug/L
									MG	Magnesium, Total	2,130 J	J	ug/L
									MN_T_R	Manganese, Total	26.7		ug/L
									O2_DIS	Oxygen, Dissolved	9,710		ug/L
									K	Potassium, Total	1,920 J	J	ug/L
									NA	Sodium, Total	3,200 J	J	ug/L
									TDS	Solids, Total Dissolved	104,000		ug/L
									TS	Solids, Total Suspended	5,000 J	J	ug/L
									SULFAT	Sulfate	14,800		ug/L
									ZN_T_R	Zinc, Total Recoverable	184 J	J	ug/L
									SPCON_	Conductance Field	68		umhos/cm

TABLE 3-10. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MINE AOC BLACK PINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
CPSW-2	CPSW-2	CPSW-2	10158290	10158290007	5/19/2011	Water	999451.31	822083.45	FLOW	Flow	105		gpm
									TEMP	Temperature	17.14		oC
									PH	pH	6.1		Std Units
									ACIDITY	Acidity	36,300 J	J	ug/L
									ALKLNT	Alkalinity	10,200		ug/L
									AS_T_R	Arsenic, Total Recoverable	2.3		ug/L
									CD_T_R	Cadmium, Total Recoverable	2.3		ug/L
									CA	Calcium, Total	6,960		ug/L
									CU_T_R	Copper, Total Recoverable	126 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	777 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	3.1		ug/L
									MG	Magnesium, Total	2,320 J	J	ug/L
									MN_T_R	Manganese, Total	19.3		ug/L
									O2_DIS	Oxygen, Dissolved	9,040		ug/L
									K	Potassium, Total	2,030 J	J	ug/L
									NA	Sodium, Total	3,280 J	J	ug/L
									TDS	Solids, Total Dissolved	116,000		ug/L
					5/16/2011				TS	Solids, Total Suspended	4,500 J	J	ug/L
									SULFAT	Sulfate	21,900		ug/L
									ZN_T_R	Zinc, Total Recoverable	199 J	J	ug/L
									SPCON_	Conductance Field	90		umhos/cm
DTRD	DTRD	CPS-10A	10158290	10158290002	5/19/2011	Water			FLOW	Flow	1.5		gpm
									TEMP	Temperature	8.54?0		oC
									PH	pH	3.42?0		Std Units
									ACIDITY	Acidity	75,700 J	J	ug/L
									ALKLNT	Alkalinity	ND(5,000)		ug/L
									AS_T_R	Arsenic, Total Recoverable	2.9		ug/L
									CD_T_R	Cadmium, Total Recoverable	215		ug/L
									CA	Calcium, Total	20,000		ug/L
									CU_T_R	Copper, Total Recoverable	20,900 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	1,140 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	34.3		ug/L
									MG	Magnesium, Total	9,020 J	J	ug/L
									MN_T_R	Manganese, Total	6,640		ug/L
									O2_DIS	Oxygen, Dissolved	11,050		ug/L
									K	Potassium, Total	2,100 J	J	ug/L
									NA	Sodium, Total	4,180 J	J	ug/L
									TDS	Solids, Total Dissolved	284,000		ug/L
		Dump Toe Runoff Ditch							TS	Solids, Total Suspended	76,800 J	J	ug/L
									SULFAT	Sulfate	169,000		ug/L
									ZN_T_R	Zinc, Total Recoverable	20,400 J	J	ug/L
									SPCON_	Conductance Field	415?0		umhos/cm

TABLE 3-10. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MINE AOC
BLACK PINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
North Area Spring (N)	North Area Spring (N)	CPS-11	10158290	10158290012	5/19/2011	Water			FLOW	Flow	3		gpm
									TEMP	Temperature	7.79		oC
									PH	pH	5.35		Std Units
									ACIDITY	Acidity	34,400 J	J	ug/L
									ALKLNT	Alkalinity	12,900		ug/L
									AS_T_R	Arsenic, Total Recoverable	1.7		ug/L
									CD_T_R	Cadmium, Total Recoverable	13.4		ug/L
									CA	Calcium, Total	13,300		ug/L
									CU_T_R	Copper, Total Recoverable	638 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	1,340 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	2.8		ug/L
									MG	Magnesium, Total	5,120 J	J	ug/L
									MN_T_R	Manganese, Total	113		ug/L
									O2_DIS	Oxygen, Dissolved	14,300		ug/L
									K	Potassium, Total	1,930 J	J	ug/L
									NA	Sodium, Total	3,260 J	J	ug/L
		North Area Spring (N)							TDS	Solids, Total Dissolved	144,000		ug/L
									TS	Solids, Total Suspended	21,000 J	J	ug/L
									SULFAT	Sulfate	28,500 J	J	ug/L
									ZN_T_R	Zinc, Total Recoverable	1,010 J	J	ug/L
									SPCON_	Conductance Field	145		umhos/cm
North Runoff	North Runoff	NORTH RUNOFF	10158290	10158290008	5/19/2011	Water	996449.23	822751.72	FLOW	Flow	15		gpm
									TEMP	Temperature	12.09		oC
									PH	pH	6.18		Std Units
									ACIDITY	Acidity	36,300 J	J	ug/L
									ALKLNT	Alkalinity	10,500		ug/L
									AS_T_R	Arsenic, Total Recoverable	2.1		ug/L
									CD_T_R	Cadmium, Total Recoverable	17.9		ug/L
									CA	Calcium, Total	16,600		ug/L
									CU_T_R	Copper, Total Recoverable	666 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	1,460 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	3.2		ug/L
									MG	Magnesium, Total	6,460 J	J	ug/L
									MN_T_R	Manganese, Total	152		ug/L
									O2_DIS	Oxygen, Dissolved	10,420		ug/L
									K	Potassium, Total	2,210 J	J	ug/L
									NA	Sodium, Total	3,800 J	J	ug/L
									TDS	Solids, Total Dissolved	161,000		ug/L
									TS	Solids, Total Suspended	26,900 J	J	ug/L
									SULFAT	Sulfate	60,500		ug/L
									ZN_T_R	Zinc, Total Recoverable	1,310 J	J	ug/L
									SPCON_	Conductance Field	171		umhos/cm

J – Estimated concentration
oC - degrees Celsius
gpm - gallons per minute
ug/L - micrograms per liter
umhos/cm - micro hmos per centimeter
Std Units - Standard units
ND() - Analyte was not detected (reporting limit)

TABLE 3-11. GROUNDWATER ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	X	Y	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
CMMW-1	CMMW-1	CMMW-1	10156716	10156716001	5/5/2011	995873.6412	822600.3388	ALKLNTY	Alkalinity	42,600		ug/L
								DAS	Arsenic, Dissolved	1.6		ug/L
								DCD	Cadmium, Dissolved	0.13		ug/L
								DCA	Calcium, Dissolved	7,040		ug/L
								DCU	Copper, Dissolved	1.3 J	J	ug/L
								DFE	Iron, Dissolved	550 J	J	ug/L
								DPB	Lead, Dissolved	0.9 J	J	ug/L
								DMG	Magnesium, Dissolved	3,960		ug/L
								DMN	Manganese, Dissolved	7.1 J	J	ug/L
								DK	Potassium, Dissolved	1,270 J	J	ug/L
								DNA	Sodium, Dissolved	8,380		ug/L
								TDS	Solids, Total Dissolved	86,000 J	J	ug/L
								TSS	Solids, Total Suspended	1,930,000 J	J	ug/L
								SULFATE	Sulfate	2,300		ug/L
								DZN	Zinc, Dissolved	6.1		ug/L
								TEMP	Temperature	5.1		oC
								PH	pH	5.7		Std Units
								O2_DIS	Oxygen, Dissolved	8,600		ug/L
								SPCON_F	Conductance Field	120		umhos/cm
CMMW-2	CMMW-2	CMMW-2	10156716	10156716002	5/5/2011	995414.7286	822839.4646	ALKLNTY	Alkalinity	176,000		ug/L
								DAS	Arsenic, Dissolved	108		ug/L
								DCD	Cadmium, Dissolved	14.5		ug/L
								DCA	Calcium, Dissolved	277,000		ug/L
								DCU	Copper, Dissolved	239		ug/L
								DFE	Iron, Dissolved	121 J	J	ug/L
								DPB	Lead, Dissolved	8.6 J	J	ug/L
								DMG	Magnesium, Dissolved	56,500		ug/L
								DMN	Manganese, Dissolved	103		ug/L
								DK	Potassium, Dissolved	17,200		ug/L
								DNA	Sodium, Dissolved	106,000		ug/L
								TDS	Solids, Total Dissolved	1,600,000		ug/L
								TSS	Solids, Total Suspended	89,900		ug/L
								SULFATE	Sulfate	927,000		ug/L
								DZN	Zinc, Dissolved	1,410		ug/L
								TEMP	Temperature	5.7		oC
								PH	pH	5.8		Std Units
								O2_DIS	Oxygen, Dissolved	8,500		ug/L
								SPCON_F	Conductance Field	200		umhos/cm

TABLE 3-11. GROUNDWATER ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	X	Y	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
CMMW-3	CMMW-3	CMMW-3	10156716	10156716003	5/5/2011	996105.0482	822910.5532	ALKLNTY	Alkalinity	ND(5,000)		ug/L
								DAS	Arsenic, Dissolved	ND(0.5)		ug/L
								DCD	Cadmium, Dissolved	170		ug/L
								DCA	Calcium, Dissolved	57,200		ug/L
								DCU	Copper, Dissolved	12,100		ug/L
								DFE	Iron, Dissolved	ND(50)	UJ	ug/L
								DPB	Lead, Dissolved	0.31 J	J	ug/L
								DMG	Magnesium, Dissolved	23,400		ug/L
								DMN	Manganese, Dissolved	4,280		ug/L
								DK	Potassium, Dissolved	4,250		ug/L
								DNA	Sodium, Dissolved	6,430		ug/L
								TDS	Solids, Total Dissolved	516,000		ug/L
								TSS	Solids, Total Suspended	358,000		ug/L
								SULFATE	Sulfate	282,000		ug/L
								DZN	Zinc, Dissolved	12,200		ug/L
								TEMP	Temperature	7.2		oC
								PH	pH	5.1		Std Units
								O2_DIS	Oxygen, Dissolved	11,800		ug/L
								SPCON_F	Conductance Field	690		umhos/cm
CMMW-4	CMMW-4	CMMW-4	10156716	10156716004	5/5/2011	996275.8875	822695.3889	ALKLNTY	Alkalinity	ND(5,000)		ug/L
								DAS	Arsenic, Dissolved	ND(0.5)		ug/L
								DCD	Cadmium, Dissolved	51.9		ug/L
								DCA	Calcium, Dissolved	39,700		ug/L
								DCU	Copper, Dissolved	3,120		ug/L
								DFE	Iron, Dissolved	ND(50)	UJ	ug/L
								DPB	Lead, Dissolved	0.12 J	J	ug/L
								DMG	Magnesium, Dissolved	14,500		ug/L
								DMN	Manganese, Dissolved	884		ug/L
								DK	Potassium, Dissolved	2,340		ug/L
								DNA	Sodium, Dissolved	7,000		ug/L
								TDS	Solids, Total Dissolved	294,000		ug/L
								TSS	Solids, Total Suspended	21,900		ug/L
								SULFATE	Sulfate	174,000		ug/L
								DZN	Zinc, Dissolved	3,940		ug/L
								TEMP	Temperature	5.3		oC
								PH	pH	4.9		Std Units
								O2_DIS	Oxygen, Dissolved	11,800		ug/L
								SPCON_F	Conductance Field	430		umhos/cm

TABLE 3-11. GROUNDWATER ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	X	Y	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
CMMW-5	CMMW-5	CMMW-5	10156716	10156716005	5/5/2011	995478.4408	822901.3368	ALKLNTY	Alkalinity	ND(5,000)		ug/L
								DAS	Arsenic, Dissolved	3		ug/L
								DCD	Cadmium, Dissolved	152		ug/L
								DCA	Calcium, Dissolved	23,500		ug/L
								DCU	Copper, Dissolved	7,100		ug/L
								DFE	Iron, Dissolved	988 J	J	ug/L
								DPB	Lead, Dissolved	23.2 J	J	ug/L
								DMG	Magnesium, Dissolved	8,100		ug/L
								DMN	Manganese, Dissolved	4,040		ug/L
								DK	Potassium, Dissolved	3,400		ug/L
								DNA	Sodium, Dissolved	2,670		ug/L
								TDS	Solids, Total Dissolved	268,000		ug/L
								TSS	Solids, Total Suspended	782,000		ug/L
								SULFATE	Sulfate	113,000		ug/L
								DZN	Zinc, Dissolved	10,700		ug/L
								TEMP	Temperature	6.6		oC
								PH	pH	5.2		Std Units
								O2_DIS	Oxygen, Dissolved	8,600		ug/L
								SPCON_F	Conductance Field	230		umhos/cm
CMMW-6	CMMW-6	CMMW-6	10156716	10156716006	5/5/2011	995415.6679	823222.6316	ALKLNTY	Alkalinity	39,000		ug/L
								DAS	Arsenic, Dissolved	1.9		ug/L
								DCD	Cadmium, Dissolved	0.53		ug/L
								DCA	Calcium, Dissolved	11,600		ug/L
								DCU	Copper, Dissolved	19.4		ug/L
								DFE	Iron, Dissolved	661 J	J	ug/L
								DPB	Lead, Dissolved	4.1 J	J	ug/L
								DMG	Magnesium, Dissolved	4,920		ug/L
								DMN	Manganese, Dissolved	19.9		ug/L
								DK	Potassium, Dissolved	2,220		ug/L
								DNA	Sodium, Dissolved	3,270		ug/L
								TDS	Solids, Total Dissolved	150,000		ug/L
								TSS	Solids, Total Suspended	311,000		ug/L
								SULFATE	Sulfate	11,900		ug/L
								DZN	Zinc, Dissolved	33.3		ug/L
								TEMP	Temperature	5.9		oC
								PH	pH	5.4		Std Units
								O2_DIS	Oxygen, Dissolved	11,600		ug/L
								SPCON_F	Conductance Field	130		umhos/cm

TABLE 3-11. GROUNDWATER ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	X	Y	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
CMMW-7	CMMW-7	CMMW-7	10156716	10156716007	5/5/2011	995985.2132	822968.8146	ALKLNTY	Alkalinity	13,000		ug/L
								DAS	Arsenic, Dissolved	2.2		ug/L
								DCD	Cadmium, Dissolved	305		ug/L
								DCA	Calcium, Dissolved	95,600		ug/L
								DCU	Copper, Dissolved	22,200		ug/L
								DFE	Iron, Dissolved	2,050 J	J	ug/L
								DPB	Lead, Dissolved	2.6 J	J	ug/L
								DMG	Magnesium, Dissolved	38,800		ug/L
								DMN	Manganese, Dissolved	7,740		ug/L
								DK	Potassium, Dissolved	5,650		ug/L
								DNA	Sodium, Dissolved	7,320		ug/L
								TDS	Solids, Total Dissolved	802,000		ug/L
								TSS	Solids, Total Suspended	4,170,000		ug/L
								SULFATE	Sulfate	480,000		ug/L
								DZN	Zinc, Dissolved	22,300		ug/L
								TEMP	Temperature	7.6		oC
								PH	pH	4.4		Std Units
								O2_DIS	Oxygen, Dissolved	11,500		ug/L
								SPCON_F	Conductance Field	100		umhos/cm
CMMW-8	CMMW-8	CMMW-8	10156716	10156716008	5/5/2011	995905.6926	822780.2681	ALKLNTY	Alkalinity	18,600		ug/L
								DAS	Arsenic, Dissolved	0.57		ug/L
								DCD	Cadmium, Dissolved	155		ug/L
								DCA	Calcium, Dissolved	145,000		ug/L
								DCU	Copper, Dissolved	8,420		ug/L
								DFE	Iron, Dissolved	281 J	J	ug/L
								DPB	Lead, Dissolved	0.48 J	J	ug/L
								DMG	Magnesium, Dissolved	63,800		ug/L
								DMN	Manganese, Dissolved	4,550		ug/L
								DK	Potassium, Dissolved	5,520		ug/L
								DNA	Sodium, Dissolved	32,900		ug/L
								TDS	Solids, Total Dissolved	1,020,000		ug/L
								TSS	Solids, Total Suspended	350,000		ug/L
								SULFATE	Sulfate	656,000		ug/L
								DZN	Zinc, Dissolved	12,300		ug/L
								TEMP	Temperature	7		oC
								PH	pH	5.4		Std Units
								O2_DIS	Oxygen, Dissolved	10,900		ug/L
								SPCON_F	Conductance Field	130		umhos/cm

TABLE 3-11. GROUNDWATER ANALYTICAL RESULTS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	X	Y	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
CMMW-9	CMMW-9	CMMW-9	10156716	10156716009	5/5/2011	995908.6085	822785.0912	ALKLNTY	Alkalinity	23,400		ug/L
								DAS	Arsenic, Dissolved	0.72		ug/L
								DCD	Cadmium, Dissolved	6.9		ug/L
								DCA	Calcium, Dissolved	87,200		ug/L
								DCU	Copper, Dissolved	24.1		ug/L
								DFE	Iron, Dissolved	197 J	J	ug/L
								DPB	Lead, Dissolved	0.38 J	J	ug/L
								DMG	Magnesium, Dissolved	26,800		ug/L
								DMN	Manganese, Dissolved	86.4		ug/L
								DK	Potassium, Dissolved	4,910		ug/L
								DNA	Sodium, Dissolved	29,400		ug/L
								TDS	Solids, Total Dissolved	616,000		ug/L
								TSS	Solids, Total Suspended	1,330,000		ug/L
								SULFATE	Sulfate	299,000		ug/L
								DZN	Zinc, Dissolved	709		ug/L
								TEMP	Temperature	7		oC
								PH	pH	5.4		Std Units
								O2_DIS	Oxygen, Dissolved	12,100		ug/L
								SPCON_F	Conductance Field	790		umhos/cm

J – Estimated concentration
UJ – Estimated reporting limit oC - degrees Celsius
gpm - gallons per minute ug/L - micrograms per liter
umhos/cm - micro mhos per centimeter
Std Units - Standard units
ND() - Analyte was not detected (reporting limit)

TABLE 3-12. SURFACE WATER-MATRIX ANALYTICAL RESULTS
TIM SMITH MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
TSP-3	TSP-3	TSP-3	10160707	10160707005	6/13/2011	Water	989432.59	823797.606	ACIDITY	Acidity	8,200		ug/L
									ALKLNTY	Alkalinity	11,900		ug/L
									SB_T_R	Antimony, Total Recoverable	0.53		ug/L
									AS_T_R	Arsenic, Total Recoverable	1.2		ug/L
									BA_T_R	Barium, Total Recoverable	85.1		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.14		ug/L
									CR_T_R	Chromium, Total Recoverable	1.7		ug/L
									CU_T_R	Copper, Total Recoverable	30.5		ug/L
									FE_T_R	Iron, Total Recoverable	1,180 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	0.86 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	11.5		ug/L
									NI_T_R	Nickel, Total Recoverable	2.1		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	80,000		ug/L
									TSS	Solids, Total Suspended	3,100		ug/L
									SULFATE	Sulfate	4,900		ug/L
									ZN_T_R	Zinc, Total Recoverable	10.4		ug/L
									FLOW	Flow	1956.77		gpm
									O2_DIS	Oxygen, Dissolved	9.9		mg/L
									TEMP	Temperature	8.8		oC
									PH	pH	7.3		Std Units
									SPCON_F	Conductance Field	30		umhos/cm
			10160851	10160851005					HG_T_R	Mercury, Total Recoverable	0.0128		ug/L
TSP-6	TSP-6	TSP-6	10160673	10160673004	6/14/2011	Water	987859.714	825256.19	ACIDITY	Acidity	12,000		ug/L
									ALKLNTY	Alkalinity	12,100		ug/L
									SB_T_R	Antimony, Total Recoverable	0.53		ug/L
									AS_T_R	Arsenic, Total Recoverable	1.1		ug/L
									BA_T_R	Barium, Total Recoverable	85.4		ug/L
									CD_T_R	Cadmium, Total Recoverable	ND(0.08)		ug/L
									CR_T_R	Chromium, Total Recoverable	1.3		ug/L
									CU_T_R	Copper, Total Recoverable	22.5		ug/L
									FE_T_R	Iron, Total Recoverable	1,000		ug/L
									PB_T_R	Lead, Total Recoverable	0.97 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	8.9		ug/L
									NI_T_R	Nickel, Total Recoverable	2.2		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	101,000		ug/L
									TSS	Solids, Total Suspended	2,700		ug/L
									SULFATE	Sulfate	4,200		ug/L
									ZN_T_R	Zinc, Total Recoverable	8.2		ug/L
									FLOW	Flow	2019.6		gpm
									O2_DIS	Oxygen, Dissolved	10		mg/L
									TEMP	Temperature	10.2		oC
									PH	pH	7.48		Std Units
									SPCON_F	Conductance Field	31		umhos/cm
			10160851	10160851002					HG_T_R	Mercury, Total Recoverable	0.0132		ug/L

TABLE 3-12. SURFACE WATER-MATRIX ANALYTICAL RESULTS
TIM SMITH MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
TSP-8	TSP-8	TSP-8	10160707	10160707001	6/13/2011	Water	990839.035	824292.65	ACIDITY	Acidity	12,000		ug/L
									ALKLNTY	Alkalinity	13,400		ug/L
									SB_T_R	Antimony, Total Recoverable	1.2		ug/L
									AS_T_R	Arsenic, Total Recoverable	1.7		ug/L
									BA_T_R	Barium, Total Recoverable	83.5		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.28		ug/L
									CR_T_R	Chromium, Total Recoverable	2.3		ug/L
									CU_T_R	Copper, Total Recoverable	24.2		ug/L
									HARDNES	Hardness, Total	17,800		ug/L
									FE_T_R	Iron, Total Recoverable	2,130 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	1.8 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	13.6		ug/L
									NI_T_R	Nickel, Total Recoverable	3.4		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	125,000		ug/L
									TSS	Solids, Total Suspended	1,500		ug/L
									SULFATE	Sulfate	10,100		ug/L
									ZN_T_R	Zinc, Total Recoverable	22.3		ug/L
									FLOW	Flow	300.696		gpm
									O2_DIS	Oxygen, Dissolved	8.4		mg/L
									TEMP	Temperature	11.3		oC
									PH	pH	7.23		Std Units
									SPCON_F	Conductance Field	35		umhos/cm
			10160851	10160851003					HG_T_R	Mercury, Total Recoverable	0.0208		ug/L
TSP-9	TSP-9	TSP-9	10160707	10160707007	6/13/2011	Water	991859.77	`	ACIDITY	Acidity	13,900		ug/L
									ALKLNTY	Alkalinity	15,200		ug/L
									SB_T_R	Antimony, Total Recoverable	0.57		ug/L
									AS_T_R	Arsenic, Total Recoverable	1.7		ug/L
									BA_T_R	Barium, Total Recoverable	86.7		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.25		ug/L
									CR_T_R	Chromium, Total Recoverable	2.9		ug/L
									CU_T_R	Copper, Total Recoverable	8.9		ug/L
									FE_T_R	Iron, Total Recoverable	2,780 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	1.5 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	18.8		ug/L
									NI_T_R	Nickel, Total Recoverable	4.2		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	122,000		ug/L
									TSS	Solids, Total Suspended	4,100		ug/L
									SULFATE	Sulfate	4,100		ug/L
									ZN_T_R	Zinc, Total Recoverable	19		ug/L
									FLOW	Flow	228.888		gpm
									O2_DIS	Oxygen, Dissolved	9.2		mg/L
									TEMP	Temperature	10.9		oC
									PH	pH	6.65		Std Units
									SPCON_F	Conductance Field	34		umhos/cm
			10160851	10160851006					HG_T_R	Mercury, Total Recoverable	0.0199		ug/L

TABLE 3-12. SURFACE WATER-MATRIX ANALYTICAL RESULTS
TIM SMITH MINE AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
TSP-10	TSP-10	TSP-10	10158290	10158290009	5/19/2011	Water	993096.75	823644.40	FLOW	Flow	5		gpm
									TEMP	Temperature	8.17		oC
									PH	pH	5.95		Std Units
									ACIDITY	Acidity	ND(5,000)	UJ	ug/L
									ALKLNTY	Alkalinity	13,800		ug/L
									AS_T_R	Arsenic, Total Recoverable	2		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.08		ug/L
									CA	Calcium, Total	3,280		ug/L
									CU_T_R	Copper, Total Recoverable	6.3 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	2,990 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	2.7		ug/L
									MG	Magnesium, Total	2,130 J	J	ug/L
									MN_T_R	Manganese, Total Recoverable	52.6		ug/L
									O2_DIS	Oxygen, Dissolved	14,400		ug/L
									K	Potassium, Total	1,500 J	J	ug/L
									NA	Sodium, Total	2,050 J	J	ug/L
									TDS	Solids, Total Dissolved	100,000		ug/L
									TSS	Solids, Total Suspended	28,100 J	J	ug/L
									SULFATE	Sulfate	3,300		ug/L
									ZN_T_R	Zinc, Total Recoverable	17.1 J	J	ug/L
									SPCON_F	Conductance Field	41		umhos/cm

[a] Silver was included in original laboratory analytical reports, but was removed in revised reports by the laboratory

J – Estimated concentration
JB – Estimated concentration due to blank contamination
UJ – Estimated reporting limit
oC - degrees Celsius
gpm - gallons per minute
ug/L - micrograms per liter
umhos/cm - micro hmos per centimeter
Std Units - Standard units
ND() - Analyte was not detected (reporting limit)

TABLE 3-13. SURFACE WATER-MATRIX ANALYTICAL RESULTS HISTORIC MINE AOC BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte	Value	Reviewer	Units
MCSP-1	MCSP-1	MCSP-1	10160707	1016070708	6/13/2011	Water	992849.3321	826967.2109	ACIDITY	Acidity	25,200		ug/L
									ALKLNT	Alkalinity	8,900		ug/L
									SB_T_R	Antimony, Total	1.4		ug/L
									AS_T_R	Arsenic, Total	1.6		ug/L
									BA_T_R	Barium, Total	65.7		ug/L
									CD_T_R	Cadmium, Total	0.26		ug/L
									CR_T_R	Chromium, Total	1.5		ug/L
									CU_T_R	Copper, Total	107		ug/L
									HARDNE	Hardness, Total	17,800		ug/L
									FE_T_R	Iron, Total Recoverable	1,080 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	2.9 JB	JB	ug/L
									MN_T_R	Manganese, Total	15.4		ug/L
									NI_T_R	Nickel, Total Recoverable	2.3		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TD	Solids, Total Dissolved	105,000		ug/L
									TS	Solids, Total Suspended	5,300		ug/L
									SULFAT	Sulfate	11,400		ug/L
									ZN_T_R	Zinc, Total Recoverable	31.4		ug/L
									FLOW	Flow	175.032		gpm
									O2_DIS	Oxygen, Dissolved	NM		mg/L
									PH	pH	NM		Std Units
									SPCON_	Conductance Field	NM		umhos/c
									TEMP	Temperature	NM		oC
			10160851	1016085100					HG_T_R	Mercury, Total	0.045		ug/L
Road cut	Road cut	ROAD CUT	10158290	10158290013	5/19/2011	Water	992119.23	826789.34	TEMP	Temperature	6.62		oC
									PH	pH	6.13		Std Units
									ACIDITY	Acidity	11,100 J	J	ug/L
									ALKLNT	Alkalinity	13,100		ug/L
									AS_T_R	Arsenic, Total	3.3		ug/L
									CD_T_R	Cadmium, Total	ND(0.08		ug/L
									CA	Calcium, Total	3,190		ug/L
									CU_T_R	Copper, Total	16.8 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	1,810 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	5.3		ug/L
									MG	Magnesium, Total	1,560 J	J	ug/L
									MN_T_R	Manganese, Total	16		ug/L
									O2_DIS	Oxygen, Dissolved	17,490		ug/L
									K	Potassium, Total	1,700 J	J	ug/L
									NA	Sodium, Total	2,270 J	J	ug/L
									TD	Solids, Total Dissolved	58,000		ug/L
									TS	Solids, Total Suspended	7,300 J	J	ug/L
									SULFAT	Sulfate	6,700		ug/L
									ZN_T_R	Zinc, Total Recoverable	9.2 J	J	ug/L
									SPCON_	Conductance Field	41		umhos/c

[a] Silver was included in original laboratory analytical reports, but was removed in revised reports by the laboratory

J – Estimated concentration

JB – Estimated concentration due to blank contamination

UJ – Estimated reporting limit oC - degrees Celsius

gpm - gallons per minute ug/L - micrograms per liter

umhos/cm - micro hmos per centimeter

Std Units - Standard units

ND() - Analyte was not detected (reporting limit)

TABLE 3-14. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CML-SW-01	CML-SW-01	CML-SW-01	10160756	10160756005	6/15/2011	Water	989313.0628	838754.647	ACIDITY	Acidity	21,500		ug/L
									ALKLNTY	Alkalinity	6,800		ug/L
									SB_T_R	Antimony, Total Recoverable	3.4		ug/L
									AS_T_R	Arsenic, Total Recoverable	1.7		ug/L
									BA_T_R	Barium, Total Recoverable	36.6		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.15		ug/L
									CR_T_R	Chromium, Total Recoverable	0.83		ug/L
									CU_T_R	Copper, Total Recoverable	17.4		ug/L
									FE_T_R	Iron, Total Recoverable	617 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	3.8 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	7.1		ug/L
									NI_T_R	Nickel, Total Recoverable	0.88		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)	UJ	ug/L
									TDS	Solids, Total Dissolved	39,000		ug/L
									TSS	Solids, Total Suspended	1,400		ug/L
									SULFATE	Sulfate	3,500		ug/L
									ZN_T_R	Zinc, Total Recoverable	14.2		ug/L
									FLOW	Flow	34333.2		gpm
									O2_DIS	Oxygen, Dissolved	10,400		ug/L
									PH	pH	7.16		Std Units
									SPCON_F	Conductance Field	20		umhos/cm
									TEMP	Temperature	7.4		oC
			10160853	10160853006					HG_T_R	Mercury, Total Recoverable	0.357		ug/L
CML-SW-02	CML-SW-02	CML-SW-02	10160756	10160756003	6/15/2011	Water	988686.083	831557.868	ACIDITY	Acidity	21,500		ug/L
									ALKLNTY	Alkalinity	7,700		ug/L
									SB_T_R	Antimony, Total Recoverable	1.7 J	J	ug/L
									AS_T_R	Arsenic, Total Recoverable	1.2 J	J	ug/L
									BA_T_R	Barium, Total Recoverable	43.5		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.095		ug/L
									CR_T_R	Chromium, Total Recoverable	0.71 J	J	ug/L
									CU_T_R	Copper, Total Recoverable	14 J	J	ug/L
									FE_T_R	Iron, Total Recoverable	420 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	5.1 J	J	ug/L
									MN_T_R	Manganese, Total Recoverable	10.4 J	J	ug/L
									NI_T_R	Nickel, Total Recoverable	0.77		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)	UJ	ug/L
									TDS	Solids, Total Dissolved	37,000		ug/L
									TSS	Solids, Total Suspended	1,700		ug/L
									SULFATE	Sulfate	2,800		ug/L
									ZN_T_R	Zinc, Total Recoverable	7		ug/L
									FLOW	Flow	21632.16		gpm
									O2_DIS	Oxygen, Dissolved	10,300		ug/L
									PH	pH	7.21		Std Units
									SPCON_F	Conductance Field	20		umhos/cm
									TEMP	Temperature	7.8		oC
			10160853	10160853013					HG_T_R	Mercury, Total Recoverable	0.0772		ug/L

TABLE 3-14. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MILL AOC BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CML-SW-03	CML-SW-03	CML-SW-03	10160655	10160655002	6/15/2011	Water	988786.478	829207.604	ACIDITY	Acidity	13,900		ug/L
									ALKLNTY	Alkalinity	11,700		ug/L
									SB_T_R	Antimony, Total Recoverable	1.9		ug/L
									AS_T_R	Arsenic, Total Recoverable	2.3		ug/L
									BA_T_R	Barium, Total Recoverable	59.1		ug/L
									CD_T_R	Cadmium, Total Recoverable	ND(0.08)		ug/L
									CR_T_R	Chromium, Total Recoverable	1.2		ug/L
									CU_T_R	Copper, Total Recoverable	20.8		ug/L
									FE_T_R	Iron, Total Recoverable	1,450 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	2.9 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	8.8		ug/L
									NI_T_R	Nickel, Total Recoverable	1.7		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	103,000		ug/L
									TSS	Solids, Total Suspended	2,000		ug/L
									SULFATE	Sulfate	6,700		ug/L
									ZN_T_R	Zinc, Total Recoverable	10.5		ug/L
									FLOW	Flow	1234.2		gpm
									O2_DIS	Oxygen, Dissolved	10,700		ug/L
									PH	pH	7.06		Std Units
									SPCON_F	Conductance Field	39		umhos/cm
									TEMP	Temperature	5.5		oC
			10160853	10160853003					HG_T_R	Mercury, Total Recoverable	0.123		ug/L
CML-SW-04	CML-SW-04	CML-SW-04	10160655	10160655008	6/15/2011	Water	988269.426	828557.353	ACIDITY	Acidity	10,100		ug/L
									ALKLNTY	Alkalinity	7,800		ug/L
									SB_T_R	Antimony, Total Recoverable	ND(0.5)		ug/L
									AS_T_R	Arsenic, Total Recoverable	0.53		ug/L
									BA_T_R	Barium, Total Recoverable	41.1		ug/L
									CD_T_R	Cadmium, Total Recoverable	ND(0.08)		ug/L
									CR_T_R	Chromium, Total Recoverable	0.62		ug/L
									CU_T_R	Copper, Total Recoverable	3.8		ug/L
									FE_T_R	Iron, Total Recoverable	288 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	0.31/ND(0.31)U	U	ug/L
									MN_T_R	Manganese, Total Recoverable	4.7		ug/L
									NI_T_R	Nickel, Total Recoverable	0.54		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	29,000		ug/L
									TSS	Solids, Total Suspended	1,500		ug/L
									SULFATE	Sulfate	2,600		ug/L
									ZN_T_R	Zinc, Total Recoverable	ND(5)		ug/L
									FLOW	Flow	21048.72		gpm
									O2_DIS	Oxygen, Dissolved	8,800		ug/L
									PH	pH	6.63		Std Units
									SPCON_F	Conductance Field	23		umhos/cm
									TEMP	Temperature	6.7		oC
			10160853	10160853014					HG_T_R	Mercury, Total Recoverable	0.0337		ug/L

TABLE 3-14. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MILL AOC BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CML-SW-05	CML-SW-05	BP-CML-SW-05	10160655	10160655010	6/15/2011	Water	987789.322	825202.771	HARDNES	Hardness, Total	6,630		ug/L
									ACIDITY	Acidity	20,500		ug/L
									ALKLNTY	Alkalinity	7,200		ug/L
									SB_T_R	Antimony, Total Recoverable	ND(0.5)		ug/L
									AS_T_R	Arsenic, Total Recoverable	ND(0.5)		ug/L
									BA_T_R	Barium, Total Recoverable	39.6		ug/L
									CD_T_R	Cadmium, Total Recoverable	ND(0.08)		ug/L
									CR_T_R	Chromium, Total Recoverable	ND(0.5)		ug/L
									CU_T_R	Copper, Total Recoverable	1		ug/L
									FE_T_R	Iron, Total Recoverable	162 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	0.12/ND(0.12)U	U	ug/L
									MN_T_R	Manganese, Total Recoverable	2.5		ug/L
									NI_T_R	Nickel, Total Recoverable	ND(0.5)		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	24,000		ug/L
									TSS	Solids, Total Suspended	1,400		ug/L
									SULFATE	Sulfate	2,000		ug/L
									ZN_T_R	Zinc, Total Recoverable	ND(5)		ug/L
									FLOW	Flow	16560.72		gpm
									O2_DIS	Oxygen, Dissolved	10,700		ug/L
									PH	pH	7.46		Std Units
									SPCON_F	Conductance Field	16		umhos/cm
									TEMP	Temperature	6.4		oC
			10160853	10160853011					HG_T_R	Mercury, Total Recoverable	0.0042		ug/L
CML-SW-06	CML-SW-06	CML-SW-06	10160707	10160707003	6/13/2011	Water	988475.4747	829216.3495	ACIDITY	Acidity	ND(5,000)		ug/L
									ALKLNTY	Alkalinity	52,500		ug/L
									SB_T_R	Antimony, Total Recoverable	117		ug/L
									AS_T_R	Arsenic, Total Recoverable	36		ug/L
									BA_T_R	Barium, Total Recoverable	59.2		ug/L
									CD_T_R	Cadmium, Total Recoverable	1.1		ug/L
									CR_T_R	Chromium, Total Recoverable	1		ug/L
									CU_T_R	Copper, Total Recoverable	133		ug/L
									FE_T_R	Iron, Total Recoverable	117 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	6.7		ug/L
									MN_T_R	Manganese, Total Recoverable	39.1		ug/L
									NI_T_R	Nickel, Total Recoverable	3.2		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	148,000		ug/L
									TSS	Solids, Total Suspended	2,400		ug/L
									SULFATE	Sulfate	60,000		ug/L
									ZN_T_R	Zinc, Total Recoverable	63.1		ug/L
									FLOW	Flow	NM		gpm
									O2_DIS	Oxygen, Dissolved	NM		mg/L
									PH	pH	NM		Std Units
									SPCON_F	Conductance Field	NM		umhos/cm
									TEMP	Temperature	NM		oC
			10160851	10160851009					HG_T_R	Mercury, Total Recoverable	1.91		ug/L

TABLE 3-14. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MILL AOC BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CML-SW-07	CML-SW-07	CML-SW-07	10160655	10160655001	6/14/2011	Water	988475.4747	830441.9448	ACIDITY	Acidity	23,400		ug/L
									ALKLNTY	Alkalinity	12,100		ug/L
									SB_T_R	Antimony, Total Recoverable	42.9		ug/L
									AS_T_R	Arsenic, Total Recoverable	12.8		ug/L
									BA_T_R	Barium, Total Recoverable	81.7		ug/L
									CD_T_R	Cadmium, Total Recoverable	1.2		ug/L
									CR_T_R	Chromium, Total Recoverable	1.3		ug/L
									CU_T_R	Copper, Total Recoverable	221		ug/L
									FE_T_R	Iron, Total Recoverable	1,430 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	49		ug/L
									MN_T_R	Manganese, Total Recoverable	12.9		ug/L
									NI_T_R	Nickel, Total Recoverable	2.1		ug/L
									AG_T_R	Silver, Total Recoverable	0.64		ug/L
									TDS	Solids, Total Dissolved	94,000		ug/L
									TSS	Solids, Total Suspended	1,800		ug/L
									SULFATE	Sulfate	8,000		ug/L
									ZN_T_R	Zinc, Total Recoverable	40.5		ug/L
									FLOW	Flow	NM		gpm
									O2_DIS	Oxygen, Dissolved	NM		mg/L
									PH	pH	NM		Std Units
									SPCON_F	Conductance Field	NM		umhos/cm
									TEMP	Temperature	NM		oC
			10160851	10160851004					HG_T_R	Mercury, Total Recoverable	2.52		ug/L
CML-SW-08	CML-SW-08	CML-SW-08	10160655	10160655003	6/15/2011	Water	987914.932	836670.883	ACIDITY	Acidity	16,700		ug/L
									ALKLNTY	Alkalinity	7,400		ug/L
									SB_T_R	Antimony, Total Recoverable	3.4		ug/L
									AS_T_R	Arsenic, Total Recoverable	1.7		ug/L
									BA_T_R	Barium, Total Recoverable	37.7		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.12		ug/L
									CR_T_R	Chromium, Total Recoverable	0.68		ug/L
									CU_T_R	Copper, Total Recoverable	16.7		ug/L
									FE_T_R	Iron, Total Recoverable	381 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	3.7 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	5.8		ug/L
									NI_T_R	Nickel, Total Recoverable	0.72		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	50,000		ug/L
									TSS	Solids, Total Suspended	2,100		ug/L
									SULFATE	Sulfate	3,400		ug/L
									ZN_T_R	Zinc, Total Recoverable	12.5		ug/L
									FLOW	Flow	29441.28		gpm
									O2_DIS	Oxygen, Dissolved	8,500		ug/L
									PH	pH	6.54		Std Units
									SPCON_F	Conductance Field	25		umhos/cm
									TEMP	Temperature	8.5		oC
			10160853	10160853007					HG_T_R	Mercury, Total Recoverable	0.193		ug/L

TABLE 3-14. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MILL AOC BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CML-SW-09	CML-SW-09	CML-SW-09	10160756	10160756006	6/15/2011	Water	987927.779	836610.153	ACIDITY	Acidity	17,700		ug/L
									ALKLNTY	Alkalinity	6,500		ug/L
									SB_T_R	Antimony, Total Recoverable	3		ug/L
									AS_T_R	Arsenic, Total Recoverable	1.4		ug/L
									BA_T_R	Barium, Total Recoverable	36.2		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.13		ug/L
									CR_T_R	Chromium, Total Recoverable	0.83		ug/L
									CU_T_R	Copper, Total Recoverable	15.8		ug/L
									FE_T_R	Iron, Total Recoverable	406 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	2.9 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	6.1		ug/L
									NI_T_R	Nickel, Total Recoverable	0.84		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)	UJ	ug/L
									TDS	Solids, Total Dissolved	35,000		ug/L
									TSS	Solids, Total Suspended	2,300		ug/L
									SULFATE	Sulfate	3,500		ug/L
									ZN_T_R	Zinc, Total Recoverable	11.8		ug/L
									FLOW	Flow	27511.44		gpm
									O2_DIS	Oxygen, Dissolved	10,400		ug/L
									PH	pH	7.15		Std Units
									SPCON_F	Conductance Field	20		umhos/cm
									TEMP	Temperature	7.5		oC
			10160853	10160853001					HG_T_R	Mercury, Total Recoverable	0.178		ug/L
CML-SW-10	CML-SW-10	CML-SW-10	10160655	10160655004	6/15/2011	Water	988519.657	834758.136	ACIDITY	Acidity	21,500		ug/L
									ALKLNTY	Alkalinity	7,300		ug/L
									SB_T_R	Antimony, Total Recoverable	2.4		ug/L
									AS_T_R	Arsenic, Total Recoverable	1.2		ug/L
									BA_T_R	Barium, Total Recoverable	37		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.12		ug/L
									CR_T_R	Chromium, Total Recoverable	0.9		ug/L
									CU_T_R	Copper, Total Recoverable	13.8		ug/L
									FE_T_R	Iron, Total Recoverable	338 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	2.7 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	5.2		ug/L
									NI_T_R	Nickel, Total Recoverable	1.6		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	63,000		ug/L
									TSS	Solids, Total Suspended	2,000		ug/L
									SULFATE	Sulfate	3,300		ug/L
									ZN_T_R	Zinc, Total Recoverable	9.4		ug/L
									FLOW	Flow	29486.16		gpm
									O2_DIS	Oxygen, Dissolved	8,600		ug/L
									PH	pH	6.49		Std Units
									SPCON_F	Conductance Field	24		umhos/cm
									TEMP	Temperature	6.5		oC
			10160853	10160853010					HG_T_R	Mercury, Total Recoverable	0.221		ug/L

TABLE 3-14. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MILL AOC BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CML-SW-11	CML-SW-11	CML-SW-11	10160655	10160655011	6/15/2011	Water	989035.5467	832376.4931	ACIDITY	Acidity	7,300		ug/L
									ALKLNTY	Alkalinity	9,200		ug/L
									SB_T_R	Antimony, Total Recoverable	1.7		ug/L
									AS_T_R	Arsenic, Total Recoverable	0.9		ug/L
									BA_T_R	Barium, Total Recoverable	42		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.09		ug/L
									CR_T_R	Chromium, Total Recoverable	0.75		ug/L
									CU_T_R	Copper, Total Recoverable	11.6		ug/L
									FE_T_R	Iron, Total Recoverable	400 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	1.7 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	5.8		ug/L
									NI_T_R	Nickel, Total Recoverable	0.77		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	36,000		ug/L
									TSS	Solids, Total Suspended	1,800		ug/L
									SULFATE	Sulfate	2,900		ug/L
									ZN_T_R	Zinc, Total Recoverable	7.2		ug/L
									FLOW	Flow	25043.04		gpm
									O2_DIS	Oxygen, Dissolved	10,300		ug/L
									PH	pH	7.19		Std Units
									SPCON_F	Conductance Field	20		umhos/cm
									TEMP	Temperature	7.8		oC
			10160853	10160853002					HG_T_R	Mercury, Total Recoverable	0.196		ug/L
CML-SW-13	CML-SW-13	CML-SW-13	10160655	10160655009	6/15/2011	Water	987926.94	825441.073	ACIDITY	Acidity	ND(5,000)		ug/L
									ALKLNTY	Alkalinity	7,600		ug/L
									SB_T_R	Antimony, Total Recoverable	ND(0.5)		ug/L
									AS_T_R	Arsenic, Total Recoverable	ND(0.5)		ug/L
									BA_T_R	Barium, Total Recoverable	40.3		ug/L
									CD_T_R	Cadmium, Total Recoverable	ND(0.08)		ug/L
									CR_T_R	Chromium, Total Recoverable	0.54		ug/L
									CU_T_R	Copper, Total Recoverable	2.1		ug/L
									FE_T_R	Iron, Total Recoverable	168 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	0.18/ND(0.18)U	U	ug/L
									MN_T_R	Manganese, Total Recoverable	3.4		ug/L
									NI_T_R	Nickel, Total Recoverable	0.77		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	26,000		ug/L
									TSS	Solids, Total Suspended	1,100		ug/L
									SULFATE	Sulfate	2,000		ug/L
									ZN_T_R	Zinc, Total Recoverable	6.8		ug/L
									FLOW	Flow	18580.32		gpm
									O2_DIS	Oxygen, Dissolved	8,800		ug/L
									PH	pH	6.83		Std Units
									SPCON_F	Conductance Field	20		umhos/cm
									TEMP	Temperature	6.4		oC
			10160853	10160853012					HG_T_R	Mercury, Total Recoverable	0.006		ug/L

TABLE 3-14. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MILL AOC BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CML-SW-14	CML-SW-14	CML-SW-14	10160756	10160756001	6/15/2011	Water	988380.293	829239.694	ACIDITY	Acidity	6,300		ug/L
									ALKLNTY	Alkalinity	7,800		ug/L
									SB_T_R	Antimony, Total Recoverable	ND(0.5)		ug/L
									AS_T_R	Arsenic, Total Recoverable	0.51		ug/L
									BA_T_R	Barium, Total Recoverable	38.6		ug/L
									CD_T_R	Cadmium, Total Recoverable	ND(0.08)		ug/L
									CR_T_R	Chromium, Total Recoverable	0.64		ug/L
									CU_T_R	Copper, Total Recoverable	3.5		ug/L
									FE_T_R	Iron, Total Recoverable	442 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	0.36/ND(0.36)U	U	ug/L
									MN_T_R	Manganese, Total Recoverable	8.1		ug/L
									NI_T_R	Nickel, Total Recoverable	0.57		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)	UJ	ug/L
									TDS	Solids, Total Dissolved	31,000		ug/L
									TSS	Solids, Total Suspended	1,900		ug/L
									SULFATE	Sulfate	2,500		ug/L
									ZN_T_R	Zinc, Total Recoverable	ND(5)		ug/L
									FLOW	Flow	20420.4		gpm
									O2_DIS	Oxygen, Dissolved	10,600		ug/L
									PH	pH	7.21		Std Units
									SPCON_F	Conductance Field	19		umhos/cm
									TEMP	Temperature	6.7		oC
			10160853	10160853004					HG_T_R	Mercury, Total Recoverable	0.0292		ug/L
CML-SW-15	CML-SW-15	CML-SW-15	10160655	10160655006	6/15/2011	Water	988363.329	829506.222	HARDNES	Hardness, Total	8,260		ug/L
									ACIDITY	Acidity	12,000		ug/L
									ALKLNTY	Alkalinity	8,300		ug/L
									SB_T_R	Antimony, Total Recoverable	ND(0.5)		ug/L
									AS_T_R	Arsenic, Total Recoverable	0.68		ug/L
									BA_T_R	Barium, Total Recoverable	42.5		ug/L
									CD_T_R	Cadmium, Total Recoverable	ND(0.08)		ug/L
									CR_T_R	Chromium, Total Recoverable	0.64		ug/L
									CU_T_R	Copper, Total Recoverable	5.8		ug/L
									FE_T_R	Iron, Total Recoverable	321 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	0.61 JB	JB	ug/L
									MN_T_R	Manganese, Total Recoverable	5.6		ug/L
									NI_T_R	Nickel, Total Recoverable	0.62		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	34,000		ug/L
									TSS	Solids, Total Suspended	2,100		ug/L
									SULFATE	Sulfate	3,000		ug/L
									ZN_T_R	Zinc, Total Recoverable	ND(5)		ug/L
									FLOW	Flow	24280.08		gpm
									O2_DIS	Oxygen, Dissolved	8,700		ug/L
									PH	pH	6.69		Std Units
									SPCON_F	Conductance Field	25		umhos/cm
									TEMP	Temperature	7.4		oC
			10160853	10160853009					HG_T_R	Mercury, Total Recoverable	0.0336		ug/L

TABLE 3-14. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MILL AOC BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CML-SW-16	CML-SW-16	CML-SW-16	10160655	10160655005	6/15/2011	Water	988876.515	831915.386	ACIDITY	Acidity	8,200		ug/L
									ALKLNTY	Alkalinity	8,000		ug/L
									SB_T_R	Antimony, Total Recoverable	1.6		ug/L
									AS_T_R	Arsenic, Total Recoverable	1.2		ug/L
									BA_T_R	Barium, Total Recoverable	42.8		ug/L
									CD_T_R	Cadmium, Total Recoverable	0.11		ug/L
									CR_T_R	Chromium, Total Recoverable	0.78		ug/L
									CU_T_R	Copper, Total Recoverable	11.8		ug/L
									FE_T_R	Iron, Total Recoverable	356 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	5.1		ug/L
									MN_T_R	Manganese, Total Recoverable	5.5		ug/L
									NI_T_R	Nickel, Total Recoverable	0.72		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	34,000		ug/L
									TSS	Solids, Total Suspended	ND(2,000)		ug/L
									SULFATE	Sulfate	2,800		ug/L
									ZN_T_R	Zinc, Total Recoverable	6.1		ug/L
									FLOW	Flow	21811.68		gpm
									O2_DIS	Oxygen, Dissolved	8,500		ug/L
									PH	pH	6.61		Std Units
									SPCON_F	Conductance Field	24		umhos/cm
									TEMP	Temperature	7.9		oC
			10160853	10160853005					HG_T_R	Mercury, Total Recoverable	0.12		ug/L
CML-SW-17	CML-SW-17	CML-SW-17	10160673	10160673005	6/14/2011	Water	988827.6611	832147.2885	ACIDITY	Acidity	15,800		ug/L
									ALKLNTY	Alkalinity	ND(5,000)		ug/L
									SB_T_R	Antimony, Total Recoverable	ND(0.5)		ug/L
									AS_T_R	Arsenic, Total Recoverable	ND(0.5)		ug/L
									BA_T_R	Barium, Total Recoverable	8.7		ug/L
									CD_T_R	Cadmium, Total Recoverable	ND(0.08)		ug/L
									CR_T_R	Chromium, Total Recoverable	ND(0.5)		ug/L
									CU_T_R	Copper, Total Recoverable	2.4		ug/L
									FE_T_R	Iron, Total Recoverable	115		ug/L
									PB_T_R	Lead, Total Recoverable	0.13/ND(0.13)U	U	ug/L
									MN_T_R	Manganese, Total Recoverable	1.7		ug/L
									NI_T_R	Nickel, Total Recoverable	ND(0.5)		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	42,000		ug/L
									TSS	Solids, Total Suspended	ND(1,000)		ug/L
									SULFATE	Sulfate	4,400		ug/L
									ZN_T_R	Zinc, Total Recoverable	12.5		ug/L
									FLOW	Flow	2939.64		gpm
									O2_DIS	Oxygen, Dissolved	NM		mg/L
									PH	pH	NM		Std Units
									SPCON_F	Conductance Field	NM		umhos/cm
									TEMP	Temperature	NM		oC
			10160851	10160851001					HG_T_R	Mercury, Total Recoverable	0.0056		ug/L

TABLE 3-14. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MILL AOC BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CML-SW-18	CML-SW-18	CML-SW-18	10160673	10160673006	6/14/2011	Water	987816.7525	836602.6021	ACIDITY	Acidity	ND(5,000)		ug/L
									ALKLNTY	Alkalinity	5,400		ug/L
									SB_T_R	Antimony, Total Recoverable	ND(0.5)		ug/L
									AS_T_R	Arsenic, Total Recoverable	ND(0.5)		ug/L
									BA_T_R	Barium, Total Recoverable	20.4		ug/L
									CD_T_R	Cadmium, Total Recoverable	ND(0.08)		ug/L
									CR_T_R	Chromium, Total Recoverable	ND(0.5)		ug/L
									CU_T_R	Copper, Total Recoverable	2		ug/L
									FE_T_R	Iron, Total Recoverable	158		ug/L
									PB_T_R	Lead, Total Recoverable	0.27/ND(0.27)U	U	ug/L
									MN_T_R	Manganese, Total Recoverable	1		ug/L
									NI_T_R	Nickel, Total Recoverable	ND(0.5)		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)		ug/L
									TDS	Solids, Total Dissolved	53,000		ug/L
									TSS	Solids, Total Suspended	ND(2,000)		ug/L
									SULFATE	Sulfate	2,700		ug/L
									ZN_T_R	Zinc, Total Recoverable	ND(5)		ug/L
									FLOW	Flow	44.88		gpm
									O2_DIS	Oxygen, Dissolved	NM		mg/L
									PH	pH	NM		Std Units
									SPCON_F	Conductance Field	NM		umhos/cm
									TEMP	Temperature	NM		oC
			10160853	10160853008					HG_T_R	Mercury, Total Recoverable	0.0071		ug/L

TABLE 3-14. SURFACE WATER-MATRIX ANALYTICAL RESULTS COMBINATION MILL AOC BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	X	Y	Tri Cas	Analyte[a]	Value	Reviewer Qualifier	Units
CML-SW-19	CML-SW-19	CML-SW-19	10160756	10160756002	6/15/2011	Water	987941.839	827186.254	ACIDITY	Acidity	10,100		ug/L
									ALKLNTY	Alkalinity	7,600		ug/L
									SB_T_R	Antimony, Total Recoverable	ND(0.5)		ug/L
									AS_T_R	Arsenic, Total Recoverable	ND(0.5)		ug/L
									BA_T_R	Barium, Total Recoverable	44.6		ug/L
									CD_T_R	Cadmium, Total Recoverable	ND(0.08)		ug/L
									CR_T_R	Chromium, Total Recoverable	0.69		ug/L
									CU_T_R	Copper, Total Recoverable	3.6		ug/L
									FE_T_R	Iron, Total Recoverable	308 J	J	ug/L
									PB_T_R	Lead, Total Recoverable	0.37/ND(0.37)U	U	ug/L
									MN_T_R	Manganese, Total Recoverable	4.1		ug/L
									NI_T_R	Nickel, Total Recoverable	0.61		ug/L
									AG_T_R	Silver, Total Recoverable	ND(0.5)	UJ	ug/L
									TDS	Solids, Total Dissolved	32,000		ug/L
									TSS	Solids, Total Suspended	1,300		ug/L
									SULFATE	Sulfate	2,400		ug/L
									ZN_T_R	Zinc, Total Recoverable	ND(5)		ug/L
									FLOW	Flow	19612.56		gpm
									O2_DIS	Oxygen, Dissolved	10,700		ug/L
									PH	pH	7.37		Std Units
									SPCON_F	Conductance Field	18		umhos/cm
									TEMP	Temperature	6.4		oC
			10160853	10160853015					HG_T_R	Mercury, Total Recoverable	0.0062		ug/L

[a] Silver was included in original laboratory analytical reports, but was removed in revised reports by the laboratory

J – Estimated concentration
JB – Estimated concentration due to blank contamination
U – Evaluated to be undetected at the reporting limit
UJ – Estimated reporting limit
oC - degrees Celsius
gpm - gallons per minute
ug/L - micrograms per liter
umhos/cm - micro hmos per centimeter
Std Units - Standard units
ND() - Analyte was not detected (reporting limit)

TABLE 3-15. SUMMARY OF MATERIALS SAMPLED FOR ASBESTOS
BLACK PINE MINE

Sample	Location	Material	HM*	Result
Combination Mine AOC				
CNM-ASB-04[a]	Northern building; E wall of NE office	Aircell insulation	1	ND
CNM-ASB-05[a]	Northern building; N wall of N storage room	Aircell insulation	1	ND
CNM-ASB-06[a]	Northern building; W wall	Aircell insulation	1	ND
CNM-ASB-07[a]	Northern building; E wall of NE office	Gypsum wallboard system	2	ND
CNM-ASB-08[a]	Northern building; E wall of NE office	Gypsum wallboard system	2	ND
CNM-ASB-09[a]	Northern building; S wall of NE office	Gypsum wallboard system	2	ND
CNM-ASB-10[a]	Northern building; N storage room	White pipe sealant	3	ND
CNM-ASB-11[a]	Northern building; N storage room	White pipe sealant	3	ND
CNM-ASB-12[a]	Northern building; N central	Poured concrete floor	4	ND
CNM-ASB-13[a]	Northern building; E side of S end	Poured concrete floor	4	ND
CNM-ASB-14[a]	Northern building; W side of S end	Poured concrete floor	4	ND
CNM-ASB-15[a]	Northern building; N end of E office	Ceiling tiles	5	ND
CNM-ASB-16[a]	Northern building; E side of E office	Ceiling tiles	5	ND
CNM-ASB-17[a]	Central processing building; E wall	Sprayed on fireproofing	6	ND
CNM-ASB-18[a]	Central processing building; N wall	Sprayed on fireproofing	6	ND

TABLE 3-15. SUMMARY OF MATERIALS SAMPLED FOR ASBESTOS
BLACK PINE MINE

Sample	Location	Material	HM*	Result
CMN-ASB-19	Central processing building; W wall	Sprayed on fireproofing	6	ND
CMN-ASB-20	Southern building; N end of E wall in S office of E building addition	Gypsum wallboard system	7	ND
CMN-ASB-21	Southern building; S end of E wall in S office of E building addition	Gypsum wallboard system	7	ND
CMN-ASB-22	Southern building; E wall of S end	Square pattern wall panels	8	ND
CMN-ASB-23	Southern building; W side of S end	Square pattern wall panels	8	ND
CMN-ASB-24	Southern building; S side of S end	Square pattern wall panels	8	ND
CMN-ASB-25	Southern building; N wall of SE office	Rain drop pattern wall panels	9	ND
CMN-ASB-26	Southern building; E wall of SE office	Rain drop pattern wall panels	9	ND
CMN-ASB-27	Southern building; S wall of SE office	Laminate wall panels	10	ND
CMN-ASB-28	Southern building; S wall of SE office	Laminate wall panels	10	ND
CMN-ASB-29	Southern building; S office of E building addition	Rain drop pattern ceiling tile	11	ND
CMN-ASB-30	Southern building; E end of shower hall	Rain drop pattern ceiling tile	11	ND
CMN-ASB-31	Southern building; N end of W side	Spray pattern ceiling tiles	12	ND
CMN-ASB-32	Southern building; Central portion of W side	Spray pattern ceiling tiles	12	ND

TABLE 3-15. SUMMARY OF MATERIALS SAMPLED FOR ASBESTOS
BLACK PINE MINE

Sample	Location	Material	HM*	Result
CMN-ASB-33	Southern building; S end of W side	Spray pattern ceiling tiles	12	ND
Tim Smith Mine AOC				
HM-ASB-43[b]	Spring house on south side of Tim Smith No. 1 Adit access road	Green composite roofing	13	ND
HM-ASB-44[b]	Spring house on south side of Tim Smith No. 1 Adit access road	Green composite roofing	13	ND
HM-ASB-45[b]	Tim Smith No. 1 Adit north building; north side	Corrugated fiberglass siding	14	ND
Historic Mine Area AOC				
HM-ASB-01	Lewis Shaft building, entrance	Silver foil vapor barrier	15	ND
HM-ASB-02	Lewis Shaft building, entrance	Silver foil vapor barrier	15	ND
HM-ASB-03	Lewis Shaft garage, entrance	Silver foil vapor barrier	15	ND
HM-ASB-34	Small structure on east side of BPM access road, south of Harper Shaft	Purplish brown vent sealant	16	ND
HM-ASB-35	**Harrison Shaft rubble (collapsed)**	**Grout**	**17**	**60% Chrysotile**
HM-ASB-40	Lewis Shaft building, chimney	Chimney brick grout	18	ND
HM-ASB-41	Lewis Shaft garage building, south side	Corrugated fiberglass siding	19	ND
HM-ASB-42	Lewis Shaft garage building, north side	Corrugated fiberglass siding	19	ND

TABLE 3-15. SUMMARY OF MATERIALS SAMPLED FOR ASBESTOS
BLACK PINE MINE

Sample	Location	Material	HM*	Result
Combination Mill Area				
CML-ASB-36	Pump house at bridge	Black vapor barrier	20	ND
CML-ASB-37	Old mill site (collapsed)	Brick grout (upper half)	21	ND
CML-ASB-38	Old mill site (collapsed)	Rock grout (lower half)	22	ND
CML-ASB-39	Combination mill site (collapsed)	Grout	23	ND

[a] – Sample labeled on laboratory chain-of-custody as **CNM**-ASB-## instead of **CMN**-ASB-##.

[b]- Sample labeled on laboratory chain-of-custody as **HM**-ASB-## instead of **TS**-ASB-##.

AOC – Area of Concern

CML – Combination Mill

CMN – Combination Mine

TS – Tim Smith Mine

HM – Historic Mine

HM* – homogenous material/unique material number

ND – none detected

TABLE 3-16. RCRA METALS ANALYTICAL RESULTS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Sample ID	Field Sample ID	Lab Batch ID	Lab Sample ID	Date Sampled	Matrix	Tri Cas	Analyte	Value	Reviewer Qualifier	Units
CML-RCRA-01	CML-RCRA-01	BP-CML-RCRA-01	10166973	10166973006	8/17/2011	Soil	MOISTUR	Soil Moisture	0.19		%
							AS	Arsenic, Total	63.3		mg/kg
							BA	Barium, Total	197		mg/kg
							CD	Cadmium, Total	0.62		mg/kg
							CR	Chromium, Total	54.1		mg/kg
							CO_T_R	Cobalt, Total Recoverable	7.1 J	J	mg/kg
							PB	Lead, Total	164		mg/kg
							HG_T_R	Mercury, Total	0.51		mg/kg
							SE	Selenium, Total	ND(0.48)		mg/kg
							AG	Silver, Total	3.3		mg/kg
CML-RCRA-02	CML-RCRA-02	BP-CML-RCRA-02	10166973	10166973007	8/17/2011	Soil	MOISTUR	Soil Moisture	6		%
							AS	Arsenic, Total	680		mg/kg
							BA	Barium, Total	191		mg/kg
							CD	Cadmium, Total	14.9		mg/kg
							CR	Chromium, Total	1.6		mg/kg
							CO_T_R	Cobalt, Total Recoverable	0.7 J	J	mg/kg
							PB	Lead, Total	2640		mg/kg
							HG_T_R	Mercury, Total	5		mg/kg
							SE	Selenium, Total	0.56		mg/kg
							AG	Silver, Total	59.7		mg/kg
CML-RCRA-03	CML-RCRA-03	BP-CML-RCRA-03	10166973	10166973008	8/17/2011	Soil	MOISTUR	Soil Moisture	5.1		%
							AS	Arsenic, Total	12.7		mg/kg
							BA	Barium, Total	19.5		mg/kg
							CD	Cadmium, Total	0.88		mg/kg
							CR	Chromium, Total	ND(0.49)		mg/kg
							CO_T_R	Cobalt, Total Recoverable	ND(0.49)		mg/kg
							PB	Lead, Total	151		mg/kg
							HG_T_R	Mercury, Total	4.4		mg/kg
							SE	Selenium, Total	ND(0.49)		mg/kg
							AG	Silver, Total	8.2		mg/kg
CML-RCRA-04	CML-RCRA-04	BP-CML-RCRA-04	10166973	10166973009	8/17/2011	Soil	MOISTUR	Soil Moisture	0.13		%
							AS	Arsenic, Total	138		mg/kg
							BA	Barium, Total	547		mg/kg
							CD	Cadmium, Total	1.7		mg/kg
							CR	Chromium, Total	33		mg/kg
							CO_T_R	Cobalt, Total Recoverable	4.8 J	J	mg/kg
							PB	Lead, Total	222		mg/kg
							HG_T_R	Mercury, Total	1.7		mg/kg
							SE	Selenium, Total	ND(0.37)		mg/kg
							AG	Silver, Total	9		mg/kg

[a] Silver was included in original laboratory analytical reports, but was removed in revised reports by the laboratory
J – Estimated concentration ft - feet
meq/100g - milliequivalents per hundred grams mg/kg - milligrams per kilogram
mmhos/cm - micromhos per centimeter
% - percent
ND() - Analyte was not detected (reporting limit) Std Units - Standard Units
t/1000t - tons per thousand tons

FIGURES

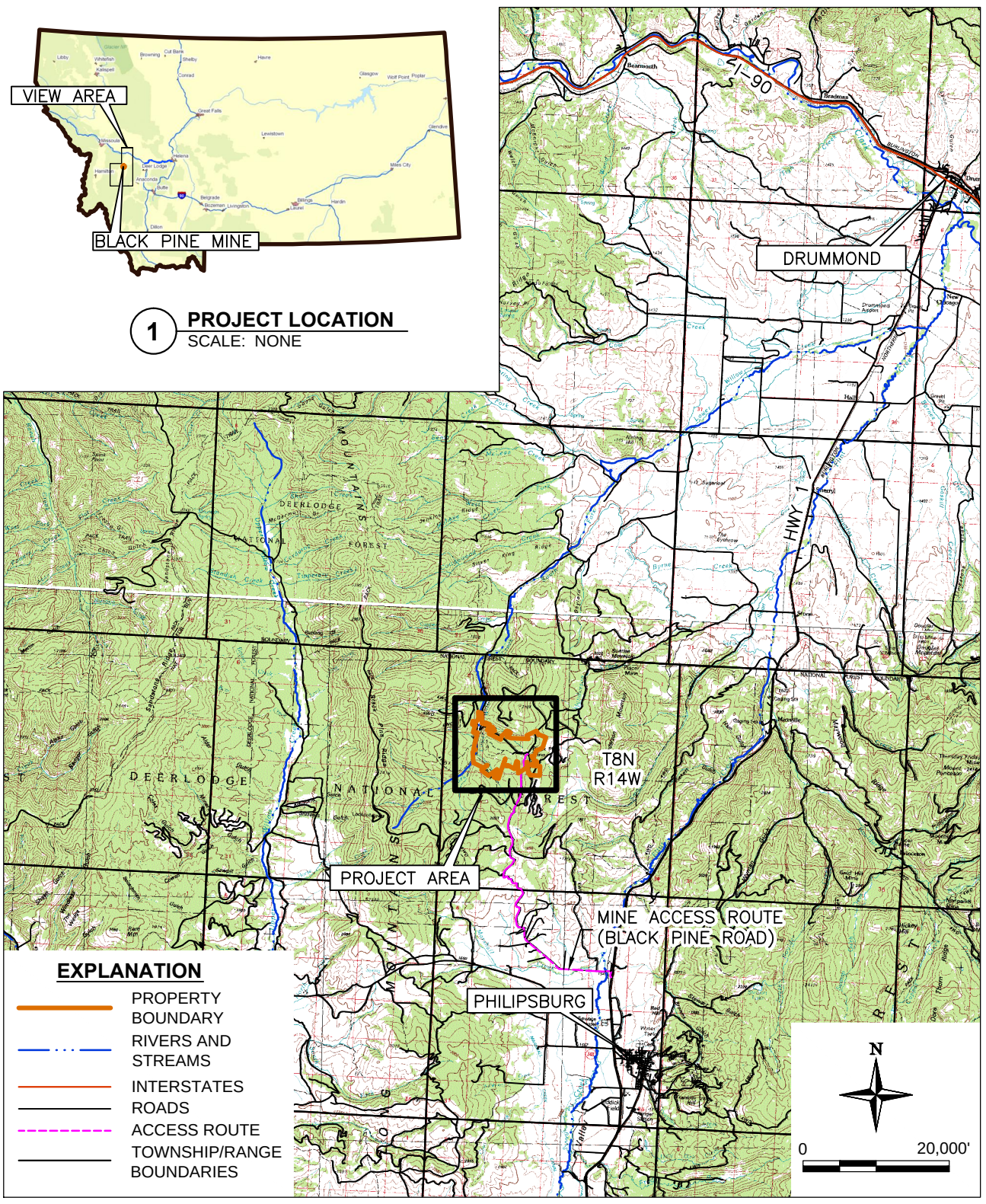

FIGURE 2-1

VICINITY MAP

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

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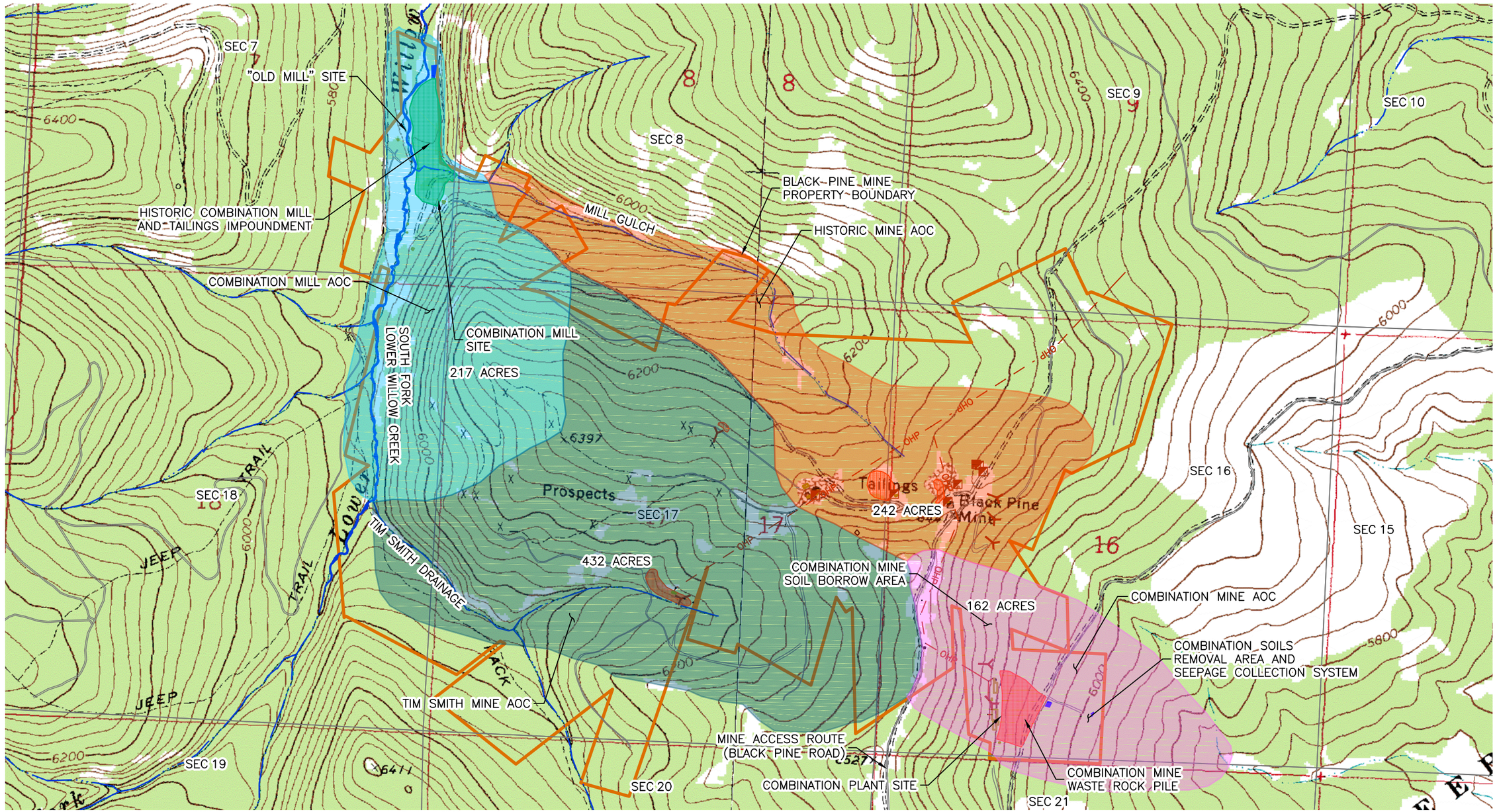
Drawn By: KBW	Checked By: MD	Scale: 1" = 20,000'	Date: 6/7/13	File: 776_VM_201306



Basemap: USDA Farm Service Agency, Montana 2009 Color NAIP Orthophoto12—kM, Granite County. Published 2009.

EXPLANATION

- PROPERTY BOUNDARY
- EDGE OF ROAD
- SECTION BOUNDARIES
- OVERHEAD POWER
- STREAMS
- BUILDING
- APPROXIMATE AREAS OF CONCERN
- WASTE ROCK AREAS
- TAILINGS AREA
- ADIT
- SHAFT

N

0 1,200'

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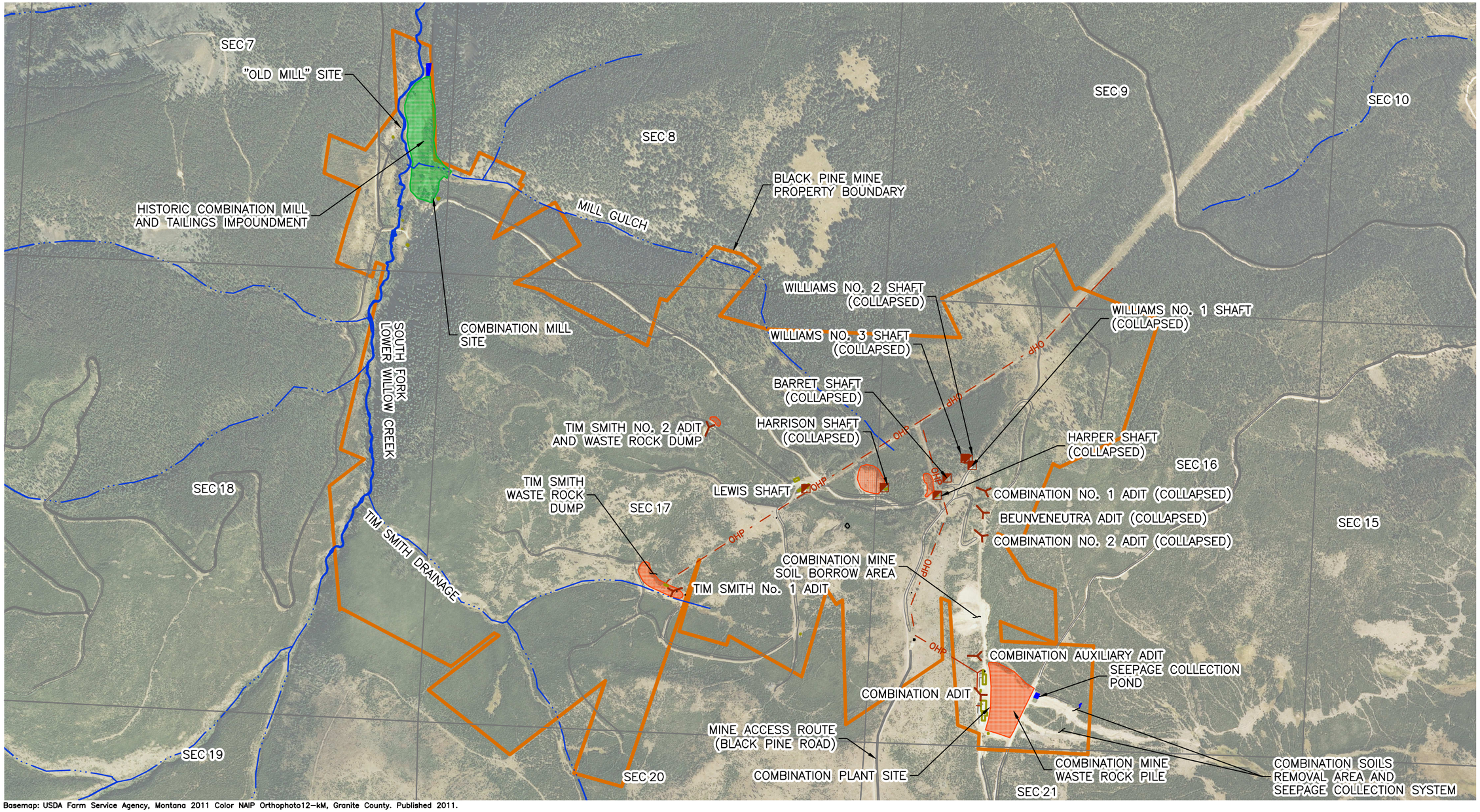
FIGURE 2-2

AREAS OF CONCERN

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 1,200'	Date: 6/14/13	File: 776_AOC_201306



Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12–kM, Granite County. Published 2011.

EXPLANATION

- PROPERTY BOUNDARY
- EDGE OF ROAD
- SECTION BOUNDARIES
- OVERHEAD POWER
- STREAMS
- BUILDING
- WASTE ROCK AREAS
- TAILINGS AREA
- ADIT
- SHAFT

N

0 1,200'

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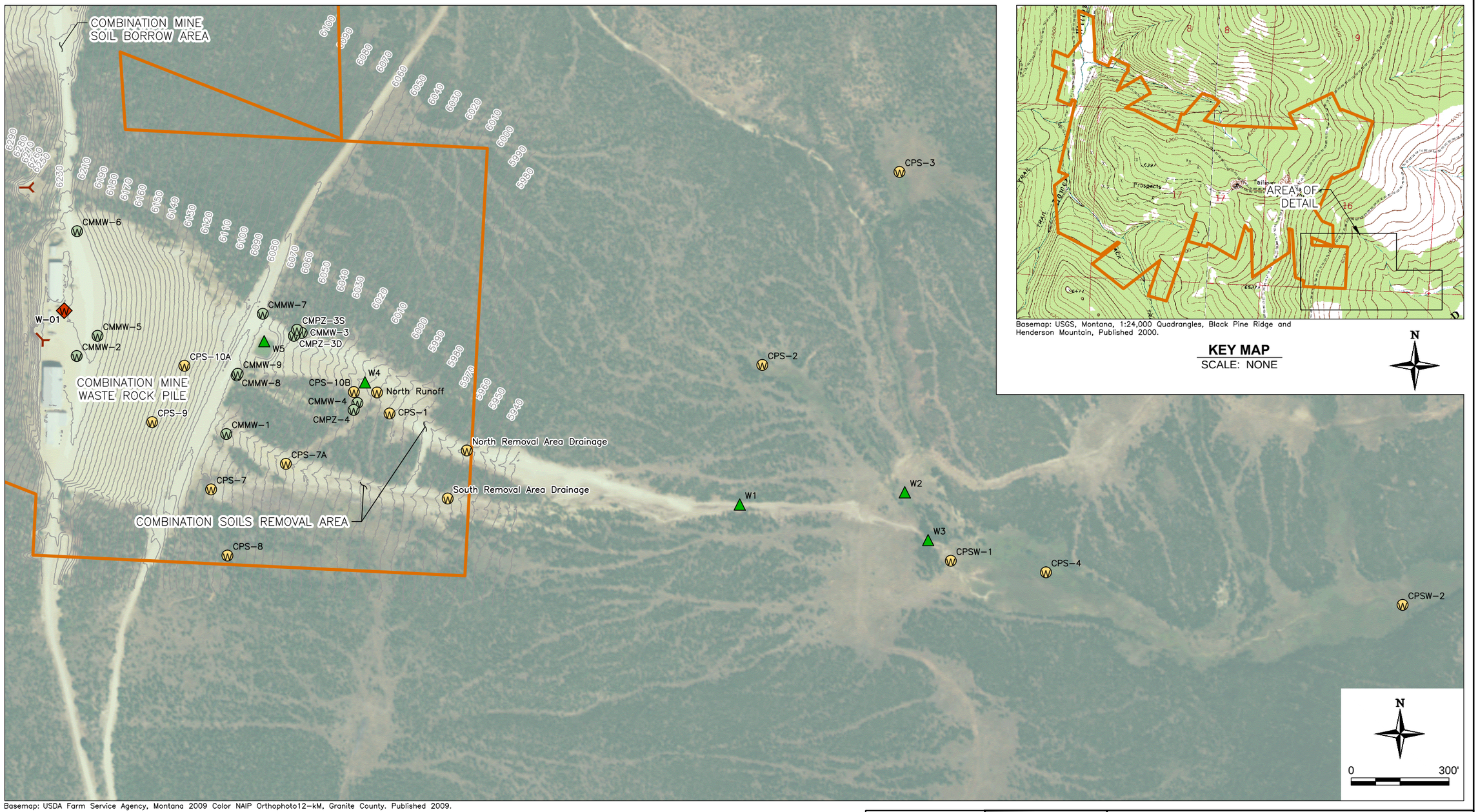
FIGURE 2-3

SITE FEATURES

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 1,200'	Date: 6/10/13	File: 776_SF_201306



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP
SCALE: NONE

N

Basemap: USDA Farm Service Agency, Montana 2009 Color NAIP Orthophoto12-kM, Granite County. Published 2009.

EXPLANATION

- PROPERTY BOUNDARY
- 5940 — EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- CPS-8 — ROUTINE SPRING/SEEP/SURFACE WATER MONITORING SITES (SAMPLED BY HYDROMETRICS AND OTHERS)
- W1 — JULY 2008 MDEQ INSPECTION SITES
- CMMW-1 — ROUTINE GROUNDWATER MONITORING SITES (SAMPLED BY HYDROMETRICS AND OTHERS)
- W-01 — 1981 BASELINE MONITORING SITES
- ADIT (APPROXIMATE LOCATION)

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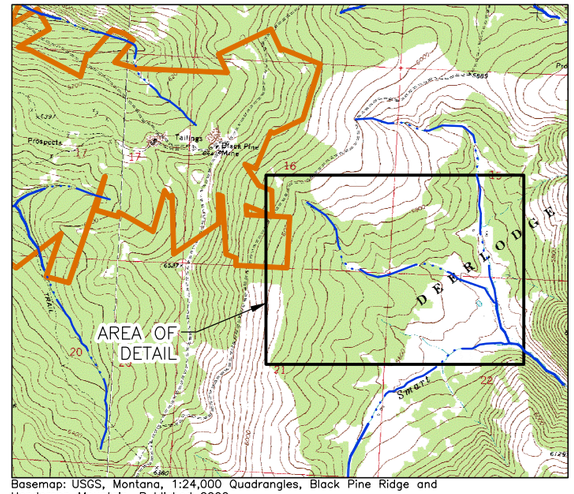
FIGURE 2-4

WATER RESOURCES MONITORING SITES, COMBINATION MINE SITE

**BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION**

Drawn By: KBW	Checked By: MD	Scale: 1" = 300'	Date: 6/7/13	File: 776_WRMS-CM-B_201306

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- STREAM

N

0 600'

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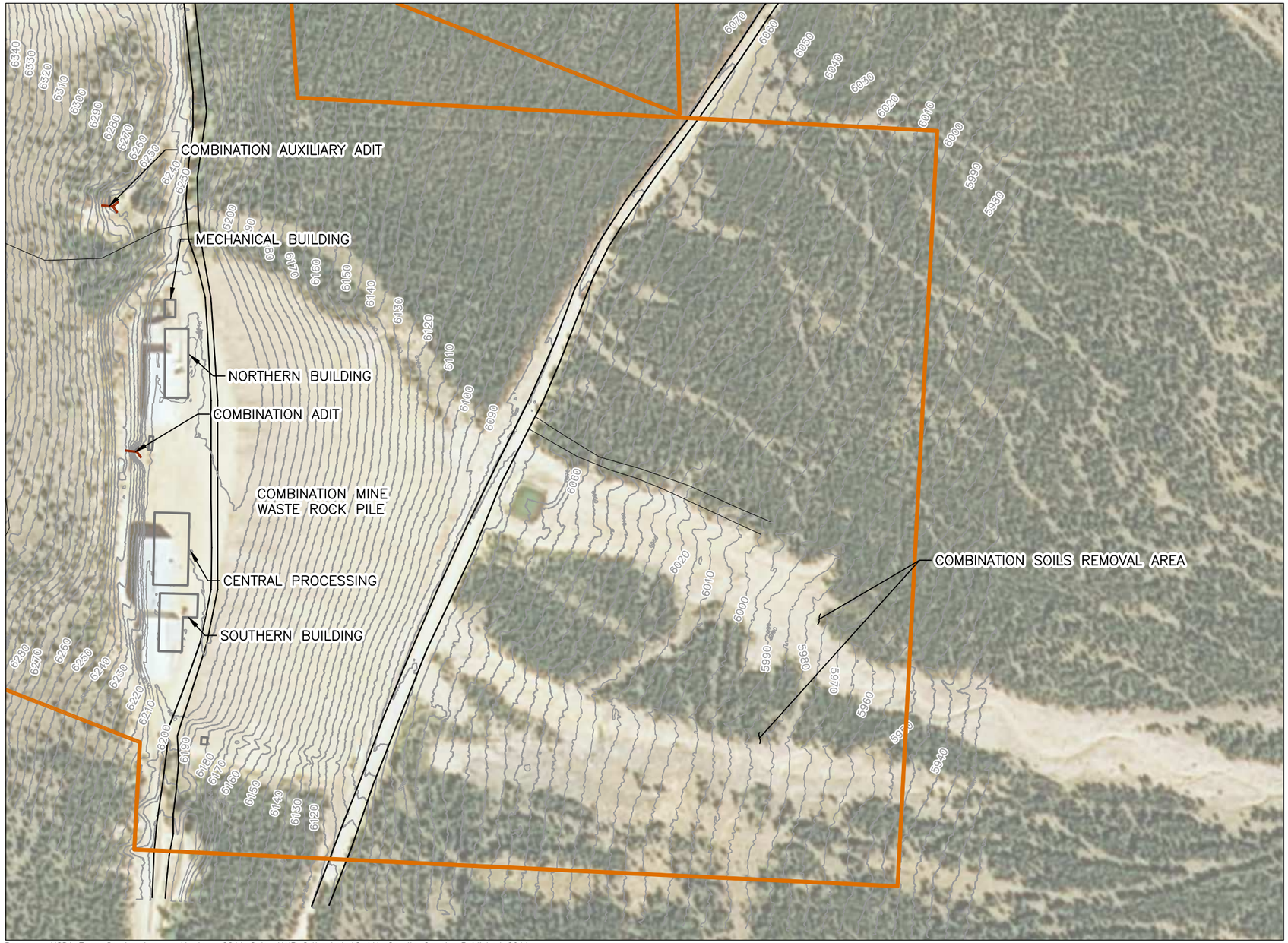
FIGURE 2-5

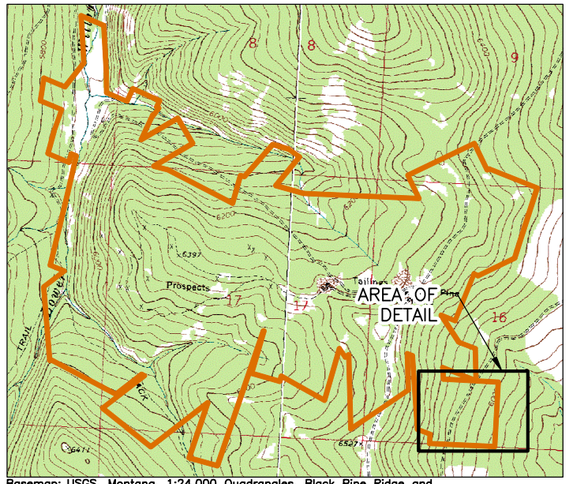
DRAINAGE AND HYDROLOGY, SMART CREEK, COMBINATION MINE AREA OF CONCERN

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 600'	Date: 6/7/13	File: 776_DH-SC-CM_201306



Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- EXISTING STRUCTURE
- 5980 EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- ADIT (APPROXIMATE LOCATION)

N

0 200'

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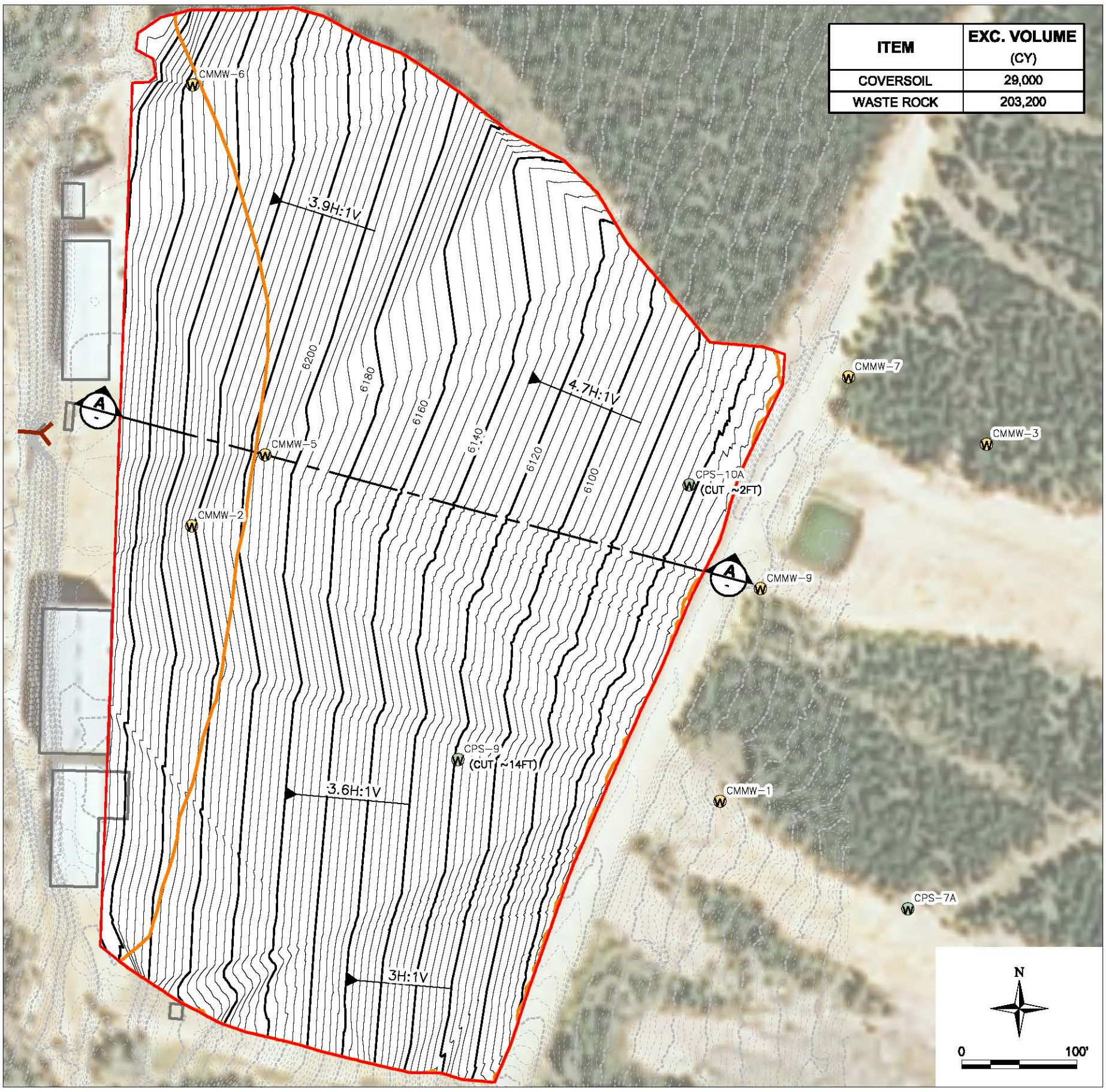
FIGURE 2-6

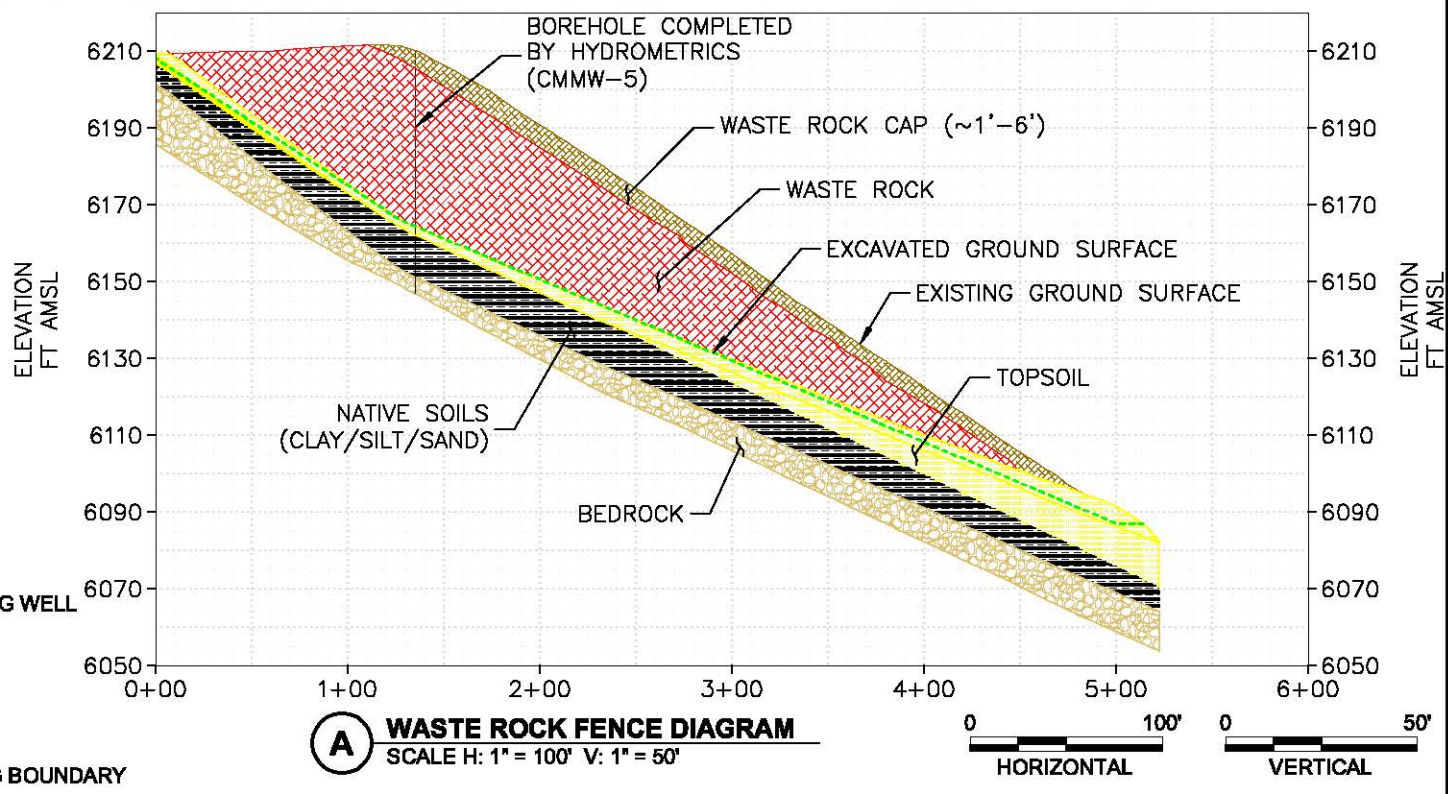
COMBINATION MINE AREA OF CONCERN

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 200'	Date: 6/7/13	File: 776_CMAOC-A_201306

ITEM	EXC. VOLUME (CY)
COVERSOIL	29,000
WASTE ROCK	203,200





A **WASTE ROCK FENCE DIAGRAM**
SCALE H: 1" = 100' V: 1" = 50'

0 100' HORIZONTAL
0 50' VERTICAL

EXPLANATION

- CMMW–1 — EXISTING MONITORING WELL
- CPS–7A — SEEP LOCATION
- MINE ADIT
- WASTE BOUNDARY
- ALTERNATE GRADING BOUNDARY
- EXISTING STRUCTURE
- EXISTING CONTOURS (5' INTERVAL)
- PROPOSED CONTOURS (10' INTERVAL)
- FT — FEET
- FT AMSL — FEET ABOVE MEAN SEA LEVEL

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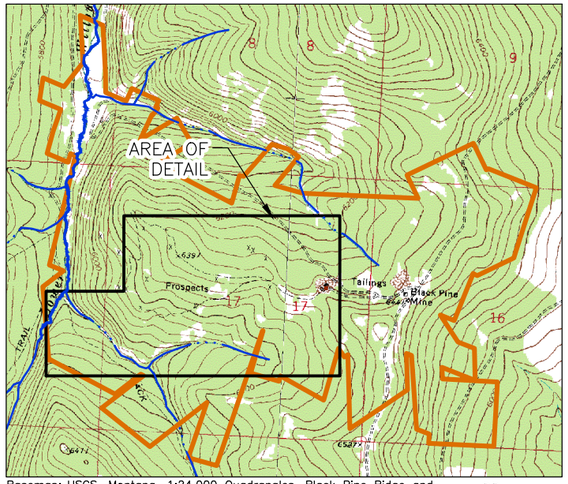
FIGURE 2-7

COMBINATION MINE WASTE ROCK PILE VOLUME ESTIMATE

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: TH	Checked By: MD	Scale: AS SHOWN	Date: 2/7/14	File: 776_COMBINATIONMINEGRADINGALT_201



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP
SCALE: NONE

N

N

0 400'

TIM SMITH No. 2 ADIT AND WASTE ROCK DUMP

LEWIS SHAFT

SOUTH FORK LOWER WILLOW CREEK

TIM SMITH DRAINAGE

TIM SMITH NO. 1 ADIT NORTH BUILDING

TIM SMITH No. 1 ADIT

TIM SMITH NO. 1 ADIT WASTE ROCK DUMP

TIM SMITH NO. 1 ADIT SOUTH BUILDING

SPRING HOUSE

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12–kM, Granite County. Published 2011.

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- ADIT (APPROXIMATE LOCATION)
- MINE SHAFT (APPROXIMATE LOCATION)
- EXISTING STRUCTURE

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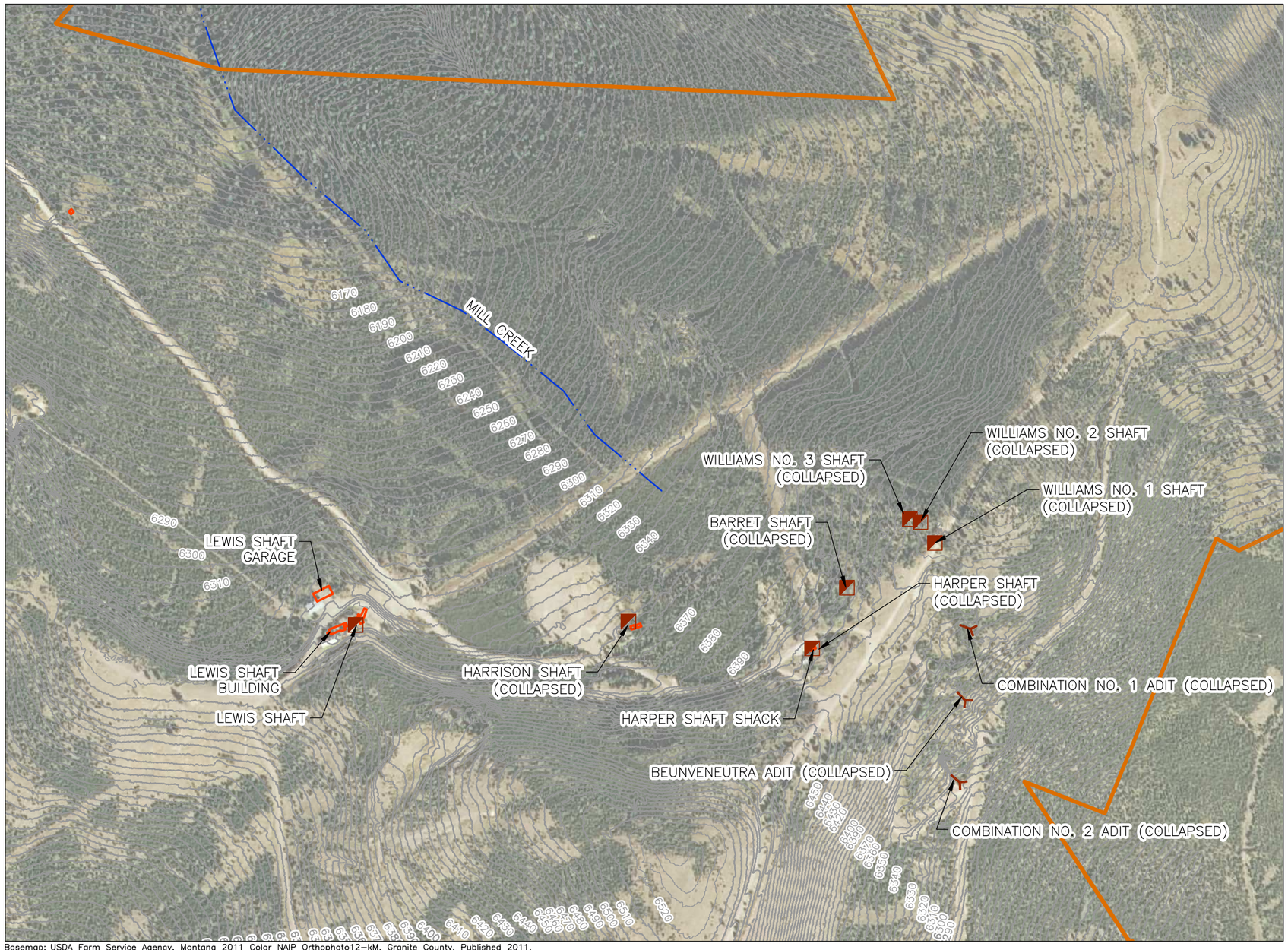
FIGURE 2-8

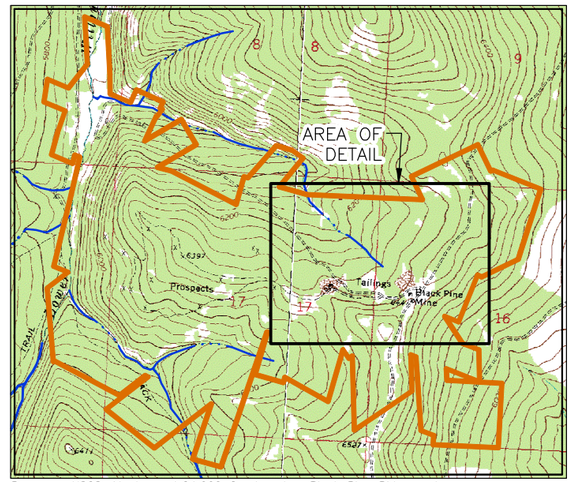
TIM SMITH MINE AREA OF CONCERN

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 400'	Date: 6/12/13	File: 776_TSMAOC_201306



Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP
SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 6290 EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- EXISTING STRUCTURE
- MINE SHAFT (APPROXIMATE LOCATION)
- ADIT (APPROXIMATE LOCATION)

N

0 400'

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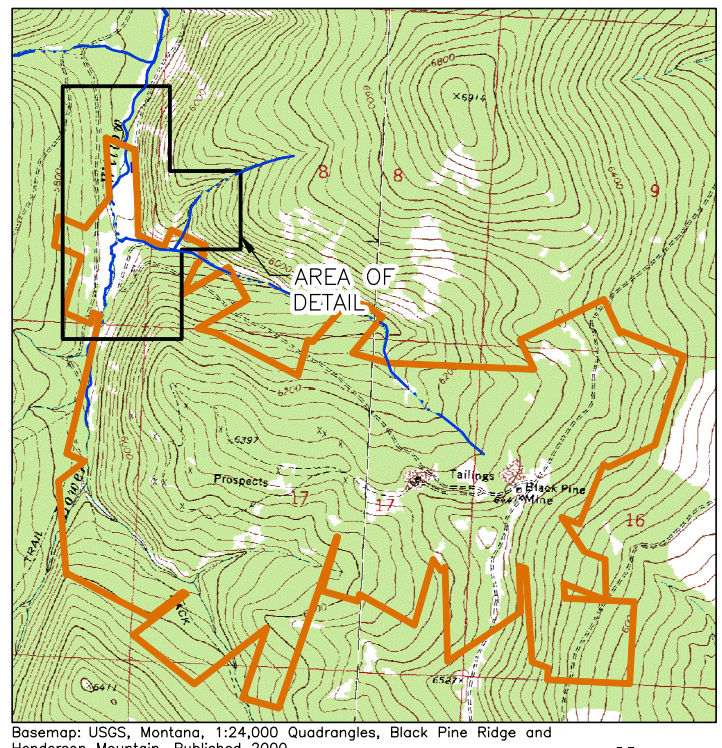
FIGURE 2-9

HISTORIC MINE AREA OF CONCERN

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 400'	Date: 6/14/13	File: 776_HMAOC_201306



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

NOT TO SCALE

N

TAILINGS IMPOUNDMENT

"OLD MILL" SITE

MILL CREEK

COMBINATION MILL SITE

SOUTH FORK LOWER WILLOW CREEK

EXPLANATION

PROPERTY BOUNDARY

STREAM

5740 EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.

N

0 300'

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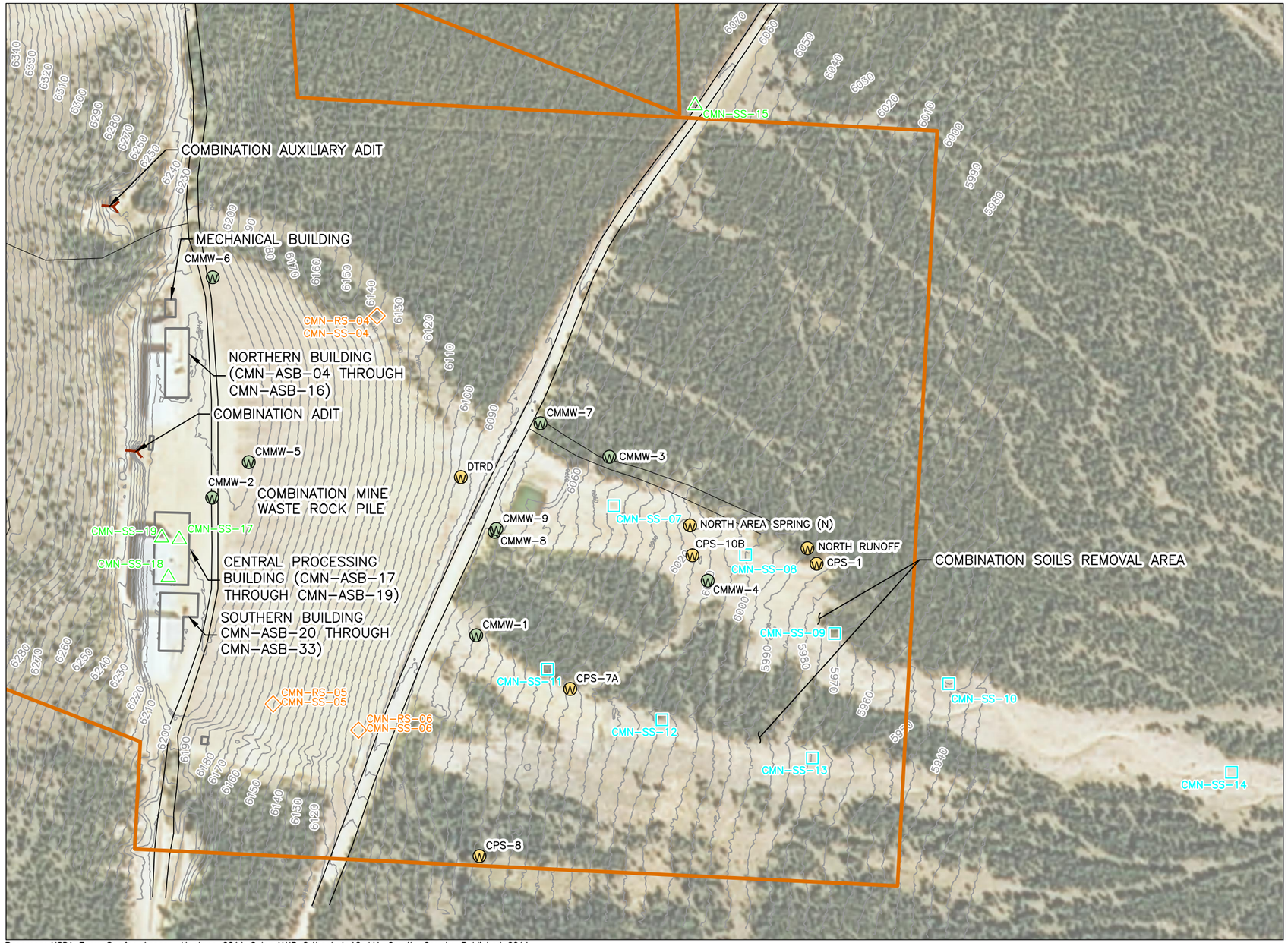
FIGURE 2-10

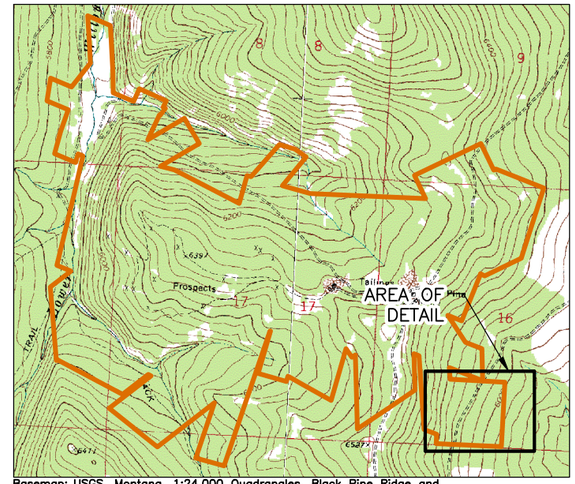
COMBINATION MILL AREA OF CONCERN

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 300'	Date: 6/7/13	File: 776_CMAOC-B_201306



Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP
SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- EXISTING STRUCTURE
- 5980 EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- ADIT (APPROXIMATE LOCATION)
- CPS-8 ROUTINE SPRING/SEEP/SURFACE WATER MONITORING SITES
- CMMW-1 ROUTINE GROUNDWATER MONITORING SITES
- CMN-SS-08 SAMPLE LOCATION AND DESIGNATION
- CMN-SS-09 TEST PIT SAMPLE LOCATION AND DESIGNATION (SOIL)
- CMN-RS-06 / CMN-SS-06 TEST PIT SAMPLE LOCATION AND DESIGNATION (WASTE ROCK)

SS	SURFACE SOIL
RS	WASTE ROCK
ASB	ASBESTOS

NOTES:

1. SEDIMENT SAMPLE AND ADDITIONAL SURFACE WATER SAMPLE LOCATIONS ARE LOCATED DOWN GRADIENT FROM CMN-SS-14 AND ARE SHOWN ON FIGURE 3-2.
2. CMN-SS-16 IS LOCATED NORTHEAST OF CMN-SS-15 AND IS SHOWN ON FIGURE 3-2.

N

0 200'

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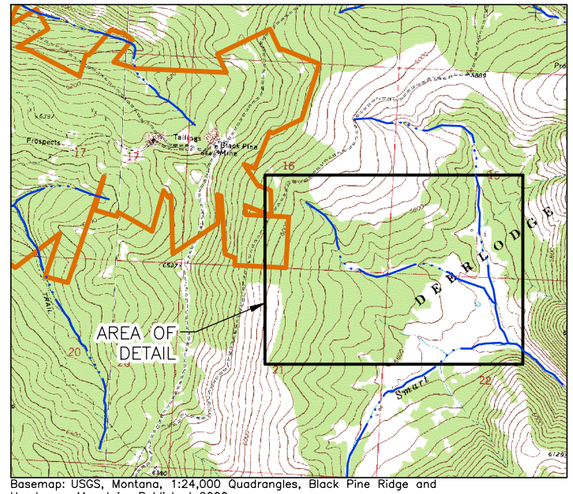
FIGURE 3-1

SAMPLE LOCATION MAP, COMBINATION MINE AREA OF CONCERN

**BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION**

Drawn By: KBW	Checked By: MD	Scale: 1" = 200'	Date: 6/7/13	File: 776_SLM-CMAOC-B_201306

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- CMN-SS-01 — SAMPLE LOCATION AND DESIGNATION
- CMN-SS-14 — TEST PIT SAMPLE LOCATION AND DESIGNATION (SOIL)
- CMMW-4 — ROUTINE GROUNDWATER MONITORING SITES
- CPSW-2 — ROUTINE SPRING/SEEP/SURFACE WATER MONITORING SITES
- SS — SURFACE SOIL

N

0 600'

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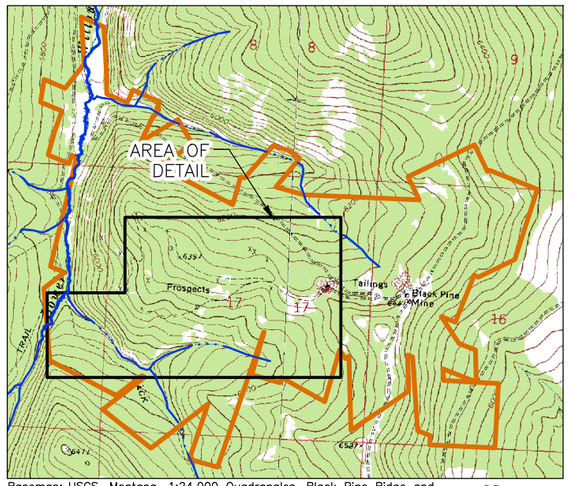
FIGURE 3-2

SAMPLE LOCATION MAP, SMART CREEK, COMBINATION MINE AREA OF CONCERN

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 600'	Date: 6/7/13	File: 776_SLM-SC_201306



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP
SCALE: NONE

N

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 6010 — EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- TSP-6 — ROUTINE SPRING/SEEP/SURFACE WATER MONITORING SITES
- CML-SD-05/CML-SW-03 — MDEQ TMDL PROGRAM SITE WITH DESIGNATION
- TS-SD-08 — SAMPLE LOCATION AND DESIGNATION
- TS-RS-03 / TS-SS-03 — TEST PIT SAMPLE LOCATION AND DESIGNATION (WASTE ROCK)
- ADIT (APPROXIMATE LOCATION)
- MINE SHAFT (APPROXIMATE LOCATION)
- EXISTING STRUCTURE
- TS-SS-08 — TEST PIT SAMPLE LOCATION AND DESIGNATION (SOIL)

ASB	ASBESTOS
SD	SEDIMENT
SW	SURFACE WATER
SS	SURFACE SOIL
RS	WASTE ROCK

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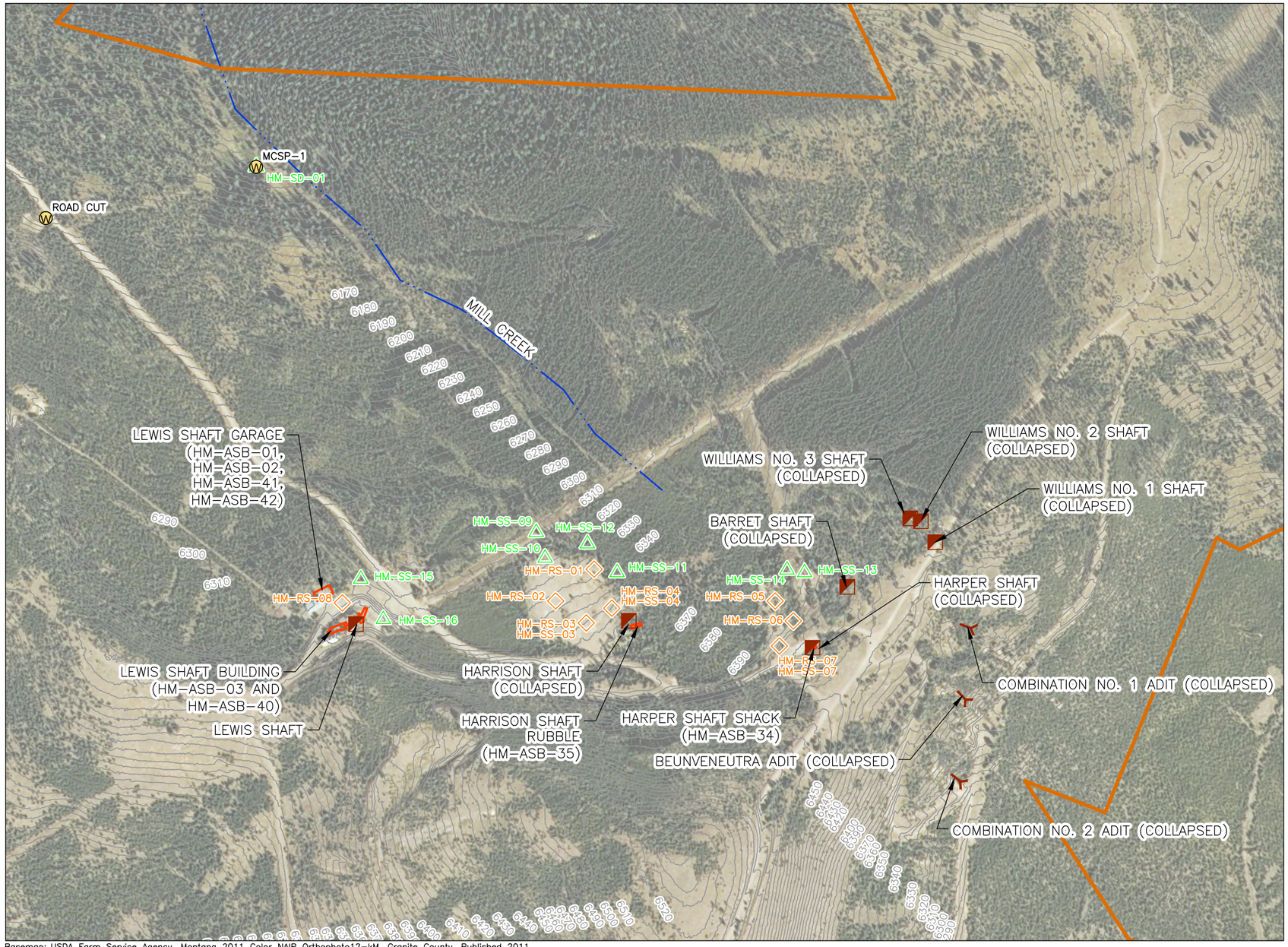
FIGURE 3-3

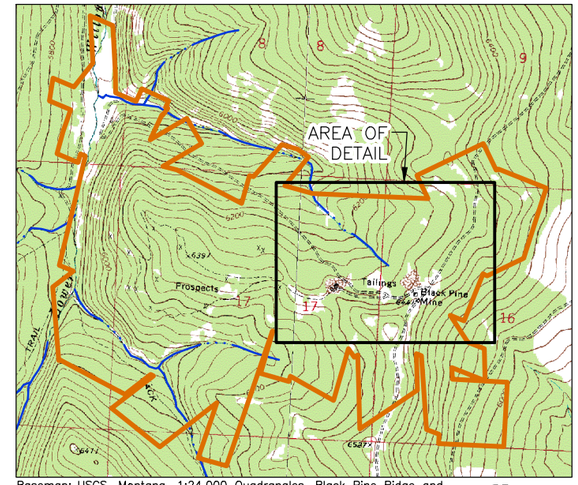
SAMPLE LOCATION MAP, TIM SMITH MINE AREA OF CONCERN

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 400'	Date: 6/11/13	File: 776_SLM-TS_201306



Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP
SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 6290 — EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- EXISTING STRUCTURE
- MINE SHAFT (APPROXIMATE LOCATION)
- ADIT (APPROXIMATE LOCATION)
- MCSP-1 — ROUTINE SPRING/SEEP/SURFACE WATER MONITORING SITES
- HM-SS-14 — SAMPLE LOCATION AND DESIGNATION
- HM-RS-03 / HM-SS-03 — TEST PIT SAMPLE LOCATION AND DESIGNATION (WASTE ROCK)

ASB	ASBESTOS
SD	SEDIMENT
SS	SURFACE SOIL
RS	WASTE ROCK

N

0 400'

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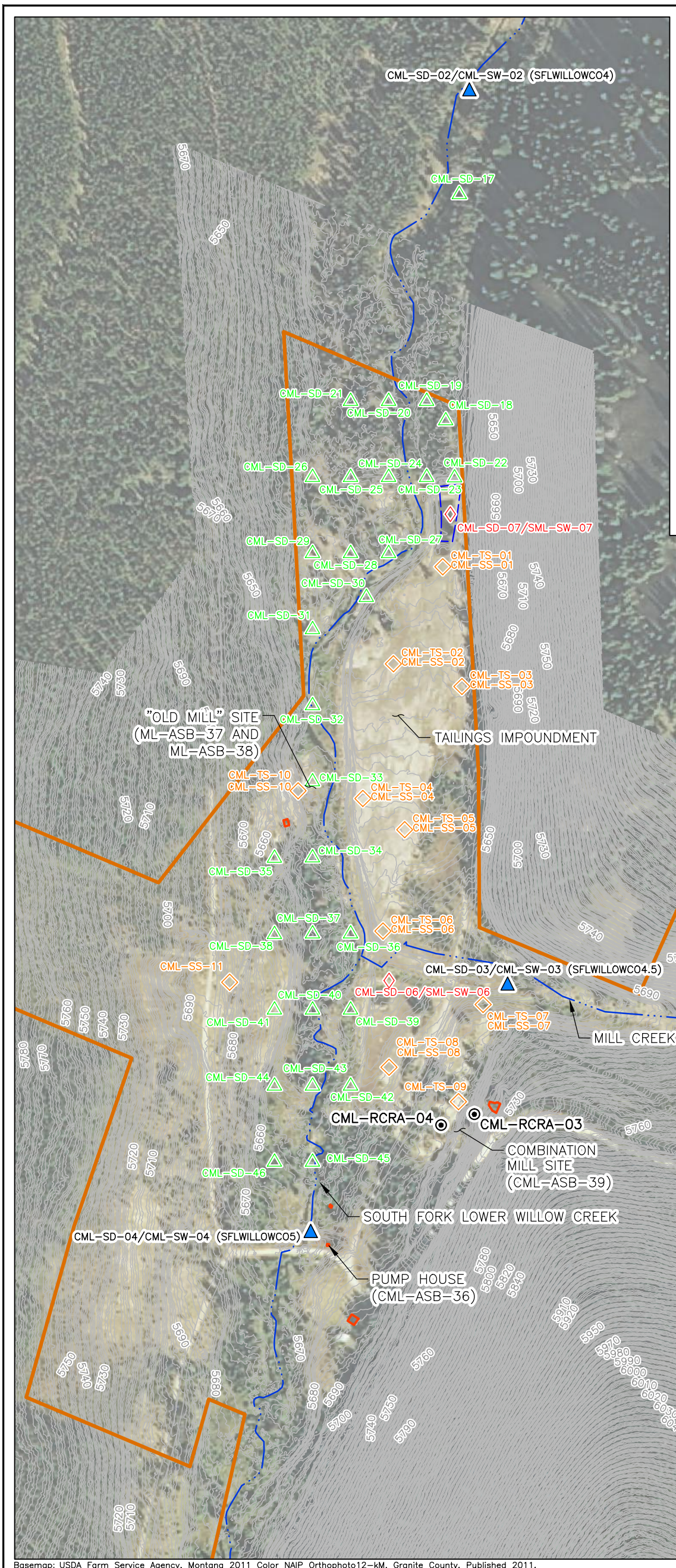
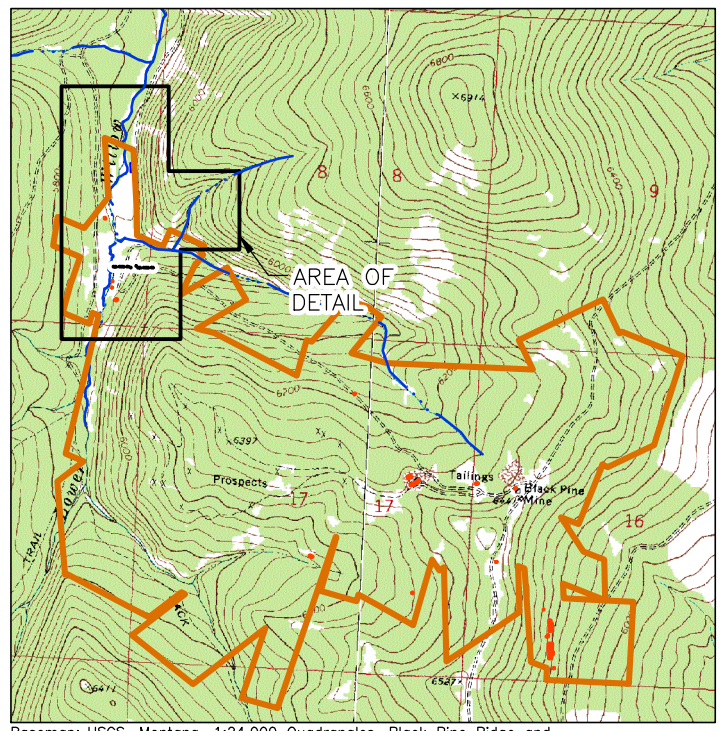
FIGURE 3-4

**SAMPLE LOCATION MAP,
HISTORIC MINE AREA OF CONCERN**

**BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION**

Drawn By: KBW	Checked By: MD	Scale: 1" = 400'	Date: 6/11/13	File: 776_SLM-HMA_201306





Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 5740 — EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- EXISTING STRUCTURE
- CML-SD-03/CML-SW-03 — MDEQ TMDL PROGRAM SITE WITH DESIGNATION
- CML-SD-47 — SAMPLE LOCATION AND DESIGNATION
- CML-SW-07/CML-SD-07 — SEDIMENT/SURFACE WATER SAMPLE LOCATION AND DESIGNATION
- CML-TS-07 / CML-SS-07 — TEST PIT SAMPLE LOCATION AND DESIGNATION
- CML-RCRA-03 — STRUCTURE SAMPLE LOCATION AND DESIGNATION

ASB	ASBESTOS
SD	SEDIMENT
SW	SURFACE WATER
SS	SURFACE SOIL
RS	WASTE ROCK
RCRA	RESOURCE CONSERVATION AND RECOVERY ACT

NOTES:

1. CML-SD-05/CML-SW-05 IS LOCATED SOUTH OF CML-SD-04/CML-SW-04 UPSTREAM OF THE CONFLUENCE WITH THE TIM SMITH DRAINAGE (FIGURE 3-3).
2. ADDITIONAL DOWNSTREAM SAMPLE LOCATIONS ARE SHOWN ON FIGURE 3-6.

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.

N

0 300'

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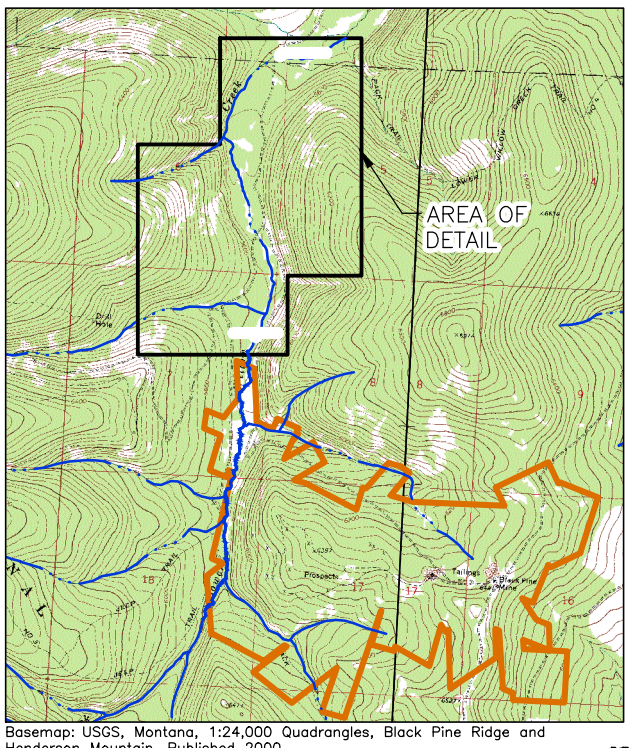
FIGURE 3-5

SAMPLE LOCATION MAP
COMBINATION MILL AREA OF CONCERN

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

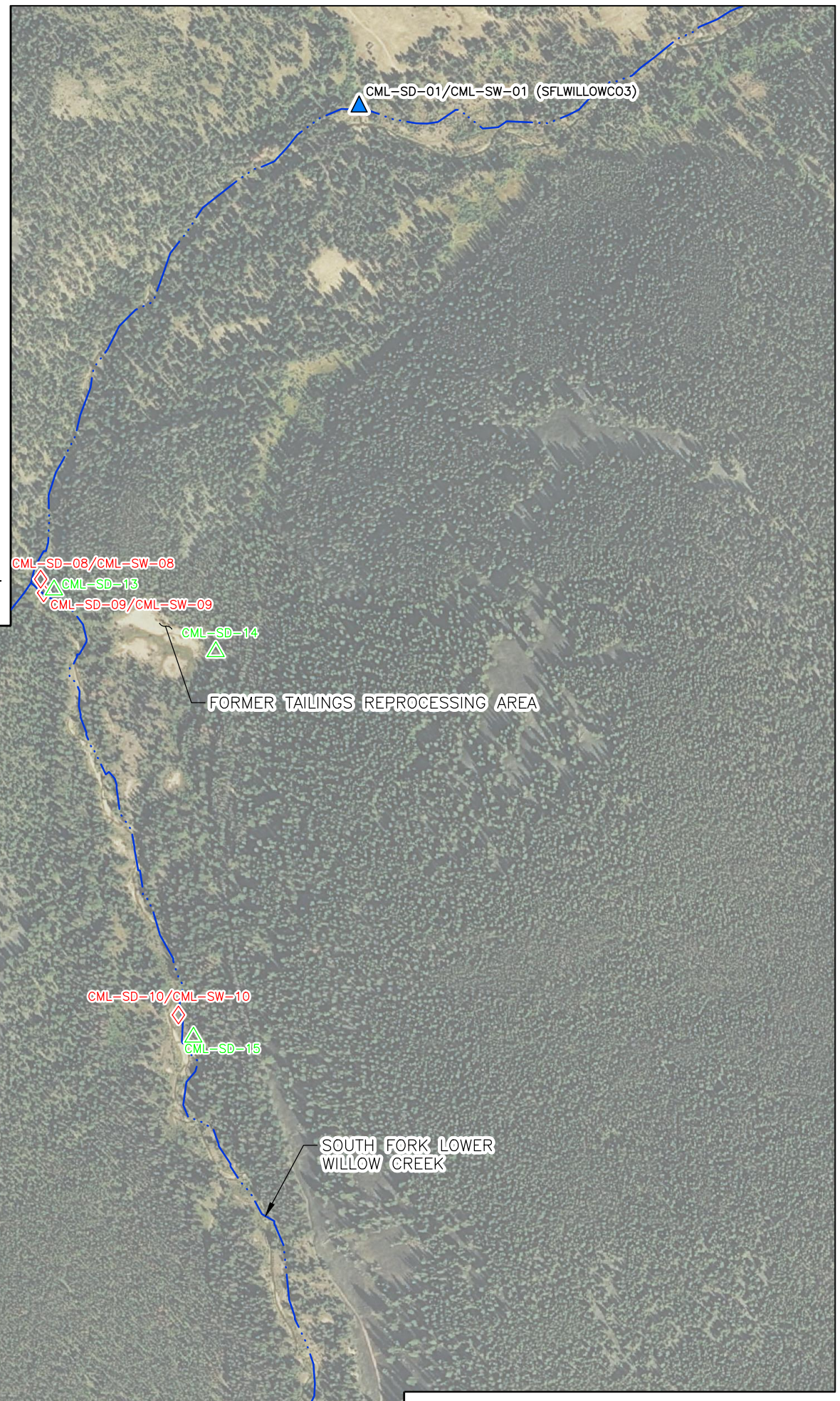
Drawn By: REP	Checked By: MD	Scale: 1" = 300'	Date: 5/29/14	File: 776_SLM-CMAOC-A_201405



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE



EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 5740 — EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- CML-SD-02/CML-SW-02 — MDEQ TMDL PROGRAM SITE WITH DESIGNATION
- CML-SD-47 — SAMPLE LOCATION AND DESIGNATION
- CML-SD-07/CML-SW-07 — SEDIMENT/SURFACE WATER SAMPLE LOCATION AND DESIGNATION
- SD — SEDIMENT
- SW — SURFACE WATER

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.

N

0 600'

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FIGURE 3-6

SAMPLE LOCATION MAP
SOUTH FORK LOWER WILLOW CREEK,
COMBINATION MILL AREA OF CONCERN

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: REP	Checked By: MD	Scale: 1" = 600'	Date: 5/29/14	File: 776_SLM-LWC-CM_201405

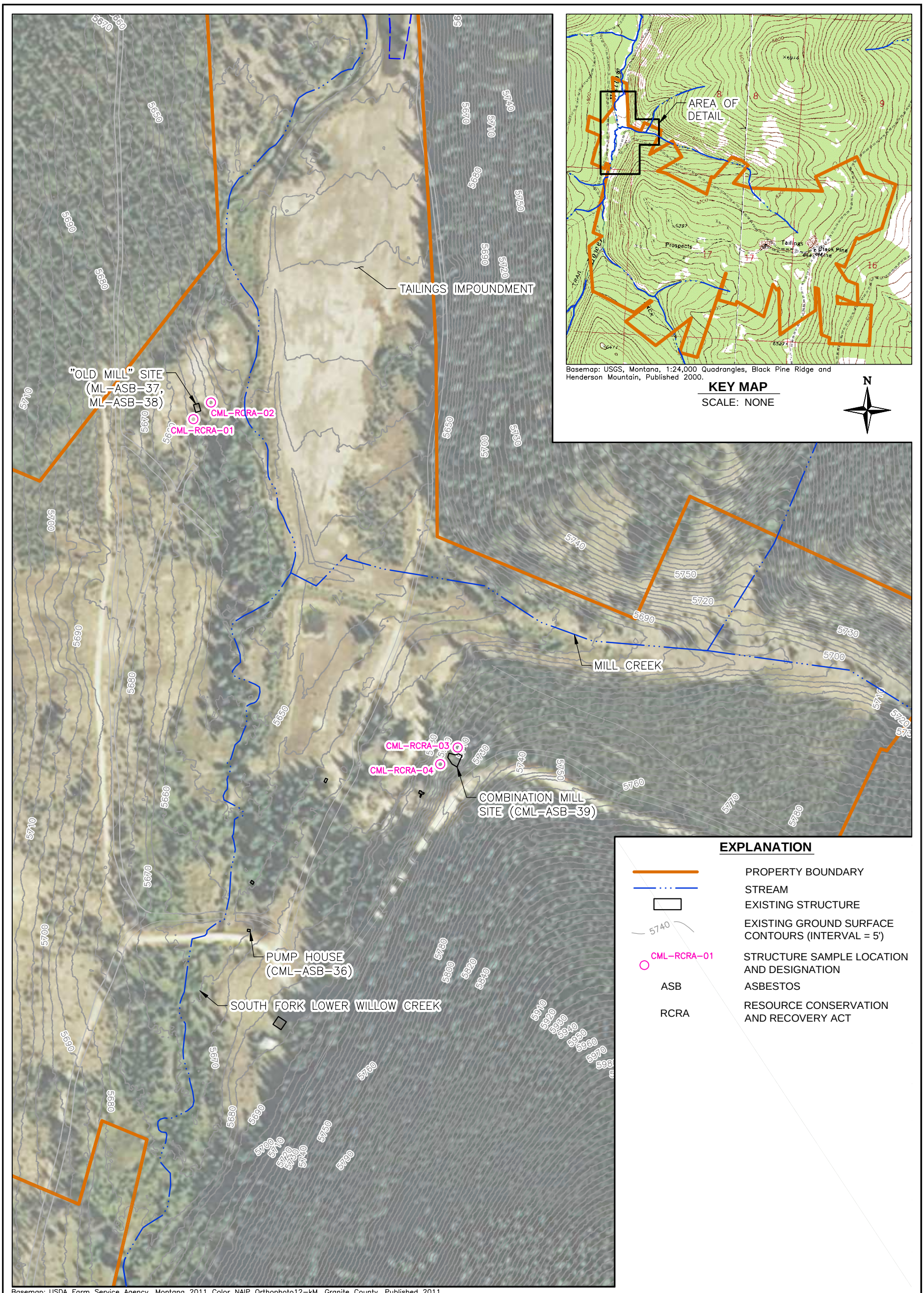

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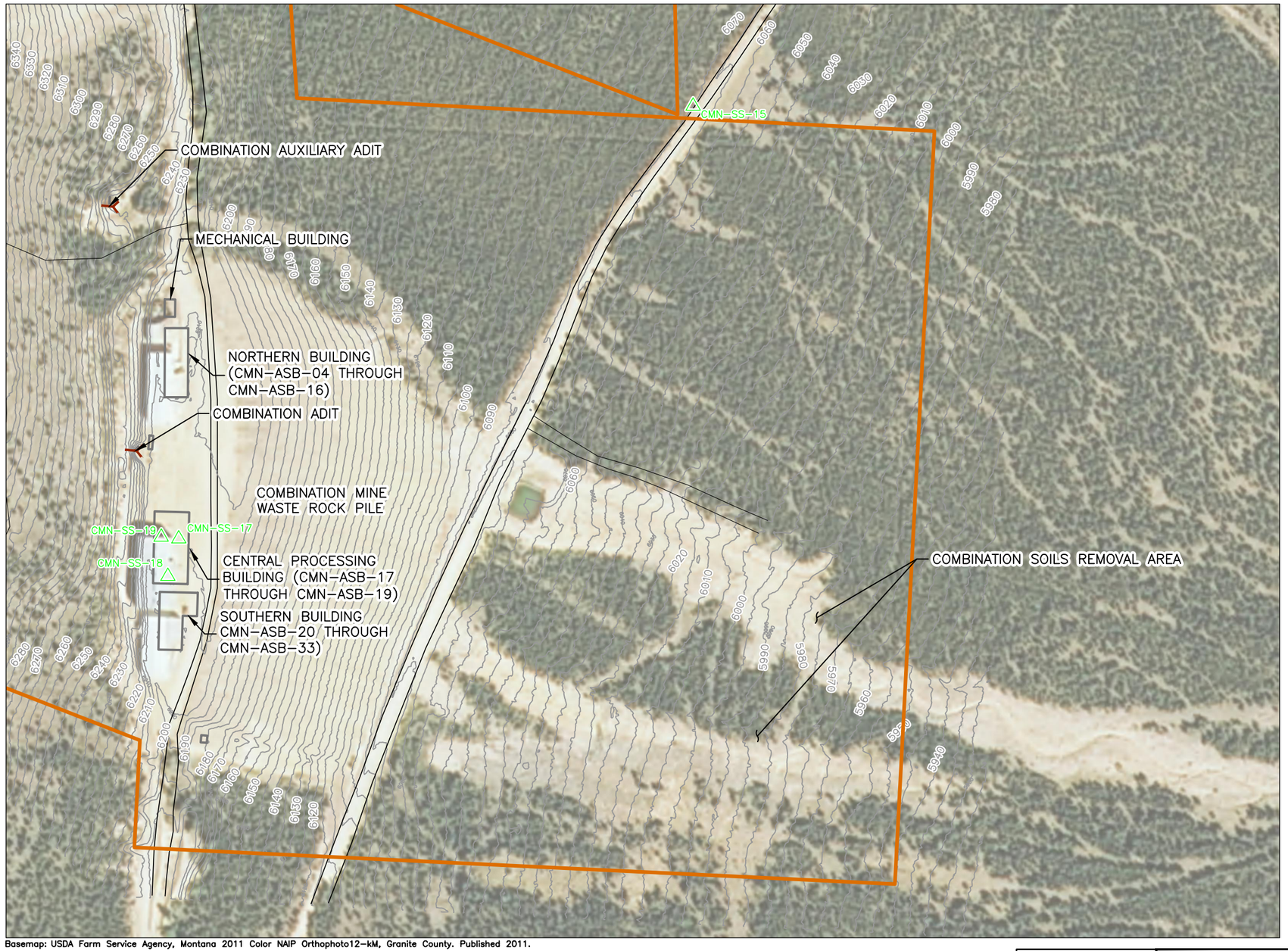
FIGURE 5-1

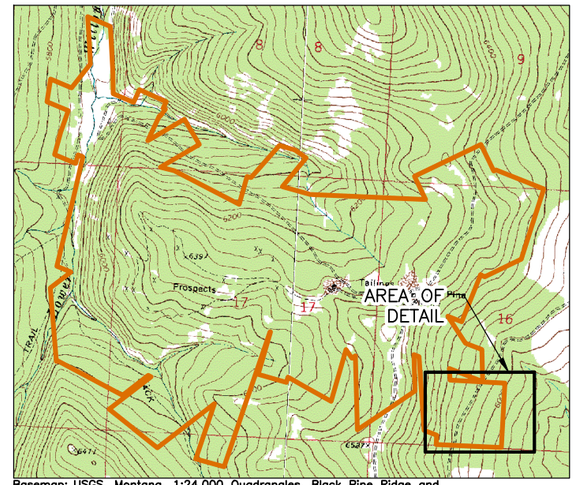
HAZARDOUS MATERIALS INVENTORY SAMPLE LOCATIONS, COMBINATION MILL AREA OF CONCERN

**BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION**

Drawn By: KBW	Checked By: MD	Scale: 1" = 200'	Date: 6/7/13	File: 776_HMI-SL-CM_201306



Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP
SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- EXISTING STRUCTURE
- 5980 EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- ADIT (APPROXIMATE LOCATION)
- CMN-SS-08 SAMPLE LOCATION AND DESIGNATION
- ASB ASBESTOS

N

0 200'

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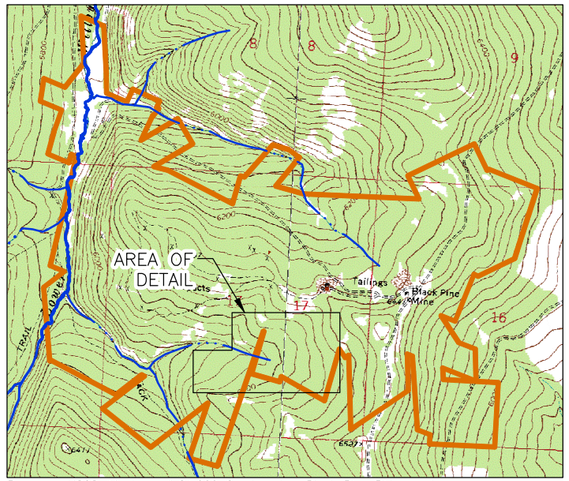
FIGURE 5-2

SAMPLE LOCATION MAP, COMBINATION MINE AREA OF CONCERN

**BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION**

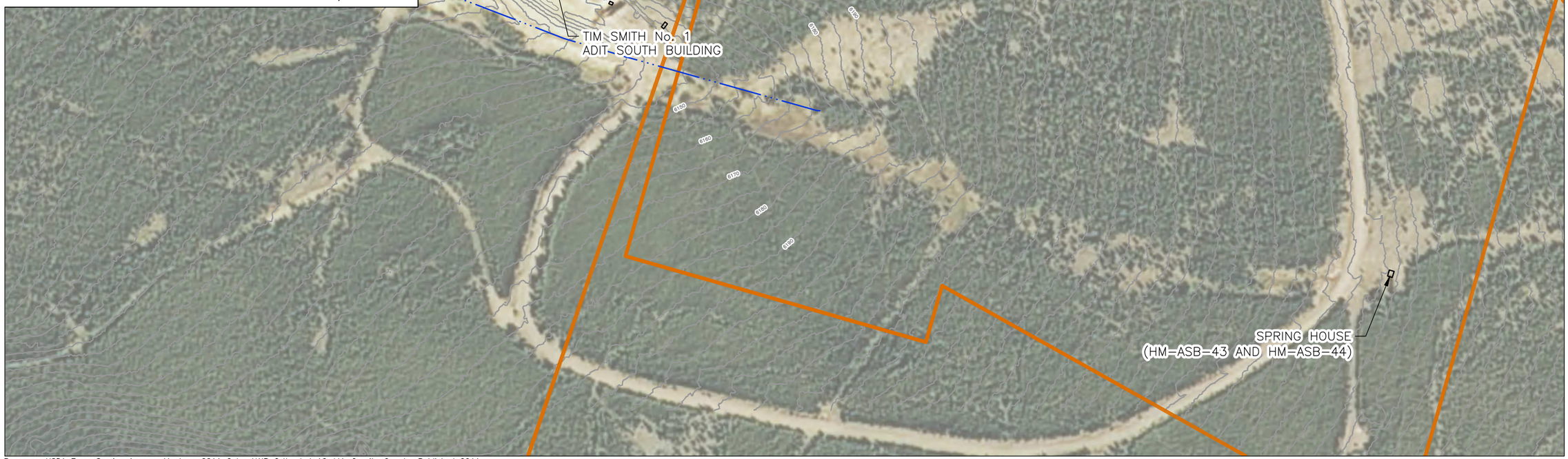
Drawn By: KBW	Checked By: MD	Scale: 1" = 200'	Date: 6/7/13	File: 776_SLM-CMAOC-C_201306



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP
SCALE: NONE

N



Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 6010 EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- ROUTINE SPRING/SEEP SURFACE
- EXISTING STRUCTURE
- ADIT (APPROXIMATE LOCATION)
- ASB ASBESTOS

NOTE

ASBESTOS SAMPLES WERE INCORRECTLY LABELED "HM" INSTEAD OF "TS" IN THE FIELD

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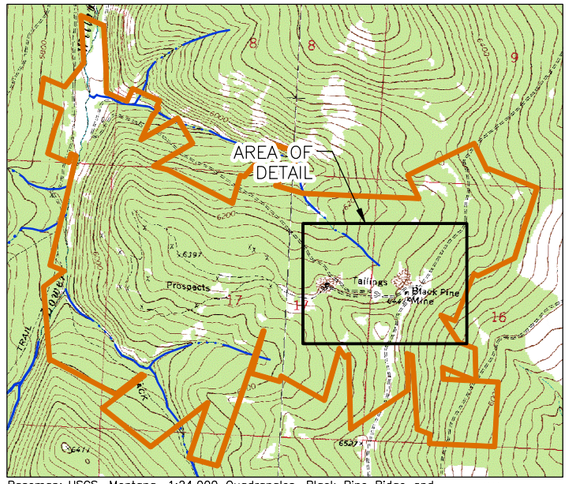
FIGURE 5-3
HAZARDOUS MATERIALS INVENTORY SAMPLE LOCATIONS, TIM SMITH MINE AREA OF CONCERN
BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 100'	Date: 6/11/13	File: 776_HMI-SL-TSM_201306

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP
SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 6290 — EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- EXISTING STRUCTURE
- MINE SHAFT (APPROXIMATE LOCATION)
- ASB — ASBESTOS

N

0 300'

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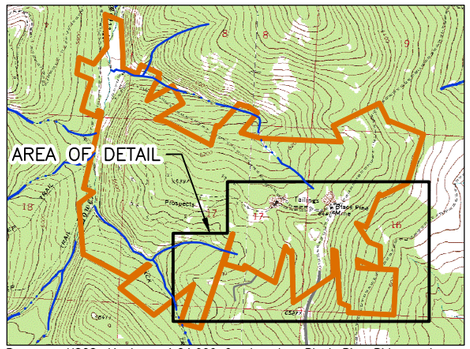
FIGURE 5-4
HAZARDOUS MATERIALS INVENTORY SAMPLE LOCATIONS, HISTORIC MINE AREA OF CONCERN
BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 300'	Date: 6/14/13	File: 776_HMI-SL-HM-B_201306



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N

LEWIS SHAFT

MW-RY-07

MW-RY-06

RY-SS-04

MW-RY-08

HARRISON SHAFT WASTE ROCK

HARPER SHAFT WASTE ROCK

RY-SS-03

POTENTIAL REPOSITORY LOCATION

RY-SS-05

TIM SMITH No. 1 ADIT AND WASTE ROCK DUMP

RY-SS-01

RY-SS-02

BLACK PINE ROAD (COUNTY ROAD 448)

PROPERTY BOUNDARY

COMBINATION MINE WASTE ROCK PILE

COMBINATION MINE SOILS REMOVAL AREA

OHP

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.

EXPLANATION

- EXISTING GROUND SURFACE CONTOURS (5' INTERVAL)
- OVERHEAD POWER
- PROPERTY BOUNDARY
- EDGE OF ROAD
- POTENTIAL REPOSITORY LOCATION
- BUILDING
- RY-SS-04 TEST PIT LOCATION AND DESIGNATION
- MW-RY-1 SOIL BORING/ MONITORING WELL LOCATION AND DESIGNATION

0 500'

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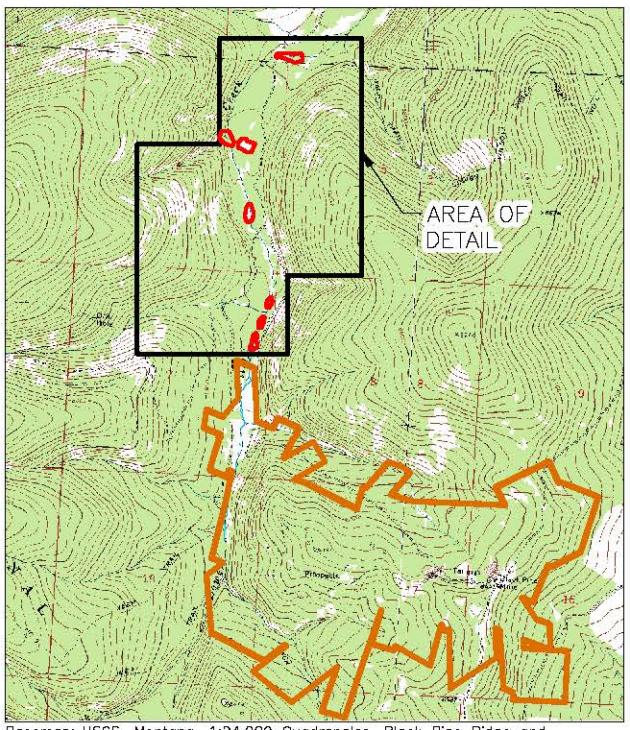
FIGURE 7-1

POTENTIAL REPOSITORY LOCATION

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 500'	Date: 6/11/13	File: 776_PRLOC_201306

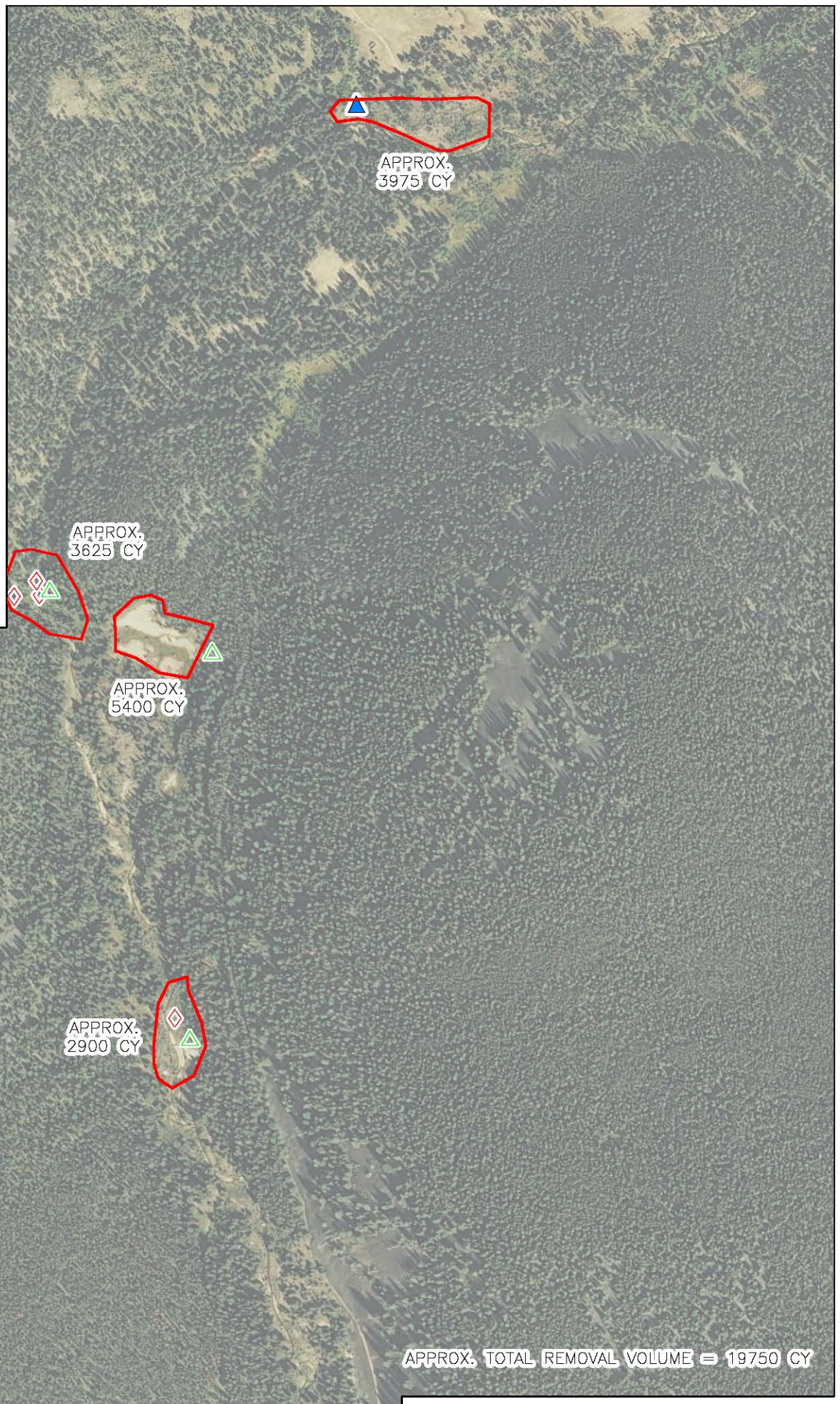


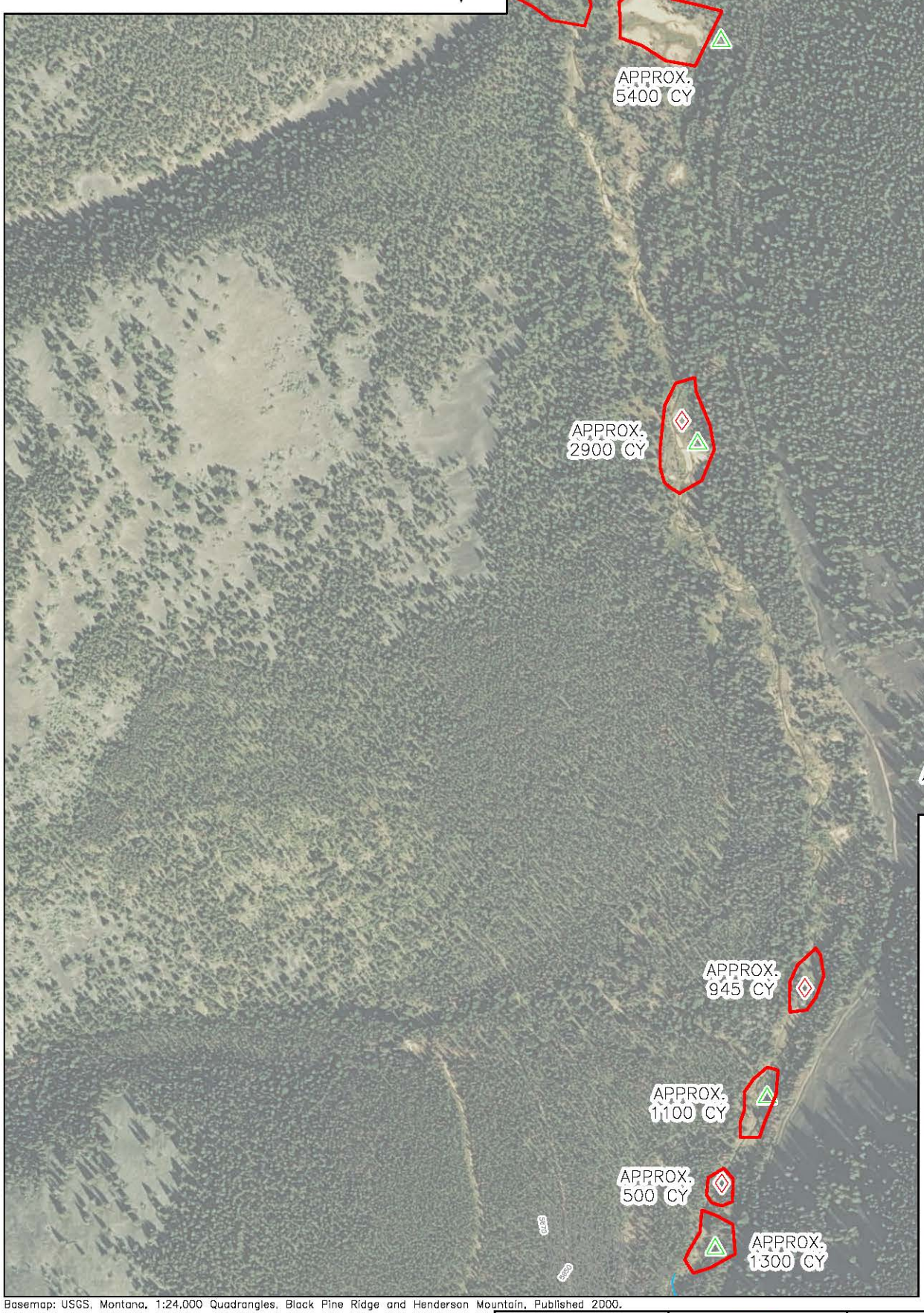
Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N





Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

EXPLANATION

- PROPERTY BOUNDARY
- EXISTING STREAM
- 5740 EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- DISPERSED CONTAMINATED MATERIAL
- MDEQ TMDL PROGRAM SITE WITH DESIGNATION
- SEDIMENT/SOIL SAMPLE LOCATION
- SEDIMENT/SURFACE WATER SAMPLE LOCATION
- TEST PIT SAMPLE LOCATION
- APPROX. APPROXIMATE

N

0 600'

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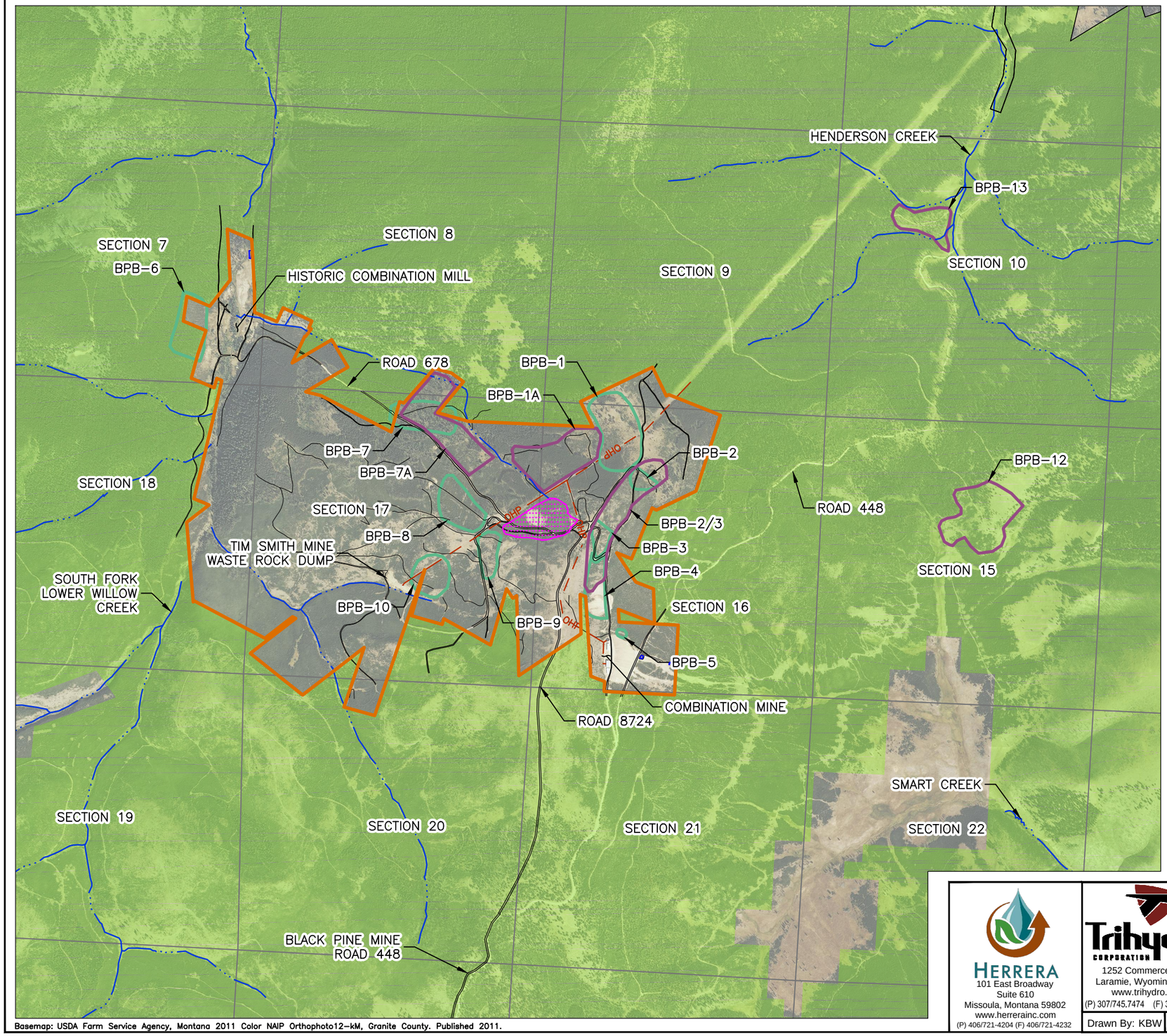
FIGURE 7-2

DISPERSED CONTAMINATED MATERIAL ON USFS ADMINISTERED LANDS

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 600'	Date: 6/18/14	File: 776_DCM-USFS_201306



EXPLANATION

- PROPERTY BOUNDARY
- SECTION BOUNDARIES
- OHP — OVERHEAD POWER
- EDGE OF ROAD
- PROPOSED REPOSITORY AREA
- OCTOBER 2000 BORROW AREAS (HYDROMETRICS)
- POTENTIAL BORROW AREA
- UNITED STATES FOREST SERVICE ADMINISTERED LANDS (APPROXIMATE)
- BPB — BORROW AREA

N

0 2,000'

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12–kM, Granite County. Published 2011.

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FIGURE 7-3

POTENTIAL BORROW AREAS

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE LANDS BUREAU

Drawn By: KBW	Checked By: MD	Scale: 1" = 2,000'	Date: 6/11/13	File: 776_POTBORROW_201306

Proposed South Fork Willow Creek Alignment

Proposed South Fork Willow Creek Alignment

USFS Road 678

Mill Creek

Figure 7-4.
Combination Mill Tailings Impoundment Site Creek Restoration Concept.

- Trust Property boundary
- USFS- administered land (Beaverhead - Deerlodge National Forest)
- Proposed channel alignment
- Existing channel alignment
- Road

N

0 100 200 400 ft

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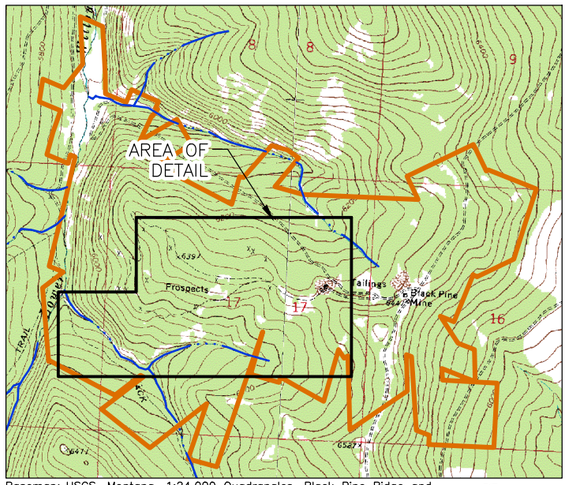
USDA, Aerial (2013)

K:\Projects\Y2006\06-03425-028\Project\creek_restoration_11x17.mxd (6/2/2014)

APPENDIX A

HISTORICAL ANALYTICAL RESULTS AND SAMPLING LOCATIONS

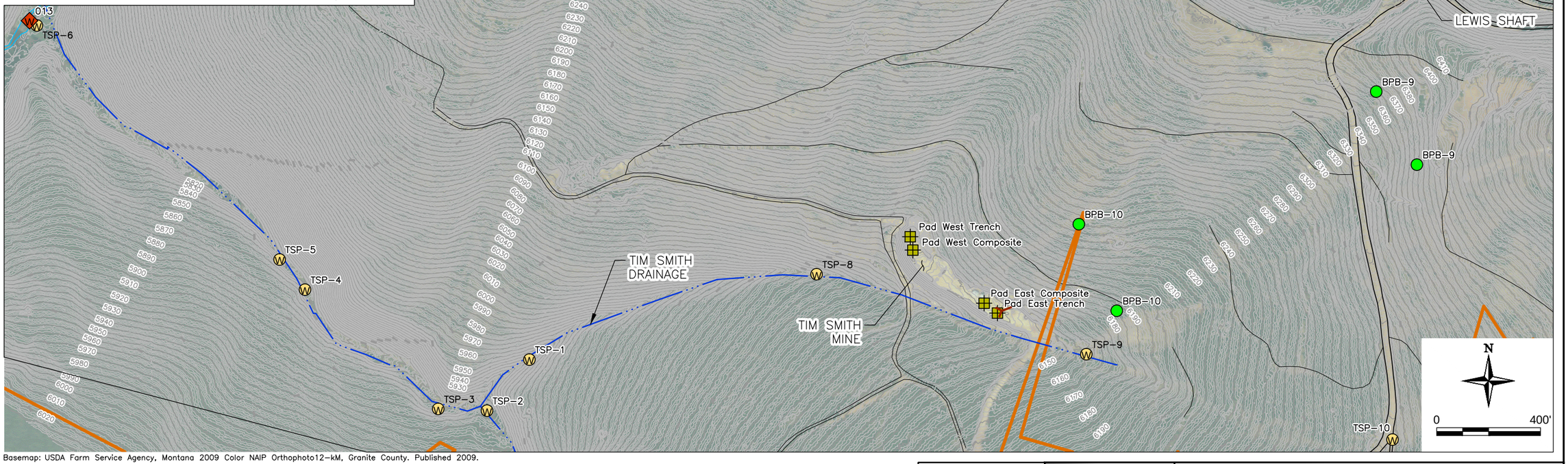


Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N



Basemap: USDA Farm Service Agency, Montana 2009 Color NAIP Orthophoto12-kM, Granite County. Published 2009.

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 6010 — EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- TSP-6 — ROUTINE SPRING/SEEP SURFACE WATER MONITORING SITES (SAMPLED BY HYDROMETRICS AND OTHERS
- Pad — HYDROMETRICS 2001 WASTE ROCK SAMPLE SITE WITH DESIGNATION
- 013 — 1981 BASELINE MONITORING SITES
- BPMSeep — MAY 1998 MDEQ INSPECTION SITES
- BPB-8 — BORROW SOIL SAMPLE SITES
- ADIT (APPROXIMATE LOCATION)

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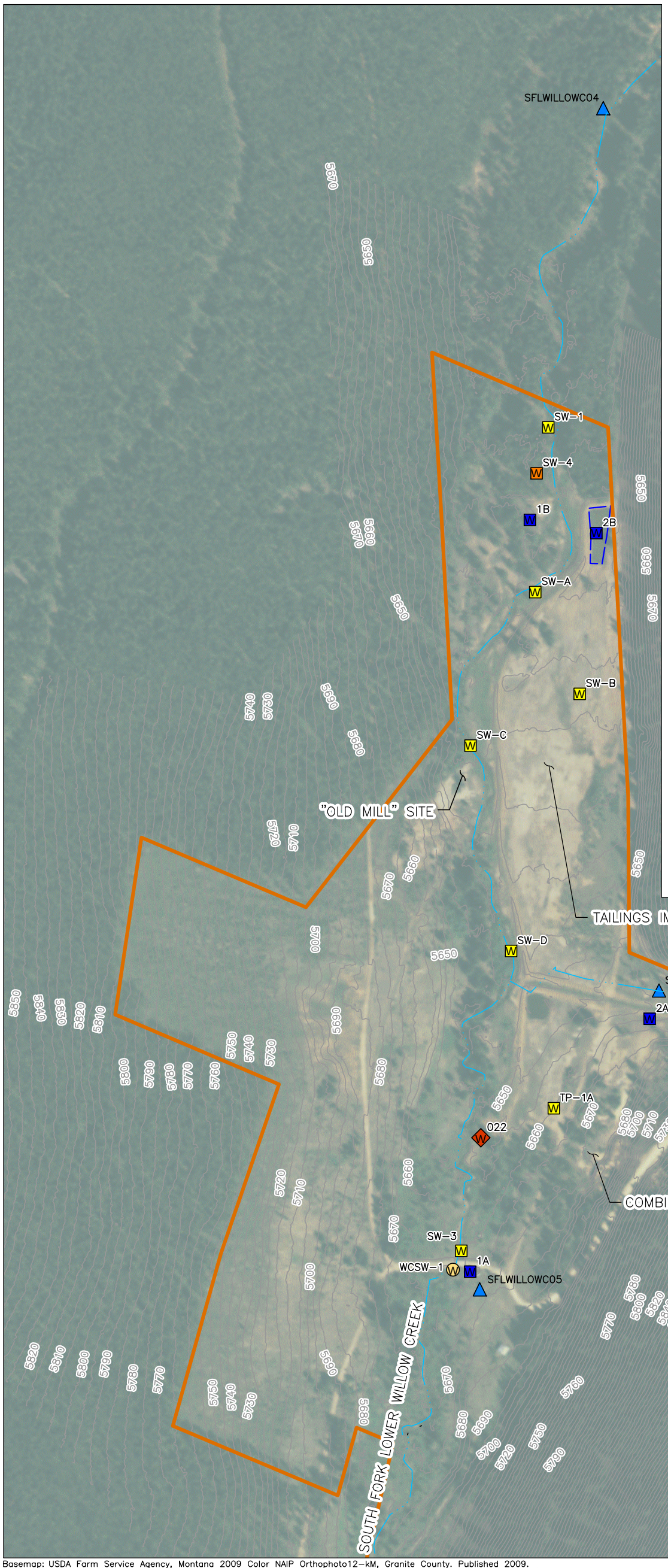
FIGURE A-1

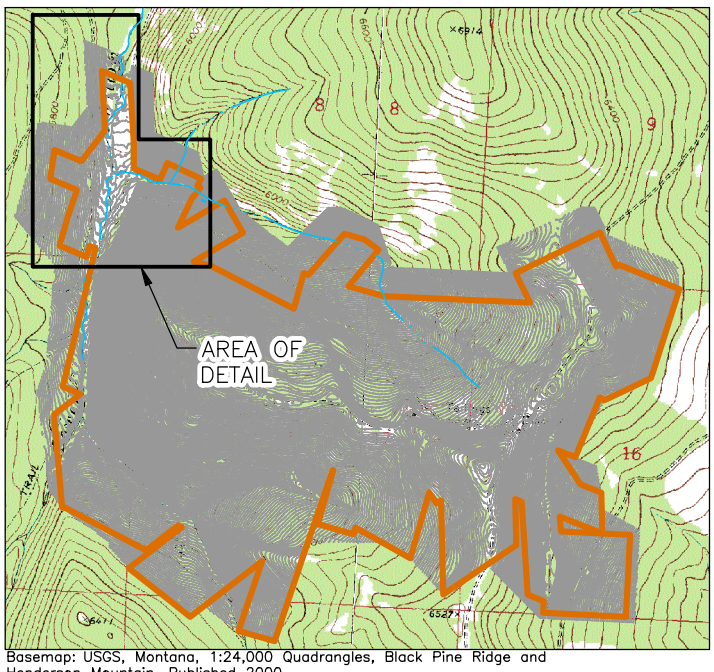
WATER RESOURCES MONITORING SITES AND SOIL SAMPLING LOCATIONS, TIM SMITH MINE AREA

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 400'	Date: 6/11/13	File: 776_WRMSSSL-TSM_201306



Basemap: USDA Farm Service Agency, Montana 2009 Color NAIP Orthophoto12–kM, Granite County. Published 2009.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 5660 — EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- MCSW–1 — ROUTINE SPRING/SEEP SURFACE WATER MONITORING SITES (SAMPLED BY HYDROMETRICS AND OTHERS
- 012 — 1981 BASELINE MONITORING SITES
- 2B — 1991 SCHAFER AND ASSOCIATES SITES
- SW–B — 1993 PIONEER SITES
- SW–4 — 1995 PIONEER SITES
- SFLWILLOWC04.5 — MDEQ TMDL PROGRAM SITES

N

0 300'

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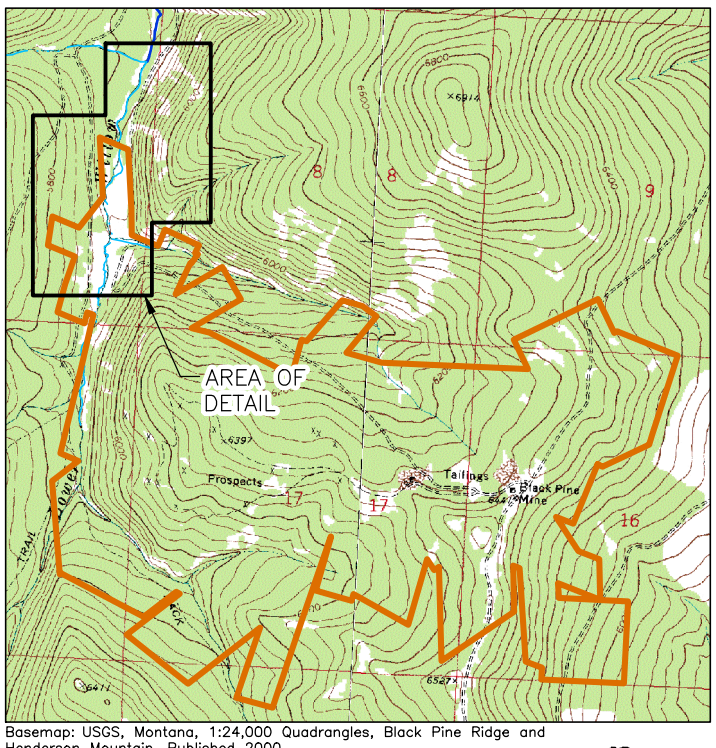
FIGURE A-2

WATER RESOURCE MONITORING SITES, COMBINATION MILL AREA

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 300'	Date: 6/7/13	File: 776_WRMS-CM-A_201306



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N

Basemap: USDA Farm Service Agency, Montana 2009 Color NAIP Orthophoto12–kM, Granite County. Published 2009.

0 300'

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 5740 — EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- 167–168 — SCHAFER 1991 pH SAMPLE SITE WITH DESIGNATION
- 88–10 — SCHAFER 1991 METALS/ABA SAMPLE SITE WITH DESIGNATION
- TP–1D — 1993 PIONEER SITE WITH DESIGNATION
- SE–4 — 1995 PIONEER SITE WITH DESIGNATION
- SFLWILLOWC04.5 — MDEQ TMDL PROGRAM SITE WITH DESIGNATION
- BPB–6 — BORROW SOIL SAMPLE SITES WITH DESIGNATION

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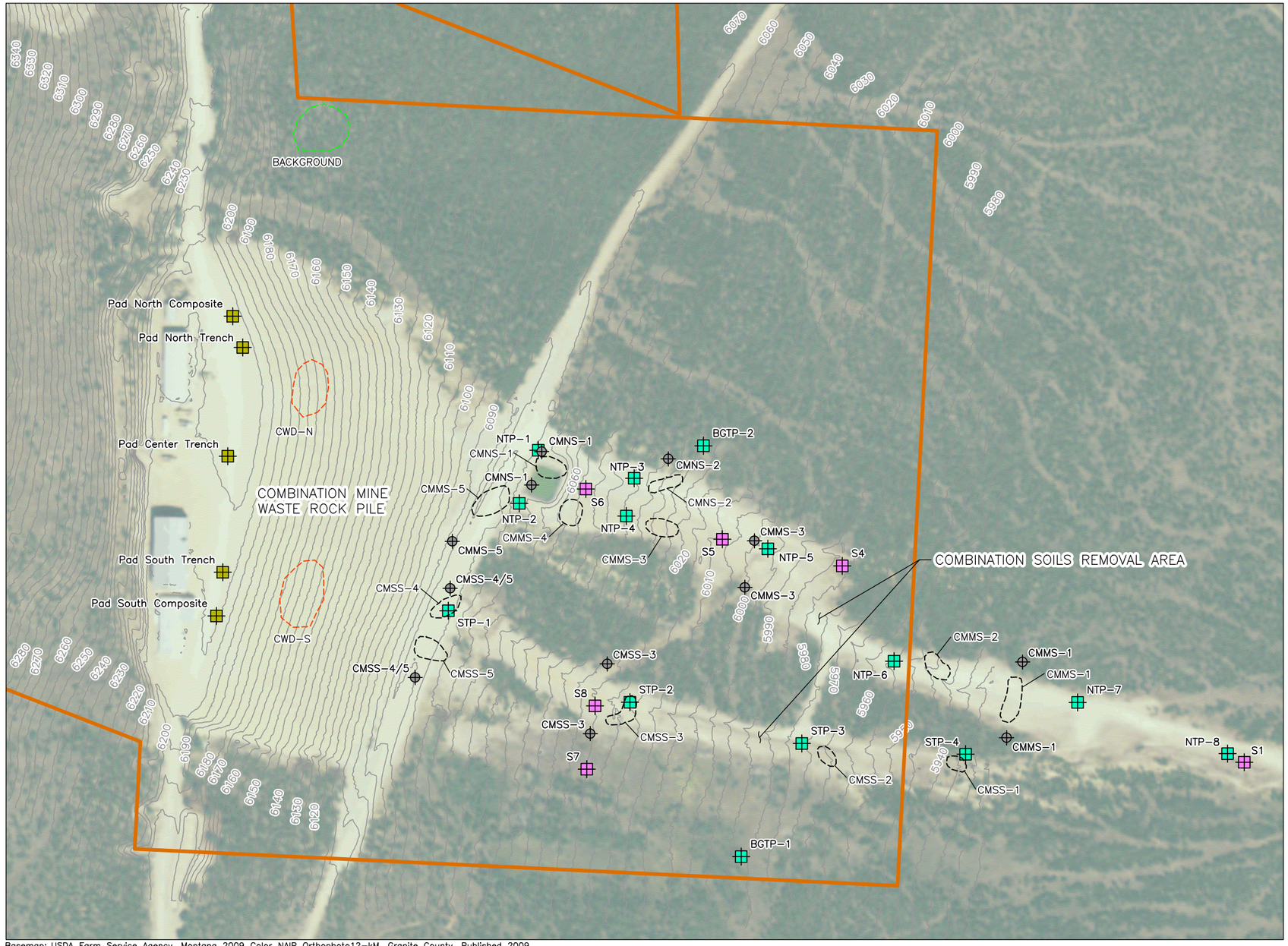
FIGURE A-3

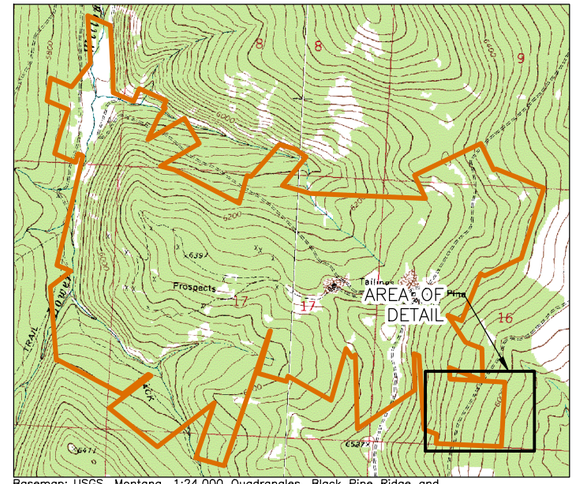
SOIL/SEDIMENT/MINE WASTE SAMPLING LOCATIONS, COMBINATION MILL AREA

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 300'	Date: 6/7/13	File: 776_SSMWSL-CM-A_201306



Basemap: USDA Farm Service Agency, Montana 2009 Color NAIP Orthophoto12–kM, Granite County. Published 2009.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- 5980 — EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- CMMS–1 — HYDROMETRICS 2000 SAMPLE SITE (PERIPHERAL AREA) WITH DESIGNATION
- NTP–8 — HYDROMETRICS 2001 TEST PIT WITH DESIGNATION
- Pad — HYDROMETRICS 2001 WASTE ROCK SAMPLE SITE WITH DESIGNATION
- S1 — MDEQ 2008 SAMPLE SITE WITH DESIGNATION
- HYDROMETRICS 2000 SAMPLE SITE (DEVEGETATED AREA)
- HYDROMETRICS 2000 SAMPLE SITE (WASTE ROCK)
- HYDROMETRICS 2000 SAMPLE SITE (BACKGROUND)

N

0 200'

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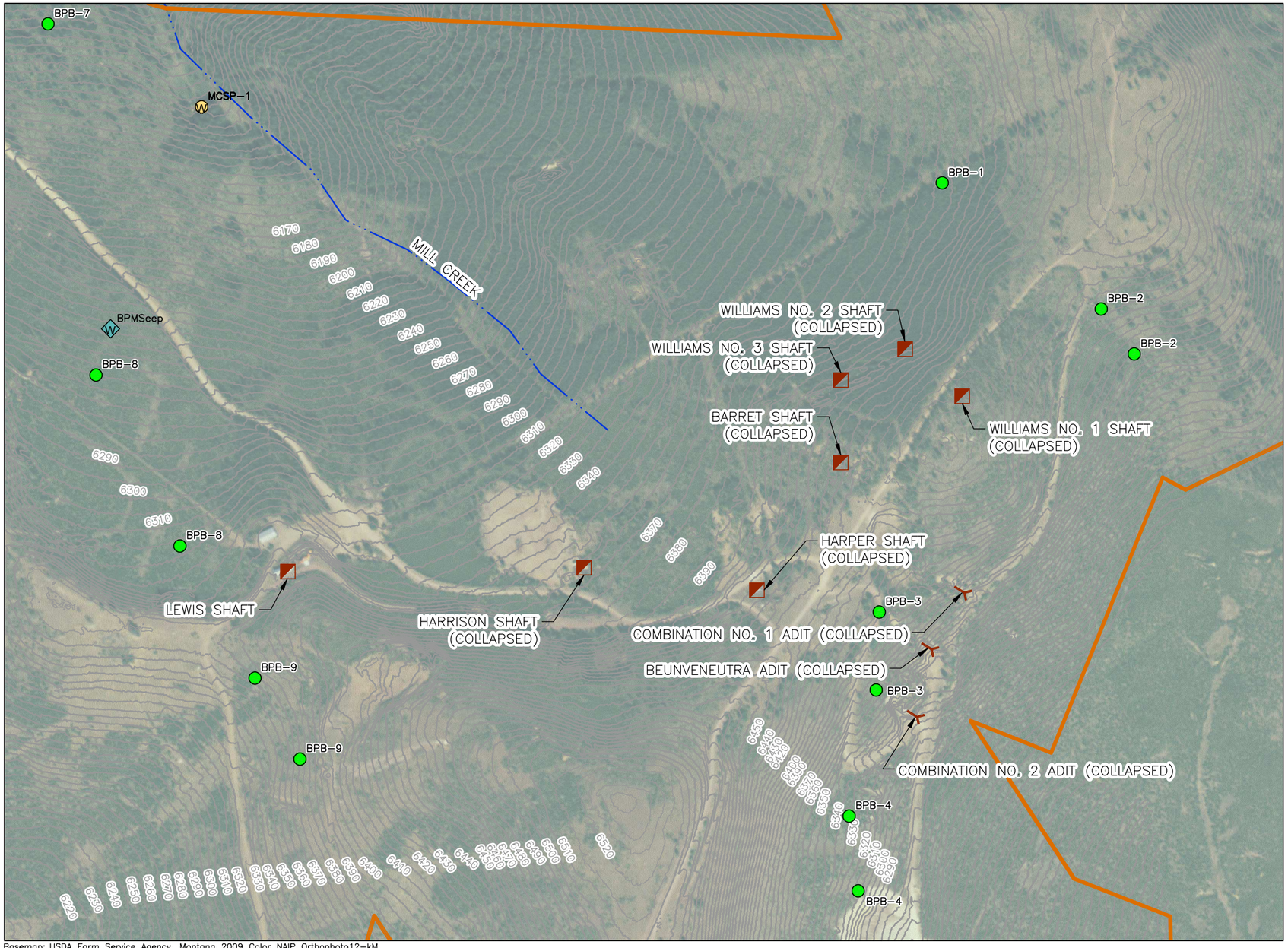
FIGURE A-4

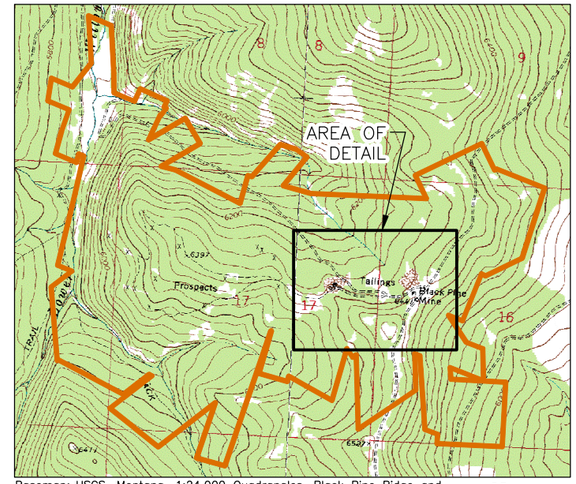
SOIL/SEDIMENT/MINE WASTE SAMPLING LOCATIONS, COMBINATION MINE AREA

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 200'	Date: 6/7/13	File: 776_SSMWSL-CM-B_201306



Basemap: USDA Farm Service Agency, Montana 2009 Color NAIP Orthophoto12–kM, Granite County. Published 2009.



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP
SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- 6290 EXISTING GROUND SURFACE CONTOURS (INTERVAL = 5')
- MINE SHAFT (APPROXIMATE LOCATION)
- BPMSeep MAY 1998 MDEQ INSPECTION SITE
- BPB–6 BORROW SOIL SAMPLE SITES WITH DESIGNATION
- MCSP–1 ROUTINE SPRING/SEEP SURFACE WATER MONITORING SITES (SAMPLED BY HYDROMETRICS AND OTHERS)
- ADIT (APPROXIMATE LOCATION)

N

0 300'

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FIGURE A-5

SAMPLING LOCATIONS, HISTORIC MINE AREA

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION

Drawn By: KBW	Checked By: MD	Scale: 1" = 300'	Date: 6/7/13	File: 776_SL-HM_201306

TABLE A-1. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS
COMBINATION MINE AOC
BLACK PINE MINE

Description	Location	Date Sampled	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc	Silver
Risk Based Cleanup Guidelines[c] (mg/kg)						**40.4[de]**	**19.5[d]**	**27,100.0**	**1,100.0**	**665.0**	**220,000.0**	**NS**
Background Samples	Background	7/21/1993	0	0	mg/kg	NA*	NA*	NA*	85.8	**1530**	47.4	NA*
	Background	10/25/2000	0	0.17	mg/kg	26	ND(10)	46	110	**2121**	170	NA*
	BGTP-1	7/19/2001	0	1	mg/kg	ND(10)	ND(10)	12	22	151	ND(10)	NA*
	BGTP-1	7/19/2001	1	2	mg/kg	ND(10)	ND(10)	13	14	98	ND(10)	NA*
	BGTP-1	7/19/2001	2	3	mg/kg	ND(10)	ND(10)	19	30	244	36	NA*
	BGTP-2	7/19/2001	0	1	mg/kg	ND(10)	ND(10)	12	19	348	ND(10)	NA*
	BGTP-2	7/19/2001	1	2	mg/kg	ND(10)	ND(10)	11	16	244	ND(10)	NA*
	BGTP-2	7/19/2001	2	3	mg/kg	ND(10)	ND(10)	17	25	356	ND(10)	NA*
Average[a]					mg/kg	8.00	5.00	18.57	40.23	637	34.80	NA*
2000 Hydrometrics Surface Soil Samples - Devegetated Area and Peripheral Area[b,f]	CMMS-1	10/25/2000	0	0.17	mg/kg	21	14	7655	63	**2546**	797	ND(20)
	CMMS-1	10/25/2000	0	0.17	mg/kg	22	ND(10)	62	83	**2309**	124	ND(20)
	CMMS-2	10/25/2000	0	0.17	mg/kg	18	**24**	11316	97	**2368**	1178	ND(20)
	CMMS-3	10/25/2000	0	0.17	mg/kg	23	ND(10)	2391	79	**2120**	377	ND(20)
	CMMS-3	10/25/2000	0	0.17	mg/kg	21	ND(10)	547	42	**2127**	246	ND(20)
	CMMS-4	10/25/2000	0	0.17	mg/kg	**46**	ND(10)	1009	268	552	131	ND(20)
	CMMS-5	10/25/2000	0	0.17	mg/kg	34	16	1296	155	**1003**	413	ND(20)
	CMMS-5	10/25/2000	0	0.17	mg/kg	12	ND(10)	217	59	**1451**	165	ND(20)
	CMNS-1	10/24/2000	0	0.17	mg/kg	**74**	19	913	179	**998**	593	ND(20)
	CMNS-1	10/25/2000	0	0.17	mg/kg	17	14	985	69	**2804**	657	ND(20)
	CMNS-2	10/24/2000	0	0.17	mg/kg	**44**	ND(10)	1259	82	**1687**	291	ND(20)
	CMSS-1	10/24/2000	0	0.5	mg/kg	36	ND(10)	437	324	**951**	358	ND(20)
	CMSS-2	10/24/2000	0	0.17	mg/kg	**1175**	**45**	1029	**8058**	186	4688	261
	CMSS-2	10/24/2000	0	0.17	mg/kg	**41**	ND(10)	830	451	**1042**	355	ND(20)
	CMSS-3	10/24/2000	0	0.17	mg/kg	**974**	**55**	888	**5936**	172	5848	210
	CMSS-3	10/24/2000	0	0.17	mg/kg	29	ND(10)	98	113	**2759**	299	ND(20)
	CMSS-4	10/24/2000	0	0.5	mg/kg	**1916**	**69**	1245	**13211**	264	8915	413
	CMSS-4/5	10/24/2000	0	0.17	mg/kg	13	ND(10)	29	64	**1232**	75	ND(20)
	CMSS-5	10/24/2000	0	0.5	mg/kg	**363**	15	1849	**2613**	**962**	694	65
Average[a]					mg/kg	**256.8**	**22.47**	1792	**1681**	**1449**	1379	58
2000 Hydrometrics Subsurface Soil Samples - Devegetated Area and Peripheral Area[b,f]	CMSS-2	10/24/2000	0.17	0.5	mg/kg	35	ND(10)	1621	187	**1332**	496	ND(20)
	CMSS-3	10/24/2000	0.17	0.5	mg/kg	26	ND(10)	1624	199	**1751**	427	ND(20)
	CMMS-1	10/25/2000	0.5	0.67	mg/kg	16	ND(10)	2134	47	**1747**	273	ND(20)
	CMMS-2	10/25/2000	0.5	0.67	mg/kg	18	11	2912	59	**1758**	384	ND(20)
	CMMS-3	10/25/2000	0.5	0.67	mg/kg	ND(10)	ND(10)	573	24	522	160	ND(20)
	CMMS-4	10/25/2000	0.5	0.67	mg/kg	12	ND(10)	506	68	565	120	ND(20)
	CMMS-5	10/25/2000	0.5	0.67	mg/kg	ND(10)	ND(10)	433	37	449	231	ND(20)
	CMNS-1	10/24/2000	0.5	0.67	mg/kg	12	ND(10)	230	23	212	96	ND(20)
	CMNS-2	10/24/2000	0.5	0.67	mg/kg	14	ND(10)	336	13	659	138	ND(20)
	CMSS-4	10/24/2000	0.5	0.67	mg/kg	29	ND(10)	383	109	**681**	127	ND(20)
Average[a]					mg/kg	17.20	5.67	1075	76.60	**967.6**	245.2	10.0
2000 and 2001 Hydrometrics Waste Rock Samples	Combination Pad Center Trench	7/19/2001	0	6	mg/kg	**274**	7	1080	**1540**	100	710	62
	Combination Pad North Composite	7/19/2001	0	1.5	mg/kg	**332**	8	863	**2620**	299	555	70
	Combination Pad North Trench	7/19/2001	0	6	mg/kg	**274**	13	1020	**2080**	353	1400	115
	Combination Pad South Composite	7/19/2001	0	1.5	mg/kg	**403**	**20**	1430	**3070**	390	1600	72
	Combination Pad South Trench	7/19/2001	0	6	mg/kg	**341**	14	1190	**2050**	380	762	134
	CWD-N	10/25/2000	0	0.5	mg/kg	**444**	14	1024	**2710**	184	1209	90
	CWD-S	10/25/2000	0	0.5	mg/kg	**904**	**37**	3402	**6393**	655	2578	179
Average[a]					mg/kg	**425**	16.14	1430	**2923**	337.3	1259	103

TABLE A-1. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS
COMBINATION MINE AOC
BLACK PINE MINE

Description	Location	Date Sampled	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc	Silver
Risk Based Cleanup Guidelines[c] (mg/kg)						**40.4[de]**	**19.5[d]**	**27,100.0**	**1,100.0**	**665.0**	**220,000.0**	**NS**
2001 Hydrometrics Surface Soil Samples	NTP-1	7/19/2001	0	1	mg/kg	**43**	ND(10)	251	53	312	108	NA*
	NTP-2	7/19/2001	0	1	mg/kg	ND(10)	ND(10)	90	18	271	187	NA*
	NTP-3	7/19/2001	0	1	mg/kg	11	ND(10)	307	26	440	133	NA*
	NTP-4	7/19/2001	0	1	mg/kg	ND(10)	ND(10)	411	23	**728**	143	NA*
	NTP-5	7/19/2001	0	1	mg/kg	ND(10)	ND(10)	787	30	**819**	140	NA*
	NTP-6	7/19/2001	0	1	mg/kg	ND(10)	ND(10)	215	24	**1990**	370	NA*
	NTP-7	7/19/2001	0	1	mg/kg	12	ND(10)	1419	29	**1201**	226	NA*
	NTP-8	7/19/2001	0	1	mg/kg	21	12	3405	58	**2865**	541	NA*
	STP-1	7/19/2001	0	1	mg/kg	20	ND(10)	242	140	231	147	NA*
	STP-2	7/19/2001	0	1	mg/kg	18	ND(10)	360	103	398	148	NA*
	STP-3	7/19/2001	0	1	mg/kg	34	ND(10)	236	241	263	121	NA*
	STP-4	7/19/2001	0	1	mg/kg	14	ND(10)	79	76	254	102	NA*
Average[a]					mg/kg	16.08	5.58	650.2	68.42	**814.3**	197.2	NA*
2001 Hydrometrics Subsurface Soil Samples	NTP-1	7/19/2001	1	2	mg/kg	10	ND(10)	157	21	186	93	NA*
	NTP-1	7/19/2001	2	3	mg/kg	11	ND(10)	141	23	175	88	NA*
	NTP-2	7/19/2001	1	2	mg/kg	ND(10)	ND(10)	135	18	206	138	NA*
	NTP-2	7/19/2001	2	3	mg/kg	ND(10)	ND(10)	111	19	210	117	NA*
	NTP-3	7/19/2001	1	2	mg/kg	ND(10)	ND(10)	135	19	207	81	NA*
	NTP-3	7/19/2001	2	3	mg/kg	ND(10)	ND(10)	106	15	135	77	NA*
	NTP-4	7/19/2001	1	2	mg/kg	ND(10)	ND(10)	122	26	276	53	NA*
	NTP-4	7/19/2001	2	3	mg/kg	14	ND(10)	57	27	360	86	NA*
	NTP-5	7/19/2001	1	2	mg/kg	ND(10)	ND(10)	286	27	253	64	NA*
	NTP-5	7/19/2001	2	3	mg/kg	9	ND(10)	68	14	190	64	NA*
	NTP-6	7/19/2001	1	2	mg/kg	ND(10)	ND(10)	319	26	467	97	NA*
	NTP-6	7/19/2001	2	3	mg/kg	17	ND(10)	40	19	336	51	NA*
	NTP-6	7/19/2001	3	4	mg/kg	14	ND(10)	49	18	219	44	NA*
	NTP-7	7/19/2001	1	2	mg/kg	ND(10)	ND(10)	632	26	427	126	NA*
	NTP-7	7/19/2001	2	3	mg/kg	ND(10)	ND(10)	217	22	204	86	NA*
	NTP-7	7/19/2001	3	4	mg/kg	24	ND(10)	57	25	172	40	NA*
	NTP-8	7/19/2001	1	2	mg/kg	6	ND(10)	119	23	45	61	NA*
	NTP-8	7/19/2001	2	3	mg/kg	ND(10)	ND(10)	211	22	199	76	NA*
	STP-1	7/19/2001	1	2	mg/kg	18	ND(10)	259	124	291	125	NA*
	STP-1	7/19/2001	2	3	mg/kg	ND(10)	ND(10)	241	83	290	158	NA*
	STP-2	7/19/2001	1	2	mg/kg	11	ND(10)	184	45	169	106	NA*
	STP-2	7/19/2001	2	3	mg/kg	14	ND(10)	48	60	211	65	NA*
	STP-3	7/19/2001	1	2	mg/kg	ND(10)	ND(10)	106	50	151	78	NA*
	STP-3	7/19/2001	2	3	mg/kg	5	ND(10)	11	25	242	43	NA*
	STP-4	7/19/2001	1	2	mg/kg	ND(10)	ND(10)	42	56	169	32	NA*
	STP-4	7/19/2001	2	3	mg/kg	13	ND(10)	18	32	219	17	NA*
Average[a]					mg/kg	8.88	5.00	148.9	33.27	231.1	79.46	NA*
2008 DEQ Surface Soil Samples	S-1	7/11/2008	0	0.17	mg/kg	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	S-2	7/11/2008	0	0.17	mg/kg	ND(5)	ND(1)	370	7.2	NA*	546	NA*
	S-3	7/11/2008	0	0.17	mg/kg	ND(5)	ND(1)	335	17.7	NA*	121	NA*
	S-4	7/11/2008	0	0.17	mg/kg	ND(5)	1.5	1230	23.9	NA*	130	NA*
	S-5	7/11/2008	0	0.17	mg/kg	ND(5)	ND(1)	250	7.2	NA*	110	NA*
	S-6	7/11/2008	0	0.17	mg/kg	12.4	2.7	50.9	24.2	NA*	90.6	NA*
	S-7	7/11/2008	0	0.17	mg/kg	ND(5)	**40.5**	1320	7.1	NA*	1520	NA*
	S-8	7/11/2008	0	0.17	mg/kg	25.2	2.5	172	183	NA*	166	NA*
Average[a]					mg/kg	7.16	6.96	532.6	38.61	NA*	383.4	NA*

TABLE A-1. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS
COMBINATION MINE AOC
BLACK PINE MINE

Description	Location	Date Sampled	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc	Silver
Risk Based Cleanup Guidelines[c] (mg/kg)						**40.4[de]**	**19.5[d]**	**27,100.0**	**1,100.0**	**665.0**	**220,000.0**	**NS**
2011 RI Waste Rock Samples	CMN-RS-04	7/14/2011	2	4	mg/kg	**216**	3.7	309	**1910**	110	423	50.2
	CMN-RS-04	7/14/2011	5	7	mg/kg	**439**	10.2	464	**2750**	36.8	1040	155
	CMN-RS-05	7/14/2011	5	7	mg/kg	**467**	13.7	1950	**3050**	850	923	69
	CMN-RS-06	7/14/2011	2	4	mg/kg	**515**	14.9	1690	**3820**	652	1150	87.6
Average[a]					mg/kg	**409.3**	10.63	1103	**2883**	412.2	884.0	90.5
2011 RI Surface Soil Samples	CMN-SS-04	7/14/2011	0	1	mg/kg	35	0.39	57.8	261	480	81.5	1
	CMN-SS-05	7/14/2011	0	1	mg/kg	26.1	0.37	73.6	282	**928**	88	1
	CMN-SS-06	7/14/2011	0	1	mg/kg	22.3	0.54	57.5	217	**910**	321	1.6
	CMN-SS-07	7/14/2011	0	1	mg/kg	12.2	0.41	30.9	19.7	252	57	ND(0.55)
	CMN-SS-08	7/14/2011	0	1	mg/kg	14.4	1.6	220	24.4	419	101	ND(0.6)
	CMN-SS-09	7/14/2011	0	1	mg/kg	9.7	2.7	489	21	460	131	0.66
	CMN-SS-10	7/14/2011	0	1	mg/kg	8.6	1.4	139	15.8	**1170**	93.2	1
	CMN-SS-11	7/14/2011	0	1	mg/kg	22.5	1.2	64.2	110	311	133	2.3
	CMN-SS-12	7/14/2011	0	1	mg/kg	12.3	1.1	105	59	316	127	2
	CMN-SS-13	7/14/2011	0	1	mg/kg	**250**	11.2	885	**1890**	540	877	70.8
	CMN-SS-14	7/14/2011	0	1	mg/kg	19.1	2.8	321	19.3	298	163	ND(1.2)
	CMN-SS-15	7/13/2011	0	0.5	mg/kg	11.5	0.6	88.5	62.1	226	55.4	ND(0.53)
	CMN-SS-16	7/13/2011	0	0.5	mg/kg	31.7	2.9	295	182	556	148	3.2
Average[a]					mg/kg	36.57	2.09	217.4	243.3	528.2	182.8	6.5
2011 RI Subsurface Soil Samples	CMN-SS-08	7/14/2011	3	5	mg/kg	7.6	0.71	124	14.8	193	62.7	ND(0.62)
	CMN-SS-09	7/14/2011	4	6	mg/kg	8.1	1.7	58.4	20.4	243	129	ND(0.57)
	CMN-SS-10	7/14/2011	4	5	mg/kg	14.1	0.32	38.1	24.9	510	44.8	ND(0.15)
	CMN-SS-11	7/14/2011	4	5	mg/kg	29.5	ND(0.079)	18.4	55.4	610	43.1	0.59
	CMN-SS-12	7/14/2011	4	5	mg/kg	10.4	0.19	22.3	23.3	239	54	ND(0.5)
	CMN-SS-13	7/14/2011	4	5	mg/kg	8.3	ND(0.093)	14.5	24.4	170	41.4	0.91
	CMN-SS-14	7/14/2011	4	5	mg/kg	19.9	6.9	917	108	602	279	3.7
	CMN-SS-06	7/14/2011	6	8	mg/kg	7	0.25	8.8	19	342	37.9	ND(0.48)
	CMN-SS-07	7/14/2011	6	7	mg/kg	12.4	ND(0.088)	14.9	24.8	393	30.5	ND(0.55)
	CMN-SS-04	7/14/2011	8	10	mg/kg	7.9	0.11	26.8	5.3	56.9	17.7	ND(0.56)
	CMN-SS-05	7/14/2011	8	10	mg/kg	7.7	ND(0.08)	8.7	14.9	137	25.7	ND(0.5)
Average[a]					mg/kg	12.08	0.941	113.8	30.47	317.8	69.62	0.65

[a] For non detect results, one half of the reporting limit was used in the calculation of the average concentration

[b] Sample results did not distinguish between samples collected in the "Devegetated Areas" and in the "Peripheral Areas"

[c] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Soil Cleanup Guidelines for Recreational Visitors Table 7-10 (DEQ 1996)

[d] Carcinogenic risk of 5E-07

[e] UCL = 95th upper confidence limit on the arithmetic mean background concentration, from background samples

[f] 2000 data was analyzed with XRF and was found to be substantially higher than results for samples collected durign the same time period and analyzed at a laboratory. 2000 data is provided for reference, but is not used for comparisons between RI and historical data.

Bold values exceed DEQ RBCG values

Shading indicates relative concentrations values, dark represents higher relative concentrations

J and UJ qualifiers not shown, refer to Table 3-2 for qualifiers on 2011 data

R - Rejected, data not usable

ft - feet

mg/kg - milligrams per kilogram.

NA* - Not Applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

NS - A standard has not been adopted

Antimony, barium, chromium, cobalt, iron, mercury, nickel, and silver were not analyzed in historical samples.

TABLE A-2. HISTORICAL SURFACE WATER (SEEP) ANALYTICAL RESULTS – METALS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Date Sampled	Metals Analysis[c]	Units	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Zinc
Risk Based Cleanup Guidelines[a] (ug/L)				**0.06[b]**	**66.5**	**472**	**4,979**	**47.1**	**16.6**	**17.2**
CPS-1	10/4/2000	Dissolved	ug/L	**ND(3)**	**1020**	**78100**	1430	3	**25500**	**81200**
CPS-1	5/21/2001	Dissolved	ug/L	**ND(5)**	**819**	**61000**	NA*	40	**19100**	**52300**
CPS-1	5/30/2001	Dissolved	ug/L	**ND(3)**	**625**	**47600**	260	ND(3)	**14800**	**41100**
CPS-1	7/18/2001	Dissolved	ug/L	**ND(3)**	**991**	**74600**	1870	3	**22200**	**64100**
CPS-1	10/16/2001	Total	ug/L	**ND(5)**	**1370**	**105000**	NA*	ND(10)	**30900**	**89100**
CPS-1	4/23/2004	Dissolved	ug/L	**ND(3)**	**662**	**38000**	ND(30)	ND(3)	**12000**	**42000**
CPS-1	5/31/2005	Dissolved	ug/L	**ND(3)**	**460**	**39680**	240	ND(3)	**10770**	**38020**
CPS-1	9/7/2006	Total	ug/L	**ND(3)**	**339.7**	**25490**	130	ND(3)	**8440**	**25800**
CPS-1	11/2/2006	Total	ug/L	**ND(3)**	**432.7**	**30930**	150	ND(3)	**10530**	**28800**
CPS-1	3/30/2007	Total	ug/L	**ND(3)**	**247.5**	**17480**	300	ND(3)	**6040**	**19060**
CPS-1	4/25/2007	Total	ug/L	**ND(3)**	**197.3**	**15510**	80	ND(3)	**4850**	**15300**
CPS-1	10/11/2007	Total	ug/L	**ND(3)**	**293.7**	**21070**	80	ND(3)	**6970**	**20200**
CPS-1	4/18/2008	Total	ug/L	**4**	**170.9**	**11370**	660	10	**3770**	**12140**
CPS-1	5/7/2008	Total	ug/L	**ND(3)**	**264.8**	**19690**	70	ND(3)	**6430**	**20390**
CPS-1	6/30/2008	Total	ug/L	**ND(3)**	**180**	**13340**	50	ND(3)	**4130**	**13100**
CPS-1	10/30/2008	Total	ug/L	**ND(3)**	**214.8**	**14370**	40	ND(3)	**5060**	**15050**
CPS-1	5/14/2009	Total	ug/L	**ND(3)**	**174.6**	**11300**	40	ND(3)	**3810**	**12370**
CPS-1	5/29/2009	Total	ug/L	**ND(3)**	**152.7**	**10890**	40	ND(3)	**3510**	**11380**
CPS-1	4/27/2010	Total	ug/L	**ND(5)**	**105**	**7710**	130	ND(2)	**2510**	**8200**
CPS-1	5/19/2011	Total Recoverable	ug/L	**ND(0.5)**	**173**	**11100**	ND(50)	0.3	**3680**	**12600**
CPS-10A	4/26/2001	Total	ug/L	**70**	**1200**	**100000**	NA*	**520**	**24900**	**79000**
CPS-10A	6/7/2001	Total	ug/L	**235**	**3820**	**181000**	**66400**	**567**	**70600**	**203000**
DTRD	5/19/2011	Total Recoverable	ug/L	**2.9**	**215**	**20900**	1140	34.3	**6640**	**20400**
CPS-10B	3/30/2007	Total	ug/L	**ND(3)**	**174.4**	**12930**	330	ND(3)	**3850**	**13700**
CPS-10B	4/25/2007	Total	ug/L	**ND(3)**	**76**	**5732**	30	ND(3)	**1680**	**5900**
CPS-10B	5/7/2008	Total	ug/L	**ND(3)**	**188.4**	**13050**	1560	6	**4010**	**14910**
CPS-10B	5/14/2009	Total	ug/L	**ND(3)**	**122.1**	**7785**	80	ND(3)	**2490**	**8460**
CPS-10B	4/27/2010	Total	ug/L	**ND(5)**	49.5	**3280**	180	ND(2)	**830**	**3620**
CPS-10B	5/19/2011	Total Recoverable	ug/L	**4.5**	**132**	**8600**	4700	9.2	**2590**	**9720**

TABLE A-2. HISTORICAL SURFACE WATER (SEEP) ANALYTICAL RESULTS – METALS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Date Sampled	Metals Analysis[c]	Units	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Zinc
Risk Based Cleanup Guidelines[a] (ug/L)				**0.06[b]**	**66.5**	**472**	**4,979**	**47.1**	**16.6**	**17.2**
CPS-2	10/4/2000	Dissolved	ug/L	**ND(3)**	ND(0.1)	2	42	ND(3)	**50**	ND(10)
CPS-2	5/30/2001	Dissolved	ug/L	**4**	ND(1)	16	250	4	ND(10)	10
CPS-2	7/18/2001	Dissolved	ug/L	**ND(3)**	1.5	12	130	ND(3)	10	10
CPS-2	4/23/2004	Dissolved	ug/L	**4**	ND(0.1)	ND(1)	120	4	**20**	**20**
CPS-2	5/31/2005	Dissolved	ug/L	**ND(3)**	0.2	10	50	ND(3)	ND(10)	10
CPS-2	9/7/2006	Total	ug/L	**ND(3)**	0.2	16	580	ND(3)	**30**	ND(10)
CPS-2	4/25/2007	Total	ug/L	**6**	0.3	33	4870	18	**30**	**50**
CPS-2	10/11/2007	Total	ug/L	**ND(3)**	ND(0.1)	16	660	5	10	**20**
CPS-2	5/7/2008	Total	ug/L	**5**	0.2	32	3370	11	**20**	**40**
CPS-2	6/30/2008	Total	ug/L	**4**	ND(0.1)	24	1810	7	10	**20**
CPS-2	10/30/2008	Total	ug/L	**3**	0.2	18	790	8	ND(10)	**20**
CPS-2	5/29/2009	Total	ug/L	**4**	1.2	22	1690	7	10	**20**
CPS-2	4/27/2010	Total	ug/L	**ND(5)**	0.2	22	1610	8	**20**	**20**
CPS-2	5/19/2011	Total Recoverable	ug/L	**3.5**	0.17	21.2	1580	6.6	13.9	**20.2**
CPS-7	5/3/2001	Total	ug/L	**ND(5)**	**774**	**45800**	NA*	ND(10)	**16700**	**46600**
CPS-7	5/30/2001	Dissolved	ug/L	**ND(3)**	**580**	**38500**	60	4	**13200**	**38500**
CPS-7	7/18/2001	Dissolved	ug/L	**ND(3)**	**982**	**64000**	110	9	**21000**	**62700**
CPS-7	10/16/2001	Total	ug/L	**ND(5)**	**1160**	**80600**	NA*	ND(10)	**24500**	**75300**
CPS-7A	4/23/2004	Dissolved	ug/L	**7**	**490**	**19000**	ND(30)	**219**	**6900**	**30000**
CPS-7A	4/25/2007	Total	ug/L	**8**	**105**	**4073**	680	**78**	**1460**	**8400**
CPS-7A	5/29/2009	Total	ug/L	**58**	**78.5**	**2699**	3040	**345**	**560**	**6010**
CPS-7A	5/19/2011	Total Recoverable	ug/L	**54.7**	52.9	**4320**	**41400**	**363**	**938**	**4650**
CPS-8	7/18/2001	Dissolved	ug/L	**5**	21	56	20	ND(3)	**80**	**1880**
CPS-8	4/23/2004	Dissolved	ug/L	**4**	4	17	ND(30)	ND(3)	**160**	**280**
CPS-8	5/31/2005	Dissolved	ug/L	**ND(3)**	14.4	159	110	ND(3)	**40**	**1120**
CPS-8	9/7/2006	Total	ug/L	**ND(3)**	5.7	155	1230	4	**160**	**370**
CPS-8	11/2/2006	Total	ug/L	**ND(3)**	4.7	114	1070	5	**30**	**330**
CPS-8	4/25/2007	Total	ug/L	**ND(3)**	1.4	18	350	ND(3)	**20**	**160**
CPS-8	10/11/2007	Total	ug/L	**ND(3)**	2.1	66	390	ND(3)	10	**140**
CPS-8	5/7/2008	Total	ug/L	**4**	5.4	148	2360	6	**60**	**330**
CPS-8	6/30/2008	Total	ug/L	**ND(3)**	4.9	39	110	ND(3)	**30**	**370**
CPS-8	10/30/2008	Total	ug/L	**3**	3.1	94	1870	7	**30**	**260**
CPS-8	5/29/2009	Total	ug/L	**ND(3)**	10.5	84	270	ND(3)	ND(10)	**500**
CPS-8	5/19/2011	Total Recoverable	ug/L	**3.8**	7.8	339	1950	7.7	**31.9**	**361**

TABLE A-2. HISTORICAL SURFACE WATER (SEEP) ANALYTICAL RESULTS – METALS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Date Sampled	Metals Analysis[c]	Units	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Zinc
Risk Based Cleanup Guidelines[a] (ug/L)				**0.06[b]**	**66.5**	**472**	**4,979**	**47.1**	**16.6**	**17.2**
CPS-9	4/30/2001	Total	ug/L	**132**	**290**	**20100**	NA*	**1280**	**6730**	**19300**
CPSW-1	10/4/2000	Dissolved	ug/L	**2**	1	57	100	ND(3)	**150**	**30**
CPSW-1	5/30/2001	Dissolved	ug/L	**ND(3)**	ND(1)	43	180	ND(3)	**60**	**20**
CPSW-1	7/18/2001	Dissolved	ug/L	**ND(3)**	2.2	211	240	ND(3)	**130**	**80**
CPSW-1	4/23/2004	Dissolved	ug/L	**3**	ND(0.1)	ND(1)	ND(30)	ND(3)	10	ND(10)
CPSW-1	5/31/2005	Dissolved	ug/L	**ND(3)**	2.5	68	ND(30)	ND(3)	**30**	**160**
CPSW-1	4/25/2007	Total	ug/L	**4**	10.1	**515**	3720	10	**250**	**780**
CPSW-1	5/7/2008	Total	ug/L	**4**	12.1	**578**	3100	8	**220**	**1020**
CPSW-1	6/30/2008	Total	ug/L	**3**	0.3	31	1750	5	**40**	**40**
CPSW-1	10/30/2008	Total	ug/L	**ND(3)**	0.6	45	1670	4	**30**	**50**
CPSW-1	5/29/2009	Total	ug/L	**ND(3)**	1.5	53	1270	3	**30**	**50**
CPSW-1	4/27/2010	Total	ug/L	**ND(5)**	0.3	25	1460	6	**20**	**30**
CPSW-1	5/19/2011	Total Recoverable	ug/L	**3.1**	2.2	89.9	1380	4.6	**26.7**	**184**
CPSW-2	5/30/2001	Dissolved	ug/L	**ND(3)**	27.7	233	20	ND(3)	**800**	**1900**
CPSW-2	7/18/2001	Dissolved	ug/L	**ND(3)**	16.9	134	120	4	**1780**	**510**
CPSW-2	4/23/2004	Dissolved	ug/L	**ND(3)**	9	55	ND(30)	ND(3)	**160**	**460**
CPSW-2	5/31/2005	Dissolved	ug/L	**ND(3)**	14.4	314	190	ND(3)	**90**	**1240**
CPSW-2	9/7/2006	Total	ug/L	**4**	3.7	221	2690	6	**1690**	**170**
CPSW-2	4/25/2007	Total	ug/L	**3**	8.4	372	2690	8	**90**	**690**
CPSW-2	10/11/2007	Total	ug/L	**ND(3)**	3.6	64	700	ND(3)	**1390**	**310**
CPSW-2	5/7/2008	Total	ug/L	**3**	10.9	367	2330	7	**210**	**1080**
CPSW-2	6/30/2008	Total	ug/L	**4**	3.2	141	970	ND(3)	**380**	**190**
CPSW-2	10/30/2008	Total	ug/L	**ND(3)**	2.5	155	2440	6	**410**	**220**
CPSW-2	5/29/2009	Total	ug/L	**ND(3)**	4.6	227	1010	ND(3)	**80**	**270**
CPSW-2	4/27/2010	Total	ug/L	**ND(5)**	2.2	226	1300	5	**70**	**230**
CPSW-2	5/19/2011	Total Recoverable	ug/L	**2.3**	2.3	126	777	3.1	**19.3**	**199**
North Area Spring (N)	5/7/2008	Total	ug/L	**3**	5.1	213	3160	9	**70**	**440**
North Area Spring (N)	5/14/2009	Total	ug/L	**ND(3)**	4.5	250	2410	6	**30**	**400**
North Area Spring (N)	4/27/2010	Total	ug/L	**ND(5)**	5	231	2360	8	**30**	**390**
North Area Spring (N)	5/19/2011	Total Recoverable	ug/L	**2**	13.7	**700**	1670	3.3	**118**	**1130**
North Area Spring (S)	5/7/2008	Total	ug/L	**ND(3)**	26.5	**1334**	1590	4	**330**	**2110**

TABLE A-2. HISTORICAL SURFACE WATER (SEEP) ANALYTICAL RESULTS – METALS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Date Sampled	Metals Analysis[c]	Units	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Zinc
Risk Based Cleanup Guidelines[a] (ug/L)				**0.06[b]**	**66.5**	**472**	**4,979**	**47.1**	**16.6**	**17.2**
North Drainage Runoff	5/31/2005	Dissolved	ug/L	**ND(3)**	**306.6**	**18790**	70	ND(3)	**7160**	**22500**
North Drainage Runoff	3/30/2007	Total	ug/L	**8**	**83.5**	**4729**	**11210**	20	**2420**	**6150**
North Drainage Runoff	4/25/2007	Total	ug/L	**ND(3)**	**103.8**	**7244**	240	ND(3)	**2780**	**7650**
North Drainage Runoff	4/18/2008	Total	ug/L	**18**	28.1	**1334**	**23040**	45	**1230**	**2270**
North Drainage Runoff	5/7/2008	Total	ug/L	**ND(3)**	40.9	**2178**	2160	5	**630**	**3300**
North Drainage Runoff	5/29/2009	Total	ug/L	**ND(3)**	35.5	**1466**	560	ND(3)	**600**	**2340**
North Drainage Runoff	4/27/2010	Total	ug/L	**ND(5)**	8.6	309	2430	7	**70**	**670**
North Runoff	5/19/2011	Total Recoverable	ug/L	**2.1**	17.9	**666**	1460	3.2	**152**	**1310**
NRAD	5/31/2005	Dissolved	ug/L	**ND(3)**	**345.4**	**19280**	ND(30)	5	**6980**	**24520**
NRAD	3/30/2007	Total	ug/L	**47**	**167.6**	**11730**	**68000**	**164**	**5910**	**11940**
NRAD	4/25/2007	Total	ug/L	**ND(3)**	**121.3**	**7987**	500	ND(3)	**3030**	**8940**
NRAD	4/18/2008	Total	ug/L	**19**	**79.6**	**5980**	**42300**	**54**	**2600**	**6060**
NRAD	5/7/2008	Total	ug/L	**ND(3)**	43.6	**2204**	2680	6	**740**	**3570**
NRAD	6/30/2008	Total	ug/L	**ND(3)**	47.3	**769**	80	ND(3)	**780**	**3480**
NRAD	5/29/2009	Total	ug/L	**ND(3)**	43.4	**1162**	100	ND(3)	**760**	**2960**
SRAD	5/31/2005	Dissolved	ug/L	**ND(3)**	37.2	**586**	120	6	**1640**	**3410**
SRAD	4/25/2007	Total	ug/L	**7**	31	343	1920	26	**880**	**3500**
SRAD	4/18/2008	Total	ug/L	**66**	15.9	**639**	**49850**	**369**	**740**	**1700**
SRAD	5/7/2008	Total	ug/L	**25**	14.2	313	**12990**	**109**	**430**	**1640**
W-01	7/27/1981	Total	ug/L	**ND(5)**	4	**500**	110	ND(10)	**70**	**180**
W-1	7/11/2008	Total	ug/L	**ND(3)**	42.8	**1000**	50	ND(2)	NA*	**3570**
W-2	7/11/2008	Total	ug/L	**ND(3)**	0.1	9	880	2	NA*	**20**
W-3	7/11/2008	Total	ug/L	**3**	0.2	18	1060	2	NA*	**20**
W-4	7/11/2008	Total	ug/L	**ND(3)**	50.2	**3538**	40	ND(2)	NA*	**3870**
W-5	7/11/2008	Total	ug/L	**ND(3)**	**148.6**	**5020**	ND(30)	4	NA*	**12440**

[a] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Water Cleanup Guidelines for Recreational Visitors Table 7-11 (DEQ 1996)

[b] Carcinogenic risk of 5E-07

[c] For samples where both dissolved and total metals analysis were performed, the result shown is for the total metals analysis.

Bold values exceed DEQ RBCG values

Shading indicates relative concentrations values, dark represents higher relative concentrations

J and UJ qualifiers not shown, refer to Table 3-5 for qualifiers on 2011 data

ug/L = micrograms per liter

NA* - Not Applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

NRAD - North Removal Area Drainage

SRAD - South Removal Area Drainage

TABLE A-3. HISTORICAL GROUNDWATER ANALYTICAL RESULTS - DISSOLVED METALS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Date Sampled	Units	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Zinc
CMMW-1	11/9/2001	ug/L	ND(3)	0.8	4	30	ND(3)	**110**	50
CMMW-1	9/7/2006	ug/L	ND(3)	0.3	3	40	ND(3)	20	ND(10)
CMMW-1	5/9/2007	ug/L	ND(3)	ND(0.1)	3	40	ND(3)	10	ND(10)
CMMW-1	10/11/2007	ug/L	ND(3)	0.2	ND(1)	170	ND(3)	ND(10)	ND(10)
CMMW-1	5/7/2008	ug/L	ND(3)	0.2	1	40	ND(3)	10	ND(10)
CMMW-1	6/30/2008	ug/L	ND(3)	ND(0.1)	ND(1)	70	ND(3)	20	ND(10)
CMMW-1	10/30/2008	ug/L	ND(3)	0.2	ND(1)	ND(10)	ND(3)	ND(10)	ND(10)
CMMW-1	5/29/2009	ug/L	ND(3)	1.6	ND(1)	80	ND(3)	10	ND(10)
CMMW-1	5/18/2010	ug/L	1.3	0.2	3.1	ND(50)	0.54	6.4	27.5
CMMW-1	5/5/2011	ug/L	1.6	0.1	1.3	73	0.15	3.6	6.1
CMMW-2	5/9/2007	ug/L	**207**	**7.4**	795	**520**	**56**	**600**	800
CMMW-2	10/11/2007	ug/L	**215**	**7.6**	554	220	**22**	**450**	670
CMMW-2	5/7/2008	ug/L	**164**	**14.2**	125	**510**	**34**	**470**	1170
CMMW-2	6/30/2008	ug/L	**252**	**8.9**	**1766**	240	**56**	**620**	730
CMMW-2	5/14/2009	ug/L	**135**	**10.3**	534	**390**	**25**	**480**	960
CMMW-2	5/29/2009	ug/L	**137**	**9.9**	460	**300**	**24**	**420**	820
CMMW-2	5/18/2010	ug/L	**129**	**5.8**	658	**868**	**42.1**	**133**	630
CMMW-2	5/5/2011	ug/L	**108**	**14.5**	239	121	8.6	**103**	1410
CMMW-3	11/9/2001	ug/L	ND(3)	**93.7**	**1750**	ND(10)	3	**3120**	**6040**
CMMW-3	9/7/2006	ug/L	6	**58.6**	**1862**	ND(10)	ND(3)	**1690**	**3810**
CMMW-3	5/9/2007	ug/L	ND(3)	**222.1**	**15990**	40	ND(3)	**6370**	**14580**
CMMW-3	10/11/2007	ug/L	ND(3)	**96**	**3658**	120	ND(3)	**2910**	**7360**
CMMW-3	5/7/2008	ug/L	ND(3)	**290.6**	**24900**	50	ND(3)	**8680**	**24800**
CMMW-3	6/30/2008	ug/L	ND(3)	**98**	**5024**	70	ND(3)	**2580**	**7040**
CMMW-3	10/30/2008	ug/L	ND(3)	**78.2**	**3240**	40	ND(3)	**2010**	**6800**
CMMW-3	5/29/2009	ug/L	ND(3)	**70.7**	**2680**	40	ND(3)	**1800**	**5000**
CMMW-3	5/18/2010	ug/L	0.56	**67.8**	**3010**	ND(50)	0.51	**1650**	**4770**
CMMW-3	5/5/2011	ug/L	ND(0.5)	**170**	**12100**	ND(50)	0.31	**4280**	**12200**

TABLE A-3. HISTORICAL GROUNDWATER ANALYTICAL RESULTS - DISSOLVED METALS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Date Sampled	Units	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Zinc
CMMW-4	11/9/2001	ug/L	ND(3)	**23**	708	ND(10)	ND(3)	**420**	1320
CMMW-4	9/7/2006	ug/L	ND(3)	**68.6**	**4107**	ND(10)	ND(3)	**1200**	**5580**
CMMW-4	5/9/2007	ug/L	ND(3)	**107.2**	**7740**	200	ND(3)	**2420**	**7660**
CMMW-4	10/11/2007	ug/L	4	**46.6**	**2497**	**1040**	11	**790**	**3420**
CMMW-4	5/7/2008	ug/L	ND(3)	**156.6**	**11920**	10	ND(3)	**3790**	**13690**
CMMW-4	6/30/2008	ug/L	ND(3)	**93**	**5518**	30	ND(3)	**1770**	**6700**
CMMW-4	10/30/2008	ug/L	ND(3)	**49.4**	**2290**	20	ND(3)	**740**	**3390**
CMMW-4	5/29/2009	ug/L	ND(3)	**88.1**	**5340**	20	ND(3)	**1480**	**6750**
CMMW-4	5/18/2010	ug/L	ND(0.5)	**26.3**	**1320**	ND(50)	0.43	**418**	1830
CMMW-4	5/5/2011	ug/L	ND(0.5)	**51.9**	**3120**	ND(50)	0.12	**884**	**3940**
CMMW-5	5/14/2009	ug/L	ND(3)	**53.6**	**2540**	170	4	**1380**	**3940**
CMMW-5	5/29/2009	ug/L	ND(3)	**29**	**1350**	**2300**	**36**	**650**	1970
CMMW-5	5/18/2010	ug/L	0.65	**27.4**	1140	178	2.7	**548**	1920
CMMW-5	5/5/2011	ug/L	3	**152**	**7100**	**988**	**23.2**	**4040**	**10700**
CMMW-6	10/30/2008	ug/L	ND(3)	0.3	3	10	ND(3)	**130**	ND(10)
CMMW-6	5/14/2009	ug/L	ND(3)	0.4	15	**310**	ND(3)	20	20
CMMW-6	5/29/2009	ug/L	ND(3)	2.6	16	**610**	ND(3)	20	20
CMMW-6	5/18/2010	ug/L	1.8	0.5	27.7	**671**	3.2	10.3	28.1
CMMW-6	5/5/2011	ug/L	1.9	0.53	19.4	**661**	4.1	19.9	33.3
CMMW-7	5/14/2009	ug/L	ND(3)	**380**	**28400**	50	ND(3)	**9520**	**27100**
CMMW-7	5/29/2009	ug/L	ND(3)	**289**	**16700**	100	ND(3)	**8250**	**20500**
CMMW-7	5/18/2010	ug/L	0.79	**393**	**25300**	ND(50)	1.6	**9410**	**26200**
CMMW-7	5/5/2011	ug/L	2.2	**305**	**22200**	**2050**	2.6	**7740**	**22300**
CMMW-8	5/14/2009	ug/L	ND(3)	**6.8**	118	10	ND(3)	**430**	400
CMMW-8	5/29/2009	ug/L	ND(3)	4.6	24	**550**	ND(3)	**500**	180
CMMW-8	5/18/2010	ug/L	0.54	**130**	**5390**	ND(50)	1	**3800**	**9640**
CMMW-8	5/5/2011	ug/L	0.57	**155**	**8420**	281	0.48	**4550**	**12300**

TABLE A-3. HISTORICAL GROUNDWATER ANALYTICAL RESULTS - DISSOLVED METALS
COMBINATION MINE AOC
BLACK PINE MINE

Location	Date Sampled	Units	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Zinc
CMMW-9	5/14/2009	ug/L	ND(3)	**7.5**	41	70	ND(3)	**740**	450
CMMW-9	5/29/2009	ug/L	ND(3)	**7.9**	38	150	ND(3)	**440**	340
CMMW-9	5/18/2010	ug/L	ND(0.5)	2.8	53.6	ND(50)	0.1	**60.4**	132
CMMW-9	5/5/2011	ug/L	0.72	**6.9**	24.1	197	0.38	**86.4**	709

[a] Human Health Standards (HHS) for Water, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)

[b] Secondary Maximum Contaminant Level based on aesthetic properties, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)

[c] Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)

[d] Maximum Contaminant Level, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)

[e] Health Advisory, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)

Bold values exceed Circular DEQ-7 values

Shading indicates relative concentrations values, dark represents higher relative concentrations

J and UJ qualifiers not shown, refer to Table 3-7 for qualifiers on 2011 data

ug/L = micrograms per liter

ND() - Analyte was not detected (reporting limit)

TABLE A-4. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS
TIM SMITH MINE AOC BLACK
PINE MINE

Description	Location	Date Sampled	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Cadmium	Copper	Lead	Manganese	Mercury	Nickel	Zinc
Risk Based Cleanup Guidelines[b] (mg/kg)						**293.0**	**40.4[cd]**	**19.5[c]**	**27,100**	**1,100**	**665.0**	**220.0**	**14,650**	**220,000**
2001 Hydrometrics Waste Rock Samples	Tim Smith Pad East Composite	7/19/2001	0	1.5	mg/kg	NA*	**669**	13	1160	**3140**	270	NA*	NA*	113
	Tim Smith Pad East Trench	7/19/2001	0	0.5	mg/kg	NA*	**417**	5	910	**1730**	390	NA*	NA*	127
	Tim Smith Pad West Composite	7/19/2001	0	1.5	mg/kg	NA*	**511**	5	848	**2360**	152	NA*	NA*	99
	Tim Smith Pad West Trench	7/19/2001	0	0.5	mg/kg	NA*	**531**	10	1740	**1890**	99	NA*	NA*	155
Average[a]					**mg/kg**	NA*	**532.0**	8.25	1,165	**2,280**	227.8	NA*	NA*	123.5
2011 RI Waste Rock Samples	TS-RS-01	7/12/2011	4	6	mg/kg	**508**	**629**	3.9	1510	**1880**	248	2.3	ND(2.2)	149
	TS-RS-03	7/12/2011	2	4	mg/kg	**712**	**868**	6	794	**3060**	125	2.1	2.7	144
	TS-RS-07	7/13/2011	4	6	mg/kg	219	**118**	0.12	31.3	162	67.6	1.1	4.9	18.6
Average[a]					**mg/kg**	**479.7**	**538.3**	3.34	778.4	**1701**	146.9	1.83	2.90	103.9
2011 RI Soil Samples	TS-SS-01	7/12/2011	6	8	mg/kg	7.5	11.5	0.31	19	28.6	660	0.047	5.1	32.3
	TS-SS-02	7/12/2011	2	4	mg/kg	109	**79.8**	3.0	189	328	325	1	4.8	56.6
	TS-SS-03	7/12/2011	3	5	mg/kg	5.7	11.5	0.87	730	65.7	457	0.029	6.5	72.4
	TS-SS-07	7/13/2011	1	3	mg/kg	64.2	**73.6**	0.14	28.2	200	217	0.69	6	36.3
	TS-SS-08	7/13/2011	1	3	mg/kg	23	**47.4**	0.15	63	147	109	0.15	9	62.1
Average[a]					**mg/kg**	41.88	**44.76**	0.894	205.8	153.9	353.6	0.383	6.28	51.94
2011 RI Sediment Samples	TS-SD-01	6/13/2011	0	0.5	mg/kg	37.2	31.1	9.1	639	110	**1140**	0.23	24.5	236
	TS-SD-02	6/13/2011	0	0.5	mg/kg	3.2	22.4	1.1	50.9	65.2	**947**	24.4	20	117
	TS-SD-03	6/14/2011	0	0.5	mg/kg	3.3	20.2	1.8	87.7	39.2	**1150**	0.76	31.2	136
Average[a]					**mg/kg**	14.57	24.57	4.00	259.2	71.47	**1079**	8.46	25.23	163.0

[a] For non detect results, one half of the reporting limit was used in the calculation of the average concentration
[b] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Soil Cleanup Guidelines for Recreational Visitors Table 7-10 (DEQ 1996)
[c] Carcinogenic risk of 5E-07
[d] UCL = 95th upper confidence limit on the arithmetic mean background concentration, from background samples
Bold values exceed DEQ RBCG values
Shading indicates relative concentrations values, dark represents higher relative concentrations
J and UJ qualifiers not shown, refer to Table 3-11 for qualifiers on 2011 data
ft - feet
mg/kg - milligrams per kilogram.
NA* - Not Applicable or not analyzed

TABLE A-5. HISTORICAL SURFACE WATER ANALYTICAL RESULTS - METALS
TIM SMITH MINE AOC
BLACK PINE MINE

Location	Date Sampled	Metals Analysis[c]	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
TSP-1	10/4/2000	Dissolved	ug/L	ND(50)	**ND(3)**	0.2	3	ND(10)	ND(3)	ND(10)	**ND(0.6)**	ND(3)	10
TSP-1	6/7/2001	Dissolved	ug/L	ND(50)	**ND(3)**	ND(0.1)	4	50	ND(3)	ND(10)	NA*	ND(3)	ND(10)
TSP-1	7/18/2001	Dissolved	ug/L	ND(50)	**ND(3)**	2.6	4	40	ND(3)	ND(10)	NA*	ND(3)	10
TSP-3[d]	6/13/2011	Total Recoverable	ug/L	0.53	**1.2**	0.14	30.5	1180	0.86	11.5	0.0128	ND(0.5)	10.4
013[e]	7/21/1981	Dissolved	ug/L	NA*	**ND(5)**	ND(1)	ND(10)	260	ND(10)	ND(20)	ND(0.2)	ND(5)	ND(10)
TSP-6	10/4/2000	Dissolved	ug/L	ND(50)	**ND(3)**	ND(0.1)	1	20	ND(3)	ND(10)	**ND(0.6)**	ND(3)	ND(10)
TSP-6	6/7/2001	Dissolved	ug/L	ND(50)	**ND(3)**	ND(0.1)	2	150	ND(3)	ND(10)	NA*	ND(3)	10
TSP-6	7/18/2001	Dissolved	ug/L	ND(50)	**ND(3)**	ND(0.1)	ND(3)	70	ND(3)	ND(10)	NA*	ND(3)	ND(10)
TSP-6	6/14/2011	Total Recoverable	ug/L	0.53	**1.1**	ND(0.08)	22.5	1000	0.97	8.9	0.0132	ND(0.5)	8.2
TSP-7	4/23/2004	Total	ug/L	NA*	**ND(3)**	ND(0.1)	ND(1)	ND(30)	ND(3)	ND(10)	NA*	NA*	ND(10)
TSP-7	5/31/2005	Dissolved	ug/L	NA*	**ND(3)**	ND(0.1)	6	110	ND(3)	ND(10)	NA*	NA*	ND(10)
TSP-8	4/30/2001	Total	ug/L	NA*	**ND(5)**	ND(1)	20	NA*	ND(10)	**40**	NA*	NA*	**40**
TSP-8	6/7/2001	Dissolved	ug/L	ND(50)	**ND(3)**	0.5	17	270	ND(3)	10	NA*	ND(3)	**40**
TSP-8	5/31/2005	Dissolved	ug/L	NA*	**ND(3)**	0.2	15	160	ND(3)	ND(10)	NA*	NA*	10
TSP-8	6/13/2011	Total Recoverable	ug/L	1.2	**1.7**	0.28	24.2	2130	1.8	13.6	0.0208	ND(0.5)	**22.3**
TSP-9	4/30/2001	Dissolved	ug/L	NA*	**ND(5)**	ND(1)	10	NA*	ND(10)	**30**	NA*	NA*	**30**
TSP-9	6/7/2001	Dissolved	ug/L	ND(50)	**ND(3)**	ND(0.1)	4	340	ND(3)	**20**	NA*	ND(3)	**20**
TSP-9	7/18/2001	Dissolved	ug/L	ND(50)	**ND(3)**	0.6	5	250	ND(3)	**270**	NA*	ND(3)	ND(10)
TSP-9	4/23/2004	Dissolved	ug/L	NA*	**ND(3)**	ND(0.1)	ND(1)	350	4	**20**	NA*	NA*	**30**
TSP-9	5/31/2005	Dissolved	ug/L	NA*	**ND(3)**	0.2	4	140	ND(3)	ND(10)	NA*	NA*	ND(10)
TSP-9	5/29/2009	Total	ug/L	NA*	**ND(3)**	2.1	17	2760	ND(3)	**70**	NA*	NA*	**30**
TSP-9	6/13/2011	Total Recoverable	ug/L	0.57	**1.7**	0.25	8.9	2780	1.5	**18.8**	0.0199	ND(0.5)	**19**
TSP-10	4/30/2001	Total	ug/L	NA*	**ND(5)**	ND(1)	ND(10)	NA*	ND(10)	**60**	NA*	NA*	**40**
TSP-10	5/19/2011	Total Recoverable	ug/L	NA*	**2**	0.08	6.3	2990	2.7	**52.6**	NA*	NA*	17.1

[a] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Water Cleanup Guidelines for Recreational Visitors Table 7-11 (DEQ 1996)

[b] Carcinogenic risk of 5E-07

[c] For samples where both dissolved and total metals analysis were performed, the result shown is for the total metals analysis.

[d] Prior to the 2011 RI TSP-3 had only been sampled for flow rate

[e] Sample location 013 corresponds to sample location TSP-6

Bold values exceed DEQ RBCG values

Shading indicates relative concentrations values, dark represents higher relative concentrations

J, JB, and UJ qualifiers not shown, refer to Table 3-14 for qualifiers on 2011 data

ug/L = micrograms per liter

NA* - Not Applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

NS - A standard has not been adopted

TABLE A-6. HISTORICAL SURFACE WATER ANALYTICAL RESULTS - METALS
HISTORIC MINE AOC
BLACK PINE MINE

Location	Date Sampled	Metals Analysis[c]	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
BPM-Seep	5/6/1998	Total	ug/L	4	**2**	ND(0.2)	11	250	ND(1)	ND(5)	NA*	ND(1)	ND(5)
MCSP-1	6/7/2001	Dissolved	ug/L	ND(50)	**ND(3)**	0.1	3	170	ND(3)	ND(10)	NA*	ND(3)	10
MCSP-1	7/18/2001	Dissolved	ug/L	ND(50)	**ND(3)**	2	3	80	ND(3)	ND(10)	NA*	ND(3)	ND(10)
MCSP-1	4/23/2004	Dissolved	ug/L	NA*	**ND(3)**	ND(0.1)	ND(1)	ND(30)	ND(3)	ND(10)	NA*	NA*	ND(10)
MCSP-1	5/31/2005	Dissolved	ug/L	NA*	**ND(3)**	ND(0.1)	4	ND(30)	ND(3)	ND(10)	NA*	NA*	ND(10)
MCSP-1	6/13/2011	Total Recoverable	ug/L	1.4	**1.6**	0.26	107	1080	2.9	15.4	0.045	ND(0.5)	**31.4**
Road cut	5/19/2011	Total Recoverable	ug/L	NA*	**3.3**	ND(0.08)	16.8	1810	5.3	16	NA*	NA*	9.2

[a] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Water Cleanup Guidelines for Recreational Visitors Table 7-11 (DEQ 1996)

[b] Carcinogenic risk of 5E-07

[c] For samples where both dissolved and total metals analysis were performed, the result shown is for the total metals analysis.

Bold values exceed DEQ RBCG values

Shading indicates relative concentrations values, dark represents higher relative concentrations

J and JB qualifiers not shown, refer to Table 3-19 for qualifiers on 2011 data

ug/L = micrograms per liter

NA* - Not Applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

NS - A standard has not been adopted

TABLE A-7. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS
COMBINATION MILL AOC
BLACK PINE MINE

Description	Location	Date Sampled	Metals Analysis	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Risk Based Cleanup Guidelines[b] (mg/kg)							**293.0**	**40.4[ce]**	**19.5[c]**	**27,100.0**	**NS**	**1,100.0**	**665.0**	**220.0**	**14,650.0**	**NS**	**220,000.0**
1991 Schafer Soil Samples[d]	88-1 B	8/27/1991	Total Metals	0.67	1.33	mg/kg	NA*	**187.0**	NA*	1,450	6,740	**1,940**	NA*	7.00	NA*	54.00	146.0
	88-10 A	8/28/1991	Total Metals	0	2	mg/kg	NA*	**1,150**	NA*	8,650	11,400	**20,500**	NA*	80.00	NA*	42.00	256.0
	88-11 A	8/28/1991	Total Metals	0	2	mg/kg	NA*	**548.0**	NA*	591.0	6,170	**5,480**	NA*	15.00	NA*	14.00	302.0
	88-3 B	8/27/1991	Total Metals	1.5	2	mg/kg	NA*	**445.0**	NA*	1,080	10,400	**3,180**	NA*	2.00	NA*	66.00	116.0
	88-4 A	8/27/1991	Total Metals	0	1	mg/kg	NA*	**613.0**	NA*	1,830	13,600	**4,860**	NA*	34.00	NA*	494.0	430.0
	88-5 A	8/27/1991	Total Metals	0.67	1.67	mg/kg	NA*	**469.0**	NA*	1,340	17,300	**4,640**	NA*	15.00	NA*	573.0	403.0
	88-6 A	8/28/1991	Total Metals	0	1	mg/kg	NA*	**733.0**	NA*	2,890	8,240	**8,150**	NA*	124.0	NA*	70.00	221.0
	88-7 A	8/28/1991	Total Metals	0	0.5	mg/kg	NA*	**457.0**	NA*	3,860	10,000	**5,220**	NA*	71.00	NA*	44.00	285.0
	88-8 B	8/29/1991	Total Metals	1.67	2.33	mg/kg	NA*	**1,090**	NA*	8,410	24,600	**21,300**	NA*	**393.0**	NA*	133.0	832.0
	88-9 A	8/28/1991	Total Metals	0.33	1.17	mg/kg	NA*	**260.0**	NA*	1,940	9,900	**2,440**	NA*	64.00	NA*	21.00	194.0
Average[a]						**mg/kg**	NA*	**595.2**	NA*	3,204	11,835	**7,771**	NA*	80.50	NA*	151.1	318.5
1990 ASARCO Soils Samples	BP-1	9/13/1990	Total Metals	NA*	NA*	mg/kg	NA*	ND(8)	**ND(0.8)**	63.50	7,282	53.90	**907.0**	2.45	NA*	ND(0.1)	91.40
	BP-2	9/13/1990	Total Metals	NA*	NA*	mg/kg	NA*	**212.0**	9.31	1,570	8,970	**1,580**	485.0	47.00	NA*	27.70	139.0
	BP-3	9/13/1990	Total Metals	NA*	NA*	mg/kg	NA*	**460.0**	13.10	1,580	12,550	**2,890**	386.0	60.00	NA*	36.20	344.0
Average[a]						**mg/kg**	NA*	**225.3**	7.60	1,071	9,601	**1,508**	592.7	36.48	NA*	21.32	191.5
1990 ASARCO Tailings	BP-Tailings	9/13/1990	Total Metals	NA*	NA*	mg/kg	NA*	**1,684**	**45.79**	5,084	18,070	**10,650**	168.4	**250.0**	NA*	87.80	520.0
1991 Schafer Sediment Samples	201	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	5.00	NA*	30.00	7,670	20.00	**1,150**	ND(2)	NA*	NA*	99.00
	202	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	ND(5)	NA*	27.00	7,840	16.00	**1,070**	ND(2)	NA*	NA*	82.00
	203	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	6.00	NA*	29.00	8,060	33.00	**1,070**	ND(2)	NA*	NA*	82.00
	204	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	8.00	NA*	40.00	9,670	27.00	**1,140**	ND(2)	NA*	NA*	90.00
	205	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	12.00	NA*	48.00	11,200	26.00	**1,020**	ND(2)	NA*	NA*	120.0
	206	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	**180.0**	NA*	1,050	11,800	**1,450**	650.0	13.00	NA*	NA*	220.0
	207	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	**160.0**	NA*	1,280	11,800	**2,190**	**690.0**	21.00	NA*	NA*	290.0
	208	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	**130.0**	NA*	650.0	8,070	970.0	360.0	7.00	NA*	NA*	240.0
	209	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	**620.0**	NA*	4,200	18,000	**5,610**	340.0	54.00	NA*	NA*	260.0
	210	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	**270.0**	NA*	1,420	15,000	**1,450**	300.0	22.00	NA*	NA*	140.0
Average[a]						**mg/kg**	NA*	**139.4**	NA*	877.4	10,911	**1,179**	**779.0**	12.70	NA*	NA*	162.3
1993 Pioneer Sediment Samples	SE-1	7/21/1993	Total Metals	NA*	NA*	mg/kg	**337.0**	**311.0**	6.90	830.0	10,800	**1,550**	372.0	52.30	ND(2.8)	NA*	241.0
	SE-2	7/21/1993	Total Metals	NA*	NA*	mg/kg	27.40	37.10	2.40	250.0	13,400	91.20	605.0	1.07	13.70	NA*	80.10
	SE-3	7/21/1993	Total Metals	NA*	NA*	mg/kg	6.07	10.20	0.90	18.80	3,710	21.00	206.0	0.06	ND(2.49)	NA*	32.60
	SE-500	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**1,352**	**81.91**	NA*	921.7	13,412	1,034	551.0	NA*	NA*	93.60	76.15
	SE-1000	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**1,834**	**104.5**	NA*	775.0	14,452	**1,163**	529.5	104.8	NA*	NA*	177.8
Average[a]						**mg/kg**	**711.2**	**108.9**	3.40	559.1	11,155	772.0	452.7	39.55	5.45	93.60	121.5
1995 Pioneer Sediment Samples	SE-1	10/19/1995	Total Metals	NA*	NA*	mg/kg	98.10	**286.0**	16.60	1,270	17,200	**1,600**	**784.0**	46.70	14.50	26.30	522.0
	SE-2	10/19/1995	Total Metals	NA*	NA*	mg/kg	64.50	**258.0**	8.10	1,060	13,800	**1,550**	**1,070**	24.70	5.40	23.20	288.0
	SE-3	10/19/1995	Total Metals	NA*	NA*	mg/kg	79.30	**223.0**	12.10	1,220	15,800	**1,450**	**707.0**	43.00	18.30	18.80	384.0
	SE-4	10/19/1995	Total Metals	NA*	NA*	mg/kg	26.70	**117.0**	5.60	582.0	11,800	768.0	639.0	14.30	8.10	9.70	157.0
Average[a]						**mg/kg**	67.15	**221.0**	10.60	1,033	14,650	**1,342**	**800.0**	32.18	11.58	19.50	337.8
1993 Pioneer Soils/Tailings Test Pit Samples	TP-1	7/21/1993	Unknown	NA*	NA*	mg/kg	**2,210**	**2,050**	**89.50**	9,620	28,300	**14,400**	462.0	**306.0**	3.29	NA*	584.0
	TP1A-1	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**11,477**	**957.1**	**213.1**	8,771	25,660	**14,598**	**703.0**	**428.0**	NA*	623.3	544.3
	TP1A-2	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**742.4**	NA*	NA*	387.3	14,242	716.5	336.4	NA*	NA*	NA*	180.3
	TP1B-1	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**2,417**	**179.2**	NA*	1,159	12,078	**2,107**	NA*	97.57	NA*	156.1	102.7
	TP1B-2	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**13,277**	**1,402**	**265.1**	10,142	34,376	**14,817**	**704.5**	**539.6**	NA*	810.8	560.3
	TP1B-3	7/21/1993	XRF Metals	NA*	NA*	mg/kg	173.3	**214.2**	NA*	1,843	18,480	275.4	**704.0**	NA*	NA*	NA*	114.6
	TP1C-1	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**4,201**	**459.8**	NA*	3,871	28,591	**4,356**	364.2	**484.8**	NA*	165.4	497.6
	TP1C-2	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**898.8**	NA*	NA*	1,250	10,620	914.4	333.3	115.1	NA*	NA*	194.0
	TP1C-3	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**2,815**	**197.9**	NA*	1,348	17,697	**3,449**	**958.5**	**261.5**	NA*	103.8	455.0
	TP1D-1	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**4,184**	**723.8**	NA*	6,881	33,141	**4,581**	**1,383**	**462.8**	NA*	109.0	488.3
	TP1D-2	7/21/1993	XRF Metals	NA*	NA*	mg/kg	135.4	**63.86**	NA*	1,003	19,429	240.2	570.2	NA*	NA*	NA*	286.1
	TP1D-3	7/21/1993	XRF Metals	NA*	NA*	mg/kg	62.22	NA*	NA*	632.3	17,001	46.07	552.8	NA*	NA*	NA*	198.4
	TP-1-COMP	7/21/1993	Total Metals	NA*	NA*	mg/kg	**12,217**	**1,129**	**406.5**	8,021	32,147	**12,842**	580.5	**590.4**	NA*	558.2	656.5
Average[a]						**mg/kg**	**4,216**	**737.7**	**243.6**	4,225	22,443	**5,642**	637.7	**365.1**	3.29	360.9	374.0

TABLE A-7. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS
COMBINATION MILL AOC
BLACK PINE MINE

Description	Location	Date Sampled	Metals Analysis	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Risk Based Cleanup Guidelines[b] (mg/kg)							**293.0**	**40.4[ce]**	**19.5[c]**	**27,100.0**	**NS**	**1,100.0**	**665.0**	**220.0**	**14,650.0**	**NS**	**220,000.0**
1995 Pioneer Soils/Tailings Test Pit Samples	TP-2	10/19/1995	Unknown	NA*	NA*	mg/kg	229.0	**652.0**	15.90	1,910	10,700	**2,910**	357.0	122.0	ND(2.3)	65.00	353.0
	TP2A	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**1,679**	**205.9**	NA*	839.9	13,184	**2,091**	NA*	122.3	NA*	NA*	274.5
	TP2B	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**7,239**	**505.1**	NA*	2,977	23,903	**5,049**	**838.4**	**253.1**	NA*	272.0	249.5
	TP2C	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**3,296**	**221.4**	NA*	1,165	17,717	**1,984**	NA*	115.9	NA*	161.2	258.9
	TP2D	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**4,067**	**386.4**	NA*	2,141	17,817	**3,318**	NA*	**400.0**	NA*	182.8	354.5
	TP2EA	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**2,246**	**296.3**	NA*	981.9	12,922	**1,899**	NA*	121.5	NA*	139.0	265.3
	TP2EB	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**2,880**	**214.3**	NA*	956.9	15,701	**2,122**	NA*	139.2	NA*	111.7	334.7
	TP2-COMP-SOUP	10/19/1995	Total Metals	NA*	NA*	mg/kg	**4,243**	**289.0**	NA*	1,666	17,552	**3,343**	NA*	212.8	NA*	102.2	385.1
	TP-3	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**447.0**	**1,230**	**36.40**	4,400	12,500	**7,620**	91.50	70.50	ND(3.3)	110.0	220.0
	TP3A	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**5,605**	**364.6**	NA*	2,249	14,114	**3,889**	NA*	191.8	NA*	219.9	247.4
	TP3B	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**5,780**	**378.9**	NA*	2,727	15,497	**4,334**	NA*	158.2	NA*	124.2	235.0
	TP3C	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**5,097**	**248.2**	**143.2**	2,444	14,582	**3,445**	NA*	151.7	NA*	215.2	185.2
	TP3-COMP	10/19/1995	Total Metals	NA*	NA*	mg/kg	**4,120**	**339.8**	**180.3**	1,598	17,725	**3,253**	NA*	190.1	NA*	149.9	281.8
	TP-4	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**485.0**	**1,490**	**39.50**	5,020	14,700	**9,000**	181.0	**282.0**	ND(3.5)	108.0	317.0
	TP4A	10/19/1995	XRF Metals	NA*	NA*	mg/kg	NA*	NA*	NA*	NA*	17,272	29.35	**697.8**	NA*	NA*	NA*	457.1
	TP4B	10/19/1995	Total Metals	NA*	NA*	mg/kg	**7,876**	**826.5**	NA*	3,211	25,317	**5,509**	373.1	**369.5**	NA*	244.2	342.1
Average[a]						**mg/kg**	**3,686**	**509.9**	**83.06**	2,286	16,325	**3,737**	423.1	193.4	1.52	157.5	297.6
2007 TMDL Sediment Sample	SFWILLOWC04	9/1/2007	Total Metals	NA*	NA*	mg/kg	43.80	**79.60**	9.56	1,100	12,900	870.0	**1,490**		12.00	14.30	273.0
2011 RI Sediment Samples at TMDL Sites (except CML-SD-05)	CML-SD-01	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**317.0**	**223.0**	4.80	378.0	14,400	826.0	413.0	17.60	3.90	11.20	188.0
	CML-SD-02	6/15/2011	Total Recoverable Metals	0	0.5	mg/kg	**461.0**	**417.0**	8.90	1,430	22,700	**1,970**	**744.0**	13.60	6.90	25.60	317.0
	CML-SD-03	6/15/2011	Total Recoverable Metals	0	0.5	mg/kg	16.80	19.40	0.43	57.90	22,300	207.0	404.0	4.10	9.10	1.60	40.50
	CML-SD-04	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	16.70	27.90	1.40	109.0	12,400	74.20	**1,980**	14.40	11.40	2.20	144.0
	CML-SD-05	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	ND(0.64)	12.00	1.20	26.80	14,500	16.30	**1,160**	0.38	13.40	ND(0.64)	96.80
Average[a]						**mg/kg**	162.4	**139.9**	3.35	400.3	17,260	618.7	**940.2**	10.02	8.94	8.18	157.3
2011 RI Tailings Pond Sediment Samples	CML-SD-06	6/13/2011	Total Recoverable Metals	0	0.5	mg/kg	**891.0**	**642.0**	**28.60**	3,620	21,200	**3,760**	602.0	32.80	14.60	64.60	768.0
	CML-SD-07	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**817.0**	**596.0**	15.40	5,320	21,800	**4,240**	**1,180**	10.10	6.10	37.60	393.0
Average[a]						**mg/kg**	**854.0**	**619.0**	**22.00**	4,470	21,500	**4,000**	**891.0**	21.45	10.35	51.10	580.5
2011 RI South Fork Lower Willow Creek Sediment Samples	CML-SD-08	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**613.0**	**553.0**	11.50	1,390	20,100	**2,960**	443.0	12.10	5.80	34.80	430.0
	CML-SD-09	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**465.0**	**377.0**	7.80	920.0	15,400	**2,070**	452.0	5.40	5.20	23.90	287.0
	CML-SD-10	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**596.0**	**492.0**	10.30	1,160	19,700	**2,460**	419.0	7.00	4.90	38.20	401.0
	CML-SD-11	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**307.0**	**219.0**	4.60	623.0	16,300	**1,170**	**1,210**	21.10	6.50	14.80	248.0
	CML-SD-13	6/16/2011	Total Recoverable Metals	0	0.5	mg/kg	**440.0**	**339.0**	7.70	NA*	17,300	NA*	NA*	17.40	6.90	23.10	257.0
	CML-SD-14	6/16/2011	Total Recoverable Metals	0	0.5	mg/kg	**1,010**	**668.0**	14.70	2,230	21,700	**3,270**	257.0	7.70	3.20	51.50	403.0
	CML-SD-15	6/16/2011	Total Recoverable Metals	0	0.5	mg/kg	**1,300**	**1,250**	**32.50**	4,810	35,900	**8,050**	342.0	9.20	4.10	213.0	1,300
	CML-SD-16	6/16/2011	Total Recoverable Metals	0	0.5	mg/kg	**2,130**	**1,670**	**26.60**	5,170	27,700	**7,330**	171.0	8.00	0.69	73.10	313.0
	CML-SD-17	6/16/2011	Total Recoverable Metals	0	0.5	mg/kg	**1,090**	**745.0**	17.10	1,910	23,800	**3,880**	325.0	10.50	2.50	56.10	496.0
Average[a]						**mg/kg**	**883.4**	**701.4**	14.76	2,277	21,989	**3,899**	452.4	10.93	4.42	58.72	459.4

TABLE A-7. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS
COMBINATION MILL AOC
BLACK PINE MINE

Description	Location	Date Sampled	Metals Analysis	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Risk Based Cleanup Guidelines[b] (mg/kg)							**293.0**	**40.4[ce]**	**19.5[c]**	**27,100.0**	**NS**	**1,100.0**	**665.0**	**220.0**	**14,650.0**	**NS**	**220,000.0**
2011 RI Grid Sediment Samples	CML-SD-18	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	76.10	**211.0**	14.80	1,070	29,700	663.0	**1,640**	11.60	24.10	16.60	479.0
	CML-SD-19	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	**614.0**	**442.0**	15.40	727.0	11,900	**2,560**	264.0	2.80	ND(5.5)	47.00	238.0
	CML-SD-19	7/13/2011	Total Recoverable Metals	2	3	mg/kg	21.10	**43.60**	6.80	361.0	26,900	197.0	**920.0**	3.40	19.50	2.70	339.0
	CML-SD-20	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**528.0**	**617.0**	**25.90**	2,430	19,400	**3,720**	**1,280**	8.60	ND(6.8)	50.70	335.0
	CML-SD-20	7/12/2011	Total Recoverable Metals	2	3	mg/kg	6.30	29.70	6.60	136.0	27,800	86.10	**1,040**	7.00	23.20	ND(2.8)	231.0
	CML-SD-21	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**475.0**	**507.0**	**22.50**	1,630	19,200	**2,940**	474.0	6.30	6.30	43.60	413.0
	CML-SD-22	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	28.50	**58.20**	2.10	154.0	22,800	186.0	610.0	1.60	7.70	ND(2.6)	118.0
	CML-SD-23	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	40.90	**61.60**	2.40	249.0	31,600	282.0	568.0	5.80	10.50	ND(2.3)	92.40
	CML-SD-23	7/13/2011	Total Recoverable Metals	2	3	mg/kg	38.00	**48.40**	3.10	661.0	30,800	300.0	**789.0**	2.90	10.50	ND(2.2)	108.0
	CML-SD-24	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	95.00	**109.0**	6.50	500.0	16,500	617.0	**1,190**	4.90	10.40	7.30	269.0
	CML-SD-24	7/12/2011	Total Recoverable Metals	1	2	mg/kg	24.00	30.50	13.80	1,390	23,200	182.0	**2,050**	5.60	22.50	ND(2.9)	328.0
	CML-SD-25	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	184.0	**232.0**	12.60	837.0	19,900	**1,210**	**1,210**	3.50	13.30	12.70	326.0
	CML-SD-26	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**312.0**	**291.0**	12.30	654.0	13,600	**1,870**	598.0	4.50	ND(5.7)	22.70	235.0
	CML-SD-27	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	172.0	**176.0**	8.00	1,130	14,100	1,050	**790.0**	10.40	6.20	14.20	175.0
	CML-SD-28	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	248.0	**265.0**	15.90	1,690	23,500	**1,440**	**1,070**	22.10	18.30	14.70	343.0
	CML-SD-29	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**706.0**	**630.0**	**27.60**	2,060	17,300	**3,890**	352.0	4.10	ND(4.9)	58.10	359.0
	CML-SD-30	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	5.60	24.90	6.60	1,550	26,500	81.80	**974.0**	9.60	12.90	ND(2.5)	232.0
	CML-SD-31	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	272.0	**301.0**	13.50	2,950	22,600	**1,350**	**1,040**	2.10	9.50	19.30	370.0
	CML-SD-31	7/12/2011	Total Recoverable Metals	2	3	mg/kg	**406.0**	**382.0**	17.90	1,950	18,900	**2,350**	**1,190**	3.80	10.40	39.20	246.0
	CML-SD-32	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**463.0**	**449.0**	16.00	921.0	19,300	**2,470**	558.0	10.90	7.20	21.60	387.0
	CML-SD-33	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	159.0	**155.0**	9.00	1,260	13,400	925.0	127.0	4.30	7.20	11.10	200.0

TABLE A-7. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS
COMBINATION MILL AOC
BLACK PINE MINE

Description	Location	Date Sampled	Metals Analysis	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Risk Based Cleanup Guidelines[b] (mg/kg)							**293.0**	**40.4[ce]**	**19.5[c]**	**27,100.0**	**NS**	**1,100.0**	**665.0**	**220.0**	**14,650.0**	**NS**	**220,000.0**
2011 RI Grid Sediment Samples (cont)	CML-SD-33	7/12/2011	Total Recoverable Metals	1	2	mg/kg	**511.0**	**527.0**	**20.60**	1,420	14,200	**2,940**	163.0	1.10	ND(4.7)	46.60	260.0
	CML-SD-34	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**683.0**	**315.0**	15.60	2,240	18,800	**2,840**	165.0	55.40	ND(11.9)	29.60	333.0
	CML-SD-35	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**293.0**	**305.0**	12.90	1,740	22,100	**2,200**	**666.0**	57.90	7.50	31.30	344.0
	CML-SD-36	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	105.0	**125.0**	6.20	479.0	9,620	769.0	**788.0**	9.30	6.50	18.80	107.0
	CML-SD-37	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	88.90	**118.0**	4.40	276.0	36,900	693.0	569.0	8.10	4.70	10.80	164.0
	CML-SD-38	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	69.30	**101.0**	4.40	375.0	16,400	518.0	**1,300**	9.70	7.10	8.30	134.0
	CML-SD-39	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	23.00	27.20	2.20	180.0	11,900	238.0	415.0	5.30	12.10	ND(2.2)	101.0
	CML-SD-40	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	11.10	16.50	1.60	75.50	11,300	88.00	**781.0**	2.10	13.90	ND(3)	127.0
	CML-SD-41	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	239.0	**270.0**	13.10	653.0	24,900	**1,570**	485.0	5.40	ND(5)	46.30	170.0
	CML-SD-42	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	26.20	37.40	1.10	123.0	14,800	174.0	88.40	3.90	ND(4.4)	ND(2.2)	32.60
	CML-SD-42	7/13/2011	Total Recoverable Metals	2	3	mg/kg	40.50	**48.70**	2.40	309.0	15,400	240.0	323.0	5.00	9.00	2.70	71.90
	CML-SD-43	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	20.00	32.90	4.20	131.0	13,100	136.0	**936.0**	3.30	12.70	ND(3.1)	211.0
	CML-SD-44	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	7.90	29.50	1.30	97.90	37,400	168.0	160.0	6.90	19.20	ND(3.3)	202.0
	CML-SD-45	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	2.80	7.80	1.10	42.50	9,690	37.50	**739.0**	1.10	11.00	ND(2.5)	78.30
	CML-SD-46	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	8.00	10.50	1.50	68.90	25,900	55.00	183.0	12.70	25.40	ND(4.9)	227.0
Average[a]						**mg/kg**	194.5	**195.4**	9.78	903.4	20,314	**1,140**	**736.0**	8.97	10.37	15.35	233.0
2011 RI Subsurface Soils Samples in Tailings Test Pits	CML-SS-01	7/15/2011	Total Recoverable Metals	6	7	mg/kg	167.0	**123.0**	8.30	2,570	12,800	**1,120**	**1,300**	0.35	6.80	14.10	163.0
	CML-SS-02	7/15/2011	Total Recoverable Metals	6	7	mg/kg	10.00	11.90	3.10	2,360	5,640	67.70	67.20	9.10	5.30	1.00	108.0
	CML-SS-03	7/15/2011	Total Recoverable Metals	6	7	mg/kg	**750.0**	**777.0**	15.00	3,840	16,200	**5,310**	136.0	12.60	4.10	70.80	384.0
	CML-SS-04	7/15/2011	Total Recoverable Metals	6	8	mg/kg	164.0	**121.0**	9.60	1,230	10,700	393.0	359.0	81.10	9.20	10.10	208.0
	CML-SS-05	7/15/2011	Total Recoverable Metals	4	6	mg/kg	**1,260**	**1,030**	**23.10**	5,600	18,900	**8,010**	155.0	24.70	3.00	101.0	371.0
	CML-SS-06	7/15/2011	Total Recoverable Metals	5	7	mg/kg	19.20	**176.0**	**63.10**	367.0	14,600	77.10	165.0	79.30	19.90	3.70	576.0
	CML-SS-07	7/15/2011	Total Recoverable Metals	5	7	mg/kg	30.30	39.50	1.50	231.0	22,400	167.0	**1,600**	67.50	8.00	2.40	80.70
	CML-SS-08	7/15/2011	Total Recoverable Metals	7	9	mg/kg	1.90	8.30	0.12	35.10	18,800	20.10	457.0	130.0	7.00	7.10	178.0
	CML-SS-10	7/15/2011	Total Recoverable Metals	6	7	mg/kg	162.0	**173.0**	1.70	606.0	49,500	**1,830**	**1,050**	0.77	7.90	9.50	251.0
Average[a]						**mg/kg**	284.9	**273.3**	13.95	1,871	18,838	**1,888**	587.7	45.05	7.91	24.41	257.7

TABLE A-7. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS
COMBINATION MILL AOC
BLACK PINE MINE

Description	Location	Date Sampled	Metals Analysis	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Risk Based Cleanup Guidelines[b] (mg/kg)							**293.0**	**40.4[ce]**	**19.5[c]**	**27,100.0**	**NS**	**1,100.0**	**665.0**	**220.0**	**14,650.0**	**NS**	**220,000.0**
2011 RI Tailings Samples in Tailings Test Pits	CML-TS-01	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**324.0**	**262.0**	8.90	1,680	16,900	**2,300**	620.0	0.24	5.70	26.50	198.0
	CML-TS-01	7/15/2011	Total Recoverable Metals	2	4	mg/kg	23.30	24.20	8.70	2,140	13,300	144.0	269.0	1.00	13.30	1.30	213.0
	CML-TS-02	7/15/2011	Total Recoverable Metals	0	1	mg/kg	6.90	11.20	0.84	846.0	7,930	32.30	147.0	0.30	4.50	0.52	60.60
	CML-TS-02	7/15/2011	Total Recoverable Metals	2	4	mg/kg	7.50	11.30	2.30	92.00	9,680	44.90	297.0	1.90	13.90	1.10	159.0
	CML-TS-03	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**1,370**	**1,640**	**31.80**	5,420	25,100	837.0	327.0	9.90	1.60	142.0	522.0
	CML-TS-03	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**1,730**	**1,610**	**23.70**	6,240	29,300	**9,390**	167.0	5.50	0.69	110.0	735.0
	CML-TS-04	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**548.0**	**390.0**	17.30	3,240	17,500	**2,460**	143.0	0.24	6.00	48.70	278.0
	CML-TS-04	7/15/2011	Total Recoverable Metals	2	4	mg/kg	52.20	**50.60**	7.10	846.0	19,000	181.0	298.0	13.10	8.50	4.20	139.0
	CML-TS-05	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**409.0**	**353.0**	13.60	2,020	17,300	**1,840**	418.0	0.80	8.20	28.40	311.0
	CML-TS-05	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**1,190**	**1,020**	**21.00**	3,690	20,600	**10,000**	172.0	2.50	2.70	79.90	654.0
	CML-TS-06	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**1,040**	**830.0**	**30.70**	1,740	15,600	**6,790**	190.0	0.40	4.10	128.0	220.0
	CML-TS-06	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**1,410**	**1,070**	**22.00**	4,040	22,600	**6,960**	246.0	46.10	2.40	99.90	334.0
	CML-TS-07	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**529.0**	**496.0**	7.50	1,110	27,600	**2,650**	315.0	215.0	9.30	52.50	250.0
	CML-TS-07	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**690.0**	**633.0**	12.50	941.0	15,500	**3,290**	289.0	**221.0**	1.60	96.20	334.0
	CML-TS-08	7/15/2011	Total Recoverable Metals	0	1	mg/kg	233.0	**188.0**	4.30	687.0	16,000	**1,290**	183.0	10.80	3.40	20.80	118.0
	CML-TS-08	7/15/2011	Total Recoverable Metals	5	7	mg/kg	**360.0**	**340.0**	8.20	1,610	26,600	**2,990**	**1,120**	7.40	3.70	113.0	194.0
	CML-TS-09	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**3,210**	**2,440**	**49.20**	6,630	52,500	**9,520**	439.0	ND(0.024)	6.20	168.0	1,110
	CML-TS-09	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**1,280**	**5,140**	13.20	3,120	60,700	**23,600**	84.40	0.64	3.60	119.0	122.0
	CML-TS-09	7/15/2011	Total Recoverable Metals	4	6	mg/kg	**2,540**	**4,980**	**35.20**	5,580	67,700	**15,100**	234.0	137.0	2.20	108.0	273.0
	CML-TS-09	7/15/2011	Total Recoverable Metals	6	8	mg/kg	**15,700**	**4,200**	**99.90**	22,700	50,700	**12,600**	**815.0**	4.10	20.70	159.0	1,570
	CML-TS-10	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**1,090**	**1,250**	5.80	2,160	42,900	**8,010**	254.0	0.33	1.80	62.30	989.0
	CML-TS-10	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**1,110**	**1,400**	4.40	1,340	21,600	**2,490**	169.0	0.59	ND(0.48)	10.50	419.0
Average[a]						**mg/kg**	**1,584**	**1,288**	19.46	3,540	27,119	**5,569**	327.1	30.86	5.65	71.81	418.3

[a] For non detect results, one half of the reporting limit was used in the calculation of the average concentration
[b] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Soil Cleanup Guidelines for Recreational Visitors Table 7-10 (DEQ 1996)
[c] Carcinogenic risk of 5E-07
[d] 1991 Schafer samples were collected at 15 locations, but data was reported for only 10 of the samples. Data was not reported for 88-1A, 88-1C, 88-2A, 88-9A, or 88-8C.
[e] UCL = 95th upper confidence limit on the arithmetic mean background concentration, from background samples

Bold values exceed DEQ RBCG values
Shading indicates relative concentrations values, dark represents higher relative concentrations
J qualifiers not shown, refer to Table 3-22 for qualifiers on 2011 data
ft - feet
mg/kg - milligrams per kilogram.
NA* - Not Applicable or not analyzed
ND() - Analyte was not detected (reporting limit)

TABLE A-8. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS BY LOCATION
COMBINATION MILL AOC
BLACK PINE MINE

Description	Location	Date Sampled	Metals Analysis	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Risk Based Cleanup Guidelines[b] (mg/kg)							**293.0**	**40.4[cd]**	**19.5[c]**	**27,100.0**	**NS**	**1,100.0**	**665.0**	**220.0**	**14,650.0**	**NS**	**220,000.0**
Sediment and Soil Samples near TMDL SFLWILLOWC03	SE-1	7/21/1993	Total Metals	NA*	NA*	mg/kg	**337.0**	**311.0**	6.90	830.0	10,800	**1,550**	372.0	52.30	ND(2.8)	NA*	241.0
	SE-1	10/19/1995	Total Metals	NA*	NA*	mg/kg	98.10	**286.0**	16.60	1,270	17,200	**1,600**	**784.0**	46.70	14.50	26.30	522.0
	TP4A	10/19/1995	XRF Metals	NA*	NA*	mg/kg	NA*	NA*	NA*	NA*	17,272	29.35	**697.8**	NA*	NA*	NA*	457.1
	CML-SD-01	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**317.0**	**223.0**	4.80	378.0	14,400	826.0	413.0	17.60	3.90	11.20	188.0
Average[a]						**mg/kg**	250.7	**273.3**	9.43	826.0	14,918	1,001	566.7	38.87	2.65	18.75	352.0
Sediment and Soil Samples below Amalgamation Mill	TP4B	10/19/1995	Total Metals	NA*	NA*	mg/kg	**7,876**	**826.5**	NA*	3,211	25,317	**5,509**	373.1	**369.5**	NA*	244.2	342.1
	SE-2	7/21/1993	Total Metals	NA*	NA*	mg/kg	27.40	37.10	2.40	250.0	13,400	91.20	605.0	1.07	13.70	NA*	80.10
	SE-2	10/19/1995	Total Metals	NA*	NA*	mg/kg	64.50	**258.0**	8.10	1,060	13,800	**1,550**	**1,070**	24.70	5.40	23.20	288.0
	CML-SD-08	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**613.0**	**553.0**	11.50	1,390	20,100	**2,960**	443.0	12.10	5.80	34.80	430.0
	CML-SD-09	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**465.0**	**377.0**	7.80	920.0	15,400	**2,070**	452.0	5.40	5.20	23.90	287.0
	CML-SD-13	6/16/2011	Total Recoverable Metals	0	0.5	mg/kg	**440.0**	**339.0**	7.70	NA*	17,300	NA*	NA*	17.40	6.90	23.10	257.0
	SE-3	10/19/1995	Total Metals	NA*	NA*	mg/kg	79.30	**223.0**	12.10	1,220	15,800	**1,450**	**707.0**	43.00	18.30	18.80	384.0
	SE-3	7/21/1993	Total Metals	NA*	NA*	mg/kg	6.07	10.20	0.900	18.80	3,710	21.00	206.0	0.062	ND(2.49)	NA*	32.60
Average[a]						**mg/kg**	**1,196**	**328.0**	7.21	1,153	15,603	**1,950**	550.9	59.15	8.08	61.34	262.6
Soil, Sediment, and Tailings Samples at Amalgamation Mill	TP3A	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**5,605**	**364.6**	NA*	2,249	14,114	**3,889**	NA*	191.8	NA*	219.9	247.4
	TP3B	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**5,780**	**378.9**	NA*	2,727	15,497	**4,334**	NA*	158.2	NA*	124.2	235.0
	TP3C	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**5,097**	**248.2**	**143.2**	2,444	14,582	**3,445**	NA*	151.7	NA*	215.2	185.2
	CML-SD-14	6/16/2011	Total Recoverable Metals	0	0.5	mg/kg	**1,010**	**668.0**	14.70	2,230	21,700	**3,270**	257.0	7.70	3.20	51.50	403.0
Average[a]						**mg/kg**	**4,373**	**414.9**	**78.93**	2,413	16,473	**3,735**	257.0	127.4	3.20	152.7	267.6
Sediment, Soil, and Tailings Samples downstream of Tailings Impoundment and upstream of Amalgamation Mill	TP2A	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**1,679**	**205.9**	NA*	839.9	13,184	**2,091**	NA*	122.3	NA*	NA*	274.5
	TP2B	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**7,239**	**505.1**	NA*	2,977	23,903	**5,049**	**838.4**	**253.1**	NA*	272.0	249.5
	TP2C	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**3,296**	**221.4**	NA*	1,165	17,717	**1,984**	NA*	115.9	NA*	161.2	258.9
	CML-SD-10	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**596.0**	**492.0**	10.30	1,160	19,700	**2,460**	419.0	7.00	4.90	38.20	401.0
	CML-SD-15	6/16/2011	Total Recoverable Metals	0	0.5	mg/kg	**1,300**	**1,250**	**32.50**	4,810	35,900	**8,050**	342.0	9.20	4.10	213.0	1,300
	206	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	**180.0**	NA*	1,050	11,800	**1,450**	650.0	13.00	NA*	NA*	220.0
	207	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	**160.0**	NA*	1,280	11,800	**2,190**	**690.0**	21.00	NA*	NA*	290.0
	208	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	**130.0**	NA*	650.0	8,070	970.0	360.0	7.00	NA*	NA*	240.0
	209	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	**620.0**	NA*	4,200	18,000	**5,610**	340.0	54.00	NA*	NA*	260.0
	210	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	**270.0**	NA*	1,420	15,000	**1,450**	300.0	22.00	NA*	NA*	140.0
	CML-SD-11	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**307.0**	**219.0**	4.60	623.0	16,300	**1,170**	**1,210**	21.10	6.50	14.80	248.0
	88-9 A	8/28/1991	Total Metals	0.33	1.17	mg/kg	NA*	**260.0**	NA*	1,940	9,900	**2,440**	NA*	64.00	NA*	21.00	194.0
	TP2D	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**4,067**	**386.4**	NA*	2,141	17,817	**3,318**	NA*	**400.0**	NA*	182.8	354.5
	CML-SD-16	6/16/2011	Total Recoverable Metals	0	0.5	mg/kg	**2,130**	**1,670**	**26.60**	5,170	27,700	**7,330**	171.0	8.00	0.690	73.10	313.0
	CML-SD-17	6/16/2011	Total Recoverable Metals	0	0.5	mg/kg	**1,090**	**745.0**	17.10	1,910	23,800	**3,880**	325.0	10.50	2.50	56.10	496.0
	SE-1000	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**1,834**	**104.5**	NA*	775.0	14,452	**1,163**	529.5	104.8	NA*	NA*	177.8
	CML-SD-02	6/15/2011	Total Recoverable Metals	0	0.5	mg/kg	**461.0**	**417.0**	8.90	1,430	22,700	**1,970**	**744.0**	13.60	6.90	25.60	317.0
	SFWILLOW C04	9/1/2007	Total Metals	NA*	NA*	mg/kg	43.80	**79.60**	9.56	1,100	12,900	870.0	**1,490**		12.00	14.30	273.0
	88-8 B	8/29/1991	Total Metals	1.67	2.33	mg/kg	NA*	**1,090**	NA*	8,410	24,600	**21,300**	NA*	**393.0**	NA*	133.0	832.0
	SE-500	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**1,352**	**81.91**	NA*	921.7	13,412	1,034	551.0	NA*	NA*	93.60	76.15
	TP2EA	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**2,246**	**296.3**	NA*	981.9	12,922	**1,899**	NA*	121.5	NA*	139.0	265.3
	TP2EB	10/19/1995	XRF Metals	NA*	NA*	mg/kg	**2,880**	**214.3**	NA*	956.9	15,701	**2,122**	NA*	139.2	NA*	111.7	334.7
Average[a]						**mg/kg**	**2,035**	**436.3**	15.65	2,087	17,604	**3,627**	597.3	95.01	5.37	103.3	341.6
Sediment Samples in Tailings Sediment Ponds	CML-SD-06	6/13/2011	Total Recoverable Metals	0	0.5	mg/kg	**891.0**	**642.0**	**28.60**	3,620	21,200	**3,760**	602.0	32.80	14.60	64.60	768.0
	CML-SD-07	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**817.0**	**596.0**	15.40	5,320	21,800	**4,240**	**1,180**	10.10	6.10	37.60	393.0
Average[a]						**mg/kg**	**854.0**	**619.0**	**22.00**	4,470	21,500	**4,000**	**891.0**	21.45	10.35	51.10	580.5

TABLE A-8. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS BY LOCATION
COMBINATION MILL AOC
BLACK PINE MINE

Description	Location	Date Sampled	Metals Analysis	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Risk Based Cleanup Guidelines[b] (mg/kg)							**293.0**	**40.4[cd]**	**19.5[c]**	**27,100.0**	**NS**	**1,100.0**	**665.0**	**220.0**	**14,650.0**	**NS**	**220,000.0**
Sediment, Soil, and Tialings Samples west of Tailings Impoundment	CML-SD-18	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	76.10	**211.0**	14.80	1,070	29,700	663.0	**1,640**	11.60	24.10	16.60	479.0
	CML-SD-19	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	**614.0**	**442.0**	15.40	727.0	11,900	**2,560**	264.0	2.80	ND(5.5)	47.00	238.0
	CML-SD-19	7/13/2011	Total Recoverable Metals	2	3	mg/kg	21.10	**43.60**	6.80	361.0	26,900	197.0	**920.0**	3.40	19.50	2.70	339.0
	CML-SD-20	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**528.0**	**617.0**	**25.90**	2,430	19,400	**3,720**	**1,280**	8.60	ND(6.8)	50.70	335.0
	CML-SD-20	7/12/2011	Total Recoverable Metals	2	3	mg/kg	6.30	29.70	6.60	136.0	27,800	86.10	**1,040**	7.00	23.20	ND(2.8)	231.0
	CML-SD-21	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**475.0**	**507.0**	**22.50**	1,630	19,200	**2,940**	474.0	6.30	6.30	43.60	413.0
	SE-4	10/19/1995	Total Metals	NA*	NA*	mg/kg	26.70	**117.0**	5.60	582.0	11,800	768.0	639.0	14.30	8.10	9.70	157.0
	CML-SD-22	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	28.50	**58.20**	2.10	154.0	22,800	186.0	610.0	1.60	7.70	ND(2.6)	118.0
	CML-SD-23	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	40.90	**61.60**	2.40	249.0	31,600	282.0	568.0	5.80	10.50	ND(2.3)	92.40
	CML-SD-23	7/13/2011	Total Recoverable Metals	2	3	mg/kg	38.00	**48.40**	3.10	661.0	30,800	300.0	**789.0**	2.90	10.50	ND(2.2)	108.0
	CML-SD-24	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	95.00	**109.0**	6.50	500.0	16,500	617.0	**1,190**	4.90	10.40	7.30	269.0
	CML-SD-24	7/12/2011	Total Recoverable Metals	1	2	mg/kg	24.00	30.50	13.80	1,390	23,200	182.0	**2,050**	5.60	22.50	ND(2.9)	328.0
	CML-SD-25	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	184.0	**232.0**	12.60	837.0	19,900	**1,210**	**1,210**	3.50	13.30	12.70	326.0
	CML-SD-26	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**312.0**	**291.0**	12.30	654.0	13,600	**1,870**	598.0	4.50	ND(5.7)	22.70	235.0
	88-10 A	8/28/1991	Total Metals	0	2	mg/kg	NA*	**1,150**	NA*	8,650	11,400	**20,500**	NA*	80.00	NA*	42.00	256.0
	CML-SD-27	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	172.0	**176.0**	8.00	1,130	14,100	1,050	**790.0**	10.40	6.20	14.20	175.0
	CML-SD-28	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	248.0	**265.0**	15.90	1,690	23,500	**1,440**	**1,070**	22.10	18.30	14.70	343.0
	CML-SD-29	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**706.0**	**630.0**	**27.60**	2,060	17,300	**3,890**	352.0	4.10	ND(4.9)	58.10	359.0
	CML-SD-30	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	5.60	24.90	6.60	1,550	26,500	81.80	**974.0**	9.60	12.90	ND(2.5)	232.0
	CML-SD-31	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	272.0	**301.0**	13.50	2,950	22,600	**1,350**	**1,040**	2.10	9.50	19.30	370.0
	CML-SD-31	7/12/2011	Total Recoverable Metals	2	3	mg/kg	**406.0**	**382.0**	17.90	1,950	18,900	**2,350**	**1,190**	3.80	10.40	39.20	246.0
	CML-SD-32	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**463.0**	**449.0**	16.00	921.0	19,300	**2,470**	558.0	10.90	7.20	21.60	387.0
	88-11 A	8/28/1991	Total Metals	0	2	mg/kg	NA*	**548.0**	NA*	591.0	6,170	**5,480**	NA*	15.00	NA*	14.00	302.0
	CML-SD-33	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	159.0	**155.0**	9.00	1,260	13,400	925.0	127.0	4.30	7.20	11.10	200.0
	CML-SD-33	7/12/2011	Total Recoverable Metals	1	2	mg/kg	**511.0**	**527.0**	**20.60**	1,420	14,200	**2,940**	163.0	1.10	ND(4.7)	46.60	260.0
	CML-TS-10	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**1,090**	**1,250**	5.80	2,160	42,900	**8,010**	254.0	0.330	1.80	62.30	989.0
	CML-TS-10	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**1,110**	**1,400**	4.40	1,340	21,600	**2,490**	169.0	0.590	ND(0.48)	10.50	419.0
	CML-SS-10	7/15/2011	Total Recoverable Metals	6	7	mg/kg	162.0	**173.0**	1.70	606.0	49,500	**1,830**	**1,050**	0.770	7.90	9.50	251.0
	CML-SD-34	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**683.0**	**315.0**	15.60	2,240	18,800	**2,840**	165.0	55.40	ND(11.9)	29.60	333.0
	CML-SD-35	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	**293.0**	**305.0**	12.90	1,740	22,100	**2,200**	**666.0**	57.90	7.50	31.30	344.0
	CML-SD-36	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	105.0	**125.0**	6.20	479.0	9,620	769.0	**788.0**	9.30	6.50	18.80	107.0
	88-3 B	8/27/1991	Total Metals	1.5	2	mg/kg	NA*	**445.0**	NA*	1,080	10,400	**3,180**	NA*	2.00	NA*	66.00	116.0
	CML-SD-37	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	88.90	**118.0**	4.40	276.0	36,900	693.0	569.0	8.10	4.70	10.80	164.0
	CML-SD-38	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	69.30	**101.0**	4.40	375.0	16,400	518.0	**1,300**	9.70	7.10	8.30	134.0
	CML-SD-39	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	23.00	27.20	2.20	180.0	11,900	238.0	415.0	5.30	12.10	ND(2.2)	101.0
	CML-SD-40	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	11.10	16.50	1.60	75.50	11,300	88.00	**781.0**	2.10	13.90	ND(3)	127.0
	CML-SD-41	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	239.0	**270.0**	13.10	653.0	24,900	**1,570**	485.0	5.40	ND(5)	46.30	170.0
	CML-SD-42	7/13/2011	Total Recoverable Metals	0	0.5	mg/kg	26.20	37.40	1.10	123.0	14,800	174.0	88.40	3.90	ND(4.4)	ND(2.2)	32.60
	CML-SD-42	7/13/2011	Total Recoverable Metals	2	3	mg/kg	40.50	**48.70**	2.40	309.0	15,400	240.0	323.0	5.00	9.00	2.70	71.90
	CML-SD-43	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	20.00	32.90	4.20	131.0	13,100	136.0	**936.0**	3.30	12.70	ND(3.1)	211.0
	CML-SD-44	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	7.90	29.50	1.30	97.90	37,400	168.0	160.0	6.90	19.20	ND(3.3)	202.0
	CML-SD-45	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	2.80	7.80	1.10	42.50	9,690	37.50	**739.0**	1.10	11.00	ND(2.5)	78.30
	CML-SD-46	7/12/2011	Total Recoverable Metals	0	0.5	mg/kg	8.00	10.50	1.50	68.90	25,900	55.00	183.0	12.70	25.40	ND(4.9)	227.0
Average[a]						**mg/kg**	234.8	**281.8**	9.24	1,105	20,583	**1,937**	**715.2**	10.14	9.88	18.79	252.9

TABLE A-8. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS BY LOCATION
COMBINATION MILL AOC
BLACK PINE MINE

Description	Location	Date Sampled	Metals Analysis	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Risk Based Cleanup Guidelines[b] (mg/kg)							**293.0**	**40.4[cd]**	**19.5[c]**	**27,100.0**	**NS**	**1,100.0**	**665.0**	**220.0**	**14,650.0**	**NS**	**220,000.0**
Soil Samples from Tailings Impoundment	BP-1	9/13/1990	Total Metals	NA*	NA*	mg/kg	NA*	ND(8)	ND(0.8)	63.50	7,282	53.90	**907.0**	2.45	NA*	ND(0.1)	91.40
	BP-2	9/13/1990	Total Metals	NA*	NA*	mg/kg	NA*	**212.0**	9.31	1,570	8,970	**1,580**	485.0	47.00	NA*	27.70	139.0
	BP-3	9/13/1990	Total Metals	NA*	NA*	mg/kg	NA*	**460.0**	13.10	1,580	12,550	**2,890**	386.0	60.00	NA*	36.20	344.0
	CML-SS-01	7/15/2011	Total Recoverable Metals	6	7	mg/kg	167.0	**123.0**	8.30	2,570	12,800	**1,120**	**1,300**	0.350	6.80	14.10	163.0
	CML-SS-02	7/15/2011	Total Recoverable Metals	6	7	mg/kg	10.00	11.90	3.10	2,360	5,640	67.70	67.20	9.10	5.30	1.00	108.0
	CML-SS-03	7/15/2011	Total Recoverable Metals	6	7	mg/kg	**750.0**	**777.0**	15.00	3,840	16,200	**5,310**	136.0	12.60	4.10	70.80	384.0
	CML-SS-04	7/15/2011	Total Recoverable Metals	6	8	mg/kg	164.0	**121.0**	9.60	1,230	10,700	393.0	359.0	81.10	9.20	10.10	208.0
	CML-SS-05	7/15/2011	Total Recoverable Metals	4	6	mg/kg	**1,260**	**1,030**	**23.10**	5,600	18,900	**8,010**	155.0	24.70	3.00	101.0	371.0
	CML-SS-06	7/15/2011	Total Recoverable Metals	5	7	mg/kg	19.20	**176.0**	**63.10**	367.0	14,600	77.10	165.0	79.30	19.90	3.70	576.0
	CML-SS-07	7/15/2011	Total Recoverable Metals	5	7	mg/kg	30.30	39.50	1.50	231.0	22,400	167.0	**1,600**	67.50	8.00	2.40	80.70
	CML-SS-08	7/15/2011	Total Recoverable Metals	7	9	mg/kg	1.90	8.30	0.120	35.10	18,800	20.10	457.0	130.0	7.00	7.10	178.0
Average[a]						**mg/kg**	**300.3**	**269.3**	13.33	1,768	13,531	**1,790**	547.0	46.74	7.91	24.92	240.3
Tailings Samples from Tailings Impoundment	TP1D-1	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**4,184**	**723.8**	NA*	6,881	33,141	**4,581**	**1,383**	**462.8**	NA*	109.0	488.3
	TP1D-2	7/21/1993	XRF Metals	NA*	NA*	mg/kg	135.4	**63.86**	NA*	1,003	19,429	240.2	570.2	NA*	NA*	NA*	286.1
	TP1D-3	7/21/1993	XRF Metals	NA*	NA*	mg/kg	62.22	NA*	NA*	632.3	17,001	46.07	552.8	NA*	NA*	NA*	198.4
	BP-Tailings	9/13/1990	Total Metals	NA*	NA*	mg/kg	NA*	**1,684**	**45.79**	5,084	18,070	**10,650**	168.4	**250.0**	NA*	87.80	520.0
	CML-TS-01	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**324.0**	**262.0**	8.90	1,680	16,900	**2,300**	620.0	0.240	5.70	26.50	198.0
	CML-TS-01	7/15/2011	Total Recoverable Metals	2	4	mg/kg	23.30	24.20	8.70	2,140	13,300	144.0	269.0	1.00	13.30	1.30	213.0
	88-7 A	8/28/1991	Total Metals	0	0.5	mg/kg	NA*	**457.0**	NA*	3,860	10,000	**5,220**	NA*	71.00	NA*	44.00	285.0
	CML-TS-02	7/15/2011	Total Recoverable Metals	0	1	mg/kg	6.90	11.20	0.840	846.0	7,930	32.30	147.0	0.300	4.50	0.520	60.60
	CML-TS-02	7/15/2011	Total Recoverable Metals	2	4	mg/kg	7.50	11.30	2.30	92.00	9,680	44.90	297.0	1.90	13.90	1.10	159.0
	CML-TS-03	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**1,370**	**1,640**	**31.80**	5,420	25,100	837.0	327.0	9.90	1.60	142.0	522.0
	CML-TS-03	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**1,730**	**1,610**	**23.70**	6,240	29,300	**9,390**	167.0	5.50	0.690	110.0	735.0
	88-6 A	8/28/1991	Total Metals	0	1	mg/kg	NA*	**733.0**	NA*	2,890	8,240	**8,150**	NA*	124.0	NA*	70.00	221.0
	CML-TS-04	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**548.0**	**390.0**	17.30	3,240	17,500	**2,460**	143.0	0.240	6.00	48.70	278.0
	CML-TS-04	7/15/2011	Total Recoverable Metals	2	4	mg/kg	52.20	**50.60**	7.10	846.0	19,000	181.0	298.0	13.10	8.50	4.20	139.0
	TP1C-1	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**4,201**	**459.8**	NA*	3,871	28,591	**4,356**	364.2	**484.8**	NA*	165.4	497.6
	TP1C-2	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**898.8**	NA*	NA*	1,250	10,620	914.4	333.3	115.1	NA*	NA*	194.0
	TP1C-3	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**2,815**	**197.9**	NA*	1,348	17,697	**3,449**	**958.5**	**261.5**	NA*	103.8	455.0
	CML-TS-05	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**409.0**	**353.0**	13.60	2,020	17,300	**1,840**	418.0	0.800	8.20	28.40	311.0
	CML-TS-05	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**1,190**	**1,020**	**21.00**	3,690	20,600	**10,000**	172.0	2.50	2.70	79.90	654.0
	88-1 B	8/27/1991	Total Metals	0.67	1.33	mg/kg	NA*	**187.0**	NA*	1,450	6,740	**1,940**	NA*	7.00	NA*	54.00	146.0
	CML-TS-06	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**1,040**	**830.0**	**30.70**	1,740	15,600	**6,790**	190.0	0.400	4.10	128.0	220.0
	CML-TS-06	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**1,410**	**1,070**	**22.00**	4,040	22,600	**6,960**	246.0	46.10	2.40	99.90	334.0
	TP1B-1	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**2,417**	**179.2**	NA*	1,159	12,078	**2,107**	NA*	97.57	NA*	156.1	102.7
	TP1B-2	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**13,277**	**1,402**	**265.1**	10,142	34,376	**14,817**	**704.5**	**539.6**	NA*	810.8	560.3
	TP1B-3	7/21/1993	XRF Metals	NA*	NA*	mg/kg	173.3	**214.2**	NA*	1,843	18,480	275.4	**704.0**	NA*	NA*	NA*	114.6
	CML-TS-07	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**529.0**	**496.0**	7.50	1,110	27,600	**2,650**	315.0	215.0	9.30	52.50	250.0
	CML-TS-07	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**690.0**	**633.0**	12.50	941.0	15,500	**3,290**	289.0	**221.0**	1.60	96.20	334.0
	88-4 A	8/27/1991	Total Metals	0	1	mg/kg	NA*	**613.0**	NA*	1,830	13,600	**4,860**	NA*	34.00	NA*	494.0	430.0
	88-5 A	8/27/1991	Total Metals	0.67	1.67	mg/kg	NA*	**469.0**	NA*	1,340	17,300	**4,640**	NA*	15.00	NA*	573.0	403.0
	CML-TS-08	7/15/2011	Total Recoverable Metals	0	1	mg/kg	233.0	**188.0**	4.30	687.0	16,000	**1,290**	183.0	10.80	3.40	20.80	118.0
	CML-TS-08	7/15/2011	Total Recoverable Metals	5	7	mg/kg	**360.0**	**340.0**	8.20	1,610	26,600	**2,990**	**1,120**	7.40	3.70	113.0	194.0
	CML-TS-09	7/15/2011	Total Recoverable Metals	0	1	mg/kg	**3,210**	**2,440**	**49.20**	6,630	52,500	**9,520**	439.0	ND(0.024)	6.20	168.0	1,110
	CML-TS-09	7/15/2011	Total Recoverable Metals	2	4	mg/kg	**1,280**	**5,140**	13.20	3,120	60,700	**23,600**	84.40	0.640	3.60	119.0	122.0
	CML-TS-09	7/15/2011	Total Recoverable Metals	4	6	mg/kg	**2,540**	**4,980**	**35.20**	5,580	67,700	**15,100**	234.0	137.0	2.20	108.0	273.0
	CML-TS-09	7/15/2011	Total Recoverable Metals	6	8	mg/kg	**15,700**	**4,200**	**99.90**	22,700	50,700	**12,600**	**815.0**	4.10	20.70	159.0	1,570
	TP1A-1	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**11,477**	**957.1**	**213.1**	8,771	25,660	**14,598**	**703.0**	**428.0**	NA*	623.3	544.3
	TP1A-2	7/21/1993	XRF Metals	NA*	NA*	mg/kg	**742.4**	NA*	NA*	387.3	14,242	716.5	336.4	NA*	NA*	NA*	180.3
Average[a]						**mg/kg**	**2,356**	**1,001**	**40.95**	3,463	22,632	**5,232**	437.1	78.60	6.11	149.9	362.7

TABLE A-8. HISTORICAL SOLID-MATRIX ANALYTICAL RESULTS - METALS BY LOCATION
COMBINATION MILL AOC
BLACK PINE MINE

Description	Location	Date Sampled	Metals Analysis	Sample Start Depth (ft)	Sample End Depth (ft)	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Risk Based Cleanup Guidelines[b] (mg/kg)							**293.0**	**40.4[cd]**	**19.5[c]**	**27,100.0**	**NS**	**1,100.0**	**665.0**	**220.0**	**14,650.0**	**NS**	**220,000.0**
Sediment and Soil Samples upstream of Combination Mill and Tailings Impoundment	CML-SD-03	6/15/2011	Total Recoverable Metals	0	0.5	mg/kg	16.80	19.40	0.430	57.90	22,300	207.0	404.0	4.10	9.10	1.60	40.50
	CML-SD-04	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	16.70	27.90	1.40	109.0	12,400	74.20	**1,980**	14.40	11.40	2.20	144.0
	201	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	5.00	NA*	30.00	7,670	20.00	**1,150**	ND(2)	NA*	NA*	99.00
	202	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	ND(5)	NA*	27.00	7,840	16.00	**1,070**	ND(2)	NA*	NA*	82.00
	203	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	6.00	NA*	29.00	8,060	33.00	**1,070**	ND(2)	NA*	NA*	82.00
	204	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	8.00	NA*	40.00	9,670	27.00	**1,140**	ND(2)	NA*	NA*	90.00
	205	8/29/1991	Total Metals	NA*	NA*	mg/kg	NA*	12.00	NA*	48.00	11,200	26.00	**1,020**	ND(2)	NA*	NA*	120.0
	CML-SD-05	6/14/2011	Total Recoverable Metals	0	0.5	mg/kg	**ND(0.64)**	12.00	1.20	26.80	14,500	16.30	**1,160**	0.380	13.40	ND(0.64)	96.80
Average[a]						**mg/kg**	11.27	11.60	1.01	45.96	11,705	52.44	**1,124**	2.99	11.30	1.37	94.29

[a] For non detect results, one half of the reporting limit was used in the calculation of the average concentration

[b] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Soil Cleanup Guidelines for Recreational Visitors Table 7-10 (DEQ 1996)

[c] Carcinogenic risk of 5E-07

[d] UCL = 95th upper confidence limit on the arithmetic mean background concentration, from background samples

Bold values exceed DEQ RBCG values

Shading indicates relative concentrations values, dark represents higher relative concentrations

J qualifiers not shown, refer to Table 3-22 for qualifiers on 2011 data

ft - feet

mg/kg - milligrams per kilogram.

NA* - Not Applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

NS - A standard has not been adopted

TABLE A-9. HISTORICAL SURFACE WATER ANALYTICAL RESULTS - METALS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Date Sampled	Metals Analysis[c]	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Risk Based Cleanup Guidelines[a] (ug/L)				**91.1**	**0.06[b]**	**66.5**	**472**	**4,979**	**47.1**	**16.6**	**0.15**	**NS**	**17.2**
12	7/21/1981	Total	ug/L	NA*	**ND(5)**	ND(1)	ND(10)	270.0	ND(10)	**ND(20)**	ND(0.2)	ND(5)	ND(10)
22	7/17/1981	Total	ug/L	NA*	**ND(5)**	ND(1)	ND(10)	60.00	ND(10)	**ND(20)**	**1.10**	ND(5)	**40.00**
1A	8/28/1991	Dissolved	ug/L	NA*	**ND(5)**	ND(1)	10.00	30.00	ND(10)	**ND(20)**	**ND(1)**	ND(5)	ND(10)
BP-3A	9/13/1990	Total	ug/L	NA*	**ND(40)**	ND(4)	50.00	266.0	ND(30)	**38.00**	**1.15**	ND(5)	ND(20)
BP-1A	9/13/1990	Total	ug/L	NA*	**ND(40)**	ND(4)	ND(15)	239.0	ND(30)	**55.00**	ND(0.15)	ND(5)	ND(20)
BP-2A	9/13/1990	Total	ug/L	NA*	**ND(40)**	ND(4)	ND(15)	292.0	ND(30)	**52.00**	**0.3100**	ND(5)	ND(20)
SW-1	7/21/1993	Total	ug/L	ND(30.7)	**3.25**	ND(2.57)	21.90	410.0	9.93	**20.90**	0.0810	NA*	ND(7.57)
SW-1	10/19/1995	Total	ug/L	9.30	**2.70**	0.20	23.60	84.00	2.70	15.70	**0.4800**	0.5200	**26.10**
SW-2	7/21/1993	Total	ug/L	ND(30.7)	**2.40**	ND(2.57)	17.20	1,280	3.30	**17.40**	ND(0.038)	NA*	ND(7.57)
SW-2	10/19/1995	Total	ug/L	8.80	**2.30**	0.16	25.00	172.0	4.00	**16.80**	**0.5000**	ND(0.21)	**29.40**
SW-3	7/21/1993	Total	ug/L	ND(30.7)	**ND(1.69)**	ND(2.57)	1.90	264.0	ND(1.55)	15.60	ND(0.038)	NA*	ND(7.57)
SW-3	10/19/1995	Total	ug/L	5.00	**1.80**	0.16	24.00	153.0	3.00	**17.90**	**0.4600**	0.5700	**22.80**
SW-4	10/19/1995	Total	ug/L	2.40	**ND(1.5)**	0.07	16.50	160.0	1.00	**17.90**	**0.2200**	0.4800	ND(9.1)
MCSW-1	10/4/2000	Total	ug/L	ND(50)	**ND(3)**	ND(0.1)	24.00	500.0	8.00	**120.0**	**ND(0.6)**	ND(3)	10.00
MCSW-1	6/7/2001	Total	ug/L	ND(50)	**ND(3)**	0.10	25.00	2,150	6.00	**20.00**	NA*	ND(3)	**30.00**
MCSW-1	7/18/2001	Total	ug/L	ND(50)	**ND(3)**	ND(0.1)	18.00	1,350	5.00	**20.00**	NA*	ND(3)	10.00
WCSW-1	10/4/2000	Total	ug/L	ND(50)	**ND(3)**	ND(5)	2.00	110.0	ND(3)	**30.00**	**ND(0.6)**	3.00	10.00
WCSW-1	6/7/2001	Total	ug/L	ND(50)	**ND(3)**	ND(0.1)	ND(5)	330.0	ND(3)	ND(10)	NA*	ND(3)	ND(10)
WCSW-1	7/18/2001	Total	ug/L	ND(50)	**ND(3)**	ND(0.1)	3.00	140.0	ND(3)	**20.00**	NA*	ND(3)	ND(10)
SFLWILLOWC02	9/1/2007	Total	ug/L	10.00	**5.00**	0.16	12.00	110.0	3.00	10.00	NA*	ND(1)	**20.10**
SFLWILLOWC02	6/9/2008	Total	ug/L	ND(5)	**ND(3)**	0.14	18.00	480.0	3.80	7.00	NA*	NA*	**20.00**
SFLWILLOWC02	7/10/2008	Total	ug/L	10.00	**5.00**	0.10	20.00	210.0	5.50	NA*	NA*	NA*	**20.00**
SFLWILLOWC02	8/11/2008	Total	ug/L	11.00	**7.00**	0.12	15.00	160.0	4.60	NA*	NA*	NA*	**20.00**
SFLWILLOWC02	5/27/2009	Total	ug/L	17.00	**7.00**	1.15	40.00	490.0	30.80	NA*	NA*	NA*	**20.00**
SFLWILLOWC02	8/20/2009	Total	ug/L	13.00	**7.00**	ND(0.08)	17.00	190.0	6.10	NA*	NA*	NA*	10.00
SFLWILLOWC03	7/8/2008	Total	ug/L	5.00	**ND(3)**	0.16	17.00	190.0	2.20	NA*	NA*	NA*	**20.00**
SFLWILLOWC03	8/11/2008	Total	ug/L	8.00	**4.00**	0.20	18.00	60.00	1.80	NA*	NA*	NA*	**20.00**
SFLWILLOWC03	5/27/2009	Total	ug/L	8.00	**3.00**	1.02	22.00	260.0	13.60	NA*	NA*	NA*	ND(10)
SFLWILLOWC03	8/20/2009	Total	ug/L	9.00	**4.00**	0.10	19.00	70.00	2.30	NA*	NA*	NA*	**20.00**
CML-SW-01	6/15/2011	Total Recoverable	ug/L	3.40	**1.70**	0.15	17.40	617.0	3.80	7.10	**0.3570**	ND(0.5)	14.20
SFLWILLOWC04	9/1/2007	Total	ug/L	3.00	**2.00**	0.12	19.00	100.0	0.80	7.00	NA*	ND(1)	7.10
SFLWILLOWC04	7/8/2008	Total	ug/L	ND(5)	**ND(3)**	0.15	13.00	230.0	1.80	NA*	NA*	NA*	**30.00**
SFLWILLOWC04	8/11/2008	Total	ug/L	ND(5)	**ND(3)**	0.16	15.00	100.0	2.40	NA*	NA*	NA*	**20.00**
SFLWILLOWC04	5/27/2009	Total	ug/L	ND(3)	**ND(3)**	1.94	6.00	220.0	1.40	NA*	NA*	NA*	ND(10)
SFLWILLOWC04	8/20/2009	Total	ug/L	5.00	**ND(3)**	ND(0.08)	16.00	100.0	1.60	NA*	NA*	NA*	10.00
CML-SW-02	6/15/2011	Total Recoverable	ug/L	1.30	**1.20**	ND(0.08)	9.90	420.0	1.00	10.40	0.0772	ND(0.5)	7.00
SFLWILLOWC04.5	7/8/2008	Total	ug/L	ND(5)	**ND(3)**	0.11	21.00	1,080	3.40	NA*	NA*	NA*	**20.00**
SFLWILLOWC04.5	8/11/2008	Total	ug/L	ND(5)	**4.00**	0.11	20.00	970.0	3.70	NA*	NA*	NA*	10.00
SFLWILLOWC04.5	5/27/2009	Total	ug/L	3.00	**ND(3)**	0.89	20.00	1,370	3.10	NA*	NA*	NA*	ND(10)
CML-SW-03	6/15/2011	Total Recoverable	ug/L	1.90	**2.30**	ND(0.08)	20.80	1,450	2.90	8.80	0.1230	ND(0.5)	10.50

TABLE A-9. HISTORICAL SURFACE WATER ANALYTICAL RESULTS - METALS
COMBINATION MILL AOC
BLACK PINE MINE

Location	Date Sampled	Metals Analysis[c]	Units	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Risk Based Cleanup Guidelines[a] (ug/L)				**91.1**	**0.06[b]**	**66.5**	**472**	**4,979**	**47.1**	**16.6**	**0.15**	**NS**	**17.2**
SFLWILLOWC05	7/8/2008	Total	ug/L	ND(5)	**ND(3)**	ND(0.08)	1.00	170.0	ND(0.5)	NA*	NA*	NA*	ND(10)
SFLWILLOWC05	8/11/2008	Total	ug/L	ND(5)	**ND(3)**	ND(0.08)	1.00	100.0	ND(0.5)	NA*	NA*	NA*	ND(10)
SFLWILLOWC05	5/27/2009	Total	ug/L	ND(3)	**ND(3)**	1.48	2.00	170.0	ND(0.5)	NA*	NA*	NA*	ND(10)
SFLWILLOWC05	8/18/2009	Total	ug/L	ND(3)	**ND(3)**	ND(0.08)	1.00	130.0	ND(0.5)	NA*	NA*	NA*	ND(10)
CML-SW-04	6/15/2011	Total Recoverable	ug/L	ND(0.5)	**0.53**	ND(0.08)	3.80	288.0	0.31/ND(0.31)	4.70	0.0337	ND(0.5)	ND(5)
CML-SW-05	6/15/2011	Total Recoverable	ug/L	ND(0.5)	**ND(0.5)**	ND(0.08)	1.00	162.0	0.12/ND(0.12)	2.50	0.0042	ND(0.5)	ND(5)
CML-SW-06	6/13/2011	Total Recoverable	ug/L	**117.0**	**36.00**	1.10	133.0	117.0	6.70	**39.10**	**1.91**	ND(0.5)	**63.10**
CML-SW-07	6/14/2011	Total Recoverable	ug/L	42.90	**12.80**	1.20	221.0	1,430	**49.00**	12.90	**2.52**	0.6400	**40.50**
CML-SW-08	6/15/2011	Total Recoverable	ug/L	3.40	**1.70**	0.12	16.70	381.0	3.70	5.80	**0.1930**	ND(0.5)	12.50
CML-SW-09	6/15/2011	Total Recoverable	ug/L	3.00	**1.40**	0.13	15.80	406.0	2.90	6.10	**0.1780**	ND(0.5)	11.80
CML-SW-10	6/15/2011	Total Recoverable	ug/L	2.40	**1.20**	0.12	13.80	338.0	2.70	5.20	**0.2210**	ND(0.5)	9.40
CML-SW-11	6/15/2011	Total Recoverable	ug/L	1.70	**0.90**	0.09	11.60	400.0	1.70	5.80	**0.1960**	ND(0.5)	7.20
CML-SW-13	6/15/2011	Total Recoverable	ug/L	ND(0.5)	**ND(0.5)**	ND(0.08)	2.10	168.0	0.18/ND(0.18)	3.40	0.0060	ND(0.5)	6.80
CML-SW-14	6/15/2011	Total Recoverable	ug/L	ND(0.5)	**0.51**	ND(0.08)	3.50	442.0	0.36/ND(0.36)	8.10	0.0292	ND(0.5)	ND(5)
CML-SW-15	6/15/2011	Total Recoverable	ug/L	ND(0.5)	**0.68**	ND(0.08)	5.80	321.0	0.61	5.60	0.0336	ND(0.5)	ND(5)
CML-SW-16	6/15/2011	Total Recoverable	ug/L	1.60	**1.20**	0.11	11.80	356.0	5.10	5.50	0.1200	ND(0.5)	6.10
CML-SW-17	6/14/2011	Total Recoverable	ug/L	ND(0.5)	**ND(0.5)**	ND(0.08)	2.40	115.0	0.13/ND(0.13)	1.70	0.0056	ND(0.5)	12.50
CML-SW-18	6/14/2011	Total Recoverable	ug/L	ND(0.5)	**ND(0.5)**	ND(0.08)	2.00	158.0	0.27/ND(0.27)	1.00	0.0071	ND(0.5)	ND(5)
CML-SW-19	6/15/2011	Total Recoverable	ug/L	ND(0.5)	**ND(0.5)**	ND(0.08)	3.60	308.0	0.37/ND(0.37)	4.10	0.0062	ND(0.5)	ND(5)

[a] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Water Cleanup Guidelines for Recreational Visitors Table 7-11 (DEQ 1996)
[b] Carcinogenic risk of 5E-07
[c] For samples where both dissolved and total metals analysis were performed, the result shown is for the total metals analysis.
Bold values exceed DEQ RBCG values
Shading indicates relative concentrations values, dark represents higher relative concentrations
J, JB, and U qualifiers not shown, refer to Table 3-26 for qualifiers on 2011 data
ug/L = micrograms per liter
NA* - Not Applicable or not analyzed
ND() - Analyte was not detected (reporting limit)
NS - A standard has not been adopted

APPENDIX B

SYNOPTIC SAMPLING

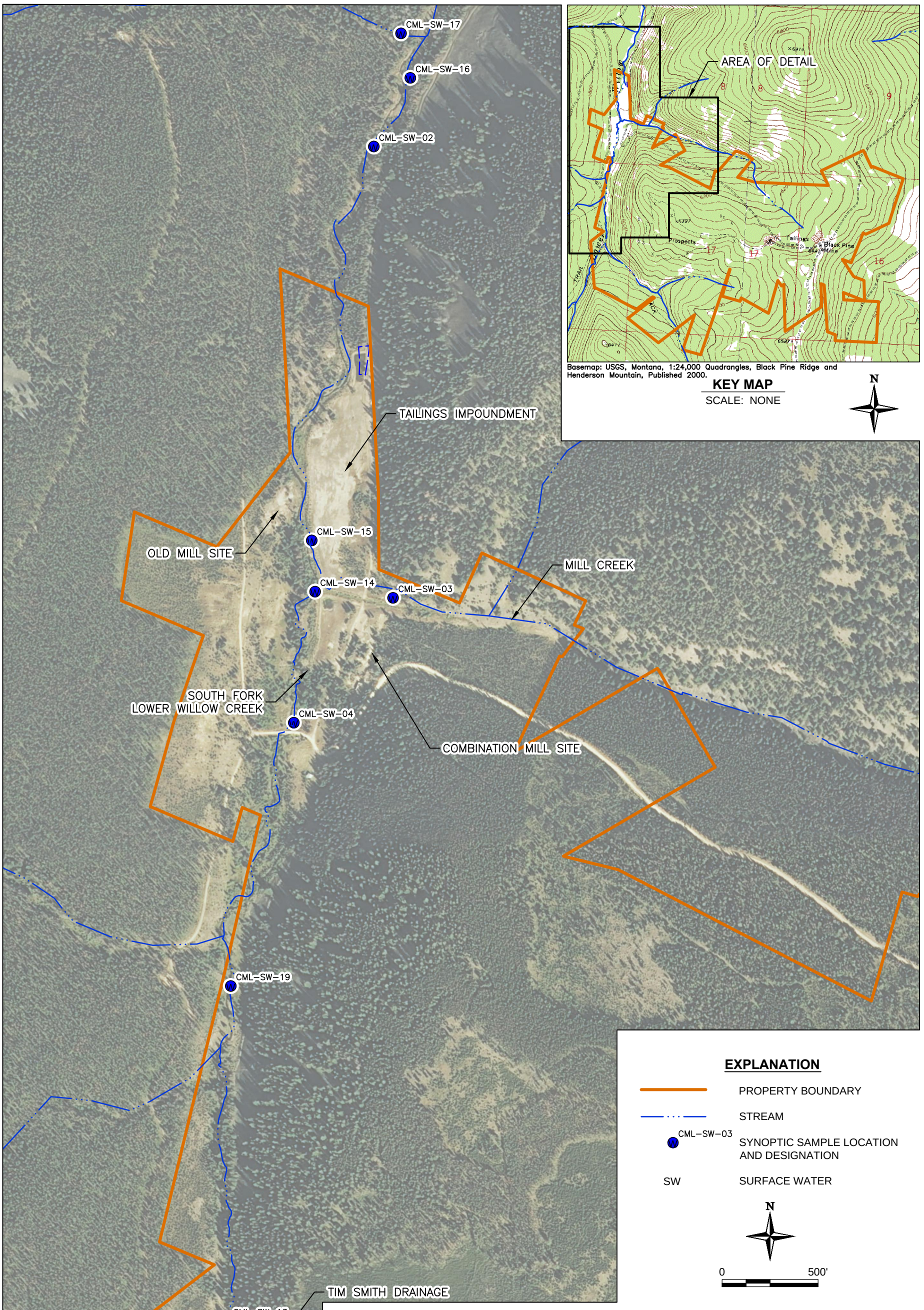

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FIGURE B-1

SYNOPTIC SAMPLE LOCATION MAP, SOUTH FORK LOWER WILLOW CREEK (UPSTREAM), COMBINATION MILL AREA OF CONCERN

**BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION**

Drawn By: KBW	Checked By: MD	Scale: 1" = 500'	Date: 6/7/13	File: 776_SSLP-LWC-A_201306

CML-SW-01

CML-SW-08

CML-SW-18

CML-SW-09

FORMER AMALGAMATION MILL

SOUTH FORK
LOWER WILLOW CREEK

CML-SW-10

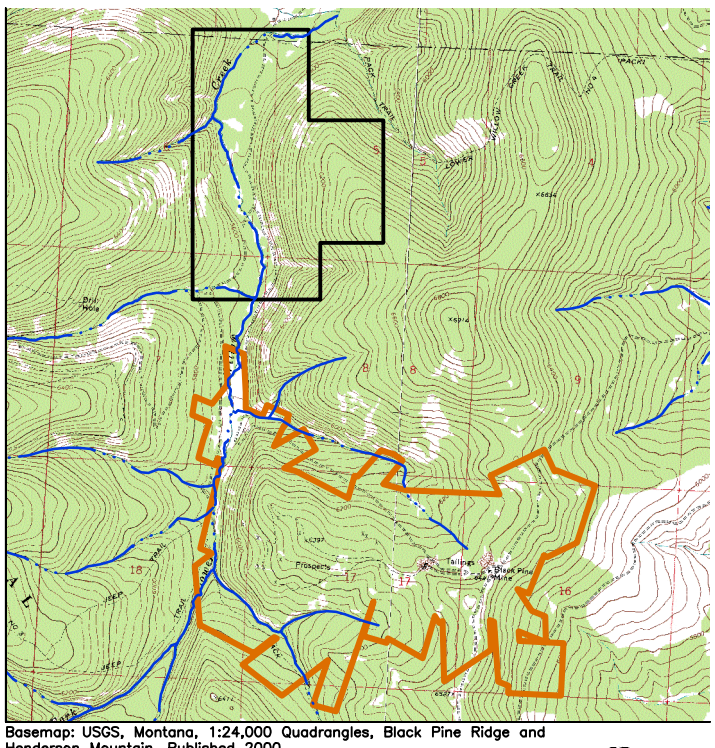
CML-SW-11

CML-SW-17

Basemap: USDA Farm Service Agency, Montana 2011 Color NAIP Orthophoto12-kM, Granite County. Published 2011.

N

0 500'



Basemap: USGS, Montana, 1:24,000 Quadrangles, Black Pine Ridge and Henderson Mountain, Published 2000.

KEY MAP

SCALE: NONE

N

EXPLANATION

- PROPERTY BOUNDARY
- STREAM
- CML-SW-03 — SYNOTPIC SAMPLE LOCATION AND DESIGNATION
- SW — SURFACE WATER

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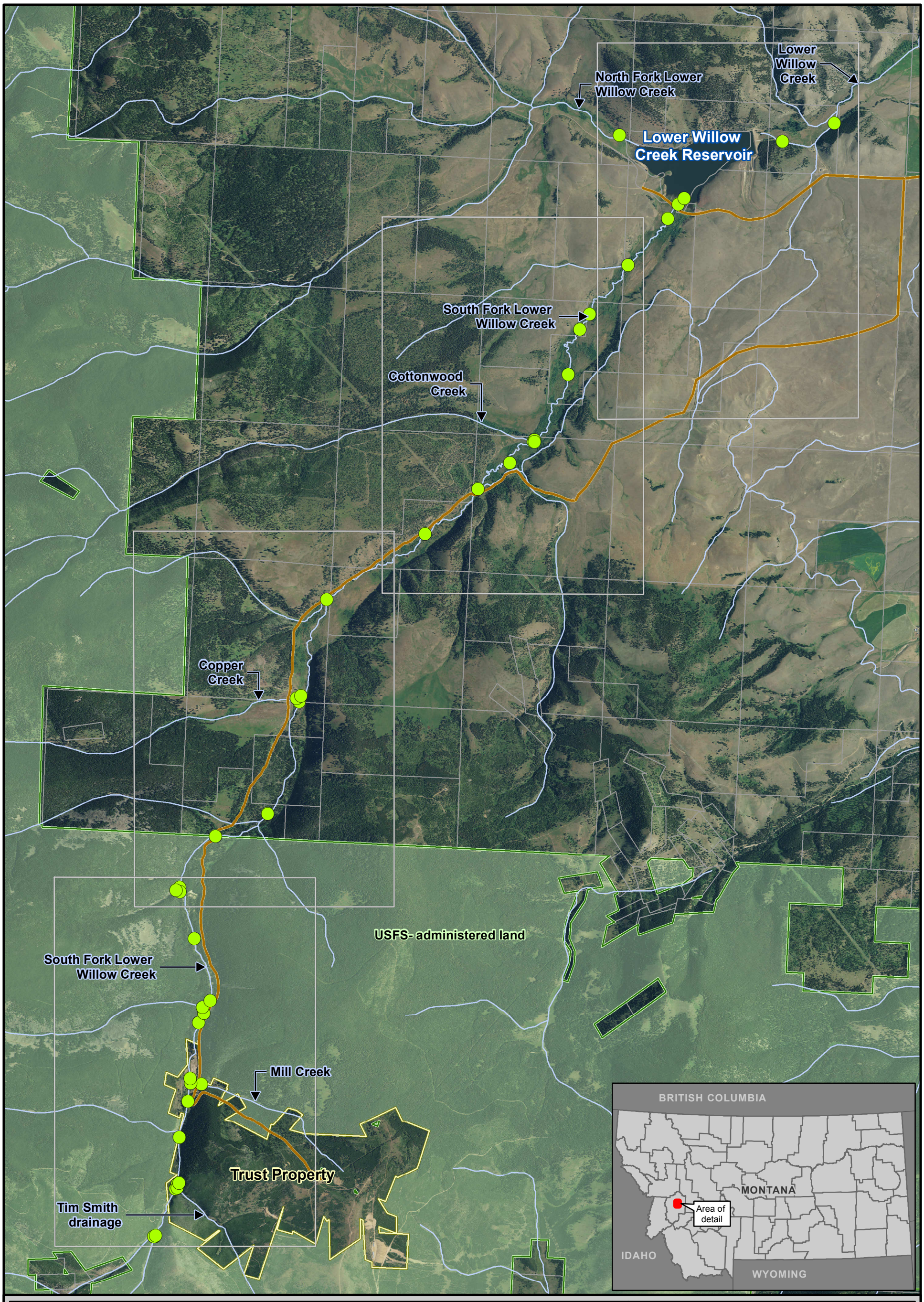
FIGURE B-2

SYNOPTIC SAMPLE LOCATION MAP, SOUTH FORK LOWER WILLOW CREEK (DOWNSTREAM), COMBINATION MILL AREA OF CONCERN

**BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
ABANDONED MINE SECTION**

Drawn By: KBW	Checked By: MD	Scale: 1" = 500'	Date: 6/7/13	File: 776_SSLP-LWC-B_201306



Legend

- Synoptic station location
- Road
- Stream
- Figure extent
- USFS- administered land (Beaverhead- Deerlodge National Forest)
- USFS - administered land boundary
- Parcel boundary

Figure B-3. Vicinity Map, Trust Property (Black Pine Mine), and South Fork Lower Willow Creek, Granite County, Montana.

N

0 1,750 3,500 7,000 Feet

HERRERA

Aerial: USDA (2009)

K:\Projects\Y2006\06-03425-028\Project\Overview_SynopticSample.mxd (6/6/2013)

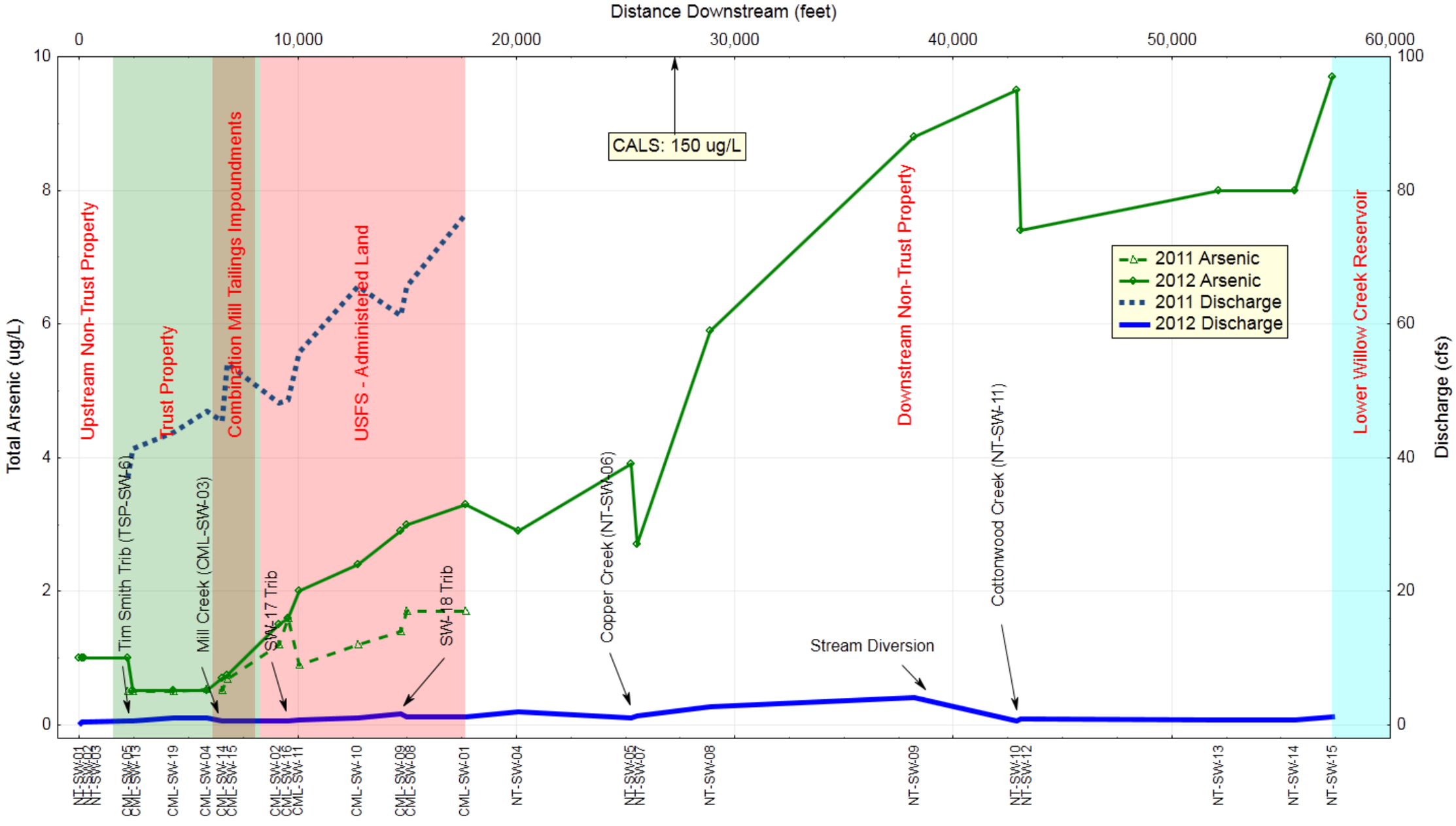


Figure B-4. Discharge and Total Recoverable Arsenic Results for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

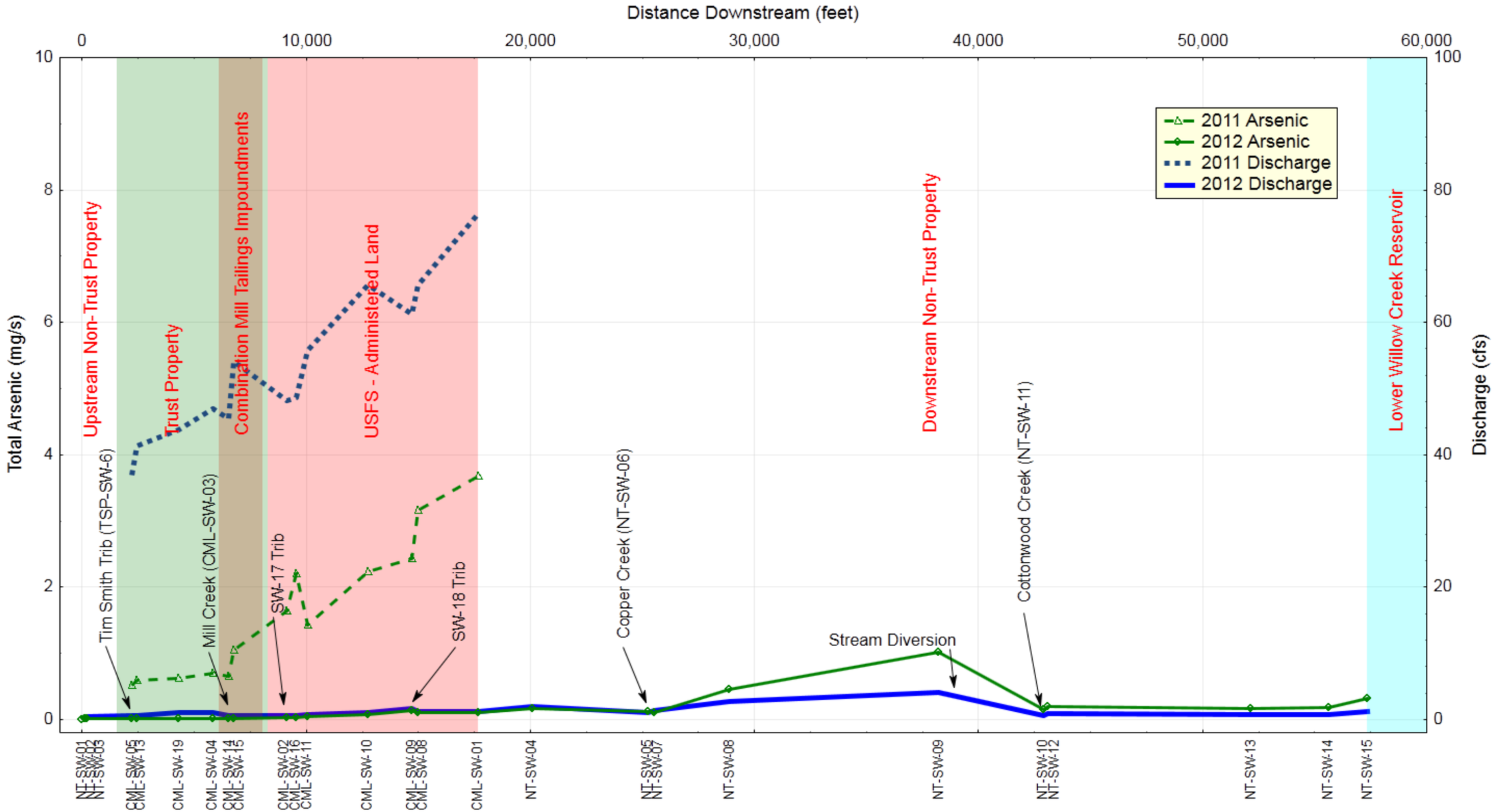


Figure B-5. Discharge and Arsenic Loading Rates for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

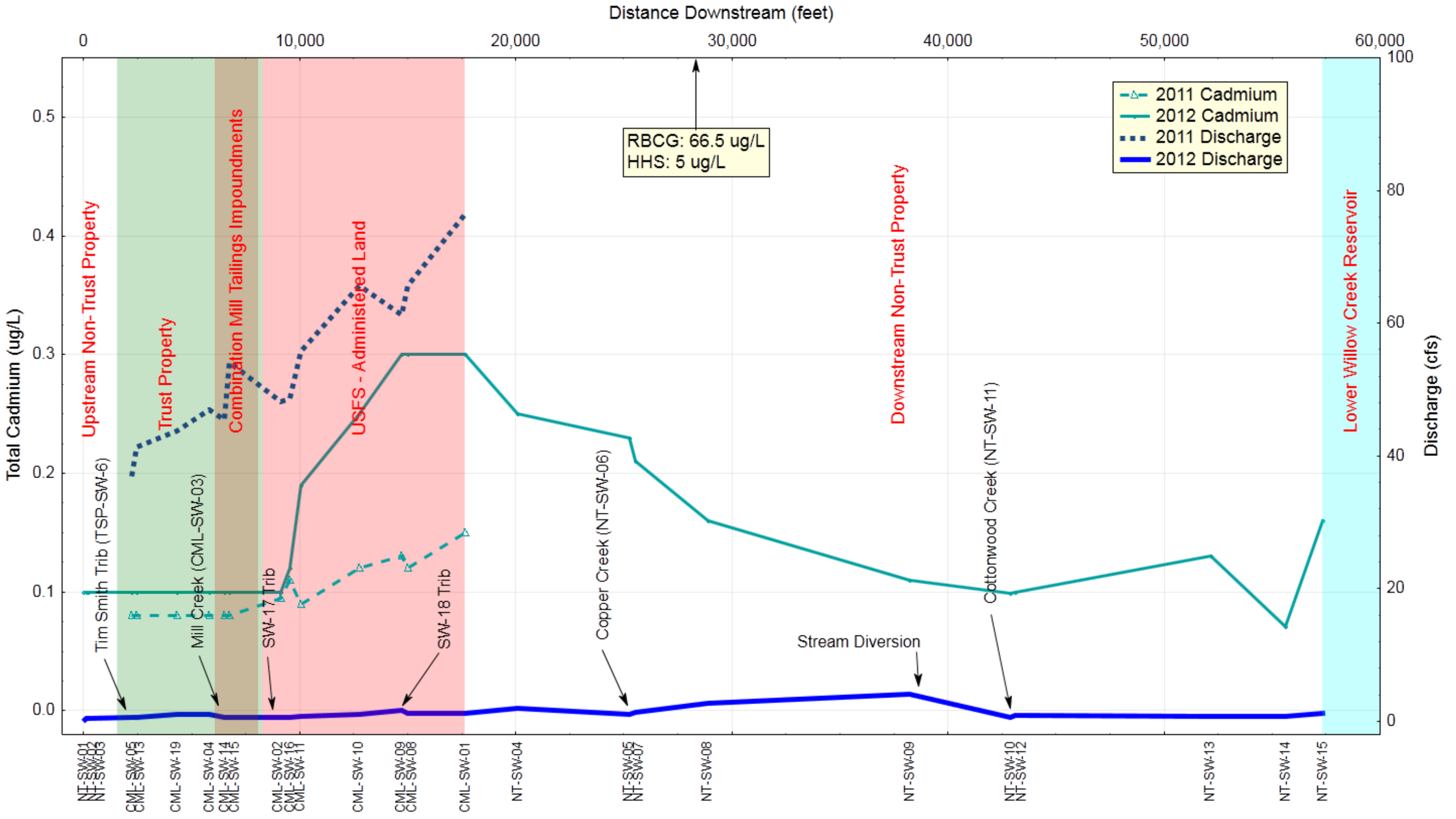


Figure B-6. Discharge and Total Recoverable Cadmium Results for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

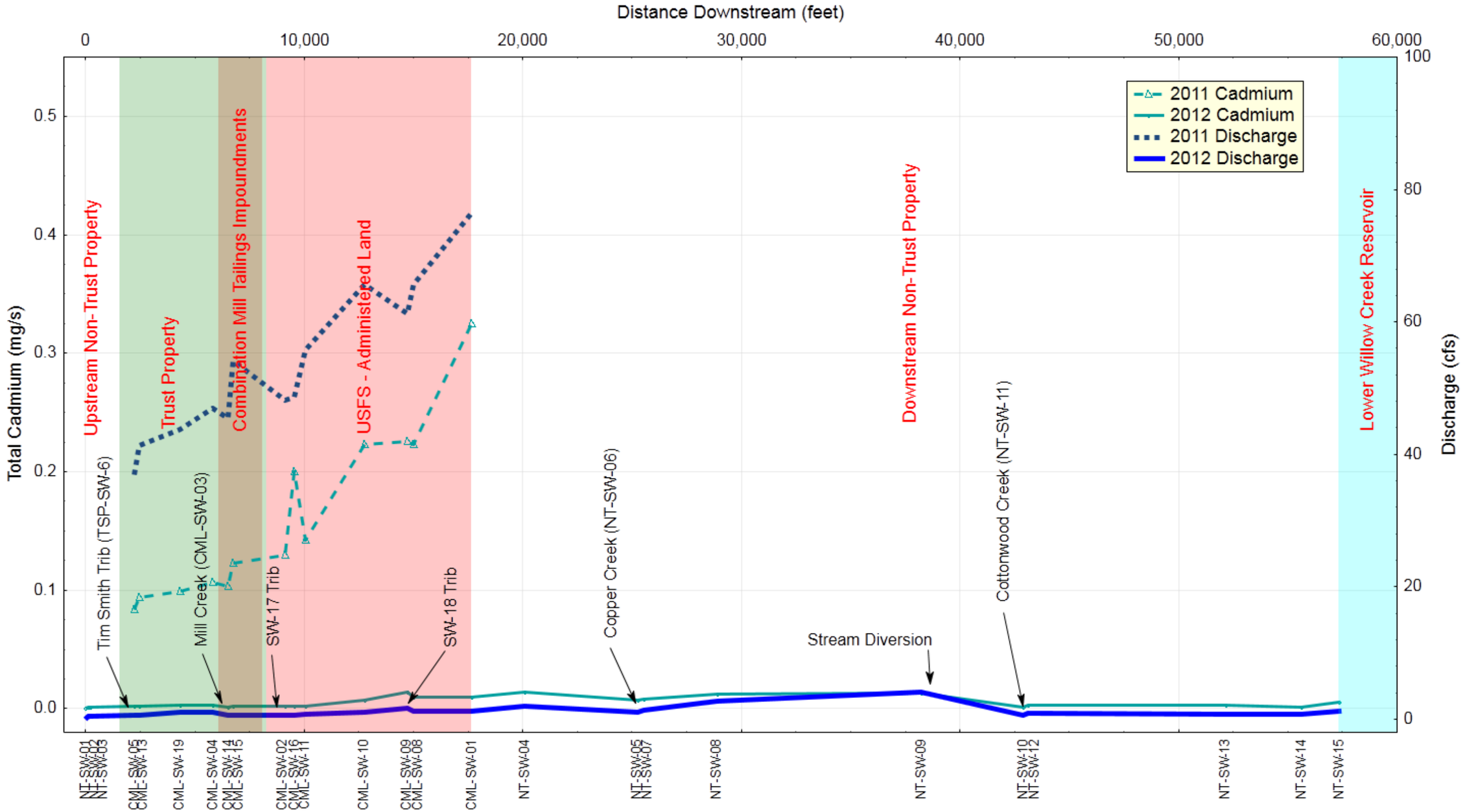


Figure B-7. Discharge and Cadmium Loading Rates for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

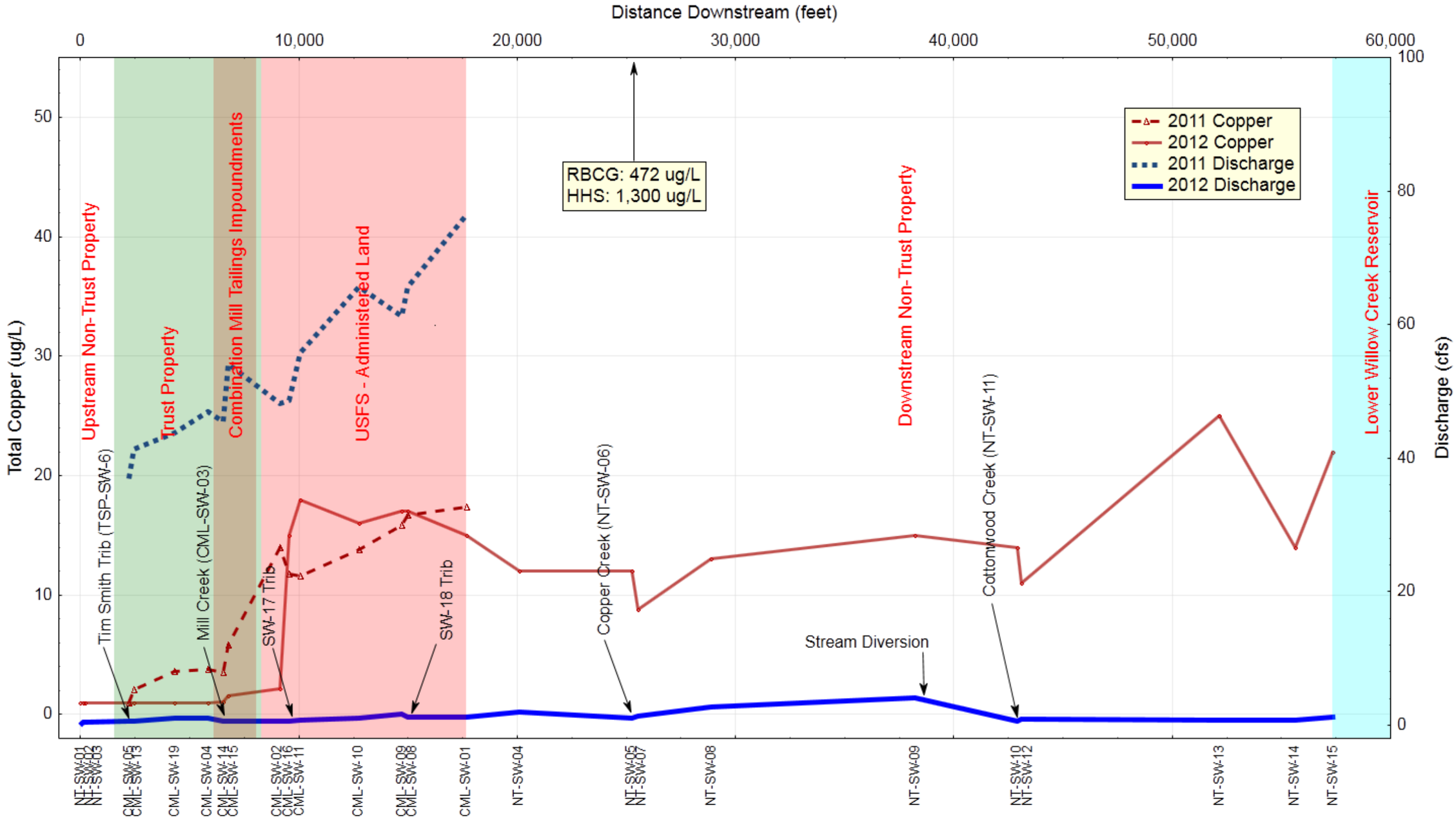


Figure B-8. Discharge and Total Recoverable Copper Results for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

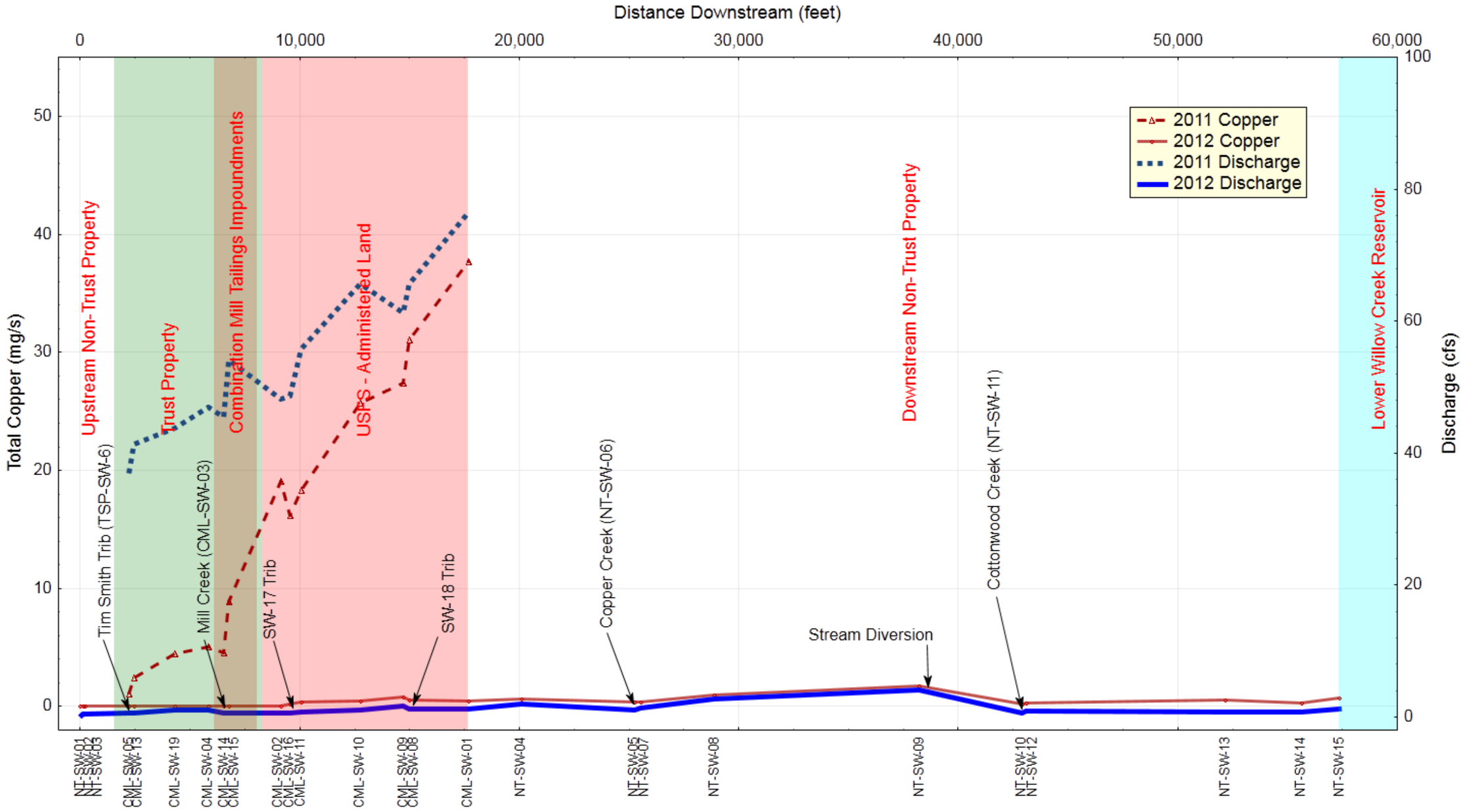


Figure B-9. Discharge and Copper Loading Rates for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

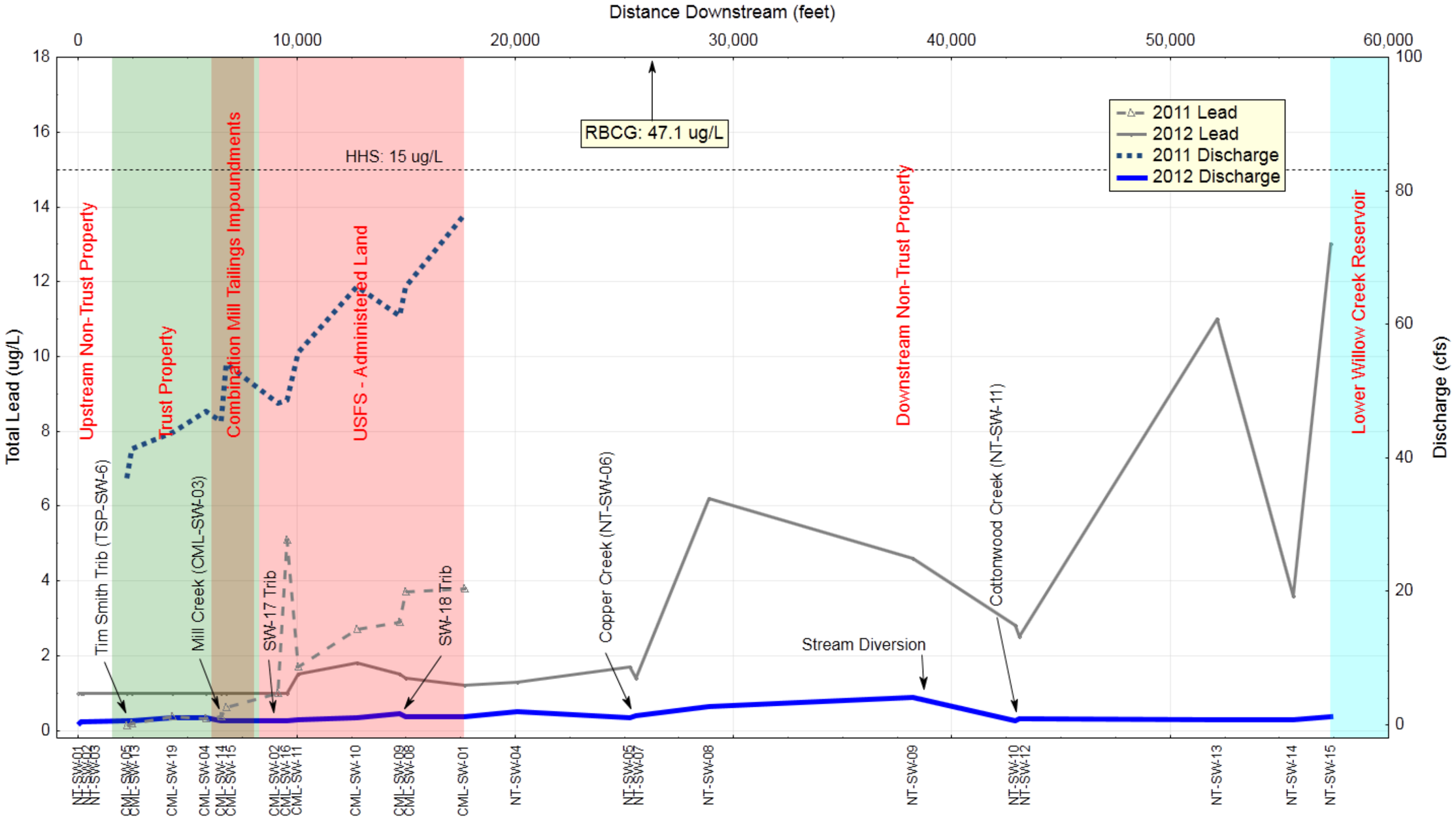


Figure B-10. Discharge and Total Recoverable Lead Results for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

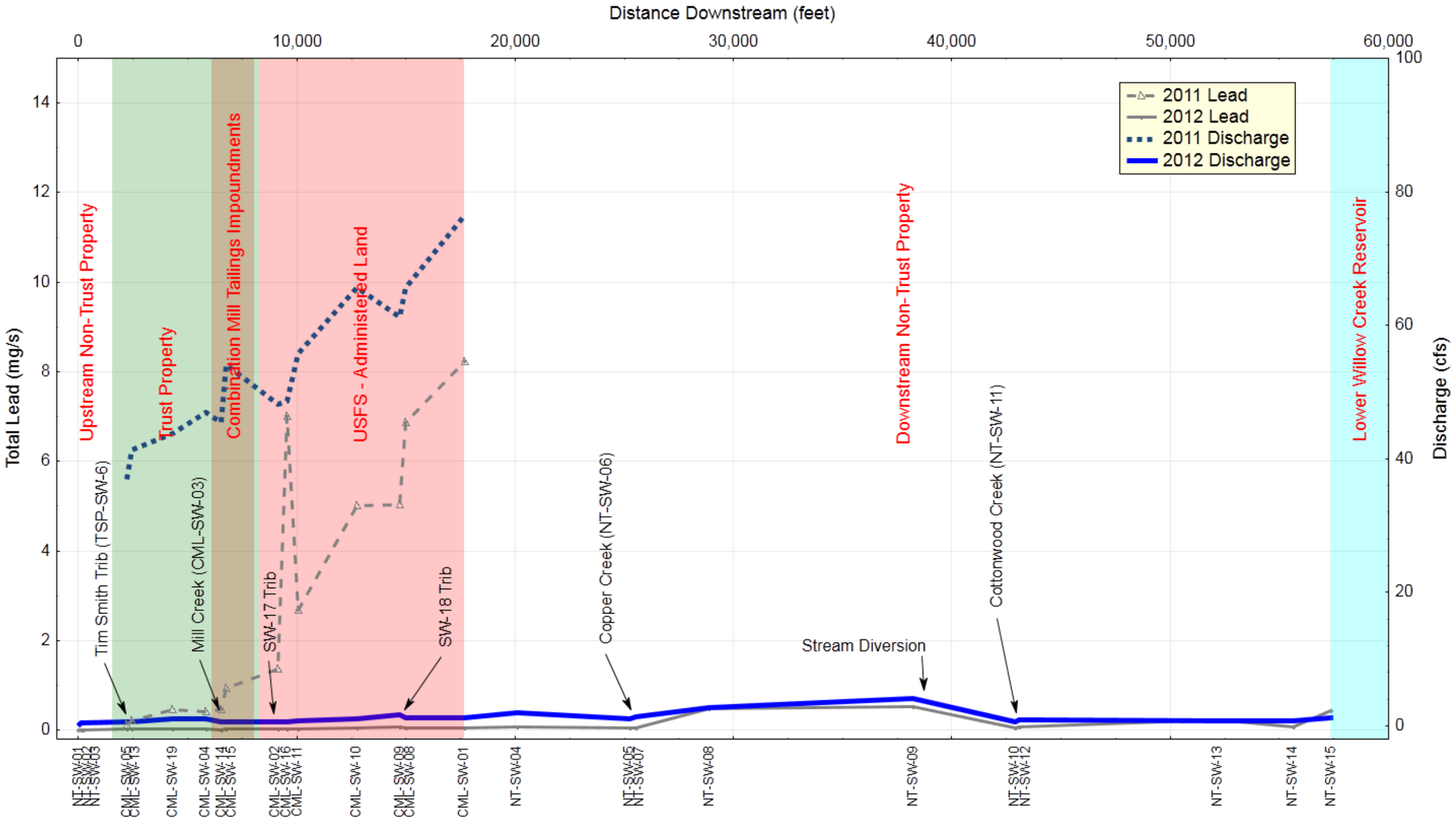


Figure B-11. Discharge and Lead Loading Rates for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

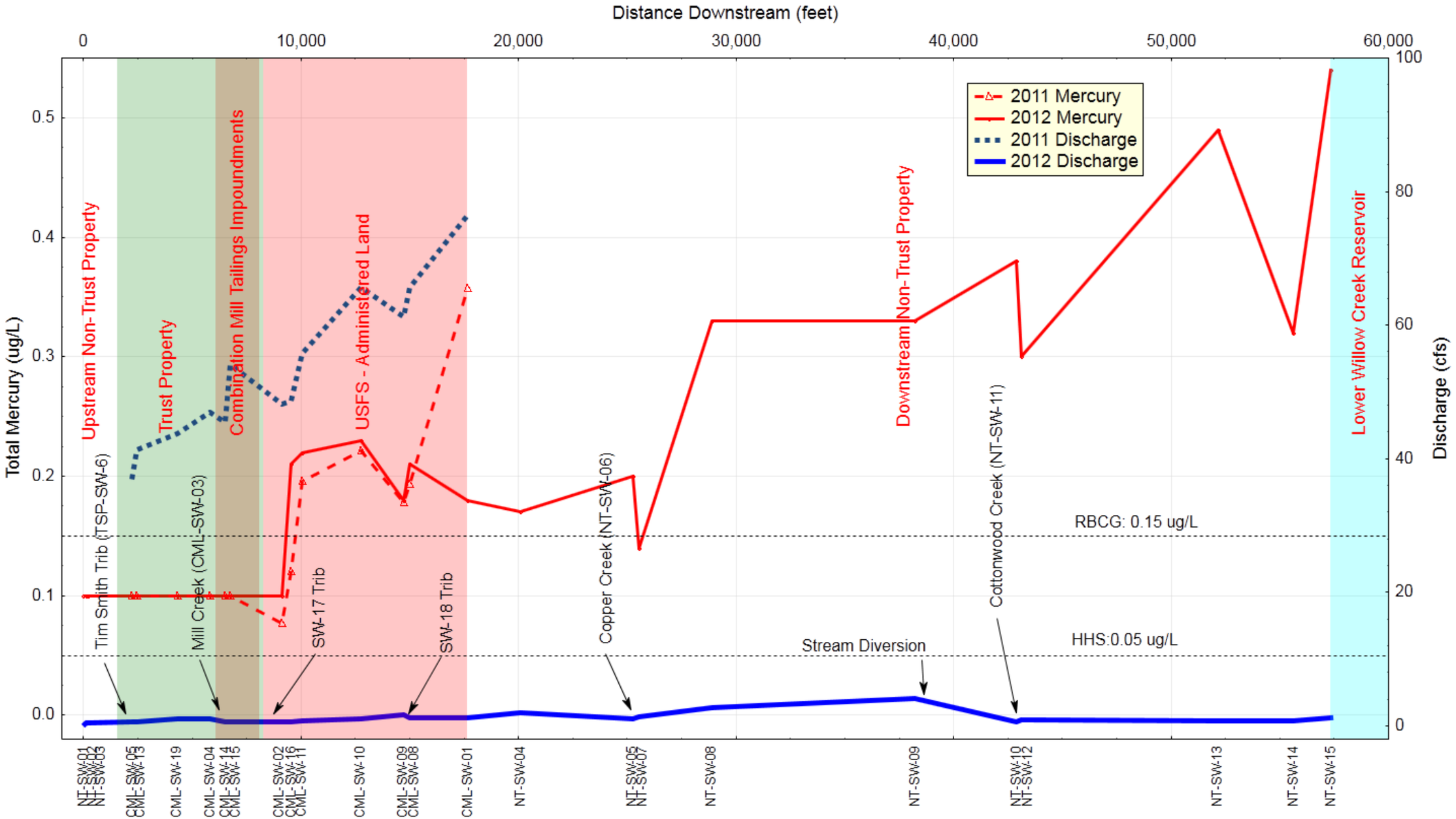


Figure B-12. Discharge and Total Recoverable Mercury Results for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

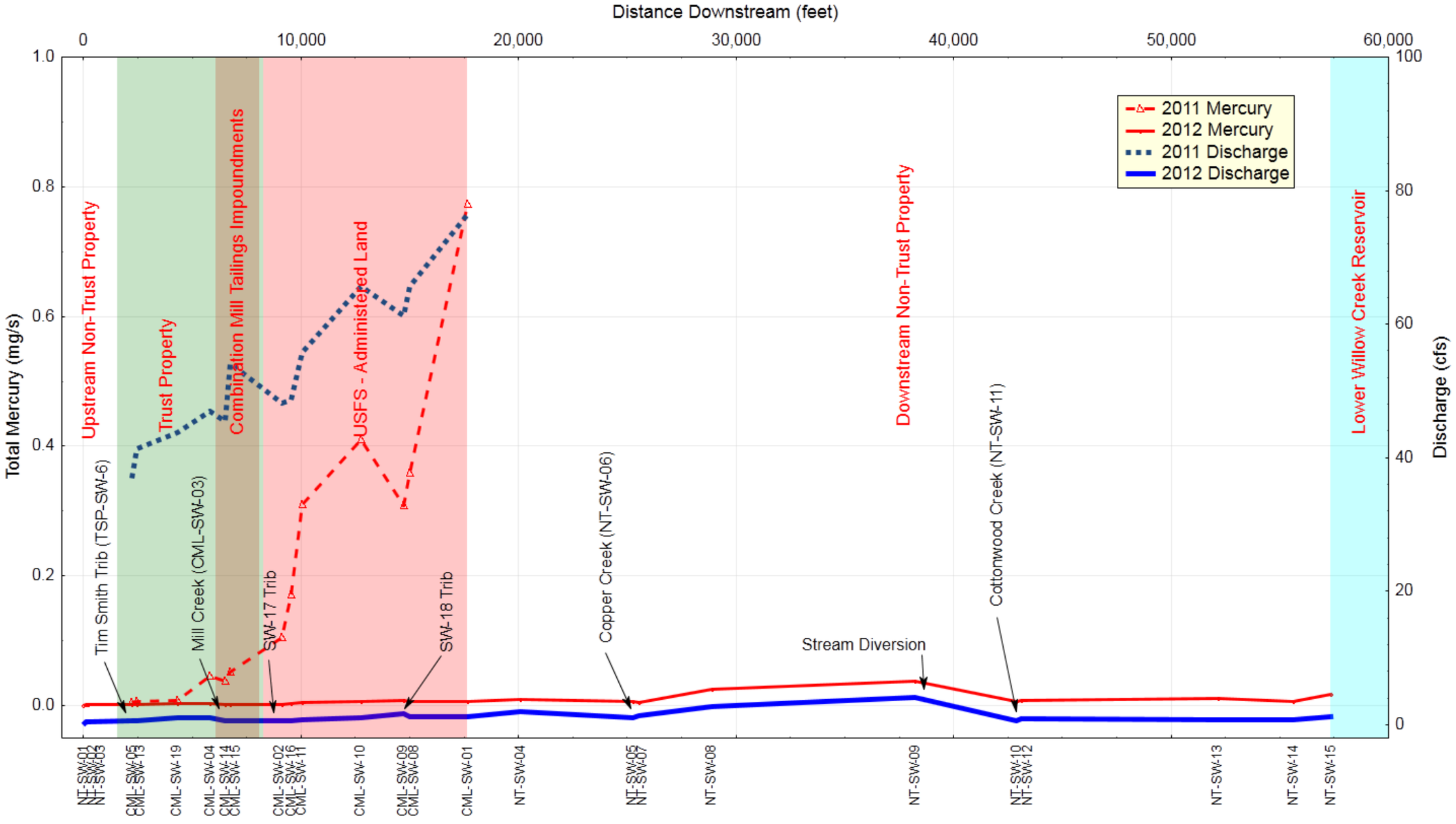


Figure B-13. Discharge and Mercury Loading Rates for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

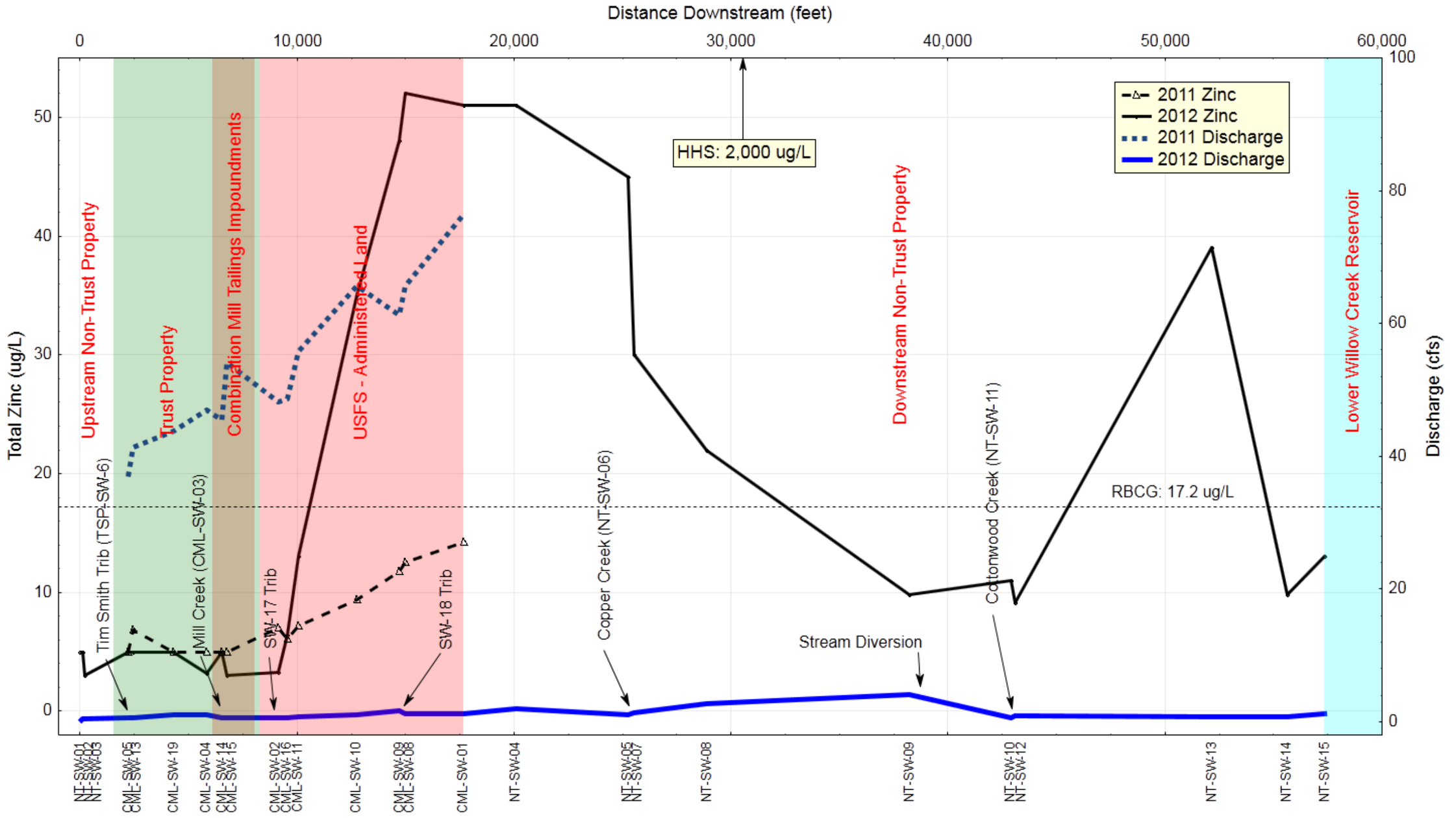


Figure B-14. Discharge and Total Recoverable Zinc Results for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

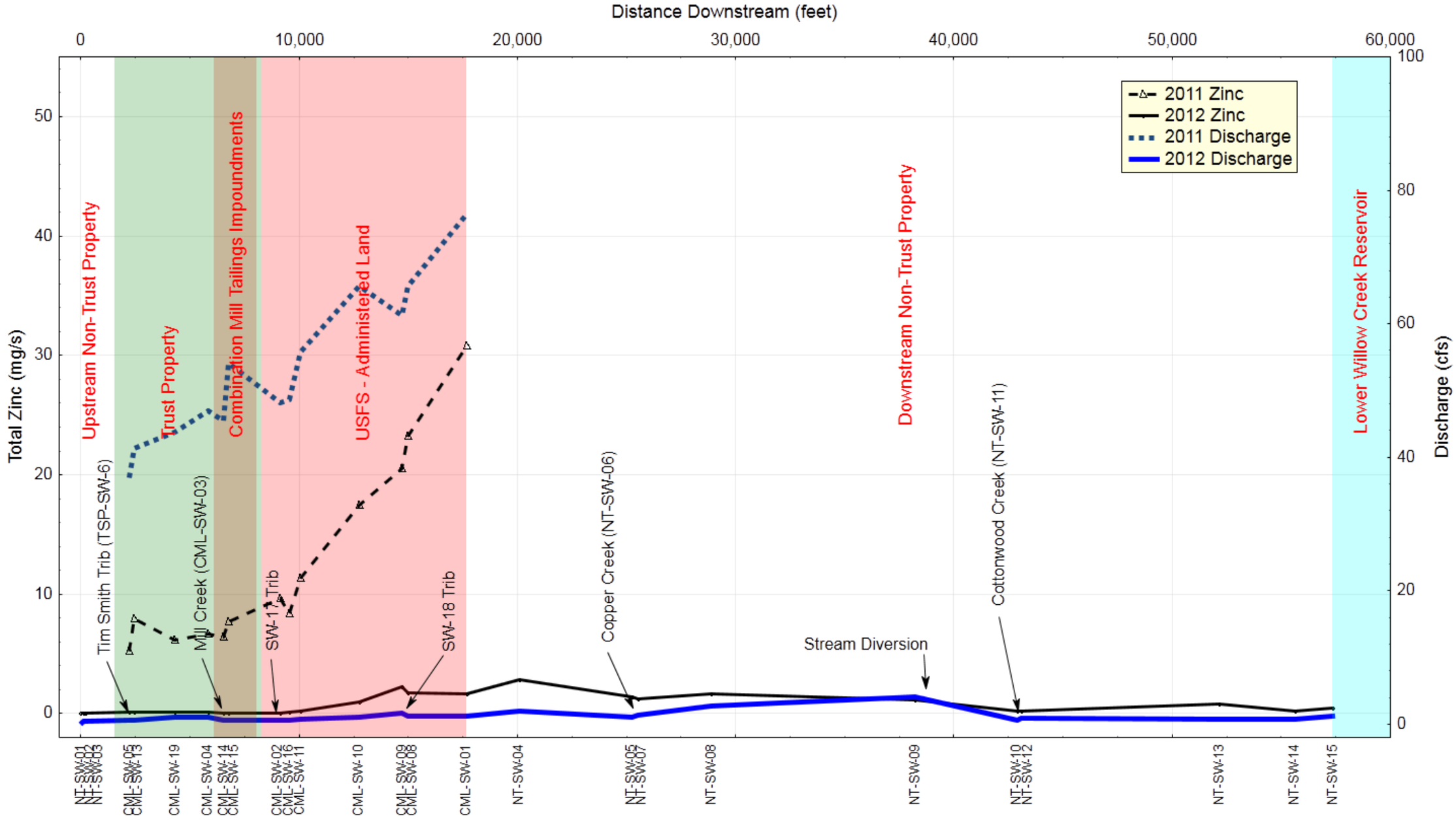


Figure B-15. Discharge and Zinc Loading Rates for Synoptic Surface Water Sampling Conducted at South Fork Lower Willow Creek in 2012 and 2011, Granite County, Montana.

TABLE B-1. Surface Water Total Recoverable Metals Results for the 2011 Synoptic Sampling Event

Compared to DEQ RBCG Standards

South Fork Lower Willow Creek

Granite County, Montana

Description	Downstream Distance (feet)	Location	Date Sampled	Discharge (cfs)	Units	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Zinc
Risk Based Cleanup Guidelines[a] (µg/L)						91.1	150[b]	17,474	66.5	100,246	472	47.1	16.6	0.15	931	17.2
Trust Property	0	CML-SW-05	6/15/2011	36.9	µg/L	ND(0.5)	ND(0.5)	39.6	ND(0.08)	ND(0.5)	1.0	ND(0.12)	2.5	0.004	ND(0.5)	ND(5.0)
	228	CML-SW-13	6/15/2011	41.4	µg/L	ND(0.5)	ND(0.5)	40.3	ND(0.08)	0.5	2.1	ND(0.18	3.4	0.006	0.8	6.8
	2,083	CML-SW-19	6/15/2011	43.7	µg/L	ND(0.5)	ND(0.5)	44.6	ND(0.08)	0.7	3.6	ND(0.37)	4.1	0.006	0.6	ND(5.0)
	3,606	CML-SW-04	6/15/2011	46.9	µg/L	ND(0.5)	0.53	41.1	ND(0.08)	0.6	3.8	ND(0.31)	4.7	0.034	0.5	ND(5.0)
	4,309	CML-SW-14	6/15/2011	45.5	µg/L	ND(0.5)	0.51	38.6	ND(0.08)	0.6	3.5	ND(0.36)	8.1	0.029	0.6	ND(5.0)
	4,514	CML-SW-15	6/15/2011	54.1	µg/L	ND(0.5)	0.65	42.5	ND(0.08)	0.6	5.8	0.61 J	5.6	0.034	0.6	5.2
	4,514	CML-SW-15 DUP	6/15/2011	NA*	µg/L	ND(0.5)	0.68	43.4	ND(0.08)	0.8	6.0	0.63 J	5.8	NA*	0.8	ND(5.0)
Average[c,d]				44.7	µg/L	0.3	0.41	41.1	0.04	0.6	3.3	0.24	4.7	0.019	0.6	3.7
USFS-administered land downstream of Trust Property	6,906	CML-SW-02	6/15/2011	48.2	µg/L	1.3 J	0.8 J	41.3	0.10	0.7 J	14.0 J	1.0 J	10.4 J	0.077	0.8	5.9
	6,906	CML-SW-02 DUP	6/15/2011	NA*	µg/L	1.7 J	1.2 J	43.5	ND(0.08)	1.1 J	9.9 J	5.1 J	6.8 J	-	-	7.0
	7,321	CML-SW-16	6/15/2011	48.6	µg/L	1.6	1.2	42.8	0.11	0.8	11.8	5.1	5.5	0.120	0.7	6.1
	7,816	CML-SW-11	6/15/2011	55.8	µg/L	1.7	0.9	42.0	0.09	0.8	11.6	1.7 J	5.8	**0.196**	0.8	7.2
	10,515	CML-SW-10	6/15/2011	65.7	µg/L	2.4	1.2	37.0	0.12	0.9	13.8	2.7 J	5.2	**0.221**	1.6	9.4
	12,489	CML-SW-09	6/15/2011	61.3	µg/L	3.0	1.4	36.2	0.13	0.8	15.8	2.9 J	6.1	**0.178**	0.8	11.8
	12,761	CML-SW-08	6/15/2011	65.6	µg/L	3.4	1.7	37.7	0.12	0.7	16.7	3.7 J	5.8	**0.193**	0.7	12.5
	15,433	CML-SW-01	6/15/2011	76.5	µg/L	3.4	1.7	36.6	0.15	0.8	17.4	3.8 J	7.1	**0.357**	0.9	14.2
Average[c,d]				60.2	µg/L	2.4	1.3	39.1	0.12	0.8	14.4	3.0	6.6	**0.192**	0.9	9.6
SFLWC Tributary Streams	100	TSP-SW-6	6/14/2011	4.50	µg/L	0.5	1.1	85.4	ND(0.08)	1.3	22.5	0.97 J	8.9	0.013	2.2	8.2
	4,412	CML-SW-03	6/14/2011	2.75	µg/L	1.9	2.3	59.1	ND(0.08)	1.2	20.8	2.9 J	8.8	0.012	1.7	10.5
	7,569	CML-SW-17	6/14/2011	6.55	µg/L	ND(0.5)	ND(0.5)	8.7	ND(0.08)	ND(0.5)	2.4	ND(0.13)	1.7	0.006	ND(0.5)	12.5
	12,625	CML-SW-18	6/14/2011	<0.01	µg/L	ND(0.5)	ND(0.5)	20.4	ND(0.08)	ND(0.5)	2.0	ND(0.27)	1.0	0.007	ND(0.5)	ND(5.0)
Average[c]				0.25	µg/L	0.7	1.0	43.4	0.04	0.6	11.9	1.0	5.1	0.010	1.1	8.4

a MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Water Cleanup Guidelines for Recreational Visitors Table 7-11 (DEQ 1996)

b Based on DEQ guidance for valuable streams and aquatic habitats (DEQ 1996), arsenic results will be compared to the freshwater Chronic Aquatic Life Standards (CALS) criterion for arsenic (150 µg/L) (DEQ 2012)

c For non detect results, one half of the reporting limit was used in the calculation of the average concentration

d Duplicate results (CML-SW-15 DUP and CML-SW-02 DUP) not included in average concentration

J – Estimated concentration

Bold, highlighted values exceed respective standards

cfs - cubic feet per second

µg/L = micrograms per liter

NA* - Not applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

TABLE B-2. Surface Water Total Recoverable Metals Results for the 2011 Synoptic Sampling Event
Compared to Human Health Standards (HHS)
South Fork Lower Willow Creek
Granite County, Montana

Location	Date Sampled	Discharge (cfs)	Units	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
			Circular DEQ-7 HHS[a] (ug/L)	5.6[d]	10[e]	1,000[f]	5[e]	100[e]	1,300[d]	300[f]	15[d]	50[f]	0.05[d]	100[g]	100[g]	2,000[g]
CML-SW-01	6/15/2011	76.50	ug/L	3.4	1.7	36.6	0.15	0.83	17.4	**617 J**	3.8 JB	7.1	**0.357**	0.88	ND(0.50)	14.2
CML-SW-02	6/15/2011	48.20	ug/L	1.7 J	1.2 J	43.5	0.095	0.71 J	14.0 J	**420 J**	5.1 J	10.4 J	**0.0772**	0.77	ND(0.50)	7.0
CML-QC-T2 (CML-SW-02)	6/15/2011	48.20	ug/L	1.3 J	0.80 J	41.3	ND(0.080)	1.1 J	9.9 J	**562 J**	1.0 JB	6.8 J	NA*	NA*	ND(0.50)	5.9
CML-SW-03	6/15/2011	2.75	ug/L	1.9	2.3	59.1	ND(0.080)	1.2	20.8	**1450 J**	2.9 JB	8.8	**0.123**	1.7	ND(0.50)	10.5
CML-SW-04	6/15/2011	46.90	ug/L	ND(0.50)	0.53	41.1	ND(0.080)	0.62	3.8	288 J	0.31/ND(0.31)U	4.7	0.0337	0.54	ND(0.50)	ND(5.0)
CML-SW-05	6/15/2011	36.90	ug/L	ND(0.50)	ND(0.50)	39.6	ND(0.080)	ND(0.50)	1.0	162 J	0.12/ND(0.12)U	2.5	0.0042	ND(0.50)	ND(0.50)	ND(5.0)
CML-SW-06	6/13/2011	NA*	ug/L	**117**	**36.0**	59.2	1.1	1.0	133	117 J	6.7	39.1	**1.910**	3.2	ND(0.50)	63.1
CML-SW-07	6/14/2011	NA*	ug/L	**42.9**	**12.8**	81.7	1.2	1.3	221	**1430 J**	**49.0**	12.9	**2.520**	2.1	0.64	40.5
CML-SW-08	6/15/2011	65.60	ug/L	3.4	1.7	37.7	0.12	0.68	16.7	**381 J**	3.7 JB	5.8	**0.193**	0.72	ND(0.50)	12.5
CML-SW-09	6/15/2011	61.30	ug/L	3.0	1.4	36.2	0.13	0.83	15.8	**406 J**	2.9 JB	6.1	**0.178**	0.84	ND(0.50)	11.8
CML-SW-10	6/15/2011	65.70	ug/L	2.4	1.2	37.0	0.12	0.90	13.8	**338 J**	2.7 JB	5.2	**0.221**	1.6	ND(0.50)	9.4
CML-SW-11	6/15/2011	55.80	ug/L	1.7	0.90	42.0	0.090	0.75	11.6	**400 J**	1.7 JB	5.8	**0.196**	0.77	ND(0.50)	7.2
CML-SW-13	6/15/2011	41.40	ug/L	ND(0.50)	ND(0.50)	40.3	ND(0.080)	0.54	2.1	168 J	0.18/ND(0.18)U	3.4	0.0060	0.77	ND(0.50)	6.8
CML-SW-14	6/15/2011	45.50	ug/L	ND(0.50)	0.51	38.6	ND(0.080)	0.64	3.5	**442 J**	0.36/ND(0.36)U	8.1	0.0292	0.57	ND(0.50)	ND(5.0)
CML-SW-15	6/15/2011	54.10	ug/L	ND(0.50)	0.68	42.5	ND(0.080)	0.64	5.8	**321 J**	0.61 JB	5.6	0.0336	0.62	ND(0.50)	ND(5.0)
CML-QC-T1 (CML-SW-15)	6/15/2011	54.10	ug/L	ND(0.50)	0.65	43.4	ND(0.080)	0.79	6.0	**340 J**	0.63 JB	5.8	NA*	0.75	ND(0.50)	5.2
CML-SW-16	6/15/2011	48.60	ug/L	1.6	1.2	42.8	0.11	0.78	11.8	**356 J**	5.1	5.5	**0.120**	0.72	ND(0.50)	6.1
CML-SW-17	6/14/2011	<0.1	ug/L	ND(0.50)	ND(0.50)	8.7	ND(0.080)	ND(0.50)	2.4	115	0.13/ND(0.13)U	1.7	0.0056	ND(0.50)	ND(0.50)	12.5
CML-SW-18	6/14/2011	<0.1	ug/L	ND(0.50)	ND(0.50)	20.4	ND(0.080)	ND(0.50)	2.0	158	0.27/ND(0.27)U	1.0	0.0071	ND(0.50)	ND(0.50)	ND(5.0)
CML-SW-19	6/15/2011	43.70	ug/L	ND(0.50)	ND(0.50)	44.6	ND(0.080)	0.69	3.6	**308 J**	0.37/ND(0.37)U	4.1	0.0062	0.61	ND(0.50)	ND(5.0)
TSP-6	6/14/2011	4.50	ug/L	0.53	1.1	85.4	ND(0.080)	1.3	22.5	**1000**	0.97 JB	8.9	0.0132	2.2	ND(0.50)	8.2

[a] Human Health Standards (HHS) for Water, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[b] Freshwater Acute Aquatic Life Standards (AALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[c] Freshwater Chronic Aquatic Life Standards (CALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[d] Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[e] Maximum Contaminant Level, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[f] Secondary Maximum Contaminant Level based on aesthetic properties, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[g] Health Advisory, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[h] @ 25 mg/L hardness, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[i] Non-Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)

Bold, highlighted values exceed respective standards
J – Estimated concentration
JB – Estimated concentration due to blank
contamination cfs - cubic feet per second
ug/L = micrograms per liter
NA* - Not applicable or not analyzed
ND() - Analyte was not detected
(reporting limit) NS - A standard
has not been adopted

TABLE B-3. Surface Water Total Recoverable Metals Results for the 2011 Synoptic Sampling Event
Compared to Freshwater Acute Aquatic Life Standards (AALS)
South Fork Lower Willow Creek
Granite County, Montana

Location	Date Sampled	Discharge (cfs)	Units	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
Circular DEQ-7 AALS[b] (ug/L)				NS	340[d]	NS	0.52[d,h]	579[d,h]	3.79[d,h]	NS	13.98[d,h]	NS	1.7[d]	145[d,h]	0.374[d,h]	37[d,h]
CML-SW-01	6/15/2011	76.50	ug/L	3.4	1.7	36.6	0.15	0.83	**17.4**	617 J	3.8 JB	7.1	0.357	0.88	**ND(0.50)**	14.2
CML-SW-02	6/15/2011	48.20	ug/L	1.7 J	1.2 J	43.5	0.095	0.71 J	**14.0 J**	420 J	5.1 J	10.4 J	0.0772	0.77	**ND(0.50)**	7.0
CML-QC-T2 (CML-SW-02)	6/15/2011	48.20	ug/L	1.3 J	0.8 J	41.3	ND(0.080)	1.1 J	**9.9 J**	562 J	1.0 JB	6.8 J	NA*	NA*	**ND(0.50)**	5.9
CML-SW-03	6/15/2011	2.75	ug/L	1.9	2.3	59.1	ND(0.080)	1.2	**20.8**	1450 J	2.9 JB	8.8	0.123	1.7	**ND(0.50)**	10.5
CML-SW-04	6/15/2011	46.90	ug/L	ND(0.50)	0.53	41.1	ND(0.080)	0.62	**3.8**	288 J	0.31/ND(0.31)U	4.7	0.0337	0.54	**ND(0.50)**	ND(5.0)
CML-SW-05	6/15/2011	36.90	ug/L	ND(0.50)	ND(0.50)	39.6	ND(0.080)	ND(0.50)	1.0	162 J	0.12/ND(0.12)U	2.5	0.0042	ND(0.50)	**ND(0.50)**	ND(5.0)
CML-SW-06	6/13/2011	NA*	ug/L	117	36.0	59.2	**1.1**	1.0	**133**	117 J	6.7	39.1	**1.910**	3.2	**ND(0.50)**	**63.1**
CML-SW-07	6/14/2011	NA*	ug/L	42.9	12.8	81.7	**1.2**	1.3	**221**	1430 J	**49.0**	12.9	**2.520**	2.1	**0.64**	**40.5**
CML-SW-08	6/15/2011	65.60	ug/L	3.4	1.7	37.7	0.12	0.68	**16.7**	381 J	3.7 JB	5.8	0.193	0.72	**ND(0.50)**	12.5
CML-SW-09	6/15/2011	61.30	ug/L	3.0	1.4	36.2	0.13	0.83	**15.8**	406 J	2.9 JB	6.1	0.178	0.84	**ND(0.50)**	11.8
CML-SW-10	6/15/2011	65.70	ug/L	2.4	1.2	37.0	0.12	0.90	**13.8**	338 J	2.7 JB	5.2	0.221	1.6	**ND(0.50)**	9.4
CML-SW-11	6/15/2011	55.80	ug/L	1.7	0.90	42.0	0.090	0.75	**11.6**	400 J	1.7 JB	5.8	0.196	0.77	**ND(0.50)**	7.2
CML-SW-13	6/15/2011	41.40	ug/L	ND(0.50)	ND(0.50)	40.3	ND(0.080)	0.54	2.1	168 J	0.18/ND(0.18)U	3.4	0.0060	0.77	**ND(0.50)**	6.8
CML-SW-14	6/15/2011	45.50	ug/L	ND(0.50)	0.51	38.6	ND(0.080)	0.64	3.5	442 J	0.36/ND(0.36)U	8.1	0.0292	0.57	**ND(0.50)**	ND(5.0)
CML-SW-15	6/15/2011	54.10	ug/L	ND(0.50)	0.68	42.5	ND(0.080)	0.64	**5.8**	321 J	0.61 JB	5.6	0.0336	0.62	**ND(0.50)**	ND(5.0)
CML-QC-T1 (CML-SW-15)	6/15/2011	54.10	ug/L	ND(0.50)	0.65	43.4	ND(0.080)	0.79	**6.0**	340 J	0.63 JB	5.8	NA*	0.75	**ND(0.50)**	5.2
CML-SW-16	6/15/2011	48.60	ug/L	1.6	1.2	42.8	0.11	0.78	**11.8**	356 J	5.1	5.5	0.120	0.72	**ND(0.50)**	6.1
CML-SW-17	6/14/2011	<0.1	ug/L	ND(0.50)	ND(0.50)	8.7	ND(0.080)	ND(0.50)	2.4	115	0.13/ND(0.13)U	1.7	0.0056	ND(0.50)	**ND(0.50)**	12.5
CML-SW-18	6/14/2011	<0.1	ug/L	ND(0.50)	ND(0.50)	20.4	ND(0.080)	ND(0.50)	2.0	158	0.27/ND(0.27)U	1.0	0.0071	ND(0.50)	**ND(0.50)**	ND(5.0)
CML-SW-19	6/15/2011	43.70	ug/L	ND(0.50)	ND(0.50)	44.6	ND(0.080)	0.69	3.6	308 J	0.37/ND(0.37)U	4.1	0.0062	0.61	**ND(0.50)**	ND(5.0)
TSP-6	6/14/2011	4.50	ug/L	0.53	1.1	85.4	ND(0.080)	1.3	**22.5**	1000	0.97 JB	8.9	0.0132	2.2	**ND(0.50)**	8.2

[a] Human Health Standards (HHS) for Water, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[b] Freshwater Acute Aquatic Life Standards (AALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[c] Freshwater Chronic Aquatic Life Standards (CALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[d] Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[e] Maximum Contaminant Level, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[f] Secondary Maximum Contaminant Level based on aesthetic properties, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[g] Health Advisory, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[h] @ 25 mg/L hardness, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[i] Non-Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)

Bold, highlighted values exceed respective standards
J – Estimated concentration
JB – Estimated concentration due to blank contamination
cfs - cubic feet per second
ug/L = micrograms per liter
NA* - Not applicable or not analyzed
ND() - Analyte was not detected (reporting limit)
NS - A standard has not been adopted

TABLE B-4. Surface Water Total Recoverable Metals Results for the 2011 Synoptic Sampling Event
Compared to Freshwater Chronic Aquatic Life Standards (CALS)
South Fork Lower Willow Creek
Granite County, Montana

Location	Date Sampled	Discharge (cfs)	Units	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
			Circular DEQ-7 CALS[c] (ug/L)	NS	150[d]	NS	0.097[d,h]	27.7[d,h]	2.85[d,h]	1,000[i]	0.545[d,h]	NS	0.91[d]	16.1[d,h]	NS	37[d,h]
CML-SW-01	6/15/2011	76.50	ug/L	3.4	1.7	36.6	**0.15**	0.83	**17.4**	617 J	**3.8 JB**	7.1	0.357	0.88	ND(0.50)	14.2
CML-SW-02	6/15/2011	48.20	ug/L	1.7 J	1.2 J	43.5	0.095	0.71 J	**14.0 J**	420 J	**5.1 J**	10.4 J	0.0772	0.77	ND(0.50)	7.0
CML-QC-T2 (CML-SW-02)	6/15/2011	48.20	ug/L	1.3 J	0.8 J	41.3	ND(0.080)	1.1 J	**9.9 J**	562 J	**1.0 JB**	6.8 J	NA*	NA*	ND(0.50)	5.9
CML-SW-03	6/15/2011	2.75	ug/L	1.9	2.3	59.1	ND(0.080)	1.2	**20.8**	**1450 J**	**2.9 JB**	8.8	0.123	1.7	ND(0.50)	10.5
CML-SW-04	6/15/2011	46.90	ug/L	ND(0.50)	0.53	41.1	ND(0.080)	0.62	**3.8**	288 J	0.31/ND(0.31)U	4.7	0.0337	0.54	ND(0.50)	ND(5.0)
CML-SW-05	6/15/2011	36.90	ug/L	ND(0.50)	ND(0.50)	39.6	ND(0.080)	ND(0.50)	1.0	162 J	0.12/ND(0.12)U	2.5	0.0042	ND(0.50)	ND(0.50)	ND(5.0)
CML-SW-06	6/13/2011	NA*	ug/L	117	36.0	59.2	**1.1**	1.0	**133**	117 J	**6.7**	39.1	**1.910**	3.2	ND(0.50)	**63.1**
CML-SW-07	6/14/2011	NA*	ug/L	42.9	12.8	81.7	**1.2**	1.3	**221**	**1430 J**	**49.0**	12.9	**2.520**	2.1	0.64	**40.5**
CML-SW-08	6/15/2011	65.60	ug/L	3.4	1.7	37.7	**0.12**	0.68	**16.7**	381 J	**3.7 JB**	5.8	0.193	0.72	ND(0.50)	12.5
CML-SW-09	6/15/2011	61.30	ug/L	3.0	1.4	36.2	**0.13**	0.83	**15.8**	406 J	**2.9 JB**	6.1	0.178	0.84	ND(0.50)	11.8
CML-SW-10	6/15/2011	65.70	ug/L	2.4	1.2	37.0	**0.12**	0.90	**13.8**	338 J	**2.7 JB**	5.2	0.221	1.6	ND(0.50)	9.4
CML-SW-11	6/15/2011	55.80	ug/L	1.7	0.90	42.0	0.090	0.75	**11.6**	400 J	**1.7 JB**	5.8	0.196	0.77	ND(0.50)	7.2
CML-SW-13	6/15/2011	41.40	ug/L	ND(0.50)	ND(0.50)	40.3	ND(0.080)	0.54	2.1	168 J	0.18/ND(0.18)U	3.4	0.0060	0.77	ND(0.50)	6.8
CML-SW-14	6/15/2011	45.50	ug/L	ND(0.50)	0.51	38.6	ND(0.080)	0.64	**3.5**	442 J	0.36/ND(0.36)U	8.1	0.0292	0.57	ND(0.50)	ND(5.0)
CML-SW-15	6/15/2011	54.10	ug/L	ND(0.50)	0.68	42.5	ND(0.080)	0.64	**5.8**	321 J	**0.61 JB**	5.6	0.0336	0.62	ND(0.50)	ND(5.0)
CML-QC-T1 (CML-SW-15)	6/15/2011	54.10	ug/L	ND(0.50)	0.65	43.4	ND(0.080)	0.79	**6.0**	340 J	**0.63 JB**	5.8	NA*	0.75	ND(0.50)	5.2
CML-SW-16	6/15/2011	48.60	ug/L	1.6	1.2	42.8	**0.11**	0.78	**11.8**	356 J	**5.1**	5.5	0.120	0.72	ND(0.50)	6.1
CML-SW-17	6/14/2011	<0.1	ug/L	ND(0.50)	ND(0.50)	8.7	ND(0.080)	ND(0.50)	2.4	115	0.13/ND(0.13)U	1.7	0.0056	ND(0.50)	ND(0.50)	12.5
CML-SW-18	6/14/2011	<0.1	ug/L	ND(0.50)	ND(0.50)	20.4	ND(0.080)	ND(0.50)	2.0	158	0.27/ND(0.27)U	1.0	0.0071	ND(0.50)	ND(0.50)	ND(5.0)
CML-SW-19	6/15/2011	43.70	ug/L	ND(0.50)	ND(0.50)	44.6	ND(0.080)	0.69	**3.6**	308 J	0.37/ND(0.37)U	4.1	0.0062	0.61	ND(0.50)	ND(5.0)
TSP-6	6/14/2011	4.50	ug/L	0.53	1.1	85.4	ND(0.080)	1.3	**22.5**	**1000**	**0.97 JB**	8.9	0.0132	2.2	ND(0.50)	8.2

[a] Human Health Standards (HHS) for Water, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[b] Freshwater Acute Aquatic Life Standards (AALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[c] Freshwater Chronic Aquatic Life Standards (CALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[d] Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[e] Maximum Contaminant Level, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[f] Secondary Maximum Contaminant Level based on aesthetic properties, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[g] Health Advisory, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[h] @ 25 mg/L hardness, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)
[i] Non-Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2010)

Bold, highlighted values exceed respective standards
J – Estimated concentration
JB – Estimated concentration due to blank contamination
cfs - cubic feet per second
ug/L = micrograms per liter
NA* - Not applicable or not analyzed
ND() - Analyte was not detected (reporting limit)
NS - A standard has not been adopted

Table B-5. Solid-Matrix (Sediment) Total Recoverable Metals Results for Trust and Non-Trust Property Locations in 2011, South Fork Lower Willow Creek, Granite County, Montana.

Description	Downstream Distance (FT)	Location	Date Sampled	Sample Start Depth (FT)	Sample End Depth (FT)	Units	Antimony	Arsenic	Barium	Cadmium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
Risk Based Cleanup Guidelines[a] (mg/kg)							**293**	**40.4[bc]**	**4,975**	**19.5[b]**	**30,500**	**27,100**	**NA**	**1,100**	**665**	**220**	**14,650**	**220,000**
Trust Property	0	CML-SD-05	6/14/2011	0	0.5	mg/kg	ND(0.6)	12	452	1.2	8	27	14,500	16	**1,160**	0.4	13	97
	228	CML-SD-13	6/16/2011	0	0.5	mg/kg	**440**	**339**	229	7.7	13	1,210	17,300	**1,690**	**741**	17	6.9	257
	2,083	CML-SD-19	7/13/2011	0	0.5	mg/kg	**614 J**	**442 J**	238 J	ND(15.4)	ND(2.8)	727 J	11,900	**2,560 J**	264	2.8	ND(19.5)	339
	3,606	CML-SD-04	6/14/2011	0	0.5	mg/kg	17	28	335	1.4	19	109	12,400	74	**1,980**	14	11	144
	4,309	CML-SD-14	6/16/2011	0	0.5	mg/kg	**1,010**	**668**	304	15	3.6	2,230	21,700	**3,270**	257	7.7	3.2	403
	4,514	CML-SD-15	6/16/2011	0	0.5	mg/kg	**1,300**	**1,250**	1,030	**33**	1.9	4,810	35,900	**8,050**	342	9.2	4.1	1,300
Average[d]							**465**	**390**	445	11	11	1,458	21,450	**2,216**	**900**	8.7	9.8	423
USFS-administered land downstream of Trust Property	6,906	CML-SD-02	6/15/2011	0	0.5	mg/kg	**461**	**417**	308	8.9	11	1,430	22,700	**1,970**	**744**	14	6.9	317
	7,321	CML-SD-16	6/16/2011	0	0.5	mg/kg	**2,130**	**1,670**	492	**27**	0.7	5,170	27,700	**7,330**	171	8.0	0.7	313
	7,816	CML-SD-11	6/14/2011	0	0.5	mg/kg	**307**	**219**	145	4.6	12	623	16,300	**1,170**	**1,210**	21	6.5	248
	10,515	CML-SD-10	6/14/2011	0	0.5	mg/kg	**596**	**492**	185	10	6.2	1,160	19,700	**2,460**	419	7	4.9	401
	12,489	CML-SD-09	6/14/2011	0	0.5	mg/kg	**465**	**377**	163	7.8	7.8	920	15,400	**2,070**	452	5	5.2	287
	12,761	CML-SD-08	6/14/2011	0	0.5	mg/kg	**613**	**553**	244	12	6.7	1,390	20,100	**2,960**	443	12	5.8	430
	15,433	CML-SD-01	6/14/2011	0	0.5	mg/kg	**317**	**223**	75	4.8	7.6	378	14,400	826	413	18	3.9	188
Average[d]							**698**	**564**	230	11	7.3	1,582	19,471	**2,684**	550	12	4.8	312
SFLWC Tributary Streams	4,412	CML-SD-03	6/15/2011	0	0.5	mg/kg	17	19	143	0.4	7.6	58	22,300	207	404	4.1	9.1	41
	9,792	CML-SD-17	7/13/2011	0	0.5	mg/kg	**1,090**	**745**	317	17	3.1	1,910	23,800	**3,880**	325	10.5	2.5	496
	14,848	CML-SD-18	7/13/2011	0	0.5	mg/kg	76	**211**	793	15	16	1,070	29,700	663	**1,640**	11.6	24.1	479
Average[d]							**394**	**325**	418	11	9.0	1,013	25,267	**1,583**	**790**	8.7	11.9	339

[a] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Soil Cleanup Guidelines for Recreational Visitors Table 7-10 (DEQ 1996)

[b] Carcinogenic risk of 5E-07

[c] UCL = 95th upper confidence limit on the arithmetic mean background concentration, from background samples

[d] For non detect results, one half of the reporting limit was used in the calculation of the average concentration

J - estimated value

Bold, highlighted values exceed respective standards

FT - feet

mg/kg - milligrams per kilogram

NA* - Not applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

TABLE B-6. Surface Water Total Recoverable Metals Results for Trust and Non-Trust Property Locations in the 2012 Synoptic Sampling Event

Compared to DEQ RBCG Standards

South Fork Lower Willow Creek

Granite County, Montana

Description	Downstream Distance (feet)	Location	Date Sampled	Discharge (cfs)	Units	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Zinc
Risk Based Cleanup Guidelines[a] (µg/L)						91.1	150[b]	17,474	66.5	100,246	472	47.1	16.6	0.15	931	17.2
Upstream Non-Trust Property	99	NT-SW-02	9/5/2012	0.39	µg/L	ND(1.0)	ND(1.0)	68	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	1.5	ND(0.10)J	ND(1.0)	ND(5.0)
	223	NT-SW-03	9/5/2012	0.42	µg/L	ND(1.0)	ND(1.0)	75	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	2.5	ND(0.10)J	ND(1.0)	3.0 J
Average[c]				0.40	µg/L	0.5	0.5	72	0.05	0.5	0.5	0.5	2.0	0.05	0.5	2.8
Trust Property	2,223	CML-SW-05	9/5/2012	0.61	µg/L	ND(1.0)	ND(1.0)	80	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	1.6	ND(0.10)J	ND(1.0)	ND(5.0)
	2,451	CML-SW-13	9/5/2012	0.65	µg/L	ND(1.0)	0.52 J	86	ND(0.10)	0.53 J	ND(1.0)	ND(1.0)	3.0	ND(0.10)J	ND(1.0)	ND(5.0)
	2,451	DUP1 (CML-SW-13)	9/5/2012	NA*	µg/L	ND(1.0)	0.50 J	80	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	3.1	ND(0.10)J	ND(1.0)	ND(5.0)
	4,306	CML-SW-19	9/5/2012	1.02	µg/L	ND(1.0)	0.52 J	73	ND(0.10)	ND(1.0)	1	ND(1.0)	3.7	ND(0.10)J	ND(1.0)	3.2 J
	5,829	CML-SW-04	9/5/2012	1.07	µg/L	ND(1.0)	0.52 J	66	ND(0.10)	ND(1.0)	1.1	ND(1.0)	11	ND(0.10)J	ND(1.0)	ND(5.0)
	6,532	CML-SW-14	9/5/2012	0.55	µg/L	ND(1.0)	0.70 J	69	ND(0.10)	ND(1.0)	1.6	ND(1.0)	8.7	ND(0.10)J	ND(1.0)	3.0 J
	6,737	CML-SW-15	9/5/2012	0.61	µg/L	ND(1.0)	0.75 J	67	ND(0.10)	ND(1.0)	2.2	ND(1.0)	8.0	ND(0.10)J	ND(1.0)	3.3 J
Average[c,d]				0.75	µg/L	0.5	0.57	74	0.05	0.5	1.1	0.5	6.0	0.05	0.5	2.8
USFS-administered land downstream of Trust Property	9,129	CML-SW-02	9/5/2012	0.64	µg/L	3.1	1.5	69	0.13	ND(1.0)	16	0.70 J	2.8	ND(0.10)J	ND(1.0)	6.2
	9,544	CML-SW-16	9/5/2012	0.59	µg/L	3.5	1.6	69	0.12	ND(1.0)	15	0.77 J	2.5	**0.21**	ND(1.0)	6.4
	10,039	CML-SW-11	9/5/2012	0.69	µg/L	4.8	2.0	70	0.19	ND(1.0)	18	1.5	5.9	**0.22**	ND(1.0)	13
	12,738	CML-SW-10	9/5/2012	1.02	µg/L	6.5	2.4	56	0.25	ND(1.0)	16	1.8	11	**0.23**	1.0	**35**
	14,712	CML-SW-09	9/5/2012	1.68	µg/L	8.5	2.9	57	0.30	ND(1.0)	17	1.5	9.7	**0.18 J**	1.2	**48**
	14,984	CML-SW-08	9/5/2012	1.18	µg/L	8.5	3.0	56	0.30	ND(1.0)	17	1.4	13	**0.21**	1.3	**52**
	17,656	CML-SW-01	9/6/2012	1.15	µg/L	9.7	3.3	61	0.30	ND(1.0)	15	1.2	5.9	**0.18 J**	1.2	**51**
Average[c]				0.99	µg/L	6.4	2.4	63	0.23	0.5	16	1.5	7.3	**0.22**	1.2	**30**
Downstream Non-Trust Property	20,089	NT-SW-04	9/6/2012	1.94	µg/L	8.5	2.9	58	0.25	ND(1.0)	12	1.3	11	**0.17 J**	1.1	**51**
	25,244	NT-SW-05	9/6/2012	1.10	µg/L	11	3.9	59	0.23	ND(1.0)	12	1.7	7.8	**0.20**	1.0	**45**
	25,244	GCD-001 (NT-SW-05)	9/6/2012	NA*	µg/L	11	3.9	60	0.28	ND(1.0)	12	1.9	7.2	0.13 J	1.0 J	**44**
	25,534	NT-SW-07	9/6/2012	1.41	µg/L	6.9	2.7	83	0.21	ND(1.0)	8.8	1.4	12	0.14 J	0.80 J	**30**
	25,534	GCD-002 (NT-SW-07)	9/6/2012	NA*	µg/L	6.8	2.7	80	0.17	ND(1.0)	8.7	1.4	11	0.19 J	0.75 J	**29**
	28,879	NT-SW-08	9/6/2012	2.71	µg/L	12	5.9	86	0.16	ND(1.0)	13	6.2	15	**0.33**	0.81 J	**22**
	28,879	DUP2 (NT-SW-08)	9/6/2012	NA*	µg/L	11	5.4	81	0.13	ND(1.0)	13	5.4	13	**0.38**	0.66 J	**20**
	38,226	NT-SW-09	9/6/2012	4.11	µg/L	14	8.8	79	0.11	ND(1.0)	15	4.6	8.6	**0.33**	ND(1.0)	9.8
	42,898	NT-SW-10	9/6/2012	0.55	µg/L	14	9.5	86	0.099 J	ND(1.0)	14	2.8	13	**0.38**	ND(1.0)	11
	43,105	NT-SW-12	9/6/2012	0.92	µg/L	11	7.4	93	0.1	ND(1.0)	11	2.5	15	**0.30**	ND(1.0)	9.1
	52,165	NT-SW-13	9/7/2012	0.76	µg/L	13	8.0	100	0.13	ND(1.0)	25	11	**27**	**0.49**	ND(1.0)	**39**
	55,623	NT-SW-14	9/7/2012	0.77	µg/L	13	8.0	96	0.071 J	ND(1.0)	14	3.6	**18**	**0.32**	ND(1.0)	9.8
	57,358	NT-SW-15	9/7/2012	1.17	µg/L	16	9.7	100	0.16	0.51 J	22	13	**36**	**0.54**	ND(1.0)	13
Average[c,d]				1.54	µg/L	12	6.7	84	0.15	0.5	15	4.8	16.3	**0.32**	0.67	**26**
SFLWC Tributary Streams	0	NT-SW-01	9/5/2012	0.04	µg/L	ND(1.0)	1.0	120	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	7.5	ND(0.10)J	ND(1.0)	ND(5.0)
	2,337	TSP-SW-6	9/5/2012	0.01 J	µg/L	ND(1.0)	1.1	100	ND(0.10)	ND(1.0)	2.9	ND(1.0)	7.8	ND(0.10)J	ND(1.0)	3.6 J
	6,635	CML-SW-03	9/7/2012	0.01	µg/L	1.9	2.0	34	0.095 J	0.51 J	14	2.2	**20**	0.15 J	0.68 J	6.8
	9,792	CML-SW-17	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	14,848	CML-SW-18	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	25,534	NT-SW-06	9/6/2012	0.53	µg/L	ND(1.0)	0.72 J	120	ND(0.10)	1.2	3.1	ND(1.0)	15	ND(0.10)J	0.71 J	4.7 J
	43,105	NT-SW-11	9/6/2012	0.46	µg/L	ND(1.0)	0.86 J	100	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	9.1	0.16 J	ND(1.0)	ND(5.0)
Average[c]				0.25	µg/L	0.8	1.1	94.8	0.06	0.6	4.2	0.8	11.9	0.09	0.58	4.0

a MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Water Cleanup Guidelines for Recreational Visitors Table 7-11 (DEQ 1996)

b Based on DEQ guidance for valuable streams and aquatic habitats (DEQ 1996), arsenic results will be compared to the freshwater Chronic Aquatic Life Standards (CALS) criterion for arsenic (150 µg/L) (DEQ 2012)

c For non detect results, one half of the reporting limit was used in the calculation of the average concentration

d Duplicate results (DUP1, DUP2, GCD-001, and GCD-002) not included in average concentration

J – Estimated concentration

Bold, highlighted values exceed respective standards

cfs - cubic feet per second

µg/L = micrograms per liter

NA* - Not applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

TABLE B-7. Surface Water Total Recoverable Metals Results for Trust and Non-Trust Property Locations in the 2012 Synoptic Sampling Event

Compared to Human Health Standards (HHS)

South Fork Lower Willow Creek

Granite County, Montana

Description	Downstream Distance (feet)	Location	Date Sampled	Discharge (cfs)	Units	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
					Circular DEQ-7 HHS[a] (µg/L)	5.6[d]	10[e]	1000[e]	5[e]	100[e]	1,300[d]	15[d]	0.05[d]	100[g]	2,000[g]
Upstream Non-Trust Property	99	NT-SW-02	9/5/2012	0.39	µg/L	ND(1.0)	ND(1.0)	68	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	**ND(0.10)J**	ND(1.0)	ND(5.0)
	223	NT-SW-03	9/5/2012	0.42	µg/L	ND(1.0)	ND(1.0)	75	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	**ND(0.10)J**	ND(1.0)	3.0 J
Average[k]				0.40	µg/L	0.5	0.67	72	0.05	0.5	0.5	0.5	**0.05**	0.5	2.8
Trust Property	2,223	CML-SW-05	9/5/2012	0.61	µg/L	ND(1.0)	ND(1.0)	80	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	**ND(0.10)J**	ND(1.0)	ND(5.0)
	2,451	CML-SW-13	9/5/2012	0.65	µg/L	ND(1.0)	0.52 J	86	ND(0.10)	0.53 J	ND(1.0)	ND(1.0)	**ND(0.10)J**	ND(1.0)	ND(5.0)
	2,451	DUP1 (CML-SW-13)	9/5/2012	NA*	µg/L	ND(1.0)	0.50 J	80	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	**ND(0.10)J**	ND(1.0)	ND(5.0)
	4,306	CML-SW-19	9/5/2012	1.02	µg/L	ND(1.0)	0.52 J	73	ND(0.10)	ND(1.0)	1	ND(1.0)	**ND(0.10)J**	ND(1.0)	3.2 J
	5,829	CML-SW-04	9/5/2012	1.07	µg/L	ND(1.0)	0.52 J	66	ND(0.10)	ND(1.0)	1.1	ND(1.0)	**ND(0.10)J**	ND(1.0)	ND(5.0)
	6,532	CML-SW-14	9/5/2012	0.55	µg/L	ND(1.0)	0.70 J	69	ND(0.10)	ND(1.0)	1.6	ND(1.0)	**ND(0.10)J**	ND(1.0)	3.0 J
	6,737	CML-SW-15	9/5/2012	0.61	µg/L	ND(1.0)	0.75 J	67	ND(0.10)	ND(1.0)	2.2	ND(1.0)	**ND(0.10)J**	ND(1.0)	3.3 J
Average[k,l]				0.75	µg/L	0.5	0.57	74	0.05	0.5	1.1	0.5	**0.05**	0.5	2.8
USFS-administered land downstream of Trust Property	9,129	CML-SW-02	9/5/2012	0.64	µg/L	3.1	1.5	69	0.13	ND(1.0)	16	0.70 J	**ND(0.10)J**	ND(1.0)	6.2
	9,544	CML-SW-16	9/5/2012	0.59	µg/L	3.5	1.6	69	0.12	ND(1.0)	15	0.77 J	**0.21**	ND(1.0)	6.4
	10,039	CML-SW-11	9/5/2012	0.69	µg/L	4.8	2.0	70	0.19	ND(1.0)	18	1.5	**0.22**	ND(1.0)	13
	12,738	CML-SW-10	9/5/2012	1.02	µg/L	**6.5**	2.4	56	0.25	ND(1.0)	16	1.8	**0.23**	1	35
	14,712	CML-SW-09	9/5/2012	1.68	µg/L	**8.5**	2.9	57	0.30	ND(1.0)	17	1.5	**0.18 J**	1.2	48
	14,984	CML-SW-08	9/5/2012	1.18	µg/L	**8.5**	3.0	56	0.30	ND(1.0)	17	1.4	**0.21**	1.3	52
	17,656	CML-SW-01	9/6/2012	1.15	µg/L	**9.7**	3.3	61	0.30	ND(1.0)	15	1.2	**0.18 J**	1.2	51
Average[k]				0.99	µg/L	**6.4**	2.4	63	0.23	0.5	16	1.5	**0.22**	1.2	30
Downstream Non-Trust Property	20,089	NT-SW-04	9/6/2012	1.94	µg/L	**8.5**	2.9	58	0.25	ND(1.0)	12	1.3	**0.17 J**	1.1	51
	25,244	NT-SW-05	9/6/2012	1.10	µg/L	**11**	3.9	59	0.23	ND(1.0)	12	1.7	**0.20**	1.0	45
	25,244	GCD-001 (NT-SW-05)	9/6/2012	NA*	µg/L	**11**	3.9	60	0.28	ND(1.0)	12	1.9	**0.13 J**	1.0 J	44
	25,534	NT-SW-07	9/6/2012	1.41	µg/L	**6.9**	2.7	83	0.21	ND(1.0)	8.8	1.4	**0.14 J**	0.80 J	30
	25,534	GCD-002 (NT-SW-07)	9/6/2012	NA*	µg/L	**6.8**	2.7	80	0.17	ND(1.0)	8.7	1.4	**0.19 J**	0.75 J	29
	28,879	NT-SW-08	9/6/2012	2.71	µg/L	**12**	5.9	86	0.16	ND(1.0)	13	6.2	**0.33**	0.81 J	22
	28,879	DUP2 (NT-SW-08)	9/6/2012	NA*	µg/L	**11**	5.4	81	0.13	ND(1.0)	13	5.4	**0.38**	0.66 J	20
	38,226	NT-SW-09	9/6/2012	4.11	µg/L	**14**	8.8	79	0.11	ND(1.0)	15	4.6	**0.33**	ND(1.0)	9.8
	42,898	NT-SW-10	9/6/2012	0.55	µg/L	**14**	9.5	86	0.099 J	ND(1.0)	14	2.8	**0.38**	ND(1.0)	11
	43,105	NT-SW-12	9/6/2012	0.92	µg/L	**11**	7.4	93	0.1	ND(1.0)	11	2.5	**0.30**	ND(1.0)	9.1
	52,165	NT-SW-13	9/7/2012	0.76	µg/L	**13**	8.0	100	0.13	ND(1.0)	25	11	**0.49**	ND(1.0)	39
	55,623	NT-SW-14	9/7/2012	0.77	µg/L	**13**	8.0	96	0.071 J	ND(1.0)	14	3.6	**0.32**	ND(1.0)	9.8
	57,358	NT-SW-15	9/7/2012	1.17	µg/L	**16**	9.7	100	0.16	0.51 J	22	13	**0.54**	ND(1.0)	13
Average[k,l]				1.54	µg/L	**12**	6.7	84	0.15	0.5	15	4.8	**0.32**	0.67	26
SFLWC Tributary Streams	0	NT-SW-01	9/5/2012	0.04	µg/L	ND(1.0)	1.0	120	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	**ND(0.10)J**	ND(1.0)	ND(5.0)
	2,337	TSP-SW-6	9/5/2012	0.01J	µg/L	ND(1.0)	1.1	100	ND(0.10)	ND(1.0)	2.9	ND(1.0)	**ND(0.10)J**	ND(1.0)	3.6 J
	6,635	CML-SW-03	9/7/2012	0.01	µg/L	1.9	2.0	34	0.095 J	0.51 J	14	2.2	**0.15 J**	0.68 J	6.8
	9,792	CML-SW-17	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	14,848	CML-SW-18	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	25,534	NT-SW-06	9/6/2012	0.53	µg/L	ND(1.0)	0.72 J	120	ND(0.10)	1.2	3.1	ND(1.0)	**ND(0.10)J**	0.71 J	4.7 J
	43,105	NT-SW-11	9/6/2012	0.46	µg/L	ND(1.0)	0.86 J	100	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	**0.16 J**	ND(1.0)	ND(5.0)
Average[k]				0.25	µg/L	0.8	1.1	94.8	0.06	0.6	4.2	0.8	**0.09**	0.58	4.0

[a] Human Health Standards (HHS) for Water, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[b] Freshwater Acute Aquatic Life Standards (AALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[c] Freshwater Chronic Aquatic Life Standards (CALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[d] Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[e] Maximum Contaminant Level, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[f] Secondary Maximum Contaminant Level based on aesthetic properties, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[g] Health Advisory, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[h] Standard calculated using a total hardness of 25 mg/L, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[i] Non-Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[k] For non detect results, one half of the reporting limit was used in the calculation of the average concentration

[l] Duplicate results (DUP1, DUP2, GCD-001, and GCD-002) not included in average concentration

J – Estimated concentration

Bold, highlighted values exceed respective standards

cfs - cubic feet per second

µg/L = micrograms per liter

NA* - Not applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

TABLE B-8. Surface Water Total Recoverable Metals Results for Trust and Non-Trust Property Locations in the 2012 Synoptic Sampling Event

Compared to Freshwater Acute Aquatic Life Standards (AALS)

South Fork Lower Willow Creek

Granite County, Montana

Description	Downstream Distance (feet)	Location	Date Sampled	Discharge (cfs)	Units	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
Circular DEQ-7 AALS[b] (µg/L)						NS	340[d]	NS	0.52[d,h]	579[d,h]	3.79[d,h]	13.98[d,h]	1.7[d]	145[d,h]	37[d,h]
Upstream Non-Trust Property	99	NT-SW-02	9/5/2012	0.39	µg/L	ND(1.0)	ND(1.0)	68	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	ND(0.10)J	ND(1.0)	ND(5.0)
	223	NT-SW-03	9/5/2012	0.42	µg/L	ND(1.0)	ND(1.0)	75	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	ND(0.10)J	ND(1.0)	3.0 J
Average[k]				0.40	µg/L	0.5	0.67	72	0.05	0.5	0.5	0.5	0.05	0.5	2.8
Trust Property	2,223	CML-SW-05	9/5/2012	0.61	µg/L	ND(1.0)	ND(1.0)	80	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	ND(0.10)J	ND(1.0)	ND(5.0)
	2,451	CML-SW-13	9/5/2012	0.65	µg/L	ND(1.0)	0.52 J	86	ND(0.10)	0.53 J	ND(1.0)	ND(1.0)	ND(0.10)J	ND(1.0)	ND(5.0)
	2,451	DUP1 (CML-SW-13)	9/5/2012	NA*	µg/L	ND(1.0)	0.50 J	80	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	ND(0.10)J	ND(1.0)	ND(5.0)
	4,306	CML-SW-19	9/5/2012	1.02	µg/L	ND(1.0)	0.52 J	73	ND(0.10)	ND(1.0)	1	ND(1.0)	ND(0.10)J	ND(1.0)	3.2 J
	5,829	CML-SW-04	9/5/2012	1.07	µg/L	ND(1.0)	0.52 J	66	ND(0.10)	ND(1.0)	1.1	ND(1.0)	ND(0.10)J	ND(1.0)	ND(5.0)
	6,532	CML-SW-14	9/5/2012	0.55	µg/L	ND(1.0)	0.70 J	69	ND(0.10)	ND(1.0)	1.6	ND(1.0)	ND(0.10)J	ND(1.0)	3.0 J
	6,737	CML-SW-15	9/5/2012	0.61	µg/L	ND(1.0)	0.75 J	67	ND(0.10)	ND(1.0)	2.2	ND(1.0)	ND(0.10)J	ND(1.0)	3.3 J
Average[k,l]				0.75	µg/L	0.5	0.57	74	0.05	0.5	1.1	0.5	0.05	0.5	2.8
USFS-administered land downstream of Trust Property	9,129	CML-SW-02	9/5/2012	0.64	µg/L	3.1	1.5	69	0.13	ND(1.0)	**16**	0.70 J	ND(0.10)J	ND(1.0)	6.2
	9,544	CML-SW-16	9/5/2012	0.59	µg/L	3.5	1.6	69	0.12	ND(1.0)	**15**	0.77 J	0.21	ND(1.0)	6.4
	10,039	CML-SW-11	9/5/2012	0.69	µg/L	4.8	2.0	70	0.19	ND(1.0)	**18**	1.5	0.22	ND(1.0)	13
	12,738	CML-SW-10	9/5/2012	1.02	µg/L	6.5	2.4	56	0.25	ND(1.0)	**16**	1.8	0.23	1	35
	14,712	CML-SW-09	9/5/2012	1.68	µg/L	8.5	2.9	57	0.30	ND(1.0)	**17**	1.5	0.18 J	1.2	**48**
	14,984	CML-SW-08	9/5/2012	1.18	µg/L	8.5	3.0	56	0.30	ND(1.0)	**17**	1.4	0.21	1.3	**52**
	17,656	CML-SW-01	9/6/2012	1.15	µg/L	9.7	3.3	61	0.30	ND(1.0)	**15**	1.2	0.18 J	1.2	**51**
Average[k]				0.99	µg/L	6.4	2.4	63	0.23	0.5	**16**	1.5	0.22	1.2	30
Downstream Non-Trust Property	20,089	NT-SW-04	9/6/2012	1.94	µg/L	8.5	2.9	58	0.25	ND(1.0)	**12**	1.3	0.17 J	1.1	**51**
	25,244	NT-SW-05	9/6/2012	1.10	µg/L	11	3.9	59	0.23	ND(1.0)	**12**	1.7	0.20	1.0	**45**
	25,244	GCD-001 (NT-SW-05)	9/6/2012	NA*	µg/L	11	3.9	60	0.28	ND(1.0)	**12**	1.9	0.13 J	1.0 J	**44**
	25,534	NT-SW-07	9/6/2012	1.41	µg/L	6.9	2.7	83	0.21	ND(1.0)	**8.8**	1.4	0.14 J	0.80 J	30
	25,534	GCD-002 (NT-SW-07)	9/6/2012	NA*	µg/L	6.8	2.7	80	0.17	ND(1.0)	**8.7**	1.4	0.19 J	0.75 J	29
	28,879	NT-SW-08	9/6/2012	2.71	µg/L	12	5.9	86	0.16	ND(1.0)	**13**	6.2	0.33	0.81 J	22
	28,879	DUP2 (NT-SW-08)	9/6/2012	NA*	µg/L	11	5.4	81	0.13	ND(1.0)	**13**	5.4	0.38	0.66 J	20
	38,226	NT-SW-09	9/6/2012	4.11	µg/L	14	8.8	79	0.11	ND(1.0)	**15**	4.6	0.33	ND(1.0)	9.8
	42,898	NT-SW-10	9/6/2012	0.55	µg/L	14	9.5	86	0.099 J	ND(1.0)	**14**	2.8	0.38	ND(1.0)	11
	43,105	NT-SW-12	9/6/2012	0.92	µg/L	11	7.4	93	0.1	ND(1.0)	**11**	2.5	0.30	ND(1.0)	9.1
	52,165	NT-SW-13	9/7/2012	0.76	µg/L	13	8.0	100	0.13	ND(1.0)	**25**	11	0.49	ND(1.0)	**39**
	55,623	NT-SW-14	9/7/2012	0.77	µg/L	13	8.0	96	0.071 J	ND(1.0)	**14**	3.6	0.32	ND(1.0)	9.8
	57,358	NT-SW-15	9/7/2012	1.17	µg/L	16	9.7	100	0.16	0.51 J	**22**	13	0.54	ND(1.0)	13
Average[k,l]				1.54	µg/L	12	6.7	84	0.15	0.5	**15**	4.8	0.32	0.67	26
SFLWC Tributary Streams	0	NT-SW-01	9/5/2012	0.04	µg/L	ND(1.0)	1.0	120	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	ND(0.10)J	ND(1.0)	ND(5.0)
	2,337	TSP-SW-6	9/5/2012	0.01J	µg/L	ND(1.0)	1.1	100	ND(0.10)	ND(1.0)	2.9	ND(1.0)	ND(0.10)J	ND(1.0)	3.6 J
	6,635	CML-SW-03	9/7/2012	0.01	µg/L	1.9	2.0	34	0.095 J	0.51 J	**14**	2.2	0.15 J	0.68 J	6.8
	9,792	CML-SW-17	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	14,848	CML-SW-18	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	25,534	NT-SW-06	9/6/2012	0.53	µg/L	ND(1.0)	0.72 J	120	ND(0.10)	1.2	3.1	ND(1.0)	ND(0.10)J	0.71 J	4.7 J
	43,105	NT-SW-11	9/6/2012	0.46	µg/L	ND(1.0)	0.86 J	100	ND(0.10)	ND(1.0)	ND(1.0)	ND(1.0)	0.16 J	ND(1.0)	ND(5.0)
Average[k]				0.25	µg/L	0.8	1.1	95	0.06	0.6	**4.2**	0.8	0.09	0.58	4.0

[a] Human Health Standards (HHS) for Water, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[b] Freshwater Acute Aquatic Life Standards (AALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[c] Freshwater Chronic Aquatic Life Standards (CALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[d] Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[e] Maximum Contaminant Level, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[f] Secondary Maximum Contaminant Level based on aesthetic properties, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[g] Health Advisory, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[h] Standard calculated using a total hardness of 25 mg/L, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[i] Non-Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[k] For non detect results, one half of the reporting limit was used in the calculation of the average concentration

[l] Duplicate results (DUP1, DUP2, GCD-001, and GCD-002) not included in average concentration

J – Estimated concentration

Bold, highlighted values exceed respective standards

cfs - cubic feet per second

µg/L = micrograms per liter

NA* - Not applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

TABLE B-9. Surface Water Total Recoverable Metals Results for Trust and Non-Trust Property Locations in the 2012 Synoptic Sampling Event
Compared to Freshwater Chronic Aquatic Life Standards (CALS)
South Fork Lower Willow Creek
Granite County, Montana

Description	Downstream Distance (feet)	Location	Date Sampled	Discharge (cfs)	Units	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
Circular DEQ-7 CALS[c] (µg/L)						NS	150[d]	NS	0.097[d,h]	27.7[d,h]	2.85[d,h]	0.545[d,h]	0.91[d]	16.1[d,h]	37[d,h]
Upstream Non-Trust Property	99	NT-SW-02	9/5/2012	0.39	µg/L	ND(1.0)	ND(1.0)	68	**ND(0.10)**	ND(1.0)	ND(1.0)	**ND(1.0)**	ND(0.10)J	ND(1.0)	ND(5.0)
	223	NT-SW-03	9/5/2012	0.42	µg/L	ND(1.0)	ND(1.0)	75	**ND(0.10)**	ND(1.0)	ND(1.0)	**ND(1.0)**	ND(0.10)J	ND(1.0)	3.0 J
Average[k]				0.40	µg/L	0.5	0.67	72	0.05	0.5	0.5	0.5	0.05	0.5	2.8
Trust Property	2,223	CML-SW-05	9/5/2012	0.61	µg/L	ND(1.0)	ND(1.0)	80	**ND(0.10)**	ND(1.0)	ND(1.0)	**ND(1.0)**	ND(0.10)J	ND(1.0)	ND(5.0)
	2,451	CML-SW-13	9/5/2012	0.65	µg/L	ND(1.0)	0.52 J	86	**ND(0.10)**	0.53 J	ND(1.0)	**ND(1.0)**	ND(0.10)J	ND(1.0)	ND(5.0)
	2,451	DUP1 (CML-SW-13)	9/5/2012	NA*	µg/L	ND(1.0)	0.50 J	80	**ND(0.10)**	ND(1.0)	ND(1.0)	**ND(1.0)**	ND(0.10)J	ND(1.0)	ND(5.0)
	4,306	CML-SW-19	9/5/2012	1.02	µg/L	ND(1.0)	0.52 J	73	**ND(0.10)**	ND(1.0)	1	**ND(1.0)**	ND(0.10)J	ND(1.0)	3.2 J
	5,829	CML-SW-04	9/5/2012	1.07	µg/L	ND(1.0)	0.52 J	66	**ND(0.10)**	ND(1.0)	1.1	**ND(1.0)**	ND(0.10)J	ND(1.0)	ND(5.0)
	6,532	CML-SW-14	9/5/2012	0.55	µg/L	ND(1.0)	0.70 J	69	**ND(0.10)**	ND(1.0)	1.6	**ND(1.0)**	ND(0.10)J	ND(1.0)	3.0 J
	6,737	CML-SW-15	9/5/2012	0.61	µg/L	ND(1.0)	0.75 J	67	**ND(0.10)**	ND(1.0)	2.2	**ND(1.0)**	ND(0.10)J	ND(1.0)	3.3 J
Average[k,l]				0.75	µg/L	0.5	0.57	74	0.05	0.5	1.1	0.5	0.05	0.5	2.8
USFS-administered land downstream of Trust Property	9,129	CML-SW-02	9/5/2012	0.64	µg/L	3.1	1.5	69	**0.13**	ND(1.0)	**16**	**0.70 J**	ND(0.10)J	ND(1.0)	6.2
	9,544	CML-SW-16	9/5/2012	0.59	µg/L	3.5	1.6	69	**0.12**	ND(1.0)	**15**	**0.77 J**	0.21	ND(1.0)	6.4
	10,039	CML-SW-11	9/5/2012	0.69	µg/L	4.8	2.0	70	**0.19**	ND(1.0)	**18**	**1.5**	0.22	ND(1.0)	13
	12,738	CML-SW-10	9/5/2012	1.02	µg/L	6.5	2.4	56	**0.25**	ND(1.0)	**16**	**1.8**	0.23	1	35
	14,712	CML-SW-09	9/5/2012	1.68	µg/L	8.5	2.9	57	**0.30**	ND(1.0)	**17**	**1.5**	0.18 J	1.2	**48**
	14,984	CML-SW-08	9/5/2012	1.18	µg/L	8.5	3.0	56	**0.30**	ND(1.0)	**17**	**1.4**	0.21	1.3	**52**
	17,656	CML-SW-01	9/6/2012	1.15	µg/L	9.7	3.3	61	**0.30**	ND(1.0)	**15**	**1.2**	0.18 J	1.2	**51**
Average[k]				0.99	µg/L	6.4	2.4	63	**0.23**	0.5	**16**	**1.5**	0.22	1.2	30
Downstream Non-Trust Property	20,089	NT-SW-04	9/6/2012	1.94	µg/L	8.5	2.9	58	**0.25**	ND(1.0)	**12**	**1.3**	0.17 J	1.1	**51**
	25,244	NT-SW-05	9/6/2012	1.10	µg/L	11	3.9	59	**0.23**	ND(1.0)	**12**	**1.7**	0.20	1.0	**45**
	25,244	GCD-001 (NT-SW-05)	9/6/2012	NA*	µg/L	11	3.9	60	**0.28**	ND(1.0)	**12**	**1.9**	0.13 J	1.0 J	**44**
	25,534	NT-SW-07	9/6/2012	1.41	µg/L	6.9	2.7	83	**0.21**	ND(1.0)	**8.8**	**1.4**	0.14 J	0.80 J	30
	25,534	GCD-002 (NT-SW-07)	9/6/2012	NA*	µg/L	6.8	2.7	80	**0.17**	ND(1.0)	**8.7**	**1.4**	0.19 J	0.75 J	29
	28,879	NT-SW-08	9/6/2012	2.71	µg/L	12	5.9	86	**0.16**	ND(1.0)	**13**	**6.2**	0.33	0.81 J	22
	28,879	DUP2 (NT-SW-08)	9/6/2012	NA*	µg/L	11	5.4	81	**0.13**	ND(1.0)	**13**	**5.4**	0.38	0.66 J	20
	38,226	NT-SW-09	9/6/2012	4.11	µg/L	14	8.8	79	**0.11**	ND(1.0)	**15**	**4.6**	0.33	ND(1.0)	9.8
	42,898	NT-SW-10	9/6/2012	0.55	µg/L	14	9.5	86	**0.099 J**	ND(1.0)	**14**	**2.8**	0.38	ND(1.0)	11
	43,105	NT-SW-12	9/6/2012	0.92	µg/L	11	7.4	93	**0.10**	ND(1.0)	**11**	**2.5**	0.30	ND(1.0)	9.1
	52,165	NT-SW-13	9/7/2012	0.76	µg/L	13	8.0	100	**0.13**	ND(1.0)	**25**	**11**	0.49	ND(1.0)	**39**
	55,623	NT-SW-14	9/7/2012	0.77	µg/L	13	8.0	96	0.071 J	ND(1.0)	**14**	**3.6**	0.32	ND(1.0)	9.8
	57,358	NT-SW-15	9/7/2012	1.17	µg/L	16	9.7	100	**0.16**	0.51 J	**22**	**13**	0.54	ND(1.0)	13
Average[k,l]				1.54	µg/L	12	6.7	84	**0.15**	0.5	**15**	**4.8**	0.32	0.67	26
SFLWC Tributary Streams	0	NT-SW-01	9/5/2012	0.04	µg/L	ND(1.0)	1.0	120	**ND(0.10)**	ND(1.0)	ND(1.0)	**ND(1.0)**	ND(0.10)J	ND(1.0)	ND(5.0)
	2,337	TSP-SW-6	9/5/2012	0.01J	µg/L	ND(1.0)	1.1	100	**ND(0.10)**	ND(1.0)	**2.9**	**ND(1.0)**	ND(0.10)J	ND(1.0)	3.6 J
	6,635	CML-SW-03	9/7/2012	0.01	µg/L	1.9	2.0	34	0.095 J	0.51 J	**14**	**2.2**	0.15 J	0.68 J	6.8
	9,792	CML-SW-17	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	14,848	CML-SW-18	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	25,534	NT-SW-06	9/6/2012	0.53	µg/L	ND(1.0)	0.72 J	120	**ND(0.10)**	1.2	**3.1**	**ND(1.0)**	ND(0.10)J	0.71 J	4.7 J
	43,105	NT-SW-11	9/6/2012	0.46	µg/L	ND(1.0)	0.86 J	100	**ND(0.10)**	ND(1.0)	ND(1.0)	**ND(1.0)**	0.16 J	ND(1.0)	ND(5.0)
Average[k]				0.25	µg/L	0.8	1.1	94.8	0.06	0.6	**4.2**	**0.8**	0.09	0.58	4.0

[a] Human Health Standards (HHS) for Water, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[b] Freshwater Acute Aquatic Life Standards (AALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[c] Freshwater Chronic Aquatic Life Standards (CALS), Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[d] Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[e] Maximum Contaminant Level, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[f] Secondary Maximum Contaminant Level based on aesthetic properties, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[g] Health Advisory, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[h] Standard calculated using a total hardness of 25 mg/L, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[i] Non-Priority Pollutant, Circular DEQ-7, Montana Numeric Water Quality Standards (DEQ 2012)

[k] For non detect results, one half of the reporting limit was used in the calculation of the average concentration

[l] Duplicate results (DUP1, DUP2, GCD-001, and GCD-002) not included in average concentration

J – Estimated concentration

Bold, highlighted values exceed respective standards

cfs - cubic feet per second

µg/L = micrograms per liter

NA* - Not applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

Table B-10. Solid-Matrix (Sediment) Total Recoverable Metals Results for Trust and Non-Trust Property Locations in September 2012, South Fork Lower Willow Creek, Granite County, Montana.

Description	Downstream Distance (FT)	Location	Date Sampled	Sample Start Depth (FT)	Sample End Depth (FT)	Units	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Zinc
Risk Based Cleanup Guidelines[a] (mg/kg)							**293**	**40.4[bc]**	**4,975**	**19.5[b]**	**735,000**	**30,500**	**27,100**	**1,100**	**665**	**220**	**14,650**	**220,000**
Upstream Non-Trust Property	99	NT-SD-02	9/5/2012	0	0.3	mg/kg	ND(0.59)	3.7	117	0.50	2.3	2.8	8.1	7.4	219	0.018	3.5	39.0
	223	NT-SD-03	9/5/2012	0	0.3	mg/kg	ND(0.82)	9.1	286	0.62	5.1	4.5	13.5	7.9	624	0.048	8.2	43.8
Average[d]							0.35	6.4	202	0.56	3.7	3.7	10.8	7.7	422	0.033	5.9	41.4
Trust Property	2,223	CML-SD-05	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	2,451	CML-SD-13	9/5/2012	0	0.3	mg/kg	ND(1.9)	11.1	596	2.1	6.9	9.1	73.8	20.8	**1,410**	0.12	13.8	103
	4,306	CML-SD-19	9/6/2012	0	0.3	mg/kg	ND(0.82)	7.6	421	1.5	6.4	4.8	46.7	18.8	607	0.25	9.7	89.5
	5,829	CML-SD-04	9/6/2012	0	0.3	mg/kg	2.1	12.6	209	0.71	2.6	6.8	25.7	142	562	2.0	5.4	59.7
	6,532	CML-SD-14	9/6/2012	0	0.3	mg/kg	26.5	34.0	422	2.4	5.4	12.7	147	206	**1,240**	11.4	11.9	170
	6,737	CML-SD-15	9/6/2012	0	0.3	mg/kg	41.2	**47.7**	531	4.6	6.5	16.2	404	313	**2,140**	39.8	15.4	236
Average[d]							14.2	22.6	436	2.3	5.6	9.9	139	140	**1,192**	10.7	11.2	132
USFS-administered land downstream of Trust Property	9,129	CML-SD-02	9/6/2012	0	0.3	mg/kg	3.4	22.8	258	2.0	4.4	11.9	311	152	**1,090**	4.9	7.6	126
	9,544	CML-SD-16	9/6/2012	0	0.3	mg/kg	177	**282**	328	8.4	7.7	14.5	1,080	**1,920**	**927**	0.1	9.0	287
	10,039	CML-SD-11	9/6/2012	0	0.3	mg/kg	44	**109**	59.3	1.6	1.9	3.5	337	817	173	7.6	2.0	116
	12,738	CML-SD-10	9/6/2012	0	0.3	mg/kg	117	**275**	203	5.2	3.3	6.2	1,120	**1,970**	283	5.3	4.4	191
	14,712	CML-SD-09	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	14,984	CML-SD-08	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	17,656	CML-SD-01	9/6/2012	0	0.3	mg/kg	6.3	15.9	62	1.1	2.1	7.9	137	111	289 J	3.5	3.4	111
Average[d]							69.5	**141**	182	3.7	3.9	8.8	597	994	552	4.3	5.3	166
Downstream Non-Trust Property	20,089	NT-SD-04	9/6/2012	0	0.3	mg/kg	26.1	**69.9**	100	2.4	2.9	8.7	355	558	339 J	11.6	4.1	119
	25,244	NT-SD-05	9/6/2012	0	0.3	mg/kg	20.6	**64.3**	89.8	1.4	5.2	8	168	466	207 J	5.7	4.4	93.6
	25,534	NT-SD-07	9/6/2012	0	0.3	mg/kg	73.6	**119**	761	8.8	11.6	20.3	749	837	**1,390 J**	31	22.9	662
	28,879	NT-SD-08	9/6/2012	0	0.3	mg/kg	19.0	**50.7**	106	1.9	3.9	10.0	219	329	247 J	11.5	5.1	155
	38,226	NT-SD-09	9/6/2012	0	0.3	mg/kg	13.0	**47.9**	84.1	1.1	2.4	10.2	133	209	253 J	3.5	3.8	129
	42,898	NT-SD-10	9/6/2012	0	0.3	mg/kg	11.8	28.8	88.2	1.0	2.5	7.2	105	175	146 J	5.3	3.7	80.0
	43,105	NT-SD-12	9/6/2012	0	0.3	mg/kg	17.0	**59.4**	129	1.9	4.3	11.2	211	340	352 J	22.3	5.5	125
	52,165	NT-SD-13	9/6/2012	0	0.3	mg/kg	10.9	27.8	95.4	1.0	2.3	8.6	86.2	151	334 J	3.2	4.4	99.2
	55,623	NT-SD-14	9/6/2012	0	0.3	mg/kg	6.5	20.4	98.7	0.58	2.1	6.5	51.6	105	169 J	3.1	3.3	90.9
	57,358	NT-SD-15A	9/6/2012	0	0.1	mg/kg	9.6	2.9	127	0.09	ND(0.63)	3.7	77.8	155	9.1 J	2.7	ND(0.4)	12.8
	57,358	NT-SD-15B	9/6/2012	0.1	0.3	mg/kg	23.8	**62.2**	598	4.5	6.3	11.7	516	723	427 J	43.9	9.0	243
Average[d]							21.1	**50.3**	207	2.2	4.0	9.6	243	368	352	13.1	6.1	165
SFLWC Tributary Streams	0	NT-SD-01	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	2,337	TSP-SD-6	9/5/2012	0	0.3	mg/kg	1.8	5.5	110	0.33	2.8	1.9	20.9	50.9	138	0.041	4.1	29.7
	6,635	CML-SD-03	9/7/2012	0	0.3	mg/kg	21.1	**83.3**	429	7.9	14.3	15.7	569	215	**1,890**	55.9	26.9	258
	9,792	CML-SD-17	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	14,848	CML-SD-18	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
	25,389	NT-SD-06	9/6/2012	0	0.3	mg/kg	2.8	9.5	663	1.7	7.8	4.9	97.1	37	**704 J**	0.85	ND(2.4)	149
	43,002	NT-SD-11	9/6/2012	0	0.3	mg/kg	ND(0.84)	2.9	248	0.16	3.6	3.1	5.6	5.7	365 J	0.064	4.4	14.8
Average[d]							6.5	25.3	363	2.5	7.1	6.4	173	77.2	**774**	14.2	9.2	113

[a] MT DEQ Risk Based Cleanup Guidelines (RBCG) Composite, Conservative Soil Cleanup Guidelines for Recreational Visitors Table 7-10 (DEQ 1996)

[b] Carcinogenic risk of 5E-07

[c] UCL = 95th upper confidence limit on the arithmetic mean background concentration, from background samples

[d] For non detect results, one half of the reporting limit was used in the calculation of the average concentration

J - estimated value

Bold, highlighted values exceed respective standards

FT - feet

mg/kg - milligrams per kilogram

NA* - Not applicable or not analyzed

ND() - Analyte was not detected (reporting limit)

APPENDIX C

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs	Description	Applicable/Relevant and Appropriate?
Federal Contaminant-Specific ARARs		
Safe Drinking Water Act		
Safe Drinking Water Act, 42 U.S.C. 300f, et seq., National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141 and 142	Establishes maximum contaminant levels (MCL) for chemicals in drinking water distributed in public water systems.	Relevant and Appropriate. However, Montana has promulgated water quality standards: MCA 75-5-101 et seq., MCA 75-5-605 et seq., MCA 75-5-303 et seq., ARM 17.30.637, and ARM 17.30.705.
Clean Water Act		
Federal Surface Water Quality Requirements, Clean Water Act, 33 U.S.C. 1251, et seq.	Allows the state to promulgate water quality standards.	Applicable. However, Montana has promulgated water quality standards: MCA 75-5-101 et seq., MCA 75-5-605 et seq., MCA 75-5-303 et seq., ARM 17.30.637, and ARM 17.30.705.
National Ambient Air Quality Standards		
National Ambient Air Quality Standards, 40 CFR 50.6 (PM-10); 40 CFR 50.12 (lead)	Establishes standards for PM-10 and lead emissions to air.	Applicable. However, Montana has promulgated ambient air quality regulations: ARM 17.8.222 (lead) and ARM 17.8.223 (PM-10).
State Contaminant-Specific ARARs		
Groundwater Protection		
Application of Groundwater Standards and Basis for Classifications, ARM 17.30.1005	Explains the applicability and basis for the groundwater standards in ARM 17.30.1006, which establish the maximum allowable changes in groundwater quality and may limit discharges to groundwater.	Applicable. Capping, removal, or treatment of the tailings, waste rock, and contaminated materials will limit discharge of contaminants to groundwater.

ARARs	Description	Applicable/Relevant and Appropriate?
Classification, Beneficial Uses and Specific Standards for Groundwater, ARM 17.30.1006	Establishes the applicable groundwater quality standards with respect to groundwater classifications I through IV.	Applicable. Groundwater quality level will be maintained and standards listed in DEQ-7 will not be exceeded. Capping, removal, or treatment of the tailings, waste rock, and contaminated materials will reduce the loading of contaminants to groundwater and reduce further degradation of groundwater.
Nondegradation, ARM 17.30.1011	Provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality.	Applicable. Groundwater quality at BPM will be maintained at its current level; and reclamation activities will reduce the loading of contaminants and reduce further degradation of groundwater.
Montana Water Quality Act		
State of Montana Surface Water Quality Requirements, Montana Water Quality Act, Section 75-5-101, et seq., MCA, and implementing regulations	Establishes requirements to protect, maintain, and improve the quality of surface and groundwater.	Applicable. Capping, removal, or treatment of the tailings, waste rock, and contaminated materials will reduce the loading of contaminants to state waters, reduce further degradation of waters, and limit interactions with groundwater.
Surface Water Quality Standards and Procedures, ARM 17.30.607, ARM 17.30.623	Sets forth water quality standards that may not be violated, including limits for E-coli, dissolved oxygen, turbidity, temperature, color, and toxins.	Applicable. Water use classification for drainages at BPM is B-1. Capping, removal, or treatment of the contaminated materials will not cause a violation of these standards.

ARARs	Description	Applicable/Relevant and Appropriate?
General Prohibitions, ARM 17.30.637	Provides that surface waters must be free from substances attributable to industrial practices or other discharges that will create sludge deposits; floating scum; odors; colors; concentrations or combinations which are toxic or harmful to human, animal, plant or aquatic life; conditions that produce undesirable aquatic life; or other conditions which create a nuisance.	Applicable. Capping, removal, or treatment of the tailings, waste rock, and contaminated materials from the stream and floodplain areas will be conducted in a way to limit discharges to the stream.
Prohibited Activities, Section 75-5-605, MCA	Provides that it is unlawful to cause pollution of any state waters or to place or cause to be placed, any wastes where they will cause pollution of any state waters.	Applicable. Capping, removal, or treatment of the tailings, waste rock, and contaminated materials will reduce the loading of contaminants to state waters and reduce further degradation of waters.
Nondegradation Policy, Section 75-5-303, MCA	Provides that existing uses of state waters and the level of quality of state waters necessary to protect those uses must be maintained and protected.	Applicable. Capping, removal, or treatment of the tailings, waste rock, and contaminated materials will reduce the loading of contaminants to state waters, protect water quality, and protect existing uses of waters.
Nondegradation Policy, Applicability and Level of Protection, ARM 17.30.705	For all state waters, existing and anticipated uses and water quality necessary to support those uses must be maintained and protected.	Applicable. Capping, removal, or treatment of the tailings, waste rock, and contaminated materials will reduce the loading of contaminants to state waters and reduce further degradation of waters.
Montana Ambient Air Quality Regulations		
Montana Ambient Air Quality Regulations, ARM 17.8.206, -.220, -221, -.222, -.223		

ARARs	Description	Applicable/Relevant and Appropriate?
Methods and Data, ARM 17.8.206	Establishes sampling, data collection, and analytical requirements to ensure compliance with ambient air quality standards.	Applicable. Sampling methods and data collection will comply with Montana Quality Assurance Project Plan.
Settled Particulate Matter, ARM 17.8.220	Settled particulate matter shall not exceed a thirty (30) day average of 10 g/m^2.	Applicable. Settled particulate matter shall be measured by the dust fall method, as more fully described in "Methods of Air Sampling and Analysis, Second Edition" (1977), Method No. 21101-0170T.
Visibility, ARM 17.8.221	Concentrations of particulate matter in ambient air shall not exceed annual scattering coefficient particulate matter of 3 x 10^{-5} /m.	Not Applicable. Applicable only in Class I areas as are designated under the Montana Clean Air Act rules. BPM is not in a designated Class I area.
Lead, ARM 17.8.222	Lead emissions to ambient air shall not exceed a ninety (90) day average of 1.5 μ/m^3.	Applicable. Lead will be measured by an applicable method as described in 40 CFR Part 50, incorporated by reference in ARM 17.8.202, or by an approved equivalent method.
PM-10, ARM 17.8.223	PM-10 concentrations in ambient air shall not exceed a 24 hour average of 150 μ/m^3 and an annual average of 50 μ/m^3.	Applicable. PM-10 will be measured by an applicable reference method based on 40 CFR Part 50 or by an equivalent method designated in accordance with 40 CFR Part 53.

ARARs	Description	Applicable/Relevant and Appropriate?
Asbestos, ARM 17.74.357	Concentration of asbestos fibers in air clearance samples must be: a) less than or equal to 0.01 fibers/cm^3 of air for each of five samples collected within the work area if analyzed by phase contrast microscopy, or b) less than or equal to the average concentration of 70 structures/mm^2 for five samples collected within the work area if analyzed by transmission electron microscopy.	Applicable. Asbestos clearance sampling will be conducted for facilities being demolished.
Federal Location-Specific ARARs		
National Historic Preservation		
National Historic Preservation Act, 16 USC 470, 36 CFR Part 63, Part 65, and Part 800 (NHPA)	Requires Federal agencies to take into account the effect of reclamation activities upon any district, site, building, structure, or object that is included in or eligible for the Register of Historic Places.	Relevant and Appropriate for work done on the Trust Property; Applicable to work done on USFS Land. MT DEQ consultant will conduct third party evaluation of the effect of reclamation activities upon facilities included on or eligible for the Register of Historic Places.
Archaeological and Historic Preservation Act		
Archaeological and Historic Preservation Act, 16 USC 469	Establishes requirements for the evaluation and preservation of historical and archaeological data, including Indian cultural and historic data, which may be destroyed through alteration of terrain as a result of a Federal program.	Relevant and Appropriate for work done on the Trust Property; Applicable to work done on USFS Land. MT DEQ consultant will conduct third party evaluation of required preservation of historic and archaeological resources prior to reclamation activities.
Historic Sites Act of 1935		

ARARs	Description	Applicable/Relevant and Appropriate?
Historic Sites Act of 1935, 16 USC 461, et seq.	Requires reclamation activities to consider the existence and location of landmarks on the National Registry of Natural Landmarks and to avoid undesirable impacts on landmarks.	Applicable. MT DEQ consultant will conduct third party evaluation of required preservation of landmarks on the National Registry of Natural Landmarks.
Protection and Enhancement of the Cultural Environment		
Executive Order 11593 Protection and Enhancement of the Cultural Environment, 16 USC 470	Directs federal agencies to institute procedures to ensure programs contribute to the preservation and enhancement of non-federally owned historic resources.	Relevant and Appropriate for work done on the Trust Property; Applicable to work done on USFS Land. MT DEQ consultant will conduct third party evaluation of required preservation of historic resources prior to reclamation activities.
The Archeological Resources Protection Act of 1979		
The Archeological Resources Protection Act of 1979, 16 USC 470aa-470mm	Requires a permit for any excavation or removal of archeological resources from public lands or Indian lands.	Relevant and Appropriate for work done on the Trust Property; Applicable to work done on USFS Land. MT DEQ consultant will conduct third party evaluation of archaeological resources prior to reclamation activities. Will comply with requirements if archeological resources are discovered during reclamation activities.

ARARs	Description	Applicable/Relevant and Appropriate?
American Indian Religious Freedom Act		
American Indian Religious Freedom Act, 42 USC 1996, et seq.	Establishes a federal responsibility to protect and preserve the inherent right of American Indians to believe, express and exercise the traditional religions of American Indians.	Relevant and Appropriate for work done on the Trust Property; Applicable to work done on USFS Land. MT DEQ consultant will conduct third party evaluation of the effect of reclamation activities on the traditional religions of American Indians.
Native American Graves Protection and Repatriation Act		
Native American Graves Protection and Repatriation Act, 25 USC 3001 et seq.	Prioritizes ownership or control over Native American cultural items, including human remains, funerary objects and sacred objects, excavated or discovered on Federal or tribal lands.	Applicable. Will comply with requirements if cultural items are encountered during reclamation activities.
Fish and Wildlife Coordination Act		
Fish and Wildlife Coordination Act, 16 USC 661, 40 CFR 6.302	Requires that Federal agencies or federally funded projects ensure that any modification of any stream or other water body affected by any action authorized or funded by the Federal agency provide for adequate protection of fish and wildlife resources.	Relevant and Appropriate for work done on the Trust Property; Applicable to work done on USFS Land. However, Montana has promulgated endangered species and wildlife regulations: ARM 17.24.751 and 87-5-106, 107, 111, MCA. Compliance with this ARAR requires consultation with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife, and Parks. Further consultation will occur during reclamation design and construction.

ARARs	Description	Applicable/Relevant and Appropriate?
Endangered Species Act		
Endangered Species Act, 16 USC 1531, 50 CRF Parts 17 and 402	Provides that reclamation activities not jeopardize the continued existence of any threatened or endangered species.	Applicable. However, Montana has promulgated endangered species and wildlife regulations: ARM 17.24.751 and 87-5-106, 107, 111, MCA. Compliance with this ARAR requires consultation with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife, and Parks. Further consultation will occur during reclamation design and construction.
Floodplain Management Regulations		
Floodplain Management Regulations, Executive Order No. 11988	Requires that actions be taken to avoid, to the extent possible, adverse effects associated with direct or indirect development of a floodplain, or to minimize adverse impacts if no practicable alternative exists.	Relevant and Appropriate for work done on the Trust Property; Applicable to work done on USFS Land. However, the State of Montana has promulgated regulations: ARM 36.15.605 (2)(c), ARM 36.15.703, 76-5-403, MCA. These regulations prohibit a solid waste facility from being located in the 100-year flood plain.

ARARs	Description	Applicable/Relevant and Appropriate?
Protection of Wetlands Regulations		
Protection of Wetlands Regulations, 40 CFR Part 6, Appendix A (See Federal Register 53652), and Executive Order No. 11990	Requires that steps be taken to avoid or mitigate the adverse impacts associated with the destruction or loss of wetlands to the extent possible and avoidance of new construction in wetlands if a practicable alternative exists.	Relevant and Appropriate for work done on the Trust Property; Applicable to work done on USFS Land. However, the State of Montana has promulgated regulations: ARM 17.50.1005. This regulation prohibits construction of a Class II or Class IV landfill on or near wetlands. Consultation with USACE will be required to mitigate for destruction, degredation, or loss of wetlands anticipated from the waste removal process.
Clean Water Act		
Section 404, Clean Water Act, 33 USC 1251 et seq., 33 CFR Part 330	Regulates discharge of dredged or fill materials into waters of the United States.	Applicable. Substantive portions are applicable for stream reconstructive activities. Consultation with USACE will be required regarding wastes removed or dredged from SFLWC or fill placed in SFLWC.

ARARs	Description	Applicable/Relevant and Appropriate?
Migratory Bird Treaty Act		
Migratory Bird Treaty Act, 16 USC 703, et seq.	Establishes a Federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the U.S. Fish and Wildlife Service during reclamation design and construction to ensure that reclamation activities at the site do not unnecessarily impact migratory birds.	Relevant and Appropriate for work done on the Trust Property; Applicable to work done on USFS Land. However, the State of Montana has promulgated regulations: 87-5-201, MCA. Compliance with this ARAR requires consultation with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife, and Parks. Further consultation will occur during reclamation design and construction.
Bald Eagle Protection Act		
Bald Eagle Protection Act, 16 USC 668, et seq.	Establishes a Federal responsibility for protection of bald and golden eagles, and requires continues consultation with the U.S. Fish and Wildlife Service during reclamation design and construction to ensure that reclamation activities at the site do not unnecessarily adversely affect bald and golden eagles.	Relevant and Appropriate for work done on the Trust Property; Applicable to work done on USFS Land. Compliance with this ARAR requires consultation with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife, and Parks. Further consultation will occur during reclamation design and construction.

ARARs	Description	Applicable/Relevant and Appropriate?
Resource Conservation and Recovery Act		
Resource Conservation and Recovery Act and Regulations, 40 CFR 264.18 (a) and (b)	Provides seismic and floodplain restrictions on the location of a waste management unit.	Relevant and Appropriate. Extraction and processing wastes from mine sites are excluded from the definition of hazardous waste under the Bevill Amendment of the Resource Conservation and Recovery Act. However, observing the seismic and floodplain restrictions in this regulation is sound practice for locating mine waste repositories.
State Location-Specific ARARs		
Montana Antiquities Act		
Montana Antiquities Act, Section 22-3-421, et seq., MCA	Requires avoidance or mitigation of impacts to heritage property or paleontological remains. Requires each State agency to establish rules regarding historic resources and appropriate permitting procedures.	Relevant and appropriate. MT DEQ consultant will conduct third party evaluation of required preservation of heritage property or paleontological remains prior to reclamation activities.
Montana Human Skeletal Remains and Burial Site Protection Act		
Montana Human Skeletal Remains and Burial Site Protection Act (1991), Section 22-3-801, et seq., MCA	Prohibits purposefully or knowingly disturbing or destroying human skeletal remains or burial sites.	Applicable. If human skeletal remains or burial sites are encountered during reclamation activities, no disturbance or destroying of human skeletal remains or burial sites shall occur.
Montana Floodplain and Floodway Management Act		
Montana Floodplain and Floodway Management Act and Regulations, Section 76-5-101 et seq., MCA, ARM 36.15.601 et seq.	Specifies types of uses and structures that are allowed or prohibited in the designated 100-year floodway and floodplain.	Applicable. These standards are applicable to all actions in the floodplain areas.

ARARs	Description	Applicable/Relevant and Appropriate?
Montana Stream Protection Requirements		
Montana Natural Streambed and Land Preservation Act of 1975 and Regulation, Section 75-7-101, et seq., MCA, and ARM 36.2.401, et seq.	Provides that activities that adversely affect or alter a streambed or its banks shall be minimized.	Relevant and Appropriate. If reclamation activities affect streambed or stream banks, the adverse effects shall be minimized.
Standards and Guidelines, ARM 36.2.410	Establishes minimum standards which would be applicable if reclamation activities alter or affect a streambed, including any channel change, new diversion, riprap or other streambank protection project, jetty, new dam or reservoir or other commercial, industrial or residential development.	Relevant and Appropriate. If reclamation activities affect streambed or stream banks, the adverse effects shall be minimized.
Sections 87-5-502 and 504, MCA	Provides that a state agency or subdivision shall not construct, modify, operate, maintain or fail to maintain any construction project or hydraulic project which may or will obstruct, damage, diminish, destroy, change, modify, or vary the natural existing shape and form of any stream or its banks or tributaries in a manner that will adversely affect any fish or game habitat without following the procedures specified in these sections.	Applicable. If reclamation activities affect a stream or its banks, notice of planned construction shall be submitted per requirements, and adverse effects on fish or game habitat shall be minimized.
Montana Solid Waste Management Act and Regulations		
Montana Solid Waste Management Act and Regulations, Section 75-10-201, et seq., MCA, ARM 17.50.1001, et seq.	Provides that the management system of any solid waste facility must protect the public health and safety and conserve natural resources.	Relevant and Appropriate. These standards provide sound guidance for any solid waste facility for the treatment, storage, or disposal of mine wastes.

ARARs	Description	Applicable/Relevant and Appropriate?
Floodplains, ARM 17.50.1004	Provides that a solid waste facility located within the 100-year floodplain may not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste that poses a hazard to human health or the environment.	Applicable. If a new solid waste repository is constructed or existing solid waste facility is expanded in the 100-year floodplain, it will not restrict the flow of 100-year flood. In any event, disposal of mine wastes within a floodplain is to be avoided per other ARAR requirements.
Wetlands, ARM 17.50.1005	Prohibits the location of a solid waste facility in a wetland, unless there is no practicable alternative.	Applicable. New solid waste facilities will not be located in a wetland.
Fault Areas, ARM 17.50.1006	Prohibits the location of a solid waste facility within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless an alternative setback will prevent damage to the solid waste facility and will protect human health and the environment.	Applicable. New solid waste facilities will not be located within 200 feet of a fault.
Seismic Areas, ARM 17.50.1007	Prohibits the location of a solid waste facility in a seismic impact zone unless the solid waste structure is designed to resist the maximum horizontal acceleration in lithified earth material for the site.	Applicable. New solid waste facility will not be located in a seismic impact zone.
Unstable Areas, ARM 17.50.1008	Prohibits the location of a solid waste facility in an unstable area (determined by local soil conditions, local geographic or geomorphologic features, and local artificial features or events) unless the solid waste facility is designed to protect its structural components.	Applicable. New solid waste facilities will not be located in an unstable geologic area or will be designed to protect the structural components of the facility.

ARARs	Description	Applicable/Relevant and Appropriate?
Location Restrictions, ARM 17.50.1009	Requires that a solid waste facility must have sufficient acreage and adequate separation of wastes from underlying groundwater or adjacent surface water, be located so as to prevent pollution of water systems, be accessible, and allow for reclamation of the land.	Applicable. The listed requirements apply to management and disposal of mine wastes at the site.
Section 75-10-212, MCA	Prohibits dumping or abandoning any debris or refuse upon or within 200 yards of any State road, other public property, or private property where hunting, fishing or other recreation is permitted.	Applicable. The listed requirements apply to management and disposal of mine wastes at the site.
Endangered Species and Wildlife		
Section 87-5-106, 107, and 111, MCA	Regulates actions for the protection of endangered species in order to maintain and enhance their numbers.	Applicable. Compliance with this ARAR requires consultation with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife, and Parks. Further consultation will occur during reclamation design and construction.
Section 87-5-201, MCA	Requires protection of wild birds, nests and eggs.	Applicable. Compliance with this ARAR requires consultation with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife, and Parks. Further consultation will occur during reclamation design and construction.

ARARs	Description	Applicable/Relevant and Appropriate?
Action-Specific ARARs		
Federal and State Water Protection Requirements		
Clean Water Act		
Clean Water Act, Point Source Discharges Requirements, 33 USC 1342 (applicable, substantive provisions only)	Authorizes the issuance of permits for the discharge of any pollutants in stormwater associated with industrial activity, including inactive mining operations that discharge stormwater contaminated by contact with overburden, raw material, intermediate products, finished products, byproducts, or waste products located on the site of such operations.	Applicable. However, Montana has been delegated the authority to implement the Clean Water Act so these requirements are enforced through the Montana Pollutant Discharge Elimination System (MPDES): ARM 17.30.1342-1344 and ARM 17.30.1203.
Montana Pollutant Discharge Elimination System Requirements		
Substantive MPDES Permit Requirements, ARM 17.30.1342-1344	Regulates the requirements applicable to all MPDES and National Pollutant Discharge Elimination System (NPDES) permits, including the requirement to properly operate and maintain all facilities and systems of treatment and control for a repository containing mine waste.	Applicable. Substantive portions involving mine reclamation and mine waste repositories are applicable.
Technology-Based Treatment, ARM 17.30.1203 and 1344	Sets forth criteria and standards for the imposition of technology-based treatment requirements for non conventional and conventional pollutants.	Applicable. Substantive portions involving mine reclamation activities are applicable; i.e. toxic and nonconventional pollutant treatment must apply the best available technology economically available (BAT); conventional pollutant treatment must apply best conventional pollutant control technology (BCT).

ARARs	Description	Applicable/Relevant and Appropriate?
Montana Water Quality Act and Regulations		
Causing of Pollution, Section 75-5-605, MCA	Provides that it is unlawful to cause pollution of any state waters or to place or cause to be placed, any wastes where they will cause pollution of any state waters.	Applicable. Capping, removal, or treatment of mine tailings and contaminated materials will reduce the loading of contaminants to state waters and reduce further degradation of waters.
Nondegradation, Section 75-5-303, MCA	Provides that existing uses of state waters and the level of quality of state waters necessary to protect those uses must be maintained and protected.	Applicable. Capping, removal, or treatment of mine tailings and contaminated materials will improve the water quality and protect existing uses of existing water bodies.
Surface Water, ARM 17.30.637	Provides that surface waters must be free from substances attributable to industrial practices or other discharges that will create sludge deposits; floating scum; odors; colors; concentrations or combinations which are toxic or harmful to human, animal, plant or aquatic life; conditions that produce undesirable aquatic life; or other conditions which create a nuisance.	Applicable. Discharges resulting from the capping or removal process will be subject to treatment requirements.
Nondegradation Policy - Application and Level of Protection, ARM 17.30.705	For all state waters, existing and anticipated uses and water quality necessary to support those uses must be maintained and protected.	Applicable. Capping, removal, or treatment of mine tailings and contaminated materials will improve the water quality and uses of existing state waters.
Nondegradation, ARM 17.30.1011	Provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality.	Applicable. Groundwater quality at BPM will be maintained at its current level; and reclamation activities will reduce the loading of contaminants and reduce further degradation of groundwater.

ARARs	Description	Applicable/Relevant and Appropriate?
Stormwater Runoff Control Requirements		
Water Quality Performance Standards, ARM 17.24.633	Requires that all surface drainage from a disturbed area must be treated by the best technology currently available (BTCA) and that sediment control be maintained until the disturbed area has been reclaimed, the revegetation requirements have been met, and the area meets the state and federal requirements for the receiving stream.	Applicable. Sediment control through BTCA must be maintained until the disturbed area has been reclaimed, the revegetation requirements have been met, and the area meets state and federal requirements for the receiving stream.
General Permits, ARM 17.30.1341	Provides that requirements of stormwater permits issued by DEQ are applicable for construction, mining, and industrial activities. Requirements include implementation of Best Management Practices (BMPs) and taking all reasonable steps to minimize or prevent discharge that could adversely affect human or ecological health.	Applicable. Substantive portions are applicable, including stormwater discharge associated with construction activities, stormwater associated with mining and with oil and gas activities, and stormwater discharge associated with industrial activity.
Federal and State RCRA Subtitle C Requirements		
Federal and State RCRA Subtitle C Requirements, 42 USC Section 6921, et seq. (relevant and appropriate for solid wastes, applicable for hazardous wastes)	Sets criteria for identifying the characteristics of hazardous waste, and for listing hazardous waste, taking into account toxicity, persistence, and degradability in nature, potential for accumulation in tissue, and other related factors such as flammability, corrosiveness, and other hazardous characteristics.	Relevant and appropriate. However, there may be some roaster brick or other RCRA wastes for which these requirements are applicable.
40 CFR Part 264 Subpart F,	Sets regulations that apply to facilities that treat, store or dispose of hazardous waste.	Relevant and appropriate. However, the State of Montana has promulgated solid waste and mine reclamation regulations: ARM 17.50. 1111, 1116, 1403,1404.

ARARs	Description	Applicable/Relevant and Appropriate?
General Facility Standards:		
40 CFR 264.92, .93, and .94	Prescribes groundwater protection standards. Ensures that hazardous constituents detected in groundwater do not exceed the concentration limits established in 40 CFR 264.94 in the uppermost aquifer underlying the waste management area.	Relevant and approriate. Reclamation activities will protect the groundwater quality by placing waste in an engineered facility that would not degrade water quality.
40 CFR 264.97	Prescribes general groundwater monitoring requirements.	Relevant and approriate. Future monitoring will need to meet these requirements, including but not limited to well structures, sample frequency, sample handling, analytical procedures, and chain of custody control if material is hauled to a Subtitle D facility.
40 CFR 264.98	Prescribes requirements for monitoring and detecting indicator parameters.	Relevant and approriate. Future monitoring will also include detection monitoring for indicator parameters, waste constituents, or reaction products, which would indicate the presence of hazardous constituents in groundwater.
Closure Requirements		
40 CFR 264.111	Requires an owner or operator of a hazardous waste management facility to close the facility in a way that minimizes the need for further maintenance, and controls or eliminates the escape of hazardous waste or its constituents, leachate, or runoff.	Relevant and appropriate. However, the State of Montana has promulgated solid waste closure regulations: ARM 17.50. 1403.

ARARs	Description	Applicable/Relevant and Appropriate?
40 CFR 264.117	Provides requirements for post-closure care and use of hazardous waste management units, including length of care period, length of security period, and prohibition of using the property in a way that would disturb the integrity of the management facility.	Relevant and appropriate. However, the State of Montana has promulgated solid waste closure regulations: ARM 17.50. 1404.
40 CFR 264.310	Specifies requirements for caps, maintenance, and monitoring after closure.	Relevant and appropriate. However, the State of Montana has promulgated solid waste closure regulations: ARM 17.50. 1404.
40 CFR 264.301	Prescribes design and operating requirements for landfills.	Relevant and appropriate. However, the State of Montana has promulgated solid waste design and operating requirements: ARM 17.50. 1101 through 17.50.1118 and ARM 17.50.1201 through 17.50.1205.
40 CFR 264.301(a)	Provides for a single liner and leachate collection and removal system.	Relevant and appropriate. However, the State of Montana has promulgated solid waste design requirements: ARM 17.50. 1204.
40 CFR 264.301(f)	Requires a run-on control system.	Relevant and appropriate. However, the State of Montana has promulgated solid waste operating requirements: ARM 17.50.1109.
40 CFR 264.301(g)	Requires a run-off management system.	Relevant and appropriate. However, the State of Montana has promulgated solid waste operating requirements: ARM 17.50.1109.
40 CFR 264.301(h)	Requires prudent management of facilities for collection and holding of run-on and run-off.	Relevant and appropriate. However, the State of Montana has promulgated solid waste operating requirements: ARM 17.50.1109.

ARARs	Description	Applicable/Relevant and Appropriate?
40 CFR 264.301(j)	Requires that wind dispersal of particulate matter be controlled.	Relevant and appropriate. However, the State of Montana has promulgated solid waste operating requirements: ARM 17.24.761 and ARM 17.50.1107.
Federal and State RCRA Subtitle D and Solid Waste Management Requirements		
Federal Requirements		
40 CFR 257	Establishes Criteria for Classification of Solid Waste Disposal Facilities and Practices.	Applicable.
40 CFR 257.3-1	Prohibits washout of solid waste in solid waste facilities in a floodplain posing a hazard to human life, wildlife, or land or water resources.	Applicable. However, Montana has promulgated state standards regulating landfill siting: ARM 17.50.1004.
40 CFR 257.3-2	Prohibits solid waste facilities from contributing to the taking of endangered species or the endangering of their critical habitat.	Applicable. However, Montana has promulgated state standards regulating landfill siting: ARM 17.50.1009.
40 CFR 257.3-3	Prohibits solid waste facilities from discharging pollutants, dredged or fill material, into waters of the states. And prohibits causing non-point source pollution in violation of applicable legal requirements.	Applicable. However, Montana has promulgated state solid waste requirements: ARM 17.50.1110, ARM 17.50.1204, ARM 17.50.1109.
40 CFR 257.3-4	Prohibits solid waste facilities from contaminating an underground source of drinking water beyond the solid waste boundary or beyond an alternative boundary.	Applicable. However, Montana has promulgated state solid waste requirements: ARM 17.50.1109 and ARM 17.50.1204.

ARARs	Description	Applicable/Relevant and Appropriate?
40 CFR 257.3-8(d)	Regulates access to a solid waste facility so as to prevent public exposure to potential health and safety hazards at the site.	Applicable. However, Montana has promulgated state requirements: ARM 17.50.1108.
State of Montana Solid Waste Requirements		
The Montana Solid Waste Management Act, Section 75-10-201 et seq., MCA, and regulations	Controls the management and disposal of all solid wastes, including mine wastes at sites that are not subject to the mining and reclamation laws.	Relevant and appropriate.
Transportation, ARM 17.50.523	Requires that solid waste be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle.	Relevant and appropriate. Will comply with requirement when transporting waste.
Location Restrictions, ARM 17.50.1009(1)(c)	Prohibits solid waste facilities from discharging pollutants in excess of state standards. A solid waste facility must contain a leachate collection system unless there is no potential for migration of a constituent in Appendix I or II to 40 CFR 258.	Relevant and appropriate. The listed requirements provide sound guidance for management and disposal of mine wastes at the site.
Design Requirements, ARM 17.50.1204	Requires solid waste facilities to either be designed to ensure that MCLs are not exceeded or contain a composite liner and leachate collection system that complies with specified criteria.	Relevant and appropriate. The listed requirements provide sound guidance for management and disposal of mine wastes at the site.
Access Requirements, ARM 17.50.1108	Requires the owner or operator of a solid waste facility to use barriers to control public access.	Relevant and appropriate. The listed requirements provide sound guidance for management and disposal of mine wastes at the site.

ARARs	Description	Applicable/Relevant and Appropriate?
Run-On and Run-Off Control Systems, ARM 17.50.1109	Requires owners or operators of solid waste facilities to design, construct and maintain a run-on control system to prevent flow onto the active portion of the solid waste facility, and a run-off control system to collect and convey stormwater from the active portion of the solid waste facility.	Relevant and appropriate. The listed requirements provide sound guidance for management and disposal of mine wastes at the site.
Surface Water Requirements, ARM 17.50.1110	Prohibits any discharge of a pollutant from a solid waste facility to state waters that violates any requirement of the Montana Water Quality Act, and any discharge from a solid waste facility of a nonpoint source of pollution to waters of the United States that violates any appropriate requirements.	Relevant and appropriate. The listed requirements provide sound guidance for management and disposal of mine wastes at the site.
Liquid Restrictions, ARM 17.50.1111	Prohibits placement of bulk or noncharacterized waste into a solid waste facility.	Relevant and appropriate. The listed requirements provide sound guidance for management and disposal of mine wastes at the site.
Operating Criteria, ARM 17.50.1116	Stipulates requirements for operations of a solid waste facility, including maintenance, fencing, signage, and control of litter, insects, rodents, odor, residues, waste water and air pollutants.	Relevant and appropriate. The listed requirements provide sound guidance for management and disposal of mine wastes at the site.

ARARs	Description	Applicable/Relevant and Appropriate?
Closure Criteria, ARM 17.50.1403	Sets forth closure requirements for solid waste facilities. Solid waste facilities must meet the following criteria: 1) install a final cover that is designed to minimize infiltration and erosion; 2) design and construct the final cover system to minimize infiltration through the closed unit by the use of an infiltration layer that contains a minimum 18 inches of earthen material and has a permeability less than or equal to the permeability of any bottom liner, barrier layer, or natural subsoils or a permeability no greater than 1 X 10^{-5} cm/sec, whichever is less; and 3) minimize erosion of the final cover by the use of a seed bed layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.	Relevant and appropriate. The listed requirements provide sound guidance for management and disposal of mine wastes at the site.
Post-Closure Criteria, ARM 17.50.1404	Provides post- closure care requirements for solid waste facilities that must be conducted for a period sufficient to protect human health and the environment.	Relevant and appropriate. The listed requirements provide sound guidance for management and disposal of mine wastes at the site.
Section 75-10-206, MCA	Allows variances from solid waste regulations if failure to comply with the rules does not result in a danger to public health or safety or compliance with specific rules would produce hardship without producing benefits to the health and safety of the public that outweigh the hardship.	Relevant and appropriate. The listed requirements provide sound guidance for management and disposal of mine wastes at the site.

ARARs	Description	Applicable/Relevant and Appropriate?
Federal and State Mine Reclamation Requirements		
Surface Mining Control and Reclamation Act		
Surface Mining Control and Reclamation Act, 30 USC 1201-1326	Establishes provisions designed to protect the environment from the effects of surface coal mining operations.	Relevant and Appropriate. These regulations require that revegetation be used to stabilize soil covers over reclaimed areas. Reclamation performance standards are currently relevant and appropriate to mining waste sites.
Montana Statutory and Regulatory Requirements		
Montana Strip and Underground Mine Reclamation Act, Section 82-4-201, et seq., MCA and Montana Metal Mining Act, Section 82-4-301, et seq., MCA	Requirements provide adequate remedies for the protection of the environmental life support system from degradation and provide adequate remedies to prevent unreasonable depletion and degradation of natural resources.	Relevant and Appropriate. Substantive portions are relevant and appropriate requirements to reduce undesireable land and surface water conditions detrimental to general welfare, health, safety, ecology, and property rights of the citizens of the state.
Section 82-4-231, MCA	Requires operators to reclaim and revegetate affected lands using most modern technology available.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.
Section 82-4-233, MCA	Operators must plant native vegetation that will yield a diverse, effective, and permanent vegetative cover that is capable of self-regeneration.	Relevant and Appropriate. The listed requirements apply to revegetation of disturbed areas, and require that revegetation be site specific and appropriate to the postmining land use.
Section 82-4-336, MCA	Disturbed areas must be reclaimed to utility and stability comparable to adjacent areas.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.
General Backfilling and Grading Requirements, ARM 17.24.501	Provides general backfilling and grading requirements.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.

ARARs	Description	Applicable/Relevant and Appropriate?
Monitoring for Settlement, ARM 17.24.519	Requires monitoring of settling of regraded areas.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.
General Hydrology Requirements, ARM 17.24.631(1), (2), (3)(a) and (b)	Requires minimization of disturbances to water quality and quantity, depth to groundwater, and location of surface water drainage channels.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.
Water Quality Performance Standards, ARM 17.24.633	Requires that surface drainage from a disturbed area must be treated by the best technology currently available (BTCA).	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.
Reclamation of Drainage Basins, ARM 17.24.634	Requires disturbed drainages be restored to the approximate pre-disturbance configuration. Drainage design must match channel and floodplain dimensions and conditions that approximate the pre-mining configuration and must blend with the undisturbed drainage above and below the area to be reclaimed.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.
Diversions, ARM 17.24.635 through 17.24.637	Sets forth requirements for temporary and permanent diversions.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.
Sediment Control Measures, ARM 17.24.638	Requires that sediment control measures be implemented during operations.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.
Sedimentation Ponds and other Treatment Facilities, ARM 17.24.639	Specifies requirements for location, construction and maintenance of sedimentation ponds.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.

ARARs	Description	Applicable/Relevant and Appropriate?
Discharge Structures, ARM 17.24.640	Requires discharges from sedimentation ponds, permanent and temporary impoundments, and diversions be controlled to reduce erosion, deepening, or enlargement of stream channels, and to minimize disturbance of the hydrologic balance.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.
Acid- and Toxic-Forming Spoils, ARM 17.24.641	Requires drainage from acid- and toxic-forming spoil into ground and surface water be avoided and establishes practices to avoid such drainage.	Relevant and Appropriate. The listed requirements apply to reclamation of a mine site.
Groundwater, ARM 17.24.643 through 17.24.646	Specifies requirements for groundwater protection, groundwater recharge protection, and groundwater and surface water monitoring.	Relevant and Appropriate. Capping, removal, or treatment of the tailings, waste rock, and contaminated materials will provide groundwater protection. Groundwater and surface water monitoring will be conducted according to these requirements.
Soil, ARM 17.24.701 and 17.24.702	Specifies requirements for redistribution and stockpiling of soil for reclamation. Outlines measures to prevent compaction, slippage, erosion, and deterioration of biological soil properties.	Relevant and Appropriate. This requirement relates to stockpiling of topsoil for reuse during reclamation.
Substitute Materials, ARM 17.24.703	Requires any materials used along with soil for final surfacing to be at least as capable as the soil of supporting vegetation and the best medium available in the area.	Relevant and Appropriate. This requirement relates to stockpiling of topsoil for reuse during reclamation.

ARARs	Description	Applicable/Relevant and Appropriate?
Establishment of Vegetation, ARM 17.24.711	Requires that a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area of land to be affected shall be established except on road surfaces and below the low-water line of permanent impoundments, except when another vegetative cover is more appropriate or requested by the landowner.	Relevant and Appropriate. This requirement relates to revegetation during reclamation.
Timing of Seeding and Planting, ARM 17.24.713	Requires seeding and planting of disturbed areas must be conducted during the first appropriate period favorable for planting after final seedbed preparation.	Relevant and Appropriate. This requirement relates to revegetation during reclamation.
Soil Stabilizing Practices, ARM 17.24.714	Requires mulch or cover crop or both must be used until adequate permanent cover can be established.	Relevant and Appropriate. This requirement relates to soil stabilization during revegetation.
Method of Revegetation, ARM 17.24.716	Requires revegetation efforts to be carried out in a manner that encourages prompt vegetation establishment and that avoids the establishment of noxious weeds. Seeding must be done on the contour, whenever possible.	Relevant and Appropriate. This requirement relates to revegetation during reclamation.
Planting of Trees and Shrubs, ARM 17.24.717	Requires planting of tree and shrub species as necessary for local site conditions and climate, to establish a diverse, effective , and permanent vegetative cover of the same seasonal variety native to the affected area and capable of self-regeneration and plant succession, except if an introduced species is necessary or desirable to achieve the approved land use plan.	Relevant and Appropriate. This requirement relates to revegetation during reclamation.

ARARs	Description	Applicable/Relevant and Appropriate?
Soil Amendments, ARM 17.24.718	Requires soil amendments, irrigation, management, fencing, or other measures, if necessary to establish a diverse and permanent vegetative cover.	Relevant and Appropriate. This requirement relates to revegetation during reclamation.
Eradication of Rills and Gullies, ARM 17.24.721	Requires rills or gullies to be filled, graded, or otherwise stabilized and the area be replanted if the rills and gullies are disrupting the reestablishment of the vegetative cover or contributing to a violation of water quality standards.	Relevant and Appropriate. This requirement relates to revegetation during reclamation.
Monitoring, ARM 17.24.723	Requires operators to conduct periodic measurements of vegetation, soils, water, and wildlife and to initiate corrective actions when necessary.	Relevant and Appropriate. This requirement relates to revegetation during reclamation.
Revegetation Success Criteria, ARM 17.24.724	Specifies that revegetation success must be measured against approved technical standards or unmined reference areas.	Relevant and Appropriate. This requirement relates to revegetation during reclamation.
Vegetation Measurements, ARM 17.24.726	Requires standard and consistent field and laboratory methods to obtain and evaluate revegetated area data with reference area data and/or technical standards. Also sets forth the required methods for measuring productivity.	Relevant and Appropriate. This requirement relates to revegetation during reclamation.
Analysis for Toxicity, ARM 17.24.731	Requires comparative chemical analyses if toxicity to plants or animals on the revegetated area due to effects of the disturbance is suspected.	Relevant and Appropriate. Toxicity testing may be conducted if toxic conditions to plants or animals are suspected.

ARARs	Description	Applicable/Relevant and Appropriate?
Protection and Enhancement of Fish and Wildlife, ARM 17.24.751	Sets forth requirements to protect and enhance fish and wildlife habitat.	Relevant and Appropriate. Compliance with this ARAR requires consultation with the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife, and Parks. Further consultation will occur during reclamation design and construction.
Air Requirements		
Airborne Particulate Matter, ARM 17.8.308(1), (2) and (3)	Prohibits production, handling, transportation, or storage of any material, use of any street, road, or parking lot, or operation of a construction site or demolition project unless measures are taken to control emissions of airborne particles. Emissions shall not exhibit an opacity exceeding 20% or greater averaged over 6 consecutive minutes from any stationary source.	Applicable. This requirement sets emission standards for airborne particulate matter.
Visible Air Contaminants, ARM 17.8.304(2)	Provides that emissions into the outdoor atmosphere shall not exhibit an opacity of 20% or greater averaged over 6 consecutive minutes.	Applicable. This requirement sets emission standards for visible air contaminants.
Materials Prohibited from Open Burning, ARM 17.8.604	Prohibits disposal of certain wastes by open burning, including oil or petroleum products, RCRA hazardous wastes, chemicals, and wood and wood byproducts that have been coated, painted, stained, treated or contaminated by a foreign material. References the requirements of ARM 12.8.611 and 17.8.612 for appropriate open burning of waste.	Applicable. Open burning may be applicable for cleared and grubbed debris.

ARARs	Description	Applicable/Relevant and Appropriate?
Fugitive Dust Emissions, ARM 17.24.761	Specifies a range of measures for controlling fugitive dust emissions during mining and reclamation activities, including but not limited to paving, watering, chemically stabilizing, frequently compacting and scraping roads, promptly removing rock, soil, or other dust-forming debris from roads, restricting vehicle speeds, revegetating, mulching, or otherwise stabilizing the surface of areas adjoining roads, restricting unauthorized vehicle travel, minimizing the area of disturbed land, and promptly revegetating regraded lands.	Relevant and Appropriate. Will comply with these requirements by requiring dust control and suppression.
Noxious Weeds		
Noxious Weeds, Section 7-22-2101(8)(a), MCA	Defines "noxious weeds" as any exotic plant species that may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses, or that may harm native plant communities.	Applicable. This requirement relates to establishment of seed during revegetation.
To Be Considered (TBC) Documents		
Other Laws (Non-Exclusive List)	Provides a reminder of other legal requirements for reclamation activity that must be addressed.	
Other Federal Laws		
Occupational Safety and Health Regulations, 29 CFR Part 1910 and Part 1926	Protects workers during the completion of reclamation.	
Other State Laws		

ARARs	Description	Applicable/Relevant and Appropriate?
Groundwater Act, Section 85-2-501 *et seq.* , MCA, ARM 17.30.601 *et seq., S* ection 85-2-505, MCA, Section 85-2-516, MCA	Regulates the use of groundwater and provides measures to protect it from depletion or contamination. Requires that wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.	Capping, removal, or treatment of the tailings, waste rock, and contaminated materials will provide protection of groundwater and reduce further degradation of groundwater. New wells will be constructed and maintained in a manner to prevent waste and contamination.
Water Rights, Section 85-2-101, MCA; Parts 3 and 4 of Title 85, Chapter 2, MCA; Section 85-2-301, MCA; Section 85-2-302, MCA; Section 85-2-306, MCA; Section 85-2-311, MCA; Section 85-2-402, MCA; and Section 85-2-412, MCA	Specifies that all waters within the state are the state's property, and may be appropriated for beneficial uses; sets out requirements for obtaining water rights and appropriating and utilizing water; regulates the appropriation of water and groundwater; and provides that any surplus of water diverted from a stream must be returned to the stream.	
Occupational Health Act, ARM 17.74.101 and 17.74.102	Regulates the exposure of workers to occupational noise and air contamination.	These rules are pertinent only to limited categories of workers and for most workers the similar federal standards in 29 CFR § 1910.95 and 29 CFR § 1910.1000 apply.
Montana Safety Act, Sections 50-71-201, 202, and 203, MCA	Requires that every employer must provide and maintain a safe place of employment and enforces the use of safety devices and safeguards.	The site contractors must do everything reasonably necessary to protect the life and safety of its employees.
Employee and Community Hazardous Chemical Information, Sections 50-78-201, 202, and 204, MCA	Requires each employer to post notice of employee rights, maintain a list of chemical names, indicate location of chemicals in the work place, and train employees in the proper handling of the chemicals.	Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals during response actions.

APPENDIX D

HUMAN HEALTH RISK ASSESSMENT

Table D-1. Determination of the Soil Contaminants of Potential Concern (COPCs) Black Pine Mine

	Surface waste rock mg/kg[b]	Surface tailings mg/kg[c]	*COPC Criteria from EPA 2004*[d]				Above soil clean-up guidelines (Table 7-10 DEQ RBCG)?[d]	COPCs for Black Pine Mine?	Reasoning
			Present at site?	Above background?	Greater than detection limit?	Acceptable QA/QC?			
Antimony	20.60	876.00	Y	Y	Y		Y	Y	Above cleanup
Arsenic	27.80	786.00	Y	Y	Y		Y	Y	Above cleanup
Barium	218.30	334.40	Y	Y	Y		N	N	
Cadmium	0.40	17.00	Y	Y	Y		Y	Y	Above cleanup
Chromium III	4.30	5.60	Y	Y	Y		N	N	
Cobalt	5.90	4.10	Y	N	Y		N	N	
Copper	63.00	2,553.30	Y	Y	Y		Y	Y	Above cleanup
Cyanide[a]	NA	NA	Unk					Unk	
Iron	7,980.00	23,933.0	Y	Y	Y		NA	Y	Above background
Lead	253.30	3,572.90	Y	Y	Y		Y	Y	Above cleanup
Manganese	772.70	303.60	Y	Y	Y		Y	Y	Above cleanup
Mercury	NA	26.40	Y	Y	Y		N	Y	
Nickel	4.90	5.10	Y	N	Y		N	N	
Silver	1.20	67.80	Y	Y	Y		NA	Y	Above background
Zinc	163.50	405.70	Y	Y	Y		N	Y	

Bold = COPC
[a] No soil sample results available
[b] Most concentrated waste area, Combination Mine Site, arithmetic mean for waste rock n=3
[c] Most concentrated tailings area, Combination Mill Site, arithmetic mean for tailings, n=10
[d] Based on DEQ RBCG Tables 7-10 and/or four criteria established by the USEPA RAGS 2004 for COPC determination
Unk = Unkown
NA = Not Applicable

Table D-2. Determination of the Water Contaminants of Potential Concern (COPCs) Black Pine Mine

	Surface water µg/L[b, c]	*COPC Criteria from EPA 2004*[d]				Above water clean-up guidelines (Table 7-11 DEQ RBCG)?[d]	Above MT DEQ-7 WQ Standards (DEQ 2010)	COPCs for Black Pine Mine?	Reasoning
		Present at site?	Above background?	Greater than detection limit?	Acceptable QA/QC?				
Antimony	117.00	Y	Y	Y		Y	Y	Y	Above clean-up
Arsenic	36.00	Y	Y	Y		Y	Y	Y	Above clean-up
Barium	86.70	Y	N	Y		N	N	N	
Cadmium	1.20	Y	Y	Y		N	N	Y	
Chromium III	2.90	Y	Y	Y		N	Unk	Y	
Cobalt[a]	NA	Unk	Unk	Unk		Unk	Unk	Unk	
Copper	221.00	Y	Y	Y		N	N	Y	
Cyanide[a]	NA	Unk	Unk	Unk		Unk	Unk	Unk	
Iron	2,990.00	Y	Y	Y		NA	N	Y	Above secondary standard
Lead	49.00	Y	Y	Y		Y	Y	Y	Above clean-up
Manganese	52.60	Y	Y	Y		Y	Y	Y	Above clean-up
Mercury	2.52	Y	Y	Y		Y	Y	Y	Above clean-up
Nickel	4.20	Y	Y	Y		N	N	Y	
Silver	0.64	Y	N	N		NA	N	Y	Above aquatic standard
Zinc	63.10	Y	Y	Y		Y	N	Y	Above clean-up

Bold = COPC
[a] No water sample results available
[b] Combined AOC maximum point concentrations for surface water
[c] Does not include adit discharge per MTDEQ RBCG 1996
[d] Based on DEQ RBCG Tables 7-11 and/or four criteria established by the USEPA RAGS 2004 for COPC determination
Unk = Unkown
NA = Not Applicable

Table D-3. Recreational Gold Panner/Rock Hound Adult Exposure to Tailings, Waste Rock, and Soils and the Resulting Hazard Quotients
Black Pine Mine

COPCs	Exposure point concentration[a] (EPCs) (mg/kg)	Exposure (mg/kg-day)			Chronic RfD (mg/kgday)		RfC (mg/m^3)	Hazard Quotient (HQ)[b]					Source for Toxic Endpoints
		Ingestion	Dermal	Inhalation	Oral	Dermal	Inhalation	Oral	Dermal	Inhalation	Sum of HQs	Percentage of Total HQ	
Antimony	**875.99**	**4.11E-04**	**9.94E-05**	**2.88E-09**	**4.00E-04**	**6.00E-05**	**NA**	**1.03E+00**	**1.66E+00**		**2.69E+00**	**41.82%**	EPA IRIS 1991
Arsenic	**786.02**	**3.69E-04**	**2.68E-04**	**2.58E-09**	**3.00E-04**	**3.00E-04**	**NA**	**1.23E+00**	**8.92E-01**		**2.12E+00**	**33.05%**	EPA IRIS 1998
Cadmium[c]	16.99	7.98E-06	1.93E-07	5.58E-11	1.00E-03	2.50E-05	NA	7.98E-03	7.72E-03		1.57E-02	0.24%	EPA IRIS 1994
Copper	2,553.30	1.20E-03	2.90E-04	8.39E-09	4.00E-02	4.00E-02	NA	3.00E-02	7.25E-03		3.72E-02	0.58%	EPA HEAST 1997
Iron	23,933.00	1.12E-02	2.72E-03	7.87E-08	7.00E-01	7.00E-01	NA	1.61E-02	3.88E-03		1.99E-02	0.31%	EPA PPRTV 2006
Lead	**3,572.93**	**1.68E-03**	**4.06E-04**	**1.17E-08**	**1.50E-03**	**1.50E-03**	**4.30E-04**	**1.12E+00**	**2.70E-01**	**2.73E-05**	**1.39E+00**	**21.63%**	DEQ RBCG; CALEPA 2005
Manganese	772.67	3.63E-04	8.77E-05	2.54E-09	1.40E-01	5.60E-03	5.00E-05	2.59E-03	1.57E-02	5.08E-05	1.83E-02	0.29%	EPA IRIS 1997
Mercury	26.45	1.24E-05	3.00E-06	8.69E-11	1.60E-04	3.00E-04	3.00E-04	7.76E-02	1.00E-02	2.90E-07	8.76E-02	1.36%	EPA IRIS 1995; CALEPA 2005
Silver	67.80	3.18E-05	7.69E-06	2.23E-10	5.00E-03	2.00E-04	NA	6.37E-03	3.85E-02		4.48E-02	0.70%	EPA IRIS 1996
Zinc	405.66	1.91E-04	4.60E-05	1.33E-09	3.00E-01	3.00E-01	NA	6.35E-04	1.53E-04		7.89E-04	0.01%	EPA IRIS 2005
						Total HQ		3.52E+00	2.90E+00	7.84E-05	6.42E+00		
						% of Total Exposure HQ		54.80%	45.20%	0.00%			

Bold = COC

[a] Maximum concentration per COPC of the arithmetic mean of the COPC concentration in tailings from the Combination Mill AOC or waste rock from Combination Mine AOC

[b] HQ = Exposure/Chronic Reference Dose (RfD)

[c] Cadmium and Manganese oral RfD is for specific to food/dietary (solid) intake

NA = Not Applicable

Table D-4. Recreational Gold Panner/Rock Hound Child Exposure to Tailings, Waste Rock, and Soils and the Resulting Hazard Quotients
Black Pine Mine

COPCs	Exposure point conc.[a] (EPCs) (mg/kg)	Exposure (mg/kg-day)			Chronic RfD (mg/kg-day)		RfC (mg/m^3)	Hazard Quotient (HQ)[b]					Source for Toxic Endpoints
		Ingestion	Dermal	Inhalation	Oral	Dermal	Inhalation	Oral	Dermal	Inhalation	Sum of HQs	% of Total HQ	
Antimony	**876.00**	**8.00E-04**	**1.44E-04**	**1.13E-08**	**4.00E-04**	**6.00E-05**	**NA**	**2.00E+00**	**2.40E+00**		**4.40E+00**	**39.83%**	EPA IRIS 1991
Arsenic	**786.00**	**7.18E-04**	**3.88E-04**	**1.02E-08**	**3.00E-04**	**3.00E-04**	**NA**	**2.39E+00**	**1.29E+00**		**3.68E+00**	**33.36%**	EPA IRIS 1998
Cadmium[c]	17.00	1.55E-05	2.79E-07	2.19E-10	1.00E-03	2.50E-05	NA	1.55E-02	1.12E-02		2.67E-02	0.24%	EPA IRIS 1994
Copper	2,553.30	2.33E-03	4.20E-04	3.30E-08	4.00E-02	4.00E-02	NA	5.83E-02	1.05E-02		6.88E-02	0.62%	EPA HEAST 1997
Iron	23,933.00	2.19E-02	3.93E-03	3.09E-07	7.00E-01	7.00E-01	NA	3.12E-02	5.62E-03		3.68E-02	0.33%	EPA PPRTV 2006
Lead	**3,572.90**	**3.26E-03**	**5.87E-04**	**4.61E-08**	**1.50E-03**	**1.50E-03**	**4.30E-04**	**2.18E+00**	**3.92E-01**	**1.07E-04**	**2.57E+00**	**23.24%**	DEQ RBCG; CALEPA 2005
Manganese	772.70	7.06E-04	1.27E-04	9.98E-09	1.40E-01	5.60E-03	5.00E-05	5.04E-03	2.27E-02	2.00E-04	2.79E-02	0.25%	EPA IRIS 1997
Mercury	26.40	2.42E-05	4.35E-06	3.42E-10	1.60E-04	3.00E-04	3.00E-04	1.51E-01	1.45E-02	1.14E-06	1.65E-01	1.50%	EPA IRIS 1995; CALEPA 2005
Silver	67.80	6.19E-05	1.11E-05	8.75E-10	5.00E-03	2.00E-04	NA	1.24E-02	5.57E-02		6.81E-02	0.62%	EPA IRIS 1996
Zinc	405.66	3.70E-04	6.67E-05	5.24E-09	3.00E-01	3.00E-01	NA	1.23E-03	2.22E-04		1.46E-03	0.01%	EPA IRIS 2005
							Total HQ	6.84E+00	4.20E+00	3.08E-04	1.10E+01		
							% of Total Exposure HQ	61.94%	38.06%	0.00%			

Bold = COC
[a] Maximum concentration per COPC of the arithmetic mean of the COPC concentration in tailings from the Combination Mill AOC or waste rock from Combination Mine
[b] HQ = Exposure/Chronic Reference Dose (RfD)
[c] Cadmium and Manganese oral RfD is for specific to food/dietary (solid) intake
NA = Not Applicable

Table D-5. Recreational Gold Panner/Rock Hound Adult Exposure to Surface Water, Excluding Seep Discharge and the Resulting Hazard Quotients
Black Pine Mine

COPCs	Exposure point conc.[a] (EPCs) (µg/L)	Exposure (mg/kg-day)		Chronic RfD (mg/kg-day)		Hazard Quotient (HQ)[b]				Source for Toxic Endpoints
		Ingestion	Dermal	Oral	Dermal	Oral	Dermal	HQ Total	% of Total HQ	
Antimony	117.00	2.29E-04	3.43E-06	4.00E-04	6.00E-05	5.72E-01	5.72E-02	6.30E-01	63.55%	EPA IRIS 1991
Arsenic	36.00	7.05E-05	1.06E-06	3.00E-04	3.00E-04	2.35E-01	3.52E-03	2.38E-01	24.06%	EPA IRIS 1998
Cadmium[c]	1.20	2.35E-06	3.52E-08	5.00E-04	2.50E-05	4.70E-03	1.41E-03	6.11E-03	0.62%	EPA IRIS 1994
Chromium III	2.90	5.68E-06	8.51E-08	1.50E+00	1.95E-02	3.78E-06	4.37E-06	8.15E-06	0.00%	EPA IRIS 1998
Copper	221.00	4.32E-04	6.49E-06	4.00E-02	4.00E-02	1.08E-02	1.62E-04	1.10E-02	1.11%	EPA HEAST 1997
Iron	2,990.00	5.85E-03	8.78E-05	7.00E-01	7.00E-01	8.36E-03	1.25E-04	8.48E-03	0.86%	EPA PPRTV 2006
Lead	49.00	9.59E-05	1.44E-07	1.50E-03	1.50E-03	6.39E-02	9.59E-05	6.40E-02	6.46%	DEQ RBCG; CALEPA 2005
Manganese[d]	52.60	1.03E-04	1.54E-06	1.40E-01	5.60E-03	7.35E-04	2.76E-04	1.01E-03	0.10%	EPA IRIS 1997
Mercury	2.52	4.93E-06	7.40E-08	1.60E-04	3.00E-04	3.08E-02	2.47E-04	3.11E-02	3.14%	EPA IRIS 1995; CALEPA 2005
Nickel	4.20	8.22E-06	2.47E-08	2.00E-02	8.00E-04	4.11E-04	3.08E-05	4.42E-04	0.04%	EPA IRIS 1996; ATSDR 2005
Silver	0.64	1.25E-06	1.13E-08	5.00E-03	2.00E-04	2.50E-04	5.64E-05	3.07E-04	0.03%	EPA IRIS 1996
Zinc	63.10	1.23E-04	1.11E-06	3.00E-01	3.00E-01	4.12E-04	3.70E-06	4.15E-04	0.04%	EPA IRIS 2005
					Total HQ	9.28E-01	6.32E-02	9.91E-01		
					% of Total HQ	93.62%	6.38%			

Bold = COC

[a] Maximum sample point concentration for surface waters, excluding seep discharge

[b] HQ = Exposure/Chronic Reference Dose (RfD)

[c] Cadmium oral RfD is for specific to water intake

[d] Manganese oral RfD is specific to dietary intake

Table D-6. Recreational Gold Panner/Rock Hound Child Exposure to Surface Water, Excluding Seep Discharge and the Resulting Hazard Quotients
Black Pine Mine

COPCs	Exposure point conc.[a] (EPCs) (µg/L)	Exposure (mg/kg-day)		Chronic RfD (mg/kg-day)		Hazard Quotient (HQ)[b]				Source for Toxic Endpoints
		Ingestion	Dermal	Oral	Dermal	Oral	Dermal	Sum of HQs	% of Total HQ	
Antimony	**117.00**	**1.07E-03**	**4.81E-06**	**4.00E-04**	**6.00E-05**	**2.67E+00**	**8.01E-02**	**2.75E+00**	**62.28%**	EPA IRIS 1991
Arsenic	**36.00**	**3.29E-04**	**1.48E-06**	**3.00E-04**	**3.00E-04**	**1.10E+00**	**4.93E-03**	**1.10E+00**	**24.92%**	EPA IRIS 1998
Cadmium[c]	1.20	1.10E-05	4.93E-08	5.00E-04	2.50E-05	2.19E-02	1.97E-03	2.39E-02	0.54%	EPA IRIS 1994
Chromium III	2.90	2.65E-05	1.19E-07	1.50E+00	1.95E-02	1.77E-05	6.11E-06	2.38E-05	0.00%	EPA IRIS 1998
Copper	221.00	2.02E-03	9.08E-06	4.00E-02	4.00E-02	5.05E-02	2.27E-04	5.07E-02	1.15%	EPA HEAST 1997
Iron	2,990.00	2.73E-02	1.23E-04	7.00E-01	7.00E-01	3.90E-02	1.76E-04	3.92E-02	0.89%	EPA PPRTV 2006
Lead	49.00	4.47E-04	2.01E-07	1.50E-03	1.50E-03	2.98E-01	1.34E-04	2.98E-01	6.76%	DEQ RBCG; CALEPA 2005
Manganese[d]	52.60	4.80E-04	2.16E-06	1.40E-01	5.60E-03	3.43E-03	3.86E-04	3.82E-03	0.09%	EPA IRIS 1997
Mercury	2.50	2.30E-05	1.04E-07	1.60E-04	3.00E-04	1.44E-01	3.45E-04	1.44E-01	3.26%	EPA IRIS 1995; CALEPA 2005
Nickel	4.20	3.84E-05	3.45E-08	2.00E-02	8.00E-04	1.92E-03	4.32E-05	1.96E-03	0.04%	EPA IRIS 1996; ATSDR 2005
Silver	0.60	5.84E-06	1.58E-08	5.00E-03	2.00E-04	1.17E-03	7.89E-05	1.25E-03	0.03%	EPA IRIS 1996
Zinc	63.10	5.76E-04	1.56E-06	3.00E-01	3.00E-01	1.92E-03	5.19E-06	1.93E-03	0.04%	EPA IRIS 2005
				Total HQs		4.33E+00	8.84E-02	4.42E+00		
				% of Total HQ		98.00%	2.00%			

Bold = COC
[a] Maximum sample point concentration for surface waters, excluding seep discharge
[b] HQ = Exposure/Chronic Reference Dose (RfD)
[c] Cadmium oral RfD is for specific to water intake
[d] Manganese oral RfD is specific to dietary intake

Table D-7. Recreational Gold Panner/Rock Hound Adult Exposure to Sediment and the Resulting Hazard Quotients Black Pine Mine

COPCs	Exposure Point Concentration in Sediment[a] (EPCs) (mg/kg)	Exposure[b] (mg/kg-day)	Chronic RfD (mg/kg-day)	Hazard Quotient (HQ)[c]
		Ingestion	Oral	Oral
Antimony	**891.00**	**4.18E-04**	**4.00E-04**	**1.05E+00**
Arsenic	**642.00**	**3.02E-04**	**3.00E-04**	**1.01E+00**
Cadmium[d]	32.50	1.53E-05	1.00E-03	1.53E-02
Copper	5320.00	2.50E-03	4.00E-02	6.25E-02
Iron	37400.00	1.76E-02	7.00E-01	2.51E-02
Lead	**4240.00**	**1.99E-03**	**1.50E-03**	**1.33E+00**
Manganese[e]	2780.00	1.31E-03	1.40E-01	9.33E-03
Mercury	57.90	2.72E-05	1.60E-04	1.70E-01
Silver	213.00	1.00E-04	5.00E-03	2.00E-02
Zinc	768.00	3.61E-04	3.00E-01	1.20E-03

Bold =COC
[a] Maximum exposure point concentration in sediments
[b] Calculations use Gold Panner/ Rock Hound Exposure Parameters
[c] HQ = Exposure/Chronic Reference Dose (RfD)
[d] Cadmium oral RfD is for specific to food (solid) intake
[e] Manganese oral RfD is specific to dietary intake

Table D-8. Recreational Gold Panner/Rock Hound Child Exposure to Sediment and the Resulting Hazard Quotients Black Pine Mine

COPCs	Exposure Point Concentration in Sediment[a] (EPCs) (mg/kg)	Exposure[b] (mg/kg-day)	Chronic RfD (mg/kg-day)	Hazard Quotient (HQ)[c]
		Ingestion	Oral	Oral
Antimony	**891.00**	**8.14E-04**	**4.00E-04**	**2.03E+00**
Arsenic	**642.00**	**5.86E-04**	**3.00E-04**	**1.95E+00**
Cadmium[d]	32.50	2.97E-05	1.00E-03	2.97E-02
Copper	5320.00	4.86E-03	4.00E-02	1.21E-01
Iron	37400.00	3.42E-02	7.00E-01	4.88E-02
Lead	**4240.00**	**3.87E-03**	**1.50E-03**	**2.58E+00**
Manganese[e]	2780.00	2.54E-03	1.40E-01	1.81E-02
Mercury	57.90	5.29E-05	1.60E-04	3.30E-01
Silver	213.00	1.95E-04	5.00E-03	3.89E-02
Zinc	768.00	7.01E-04	3.00E-01	2.34E-03

Bold =COC
[a] Maximum exposure point concentration in sediments
[b] Calculations use Gold Panner/ Rock Hound Expsoure Parameters
[c] HQ = Exposure/Chronic Reference Dose (RfD)
[d] Cadmium oral RfD is for specific to food (solid) intake
[e] Manganese oral RfD is specific to dietary intake

Table D-9. Recreational Fisherman Adult Exposure to Fish Consumption and the Resulting Hazard Quotients Black Pine Mine

COPCs	Exposure Point Concentration in Water[a] (EPCs) (µg/L)	Exposure[b] (mg/kg-day)	Chronic RfD (mg/kg-day)	Hazard Quotient (HQ)[c]
		Ingestion	Oral	Oral
Antimony	117.00	2.17E-05	4.00E-04	5.43E-02
Arsenic	36.00	2.94E-04	3.00E-04	9.81E-01
Cadmium[d]	1.20	1.81E-05	1.00E-03	1.81E-02
Chromium III	2.90	8.62E-06	1.50E+00	5.75E-06
Copper	221.00	8.21E-03	4.00E-02	2.05E-01
Iron	2,990.00	5.55E-04	7.00E-01	7.93E-04
Lead	49.00	4.46E-04	1.50E-03	2.97E-01
Manganese[e]	52.60	4.69E-04	1.40E-01	3.35E-03
Mercury	**2.52**	**2.57E-03**	**1.60E-04**	**1.61E+01**
Nickel	4.20	3.67E-05	2.00E-02	1.83E-03
Silver	0.64	1.19E-07	5.00E-03	2.38E-05
Zinc	63.10	5.51E-04	3.00E-01	1.84E-03

Bold = COC
[a] Maximum exposure point concentration in surface waters excluding seep discharge
[b] Exposure calculations use Fisherman Exposure Parameters
[c] HQ = Exposure/Chronic Reference Dose (RfD)
[d] Cadmium oral RfD is for specific to food (solid) intake
[e] Manganese oral RfD is specific to dietary intake

Table D-10. Estimated Lifetime Cancer Risks for Gold Panner/Rock Hound Recreationalist from Tailings, Waste Rock, and Soils
Black Pine Mine

Carcinogen COPCs	Exposure Point Concentration[a] (mg/kg)	Lifetime Exposure (mg/kg-day)			Slope Factor (mg/kg-d)$^{-1}$ or (ug/cu.m)			Estimated Lifetime Cancer Risk[b]				Source
		Ingestion	Dermal	Inhalation	Oral	Dermal	Inhalation	Oral	Dermal	Inhalation	Total ELCR	
Arsenic	**786.02**	**1.88E-04**	**1.25E-04**	**1.76E-09**	**1.50E+00**	**1.50E+00**	**1.50E+00**	**2.82E-04**	**1.87E-04**	**2.63E-09**	**4.70E-04**	EPA IRIS 1998
Cadmium	16.99	4.07E-06	9.01E-08	3.80E-11	NA	NA	1.80E-03			6.83E-14	6.83E-14	EPA IRIS 1994
Lead	**3,572.93**	**8.55E-04**	**1.89E-04**	**7.98E-09**	**8.50E-03**	**8.50E-03**	**NA**	**7.27E-06**	**1.61E-06**		**8.88E-06**	DEQ RBCG; CALEPA 2005

Bold = Carcinogen COC
[a] Maximum concentration per COPC of the arithmetic mean of the COPC concentration in tailings from the Combination Mill AOC or waste rock from Combination Mine AOC
[b] Estimated Lifetime Cancer Risk = Lifetime Exposure * Slope Factor; Cancer Risk greater than 1x10-6 is unacceptable (EPA 2004b)

Table D-11. Estimated Lifetime Cancer Risks for Gold Panner/Rock Hound Recreationalist from Surface Waters, Excluding Seep Discharge
Black Pine Mine

Carcinogen COPCs	Exposure Point Concentration[a] (µg/L)	Lifetime Exposure (mg/kg-day)		Slope Factor (mg/kg-d)$^{-1}$ or (ug/cu.m)		Estimated Lifetime Cancer Risk[b]			Source
		Ingestion	Dermal	Oral	Dermal	Oral	Dermal	Total ELCR	
Arsenic	**36.00**	**5.23E-05**	**4.89E-07**	**1.50E+00**	**1.50E+00**	**7.85E-05**	**7.34E-07**	**7.92E-05**	EPA IRIS 1995; CALEPA 2005
Cadmium	1.20	1.74E-06	1.63E-08	NA	NA				EPA IRIS 1996
Lead	49.00	3.84E-05	1.73E-08	8.50E-03	8.50E-03	3.26E-07	1.47E-10	3.26E-07	DEQ RBCG; CALEPA 2005

Bold = Carcinogen COC
[a] Maximum sample point concentration for surface waters, excluding adit discharge
[b] Estimated Lifetime Cancer Risk = Lifetime Exposure * Slope Factor; Cancer Risk greater than 1x10-6 is unacceptable (EPA 2004b)

Table D-12. Estimated Lifetime Cancer Risks for Gold Panner/Rock Hound Recreationalist from Sediment Black Pine Mine

Carcinogen COPCs	Exposure Point Concentration[a] (mg/kg)	Lifetime Exposure (mg/kg-day) Ingestion	Slope Factor $(mg/kg\text{-}d)^{-1}$ or (ug/cu.m) Oral	Estimated Lifetime Cancer Risk[b] Oral	Source
Arsenic	**642.00**	**1.54E-04**	**1.50E+00**	**2.30E-04**	EPA IRIS 1998
Cadmium	32.50	7.78E-06	NA		EPA IRIS 1994
Lead	**4240.00**	**1.01E-03**	**8.50E-03**	**8.62E-06**	DEQ RBCG; CALEPA 2005

Bold = Carcinogen COC

[a] Maximum exposure point concentration in sediment

[b] Estimated Lifetime Cancer Risk = Lifetime Exposure * Slope Factor; Cancer Risk greater than 1x10-6 is unacceptable (EPA 2004b)

Table D-13. Estimated Lifetime Cancer Risks for Gold Panner/Rock Hound Recreationalist from Fish Consumption Black Pine Mine

Carcinogen COPCs	Exposure Point Concentration[a] (µg/L)	Exposure (mg/kg-day) Ingestion	Slope Factor $(mg/kg\text{-}d)^{-1}$ Oral	Estimated Lifetime Cancer Risk[b]	Source
Arsenic	**117.00**	**4.10E-04**	**1.50E+00**	**6.15E-04**	EPA IRIS 1991
Cadmium	86.70	3.80E-02	NA		EPA IRIS 2005; EPA HEAST 1997
Lead	**2,990.00**	**1.17E-02**	**8.50E-03**	**9.91E-05**	EPA PPRTV 2006

Bold = Carcinogen COC

[a] Maximum exposure point concentration in surface waters, excluding seep discharge

[b] Estimated Lifetime Cancer Risk = Lifetime Exposure * Slope Factor; ELCR greater than $1x10^{-6}$ is unacceptable (EPA 2004b)

APPENDIX E

ECOLOGICAL RISK ASSESSMENT

Table E-1. Exposure Point Concentrations used in Exposure Calculations for the three different scenarios in the Black Pine Mine Ecological Risk Assessment
Black Pine Mine

COPC	Aquatic Life Surface Water Conc. µg/L[b]	Associated Water Hardness mg/L[c] $CaCO^3$	Sediment Conc. mg/kg[d]	Deer Ingestion Water Conc. µg/L[e]	Deer Ingestion/ Phytotoxicity Soil, Tailings, or Waste Rock Surface Conc. mg/kg[f]	Contaminant of Potential Concern
Aluminum	----	25	---	----	----	Unk
Antimony	117.00	25	891.00	117.00	875.99	Y
Arsenic	36.00	25	642.00	54.70	786.02	Y
Barium	86.70	25	800.00	86.70	334.37	N
Cadmium	1.20	25	32.50	215.00	16.99	Y
Chromium III	2.90	25	25.8	2.90	5.60	Y
Colbalt[a]	NA	25	23.7	NA	5.87	N
Copper	221.00	25	5320.00	20900.00	2553.30	Y
Iron	2990.00	25	37400.00	41400.00	23933.00	Y
Lead	49.00	25	4240.00	363.00	3572.93	Y
Manganese	52.60	25	2780.00	6640.00	772.67	Y
Mercury	2.52	25	57.90	2.52	26.45	Y
Nickel	4.20	25	31.20	4.20	5.08	Y
Silver	0.64	25	213.00	0.64	67.77	Y
Zinc	63.10	25	768.00	20400.00	405.66	Y
Note: Minimum hardness=25 mg/L; Maximum=400 mg/L						

Bold = COPC
[a] No analytical results available, NA
[b] Maximum concentration per COPC for surface water, excluding seep discharge
[c] Hardness results for surface water were all < 25 mg/kg CaCO3; therefore the minimum hardness value of 25 was used
[d] Maximum concentration per COPC for sediment
[e] Maximum concentration per COPC for surface waters including seep discharge
[f] Maximum concentration per COPC of the arithmetic means from the COPC concentrations in tailings at the Combination Mill AOC or waste rock at the Combination Mine AOC
Unk = Unkown

Table E-2. Aquatic Ecological Impact Quotients for Acute and Chronic Health Effects from Exposure to Surface Waters, excluding Seep Discharge Black Pine Mine

COPC	Acute Criteria* µg/L	Chronic Criteria* µg/L	Acute Ecological Impact Quotient (EQ)	Chronic Ecological Impact Quotient (EQ)
Aluminum	750.0	87.0	NA	NA
Antimony	NA	NA	NA	NA
Arsenic	340.0	150.0	0.106	0.240
Cadmium**	0.52	0.097	**2.303**	**12.385**
Chromium III**	579.3	27.7	0.005	0.105
Copper**	3.79	2.85	**58.285**	**77.450**
Iron	NA	1000.0	NA	2.990
Lead**	13.98	0.545	**3.505**	**89.944**
Manganese	NA	NA	NA	NA
Mercury	1.7	0.91	**1.482**	**2.769**
Nickel**	145.2	16.1	0.029	0.260
Silver**	0.374	NA	**1.711**	NA
Zinc**	37.0	37.0	**1.705**	**1.705**
TOTAL			69.130	187.848

Bold = COC
*Aquatic Life Standards are from DEQ's Circular DEQ-7 Montana Numeric Water Quality Standards (WQB-7), 2010
**Aquatic Life Standards did not have to be adjusted for hardness, all hardness measured in chemical analyses of surface water samples taken from Black Pine Mine Site resulted in values less than 25 mg/L $CaCO_3$.

Table E-3. Aquatic Ecological Impact Quotients for Moderate Range Biological Effects from Exposure to Sediments
Black Pine Mine

COPC	SQG Effects Range-Moderate* (mg/kg)	Sediment Ecological Impact Quotient (EQ)
Arsenic	70.0	**9.17**
Cadmium	906.0	0.04
Chromium III	370.0	0.07
Copper	270.0	**19.70**
Lead	218.0	**19.45**
Mercury	0.7	**81.55**
Nickel	51.6	0.60
Silver	3.7	**57.57**
Zinc	410.0	**1.87**
TOTAL		190.02

Bold = COC
*From NOAA, 1999; Sediment quality guidelines-moderate effects range for biological effects in aquatic life

Table E-4. Deer Ingestion Ecological Impact Quotients for Whitetail Deer as the Representative Terrestrial Wildlife Species from Ingestion of Soil and Surface Water, including Seep Discharge
Black Pine Mine

COPC	Deer Intake Dose Est. Soil and Water [a, b] (mg/kg-day) E_{COPC}	NOAELs or Toxic Thresholds Values[c] (mg/kg-day)	Deer Ingestion EQ	Toxic Endpoint Source
Aluminum	NA	0.294	NA	Sample et. al, 1996
Antimony	1.006	0.019	52.956	Sample et. al, 1996
Arsenic	0.900	0.019	47.343	Sample et. al, 1996
Barium	0.387	1.5	0.258	Sample et. al, 1996
Cadmium	0.033	0.271	0.123	Sample et. al, 1996
Chromium	0.007	768	0.000	Sample et. al, 1996
Copper	4.279	4.3	0.995	Sample et. al, 1996
Lead	4.096	0.005	819.274	ATSDR, 1993
Manganese	1.316	25	0.053	Sample et. al, 1996
Mercury	0.030	0.36	0.084	Sample et. al, 1996
Nickel	0.006	11.22	0.001	Sample et. al, 1996
Zinc	1.798	44.9	0.040	Sample et. al, 1996
TOTAL			921.1266	

Bold = COC

[a] Exposure parameters were obtained from Sample and Suter II 1994

[b] Maximum concentration per COPC of the arithmetic means from the COPC concentration in tailings at the Combination Mill AOC or waste rock at the Combination Mine AOC were used for the exposure point concentration in soil ingestion exposure calculations; the maximum surface water concentration for each COPC, including seep discharge, was used for the exposure point concentration in exposure calculations

[c] The most recent and most conservative estimated NOAELs are used for toxic threshold values

Table E-5. Phytotoxicity Ecological Impact Quotients for Terrestrial Plants from Exposures to Tailings, Waste Rock, and Soils Black Pine Mine

COPC	Phytotoxic Soil Conc.[a] mg/kg	Phytotoxicity Ecological Impact Quotients (EQ)[b]
Arsenic	10	**78.60**
Cadmium	3	**5.66**
Copper	60	**42.56**
Lead	50	**71.46**
Mercury	5	**5.29**
Zinc	50	**8.11**
TOTAL		211.68

Bold = COC

[a] Most conservative phytotoxicity criteria in soil concentrations from CH2MHill (1987) (Hg); Efroymson et al. (1997) (As, Pb, Zn); and Kabata-Pemdias (1992) (Cd, Cu)

[b] Maximum concentration per COPC of the arithmetic means from the COPC concentrations in tailings at the Combination Mill AOC or waste rock at Combination Mine AOC were used for the exposure point concentration in soil ingestion exposure calculations

Table E-6. Summary of All Ecological Impact Quotients for All Ecological Receptors and All Exposure Pathways
Black Pine Mine

COPC	Aquatic Life-Surface Water EQ	Aquatic Life-Sediment EQ	Deer Ingestion- Soil and Water EQ	Plant Phytotoxicity EQ	Total EQ by COPC
Antimony	NA	NA	**52.96**	NA	52.96
Arsenic	0.11	**9.17**	**47.34**	**78.60**	135.22
Cadmium	**2.30**	0.04	0.12	**5.66**	8.13
Chromium III	0.01	0.07	0.00	NA	0.08
Copper	**58.28**	**19.70**	0.995	**42.56**	121.54
Iron	NA	NA	NA	NA	NA
Lead	**3.51**	**19.45**	**819.27**	**71.46**	913.69
Manganese	NA	NA	0.05	NA	0.05
Mercury	**1.48**	**81.55**	0.08	**5.29**	88.40
Nickel	0.03	0.60	0.00	NA	0.63
Silver	**1.71**	**57.57**	NA	NA	59.28
Zinc	**1.70**	**1.87**	0.04	**8.11**	11.73
TOTAL	69.13	190.02	921.13	211.68	1391.89

Bold = COC

APPENDIX F

PRESENTATION OF SCREENED-OUT PROCESS OPTIONS

F-1.0 Screened-Out Process Options

Through process-option screening, options that were found to be ineffective, difficult to implement, and/or cost prohibitive were eliminated. This appendix provides descriptions of the screened-out options and justification for their removal from further evaluation.

Process options discussed in this appendix are listed in Table F-1 and are described in further detail below.

Table F-1. Screened-Out Process Options, Black Pine Mine.

General Response Action	Reclamation Technology	Process Option
Institutional Controls	Access and Use Control	Fencing and Signage
		Land Use Restrictions
Engineering Controls	Surface Restoration	Revegetation – Import Topsoil
	Stream Restoration	No Restoration of South Fork Lower Willow Creek and Mill Creek
Treatment	Solid Media Treatment	Waste Rock Reprocessing
		Soil Binding with Enzymes
		Lime Solidification
		Cement Solidification

F-1.1. Institutional Controls

F-1.1.1. Fencing and Signage Option

The fencing and signage option includes the installation of fencing, or other non-engineered barriers, to keep the public out of the contaminated areas in each AOC. Signage would be placed along each fence line as a warning of the contamination within.

As a sole means for addressing reclamation activities at BPM, this option it is not effective at meeting reclamation goals and provides limited protection of human and ecological health. Although the fencing and signage option could be readily implemented and is low in cost, it was not retained for further evaluation due to the ineffective nature of its approach. However, fencing and signage will likely accompany options within the reclamation technologies of removal and containment and physical hazard removal. Under these reclamation technologies, fencing and signage would be installed once the hazards associated with contaminated material or physical structures are addressed.

F-1.1.2. Land Use Restrictions Option

The land use restrictions option would include implementation of legal restrictions, such as deed restrictions, to limit access and use of the land at BPM. Land use restrictions would be employed to minimize potential contaminant disturbance and potential activities that may result in contaminant exposure.

The land use restrictions option does not address contaminated material or physical hazards at BPM and is therefore not effective at meeting reclamation goals and has limited implementability. Although the option is low in cost, it was not retained for further evaluation.

F-1.2. Engineering Controls

F-1.2.1. Revegetation– Import Topsoil Option

The import topsoil option for revegetation entails purchasing and importing topsoil to BPM. Under this option, import topsoil would be placed over disturbed and capped areas to provide a medium for vegetation establishment.

This option is implementable and effective for establishing vegetation. However, the unit cost for topsoil and the costs associated with its transport to BPM make this option cost prohibitive. It is approximately four times the cost for onsite borrow and approximately seven times the cost for offsite borrow; therefore, it was not retained for further evaluation.

F-1.2.2. No Restoration of SFLWC and Mill Creek Option

Under the no restoration of SFLWC and Mill Creek option, the current alignments of SFLWC and Mill Creek would remain. The existing impoundment berms would continue to restrict and channelize SFLWC, thereby preventing it from naturally meandering. In addition, the berms would lead to higher velocities and further erosion problems, causing detriment to fish habitat.

The no restoration of SFLWC and Mill Creek option is not effective at protecting ecological health. In addition, the result of this option is not consistent with the historic and natural creek alignments, which could lead to higher velocities and future ecological problems. Thus, this option was not retained for further evaluation.

F-1.3. Treatment

The treatment of solid media can occur either *in situ* (in place) or *ex situ* (following removal). In *situ* technologies include biological, chemical, thermal, and physical processes that have been applied to solid matrices cleanup with varying degrees of success. A major controlling factor is the requirement for complete access to contaminants and control of the surrounding natural environment. *In situ* processes have had limited success at remote and physically constrained sites. *Ex situ* technologies include biological, chemical, and physical processes, with the contaminated material placed into a controlled environment that allows physical manipulation to achieve complete access to contaminants.

Stabilization, solidification, and chemical fixation are techniques that use chemical and/or physical processes to reduce potential adverse effects on the environment by hazardous materials. Stabilization techniques chemically reduce the hazard potential of a material and limit the solubility, mobility, or toxicity of contaminants, even though the physical characteristics of the contaminated materials may not have changed. Solidification methods encapsulate the contaminated material which results in a solid, low-permeable block of contaminated material. Solidification requires chemical admixtures, such as lime and cement, be applied to mechanically lock contaminants within the solid matrix. This may or may not involve chemical bonding between the toxic contaminant and the additive. By decreasing the exposed surface area and/or encapsulating the waste, contaminant migration can be significantly decreased. Chemical fixation implies transformation of toxic contaminants to nontoxic forms. This requires specially designed or proprietary reagents incorporated during the mixing process to effect destruction, alteration, or chemical bonding of the contaminants.

F-1.3.1. Waste Rock Reprocessing Option

Waste rock reprocessing involves the excavation and transportation of contaminated materials to an existing mill or smelter for processing and recovery of valuable metals. Reprocessing and recovery consists of physical or chemical processes designed to extract useful minerals, including acid leaching, cyanide leaching, roasting, floatation, and concentration. Reprocessing could generate income to offset remediation costs and would reduce the volume of waste material. However, the viability of reprocessing depends on the economic value of the metals that can be extracted from the mine waste and the proximity to the nearest reprocessing facility.

The waste rock reprocessing option would be effective at meeting the reclamation goals of protecting human and ecological health at the Tim Smith Mine AOC, Historic Mine AOC, and the waste rock portion of the Combination Mine AOC, which account for approximately 70% of the total quantity of contaminated material. However, this option is not implementable due to the distance required to haul the material to the nearest reprocessing facility and the cost associated with the haul. Additionally, there is low potential that the waste rock will generate enough income to offset the high cost of reprocessing. Therefore, the waste rock reprocessing option was not retained for further evaluation.

F-1.3.2. Soil Binding with Enzymes Option

Metals binding involve using a soil-binding enzyme to stabilize and solidify clays and silts, which immobilizes metals in the soil matrix. This process works through ion exchange by breaking the electro-chemical bond of absorbed water to the clays and silts. Soil-binding enzymes have a large potential for ionic exchange and exchange electric charges with the soil particles, thereby breaking the electro-chemical bond of the absorbed water. This water then becomes free water and is allowed to drain by gravity, evaporation, and/or compaction. Once the water drains, a higher densification of the soil particles can be achieved. In addition, the enzyme's ability to carry different charges simultaneously allows it to create the appropriate cation exchange required by soil mineralogy to increase the cementation of

particles and lock the metals in place. The application of a soil-binding enzyme involves spraying it over the contaminated material, which essentially forms a cap, and allowing it to cure for 12 hours. This process is repeated over consecutive eight-inch lifts.

The soil-binding with enzymes option provides minimal protection of human and ecological health, and only addresses contaminated material in the Combination Mill AOC and the contaminated soils portion of the Combination Mine AOC, which account for approximately 30% of the total quantity of contaminated material. This option has limited implementability and would involve excavating material from contaminated areas and then placing the material back in its original location in a series of lifts. The level of effort involved with applying the soil-binding enzyme coupled with the limited quantity of material treated make this option cost prohibitive. Therefore, it was not retained for further evaluation.

F-1.3.3. Lime Solidification Option

Solidification with lime entails *in situ* blending of lime with contaminated material to raise the pH and lower the water content. By increasing the pH above 5.5, metals remain in their solid form and their mobility is reduced. In addition, once lime is added to damp material, the reaction results in a reduction in the water content through hydration and evaporation. This reduction in water causes the material to become friable and more easily compacted. The material becomes stabilized once crystallization occurs and hydrated calcium aluminates and silicates are formed. A lime spreader would be used to initially apply the lime to the surface of the contaminated material. A pulvimixer, rotary paddle mixer, disk plough, or similar mixing equipment would then be used to incorporate the lime evenly throughout the profile. Once incorporated, the contaminated material would be compacted and left in place.

The lime solidification option provides minimal protection of human and ecological health, and only addresses contaminated material in the Combination Mill AOC and the contaminated soils portion of the Combination Mine AOC (approximately 30% of the total quantity of contaminated material). It also has limited implementability due to the specialized equipment necessary to inject the lime and the difficulty of obtaining a thorough blend *in situ.* In addition, it is not cost effective for the limited quantity of material that would be treated. Therefore, it was not retained for further evaluation.

F-1.3.4. Cement Solidification Option

Solidification with cement entails *in situ* mixing of cement with contaminated material to physically solidify and chemically stabilize the contaminants within the treated material. When cement is mixed in with soil, it reacts with water to form physical bonds between the cement and water that encapsulate and immobilize contaminants. Solidification lowers the permeability of water through the material, which inhibits contaminant leaching. Various methods are used for blending, such as rotating drums with cutting teeth that mix cement in with material or rotating augers that drill into contaminated material while injecting a cement grout. Once the cement is incorporated into the contaminated material, the treated

material would be left in place and surface restoration would be done to tie the disturbed area in with the surrounding terrain.

The cement solidification option provides minimal protection of human and ecological health, and only addresses contaminated material in the Combination Mill AOC and the contaminated soils portion of the Combination Mine AOC (approximately 30% of the total quantity of contaminated material). It also has limited implementability due to the specialized equipment necessary to inject the cement and the difficulty of obtaining a thorough blend *in situ.* In addition, it is not cost effective for the limited quantity of material that would be treated. Therefore, it was not retained for further evaluation.

APPENDIX G

2014 SITE RECLAMATION AND WATER TREATMENT TECHNICAL MEMORANDUM

Herrera Environmental Consultants, Inc.

Memorandum

To	Devin Clary, Montana Department of Environmental Quality
From	Kevin Houck and Michael Spillane, Herrera Environmental Consultants and Mark Donner, Trihydro Corporation
Date	March 11, 2014
Subject	Site Reclamation and Water Treatment

1. Introduction

This Technical Memorandum (Tech Memo), prepared for Montana Department of Environmental Quality (DEQ), provides an overview of the current conditions, summarizes previously identified reclamation alternatives, presents two new reclamation alternatives, prioritizes reclamation activities by Area of Concern (AOC), and presents a preferred alternative for reclamation of the Black Pine Mine (BPM). This Tech Memo serves as a supplement to the Black Pine Mine Reclamation Investigation (RI) Report (Herrera/Trihydro 2012) and the Draft Engineering Evaluation and Cost Assessment (EE/CA) (Herrera/Trihydro 2013a). Specific details regarding methodologies, sample locations, and results are presented in the RI and EE/CA.

1.1. Summary of Site Characterization and Reclamation Activities

The BPM is located approximately 10 miles northwest of Philipsburg, Montana and consists of approximately 1,055 acres of patented mining claims and 157 unpatented lode claims on lands administered by the United States Forest Service (USFS). Mining began at the property in 1882 and continued intermittently up until 1993. The last company to mine the property was the American Smelting and Refining Company (ASARCO). Through the bankruptcy of ASARCO in 2009, the Montana Environmental Custodial Trust (Trust) was created to address environmental actions at the BPM property and manage the remediation funds.

Investigations and environmental monitoring began at the BPM in 1981 and have continued with investigations and routine monitoring being completed by DEQ. In addition, ASARCO performed reclamation activities in the Combination Mill AOC and Combination Mine AOC. Reclamation activities in these areas consisted of partial reclamation of the Combination Mill tailings impoundment in the mid-1990s, installation of the Combination Mine seepage collection and pumpback system in 2001, and excavation of impacted soils from the Combination Mine Soils Removal Areas between 2004 and 2006 (Hydrometrics 2010).

In 1994, ASARCO partially reclaimed the Combination Mill AOC. Tailings in the floodplain were impounded, ripped with lime, and vegetated. Berms were constructed to separate Mill

Creek from the tailings impoundments, and along the western edge of the tailings impoundments to separate them from the South Fork Lower Willow Creek (SFLWC).

During 2001, ASARCO constructed a mine seepage collection system at the Combination Mine, to minimize transport of metals-bearing surface runoff, seepage, and shallow groundwater. The system was expanded and modified during 2003, prior to regrading of the waste rock pile. The system collects flows via buried seepage collection piping beneath the toe of the Combination Mine waste rock pile as well as from two downslope seeps (CPS-1 and CPS-7). An interim, lined pond was also constructed to detain flows during high flow periods, corresponding to spring snowmelt. The collected flow is pumped back to the mine pool through the Combination Mine auxiliary adit (Hydrometrics 2010).

Between 2004 and 2006, impacted soils from the Combination Mine Soils Removal Areas were combined with the Combination Mine waste rock pile. ASARCO regraded the Combination Mine waste rock pile, estimated at 220,000 cubic yards in 2001, from a 2:1 slope to a 3.5:1 slope to stabilize it. Following regrading of the waste rock pile, ASARCO constructed a cover system that is reported to have consisted of a PVC liner overlain by 3 feet of soil (Hydrometrics 2010). Vegetation of the cap was attempted during this time (Hydrometrics 2010).

In 2011, DEQ contracted Herrera to conduct a RI. The RI report delineates the nature and extent of contaminated material at the site, estimates the risk that these materials may pose to human health and the environment, and analyzes data pertinent to potential reclamation alternatives. A total of 164 samples were collected for, surface water, groundwater, soil, sediment, and waste rock. A summary of the samples collected during the RI is provided in Table 1. This table includes Contaminants of Concern (COC) based on the Human Health Risk Assessment performed during the EE/CA.

Table 1. Samples Collected during 2011 RI, Black Pine Mine.

AOC	Media	Samples Collected	Contaminants of Concern
Combination Mine	Solid	33	Antimony, Arsenic
	Surface Water	10	Antimony, Arsenic, Lead
	Groundwater	9	NA
Tim Smith Mine	Solid	12	Antimony, Arsenic, Lead
	Surface Water	5	Antimony, Arsenic, Lead
Historic Mine	Solid	26	Antimony, Arsenic, Lead
	Surface Water	2	Antimony, Arsenic, Lead
Combination Mill	Solid	49	Antimony, Arsenic, Lead
	Surface Water	18	Antimony, Arsenic, Lead, Mercury

The AOCs have similar COCs throughout; however, the Combination Mill AOC, due to the mills processing procedures, has mercury as an additional COC in surface water. Mercury is

considered a human health risk through fish consumption and has low surface water cleanup guidelines due to the serious health effects it poses to the environment.

While characterizing the waste during the RI, measurements were collected to quantify the volume of waste onsite. The total estimated waste volume for BPM is approximately 400,000 cubic yards (Table 2). The volume estimates are based on test pit data, drilling data, soil sampling data, stream sediment sampling, and existing topography.

Table 2. Estimated Waste Volumes, Black Pine Mine.

Impacted Waste Location	Estimated Volume (cubic yards)
Combination Mine Waste Rock Pile	203,200
Combination Mine Soils Removal Areas	5,000
Tim Smith Waste Rock Piles at Tim Smith No. 1 and No. 2 Adits	22,650
Combination Mill Sediments, Soils, and Tailings Impoundments	126,900
South Fork Lower Willow Creek Stream Sediments	21,100
Historic Mine Area Waste Rock Piles	13,350
TOTAL:	392,200

A Repository Investigation was performed as part of the RI as well as subsequent field investigations in 2012 to identify a suitable location for a repository on Trust property (Herrera/Trihydro 2013b). Based on the total volume of waste, an estimated footprint of approximately 12 to 15 acres would be required to site a repository. This estimate is based on variability in combinations of the depth of repository excavation, fill height limits, and side slope constraints. Repository grading/design will focus on developing an economical repository, while also attempting to blend the repository with the surrounding terrain and provide sufficient quantities of borrow material to backfill waste removal areas. The preferred repository location is within the Historic Mine AOC.

1.2. Summary of Evaluated Alternatives

The overall objectives of reclamation at BPM are to protect human health and the environment by minimizing direct contact with contaminants and prevent degradation of adjacent lands. Reclamation actions will be taken to meet the following objectives:

- Minimize human and wildlife contact with contaminated material (e.g. tailings, waste rock, soils, sediment, and seeps);

- Reduce the potential for contaminant migration from mine waste (waste rock/tailings), soils, and sediments to surface water, groundwater, and air;
- Reduce the potential risk to human health through ingestion of contaminated material and/or inhalation of dust;
- Improve water quality in SFLWC, accounting for the presence of upgradient and downgradient sources;
- Stabilize soil in disturbed areas to prevent erosion;
- Improve watershed functionality to promote a more stable, natural hydrologic system;
- Leave the site in a condition that supports sustainable ecological communities (terrestrial and aquatic); and
- Minimize post-reclamation visual contrasts between the site and adjacent land.

The EE/CA evaluated the most effective alternatives that would address overall site objectives as well as specific reclamation goals. Based on prior reclamation activities, historical data, and meetings and discussions held prior to the RI and EE/CA, source removal was identified as the fundamental reclamation action. Source removal was evaluated due to limited projects funds; the extent of known impacted waste, sediments, and soils; seep locations and seep contact with waste rock; and cost prohibitive water treatment requirements. Identified alternatives include the following options:

- No action – **Alternative 1** (evaluated as a baseline for other alternatives).
- Cap in-place waste within the Historic Mine AOC and Tim Smith Mine AOC. Complete removal of waste from Combination Mine AOC and Combination Mill AOC, with:
    - Transport of waste to an onsite repository – **Alternative 2**
    - Transport of waste to an offsite disposal facility – **Alternative 3**
- Complete removal of waste from Combination Mine AOC, Tim Smith Mine AOC, Historic Mine AOC, and Combination Mill AOC, with:
    - Transport of waste to an onsite repository – **Alternative 4**
    - Transport of waste to an offsite disposal facility – **Alternative 5**

Stabilization and capping in-place and total removal alternatives include backfilling, regrading, amending cover soil as needed, and establishing a vegetative and/or rock cover. The alternatives also address adit stabilization, adit closure, building maintenance and protection, building demolition, and reconstruction of SFLWC and Mill Creek. Some of these actions may be considered as part of a phased approach and costs for each are broken out as optional in Section

4. The alternatives were evaluated on effectiveness, implementability, and cost after an initial screening of process options. The results are presented in Table 3.

Table 3. EE/CA Alternatives Screening, Black Pine Mine.

Alternative	Effectiveness	Implementability	Cost
Alternative 1	Low	High	$82,400
Alternative 2	Moderate	High	$12,924,500
Alternative 3	Moderate	High	$25,886,800
Alternative 4	High	High	$13,475,500
Alternative 5	High	High	$27,950,600

A summary discussion of key evaluation elements for each AOC is presented below with information regarding the decision making process. More details are presented in the Draft EE/CA.

Combination Mill AOC

The Combination Mill AOC is located in the floodplain of SFLWC. Two historical mills were located within the AOC where Mill Creek enters SFLWC.

A full removal alternative was deemed necessary based on the presence of mercury in dispersed sediment within the floodplain. Mercury contamination in water exceeds human health standards and is a contamination of concern based on fish consumption. Based on the presence of mercury, partial removal or cap in place options were not evaluated as they cannot effectively address human health or ecological cleanup goals. Sediments not excavated and impounded during the 1994 reclamation activities are still prone to mobilization and deposition downstream on USFS administered lands and private property.

Due to the location and extent of sediment within the floodplain, an alternative was evaluated for the removal of waste on USFS administered lands and on private property. This alternative was separately identified because it is dependent on an agreement between the Trust, USFS and private landowners that would allow for waste that has been transported downstream to be removed and placed in a repository on Trust property.

Combination Mine AOC

The Combination Mine AOC is located along the east slope of Black Pine ridge in the Smart Creek drainage. A large waste rock pile, the Combination Mine waste rock pile, associated with the main and auxiliary Combination Mine adits and the downgradient Combination Mine Soils Removal Areas are the primary features in this AOC.

A full waste rock removal alternative was recommended in the Draft EE/CA due to the presence of seeps, as well as elevated metals concentrations in samples collected from the waste rock. When ASARCO regraded and capped the waste rock pile, as-builts were not prepared. During the RI, test pits were excavated to document the location and configuration of the waste placement and cover material construction. Soil cover ranging from one foot to six feet was observed. An impermeable synthetic liner was only observed in one test pit, CMN-GT-01, and this liner was thought to be a scrap piece as opposed to part of a full liner system. Liner was not observed in other test pits and is only noted in the borehole log for CMMW-5, which was installed in 2008 by ASARCO.

Metals concentrations in waste rock samples and one (CMN-SS-13) soil sample collected from the South Soils Removal Area during the RI exceeded DEQs Risked Based Cleanup Guidelines. The concentrations exceeded for Antimony, Arsenic, Lead, and Manganese in both the waste rock samples and soil sample.

Seeps have been sampled since 2000 and have shown elevated levels of metals in water samples that exceed human health and ecological standards. The seep collection and pumpback system installed in 2001 has caused the mine pool water elevation to rise from an estimated 6000 feet on September 1, 2000 to 6115 feet on January 14, 2014. Samples were collected in April 2001 from seeps CPS-9, approximate elevation 6119 feet, and CPS-10A, approximate elevation 6095 feet, which were above the mine pool elevation of 6000 feet. Since seeps expressed themselves above the mine pool elevation at the time, and due to the large seasonal fluctuation in flow rates, there are likely other sources of water contributing to the seeps. Unknown geology underlying the waste rock pile makes it difficult to determine if the seeps are primarily influenced by shallow groundwater, seepage from the mine pool, groundwater flow through mineralized rock, or a combination of each of these. The lack of information regarding the source of the seeps was a determining factor in the evaluation of a full removal of the waste rock pile. Capping in-place was not deemed feasible due to the persistent and continued elevated metals concentrations in seep samples.

Historic Mine AOC

The Historic Mine AOC is located along the northwest facing slope of Black Pine Ridge. An ephemeral creek, Mill Creek, collects runoff from the AOC and conveys the runoff west to SFLWC.

Full removal and cap in-place alternatives were evaluated due to because the Historic Mine AOC AOC has lower risk to human health and ecological receptors, as compared to the Combination Mill and Combination Mine AOCs. Metals concentrations in soils exceeded DEQ's Risked Based Cleanup Guidelines for Antimony, Arsenic, Cadmium, Lead, and Manganese. The small volume of waste and the location of the preferred repository in the Historic Mine AOC led to the recommendation for full removal and placement in the onsite repository.

Tim Smith Mine AOC

The Tim Smith Mine AOC is located along the east side of Black Pine Ridge in the SFLWC drainage. An ephemeral drainage, Tim Smith drainage, collects runoff from the AOC and conveys the runoff west to SFLWC.

Full removal and cap in-place alternatives were evaluated because the Tim Smith Mine AOC has lower risk to human health and ecological receptors. Metals concentrations in soils exceeded DEQs Risked Based Cleanup Guidelines for Antimony, Arsenic, Lead, and Manganese. The small volume of waste, the potential for waste to recontaminate material downstream, and the close proximity to the proposed repository led to the recommendation for full removal and placement in the onsite repository.

2. Evaluation of Additional Alternatives

Based on feedback from DEQ and initial EE/CA alternative costs, additional alternatives were requested to be evaluated as part of this Tech Memo. The additional alternatives include partial removal of the Combination Mine waste rock pile and water treatment of metals-impacted flows emanating from the seeps at the Combination Mine AOC.

2.1. Combination Mine Waste Rock Pile – Partial Removal

DEQ requested evaluating partial removal of the Combination Mine waste rock pile was as an alternative to removal of the entire waste rock pile. This alternative would be less expensive than full removal; allowing more of the reclamation budget to be set aside for water treatment.

Partial removal of the Combination Mine waste rock pile was assumed to involve excavating sufficient waste rock to expose the known seep locations buried during regrading/reclamation of the waste rock pile completed by ASARCO between 2004 and 2006. During these reclamation activities, the waste rock pile was regraded from approximately 2:1 slopes to approximately 3.5:1 slopes. This extended the toe of the waste rock pile, covering seeps CPS-9 and CPS-10A, which both had elevated metals concentrations during sampling conducted in 2001. Seepage collection piping was installed in 2001, prior to regrading of the waste rock pile, to collect seepage from these two seeps. Flows collected in the seepage collection system are pumped back into the mine workings (Hydrometrics 2010).

The cover material and liner (where it exists) installed during ASARCO's reclamation of the waste rock pile would be removed to excavate waste rock as part of both the full and partial removal alternatives. Under both alternatives, clean cover material excavated from the surface of the waste rock pile is planned to be stockpiled and replaced (due to a shortage of on-site borrow materials) following excavation. Under the partial removal alternative, a new liner would be installed over the remaining regraded waste rock. Estimated volumes and the proposed reclaimed surfaces are shown on Figure 1 for the full removal alternative and on Figure 2 and Figure 3 for the partial removal alternative.

While the thickness of cover material installed by ASARCO is reported as 3 feet, the observed thickness during test pits excavated during the 2011 RI varied from 1 feet to 6 feet.. A thickness of 2 feet of clean cover material is assumed as part of the alternatives evaluation. This thickness is assumed based on the range of thicknesses observed and the assumption that the cover material in contact with the waste rock may be impacted.

The extent of the partial waste rock removal is estimated based on coordinates provided in historical documents for seeps CPS-9 and CPS-10A. While horizontal location information exists for these seep locations, elevation information was not found. Therefore, the elevations are estimated. Two approaches to estimate the elevations are employed to allow bracketing of excavation volumes.

- The first approach, considered to be more accurate, estimates the seep elevations based on their location along the assumed native ground surface. This surface was estimated based on the topography surrounding the waste rock pile, borehole logs for CMMW-2, CMMW-5, and CMMW-6 (installed by ASARCO), and test pit logs for CMN-RS-04, CMN-RS-05, and CMN-RS-06 (excavated during the 2011 RI). After establishing the approximate elevations of the seeps (~6119 feet for CPS-9 and ~6095 feet for CPS-10A), the proposed grading that would expose these seeps was developed. The proposed grading, shown on Figure 2, incorporates a 20-foot buffer/bench between the estimated seep locations and the proposed toe of the remaining waste rock pile. Based on the proposed grading, approximately 78,000 cubic yards (cy) of material would be excavated, including cover material. Assuming an existing, clean cover material depth of 2 feet equates to 23,000 cy of cover material that would be salvaged and replaced on the waste rock pile after installation of a liner. The remaining 55,000 cy of material would be placed in the repository. If the pad at the top of the waste rock pile is maintained, this excavation would result in slopes of 2.25:1 to 2.7:1 as shown on Figure 2. These slopes would require erosion protection.
- The second approach estimates the seep elevations at approximately the same elevation as the upslope elevation of the USFS road along the toe of the waste rock pile. This approach is used to provide an upper limit of the estimated partial removal volume and is not considered to accurately represent the seep elevations. Employing this assumption, and also allowing for a 20-foot buffer/bench upslope of the seep locations, results in an excavation of approximately 173,000 cy of material. Assuming an existing, clean cover material depth of 2 feet, equates to 23,000 cy of cover material that would be salvaged and replaced on the waste rock pile after installation of a liner. The remaining 150,000 cy of material would be placed in the repository. If the pad at the top of the waste rock pile is maintained, this excavation would result in slopes of 1.6:1 to 2.7:1 (Figure 3). These slopes would require erosion protection.

The waste rock volume estimated through the first approach is used to estimate costs associated with the partial waste rock removal alternative. This alternative would involve excavation of 78,000 cy of material, hauling and placement of 55,000 cy in the repository, regrading of the remaining waste rock face, placement of a liner over the exposed waste rock, and placement of

23,000 cy of clean cover soil from stockpiles. The conceptual cost for this alternative is $2.1 million, assuming the repository is already being constructed to hold impacted materials from the Combination Mill. This alternative would leave approximately 150,000 cy of waste rock in place at the Combination Mine.

2.2. Combination Mine Seeps – Water Treatment

Based on seep water quality data at the Combination Mine AOC, a water treatment system capable of meeting surface water quality standards would be required. If source removal occurs, water treatment may not be necessary. The need for water treatment is likely lower under the full waste rock removal alternative than the partial removal alternative. Water treatment options for reclamation of the metals generating seeps may include one or more treatment processes that involve metals precipitation, reverse osmosis, ion exchange resin, and/or electrocoagulation. Of these water treatment options, metals precipitation was evaluated further due to:

- The capability to meet water quality standards
- The anticipated flow rates
- The capital and operations and maintenance (O&M) costs

This has been done to assess water treatment as a reclamation option and provide costs for use in comparison of alternatives.

The analysis of water treatment at the Combination Mine AOC required a series of assumptions to be made. Those assumptions include the following: influent metals concentrations, effluent requirements, treatment system configuration, and treatment system operations. Assumptions for the water treatment system influent metals concentrations are based on the current and historical analytical data for the seeps, groundwater, and surface of the mine pool. Further sampling may be required to assess the variability of water quality within the mine pool with respect to depth. The target level effluent rates are based on the DEQ Circular-7 Human Health Standards for Surface Water (DEQ 2012). Water to be treated at the Combination Mine AOC consists of the mine pool and the seeps within and downgradient of the waste rock pile. The existing collection/pumpback system would be used for water collection and supply to the water treatment facility. The point of compliance to meet the discharge requirements was assumed to be at the water treatment facility prior to the point of discharge. The water treatment system must handle maximum flows up to 70 gallons per minute (gpm) during spring runoff, and no waste treatment bi-products from the water treatment facility can be disposed of onsite. Construction of settling ponds will be required for the treatment process. To reduce operational costs the water treatment system may be shut down during the winter months. If the water treatment system were shut down during winter months, the water could be collected and pumped into the mine pool through the Combination Mine auxiliary adit. The water currently in the mine pool and the water pumped into the mine pool during shut down would then be treated at times of reduced flows throughout the rest of the year. Pumping water through the auxiliary adit would also allow for periodic maintenance and operational adjustments of the water treatment system without

requiring additional storage capacity within the treatment process. Depending on influent flow rates during the summer, the period of shut down could be extended; further reducing operation time and overall O&M costs of the water treatment system. The capacity of the mine pool is not currently known; the storage volume would be evaluated during the water treatment design phase.

Water treatment vendors provided variable costs due to unknowns including the possibility of multiple stage chemical reactions, additional filtration, and possibly a polishing process such as reverse osmosis to meet the target level effluent rates. In particular there was a range in estimates related to the capital cost associated with the filtration processes required to reduce the total suspended solids (TSS). For this reason, both a process design including filtration though a granular media and filtration implementing a microfiltration process has been included as part of the cost estimate. The different filtration processes will provide different levels of treatment due to the sediment levels of the effluent and the total metal concentrations within those sediments. The granular filtration process is anticipated in the parts per million (ppm) effluent range while the microfiltration process would be predicted in the parts per billion (ppb) effluent range.

The effluent water quality standards and the point of compliance will dictate the final process design and therefor the capital and O&M costs. Conversely, system flow rates are subject to economies of scale reducing the cost/gallon for systems with higher flow rates. As a result, when comparing the anticipated capital cost to treat 1,000 gallons of water at the BPM to existing water treatment systems there is not a significant reduction in capital costs due to the lower flow rate at BPM. There is also, a substantial increase in the average annual O&M costs per 1,000 gallons of treated water at the BPM when compared to other systems due to the economies of scale associated. A cost comparison of the existing water treatment systems located at the Beal Mine, Zortman-Landusky Mines, and Upper Blackfoot Mining Complex (UBMC) is summarized in Table 4. As shown in the table, a metals precipitation process has been utilized in all of the water treatment processes with the exception of the Beal Mine, which is implementing reverse osmosis. The metals removal, shown as either ppm or ppb for each facility, has been included for a broad comparison between the levels of treatment provided and the costs associated with those levels of treatment.

Table 4. Evaluation of Water Treatment Systems, Black Pine Mine.							
Facility	**Treatment Process**	**Metals Removal**	**Average flow (Gallons Per Year)**	**Capital Cost**	**2014 Capital Cost (2.5% annual inflation)**	**Average annual O&M Cost (Not adjusted for Inflation)**	**Average annual O&M cost/K gallon**
Beal	Reverse Osmosis	ppb	17,500,000[c]	$1,505,296	$1,834,000	$236,186	$13.50
Zortman-Landusky Mines							
Zortman	Metals Precipitation	>50%[a] (ppm)	87,288,601[d]	$1,000,000[h]	$1,639,000	$446,655	$5.12
Landusky	Metals Precipitation	>40%[a] (ppm)	235,993,499[d]	$3,600,000[i]	$5,478,000	$492,345	$2.09
Swift Gulch	Metals Precipitation (RCTS)	-	23,881,445[e]	$1,140,000[j]	$1,228,000	$95,374	$3.99
UBMC	Metals Precipitation Ceramic Microfiltration	99.5%[b] (ppb)	24,628,273[f]	$3,000,000[k]	-	$633,852	$25.74
BPM	Metals Precipitation Granular Media Filtration	ppm	2,000,000[g]	$560,000	$560,000	$80,000	$40.00
BPM	Metals Precipitation Microfiltration	ppb	2,000,000[g]	$1,130,000	$1,130,000	$100,000	$50.00

[a] US Deparment of the Interior, Bureau of Land Mnanagment. Zortman and Landusky Mines Reclamation Project. Zortman and Landusky Mines - Water Management. 6/28.2012. http://www.blm.gov/mt/st/en/fo/lewistown_field_office/zortman.html
[b] Stewart Environmental Consultants, Inc. http://www.stewartenv.com/php_uploads/stewart_lg_20100330143109.pdf
[c] Average annual flow from 2006-2013 (Sonny Thornborrow, USFS)
[d] Average annual flow from 2004-2012 (Zortman Invoicing Summary by Cost Category spreadsheet, courtesy Wayne Jepson, DEQ)
[e] Average annual flow from 2008-2012 (Zortman Invoicing Summary by Cost Category spreadsheet, courtesy Wayne Jepson, DEQ)
[f] Average annual flow from 2011, 2012, and 2013 (CECRA Discharge Report December 2013 spreadsheet, courtesy Robert Roll, DEQ)
[g] Average flow from November 2011-April 2012, doubled to project yearly flow, collected from pumpback flow meters
[h] Wayne Jepson's estimate from Pegasus Gold in 1994. Jepson stated this may have increased due to upgrades in 1996 (unknown amount).
[i] Wayne Jepson's estimate from Pegasus Gold in 1997.
[j] Wayne Jepson's estimate from 2011.
[k] Robert Roll's estimate to rebuild - no initial cost is known and year of construction not stated.

Long term O&M costs can be estimated for water treatment at the Combination Mine AOC using the metals precipitation processes as a cost basis. The annual rate of inflation for the long term costs analysis has been estimated at 2.5%. The real rate of return, which is the rate of return minus inflation, is assumed to be between1.5 - 2% for the annuity set aside to pay for the O&M costs in perpetuity. Table 5 displays the capital and O&M costs as a total cost for 25 years and a total cost in perpetuity for both a 2% and 1.5% real rate of return. Both the 2% and 1.5% real rate of return are shown to highlight the impact of the real rate of return on the total cost.

Table 5. Water Treatment Costs, Black Pine Mine.

Treatment Process	Capital Cost	Average Annual O&M Cost	Total Cost 25 Years (2.5% Inflation) (2% Real Rate of Return)	Total Cost in Perpetuity (2% Real Rate of Return)	Total Cost in Perpetuity (1.5% Real Rate of Return)
Metals Precipitation w/ Granular Media Filtration	$560,000	$80,000	$2,693,000	$4,560,000	$5,893,000
Metals Precipitation w/ Microfiltration	$1,130,000	$100,000	$3,796,000	$6,130,000	$7,797,000

The estimate for water treatment costs at the Combination Mine AOC is variable due to the system process variability and assumptions with the real rate of return expected on the annuity. General ranges for initial capital costs are $560,000 - $1,130,000 with estimated annual O&M cost being in the range of $80,000 - $100,000. Total costs to operate the system in perpetuity range from $4.6 million to $7.8 million. While the initial capital costs between the two options is significant, when analyzing the costs in perpetuity it is apparent that the O&M and real rate of return has a larger influence on the total cost. System optimization and selection based on lower O&M costs will be the driving factor even if requiring greater initial capital costs.

If water treatment is selected as part of the overall alternative for remedial action, further investigation and evaluation of water treatment options will be warranted. A pilot study will also be required to establish process design, system optimization, and how to most efficiently meet the required water quality standards while reducing O&M costs.

3. AOC and Reclamation Option Prioritization

The AOC and reclamation option prioritization is based on the following factors: human health and ecological risks, quantity of waste, potential of recontamination, and potential of future site reuse. The prioritization was performed to provide a tool for selecting a combination of reclamation options and AOC's to most effectively meet the reclamation goals and objectives. The prioritization and cost information will be used to determine the best use of the Trust's reclamation funds. For example, the cost to perform water treatment at the Combination Mine

AOC, evaluated in Section 2, may be set aside and lower priority AOCs may not be included in reclamation activities depending upon the preferred alternative selected.

Table 6 presents the prioritization of the AOCs along with the cost for removal and disposal in an onsite repository. The costs are dependent on waste quantities. The repository size (and associated cost) is adjusted for each AOC based on the incremental amount of waste that would be added to the repository. However, a base repository, associated with full removal of wastes from the Combination Mill AOC is assumed. In other words, the costs for the Combination Mine full waste rock removal assumes that this would only be completed in combination with removal of materials form the Combination Mill AOC; a repository would not be constructed just to hold the Combination Mine waste rock.

Table 6. Prioritization of AOCs, Black Pine Mine.					
AOC Prioritization Ranking	**1**	**2**	**3**	**4**	
AOC Name	**Combination Mill**	**Historic Mine**	**Combination Mine**	**Tim Smith Mine**	**Comments**
Quantities (cy)	148,000	13,350	203,200	22,650	Combination Mill includes dispersed sediments. Combination Mine includes Soils Removal Areas.
Human Health/Ecological Risk	Mercury contaminated waste dispersed in floodplain	Unvegetated waste that is above an ephemeral drainage, which drains to SFLWC	Seeps expressing metals contaminated water	Unvegetated waste that is next to an ephemeral drainage, which drains to SFLWC	
	Ability to mobilize during runoff and high flows in SFLWC and Mill Creek	Moderate probability of material mobilizing to Mill Creek, erosion of soils can occur due to lack of vegetative cover	Close to Smart Creek, sediment transported downgradient during snow melt and seeps, wattles in place as bmps (maintenance required) due to lack of vegetation	Moderate probability of material mobilizing to SFLWC in drainage	
Recreational Use	High potential for recreational user contact (gold panner / recreationalist / fisherman)	Moderate potential for recreational user (rock hound / recreationalist)	Moderate potential for recreational user (rock hound / recreationalist)	Moderate potential for recreational user (rock hound / recreationalist)	
Downgradient Receptors	Fish, cattle, Lower Willow Creek Reservoir (used for irrigation)	No grazing or fish in ephemeral drainage, Mill Creek flows into SFLWC	Cattle grazing on site, ephemeral drainage flows to Smart Creek	No grazing or fish in ephemeral drainage, Tim Smith Drainage flows into SFLWC	
Potential for Recontamination	Waste is dispersed in floodplain - waste not in tailings impoundments can still be transported downstream. Waste in tailings impoundment is saturated and metals are mobilized during spring runoff	Areas unvegetated. Headwaters of Mill Creek. Unlikely that material is mobilized during Spring runoff.	Seep expressing downgradient from waste rock pile. N and S Soils Removal Area are unvegetated along with waste rock pile. Seeps can flow to Smart Creek during Spring runoff	Upgradient of Combination Mill AOC and ephemeral drainage to SFLWC	

Table 6. Prioritization of AOCs, Black Pine Mine.					
AOC Prioritization Ranking	**1**	**2**	**3**	**4**	
AOC Name	**Combination Mill**	**Historic Mine**	**Combination Mine**	**Tim Smith Mine**	**Comments**
Location and Activity		Location is site of proposed repository. Compatible with Combination Mill reclamation.			
Potential for Future Mine Activities	No	No	Yes	Yes	
Estimated cost of Source Removal and Placement in Onsite Repository	**$8,012,900**	**$261,000**	**$4,650,600**	**$551,000**	Cost includes repository construction and waste removal cost
Total Accumulated Cost for Source Removal and Placement in Onsite Repository	**$8,012,900**	**$8,273,900**	**$12,924,500**	**$13,475,500**	

The Combination Mill AOC is the highest priority AOC. Removing the tailings and disposing of them onsite would reduce the largest risk to human health and ecological receptors. Tailings would be removed from the floodplain and would not be susceptible to mobilization. The second highest ranked AOC is the Historic Mine AOC due to the overlap with the proposed repository site. Although wastes in this AOC have moderate potential to recontaminate reclaimed areas, a large portion of the wastes in this AOC would have to be removed for repository construction and the remaining waste would be sited adjacent to the repository, allowing for economical disposal. This would also remove the risk to human health and the environment. The third ranked AOC is the Combination Mine AOC due to seeps and the large quantity of waste material. The fourth ranked AOC is the Tim Smith Mine AOC, which like the Historic Mine AOC, has a small volume of waste and has moderate potential to recontaminate the reclaimed Combination Mill AOC. The Tim Smith Mine AOC would still pose a threat to human health and the environment if it is not reclaimed.

AOC's that have the potential of operating again as active mines include the Combination Mine and Tim Smith Mine. The adits for both AOCs could be sealed with a closure that would allow for their reopening in the future.

The costs of water treatment in conjunction with waste removal and placement in repository by AOC is presented in Table 7. This table provides an overview of estimated costs including water treatment based on the prioritization of AOCs.

Table 7. Total Costs of Removal and Water Treatment by AOC, Black Pine Mine.

AOC Prioritization Ranking	**1**	**2**	**3**	**4**	
AOC Name	**Combination Mill**	**Historic Mine**	**Combination Mine**	**Tim Smith Mine**	**Comments**
Estimated cost of Source Removal and Placement in Onsite Repository	$8,012,900	$261,000	$4,650,600	$551,000	Cost includes repository construction and removal cost
Total Accumulated Cost for Source Removal and Placement in Onsite Repository	**$8,012,900**	**$8,273,900**	**$12,924,500**	**$13,475,500**	
Estimated Range of Cost of Water Treatment	$4,560,000 - $7,797,000	$4,560,000 - $7,797,000	$4,560,000 - $7,797,000	$4,560,000 - $7,797,000	Low and high cost of water treatment based on metals precipitation
Total Accumulated Cost for Source Removal and	**$12,572,900 - $15,809,900**	**$12,833,900 - $16,070,900**	**$17,484,500 - $20,721,500**	**$18,035,500 - $21,272,500**	

Water Treatment					

4. Reclamation Alternatives and Scenarios

The inclusion of new alternatives incorporating water treatment and partial removal of the Combination Mine waste rock pile provides an opportunity to select a combination of scenarios that will result in the most effective reclamation while maximizing the limited funds available. Table 8 presents several scenarios, their associated costs as well as optional cost bid items and cost comparisons showing base difference and incremental increases associated with added reclamation activities. All costs are conceptual and will be refined during the design phase.

Scenario 1 – Removal of Wastes in the Combination Mill and Historic Mine AOC and Placement in an Onsite Repository

The base scenario includes full removal of wastes in both the Combination Mill and Historic Mine AOCs, and placement of these wastes in an onsite repository. The onsite repository would be located in the Historic Mine AOC in the area of the Harrison Shaft waste rock. This alternative is identified as the base, and minimum preferred, option for reclamation due to the prioritization of the Combination Mill AOC and the proposed repository location. The cost of the alternative is estimated at approximately $8.3 million, which also includes the costs of adit stabilization, adit closure, and building demolition, maintenance and protection. The size of the repository footprint would not change significantly for this scenario because the repository would still need to blend in with the matching topography, match natural grades, and generate sufficient borrow material to support backfill of waste removal areas in the Combination Mill AOC. The footprint of the repository would be approximately 12 acres (Figure 4).

Scenario 2 – Scenario 1 and Partial Removal of the Combination Mine Waste Rock Pile

The second scenario includes the alternatives included in Scenario 1, as well as partial removal of the Combination Mine waste rock pile to expose seeps CSP-9 and CSP-10A. The estimated cost of the partial removal of the waste rock pile in addition to Scenario 1 is approximately $10.2 million dollars, which would leave approximately $7.3 million dollars for water treatment, if necessary. The partial removal and placement in the proposed repository would maintain the footprint of the repository at approximately 12 acres with grades and elevations changing from the base scenario. Increases in costs as compared to Scenario 1 are primarily associated with the cost of excavating, hauling, and placing waste rock from the Combination Mine AOC in the repository. Other notable costs are associated with removal, stockpiling, and replacement of the waste rock cover soils, as well as installation of a liner over the remaining waste rock, and an increased revegetation footprint.

While partial removal of the Combination Mine waste rock pile is a cheaper alternative than full removal, this alternative is not as cost efficient. Nearly the same footprint and quantity of cover soil must be disturbed to access the underlying waste rock for the partial removal as for the full

removal. Partial removal would also involve installation of a new liner over the remaining waste rock face to limit interaction of surface water with the waste rock, which would not be required for a full removal. Additionally, partial removal results in steeper slopes that will require more effort to control erosion and protect the cover soil.

Additionally, partial removal of the waste rock may not affect the quality or quantity of the seeps. Seeps existed prior to the current waste rock configuration and exhibited, in some cases, higher metals concentrations than recorded in more recent samples. There would remain the potential for recontamination as groundwater may still interact with the remaining waste rock or surface runoff may still find paths into the waste rock, potentially along the upslope waste rock/bedrock interface. These interactions would occur upgradient of seeps and could still contribute to degraded water quality at the seeps.

Scenario 3 – Scenario 1 and Full Removal of Wastes from the Combination Mine Waste Rock Pile

The third scenario includes the alternatives listed under Scenario 1, as well as full removal of waste from the Combination Mine AOC. The estimated cost of the full removal of waste from the Combination Mine AOC, in addition to Scenario 1 is approximately $12.9 million, which would leave approximately $4.6 million dollars for water treatment if necessary. Full removal of wastes in the Combination Mine AOC would increase the footprint of the repository to 15 acres (Figure 5). Increases in costs as compared to Scenario 1 are associated with the cost of excavating, hauling, and placing waste rock and impacted soils from the Combination Mine AOC in the repository. The repository footprint would also be increased, leading to increased excavation, repository base preparation, and cover system costs. Other notable costs are associated with removal, stockpiling, and replacement of the waste rock cover soils, and an increased revegetation footprint.

The benefits of full source removal at the Combination Mine AOC include removing a significant source of contamination from the drainage. Removal of this material would reduce concerns associated with metals loading caused by interaction of shallow groundwater or surface water infiltration through the waste rock. Full removal of the waste rock would also allow for inspection of the underlying subsurface to evaluate possible pathways for seeps. The possibility exists that the waste rock is the driver in terms of the poor seep water quality. Removal of the waste rock could reduce the magnitude of, or need for, water treatment.

While there are benefits to full removal, the cost increase associated with the full removal is significant. This alternative may improve seep water quality or reduce the quantity of flow, but water treatment may still be necessary. Investigations and sampling would still need to be completed to determine the interaction between the mine pool and the seeps. This scenario would leave approximately $4.6 million dollars from the settlement to go toward water treatment assessment, pilot study, and initial treatment implementation if necessary. Additional funds may be needed to support the water treatment in perpetuity (if needed) based on the cost estimate presented in Table 5.

Scenario 4 – Scenario 3 and Full Removal of Wastes from the Tim Smith Mine AOC

The fourth scenario includes the alternatives listed under Scenario 3, as well as full removal of waste from the Tim Smith Mine AOC. The total cost is approximately $13.5 million dollars; a difference of approximately $550 thousand from the Scenario 3. This scenario would leave approximately $4 million dollars for water treatment if necessary. The relative small difference in cost is due to the small quantity of waste located at the Tim Smith Mine AOC that would be excavated, hauled, and placed in the repository. This scenario also includes incrementally small increases in revegetation areas. The small quantity of waste would not affect the 15 acre footprint for the repository, although the waste material height in the repository would increase.

The benefit to this scenario is that it allows for full removal of source areas across the site. The cost of the repository is largely associated with disposal of the larger waste volumes associated with the Combination Mill and Combination Mine AOC. Therefore, waste materials from the Tim Smith Mine AOC could be addressed cost effectively. The removal of the waste would also address human health and ecological receptors, as well as remove the likelihood of wastes being transported via the Tim Smith drainage to SFLWC and recontaminating previously reclaimed areas.

Table 8. Reclamation Scenarios by Cost, Black Pine Mine.

Scenario	Description	Estimated Cost (w/out Optional Bid Items)	Total Cost (w/Optional Bid Items)	Difference from Base Cost	Incremental Increase	Notes
1	Excavation of Combination Mill, Downstream Soils and Sediments, and Excavation of Historic Mine Waste Rock and Placement in Repository	$7,924,700	**$8,273,900**	-	-	**Base Case – Combination Mill and Historic Mine AOCs**
2	Excavation of Combination Mill and Downstream Soils and Sediment; Excavation of Historic Mine Waste Rock; and Partial Removal of Combination Mine Waste Rock and Soils Removal Areas and Placement in Repository	$9,837,300	**$10,237,600**	$1,963,700	$1,963,700	**Addition of partial Combination Mine AOC**
3	Excavation of Combination Mill and Downstream Soils and Sediment; Excavation of Historic Mine Waste	$12,524,200	**$12,924,500**	$4,650,600	$2,686,900	**Addition of full Combination Mine AOC**

Table 8. Reclamation Scenarios by Cost, Black Pine Mine.						
Scenario	**Description**	**Estimated Cost (w/out Optional Bid Items)**	**Total Cost (w/Optional Bid Items)**	**Difference from Base Cost**	**Incremental Increase**	**Notes**
	Rock; and Excavation of Combination Mine Waste Rock and Soils Removal Areas and Placement in Repository					
4	Excavation of Combination Mill and Downstream Soils and Sediment; Excavation of Historic Mine Waste Rock; Excavation of Combination Mine Waste Rock and Soils Removal Areas; and Excavation of Tim Smith Waste Rock Piles and Placement in Repository	$13,027,200	**$13,475,500**	$5,201,600	$551,000	**Addition of Tim Smith Mine AOC**

Water treatment in the Combination Mine AOC could be considered as part of each of the scenarios presented. However, the most efficient water treatment would likely occur if some, or preferably all of the source material was removed from the Combination Mine waste rock pile.

5. Summary and Recommendations

Based on the evaluation performed for this Tech Memo, previous project discussions, information compiled during the RI, and evaluations performed as part of the developing the EE/CA, we are recommending DEQ consider implementing Scenario 4. This scenario includes a full removal of waste from the Combination Mine AOC, Combination Mill AOC, Historic Mine AOC, and Tim Smith Mine AOC and placement of these wastes in an onsite repository constructed in the Historic Mine AOC. This scenario removes the contaminated source material in the areas that are susceptible to contaminant migration impacting human health or ecological receptors. Implementation of this scenario does not preclude future site use nor does it preclude additional reclamation activities. This scenario would leave approximately $4 million dollars from the settlement to go toward water treatment assessment, pilot study, and initial treatment implementation if necessary. Additional funds may be needed to support the water treatment in perpetuity.

5.1. Future Investigations and Samples

Samples should be collected from the mine pool and seep collection system outlet discharge to the pumpback wet vault on a quarterly basis. Samples should be analyzed for total recoverable metals and anions and cations to assist with the analysis of the seeps. Flow measurements from the flow meters on the pumpback system should be collected to assist with design of a water treatment system. If the full removal of the waste rock pile occurs, an investigation should be performed on the subgrade to determine if seeps are interacting with groundwater/mine pool and determine preferential pathways for surface water and shallow groundwater.

6. References

Herrera, Trihydro. 2012. "Reclamation Investigation Report – Black Pine Mine." Prepared for Montana DEQ/AMLB. DEQ Contract No. 407032.

Herrera, Trihydro. 2013a. "EE/CA – Black Pine Mine." Prepared for Montana DEQ/AMLB. DEQ Contract No.407032.

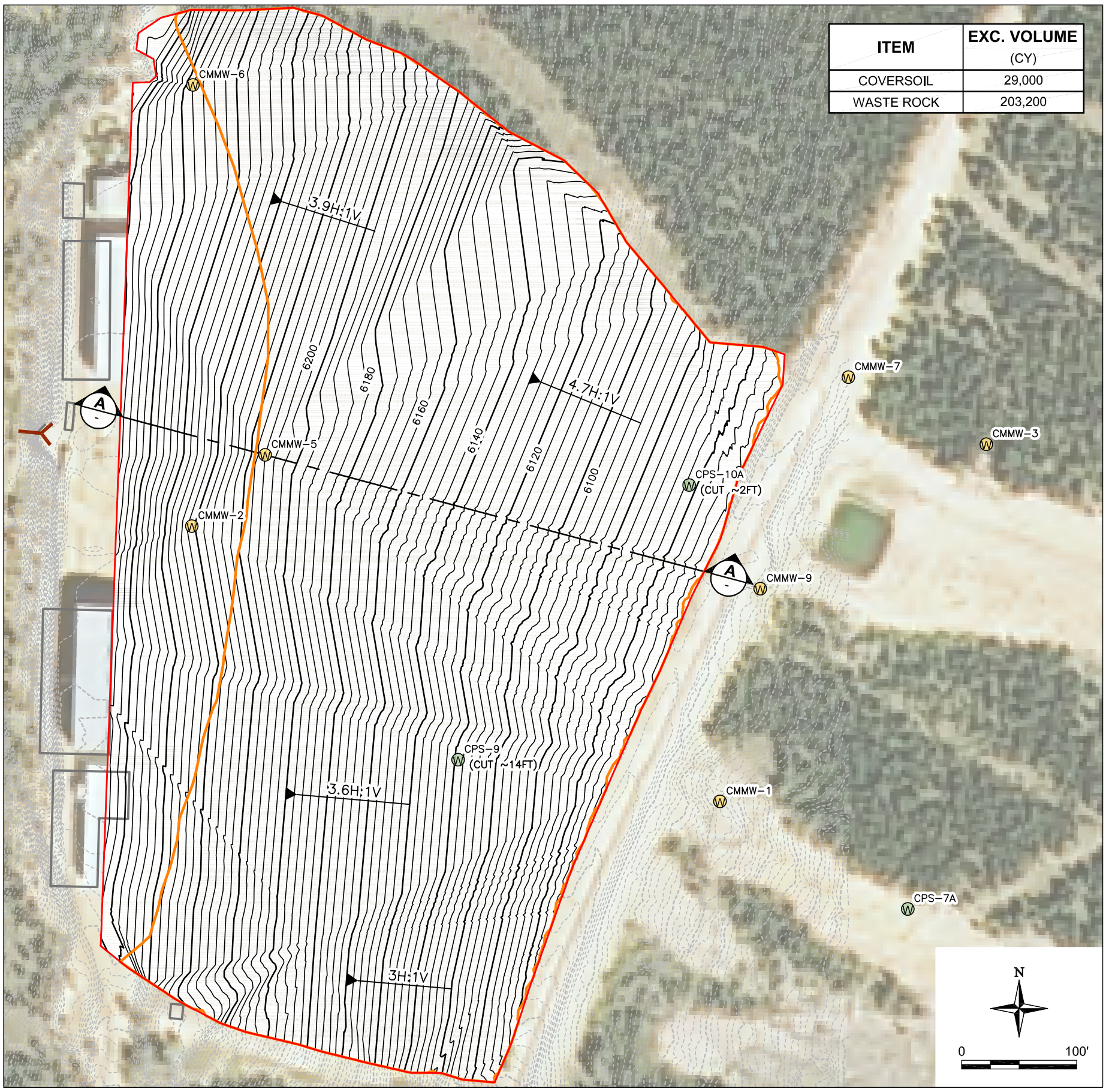
Herrera, Trihydro. 2013b. "Repository Investigation Report – Black Pine Mine." Prepared for Montana DEQ/AMLB. DEQ Contract No. 407032.

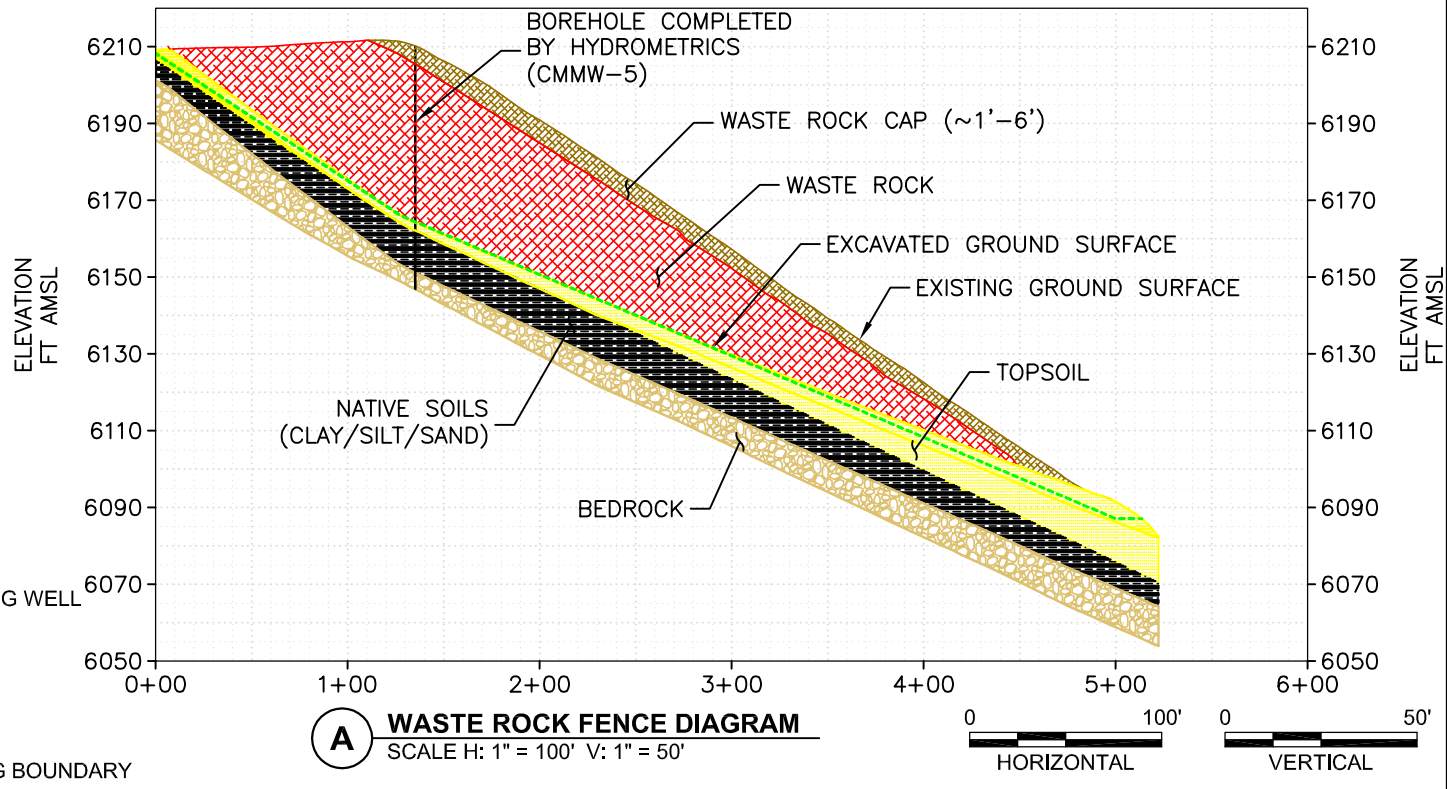
Hydrometrics, Inc. 2010. Data Compilation Report for the Black Pine Mine, Granite County, Montana. Prepared for Montana Department of Environmental Quality. August 2010.

Montana Department of Environmental Quality (DEQ). 2012. Final Circular DEQ-7 Montana Numeric Water Quality Standards. http://www.deq.mt.gov/wqinfo/standards/default.mcp

APPENDIX A
Figures

ITEM	EXC. VOLUME (CY)
COVERSOIL	29,000
WASTE ROCK	203,200





A **WASTE ROCK FENCE DIAGRAM**
SCALE H: 1" = 100' V: 1" = 50'

0 100' HORIZONTAL
0 50' VERTICAL

EXPLANATION

- CMMW–1 — EXISTING MONITORING WELL
- CPS–7A — SEEP LOCATION
- MINE ADIT
- WASTE BOUNDARY
- ALTERNATE GRADING BOUNDARY
- EXISTING STRUCTURE
- EXISTING CONTOURS (5' INTERVAL)
- PROPOSED CONTOURS (10' INTERVAL)
- FT — FEET
- FT AMSL — FEET ABOVE MEAN SEA LEVEL

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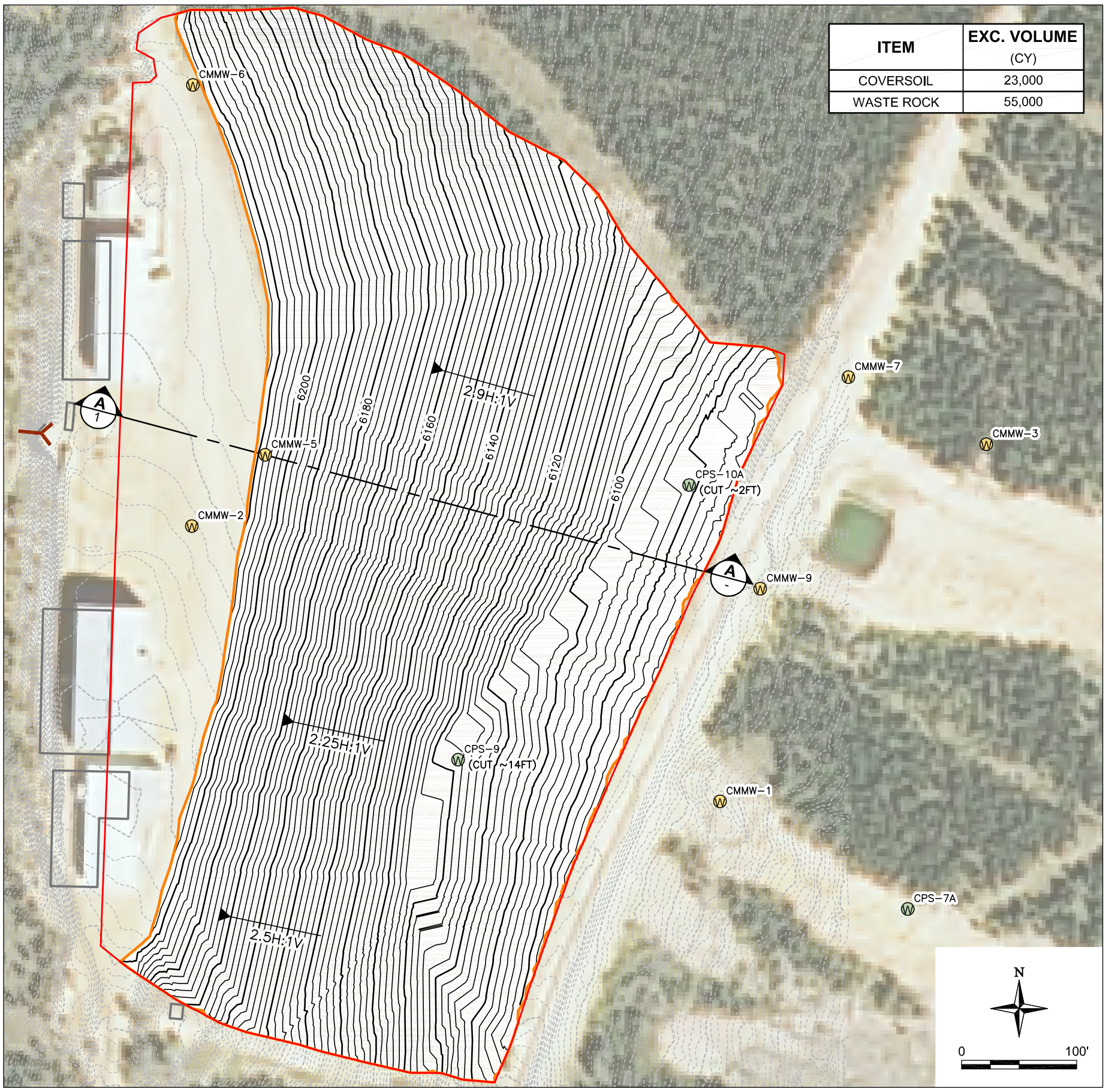
FIGURE 1

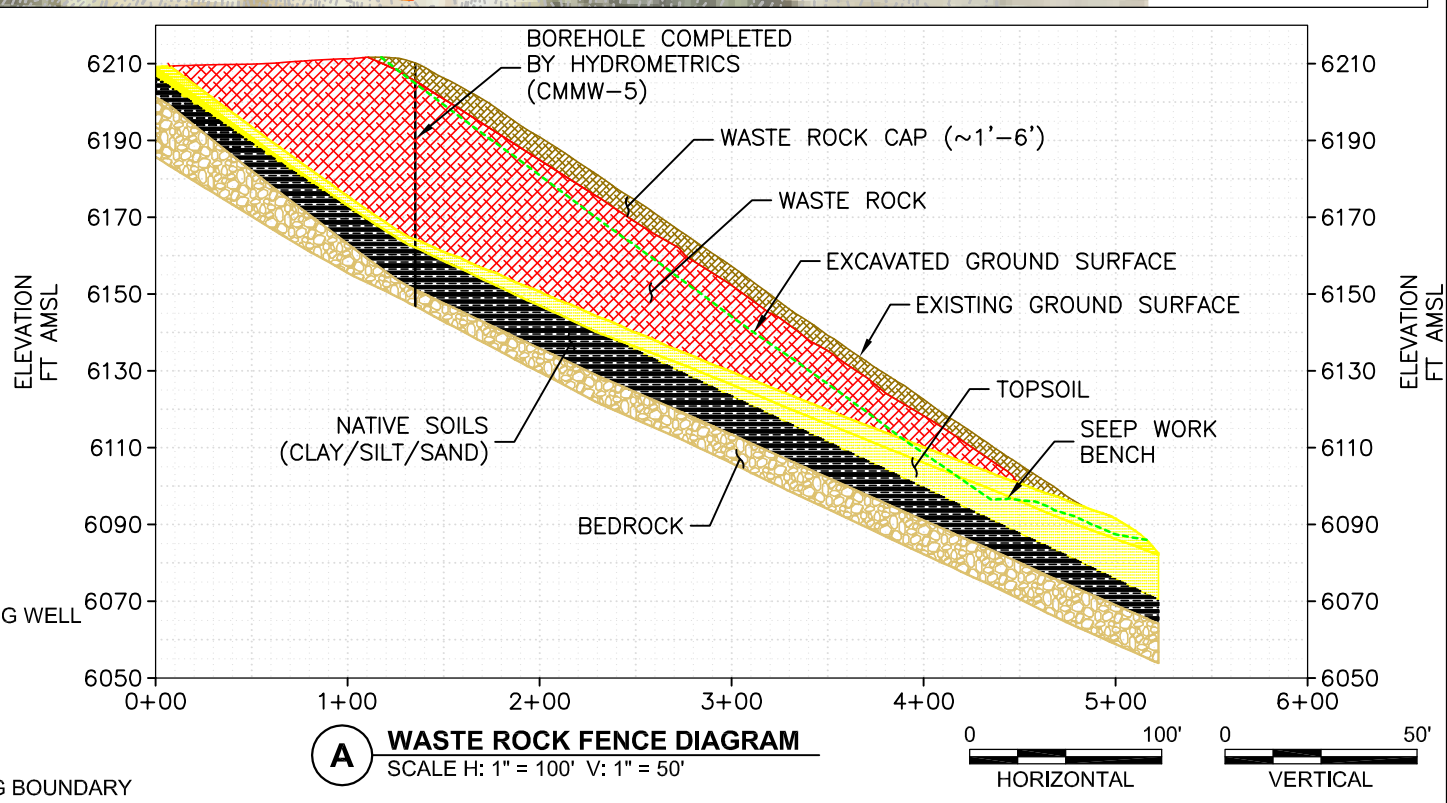
COMBINATION MINE WASTE ROCK PILE VOLUME ESTIMATE AND PROPOSED SURFACE - FULL REMOVAL

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
MINE WASTE CLEANUP BUREAU

Drawn By: BAH	Checked By: MD	Scale: AS SHOWN	Date: 2/7/14	File: 776_COMBINATIONMINEGRADINGALT_201

ITEM	EXC. VOLUME (CY)
COVERSOIL	23,000
WASTE ROCK	55,000





A **WASTE ROCK FENCE DIAGRAM**
SCALE H: 1" = 100' V: 1" = 50'

0 100' HORIZONTAL
0 50' VERTICAL

EXPLANATION

- CMMW–1 — EXISTING MONITORING WELL
- CPS–7A — SEEP LOCATION
- MINE ADIT
- WASTE BOUNDARY
- ALTERNATE GRADING BOUNDARY
- EXISTING STRUCTURE
- EXISTING CONTOURS (5' INTERVAL)
- PROPOSED CONTOURS (10' INTERVAL)
- FT — FEET
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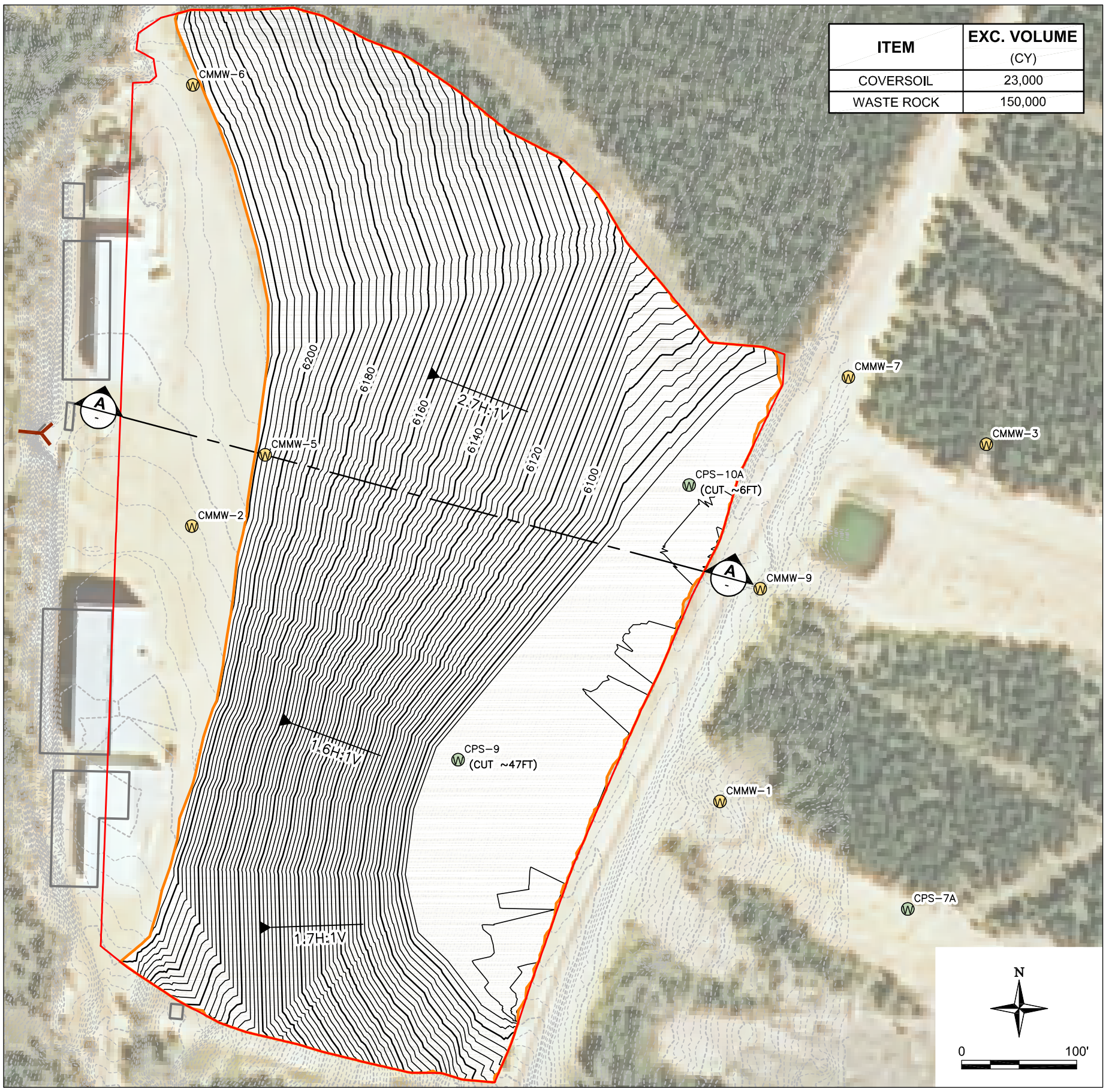
FIGURE 2

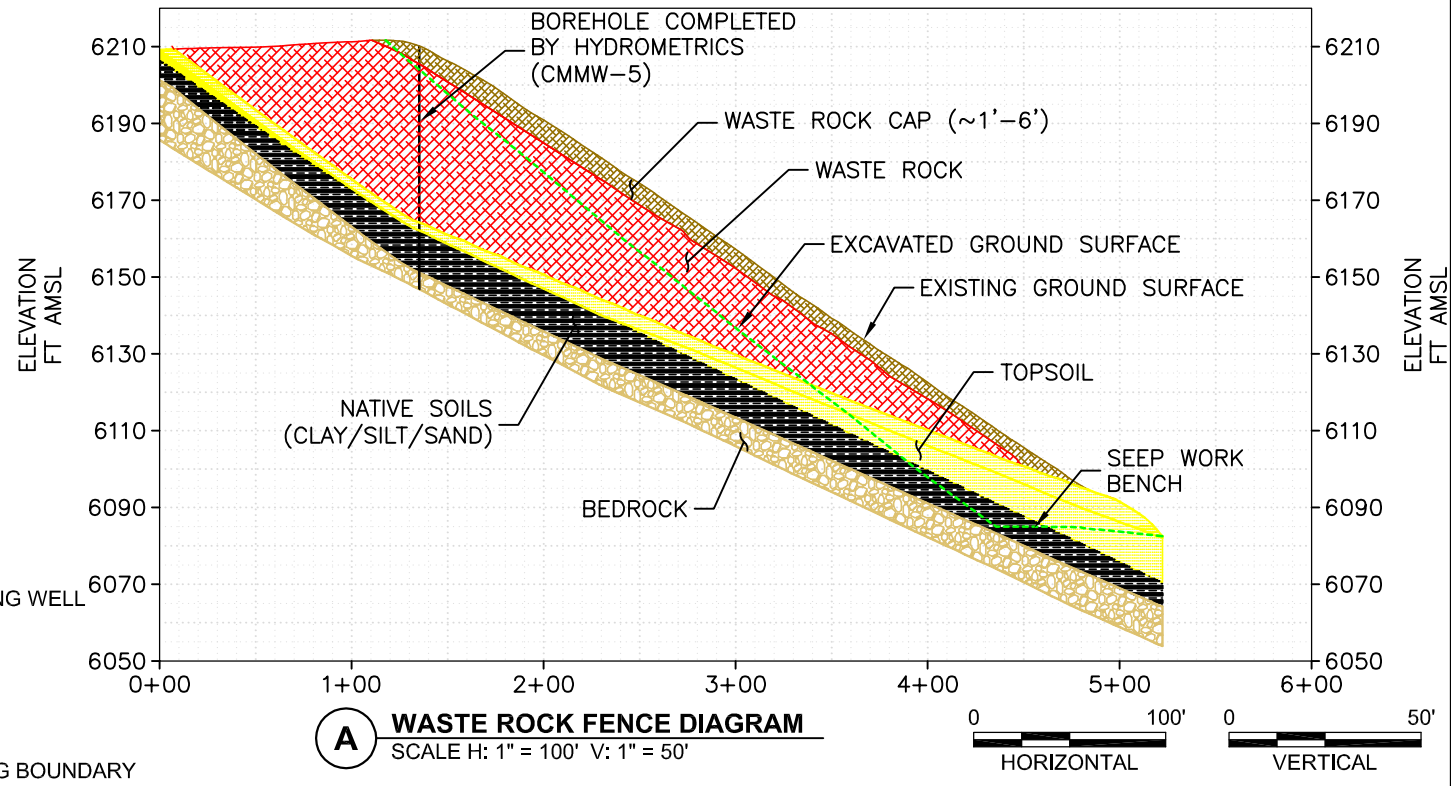
COMBINATION MINE WASTE ROCK PILE VOLUME ESTIMATE AND PROPOSED SURFACE - PARTIAL REMOVAL, APPROACH 1

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
MINE WASTE CLEANUP BUREAU

Drawn By: BAH	Checked By: MD	Scale: AS SHOWN	Date: 2/7/14	File: 776_COMBINATIONMINEGRADINGALT_201

ITEM	EXC. VOLUME (CY)
COVERSOIL	23,000
WASTE ROCK	150,000





A **WASTE ROCK FENCE DIAGRAM**
SCALE H: 1" = 100' V: 1" = 50'

0 100' HORIZONTAL
0 50' VERTICAL

EXPLANATION

- CMMW–1 — EXISTING MONITORING WELL
- CPS–7A — SEEP LOCATION
- MINE ADIT
- WASTE BOUNDARY
- ALTERNATE GRADING BOUNDARY
- EXISTING STRUCTURE
- EXISTING CONTOURS (5' INTERVAL)
- PROPOSED CONTOURS (10' INTERVAL)
- FT — FEET
- FT AMSL — FEET ABOVE MEAN SEA LEVEL

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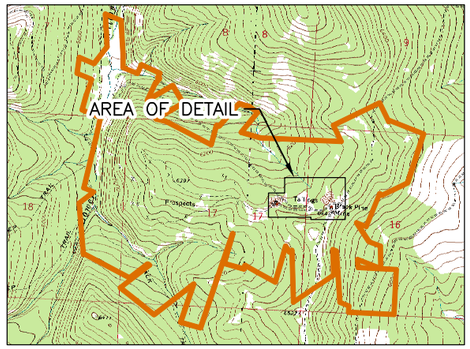
FIGURE 3
COMBINATION MINE WASTE ROCK PILE VOLUME ESTIMATE AND PROPOSED SURFACE - PARTIAL REMOVAL, APPROACH 2
BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
MINE WASTE CLEANUP BUREAU

Drawn By: BAH	Checked By: MD	Scale: AS SHOWN	Date: 2/7/14	File: 776_COMBINATIONMINEGRADINGALT_201



KEY MAP
SCALE: NONE

N

USFS ROAD 678

LEWIS SHAFT

HARPER SHAFT

USFS ROAD 448

OHP

9H:1V

6.6H:1V

10.9H:1V

4H:1V

5.3H:1V

N

0 150'

Image Cite: USDA Farm Service Agency, Wyoming 2011 Color National Agriculture Imaging Program (NAIP) Orthophoto, Granite County. Published 2011

EXPLANATION

- EXISTING GROUND SURFACE CONTOURS (5' INTERVAL)
- PROPOSED GROUND SURFACE CONTOURS (10' INTERVAL)
- OVERHEAD POWER
- ORIGINAL GRADING LIMITS
- ALTERNATIVE GRADING LIMITS
- EDGE OF ROAD
- INTERCEPTOR TRENCH/STORMWATER DIVERSION DITCH
- PROPOSED CENTERLINE USFS ROAD
- BUILDING

REPOSITORY DISTURBANCE FOOTPRINT: 12.8 AC

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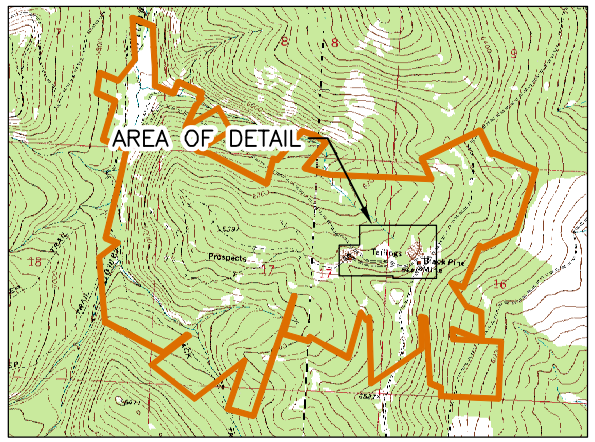
FIGURE 4

PROPOSED REPOSITORY SURFACE GRADING PARTIAL REMOVAL

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
MINE WASTE CLEANUP BUREAU

Drawn By: CJN	Checked By: MD	Scale: AS SHOWN	Date: 2/6/14	File: 776_BPM_REPOSITORYALT



KEY MAP
SCALE: NONE

N

USFS ROAD 678

LEWIS SHAFT

USFS ALT. NO. 3

USFS ALT. NO. 2

USFS ALT. NO. 1

USFS ROAD 448

HARPER SHAFT

OHP

7H:1V

4H:1V

3H:1V

3.7H:1V

10H:1V

0 150'

Image Cite: USDA Farm Service Agency, Wyoming 2011 Color National Agriculture Imaging Program (NAIP) Orthophoto, Granite County. Published 2011

EXPLANATION

- EXISTING GROUND SURFACE CONTOURS (5' INTERVAL)
- PROPOSED GROUND SURFACE CONTOURS (5' INTERVAL)
- OHP - OVERHEAD POWER
- GRADING LIMITS
- EDGE OF ROAD
- INTERCEPTOR TRENCH/STORMWATER DIVERSION DITCH
- PROPOSED CENTERLINE USFS ROAD ALTERNATIVE NO. 1
- PROPOSED CENTERLINE USFS ROAD ALTERNATIVE NO. 2
- PROPOSED CENTERLINE USFS ROAD ALTERNATIVE NO. 3
- BUILDING
- ALT. ALTERNATIVE
- NO. NUMBER

REPOSITORY DISTURBANCE FOOTPRINT: 15.5 AC

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FIGURE 5

PROPOSED REPOSITORY SURFACE GRADING
FULL REMOVAL

BLACK PINE MINE RECLAMATION PROJECT
MONTANA DEQ
MINE WASTE CLEANUP BUREAU

Drawn By: CJN	Checked By: MD	Scale: AS SHOWN	Date: 2/6/14	File: 776_BPM_REPOSITORYOORIG

APPENDIX B
Cost Estimates

Summary of Cost Options

Description	Estimated Cost (w/out Optional Bid Items)	Estimated Cost (w/Optional Bid Items)	Difference from Base Cost	Incremental Difference	Notes
Excavation of Combination Mill and Downstream Soils and Sediments and Placement in Repository	$ 7,924,700	$ 8,273,900	$ -		**Base Case - CML**
Excavation of Combination Mill and Downstream Soils and Sediment; and Partial Removal of Combination Mine Waste Rock and Soils Removal Areas and Placement in Repository	$ 9,837,300	$ 10,237,600	$ 1,963,700	$ 1,963,700	**Addition of partial CMN**
Excavation of Combination Mill and Downstream Soils and Sediment; and Excavation of Combination Mine Waste Rock and Soils Removal Areas and Placement in Repository	$ 12,524,200	$ 12,924,500	$ 4,650,600	$ 2,686,900	**Addition of whole CMN**
Excavation of Combination Mill and Downstream Soils and Sediment; Excavation of Combination Mine Waste Rock and Soils Removal Areas; and Excavation of Tim Smith and Placement in Repository	$ 13,027,200	$ 13,475,500	$ 5,201,600	$ 551,000	**Addition of Tim Smith**

Combination Mill Reclamation Cost Estimate

Notes:

1. Repository quantities are based off initial repository footprint of 12.8 acres.
2. Quantities are rolled up by task and assigned unit price for the entire task. Sub-tasks are added together and divided by the task quantity to create the unit price.

Combination Mill Removal Only

Activity/Material/Description		Quantity	Unit	Unit Price	Sub-item Cost	Cost (rounded)
CAPITAL COSTS						
Mobilization/Demobilization (not to exceed 10% of		1	LS	$705,630		$705,700
Clearing and Grubbing		35	AC	$5,300		$187,600
BMPs		1	LS	$42,743		$42,800
Temporary Fencing		2,987	LF	$5		$15,300
Signage		1	LS	$100		$100
Road Improvements		10,890	LF	$14		$153,600
Provide Water		7,200	Kgal	$50		$360,000
Repository Excavation and Embankment		189,300	CY	$5		$889,300
	Excavation	189,300	CY	$4	$671,474	
	Prepare Subgrade Soil	48,400	SY	$2	$72,600	
	Geosynthetic Clay Liner	0	SY	$6	$0	
	Grading/Compaction	48,400	SY	$3	$145,200	
Repository Cover		61,952	SY	$21		$1,292,100
	Drain System/Layer	61,952	SY	$10	$619,520	
	Surface Water Diversion Ditch	2,987	LF	$10	$29,032	
	Geomembrane Liner	61,952	SY	$8	$464,640	
	Cover Soil Placement	35,776	CY	$5	$178,880	
Removal of Contaminated Material		126,900	CY	$15		$1,961,800
	Contaminated Material Excavation, Haul, Placement, and Compaction	126,900	CY	$15	$1,961,757	
Removal of Dispersed Contaminated Material		21,100	CY	$22		$460,300
	Dispersed Contaminated Material Excavation, Haul, Placement, and Compaction	21,100	CY	$22	$460,212	
Borrow		148,000	CY	$4		$592,000
	Onsite Borrow - Load, haul, place	148,000	CY	$4	$592,000	
	Offsite Borrow	0	CY	$11	$0	
Rock Cover		5,600	CY	$20		$112,400
	Screening	1	LS	$92,456	$92,456	
	Haul and Place	5,600	CY	$4	$19,864	
Relocation and Reconstruction of SFLWC and Mill Creek		1	LS	$460,416		$460,500
	Water Management	1	LS	$54,873	$54,873	
	BMPs	1	LS	$10,400	$10,400	
	Channel Excavation	5,700	CY	$13	$73,416	
	SFLWC Channel Reconstruction	3,000	LF	$95	$283,877	
	Mill Creek Channel Reconstruction	400	LF	$95	$37,850	
Seeding and Soil Amendments		59	AC	$3,243		$190,600
Planting		59	AC	$5,000		$293,800
	Lodgepole Pine Planting	56	AC	$4,095	$229,747	
	Willow Planting	3	AC	$24,200	$64,000	
Adit Stabilization		1	LS	$9,933		$10,000

	Remove Temporary Combination Auxiliary Adit Barrier	1	LS	$1,710	$1,710		
	Dispose of Temporary Combination Auxiliary Adit Barrier	20	CY	$50	$1,009		
	Stablize Combination Auxiliary Adit	1	LS	$5,056	$5,056		
	Upgrade Combination Adit Barrier	1	LS	$2,157	$2,157		
Adit Closure		1	LS	$25,330		$25,400	
	Inspection	2	EA	$3,000	$6,000		
	Demolition and Disposal of Debris	2	EA	$3,628	$7,256		
	Backfill	2	EA	$6,037	$12,074		
Building Demolition, Maintenance, and Protection		1	LS	$8,647		$8,700	
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587		
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295		
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980		
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786		
	Demolition and Disposal of Select Buildings and Rubble		CY				Cost (without optional bid items)
TOTAL CAPITAL COST						**$7,762,000**	**$7,424,100**
ANNUAL O+M COSTS							
Inspections (1/yr)		1	EA	$3,600		$3,600	$3,600
Sampling and Analysis (1/yr)		1	EA	$3,500		$3,500	$3,500
Maintenance		1	LS	$5,625		$5,700	$5,700
TOTAL ANNUAL O+M COST						***$12,800***	**$12,800**
Present Value of O+M cost (2013)		30	yr			$250,900	$250,900
TOTAL PRESENT VALUE COST						**$8,012,900**	**$7,675,000**

Optional Costs

Planting		59	AC	$5,000		$293,800
	Lodgepole Pine Planting	56	AC	$4,095	$229,747	
	Willow Planting	3	AC	$24,200	$64,000	
Adit Stabilization		1	LS	$9,933		$10,000
	Remove Temporary Combination Auxiliary Adit Barrier	1	LS	$1,710	$1,710	
	Dispose of Temporary Combination Auxiliary Adit Barrier	20	CY	$50	$1,009	
	Stablize Combination Auxiliary Adit	1	LS	$5,056	$5,056	
	Upgrade Combination Adit Barrier	1	LS	$2,157	$2,157	
Adit Closure		1	LS	$25,330		$25,400
	Inspection	2	EA	$3,000	$6,000	
	Demolition and Disposal of Debris	2	EA	$3,628	$7,256	
	Backfill	2	EA	$6,037	$12,074	
Building Demolition, Maintenance, and Protection		1	LS	$8,647		$8,700
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587	
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295	
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980	
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786	
	Demolition and Disposal of Select Buildings and Rubble		CY			
Subtotal						**$337,900**

Notes:
1. Repository quantities are based off initial repository footprint of 12.8 acres.
2. Quantities are rolled up by task and assigned unit price for the entire task. Sub-tasks are added together and divided by the task quantity to create the unit price.

Combination Mill and Historic Mine Removal

Activity/Material/Description		Quantity	Unit	Unit Price	Sub-item Cost	Cost (rounded)
CAPITAL COSTS						
Mobilization/Demobilization (not to exceed 10% of		1	LS	$729,360		$729,400
Clearing and Grubbing		37	AC	$5,300		$196,200
BMPs		1	LS	$44,819		$44,900
Temporary Fencing		2,987	LF	$5		$15,300
Signage		1	LS	$100		$100
Road Improvements		10,890	LF	$14		$153,600
Provide Water		7,200	Kgal	$50		$360,000
Repository Excavation and Embankment		189,300	CY	$5		$889,300
	Excavation	189,300	CY	$4	$671,474	
	Prepare Subgrade Soil	48,400	SY	$2	$72,600	
	Geosynthetic Clay Liner	0	SY	$6	$0	
	Grading/Compaction	48,400	SY	$3	$145,200	
Repository Cover		61,952	SY	$21		$1,292,100
	Drain System/Layer	61,952	SY	$10	$619,520	
	Surface Water Diversion Ditch	2,987	LF	$10	$29,032	
	Geomembrane Liner	61,952	SY	$8	$464,640	
	Cover Soil Placement	35,776	CY	$5	$178,880	
Removal of Contaminated Material		140,250	CY	$15		$2,168,200
	Contaminated Material Excavation, Haul, Placement, and Compaction	140,250	CY	$15	$2,168,135	
Removal of Dispersed Contaminated Material		21,100	CY	$22		$460,300
	Dispersed Contaminated Material Excavation, Haul, Placement, and Compaction	21,100	CY	$22	$460,212	
Borrow		148,000	CY	$4		$592,000
	Onsite Borrow - Load, haul, place	148,000	CY	$4	$592,000	
	Offsite Borrow	0	CY	$11	$0	
Rock Cover		5,600	CY	$20		$112,400
	Screening	1	LS	$92,456	$92,456	
	Haul and Place	5,600	CY	$4	$19,864	
Relocation and Reconstruction of SFLWC and Mill Creek		1	LS	$460,416		$460,500
	Water Management	1	LS	$54,873	$54,873	
	BMPs	1	LS	$10,400	$10,400	
	Channel Excavation	5,700	CY	$13	$73,416	
	SFLWC Channel Reconstruction	3,000	LF	$95	$283,877	
	Mill Creek Channel Reconstruction	400	LF	$95	$37,850	
Seeding and Soil Amendments		61	AC	$3,243		$199,500
Planting		61	AC	$4,960		$305,100
	Lodgepole Pine Planting	59	AC	$4,095	$241,008	
	Willow Planting	3	AC	$24,200	$64,000	

Adit Stabilization		1	LS	$9,933		$10,000	
	Remove Temporary Combination Auxiliary Adit Barrier	1	LS	$1,710	$1,710		
	Dispose of Temporary Combination Auxiliary Adit Barrier	20	CY	$50	$1,009		
	Stablize Combination Auxiliary Adit	1	LS	$5,056	$5,056		
	Upgrade Combination Adit Barrier	1	LS	$2,157	$2,157		
Adit Closure		1	LS	$25,330		$25,400	
	Inspection	2	EA	$3,000	$6,000		
	Demolition and Disposal of Debris	2	EA	$3,628	$7,256		
	Backfill	2	EA	$6,037	$12,074		
Building Demolition, Maintenance, and Protection		1	LS	$8,647		$8,700	
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587		
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295		
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980		
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786		
	Demolition and Disposal of Select Buildings and Rubble		CY				Cost (without optional bid items)
TOTAL CAPITAL COSTS						**$8,023,000**	**$7,673,800**
ANNUAL O+M COSTS							
Inspections (1/yr)		1	EA	$3,600		$3,600	$3,600
Sampling and Analysis (1/yr)		1	EA	$3,500		$3,500	$3,500
Maintenance		1	LS	$5,625		$5,700	$5,700
TOTAL ANNUAL O+M COST						***$12,800***	***$12,800***
Present Value of O+M cost (2013)		30	yr			$250,900	$250,900
TOTAL PRESENT VALUE COST						**$8,273,900**	**$7,924,700**

Optional Costs

Planting		61	AC	$4,960		$305,100
	Lodgepole Pine Planting	59	AC	$4,095	$241,008	
	Willow Planting	3	AC	$24,200	$64,000	
Adit Stabilization		1	LS	$9,933		$10,000
	Remove Temporary Combination Auxiliary Adit Barrier	1	LS	$1,710	$1,710	
	Dispose of Temporary Combination Auxiliary Adit Barrier	20	CY	$50	$1,009	
	Stablize Combination Auxiliary Adit	1	LS	$5,056	$5,056	
	Upgrade Combination Adit Barrier	1	LS	$2,157	$2,157	
Adit Closure		1	LS	$25,330		$25,400
	Inspection	2	EA	$3,000	$6,000	
	Demolition and Disposal of Debris	2	EA	$3,628	$7,256	
	Backfill	2	EA	$6,037	$12,074	
Building Demolition, Maintenance, and Protection		1	LS	$8,647		$8,700
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587	
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295	
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980	
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786	
	Demolition and Disposal of Select Buildings and Rubble		CY			
Subtotal						**$349,200**

Notes:
1. Repository quantities are based off initial repository footprint of 12.8 acres.
2. Quantities are rolled up by task and assigned unit price for the entire task. Sub-tasks are added together and divided by the task quantity to create the unit price.

Combination Mill, Historic Mine, and Partial Combination Mine Removal

Activity/Material/Description		Quantity	Unit	Unit Price	Sub-item Cost	Cost (rounded)
CAPITAL COSTS						
Mobilization/Demobilization (not to exceed 10% of		1	LS	$907,880		$907,900
Clearing and Grubbing		37	AC	$5,300		$196,200
BMPs		1	LS	$54,254		$54,300
Temporary Fencing		2,987	LF	$5		$15,300
Signage		1	LS	$100		$100
Road Improvements		10,890	LF	$14		$153,600
Provide Water		8,800	Kgal	$50		$440,000
Repository Excavation and Embankment		194,300	CY	$5		$907,100
	Excavation	194,300	CY	$4	$689,210	
	Prepare Subgrade Soil	48,400	SY	$2	$72,600	
	Geosynthetic Clay Liner	0	SY	$6	$0	
	Grading/Compaction	48,400	SY	$3	$145,200	
Repository Cover		61,952	SY	$21		$1,292,100
	Drain System/Layer	61,952	SY	$10	$619,520	
	Surface Water Diversion Ditch	2,987	LF	$10	$29,032	
	Geomembrane Liner	61,952	SY	$8	$464,640	
	Cover Soil Placement	35,776	CY	$5	$178,880	
Removal of Contaminated Material		200,500	CY	$15		$3,099,600
	Contaminated Material Excavation, Haul, Placement, and Compaction	200,500	CY	$15	$3,099,544	
Removal of Dispersed Contaminated Material		21,100	CY	$22		$460,300
	Dispersed Contaminated Material Excavation, Haul, Placement, and Compaction	21,100	CY	$22	$460,212	
Borrow		153,000	CY	$4		$612,000
	Onsite Borrow - Load, haul, place	153,000	CY	$4	$612,000	
	Offsite Borrow	0	CY	$11	$0	
Rock Cover		5,600	CY	$20		$112,400
	Screening	1	LS	$92,456	$92,456	
	Haul and Place	5,600	CY	$4	$19,864	
Waste Rock Cover		26,000	SY	$24		$635,000
	Drain System/Layer	26,000	SY	$13	$325,000	
	Geomembrane Liner	26,000	SY	$8	$195,000	
	Cover Soil Placement	23,000	CY	$5	$115,000	
Relocation and Reconstruction of SFLWC and Mill Creek		1	LS	$460,416		$460,500
	Water Management	1	LS	$54,873	$54,873	
	BMPs	1	LS	$10,400	$10,400	
	Channel Excavation	5,700	CY	$13	$73,416	
	SFLWC Channel Reconstruction	3,000	LF	$95	$283,877	
	Mill Creek Channel Reconstruction	400	LF	$95	$37,850	
Seeding and Soil Amendments		74	AC	$3,243		$240,000
Planting		74	AC	$4,814		$356,200
	Lodgepole Pine Planting	71	AC	$4,095	$292,196	
	Willow Planting	3	AC	$24,200	$64,000	

Adit Stabilization		1	LS	$9,933		$10,000	
	Remove Temporary Combination Auxiliary Adit Barrier	1	LS	$1,710	$1,710		
	Dispose of Temporary Combination Auxiliary Adit Barrier	20	CY	$50	$1,009		
	Stablize Combination Auxiliary Adit	1	LS	$5,056	$5,056		
	Upgrade Combination Adit Barrier	1	LS	$2,157	$2,157		
Adit Closure		1	LS	$25,330		$25,400	
	Inspection	2	EA	$3,000	$6,000		
	Demolition and Disposal of Debris	2	EA	$3,628	$7,256		
	Backfill	2	EA	$6,037	$12,074		
Building Demolition, Maintenance, and Protection		1	LS	$8,647		$8,700	
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587		
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295		
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980		
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786		
	Demolition and Disposal of Select Buildings and Rubble		CY				Cost (without optional bid items)
TOTAL CAPITAL COST						**$9,986,700**	**$9,586,400**
ANNUAL O+M COSTS							
Inspections (1/yr)		1	EA	$3,600		$3,600	$3,600
Sampling and Analysis (1/yr)		1	EA	$3,500		$3,500	$3,500
Maintenance		1	LS	$5,625		$5,700	$5,700
TOTAL ANNUAL O+M COST						**$12,800**	**$12,800**
Present Value of O+M cost (2013)		30	yr			$250,900	$250,900
TOTAL PRESENT VALUE COST						**$10,237,600**	**$9,837,300**

Optional Costs

Planting		74	AC	$4,814		$356,200
	Lodgepole Pine Planting	71	AC	$4,095	$292,196	
	Willow Planting	3	AC	$24,200	$64,000	
Adit Stabilization		1	LS	$9,933		$10,000
	Remove Temporary Combination Auxiliary Adit Barrier	1	LS	$1,710	$1,710	
	Dispose of Temporary Combination Auxiliary Adit Barrier	20	CY	$50	$1,009	
	Stablize Combination Auxiliary Adit	1	LS	$5,056	$5,056	
	Upgrade Combination Adit Barrier	1	LS	$2,157	$2,157	
Adit Closure		1	LS	$25,330		$25,400
	Inspection	2	EA	$3,000	$6,000	
	Demolition and Disposal of Debris	2	EA	$3,628	$7,256	
	Backfill	2	EA	$6,037	$12,074	
Building Demolition, Maintenance, and Protection		1	LS	$8,647		$8,700
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587	
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295	
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980	
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786	
	Demolition and Disposal of Select Buildings and Rubble		CY			
Subtotal						**$400,300**

Notes:
1. Repository quantities are based off initial repository footprint of 15 acres.
2. Quantities are rolled up by task and assigned unit price for the entire task. Sub-tasks are added together and divided by the task quantity to create the unit price.

Combination Mill, Historic Mine, and Full Combination Mine Removal

Activity/Material/Description		Quantity	Unit	Unit Price	Sub-item Cost	Cost (rounded)
CAPITAL COSTS						
Mobilization/Demobilization (not to exceed 10% of		1	LS	$1,152,140		$1,152,200
Clearing and Grubbing		39	AC	$5,300		$207,900
BMPs		1	LS	$55,915		$56,000
Temporary Fencing		3,233	LF	$5		$16,600
Signage		1	LS	$108		$200
Road Improvements		10,890	LF	$14		$153,600
Provide Water		12,800	Kgal	$50		$640,000
Repository Excavation and Embankment		192,580	CY	$5		$950,800
	Excavation	192,580	CY	$4	$683,109	
	Prepare Subgrade Soil	59,470	SY	$2	$89,205	
	Geosynthetic Clay Liner	0	SY	$6	$0	
	Grading/Compaction	59,470	SY	$3	$178,410	
Repository Cover		75,020	SY	$21		$1,556,400
	Drain System/Layer	75,020	SY	$10	$750,200	
	Surface Water Diversion Ditch	3,287	LF	$10	$31,947	
	Geomembrane Liner	75,020	SY	$8	$562,650	
	Cover Soil Placement	42,310	CY	$5	$211,550	
Removal of Contaminated Material		348,450	CY	$15		$5,386,800
	Contaminated Material Excavation, Haul, Placement, and Compaction	348,450	CY	$15	$5,386,714	
Removal of Dispersed Contaminated Material		21,100	CY	$22		$460,300
	Dispersed Contaminated Material Excavation, Haul, Placement, and Compaction	21,100	CY	$22	$460,212	
Borrow		153,000	CY	$4		$679,200
	Onsite Borrow - Load, haul, place	142,970	CY	$4	$571,880	
	Offsite Borrow	10,030	CY	$11	$107,240	
Rock Cover		7,300	CY	$20		$146,500
	Screening	1	LS	$120,523	$120,523	
	Haul and Place	7,300	CY	$4	$25,894	
Cover Soil Replacement at Combination Mine		29,000	CY	$5		$145,000
Relocation and Reconstruction of SFLWC and Mill Creek		1	LS	$460,416		$460,500
	Water Management	1	LS	$54,873	$54,873	
	BMPs	1	LS	$10,400	$10,400	
	Channel Excavation	5,700	CY	$13	$73,416	
	SFLWC Channel Reconstruction	3,000	LF	$95	$283,877	
	Mill Creek Channel Reconstruction	400	LF	$95	$37,850	
Seeding and Soil Amendments		74	AC	$3,243		$240,000
Planting		74	AC	$4,814		$356,200
	Lodgepole Pine Planting	71	AC	$4,095	$292,196	
	Willow Planting	3	AC	$24,200	$64,000	
Adit Stabilization		1	LS	$9,933		$10,000

	Remove Temporary Combination Auxiliary Adit Barrier	1	LS	$1,710	$1,710		
	Dispose of Temporary Combination Auxiliary Adit Barrier	20	CY	$50	$1,009		
	Stablize Combination Auxiliary Adit	1	LS	$5,056	$5,056		
	Upgrade Combination Adit Barrier	1	LS	$2,157	$2,157		
Adit Closure		1	LS	$25,330		$25,400	
	Inspection	2	EA	$3,000	$6,000		
	Demolition and Disposal of Debris	2	EA	$3,628	$7,256		
	Backfill	2	EA	$6,037	$12,074		
Building Demolition, Maintenance, and Protection		1	LS	$29,927		$30,000	
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587		
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295		
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980		
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786		
	Demolition and Disposal of Select Buildings and Rubble	199	CY	$107	$21,280		Cost (without optional bid items)
TOTAL CAPITAL COST						**$12,673,600**	**$12,273,300**
ANNUAL O+M COSTS							
Inspections (1/yr)		1	EA	$3,600		$3,600	$3,600
Sampling and Analysis (1/yr)		1	EA	$3,500		$3,500	$3,500
Maintenance		1	LS	$5,625		$5,700	$5,700
TOTAL ANNUAL O+M COST						***$12,800***	**$12,800**
Present Value of O+M cost (2013)		30	yr			$250,900	$250,900
TOTAL PRESENT VALUE COST						**$12,924,500**	**$12,524,200**

Optional Costs

Planting		74	AC	$4,814		$356,200
	Lodgepole Pine Planting	71	AC	$4,095	$292,196	
	Willow Planting	3	AC	$24,200	$64,000	
Adit Stabilization		1	LS	$9,933		$10,000
	Remove Temporary Combination Auxiliary Adit Barrier	1	LS	$1,710	$1,710	
	Dispose of Temporary Combination Auxiliary Adit Barrier	20	CY	$50	$1,009	
	Stablize Combination Auxiliary Adit	1	LS	$5,056	$5,056	
	Upgrade Combination Adit Barrier	1	LS	$2,157	$2,157	
Adit Closure		1	LS	$25,330		$25,400
	Inspection	2	EA	$3,000	$6,000	
	Demolition and Disposal of Debris	2	EA	$3,628	$7,256	
	Backfill	2	EA	$6,037	$12,074	
Building Demolition, Maintenance, and Protection		1	LS	$8,647		$8,700
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587	
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295	
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980	
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786	
	Demolition and Disposal of Select Buildings and Rubble		CY			
Subtotal						**$400,300**

Site-Wide Source Removal Cost Estimate

Notes:

1. Repository quantities are based off initial repository footprint of 15 acres.
2. Quantities are rolled up by task and assigned unit price for the entire task. Sub-tasks are added together and divided by the task quantity to create the unit price.

Site-Wide Removal

Activity/Material/Description		Quantity	Unit	Unit Price	Sub-item Cost	Cost (rounded)
CAPITAL COSTS						
Mobilization/Demobilization (not to exceed 10% of		1	LS	$1,202,230		$1,202,300
Clearing and Grubbing		39	AC	$5,300		$207,900
BMPs		1	LS	$60,821		$60,900
Temporary Fencing		3,233	LF	$5		$16,600
Signage		1	LS	$108		$200
Road Improvements		10,890	LF	$14		$153,600
Provide Water		14,400	Kgal	$50		$720,000
Repository Excavation and Embankment		192,580	CY	$5		$950,800
	Excavation	192,580	CY	$4	$683,109	
	Prepare Subgrade Soil	59,470	SY	$2	$89,205	
	Geosynthetic Clay Liner	0	SY	$6	$0	
	Grading/Compaction	59,470	SY	$3	$178,410	
Repository Cover		75,020	SY	$21		$1,556,400
	Drain System/Layer	75,020	SY	$10	$750,200	
	Surface Water Diversion Ditch	3,287	LF	$10	$31,947	
	Geomembrane Liner	75,020	SY	$8	$562,650	
	Cover Soil Placement	42,310	CY	$5	$211,550	
Removal of Contaminated Material		371,100	CY	$15		$5,736,900
	Contaminated Material Excavation, Haul, Placement, and Compaction	371,100	CY	$15	$5,736,862	
Removal of Dispersed Contaminated Material		21,100	CY	$22		$460,300
	Dispersed Contaminated Material Excavation, Haul, Placement, and Compaction	21,100	CY	$22	$460,212	
Borrow		154,692	CY	$5		$697,300
	Onsite Borrow - Load, haul, place	142,970	CY	$4	$571,880	
	Offsite Borrow	11,722	CY	$11	$125,331	
Rock Cover		7,300	CY	$20		$146,500
	Screening	1	LS	$120,523	$120,523	
	Haul and Place	7,300	CY	$4	$25,894	
Cover Soil Replacement at Combination Mine		29,000	CY	$5		$145,000
Relocation and Reconstruction of SFLWC and Mill Creek		1	LS	$460,416		$460,500
	Water Management	1	LS	$54,873	$54,873	
	BMPs	1	LS	$10,400	$10,400	
	Channel Excavation	5,700	CY	$13	$73,416	

Site-Wide Source Removal Cost Estimate

	SFLWC Channel Reconstruction	3,000	LF	$95	$283,877	
	Mill Creek Channel Reconstruction	400	LF	$95	$37,850	
Seeding and Soil Amendments		80	AC	$3,243		$261,100
Planting		80	AC	$4,756		$382,900
	Lodgepole Pine Planting	78	AC	$4,095	$318,813	
	Willow Planting	3	AC	$24,200	$64,000	
Adit Stabilization		1	LS	$9,933		$10,000
	Remove Temporary Combination Auxiliary Adit Barrier	1	LS	$1,710	$1,710	
	Dispose of Temporary Combination Auxiliary Adit Barrier	20	CY	$50	$1,009	
	Stablize Combination Auxiliary Adit	1	LS	$5,056	$5,056	
	Upgrade Combination Adit Barrier	1	LS	$2,157	$2,157	
Adit Closure		1	LS	$25,330		$25,400
	Inspection	2	EA	$3,000	$6,000	
	Demolition and Disposal of Debris	2	EA	$3,628	$7,256	
	Backfill	2	EA	$6,037	$12,074	
Building Demolition, Maintenance, and Protection		1	LS	$29,927		$30,000
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587	
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295	
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980	
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786	
	Demolition and Disposal of Select Buildings and Rubble	199	CY	$107	$21,280	
TOTAL CAPITAL COST						**$13,224,600**
ANNUAL O+M COSTS						
Inspections (1/yr)		1	EA	$3,600		$3,600
Sampling and Analysis (1/yr)		1	EA	$3,500		$3,500
Maintenance		1	LS	$5,625		$5,700
TOTAL ANNUAL O+M COST						***$12,800***
Present Value of O+M cost (2013)		30	yr			$250,900
TOTAL PRESENT VALUE COST						**$13,475,500**

APPENDIX H

PROCESS OPTION SCREENING TABLE

Table H-1.Process Options Initial Screening Summary, Black Pine Mine.					
General Response Action	**Reclamation Technology**	**Process Option**	**Effectiveness**	**Implementability**	**Cost**
No Action	None	No Action	Not Applicable: Toxicity, mobility, and volume of the contaminated material would not be reduced. Human and ecological health risks would not be addressed. Reclamation goals would not be achieved.	Not Applicable: Technical feasibility, availability of services and materials, and administrative feasibility do not apply since no work would be performed.	$0
Institutional Controls	Access and Use Control	Fencing and Signage	Low Effectiveness: Toxicity, mobility, and volume of contaminants would not be reduced. Human health risks would be reduced by limiting contact with contaminated material. However, ecological health risks would not be addressed. Reclamation goals would not be achieved under this option, and reclamation may be required at a later date.	Highly Feasible: Technical feasibility and availability of services and materials would be high since this option would only require boundaries to be established, fencing to be installed, and signage to be created. Administrative feasibility would be high since minimal considerations would be required.	$123,900
		Land Use Restrictions	Low Effectiveness: Toxicity, mobility, and volume of contaminants would not be reduced. Human health risks would be reduced by limiting	Moderately Feasible: Technical feasibility and availability of services and materials do not apply because no construction	$200

			contact with contaminated material. However, ecological health risks would not be addressed. Reclamation goals would not be achieved, and reclamation may be required at a later date.	work would be performed. Administrative feasibility would be moderate since it would require a land use analysis and deed restrictions.	
Engineering Controls	Removal and/or Containment	Removal of Contaminated Material and Placement in Repository on Trust Property	Highly Effective: Toxicity and volume would not be reduced; Mobility would be reduced by removing and containing the contaminated material in a secure repository. Human and ecological health risks would be reduced by removing and isolating contaminated material. Reclamation goals would likely be achieved under this option. The geology of the repository location would allow proper excavation and accumulation of cover soil and top soil for lining purposes. Post-construction maintenance would be required.	Highly Feasible: Technical feasibility and availability of services and materials would be high since removal could be readily implemented with standard construction techniques. Administrative feasibility would be moderate since it would require preventing future site development and/or use.	$8,537,700
		Removal of Contaminated Material and Placement in Offsite Disposal Facility	Highly Effective: Toxicity, mobility, and volume would be reduced by removing the contaminated material. Human and ecological health	Highly Feasible: Technical feasibility and availability of services and materials would be high since this option could be readily	$20,106,100

			risks would be reduced. Reclamation goals would likely be achieved under this option.	implemented with standard construction techniques. Administrative feasibility would be high and would require permitting and coordination with agencies.	
		In-Place Capping	Moderately Effective: Toxicity and volume would not be reduced; Mobility would be reduced by containing the contaminated material. Human and ecological health risks would be reduced by physically containing contamination. Some reclamation goals would likely be achieved under this option. Post-construction maintenance would be required.	Highly Feasible: Technical feasibility and availability of services and materials would be high since this option could be readily implemented with standard construction techniques. Administrative feasibility would be moderate since it would require preventing future site development and/or use.	$2,404,400
		Removal of Dispersed Contaminated Material	Highly Effective: Toxicity, volume, and mobility would be reduced by removing the dispersed tailings. Human and ecological health risks would be reduced by physically removing the contaminated material. Reclamation goals for the dispersed tailings areas would likely be achieved under this option.	Highly Feasible: Technical feasibility and availability of services and materials would be high and could be readily implemented with standard construction techniques. Construction techniques would need to include proper in-water practices during excavation of contaminated material. Administrative feasibility	$424,700

				would be high and would require permitting and coordination with agencies.	
	Surface Restoration	Revegetation	Highly Effective: Revegetation would provide erosion control for disturbed areas. For the repository cover, dense grass would reduce infiltration and reduce the potential for establishment of woody plants that could puncture liner. Vegetation along the stream corridor would protect water quality by stabilizing the bank.	Highly Feasible: Technical feasibility and availability of services and materials would be high because revegetation can be readily implemented with standard construction techniques. Administrative feasibility would be high and would include preventing access onto newly planted areas. Successful implementation will depend on the quality of the plant material and weather conditions.	**Removal Areas** Onsite Borrow: $1,024,200 Offsite Borrow: $1,191,300 Import Borrow: $2,709,200 **Repository** Onsite Borrow: $106,200 Offsite Borrow: $135,000 Import Borrow: $396,900
		Rock Cover	Highly Effective: Rock cover on the repository would divert runoff, thereby minimizing infiltration. Rock cover would blend in with the surrounding habitat.	Highly Feasible: Technical feasibility and availability of services and materials would be high because this option could be readily implemented with standard construction techniques. Administrative feasibility would be high and would require permitting and coordination with agencies.	$728,200 – Screen Native Material (Repository Cover Only) $1,381,400 – Import Material (Repository Cover Only)

	Stream Restoration	Relocation and Reconstruction of SFLWC and Mill Creek	Highly Effective: Stream and riparian habitat would be improved. Realignment would restore channels to their approximate historic locations.	Moderately Feasible: Technical feasibility and availability of services and materials would be high because this option could be readily implemented with standard construction techniques. Administrative feasibility would be moderate since it would require special permitting to allow work in the creek and coordination with agencies.	$462,500
		No Restoration of SFLWC and Mill Creek	Low Effectiveness: The current alignments and berms along the channel would remain; thus channelizing the stream and increasing the potential for flooding and habitat reduction.	Moderate Feasibility: Technical feasibility and availability of services and materials do not apply because no construction work would be performed. Administrative feasibility would be moderate since this option may only delay habitat remediation.	$0
	Physical Hazard Removal	Adit Closure and Stabilization	Highly Effective: Human and ecological health risks would be reduced by preventing people and wildlife from entering the potentially dangerous underground mine workings.	Highly Feasible: Technical feasibility and availability of services and materials would be high because this option could be readily implemented with standard construction techniques. Administrative feasibility	$37,600

				would be high and would require permitting.	
		Building Demolition	Highly Effective: Human and ecological health risks would be reduced by preventing people and wildlife from entering buildings in various states of deterioration and removing hazards associated with the current remaining infrastructure.	Highly Feasible. Technical feasibility and availability of services and materials would be high because this option could be readily implemented with standard construction techniques. Administrative feasibility would be high and would require permitting.	$21,400
		Building Maintenance and Protection	Moderately Effective: Building maintenance and protection would involve disposing of various hazards within the buildings, thereby decreasing possible human and ecological health risks.	Highly Feasible: Technical feasibility and availability of services and materials would be high because this option could be readily implemented with standard construction techniques. Administrative feasibility would be high but would require special handling for some of the hazards.	$7,900
Treatment	Solid Media Treatment	Waste Rock Reprocessing	Highly Effective: Toxicity, mobility, and volume, as well as human and ecological health risks, would be reduced by removing the waste rock. Reclamation goals for the waste rock areas would likely be achieved under this option.	Low Feasibility: Technical feasibility and availability of services and materials would be moderate and could be readily implemented with standard construction techniques, however, haul to closest processing plant is	$54,675,900

				significant. Administrative feasibility would be moderate since it would require special permitting and coordination with agencies. Significant mineral value recovery is unlikely based on low mineral content.	
		Soil Binding with Enzymes	Low Effectiveness: Toxicity and volume would not be reduced; Mobility would be reduced by solidifying the contaminated material. Human and ecological health risks would be somewhat reduced by stabilization. Minimal reclamation goals would be achieved under this option. Effectiveness is dependent on applying enzymes to soils having at least 20% clay/silt content. Post-construction maintenance would be required.	Moderately Feasible: Technical feasibility and availability of services and materials would be moderate since treatment could be readily implemented with standard construction techniques, providing a soil-binding enzyme product is readily available. Administrative feasibility would be moderate since it would require preventing access onto the reclaimed areas and ensuring that the areas would not be disturbed by future site development and/or use.	$6,278,900
		Lime Solidification	Low Effectiveness: Toxicity would not be reduced; Volume would increase due to bulk created by a lime	Low Feasibility: Technical feasibility and availability of services and materials would be low due to the	$9,914,600

			additive; Mobility would be reduced by solidifying the contaminated material. Human and ecological health risks would be somewhat reduced by stabilization. Minimal reclamation goals would be achieved under this option. Post-construction maintenance would be required.	specialized equipment necessary to inject lime and mix with contaminated material, and due to the difficulty of blending the lime thoroughly. Administrative feasibility would be moderate since it would require preventing access onto the reclaimed areas and ensuring that the areas would not be disturbed by future site development and/or use.	
		Cement Solidification	Low Effectiveness: Toxicity would not be reduced; Volume would increase due to addition of cement; Mobility would be reduced by solidifying the contaminated material. Human and ecological health risks would be somewhat reduced by stabilization. Minimal reclamation goals would be achieved under this option. Post-construction maintenance would be required.	Low Feasibility: Technical feasibility and availability of services and materials would be low due to the specialized equipment required to inject cement and mix with contaminated material. Administrative feasibility would be moderate since it would require preventing access onto the reclaimed areas and ensuring that the areas would not be disturbed by future site development and/or use.	$10,396,400

APPENDIX I

CONCEPTUAL REPOSITORY DESIGN

APPENDIX J

HYDROLOGIC CALCULATIONS AND HYDRAULIC MODELING

Appendix J: Hydrologic Calculations

Hydrologic analyses were conducted to determine peak discharges from 2-year to 500-year storm events for South Fork Willow Lower Willow Creek (SFLWC) and Mill Creek. Peak flow estimates were calculated using regression equations for the West Region of Montana (Parrett and Johnson 2004) with mean annual precipitation estimated from gridded annual average precipitation data (Montana DEQ 2011), drainage basin area derived from USGS 7.5' topographic quadrangle contours, and percent forest cover estimated from 2012 aerial photographs in ArcExplorer (ESRI 2012). Peak flows below the confluence of SFLWC and Mill Creek were determined by the method of summing the calculated flow from each contributing basin, rather than by applying the regression equations to the combined drainage area of both creeks. For engineering purposes this was the more conservative approach, as it resulted in 7 – 14 percent higher flows for a given return interval. Calculated peak discharges are summarized in Table J-1. Tables J-2 and J-3 present calculation details for the individual creeks.

Table J1. Calculated Peak Discharges, SFLWC & Mill Creek, Black Pine Mine

Return Interval (years)	Stream Flow (cfs)		
	SFLWC, above Mill Creek confluence	Mill Creek	SFLWC below Mill Creek confluence
2	79	7	86
5	153	14	166
10	218	20	238
25	304	28	333
50	375	35	411
100	453	43	497
200	534	51	585
500	664	64	728

Table J2. SFLWC Peak Discharge Calculations, Black Pine Mine

9.565	A	Drainage Area (sq. mi)			
25.58	P	Precipitation (in/yr)			
22	F	% Forest	2.082	sq. mi.	
Return Interval (yr)	**α**	**β**	**γ**	**δ**	**Q (cfs)**
2	0.268	0.927	1.6	-0.508	79
5	1.54	0.884	1.36	-0.577	153
10	3.63	0.86	1.25	-0.605	218
25	8.5	0.835	1.14	-0.639	304
50	13.2	0.823	1.09	-0.652	375
100	18.7	0.812	1.06	-0.664	453
200	24.7	0.804	1.04	-0.674	534

500	35.4	0.792	1.02	-0.69	664
Regression equation: $Q_{RI} = \alpha A^{\beta} P^{\gamma} (F+1)^{\delta}$					

Table J3. Mill Creek Peak Discharge Calculations, Black Pine Mine

1.323	Drainage Area (sq. mi)				
24.36	Precipitation (in/yr)				
64	% Forest		0.843	sq. mi.	
Return Interval (yr)	**α**	**β**	**γ**	**δ**	**Q (cfs)**
2	0.268	0.927	1.6	-0.508	7
5	1.54	0.884	1.36	-0.577	14
10	3.63	0.86	1.25	-0.605	20
25	8.5	0.835	1.14	-0.639	28
50	13.2	0.823	1.09	-0.652	35
100	18.7	0.812	1.06	-0.664	43
200	24.7	0.804	1.04	-0.674	51
500	35.4	0.792	1.02	-0.69	64
Regression equation: $Q_{RI} = \alpha A^{\beta} P^{\gamma} (F+1)^{\delta}$					

Hydraulic Modeling

Hydraulic calculations were performed using HEC-RAS 4.1 (U.S. Army Corps of Engineers 2010) to determine if the existing channel and berms are adequate to convey the estimated peak flows, and to provide preliminary guidance for channel restoration design. Channel alignments and cross-sections (Figure J-1) were derived from 1-foot contours based on 2010 survey data provided by Montana DEQ. Roughness values for channel and floodplain areas were estimated using the methods in Arcement and Schneider (1989). Data was not available to calibrate the model at high-recurrence interval flows, but the model agreed reasonably well with field measurements taken in June 2011 at approximately 50 cfs.

Model results in the form of oblique profiles and selected cross-sections are presented below, followed by a HEC-RAS report including input parameters and standard output tables for 2, 5, 10, 25, 50, 100, and 500 year peak flows. Figures J-2, J-3, and J-4 illustrate model geometry and calculated water surface elevations and widths at extracted and interpolated cross-sections on both SFLWC and Mill Creek for 2-year, 100-year, and 500-year peak flows respectively. Figures J-5, J-6, and J-7 show cross sections of SFLWC above the confluence, SFLWC below the confluence, and Mill Creek at approximately the upstream extent of the north impoundment berm. At each cross-section the 500-year peak flow water surface elevation is below the elevation of the berm separating the creek from the tailings impoundment on the right. In Figure J-5 the 500-year flow can be seen to overtop the right bank and inundate the floodplain between the bank and the impoundment berm. The impoundment berms are above the 500-year water surface at every cross-section, but overtopping of the existing channel banks and inundation of the floodplain is widespread at

both 100-year and 500-year flows (Figures J-3 and J-4), and occurs at the 2-year flow at some cross-sections (Figure J-2).

Hydraulic modeling of the proposed channel design will be completed during design development of the selected site-wide alternative.

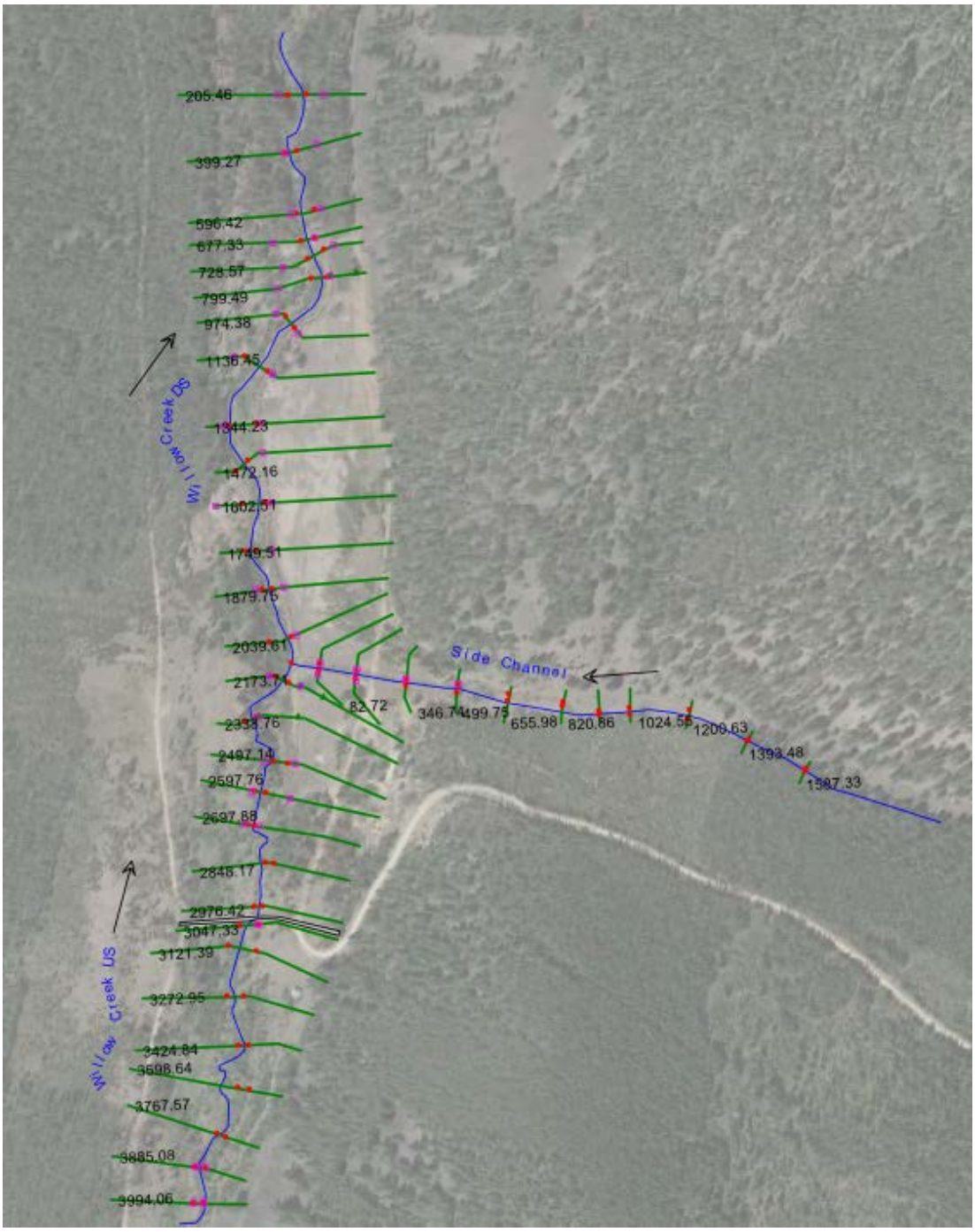

Figure J-1: HEC-RAS model geometry over 2012 aerial photograph, Black Pine Mine. Interpolated cross sections not shown.

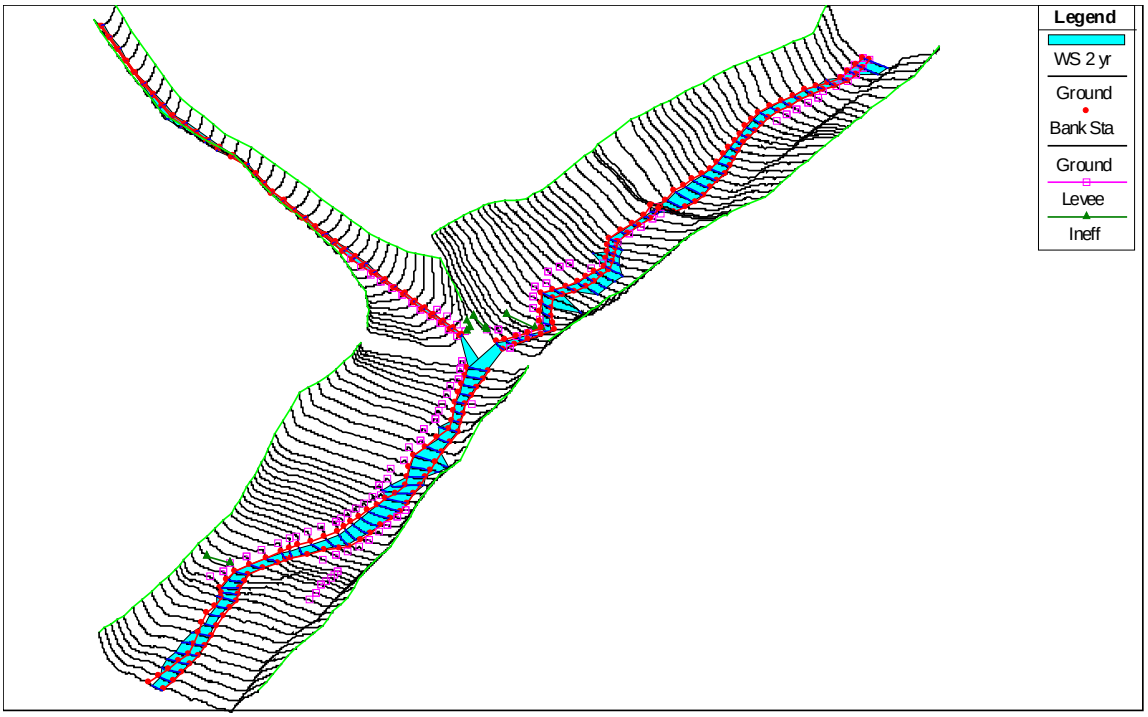

Figure J-2: Oblique profile, 2-year Peak Flow, Black Pine Mine

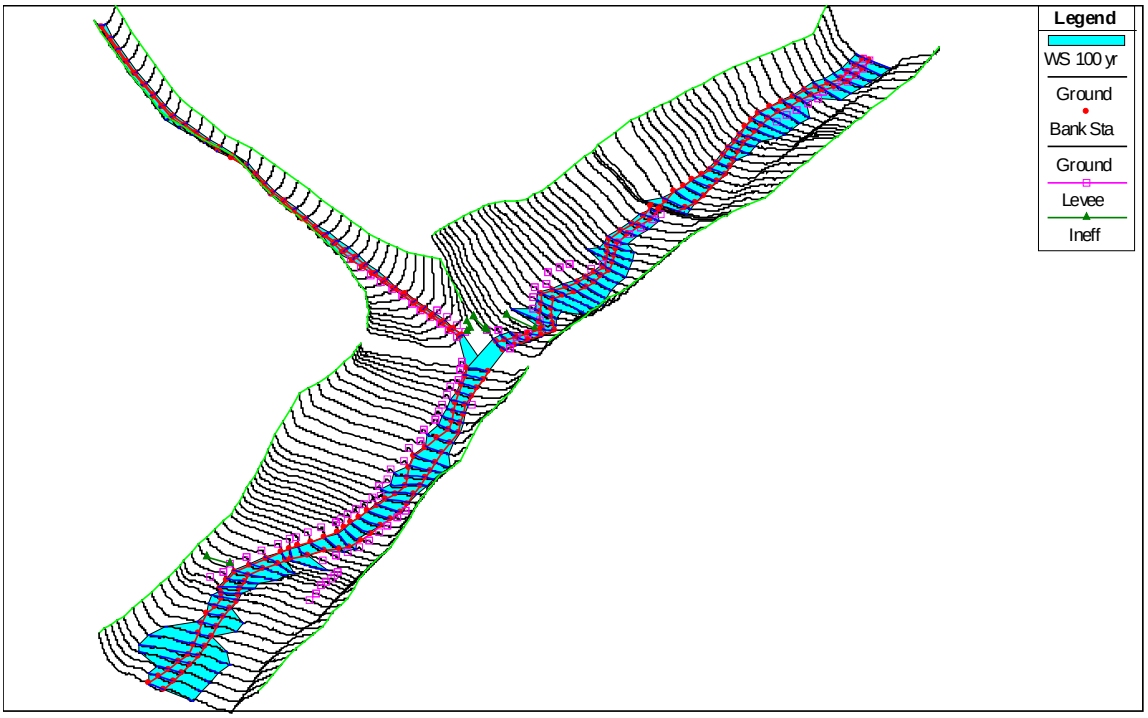

Figure J-3: Oblique profile, 100-year Peak Flow, Black Pine Mine

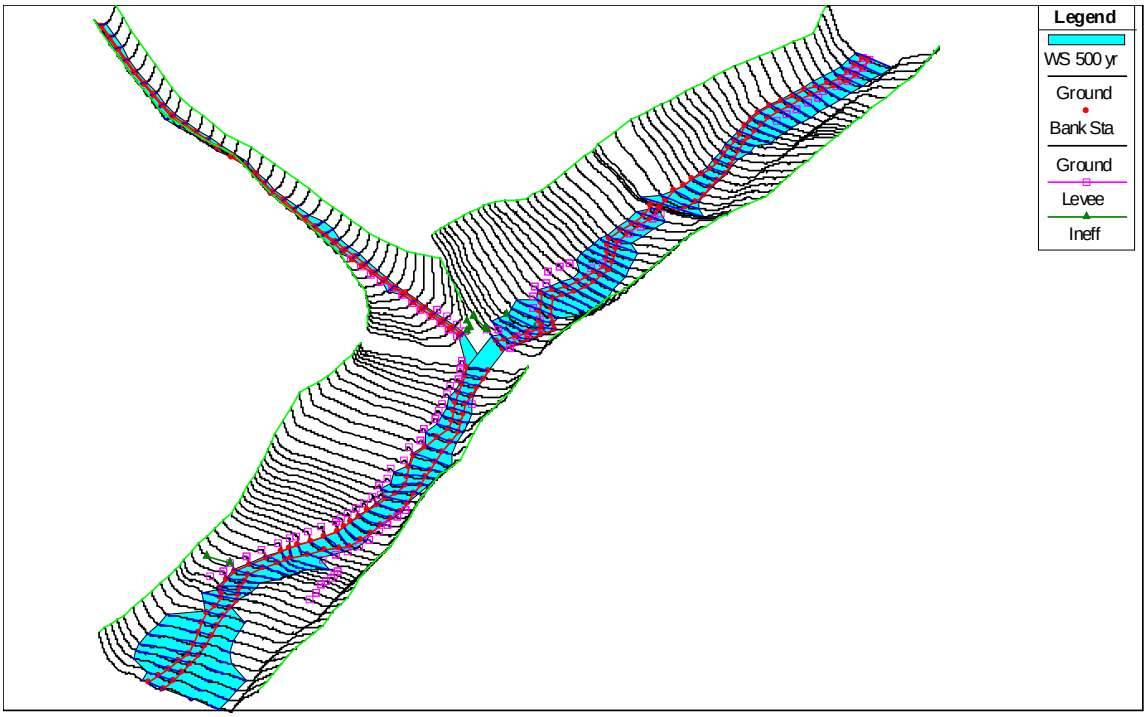

Figure J-4: Oblique profile, 500-year Peak Flow, Black Pine Mine

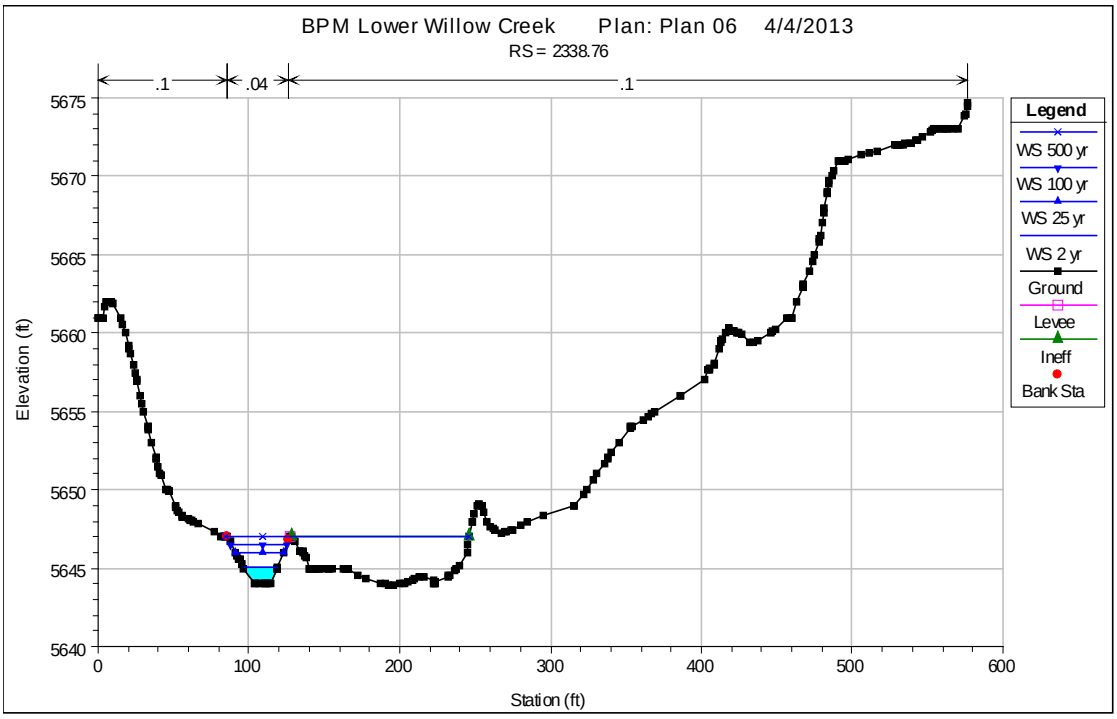

Figure J-5: Cross-section 2338.76, SFLWC upstream of Mill Creek, Black Pine Mine.

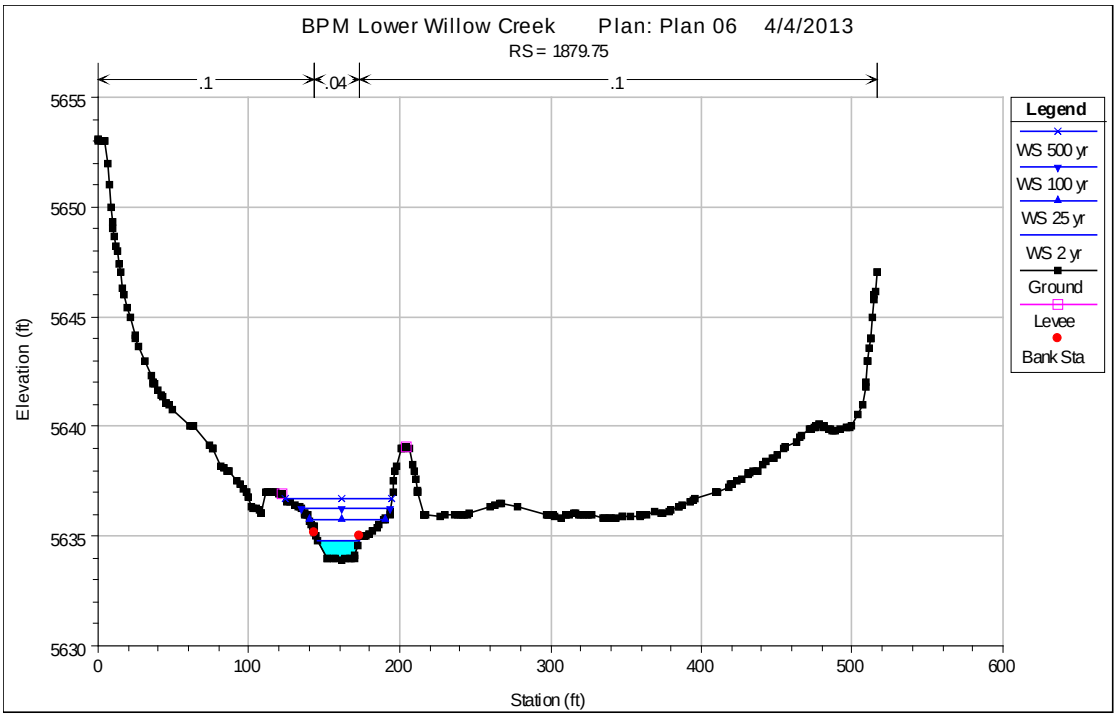

Figure J-6: Cross-section 1879.75, SFLWC, downstream Mill Creek, Black Pine Mine

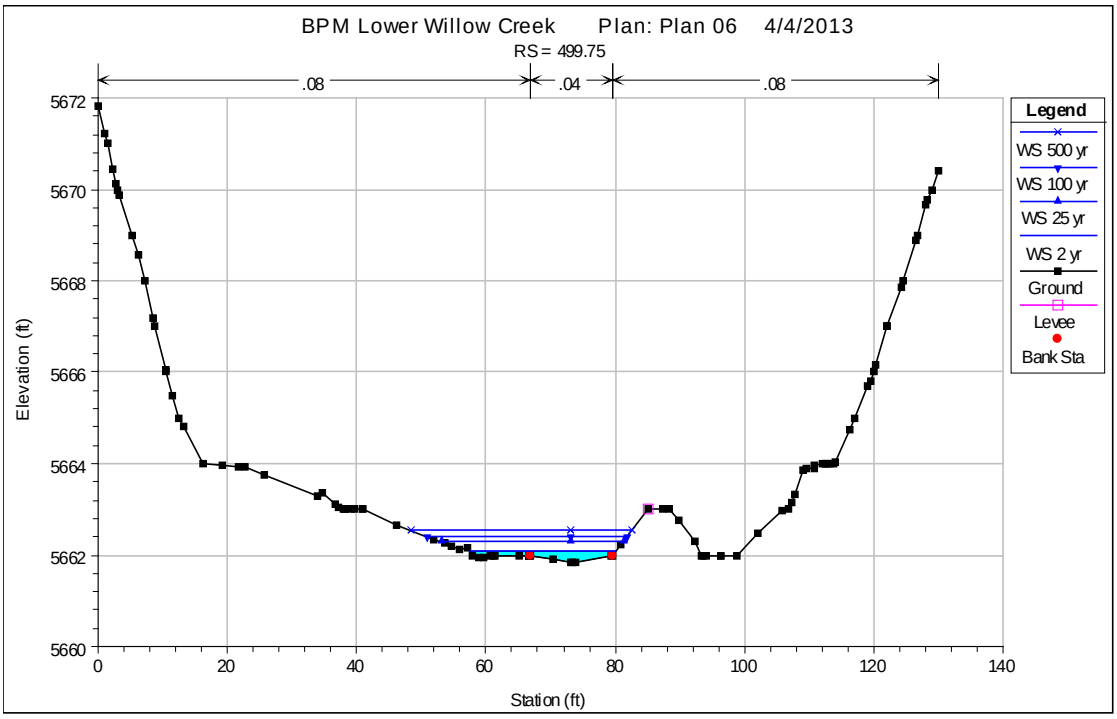

Figure J-7: Cross-section 499.75, Mill Creek, upstream of impoundment, Black Pine Mine.

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X       X    X       X   X     X  X    X
X     X  X       X            X   X    X    X   X
XXXXXXX  XXXX    X       XXX  XXXX     XXXXXX    XXXX
X     X  X       X            X  X     X    X       X
X     X  X       X    X       X   X    X    X       X
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PROJECT DATA
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Project File : BPMLowerWillowCr.prj
Run Date and Time: 4/4/2013 2:49:58 PM

Project in English units

FLOW DATA

Flow Title: combination flow revised
Flow File : m:\missoula\PROJECTS\06-03425-027 TO 19 Black Pine Mine EEECA\Calculations\SFLWC_HEC-RAS_Model\BPMLowerWillowCr.f03

Flow Data (cfs)

River	Reach	RS	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr	500 yr	100 yr + df
Side Channel	Side Channel	1587.33	7	14	20	28	35	43	64	43
Side Channel	Side Channel	820.86	7	14	20	28	35	43	64	5000
Willow Creek DS	Willow Creek DS	2039.61	86	166	238	333	411	497	728	5537
Willow Creek US	Willow Creek US	3994.06	79	153	218	304	375	453	664	537

River	Reach	RS	Model Check
Side Channel	Side Channel	1587.33	3
Side Channel	Side Channel	820.86	3
Willow Creek DS	Willow Creek DS	2039.61	53
Willow Creek US	Willow Creek US	3994.06	50

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Side Channel	Side Channel	2 yr	Critical	
Side Channel	Side Channel	5 yr	Critical	
Side Channel	Side Channel	10 yr	Critical	
Side Channel	Side Channel	25 yr	Critical	
Side Channel	Side Channel	50 yr	Critical	
Side Channel	Side Channel	100 yr	Critical	
Side Channel	Side Channel	500 yr	Critical	
Side Channel	Side Channel	100 yr + df	Critical	
Side Channel	Side Channel	Model Check	Critical	
Willow Creek DS	Willow Creek DS	2 yr		Normal S = 0.027
Willow Creek DS	Willow Creek DS	5 yr		Normal S = 0.027
Willow Creek DS	Willow Creek DS	10 yr		Critical
Willow Creek DS	Willow Creek DS	25 yr		Critical
Willow Creek DS	Willow Creek DS	50 yr		Critical
Willow Creek DS	Willow Creek DS	100 yr		Critical
Willow Creek DS	Willow Creek DS	500 yr		Critical
Willow Creek DS	Willow Creek DS	100 yr + df		Critical
Willow Creek DS	Willow Creek DS	Model Check		Normal S = 0.027

Willow Creek US	Willow Creek US 2 yr	Normal S = 0.0092
Willow Creek US	Willow Creek US 5 yr	Normal S = 0.026
Willow Creek US	Willow Creek US 10 yr	Critical
Willow Creek US	Willow Creek US 25 yr	Critical
Willow Creek US	Willow Creek US 50 yr	Critical
Willow Creek US	Willow Creek US 100 yr	Critical
Willow Creek US	Willow Creek US 500 yr	Critical
Willow Creek US	Willow Creek US 100 yr + df	Critical
Willow Creek US	Willow Creek US Model Check	Normal S = 0.0037

Profile Output Table - Standard Table 1

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Willow Creek US	Willow Creek US	3994.06	2 yr	79.00	5685.46	5686.00	5686.00	5686.02	0.009222	1.60	60.98	90.49	0.51
Willow Creek US	Willow Creek US	3994.06	5 yr	153.00	5685.46	5686.06	5686.00	5686.14	0.024518	2.97	71.09	115.25	0.87
Willow Creek US	Willow Creek US	3994.06	10 yr	218.00	5685.46	5686.18	5686.00	5686.30	0.028852	3.89	85.06	117.48	0.98
Willow Creek US	Willow Creek US	3994.06	25 yr	304.00	5685.46	5686.36	5686.02	5686.53	0.027462	4.70	106.95	120.92	1.01
Willow Creek US	Willow Creek US	3994.06	50 yr	375.00	5685.46	5686.50	5686.11	5686.70	0.026646	5.23	123.35	123.43	1.03
Willow Creek US	Willow Creek US	3994.06	100 yr	453.00	5685.46	5686.63	5686.21	5686.87	0.026201	5.74	139.79	125.91	1.05
Willow Creek US	Willow Creek US	3994.06	500 yr	664.00	5685.46	5686.96	5686.50	5687.29	0.024474	6.79	182.26	132.20	1.06
Willow Creek US	Willow Creek US	3957.73*	2 yr	79.00	5684.30	5685.00	5685.00	5685.04	0.010458	2.31	53.39	81.88	0.59
Willow Creek US	Willow Creek US	3957.73*	5 yr	153.00	5684.30	5685.06	5685.00	5685.18	0.025992	3.92	66.34	106.42	0.95
Willow Creek US	Willow Creek US	3957.73*	10 yr	218.00	5684.30	5685.28	5685.00	5685.42	0.019362	4.28	90.56	109.65	0.87
Willow Creek US	Willow Creek US	3957.73*	25 yr	304.00	5684.30	5685.46	5685.13	5685.66	0.019863	5.00	110.55	112.27	0.91
Willow Creek US	Willow Creek US	3957.73*	50 yr	375.00	5684.30	5685.59	5685.25	5685.83	0.020166	5.50	125.53	114.27	0.94
Willow Creek US	Willow Creek US	3957.73*	100 yr	453.00	5684.30	5685.73	5685.37	5686.02	0.019969	5.96	142.06	116.80	0.95
Willow Creek US	Willow Creek US	3957.73*	500 yr	664.00	5684.30	5686.03	5685.68	5686.43	0.021377	7.13	177.43	121.13	1.02
Willow Creek US	Willow Creek US	3921.40*	2 yr	79.00	5683.15	5683.95	5684.01	5684.36	0.035225	5.12	15.44	24.86	1.13
Willow Creek US	Willow Creek US	3921.40*	5 yr	153.00	5683.15	5684.01	5684.01	5684.19	0.026283	4.54	61.05	98.79	0.99
Willow Creek US	Willow Creek US	3921.40*	10 yr	218.00	5683.15	5684.05	5684.05	5684.38	0.042283	6.03	65.75	99.76	1.27
Willow Creek US	Willow Creek US	3921.40*	25 yr	304.00	5683.15	5684.23	5684.23	5684.63	0.039660	6.75	83.09	103.19	1.27
Willow Creek US	Willow Creek US	3921.40*	50 yr	375.00	5683.15	5684.35	5684.35	5684.81	0.037950	7.23	96.50	105.55	1.27
Willow Creek US	Willow Creek US	3921.40*	100 yr	453.00	5683.15	5684.48	5684.47	5685.00	0.037133	7.74	109.89	107.92	1.28
Willow Creek US	Willow Creek US	3921.40*	500 yr	664.00	5683.15	5684.81	5684.81	5685.45	0.032612	8.61	146.48	111.79	1.26
Willow Creek US	Willow Creek US	3885.08	2 yr	79.00	5681.99	5682.78	5682.82	5683.17	0.030619	5.01	15.78	23.14	1.07
Willow Creek US	Willow Creek US	3885.08	5 yr	153.00	5681.99	5683.02	5683.01	5683.22	0.017522	4.38	63.68	96.83	0.84
Willow Creek US	Willow Creek US	3885.08	10 yr	218.00	5681.99	5683.22	5683.07	5683.45	0.016321	4.85	82.92	99.64	0.84
Willow Creek US	Willow Creek US	3885.08	25 yr	304.00	5681.99	5683.46	5683.24	5683.73	0.014622	5.29	108.17	105.10	0.82
Willow Creek US	Willow Creek US	3885.08	50 yr	375.00	5681.99	5683.59	5683.38	5683.92	0.015815	5.86	121.74	108.20	0.87
Willow Creek US	Willow Creek US	3885.08	100 yr	453.00	5681.99	5683.75	5683.52	5684.12	0.015555	6.25	139.89	112.82	0.88
Willow Creek US	Willow Creek US	3885.08	500 yr	664.00	5681.99	5684.13	5683.86	5684.59	0.015244	7.13	184.18	121.41	0.90
Willow Creek US	Willow Creek US	3845.91*	2 yr	79.00	5680.98	5681.85	5681.85	5682.18	0.025603	4.62	17.91	32.99	0.98
Willow Creek US	Willow Creek US	3845.91*	5 yr	153.00	5680.98	5682.17	5682.17	5682.48	0.018989	4.92	49.07	83.48	0.89
Willow Creek US	Willow Creek US	3845.91*	10 yr	218.00	5680.98	5682.38	5682.31	5682.75	0.018101	5.48	67.30	94.73	0.90
Willow Creek US	Willow Creek US	3845.91*	25 yr	304.00	5680.98	5682.56	5682.56	5683.03	0.019731	6.31	85.23	102.97	0.96
Willow Creek US	Willow Creek US	3845.91*	50 yr	375.00	5680.98	5682.75	5682.75	5683.23	0.017717	6.52	104.68	107.03	0.93
Willow Creek US	Willow Creek US	3845.91*	100 yr	453.00	5680.98	5682.88	5682.88	5683.42	0.018368	7.02	119.01	108.84	0.96
Willow Creek US	Willow Creek US	3845.91*	500 yr	664.00	5680.98	5683.22	5683.22	5683.89	0.018696	8.02	156.86	114.31	1.00
Willow Creek US	Willow Creek US	3806.74*	2 yr	79.00	5679.98	5680.93	5680.90	5681.22	0.022018	4.28	18.46	26.87	0.91
Willow Creek US	Willow Creek US	3806.74*	5 yr	153.00	5679.98	5681.22	5681.26	5681.64	0.023332	5.41	35.32	56.17	0.99
Willow Creek US	Willow Creek US	3806.74*	10 yr	218.00	5679.98	5681.44	5681.44	5681.95	0.021478	6.01	50.50	82.90	0.98
Willow Creek US	Willow Creek US	3806.74*	25 yr	304.00	5679.98	5681.73	5681.81	5682.27	0.017952	6.36	78.13	111.71	0.93
Willow Creek US	Willow Creek US	3806.74*	50 yr	375.00	5679.98	5681.85	5681.98	5682.48	0.019242	6.96	92.21	116.27	0.98
Willow Creek US	Willow Creek US	3806.74*	100 yr	453.00	5679.98	5682.19	5682.13	5682.66	0.012108	6.28	132.20	121.21	0.80
Willow Creek US	Willow Creek US	3806.74*	500 yr	664.00	5679.98	5682.33	5682.46	5683.12	0.019176	8.28	149.36	122.84	1.02
Willow Creek US	Willow Creek US	3767.57	2 yr	79.00	5678.97	5679.93	5679.93	5680.25	0.028058	4.51	17.52	28.29	1.01
Willow Creek US	Willow Creek US	3767.57	5 yr	153.00	5678.97	5680.26	5680.30	5680.70	0.024210	5.45	32.58	51.27	1.00
Willow Creek US	Willow Creek US	3767.57	10 yr	218.00	5678.97	5680.44	5680.52	5681.02	0.025297	6.30	42.23	53.01	1.06
Willow Creek US	Willow Creek US	3767.57	25 yr	304.00	5678.97	5680.65	5680.78	5681.40	0.026523	7.22	53.30	55.09	1.11
Willow Creek US	Willow Creek US	3767.57	50 yr	375.00	5678.97	5680.89	5680.98	5681.65	0.022050	7.36	66.82	58.62	1.04
Willow Creek US	Willow Creek US	3767.57	100 yr	453.00	5678.97	5681.00	5681.00	5681.93	0.025006	8.21	73.44	60.28	1.12
Willow Creek US	Willow Creek US	3767.57	500 yr	664.00	5678.97	5681.28	5681.52	5682.24	0.023694	8.89	134.72	126.30	1.12

Willow Creek US	Willow Creek US	3725.33*	2 yr	79.00	5677.73	5678.64	5678.68	5678.98	0.032535	4.67	16.91	28.96	1.08
Willow Creek US	Willow Creek US	3725.33*	5 yr	153.00	5677.73	5678.89	5679.04	5679.46	0.036715	6.09	27.82	52.72	1.20
Willow Creek US	Willow Creek US	3725.33*	10 yr	218.00	5677.73	5679.07	5679.25	5679.78	0.035473	6.87	37.61	54.79	1.23
Willow Creek US	Willow Creek US	3725.33*	25 yr	304.00	5677.73	5679.28	5679.50	5680.14	0.034348	7.69	49.19	57.02	1.25
Willow Creek US	Willow Creek US	3725.33*	50 yr	375.00	5677.73	5679.39	5679.58	5680.44	0.037822	8.56	55.55	58.21	1.33
Willow Creek US	Willow Creek US	3725.33*	100 yr	453.00	5677.73	5679.56	5679.83	5680.70	0.035186	8.97	65.71	60.63	1.31
Willow Creek US	Willow Creek US	3725.33*	500 yr	664.00	5677.73	5679.78	5680.18	5681.04	0.037052	10.08	114.59	123.61	1.37
Willow Creek US	Willow Creek US	3683.10*	2 yr	79.00	5676.49	5677.42	5677.42	5677.71	0.027266	4.30	18.39	31.29	0.99
Willow Creek US	Willow Creek US	3683.10*	5 yr	153.00	5676.49	5677.71	5677.78	5678.14	0.025473	5.33	32.90	56.69	1.02
Willow Creek US	Willow Creek US	3683.10*	10 yr	218.00	5676.49	5677.88	5677.98	5678.45	0.027449	6.22	42.35	58.79	1.09
Willow Creek US	Willow Creek US	3683.10*	25 yr	304.00	5676.49	5678.06	5678.14	5678.80	0.028933	7.14	53.57	61.18	1.15
Willow Creek US	Willow Creek US	3683.10*	50 yr	375.00	5676.49	5678.38	5678.38	5678.82	0.014746	5.95	108.52	124.19	0.85
Willow Creek US	Willow Creek US	3683.10*	100 yr	453.00	5676.49	5678.20	5678.50	5679.18	0.037122	8.68	86.09	122.23	1.32
Willow Creek US	Willow Creek US	3683.10*	500 yr	664.00	5676.49	5678.50	5678.83	5679.58	0.033337	9.43	124.06	127.21	1.30
Willow Creek US	Willow Creek US	3640.87*	2 yr	79.00	5675.24	5676.13	5676.17	5676.45	0.032719	4.50	17.54	31.90	1.07
Willow Creek US	Willow Creek US	3640.87*	5 yr	153.00	5675.24	5676.39	5676.51	5676.89	0.034570	5.76	29.58	59.35	1.16
Willow Creek US	Willow Creek US	3640.87*	10 yr	218.00	5675.24	5676.56	5676.70	5677.19	0.033084	6.47	40.30	61.91	1.18
Willow Creek US	Willow Creek US	3640.87*	25 yr	304.00	5675.24	5676.72	5676.91	5677.55	0.036512	7.55	50.40	65.94	1.27
Willow Creek US	Willow Creek US	3640.87*	50 yr	375.00	5675.24	5677.05	5677.05	5677.47	0.015906	5.91	110.02	127.29	0.87
Willow Creek US	Willow Creek US	3640.87*	100 yr	453.00	5675.24	5676.94	5677.17	5677.73	0.031906	7.96	96.90	126.33	1.22
Willow Creek US	Willow Creek US	3640.87*	500 yr	664.00	5675.24	5677.17	5677.48	5678.19	0.035522	9.33	125.45	128.46	1.32
Willow Creek US	Willow Creek US	3598.64	2 yr	79.00	5674.00	5674.87	5674.91	5675.19	0.035485	4.55	17.37	33.06	1.11
Willow Creek US	Willow Creek US	3598.64	5 yr	153.00	5674.00	5675.19	5675.26	5675.60	0.026483	5.19	34.13	64.75	1.02
Willow Creek US	Willow Creek US	3598.64	10 yr	218.00	5674.00	5675.25	5675.41	5675.95	0.042545	6.87	37.61	65.86	1.31
Willow Creek US	Willow Creek US	3598.64	25 yr	304.00	5674.00	5675.41	5675.58	5676.03	0.034545	6.95	71.86	127.93	1.22
Willow Creek US	Willow Creek US	3598.64	50 yr	375.00	5674.00	5675.41	5675.71	5676.36	0.052137	8.55	72.11	127.94	1.50
Willow Creek US	Willow Creek US	3598.64	100 yr	453.00	5674.00	5675.61	5675.81	5676.38	0.035753	7.98	97.83	129.70	1.28
Willow Creek US	Willow Creek US	3598.64	500 yr	664.00	5674.00	5675.87	5676.00	5676.78	0.034664	8.94	131.84	132.14	1.30
Willow Creek US	Willow Creek US	3555.19*	2 yr	79.00	5672.79	5673.75	5673.75	5674.05	0.029353	4.41	17.90	30.89	1.02
Willow Creek US	Willow Creek US	3555.19*	5 yr	153.00	5672.79	5674.08	5674.12	5674.49	0.025105	5.22	32.86	62.02	1.00
Willow Creek US	Willow Creek US	3555.19*	10 yr	218.00	5672.79	5674.35	5674.38	5674.76	0.017594	5.29	56.55	103.74	0.88
Willow Creek US	Willow Creek US	3555.19*	25 yr	304.00	5672.79	5674.57	5674.61	5675.03	0.016721	5.81	81.33	120.61	0.89
Willow Creek US	Willow Creek US	3555.19*	50 yr	375.00	5672.79	5674.71	5674.75	5675.22	0.016806	6.22	98.26	124.19	0.90
Willow Creek US	Willow Creek US	3555.19*	100 yr	453.00	5672.79	5674.86	5674.88	5675.40	0.016152	6.51	117.37	126.10	0.90
Willow Creek US	Willow Creek US	3555.19*	500 yr	664.00	5672.79	5675.19	5675.19	5675.83	0.016081	7.35	159.57	130.54	0.93
Willow Creek US	Willow Creek US	3511.74*	2 yr	79.00	5671.58	5672.63	5672.60	5672.92	0.023987	4.26	18.55	28.99	0.94
Willow Creek US	Willow Creek US	3511.74*	5 yr	153.00	5671.58	5672.95	5672.99	5673.39	0.025751	5.37	30.58	57.42	1.02
Willow Creek US	Willow Creek US	3511.74*	10 yr	218.00	5671.58	5673.06	5673.23	5673.73	0.032854	6.62	37.80	63.14	1.18
Willow Creek US	Willow Creek US	3511.74*	25 yr	304.00	5671.58	5673.27	5673.44	5674.07	0.031378	7.35	52.33	73.19	1.19
Willow Creek US	Willow Creek US	3511.74*	50 yr	375.00	5671.58	5673.44	5673.69	5674.29	0.028933	7.71	64.93	86.54	1.17
Willow Creek US	Willow Creek US	3511.74*	100 yr	453.00	5671.58	5673.61	5673.86	5674.52	0.026989	8.07	81.53	99.88	1.15
Willow Creek US	Willow Creek US	3511.74*	500 yr	664.00	5671.58	5673.99	5674.25	5675.02	0.024132	8.85	122.93	120.20	1.13
Willow Creek US	Willow Creek US	3468.29*	2 yr	79.00	5670.37	5671.45	5671.45	5671.79	0.027902	4.64	17.04	26.22	1.01
Willow Creek US	Willow Creek US	3468.29*	5 yr	153.00	5670.37	5671.83	5671.84	5672.29	0.025025	5.43	29.70	44.70	1.01
Willow Creek US	Willow Creek US	3468.29*	10 yr	218.00	5670.37	5672.10	5672.14	5672.60	0.019965	5.77	45.79	68.99	0.94
Willow Creek US	Willow Creek US	3468.29*	25 yr	304.00	5670.37	5672.30	5672.38	5672.94	0.021336	6.62	59.73	71.41	1.00
Willow Creek US	Willow Creek US	3468.29*	50 yr	375.00	5670.37	5672.44	5672.57	5673.19	0.022672	7.27	69.45	73.31	1.05
Willow Creek US	Willow Creek US	3468.29*	100 yr	453.00	5670.37	5672.55	5672.69	5673.45	0.024912	8.01	77.99	75.01	1.11
Willow Creek US	Willow Creek US	3468.29*	500 yr	664.00	5670.37	5672.95	5673.22	5674.04	0.023450	9.01	113.89	102.74	1.12
Willow Creek US	Willow Creek US	3424.84	2 yr	79.00	5669.16	5670.24	5670.32	5670.69	0.039853	5.41	14.60	23.28	1.20
Willow Creek US	Willow Creek US	3424.84	5 yr	153.00	5669.16	5670.71	5670.75	5671.20	0.025262	5.61	28.48	40.21	1.02
Willow Creek US	Willow Creek US	3424.84	10 yr	218.00	5669.16	5670.89	5671.05	5671.56	0.028677	6.59	37.03	60.83	1.12
Willow Creek US	Willow Creek US	3424.84	25 yr	304.00	5669.16	5671.13	5671.30	5671.91	0.026802	7.28	52.66	68.32	1.12
Willow Creek US	Willow Creek US	3424.84	50 yr	375.00	5669.16	5671.29	5671.48	5672.16	0.026147	7.77	64.00	70.76	1.12
Willow Creek US	Willow Creek US	3424.84	100 yr	453.00	5669.16	5671.47	5671.66	5672.40	0.025110	8.19	76.30	73.14	1.12
Willow Creek US	Willow Creek US	3424.84	500 yr	664.00	5669.16	5671.81	5671.87	5673.01	0.026267	9.49	101.91	77.04	1.18
Willow Creek US	Willow Creek US	3386.86*	2 yr	79.00	5668.61	5669.64	5669.55	5669.87	0.018662	3.87	20.40	30.49	0.83
Willow Creek US	Willow Creek US	3386.86*	5 yr	153.00	5668.61	5669.97	5669.90	5670.35	0.020095	4.94	30.96	33.86	0.91
Willow Creek US	Willow Creek US	3386.86*	10 yr	218.00	5668.61	5670.19	5670.15	5670.68	0.020654	5.65	38.61	36.69	0.95
Willow Creek US	Willow Creek US	3386.86*	25 yr	304.00	5668.61	5670.38	5670.45	5671.07	0.022906	6.65	47.58	52.17	1.03
Willow Creek US	Willow Creek US	3386.86*	50 yr	375.00	5668.61	5670.52	5670.60	5671.36	0.024667	7.38	55.09	57.57	1.09
Willow Creek US	Willow Creek US	3386.86*	100 yr	453.00	5668.61	5670.88	5670.89	5671.59	0.016072	6.91	80.31	77.89	0.91

Willow Creek US	Willow Creek US	3386.86*	500 yr	664.00	5668.61	5671.31	5671.33	5672.17	0.015165	7.76	115.40	83.79	0.92
Willow Creek US	Willow Creek US	3348.89*	2 yr	79.00	5668.06	5668.87	5668.82	5669.10	0.022275	3.85	20.53	35.40	0.89
Willow Creek US	Willow Creek US	3348.89*	5 yr	153.00	5668.06	5669.17	5669.14	5669.54	0.022718	4.89	31.29	38.17	0.95
Willow Creek US	Willow Creek US	3348.89*	10 yr	218.00	5668.06	5669.37	5669.36	5669.85	0.022981	5.54	39.33	40.07	0.99
Willow Creek US	Willow Creek US	3348.89*	25 yr	304.00	5668.06	5669.58	5669.60	5670.21	0.023592	6.37	48.04	44.88	1.03
Willow Creek US	Willow Creek US	3348.89*	50 yr	375.00	5668.06	5669.77	5669.79	5670.48	0.021919	6.77	56.89	49.95	1.02
Willow Creek US	Willow Creek US	3348.89*	100 yr	453.00	5668.06	5669.82	5670.00	5670.78	0.028176	7.87	59.55	52.21	1.16
Willow Creek US	Willow Creek US	3348.89*	500 yr	664.00	5668.06	5670.23	5670.43	5671.42	0.025204	8.81	83.58	63.63	1.15
Willow Creek US	Willow Creek US	3310.92*	2 yr	79.00	5667.51	5668.26		5668.41	0.014300	3.16	25.00	41.56	0.72
Willow Creek US	Willow Creek US	3310.92*	5 yr	153.00	5667.51	5668.55		5668.81	0.015137	4.09	37.45	44.10	0.78
Willow Creek US	Willow Creek US	3310.92*	10 yr	218.00	5667.51	5668.74		5669.09	0.016054	4.73	46.06	46.08	0.83
Willow Creek US	Willow Creek US	3310.92*	25 yr	304.00	5667.51	5668.75	5668.84	5669.41	0.029998	6.52	46.62	46.26	1.13
Willow Creek US	Willow Creek US	3310.92*	50 yr	375.00	5667.51	5669.05	5669.01	5669.65	0.019450	6.23	61.37	53.37	0.95
Willow Creek US	Willow Creek US	3310.92*	100 yr	453.00	5667.51	5669.10	5669.19	5669.91	0.025238	7.26	63.90	54.48	1.09
Willow Creek US	Willow Creek US	3310.92*	500 yr	664.00	5667.51	5669.57	5669.63	5670.50	0.019608	7.80	92.63	66.39	1.01
Willow Creek US	Willow Creek US	3272.95	2 yr	79.00	5666.96	5667.47	5667.46	5667.68	0.026969	3.66	21.56	46.16	0.94
Willow Creek US	Willow Creek US	3272.95	5 yr	153.00	5666.96	5667.71	5667.71	5668.05	0.026838	4.69	32.65	48.12	1.00
Willow Creek US	Willow Creek US	3272.95	10 yr	218.00	5666.96	5667.89	5667.89	5668.32	0.025690	5.26	41.43	49.61	1.01
Willow Creek US	Willow Creek US	3272.95	25 yr	304.00	5666.96	5668.11	5668.11	5668.63	0.023500	5.81	52.44	52.49	1.01
Willow Creek US	Willow Creek US	3272.95	50 yr	375.00	5666.96	5668.27	5668.27	5668.86	0.022047	6.19	61.19	56.33	1.00
Willow Creek US	Willow Creek US	3272.95	100 yr	453.00	5666.96	5668.34	5668.44	5669.11	0.026385	7.05	65.35	58.06	1.10
Willow Creek US	Willow Creek US	3272.95	500 yr	664.00	5666.96	5668.71	5668.84	5669.68	0.023925	7.95	88.26	66.53	1.09
Willow Creek US	Willow Creek US	3235.06*	2 yr	79.00	5666.06	5666.63		5666.79	0.020441	3.20	24.69	52.73	0.82
Willow Creek US	Willow Creek US	3235.06*	5 yr	153.00	5666.06	5666.85	5666.80	5667.12	0.021521	4.16	36.77	54.98	0.90
Willow Creek US	Willow Creek US	3235.06*	10 yr	218.00	5666.06	5667.00	5666.97	5667.36	0.022954	4.83	45.13	56.61	0.95
Willow Creek US	Willow Creek US	3235.06*	25 yr	304.00	5666.06	5667.12	5667.17	5667.65	0.028860	5.86	51.90	57.85	1.09
Willow Creek US	Willow Creek US	3235.06*	50 yr	375.00	5666.06	5667.22	5667.32	5667.87	0.031646	6.50	57.68	58.92	1.16
Willow Creek US	Willow Creek US	3235.06*	100 yr	453.00	5666.06	5667.39	5667.46	5668.08	0.026629	6.66	68.34	62.59	1.09
Willow Creek US	Willow Creek US	3235.06*	500 yr	664.00	5666.06	5667.62	5667.83	5668.65	0.031172	8.12	83.22	67.33	1.22
Willow Creek US	Willow Creek US	3197.17*	2 yr	79.00	5665.16	5665.71	5665.70	5665.89	0.027975	3.37	23.45	58.68	0.94
Willow Creek US	Willow Creek US	3197.17*	5 yr	153.00	5665.16	5665.91	5665.90	5666.20	0.027635	4.32	35.40	60.36	0.99
Willow Creek US	Willow Creek US	3197.17*	10 yr	218.00	5665.16	5666.07	5666.07	5666.44	0.026384	4.84	45.02	62.51	1.01
Willow Creek US	Willow Creek US	3197.17*	25 yr	304.00	5665.16	5666.18	5666.26	5666.71	0.032647	5.84	52.07	64.05	1.14
Willow Creek US	Willow Creek US	3197.17*	50 yr	375.00	5665.16	5666.30	5666.40	5666.91	0.032315	6.27	59.79	65.53	1.16
Willow Creek US	Willow Creek US	3197.17*	100 yr	453.00	5665.16	5666.52	5666.53	5667.10	0.023887	6.11	74.21	68.65	1.03
Willow Creek US	Willow Creek US	3197.17*	500 yr	664.00	5665.16	5666.83	5666.86	5667.58	0.022375	6.97	96.71	75.90	1.04
Willow Creek US	Willow Creek US	3159.28*	2 yr	79.00	5664.25	5664.91	5664.83	5665.03	0.017901	2.82	28.04	65.64	0.76
Willow Creek US	Willow Creek US	3159.28*	5 yr	153.00	5664.25	5665.11		5665.32	0.019175	3.71	41.24	67.21	0.83
Willow Creek US	Willow Creek US	3159.28*	10 yr	218.00	5664.25	5665.24	5665.18	5665.53	0.020564	4.31	50.55	69.26	0.89
Willow Creek US	Willow Creek US	3159.28*	25 yr	304.00	5664.25	5665.40	5665.35	5665.78	0.021904	4.95	61.44	71.81	0.94
Willow Creek US	Willow Creek US	3159.28*	50 yr	375.00	5664.25	5665.50	5665.49	5665.96	0.023314	5.44	68.95	73.27	0.99
Willow Creek US	Willow Creek US	3159.28*	100 yr	453.00	5664.25	5665.59	5665.63	5666.15	0.025891	6.01	75.33	74.48	1.05
Willow Creek US	Willow Creek US	3159.28*	500 yr	664.00	5664.25	5665.82	5665.93	5666.62	0.028749	7.18	92.82	80.59	1.15
Willow Creek US	Willow Creek US	3121.39	2 yr	79.00	5663.35	5663.98	5663.97	5664.15	0.030795	3.29	24.04	67.11	0.97
Willow Creek US	Willow Creek US	3121.39	5 yr	153.00	5663.35	5664.17	5664.17	5664.43	0.029419	4.08	37.49	73.08	1.00
Willow Creek US	Willow Creek US	3121.39	10 yr	218.00	5663.35	5664.31	5664.31	5664.63	0.027725	4.59	47.49	74.14	1.01
Willow Creek US	Willow Creek US	3121.39	25 yr	304.00	5663.35	5664.48	5664.48	5664.87	0.025749	5.05	60.17	76.96	1.01
Willow Creek US	Willow Creek US	3121.39	50 yr	375.00	5663.35	5664.60	5664.60	5665.05	0.024989	5.38	69.72	79.37	1.01
Willow Creek US	Willow Creek US	3121.39	100 yr	453.00	5663.35	5664.70	5664.73	5665.22	0.026030	5.83	77.74	80.92	1.05
Willow Creek US	Willow Creek US	3121.39	500 yr	664.00	5663.35	5665.25	5665.02	5665.69	0.012425	5.35	126.70	98.49	0.78
Willow Creek US	Willow Creek US	3084.36*	2 yr	79.00	5662.17	5662.81	5662.81	5663.00	0.031723	3.54	22.35	57.17	1.00
Willow Creek US	Willow Creek US	3084.36*	5 yr	153.00	5662.17	5663.01	5663.02	5663.31	0.031030	4.40	34.78	63.01	1.04
Willow Creek US	Willow Creek US	3084.36*	10 yr	218.00	5662.17	5663.14	5663.18	5663.54	0.032036	5.05	43.13	64.95	1.09
Willow Creek US	Willow Creek US	3084.36*	25 yr	304.00	5662.17	5663.29	5663.36	5663.80	0.032816	5.72	53.17	68.71	1.14
Willow Creek US	Willow Creek US	3084.36*	50 yr	375.00	5662.17	5663.87	5663.50	5664.11	0.007767	3.98	100.29	90.13	0.61
Willow Creek US	Willow Creek US	3084.36*	100 yr	453.00	5662.17	5664.30	5663.63	5664.49	0.004355	3.58	142.34	104.60	0.47
Willow Creek US	Willow Creek US	3084.36*	500 yr	664.00	5662.17	5665.31		5665.45	0.001887	3.19	263.37	132.54	0.34
Willow Creek US	Willow Creek US	3047.33	2 yr	79.00	5661.00	5661.99	5661.64	5662.03	0.003768	1.83	51.03	80.12	0.38
Willow Creek US	Willow Creek US	3047.33	5 yr	153.00	5661.00	5662.62	5661.85	5662.67	0.001616	1.83	105.05	90.25	0.28
Willow Creek US	Willow Creek US	3047.33	10 yr	218.00	5661.00	5663.11	5662.00	5663.15	0.001154	1.89	152.80	108.76	0.25
Willow Creek US	Willow Creek US	3047.33	25 yr	304.00	5661.00	5663.50	5662.19	5663.56	0.001130	2.13	197.10	115.45	0.25
Willow Creek US	Willow Creek US	3047.33	50 yr	375.00	5661.00	5663.92	5662.33	5663.98	0.000940	2.18	246.43	122.87	0.24

Willow Creek US	Willow Creek US	3047.33	100 yr	453.00	5661.00	5664.32	5662.44	5664.39	0.000832	2.26	301.22	142.63	0.23
Willow Creek US	Willow Creek US	3047.33	500 yr	664.00	5661.00	5665.32	5662.81	5665.39	0.000643	2.39	471.18	207.88	0.21
Willow Creek US	Willow Creek US	3001.56		Bridge									
Willow Creek US	Willow Creek US	2976.42	2 yr	79.00	5659.00	5660.59	5660.59	5660.99	0.025267	5.07	15.58	19.07	0.99
Willow Creek US	Willow Creek US	2976.42	5 yr	153.00	5659.00	5661.07	5661.07	5661.60	0.022695	5.84	26.28	25.80	0.98
Willow Creek US	Willow Creek US	2976.42	10 yr	218.00	5659.00	5661.39	5661.39	5662.03	0.019834	6.45	35.29	32.27	0.96
Willow Creek US	Willow Creek US	2976.42	25 yr	304.00	5659.00	5661.53	5661.80	5662.49	0.026660	7.98	45.19	53.36	1.13
Willow Creek US	Willow Creek US	2976.42	50 yr	375.00	5659.00	5661.67	5661.96	5662.83	0.029285	8.86	53.63	65.13	1.20
Willow Creek US	Willow Creek US	2976.42	100 yr	453.00	5659.00	5661.79	5662.33	5663.20	0.033159	9.86	61.62	72.34	1.29
Willow Creek US	Willow Creek US	2976.42	500 yr	664.00	5659.00	5662.08	5662.77	5664.09	0.040158	11.98	86.31	102.76	1.46
Willow Creek US	Willow Creek US	2933.67*	2 yr	79.00	5658.00	5659.10	5659.23	5659.64	0.040128	5.87	13.46	19.01	1.23
Willow Creek US	Willow Creek US	2933.67*	5 yr	153.00	5658.00	5659.47	5659.69	5660.28	0.042445	7.19	21.28	23.03	1.32
Willow Creek US	Willow Creek US	2933.67*	10 yr	218.00	5658.00	5659.69	5660.02	5660.74	0.046191	8.25	26.48	26.22	1.41
Willow Creek US	Willow Creek US	2933.67*	25 yr	304.00	5658.00	5660.01	5660.37	5661.16	0.036192	8.69	39.95	50.98	1.30
Willow Creek US	Willow Creek US	2933.67*	50 yr	375.00	5658.00	5660.19	5660.60	5661.47	0.034883	9.27	49.61	56.92	1.30
Willow Creek US	Willow Creek US	2933.67*	100 yr	453.00	5658.00	5660.37	5660.89	5661.77	0.033547	9.78	61.08	66.00	1.30
Willow Creek US	Willow Creek US	2933.67*	500 yr	664.00	5658.00	5660.78	5661.37	5662.47	0.032232	11.03	92.57	91.72	1.32
Willow Creek US	Willow Creek US	2890.92*	2 yr	79.00	5656.99	5657.96	5657.96	5658.33	0.027248	4.89	16.15	22.50	1.02
Willow Creek US	Willow Creek US	2890.92*	5 yr	153.00	5656.99	5658.39	5658.39	5658.90	0.022737	5.71	26.96	29.38	0.99
Willow Creek US	Willow Creek US	2890.92*	10 yr	218.00	5656.99	5658.61	5658.73	5659.26	0.023216	6.55	38.84	53.06	1.03
Willow Creek US	Willow Creek US	2890.92*	25 yr	304.00	5656.99	5658.76	5659.03	5659.70	0.029538	7.98	47.25	57.63	1.18
Willow Creek US	Willow Creek US	2890.92*	50 yr	375.00	5656.99	5658.90	5659.21	5660.02	0.031258	8.75	55.98	63.92	1.24
Willow Creek US	Willow Creek US	2890.92*	100 yr	453.00	5656.99	5659.05	5659.48	5660.33	0.032476	9.47	65.41	67.12	1.28
Willow Creek US	Willow Creek US	2890.92*	500 yr	664.00	5656.99	5659.41	5659.94	5661.05	0.033557	10.95	92.42	85.23	1.34
Willow Creek US	Willow Creek US	2848.17	2 yr	79.00	5655.99	5656.88	5656.80	5657.14	0.018514	4.08	19.35	26.49	0.84
Willow Creek US	Willow Creek US	2848.17	5 yr	153.00	5655.99	5657.03	5657.20	5657.67	0.036247	6.44	26.10	51.48	1.21
Willow Creek US	Willow Creek US	2848.17	10 yr	218.00	5655.99	5657.22	5657.44	5658.02	0.035824	7.30	36.35	56.46	1.25
Willow Creek US	Willow Creek US	2848.17	25 yr	304.00	5655.99	5657.47	5657.73	5658.37	0.032312	7.96	50.80	62.37	1.23
Willow Creek US	Willow Creek US	2848.17	50 yr	375.00	5655.99	5657.62	5657.92	5658.65	0.032353	8.57	60.74	66.92	1.25
Willow Creek US	Willow Creek US	2848.17	100 yr	453.00	5655.99	5657.78	5658.15	5658.92	0.032069	9.13	71.38	69.70	1.26
Willow Creek US	Willow Creek US	2848.17	500 yr	664.00	5655.99	5658.13	5658.60	5659.59	0.032647	10.53	99.00	84.84	1.32
Willow Creek US	Willow Creek US	2810.59*	2 yr	79.00	5655.24	5656.22	5656.11	5656.47	0.017110	4.04	20.24	41.85	0.82
Willow Creek US	Willow Creek US	2810.59*	5 yr	153.00	5655.24	5656.54	5656.50	5656.95	0.017712	5.22	36.57	55.63	0.88
Willow Creek US	Willow Creek US	2810.59*	10 yr	218.00	5655.24	5656.77	5656.77	5657.27	0.017597	5.90	50.03	61.79	0.91
Willow Creek US	Willow Creek US	2810.59*	25 yr	304.00	5655.24	5657.08	5657.08	5657.64	0.015494	6.38	71.44	77.62	0.88
Willow Creek US	Willow Creek US	2810.59*	50 yr	375.00	5655.24	5657.27	5657.27	5657.88	0.015409	6.83	85.94	81.18	0.89
Willow Creek US	Willow Creek US	2810.59*	100 yr	453.00	5655.24	5657.52	5657.45	5658.13	0.013280	6.92	107.60	89.44	0.85
Willow Creek US	Willow Creek US	2810.59*	500 yr	664.00	5655.24	5657.91	5657.98	5658.73	0.014753	8.19	150.71	126.25	0.92
Willow Creek US	Willow Creek US	2773.02*	2 yr	79.00	5654.49	5655.52	5655.45	5655.80	0.018671	4.23	20.04	43.53	0.85
Willow Creek US	Willow Creek US	2773.02*	5 yr	153.00	5654.49	5655.87	5655.87	5656.28	0.017969	5.32	37.39	57.19	0.89
Willow Creek US	Willow Creek US	2773.02*	10 yr	218.00	5654.49	5656.09	5656.12	5656.60	0.018302	6.06	51.58	68.77	0.93
Willow Creek US	Willow Creek US	2773.02*	25 yr	304.00	5654.49	5656.27	5656.37	5656.95	0.021228	7.12	64.61	72.10	1.02
Willow Creek US	Willow Creek US	2773.02*	50 yr	375.00	5654.49	5656.44	5656.59	5657.20	0.021074	7.62	77.52	80.19	1.03
Willow Creek US	Willow Creek US	2773.02*	100 yr	453.00	5654.49	5656.57	5656.57	5657.47	0.023322	8.39	88.31	96.65	1.10
Willow Creek US	Willow Creek US	2773.02*	500 yr	664.00	5654.49	5656.93	5657.25	5658.03	0.023699	9.57	133.10	138.35	1.14
Willow Creek US	Willow Creek US	2735.45*	2 yr	79.00	5653.74	5654.88	5654.80	5655.14	0.016567	4.14	22.11	50.77	0.81
Willow Creek US	Willow Creek US	2735.45*	5 yr	153.00	5653.74	5655.16	5655.20	5655.59	0.019482	5.49	40.15	70.15	0.92
Willow Creek US	Willow Creek US	2735.45*	10 yr	218.00	5653.74	5655.35	5655.43	5655.88	0.020830	6.31	55.08	89.11	0.98
Willow Creek US	Willow Creek US	2735.45*	25 yr	304.00	5653.74	5655.60	5655.73	5656.18	0.019413	6.85	80.38	116.21	0.98
Willow Creek US	Willow Creek US	2735.45*	50 yr	375.00	5653.74	5655.72	5655.87	5656.41	0.021441	7.58	95.57	127.41	1.04
Willow Creek US	Willow Creek US	2735.45*	100 yr	453.00	5653.74	5655.86	5656.06	5656.60	0.021353	8.00	115.18	143.62	1.05
Willow Creek US	Willow Creek US	2735.45*	500 yr	664.00	5653.74	5656.08	5656.37	5657.09	0.026897	9.69	148.72	160.58	1.20
Willow Creek US	Willow Creek US	2697.88	2 yr	79.00	5652.99	5654.15	5654.15	5654.44	0.020905	4.47	23.45	59.72	0.90
Willow Creek US	Willow Creek US	2697.88	5 yr	153.00	5652.99	5654.46	5654.47	5654.85	0.019702	5.46	44.96	74.05	0.93
Willow Creek US	Willow Creek US	2697.88	10 yr	218.00	5652.99	5654.68	5654.72	5655.13	0.018826	6.05	62.61	83.47	0.93
Willow Creek US	Willow Creek US	2697.88	25 yr	304.00	5652.99	5654.86	5654.95	5655.44	0.021306	7.01	77.72	85.69	1.02
Willow Creek US	Willow Creek US	2697.88	50 yr	375.00	5652.99	5655.07	5655.10	5655.65	0.018835	7.19	95.85	88.79	0.98
Willow Creek US	Willow Creek US	2697.88	100 yr	453.00	5652.99	5655.27	5655.27	5655.87	0.017435	7.45	113.84	91.84	0.96
Willow Creek US	Willow Creek US	2697.88	500 yr	664.00	5652.99	5655.45	5655.45	5655.86	0.014269	7.16	220.79	173.95	0.88
Willow Creek US	Willow Creek US	2664.50*	2 yr	79.00	5652.07	5653.09	5653.21	5653.51	0.037807	5.20	16.34	40.66	1.17
Willow Creek US	Willow Creek US	2664.50*	5 yr	153.00	5652.07	5653.38	5653.56	5653.97	0.035271	6.35	33.48	80.82	1.20

Willow Creek US	Willow Creek US	2664.50*	10 yr	218.00	5652.07	5653.54	5653.75	5654.25	0.036759	7.22	46.18	84.10	1.26
Willow Creek US	Willow Creek US	2664.50*	25 yr	304.00	5652.07	5653.74	5653.93	5654.52	0.034168	7.84	63.39	87.48	1.25
Willow Creek US	Willow Creek US	2664.50*	50 yr	375.00	5652.07	5653.85	5654.10	5654.76	0.035844	8.53	73.72	89.61	1.30
Willow Creek US	Willow Creek US	2664.50*	100 yr	453.00	5652.07	5653.97	5654.28	5655.00	0.037294	9.20	84.52	93.17	1.34
Willow Creek US	Willow Creek US	2664.50*	500 yr	664.00	5652.07	5654.50	5654.64	5655.26	0.021028	8.50	162.48	161.01	1.06
Willow Creek US	Willow Creek US	2631.13*	2 yr	79.00	5651.14	5652.25	5652.25	5652.51	0.023132	4.18	22.38	59.26	0.92
Willow Creek US	Willow Creek US	2631.13*	5 yr	153.00	5651.14	5652.50	5652.54	5652.91	0.025862	5.39	38.67	73.19	1.02
Willow Creek US	Willow Creek US	2631.13*	10 yr	218.00	5651.14	5652.69	5652.79	5653.18	0.024693	6.02	54.52	89.01	1.03
Willow Creek US	Willow Creek US	2631.13*	25 yr	304.00	5651.14	5652.86	5653.00	5653.47	0.026206	6.86	70.12	95.82	1.09
Willow Creek US	Willow Creek US	2631.13*	50 yr	375.00	5651.14	5653.02	5653.15	5653.68	0.025263	7.29	85.71	104.54	1.09
Willow Creek US	Willow Creek US	2631.13*	100 yr	453.00	5651.14	5653.15	5653.30	5653.88	0.025257	7.75	100.23	110.27	1.11
Willow Creek US	Willow Creek US	2631.13*	500 yr	664.00	5651.14	5653.39	5653.70	5654.41	0.030118	9.34	128.70	134.73	1.24
Willow Creek US	Willow Creek US	2597.76	2 yr	79.00	5650.22	5651.24	5651.30	5651.55	0.036254	4.62	20.64	56.57	1.12
Willow Creek US	Willow Creek US	2597.76	5 yr	153.00	5650.22	5651.49	5651.57	5651.92	0.033964	5.55	36.67	66.65	1.14
Willow Creek US	Willow Creek US	2597.76	10 yr	218.00	5650.22	5651.64	5651.78	5652.19	0.035422	6.37	47.29	77.92	1.20
Willow Creek US	Willow Creek US	2597.76	25 yr	304.00	5650.22	5651.84	5651.96	5652.49	0.032672	7.01	64.90	99.73	1.19
Willow Creek US	Willow Creek US	2597.76	50 yr	375.00	5650.22	5651.99	5652.22	5652.73	0.032107	7.56	80.70	120.37	1.21
Willow Creek US	Willow Creek US	2597.76	100 yr	453.00	5650.22	5652.10	5652.34	5652.92	0.032361	8.05	94.95	127.86	1.23
Willow Creek US	Willow Creek US	2597.76	500 yr	664.00	5650.22	5652.37	5652.70	5653.35	0.032532	9.12	130.71	139.37	1.27
Willow Creek US	Willow Creek US	2564.22*	2 yr	79.00	5649.48	5650.52	5650.48	5650.77	0.022641	3.94	20.07	33.87	0.90
Willow Creek US	Willow Creek US	2564.22*	5 yr	153.00	5649.48	5650.85	5650.85	5651.18	0.019295	4.67	39.07	82.87	0.89
Willow Creek US	Willow Creek US	2564.22*	10 yr	218.00	5649.48	5650.98	5651.06	5651.45	0.023801	5.67	50.13	97.42	1.01
Willow Creek US	Willow Creek US	2564.22*	25 yr	304.00	5649.48	5651.26	5651.27	5651.69	0.017064	5.67	81.62	134.25	0.89
Willow Creek US	Willow Creek US	2564.22*	50 yr	375.00	5649.48	5651.29	5651.29	5651.90	0.023497	6.77	85.89	138.95	1.05
Willow Creek US	Willow Creek US	2564.22*	100 yr	453.00	5649.48	5651.53	5651.62	5652.07	0.017070	6.47	123.08	161.31	0.92
Willow Creek US	Willow Creek US	2564.22*	500 yr	664.00	5649.48	5651.79	5651.89	5652.46	0.018658	7.50	165.60	169.83	0.98
Willow Creek US	Willow Creek US	2530.68*	2 yr	79.00	5648.73	5649.69	5649.69	5649.95	0.026904	4.08	19.38	35.35	0.97
Willow Creek US	Willow Creek US	2530.68*	5 yr	153.00	5648.73	5649.94	5650.03	5650.37	0.030599	5.29	30.20	63.11	1.09
Willow Creek US	Willow Creek US	2530.68*	10 yr	218.00	5648.73	5650.16	5650.23	5650.63	0.024814	5.62	46.52	89.49	1.02
Willow Creek US	Willow Creek US	2530.68*	25 yr	304.00	5648.73	5650.29	5650.46	5650.94	0.029195	6.66	59.65	103.89	1.13
Willow Creek US	Willow Creek US	2530.68*	50 yr	375.00	5648.73	5650.49	5650.64	5651.12	0.023566	6.69	82.74	137.64	1.04
Willow Creek US	Willow Creek US	2530.68*	100 yr	453.00	5648.73	5650.56	5650.82	5651.33	0.027058	7.45	93.87	154.31	1.13
Willow Creek US	Willow Creek US	2530.68*	500 yr	664.00	5648.73	5650.86	5651.08	5651.71	0.025365	8.22	143.40	176.31	1.13
Willow Creek US	Willow Creek US	2497.14	2 yr	79.00	5647.99	5648.94	5648.88	5649.14	0.020064	3.58	23.84	47.29	0.84
Willow Creek US	Willow Creek US	2497.14	5 yr	153.00	5647.99	5649.25	5649.18	5649.50	0.016987	4.16	46.39	85.20	0.82
Willow Creek US	Willow Creek US	2497.14	10 yr	218.00	5647.99	5649.43	5649.36	5649.73	0.015866	4.63	63.02	90.99	0.82
Willow Creek US	Willow Creek US	2497.14	25 yr	304.00	5647.99	5649.63	5649.56	5650.01	0.015777	5.23	82.75	104.35	0.84
Willow Creek US	Willow Creek US	2497.14	50 yr	375.00	5647.99	5649.80	5649.69	5650.20	0.014717	5.51	102.27	134.18	0.83
Willow Creek US	Willow Creek US	2497.14	100 yr	453.00	5647.99	5649.97	5649.88	5650.40	0.013606	5.74	128.16	162.27	0.82
Willow Creek US	Willow Creek US	2497.14	500 yr	664.00	5647.99	5650.58	5650.31	5650.89	0.007136	5.19	245.06	198.07	0.63
Willow Creek US	Willow Creek US	2457.54*	2 yr	79.00	5646.99	5648.05	5648.01	5648.29	0.022327	3.96	19.93	32.91	0.90
Willow Creek US	Willow Creek US	2457.54*	5 yr	153.00	5646.99	5648.38	5648.34	5648.74	0.021716	4.81	31.83	38.53	0.93
Willow Creek US	Willow Creek US	2457.54*	10 yr	218.00	5646.99	5648.63	5648.58	5649.04	0.019552	5.17	44.46	67.51	0.91
Willow Creek US	Willow Creek US	2457.54*	25 yr	304.00	5646.99	5648.87	5648.87	5649.35	0.017678	5.68	62.18	77.28	0.90
Willow Creek US	Willow Creek US	2457.54*	50 yr	375.00	5646.99	5649.02	5649.02	5649.58	0.017528	6.11	74.27	79.34	0.91
Willow Creek US	Willow Creek US	2457.54*	100 yr	453.00	5646.99	5649.18	5649.18	5649.80	0.017447	6.54	86.61	82.15	0.93
Willow Creek US	Willow Creek US	2457.54*	500 yr	664.00	5646.99	5649.36	5649.36	5650.37	0.024702	8.39	103.43	100.11	1.12
Willow Creek US	Willow Creek US	2417.95*	2 yr	79.00	5646.00	5647.08	5647.05	5647.37	0.024093	4.36	18.12	27.42	0.95
Willow Creek US	Willow Creek US	2417.95*	5 yr	153.00	5646.00	5647.46	5647.44	5647.86	0.022334	5.11	29.94	33.73	0.96
Willow Creek US	Willow Creek US	2417.95*	10 yr	218.00	5646.00	5647.69	5647.69	5648.20	0.022879	5.73	38.67	42.27	0.99
Willow Creek US	Willow Creek US	2417.95*	25 yr	304.00	5646.00	5647.94	5647.99	5648.55	0.023104	6.29	51.31	55.60	1.02
Willow Creek US	Willow Creek US	2417.95*	50 yr	375.00	5646.00	5648.12	5648.23	5648.80	0.022244	6.68	62.82	75.75	1.02
Willow Creek US	Willow Creek US	2417.95*	100 yr	453.00	5646.00	5648.27	5648.39	5649.03	0.021758	7.11	75.21	81.54	1.03
Willow Creek US	Willow Creek US	2417.95*	500 yr	664.00	5646.00	5648.62	5648.75	5649.34	0.017979	7.42	145.31	151.30	0.97
Willow Creek US	Willow Creek US	2378.35*	2 yr	79.00	5645.00	5646.03	5646.03	5646.38	0.025678	4.74	16.66	23.27	0.99
Willow Creek US	Willow Creek US	2378.35*	5 yr	153.00	5645.00	5646.45	5646.45	5646.93	0.024740	5.56	27.52	29.46	1.01
Willow Creek US	Willow Creek US	2378.35*	10 yr	218.00	5645.00	5646.73	5646.75	5647.29	0.023024	6.01	36.26	32.66	1.01
Willow Creek US	Willow Creek US	2378.35*	25 yr	304.00	5645.00	5647.03	5647.05	5647.69	0.021985	6.52	46.65	35.94	1.01
Willow Creek US	Willow Creek US	2378.35*	50 yr	375.00	5645.00	5647.25	5647.27	5647.98	0.021568	6.86	54.64	38.39	1.01
Willow Creek US	Willow Creek US	2378.35*	100 yr	453.00	5645.00	5647.64	5647.47	5647.80	0.005607	3.98	205.54	157.63	0.53
Willow Creek US	Willow Creek US	2378.35*	500 yr	664.00	5645.00	5647.47	5647.47	5647.92	0.017534	6.58	179.74	144.52	0.93
Willow Creek US	Willow Creek US	2338.76	2 yr	79.00	5644.00	5645.08	5645.00	5645.37	0.018334	4.29	18.42	23.19	0.85

Willow Creek US	Willow Creek US	2338.76	5 yr	153.00	5644.00	5645.51	5645.41	5645.94	0.018567	5.28	28.96	26.87	0.90
Willow Creek US	Willow Creek US	2338.76	10 yr	218.00	5644.00	5645.67	5645.74	5646.33	0.025460	6.50	33.55	28.91	1.06
Willow Creek US	Willow Creek US	2338.76	25 yr	304.00	5644.00	5645.98	5646.07	5646.76	0.024837	7.07	42.98	31.98	1.08
Willow Creek US	Willow Creek US	2338.76	50 yr	375.00	5644.00	5646.20	5646.29	5647.06	0.024136	7.45	50.35	33.90	1.08
Willow Creek US	Willow Creek US	2338.76	100 yr	453.00	5644.00	5646.53	5646.53	5647.36	0.019608	7.31	62.01	36.74	0.99
Willow Creek US	Willow Creek US	2338.76	500 yr	664.00	5644.00	5647.01	5647.01	5647.10	0.003312	3.36	350.06	161.44	0.42
Willow Creek US	Willow Creek US	2297.49*	2 yr	79.00	5643.23	5644.34	5644.26	5644.61	0.018581	4.16	18.98	25.30	0.85
Willow Creek US	Willow Creek US	2297.49*	5 yr	153.00	5643.23	5644.72	5644.67	5645.13	0.020388	5.14	29.76	30.97	0.92
Willow Creek US	Willow Creek US	2297.49*	10 yr	218.00	5643.23	5644.98	5644.94	5645.48	0.020349	5.72	38.11	33.73	0.95
Willow Creek US	Willow Creek US	2297.49*	25 yr	304.00	5643.23	5645.24	5645.24	5645.88	0.021102	6.41	47.41	36.29	0.99
Willow Creek US	Willow Creek US	2297.49*	50 yr	375.00	5643.23	5645.36	5645.44	5646.17	0.024816	7.23	51.90	37.48	1.08
Willow Creek US	Willow Creek US	2297.49*	100 yr	453.00	5643.23	5645.57	5645.67	5646.46	0.024224	7.58	59.79	39.47	1.08
Willow Creek US	Willow Creek US	2297.49*	500 yr	664.00	5643.23	5645.93	5645.73	5646.27	0.010550	5.69	213.65	160.54	0.74
Willow Creek US	Willow Creek US	2256.23*	2 yr	79.00	5642.46	5643.49	5643.46	5643.76	0.023298	4.15	19.02	30.25	0.92
Willow Creek US	Willow Creek US	2256.23*	5 yr	153.00	5642.46	5643.82	5643.82	5644.23	0.023148	5.13	29.83	34.33	0.97
Willow Creek US	Willow Creek US	2256.23*	10 yr	218.00	5642.46	5644.03	5644.02	5644.56	0.024497	5.86	37.22	36.62	1.02
Willow Creek US	Willow Creek US	2256.23*	25 yr	304.00	5642.46	5644.28	5644.33	5644.94	0.024740	6.52	46.64	39.35	1.06
Willow Creek US	Willow Creek US	2256.23*	50 yr	375.00	5642.46	5644.46	5644.53	5645.21	0.024419	6.97	53.88	42.67	1.07
Willow Creek US	Willow Creek US	2256.23*	100 yr	453.00	5642.46	5644.50	5644.72	5645.38	0.028623	7.72	70.68	75.83	1.16
Willow Creek US	Willow Creek US	2256.23*	500 yr	664.00	5642.46	5645.17	5645.17	5645.81	0.013471	6.90	147.06	141.58	0.85
Willow Creek US	Willow Creek US	2214.97*	2 yr	79.00	5641.69	5642.59	5642.53	5642.83	0.021515	3.86	20.46	34.23	0.88
Willow Creek US	Willow Creek US	2214.97*	5 yr	153.00	5641.69	5642.88	5642.87	5643.27	0.023407	4.95	30.88	37.81	0.97
Willow Creek US	Willow Creek US	2214.97*	10 yr	218.00	5641.69	5643.11	5643.11	5643.57	0.022511	5.48	40.80	51.98	0.98
Willow Creek US	Willow Creek US	2214.97*	25 yr	304.00	5641.69	5643.29	5643.39	5643.92	0.024515	6.37	51.52	65.61	1.05
Willow Creek US	Willow Creek US	2214.97*	50 yr	375.00	5641.69	5643.41	5643.57	5644.17	0.026442	7.07	59.47	68.95	1.10
Willow Creek US	Willow Creek US	2214.97*	100 yr	453.00	5641.69	5643.66	5643.73	5644.38	0.020109	6.95	77.64	74.05	0.99
Willow Creek US	Willow Creek US	2214.97*	500 yr	664.00	5641.69	5643.85	5644.15	5645.02	0.028490	8.94	91.75	77.86	1.20
Willow Creek US	Willow Creek US	2173.71	2 yr	79.00	5640.92	5641.56	5641.56	5641.82	0.028108	4.06	19.45	36.87	0.99
Willow Creek US	Willow Creek US	2173.71	5 yr	153.00	5640.92	5641.85	5641.85	5642.24	0.026525	4.98	30.70	40.94	1.01
Willow Creek US	Willow Creek US	2173.71	10 yr	218.00	5640.92	5642.02	5642.09	5642.54	0.027955	5.82	38.21	55.47	1.08
Willow Creek US	Willow Creek US	2173.71	25 yr	304.00	5640.92	5642.23	5642.33	5642.88	0.026305	6.49	50.51	59.93	1.08
Willow Creek US	Willow Creek US	2173.71	50 yr	375.00	5640.92	5642.39	5642.51	5643.12	0.024951	6.92	60.53	63.30	1.08
Willow Creek US	Willow Creek US	2173.71	100 yr	453.00	5640.92	5642.48	5642.69	5643.39	0.028819	7.78	66.21	65.14	1.17
Willow Creek US	Willow Creek US	2173.71	500 yr	664.00	5640.92	5642.92	5643.12	5643.95	0.022926	8.36	97.18	74.44	1.09
Willow Creek DS	Willow Creek DS	2039.61	2 yr	86.00	5637.96	5638.28	5638.44	5638.79	0.142512	5.77	14.90	56.37	1.98
Willow Creek DS	Willow Creek DS	2039.61	5 yr	166.00	5637.96	5638.40	5638.67	5639.28	0.148826	7.50	22.13	58.37	2.15
Willow Creek DS	Willow Creek DS	2039.61	10 yr	238.00	5637.96	5638.52	5638.84	5639.58	0.132074	8.26	28.81	60.12	2.10
Willow Creek DS	Willow Creek DS	2039.61	25 yr	333.00	5637.96	5638.63	5639.04	5639.99	0.134086	9.39	35.48	61.82	2.18
Willow Creek DS	Willow Creek DS	2039.61	50 yr	411.00	5637.96	5638.70	5639.16	5640.31	0.135489	10.16	40.45	63.05	2.24
Willow Creek DS	Willow Creek DS	2039.61	100 yr	497.00	5637.96	5638.83	5639.30	5640.48	0.114530	10.31	48.18	64.73	2.11
Willow Creek DS	Willow Creek DS	2039.61	500 yr	728.00	5637.96	5639.00	5639.67	5641.31	0.126091	12.18	59.77	67.24	2.28
Willow Creek DS	Willow Creek DS	1999.64*	2 yr	86.00	5636.95	5637.55	5637.48	5637.72	0.020247	3.33	25.79	51.41	0.83
Willow Creek DS	Willow Creek DS	1999.64*	5 yr	166.00	5636.95	5637.81	5637.73	5638.08	0.019379	4.16	39.91	55.21	0.86
Willow Creek DS	Willow Creek DS	1999.64*	10 yr	238.00	5636.95	5638.00	5637.93	5638.34	0.019096	4.70	50.63	57.63	0.88
Willow Creek DS	Willow Creek DS	1999.64*	25 yr	333.00	5636.95	5638.20	5638.15	5638.64	0.019021	5.35	62.30	59.15	0.91
Willow Creek DS	Willow Creek DS	1999.64*	50 yr	411.00	5636.95	5638.33	5638.30	5638.87	0.019692	5.88	70.13	60.05	0.95
Willow Creek DS	Willow Creek DS	1999.64*	100 yr	497.00	5636.95	5638.46	5638.44	5639.10	0.020459	6.42	77.96	60.91	0.98
Willow Creek DS	Willow Creek DS	1999.64*	500 yr	728.00	5636.95	5638.84	5638.84	5639.66	0.018997	7.31	101.46	63.33	0.98
Willow Creek DS	Willow Creek DS	1959.68*	2 yr	86.00	5635.95	5636.57	5636.55	5636.80	0.025978	3.87	22.22	42.70	0.95
Willow Creek DS	Willow Creek DS	1959.68*	5 yr	166.00	5635.95	5636.85	5636.84	5637.21	0.024286	4.77	34.83	46.50	0.97
Willow Creek DS	Willow Creek DS	1959.68*	10 yr	238.00	5635.95	5637.06	5637.06	5637.50	0.022791	5.31	44.82	48.91	0.97
Willow Creek DS	Willow Creek DS	1959.68*	25 yr	333.00	5635.95	5637.30	5637.28	5637.84	0.020808	5.90	56.76	51.16	0.97
Willow Creek DS	Willow Creek DS	1959.68*	50 yr	411.00	5635.95	5637.50	5637.44	5638.10	0.018590	6.20	67.16	52.89	0.94
Willow Creek DS	Willow Creek DS	1959.68*	100 yr	497.00	5635.95	5637.72	5637.64	5638.36	0.016648	6.47	78.61	54.44	0.91
Willow Creek DS	Willow Creek DS	1959.68*	500 yr	728.00	5635.95	5638.26	5638.07	5639.01	0.013130	7.00	109.10	57.92	0.85
Willow Creek DS	Willow Creek DS	1919.71*	2 yr	86.00	5634.94	5635.74	5635.65	5635.95	0.017744	3.70	23.24	35.81	0.81
Willow Creek DS	Willow Creek DS	1919.71*	5 yr	166.00	5634.94	5636.09	5635.98	5636.41	0.016229	4.52	36.77	40.49	0.82
Willow Creek DS	Willow Creek DS	1919.71*	10 yr	238.00	5634.94	5636.34	5636.20	5636.75	0.015464	5.14	47.03	43.66	0.83
Willow Creek DS	Willow Creek DS	1919.71*	25 yr	333.00	5634.94	5636.60	5636.49	5637.13	0.015514	5.87	58.61	46.30	0.86
Willow Creek DS	Willow Creek DS	1919.71*	50 yr	411.00	5634.94	5636.78	5636.67	5637.41	0.015813	6.42	67.18	48.42	0.89
Willow Creek DS	Willow Creek DS	1919.71*	100 yr	497.00	5634.94	5636.96	5636.90	5637.70	0.016174	6.96	75.97	49.97	0.92
Willow Creek DS	Willow Creek DS	1919.71*	500 yr	728.00	5634.94	5637.38	5637.38	5638.40	0.016726	8.16	98.64	57.96	0.96

Willow Creek DS	Willow Creek DS	1879.75	2 yr	86.00	5633.93	5634.81	5634.79	5635.12	0.024172	4.50	19.10	27.56	0.95
Willow Creek DS	Willow Creek DS	1879.75	5 yr	166.00	5633.93	5635.19	5635.19	5635.65	0.021600	5.48	31.29	37.52	0.96
Willow Creek DS	Willow Creek DS	1879.75	10 yr	238.00	5633.93	5635.46	5635.46	5636.03	0.019872	6.14	42.09	43.27	0.96
Willow Creek DS	Willow Creek DS	1879.75	25 yr	333.00	5633.93	5635.79	5635.79	5636.46	0.017485	6.71	57.60	50.55	0.93
Willow Creek DS	Willow Creek DS	1879.75	50 yr	411.00	5633.93	5636.03	5636.03	5636.77	0.015979	7.06	70.80	56.50	0.91
Willow Creek DS	Willow Creek DS	1879.75	100 yr	497.00	5633.93	5636.26	5636.26	5637.07	0.015402	7.47	83.73	58.95	0.91
Willow Creek DS	Willow Creek DS	1879.75	500 yr	728.00	5633.93	5636.73	5636.79	5637.77	0.015582	8.61	114.57	70.78	0.95
Willow Creek DS	Willow Creek DS	1836.33*	2 yr	86.00	5632.83	5633.82	5633.77	5634.12	0.021786	4.38	19.64	27.37	0.91
Willow Creek DS	Willow Creek DS	1836.33*	5 yr	166.00	5632.83	5634.14	5634.18	5634.66	0.024539	5.74	29.65	37.85	1.02
Willow Creek DS	Willow Creek DS	1836.33*	10 yr	238.00	5632.83	5634.36	5634.48	5635.05	0.025766	6.70	38.79	48.66	1.08
Willow Creek DS	Willow Creek DS	1836.33*	25 yr	333.00	5632.83	5634.57	5634.78	5635.49	0.028252	7.82	49.81	53.99	1.16
Willow Creek DS	Willow Creek DS	1836.33*	50 yr	411.00	5632.83	5634.71	5634.95	5635.81	0.030025	8.61	57.83	56.32	1.22
Willow Creek DS	Willow Creek DS	1836.33*	100 yr	497.00	5632.83	5634.88	5635.21	5636.13	0.030213	9.24	67.40	58.49	1.24
Willow Creek DS	Willow Creek DS	1836.33*	500 yr	728.00	5632.83	5635.30	5635.78	5636.84	0.028777	10.44	94.06	68.72	1.26
Willow Creek DS	Willow Creek DS	1792.92*	2 yr	86.00	5631.72	5632.78	5632.77	5633.11	0.024804	4.60	18.68	26.61	0.97
Willow Creek DS	Willow Creek DS	1792.92*	5 yr	166.00	5631.72	5633.16	5633.21	5633.64	0.022137	5.59	32.45	52.69	0.97
Willow Creek DS	Willow Creek DS	1792.92*	10 yr	238.00	5631.72	5633.39	5633.46	5633.99	0.021933	6.36	45.00	56.97	1.00
Willow Creek DS	Willow Creek DS	1792.92*	25 yr	333.00	5631.72	5633.65	5633.75	5634.38	0.021460	7.12	60.27	61.54	1.02
Willow Creek DS	Willow Creek DS	1792.92*	50 yr	411.00	5631.72	5633.83	5633.98	5634.66	0.021317	7.67	72.04	66.60	1.04
Willow Creek DS	Willow Creek DS	1792.92*	100 yr	497.00	5631.72	5634.00	5634.16	5634.95	0.021787	8.26	83.69	70.47	1.07
Willow Creek DS	Willow Creek DS	1792.92*	500 yr	728.00	5631.72	5634.37	5634.71	5635.65	0.023789	9.74	112.15	87.80	1.15
Willow Creek DS	Willow Creek DS	1749.51	2 yr	86.00	5630.62	5631.77	5631.77	5632.08	0.022739	4.47	22.02	43.72	0.93
Willow Creek DS	Willow Creek DS	1749.51	5 yr	166.00	5630.62	5632.04	5632.16	5632.56	0.028973	5.95	35.37	59.37	1.09
Willow Creek DS	Willow Creek DS	1749.51	10 yr	238.00	5630.62	5632.23	5632.38	5632.89	0.030006	6.85	47.89	69.55	1.15
Willow Creek DS	Willow Creek DS	1749.51	25 yr	333.00	5630.62	5632.41	5632.63	5633.26	0.032702	7.91	60.72	72.41	1.23
Willow Creek DS	Willow Creek DS	1749.51	50 yr	411.00	5630.62	5632.54	5632.82	5633.53	0.034125	8.63	70.46	74.54	1.28
Willow Creek DS	Willow Creek DS	1749.51	100 yr	497.00	5630.62	5632.69	5632.98	5633.79	0.034314	9.23	81.39	76.14	1.30
Willow Creek DS	Willow Creek DS	1749.51	500 yr	728.00	5630.62	5633.02	5633.41	5634.43	0.035131	10.64	108.18	86.30	1.36
Willow Creek DS	Willow Creek DS	1700.51*	2 yr	86.00	5629.38	5630.18	5630.26	5630.55	0.045172	4.88	17.63	36.23	1.23
Willow Creek DS	Willow Creek DS	1700.51*	5 yr	166.00	5629.38	5630.48	5630.56	5630.98	0.035868	5.66	29.33	40.53	1.17
Willow Creek DS	Willow Creek DS	1700.51*	10 yr	238.00	5629.38	5630.68	5630.80	5631.30	0.034903	6.34	37.58	43.92	1.19
Willow Creek DS	Willow Creek DS	1700.51*	25 yr	333.00	5629.38	5630.91	5631.06	5631.67	0.031439	7.02	48.43	50.51	1.18
Willow Creek DS	Willow Creek DS	1700.51*	50 yr	411.00	5629.38	5631.07	5631.27	5631.94	0.029833	7.50	58.06	66.24	1.17
Willow Creek DS	Willow Creek DS	1700.51*	100 yr	497.00	5629.38	5631.22	5631.49	5632.20	0.029258	8.01	68.69	71.85	1.18
Willow Creek DS	Willow Creek DS	1700.51*	500 yr	728.00	5629.38	5631.55	5631.90	5632.83	0.029565	9.26	96.09	87.50	1.23
Willow Creek DS	Willow Creek DS	1651.51*	2 yr	86.00	5628.15	5628.85	5628.85	5629.10	0.033322	4.03	21.36	46.62	1.05
Willow Creek DS	Willow Creek DS	1651.51*	5 yr	166.00	5628.15	5629.10	5629.14	5629.47	0.031356	4.89	33.91	52.73	1.08
Willow Creek DS	Willow Creek DS	1651.51*	10 yr	238.00	5628.15	5629.30	5629.34	5629.73	0.027517	5.25	45.35	58.19	1.04
Willow Creek DS	Willow Creek DS	1651.51*	25 yr	333.00	5628.15	5629.43	5629.55	5630.05	0.032997	6.34	52.91	62.89	1.17
Willow Creek DS	Willow Creek DS	1651.51*	50 yr	411.00	5628.15	5629.52	5629.72	5630.30	0.036788	7.12	58.71	68.60	1.25
Willow Creek DS	Willow Creek DS	1651.51*	100 yr	497.00	5628.15	5629.62	5629.88	5630.56	0.038307	7.77	66.35	79.19	1.30
Willow Creek DS	Willow Creek DS	1651.51*	500 yr	728.00	5628.15	5629.88	5630.27	5631.15	0.040237	9.13	86.93	87.28	1.38
Willow Creek DS	Willow Creek DS	1602.51	2 yr	86.00	5626.91	5627.51	5627.48	5627.68	0.024076	3.38	29.85	76.99	0.89
Willow Creek DS	Willow Creek DS	1602.51	5 yr	166.00	5626.91	5627.77	5627.69	5627.98	0.020872	3.89	51.62	92.53	0.87
Willow Creek DS	Willow Creek DS	1602.51	10 yr	238.00	5626.91	5627.96	5627.88	5628.20	0.018812	4.09	71.56	110.92	0.85
Willow Creek DS	Willow Creek DS	1602.51	25 yr	333.00	5626.91	5628.12	5628.00	5628.43	0.019023	4.68	90.69	124.64	0.88
Willow Creek DS	Willow Creek DS	1602.51	50 yr	411.00	5626.91	5628.24	5628.18	5628.59	0.018417	5.02	105.60	125.66	0.89
Willow Creek DS	Willow Creek DS	1602.51	100 yr	497.00	5626.91	5628.36	5628.30	5628.75	0.018048	5.36	120.63	126.65	0.89
Willow Creek DS	Willow Creek DS	1602.51	500 yr	728.00	5626.91	5628.66	5628.55	5629.15	0.016505	6.02	159.72	129.23	0.89
Willow Creek DS	Willow Creek DS	1559.06*	2 yr	86.00	5625.93	5626.63	5626.56	5626.78	0.017802	3.12	28.22	64.92	0.78
Willow Creek DS	Willow Creek DS	1559.06*	5 yr	166.00	5625.93	5626.86	5626.80	5627.10	0.020310	3.98	45.65	96.11	0.87
Willow Creek DS	Willow Creek DS	1559.06*	10 yr	238.00	5625.93	5626.98	5626.98	5627.31	0.022302	4.69	58.00	98.81	0.94
Willow Creek DS	Willow Creek DS	1559.06*	25 yr	333.00	5625.93	5627.16	5627.16	5627.56	0.021189	5.24	75.63	102.36	0.94
Willow Creek DS	Willow Creek DS	1559.06*	50 yr	411.00	5625.93	5627.29	5627.29	5627.75	0.020512	5.61	89.17	105.64	0.95
Willow Creek DS	Willow Creek DS	1559.06*	100 yr	497.00	5625.93	5627.42	5627.42	5627.93	0.020085	5.98	102.93	107.78	0.96
Willow Creek DS	Willow Creek DS	1559.06*	500 yr	728.00	5625.93	5627.72	5627.72	5628.38	0.019603	6.85	135.83	111.67	0.98
Willow Creek DS	Willow Creek DS	1515.61*	2 yr	86.00	5624.96	5625.61	5625.59	5625.81	0.028545	3.66	23.59	54.11	0.97
Willow Creek DS	Willow Creek DS	1515.61*	5 yr	166.00	5624.96	5625.85	5625.85	5626.15	0.023539	4.42	42.42	91.83	0.94
Willow Creek DS	Willow Creek DS	1515.61*	10 yr	238.00	5624.96	5626.03	5626.03	5626.38	0.020812	4.86	59.68	100.03	0.92
Willow Creek DS	Willow Creek DS	1515.61*	25 yr	333.00	5624.96	5626.20	5626.21	5626.64	0.021511	5.55	76.60	104.79	0.96
Willow Creek DS	Willow Creek DS	1515.61*	50 yr	411.00	5624.96	5626.32	5626.35	5626.83	0.021870	6.02	89.37	107.86	0.99
Willow Creek DS	Willow Creek DS	1515.61*	100 yr	497.00	5624.96	5626.45	5626.50	5627.02	0.021670	6.44	103.47	110.98	1.00
Willow Creek DS	Willow Creek DS	1515.61*	500 yr	728.00	5624.96	5626.75	5626.83	5627.48	0.021528	7.38	137.85	118.10	1.04

Willow Creek DS	Willow Creek DS	1472.16	2 yr	86.00	5623.98	5624.57	5624.48	5624.68	0.021652	3.11	39.77	98.42	0.84
Willow Creek DS	Willow Creek DS	1472.16	5 yr	166.00	5623.98	5624.79	5624.68	5624.97	0.020454	3.99	61.90	102.92	0.87
Willow Creek DS	Willow Creek DS	1472.16	10 yr	238.00	5623.98	5624.93	5624.83	5625.18	0.021434	4.66	76.93	105.80	0.92
Willow Creek DS	Willow Creek DS	1472.16	25 yr	333.00	5623.98	5625.11	5625.00	5625.43	0.021370	5.32	96.05	111.15	0.95
Willow Creek DS	Willow Creek DS	1472.16	50 yr	411.00	5623.98	5625.24	5625.14	5625.61	0.020631	5.71	111.36	112.00	0.96
Willow Creek DS	Willow Creek DS	1472.16	100 yr	497.00	5623.98	5625.39	5625.27	5625.80	0.019608	6.05	127.94	112.92	0.95
Willow Creek DS	Willow Creek DS	1472.16	500 yr	728.00	5623.98	5625.75	5625.56	5626.26	0.017479	6.77	169.35	114.69	0.94
Willow Creek DS	Willow Creek DS	1429.51*	2 yr	86.00	5622.99	5623.67	5623.60	5623.81	0.022245	3.14	32.61	75.52	0.85
Willow Creek DS	Willow Creek DS	1429.51*	5 yr	166.00	5622.99	5623.89	5623.82	5624.11	0.021840	4.04	49.90	84.46	0.90
Willow Creek DS	Willow Creek DS	1429.51*	10 yr	238.00	5622.99	5624.06	5623.99	5624.34	0.020275	4.56	64.73	89.33	0.90
Willow Creek DS	Willow Creek DS	1429.51*	25 yr	333.00	5622.99	5624.25	5624.17	5624.61	0.019339	5.13	82.05	93.06	0.91
Willow Creek DS	Willow Creek DS	1429.51*	50 yr	411.00	5622.99	5624.37	5624.30	5624.80	0.019761	5.61	93.76	96.36	0.94
Willow Creek DS	Willow Creek DS	1429.51*	100 yr	497.00	5622.99	5624.50	5624.43	5625.00	0.019742	6.05	107.03	102.61	0.95
Willow Creek DS	Willow Creek DS	1429.51*	500 yr	728.00	5622.99	5624.79	5624.76	5625.48	0.020881	7.14	137.93	113.70	1.02
Willow Creek DS	Willow Creek DS	1386.87*	2 yr	86.00	5621.99	5622.80	5622.74	5622.94	0.019531	2.98	28.87	66.63	0.80
Willow Creek DS	Willow Creek DS	1386.87*	5 yr	166.00	5621.99	5623.01	5622.94	5623.24	0.019974	3.84	43.34	70.19	0.86
Willow Creek DS	Willow Creek DS	1386.87*	10 yr	238.00	5621.99	5623.15	5623.11	5623.47	0.021612	4.55	52.80	72.30	0.92
Willow Creek DS	Willow Creek DS	1386.87*	25 yr	333.00	5621.99	5623.30	5623.28	5623.73	0.022413	5.25	64.50	75.31	0.97
Willow Creek DS	Willow Creek DS	1386.87*	50 yr	411.00	5621.99	5623.44	5623.44	5623.93	0.021569	5.64	74.80	77.24	0.97
Willow Creek DS	Willow Creek DS	1386.87*	100 yr	497.00	5621.99	5623.56	5623.56	5624.13	0.021534	6.08	84.57	77.95	0.99
Willow Creek DS	Willow Creek DS	1386.87*	500 yr	728.00	5621.99	5623.90	5623.90	5624.63	0.019678	6.88	111.31	80.04	0.98
Willow Creek DS	Willow Creek DS	1344.23	2 yr	86.00	5621.00	5621.85	5621.83	5622.00	0.025550	3.06	28.12	75.96	0.89
Willow Creek DS	Willow Creek DS	1344.23	5 yr	166.00	5621.00	5622.04	5622.01	5622.28	0.025933	3.93	42.25	79.37	0.95
Willow Creek DS	Willow Creek DS	1344.23	10 yr	238.00	5621.00	5622.18	5622.16	5622.48	0.024332	4.43	53.80	80.90	0.95
Willow Creek DS	Willow Creek DS	1344.23	25 yr	333.00	5621.00	5622.33	5622.33	5622.73	0.024354	5.05	66.12	82.50	0.99
Willow Creek DS	Willow Creek DS	1344.23	50 yr	411.00	5621.00	5622.42	5622.45	5622.91	0.026779	5.65	73.05	83.38	1.05
Willow Creek DS	Willow Creek DS	1344.23	100 yr	497.00	5621.00	5622.51	5622.58	5623.10	0.027911	6.17	81.08	84.40	1.09
Willow Creek DS	Willow Creek DS	1344.23	500 yr	728.00	5621.00	5622.73	5622.89	5623.58	0.030555	7.38	100.05	88.00	1.18
Willow Creek DS	Willow Creek DS	1302.67*	2 yr	86.00	5619.97	5620.82	5620.78	5620.96	0.024461	3.09	27.79	71.42	0.87
Willow Creek DS	Willow Creek DS	1302.67*	5 yr	166.00	5619.97	5621.02	5620.98	5621.25	0.023629	3.91	42.41	74.60	0.91
Willow Creek DS	Willow Creek DS	1302.67*	10 yr	238.00	5619.97	5621.15	5621.14	5621.47	0.024496	4.51	52.80	77.21	0.96
Willow Creek DS	Willow Creek DS	1302.67*	25 yr	333.00	5619.97	5621.31	5621.32	5621.72	0.024606	5.10	65.32	79.99	0.99
Willow Creek DS	Willow Creek DS	1302.67*	50 yr	411.00	5619.97	5621.39	5621.44	5621.90	0.028228	5.75	71.55	81.33	1.08
Willow Creek DS	Willow Creek DS	1302.67*	100 yr	497.00	5619.97	5621.51	5621.56	5622.09	0.026794	6.09	81.76	83.25	1.07
Willow Creek DS	Willow Creek DS	1302.67*	500 yr	728.00	5619.97	5621.80	5621.86	5622.55	0.024901	6.94	106.18	88.71	1.08
Willow Creek DS	Willow Creek DS	1261.11*	2 yr	86.00	5618.93	5619.76	5619.74	5619.92	0.026061	3.22	26.68	67.63	0.90
Willow Creek DS	Willow Creek DS	1261.11*	5 yr	166.00	5618.93	5619.95	5619.94	5620.22	0.026327	4.14	40.06	70.16	0.97
Willow Creek DS	Willow Creek DS	1261.11*	10 yr	238.00	5618.93	5620.10	5620.08	5620.44	0.025294	4.68	50.90	72.15	0.98
Willow Creek DS	Willow Creek DS	1261.11*	25 yr	333.00	5618.93	5620.26	5620.27	5620.70	0.025616	5.30	62.80	74.38	1.02
Willow Creek DS	Willow Creek DS	1261.11*	50 yr	411.00	5618.93	5620.32	5620.41	5620.90	0.032083	6.11	67.28	76.32	1.15
Willow Creek DS	Willow Creek DS	1261.11*	100 yr	497.00	5618.93	5620.52	5620.56	5621.08	0.025200	6.00	82.84	80.88	1.04
Willow Creek DS	Willow Creek DS	1261.11*	500 yr	728.00	5618.93	5620.81	5620.88	5621.54	0.023697	6.83	107.29	87.24	1.05
Willow Creek DS	Willow Creek DS	1219.56*	2 yr	86.00	5617.90	5618.69	5618.65	5618.85	0.025216	3.31	26.02	61.95	0.90
Willow Creek DS	Willow Creek DS	1219.56*	5 yr	166.00	5617.90	5618.90	5618.88	5619.17	0.024432	4.12	40.24	67.09	0.94
Willow Creek DS	Willow Creek DS	1219.56*	10 yr	238.00	5617.90	5619.05	5619.05	5619.40	0.025185	4.77	49.95	68.58	0.98
Willow Creek DS	Willow Creek DS	1219.56*	25 yr	333.00	5617.90	5619.23	5619.24	5619.67	0.023767	5.30	62.89	70.55	0.99
Willow Creek DS	Willow Creek DS	1219.56*	50 yr	411.00	5617.90	5619.36	5619.36	5619.87	0.023997	5.74	71.65	71.77	1.01
Willow Creek DS	Willow Creek DS	1219.56*	100 yr	497.00	5617.90	5619.50	5619.51	5620.07	0.023610	6.03	82.45	75.74	1.02
Willow Creek DS	Willow Creek DS	1219.56*	500 yr	728.00	5617.90	5619.79	5619.86	5620.53	0.024808	6.92	105.33	84.48	1.07
Willow Creek DS	Willow Creek DS	1178.00*	2 yr	86.00	5616.86	5617.58	5617.57	5617.77	0.027101	3.54	24.33	55.26	0.94
Willow Creek DS	Willow Creek DS	1178.00*	5 yr	166.00	5616.86	5617.81	5617.80	5618.11	0.026774	4.37	37.98	62.17	0.99
Willow Creek DS	Willow Creek DS	1178.00*	10 yr	238.00	5616.86	5617.98	5617.98	5618.35	0.025520	4.87	48.84	65.47	0.99
Willow Creek DS	Willow Creek DS	1178.00*	25 yr	333.00	5616.86	5618.14	5618.17	5618.63	0.026385	5.58	59.71	66.99	1.04
Willow Creek DS	Willow Creek DS	1178.00*	50 yr	411.00	5616.86	5618.28	5618.32	5618.83	0.025764	5.98	68.72	68.17	1.05
Willow Creek DS	Willow Creek DS	1178.00*	100 yr	497.00	5616.86	5618.41	5618.47	5619.04	0.025508	6.39	77.78	69.33	1.06
Willow Creek DS	Willow Creek DS	1178.00*	500 yr	728.00	5616.86	5618.78	5618.86	5619.52	0.023830	6.91	106.71	84.91	1.06
Willow Creek DS	Willow Creek DS	1136.45	2 yr	86.00	5615.83	5616.50	5616.46	5616.69	0.024851	3.49	24.68	53.65	0.91
Willow Creek DS	Willow Creek DS	1136.45	5 yr	166.00	5615.83	5616.73	5616.72	5617.03	0.024915	4.39	37.82	58.23	0.96
Willow Creek DS	Willow Creek DS	1136.45	10 yr	238.00	5615.83	5616.91	5616.91	5617.29	0.024127	4.91	48.50	61.66	0.98
Willow Creek DS	Willow Creek DS	1136.45	25 yr	333.00	5615.83	5617.09	5617.11	5617.57	0.024673	5.55	60.32	68.97	1.01
Willow Creek DS	Willow Creek DS	1136.45	50 yr	411.00	5615.83	5617.22	5617.26	5617.78	0.024935	6.02	69.19	70.75	1.04
Willow Creek DS	Willow Creek DS	1136.45	100 yr	497.00	5615.83	5617.36	5617.37	5617.99	0.024586	6.42	78.95	72.56	1.05

Willow Creek DS	Willow Creek DS	1136.45	500 yr	728.00	5615.83	5617.66	5617.80	5618.50	0.025070	7.41	101.41	76.43	1.10
Willow Creek DS	Willow Creek DS	1095.93*	2 yr	86.00	5614.85	5615.57	5615.51	5615.75	0.021346	3.45	24.96	49.28	0.85
Willow Creek DS	Willow Creek DS	1095.93*	5 yr	166.00	5614.85	5615.84	5615.76	5616.12	0.020078	4.25	39.08	53.76	0.88
Willow Creek DS	Willow Creek DS	1095.93*	10 yr	238.00	5614.85	5616.03	5615.98	5616.39	0.020284	4.82	49.37	56.61	0.91
Willow Creek DS	Willow Creek DS	1095.93*	25 yr	333.00	5614.85	5616.11	5616.20	5616.70	0.030778	6.19	53.76	57.84	1.13
Willow Creek DS	Willow Creek DS	1095.93*	50 yr	411.00	5614.85	5616.29	5616.36	5616.92	0.026895	6.40	64.20	59.39	1.08
Willow Creek DS	Willow Creek DS	1095.93*	100 yr	497.00	5614.85	5616.47	5616.54	5617.15	0.024105	6.62	75.48	66.23	1.05
Willow Creek DS	Willow Creek DS	1095.93*	500 yr	728.00	5614.85	5616.88	5616.95	5617.65	0.022390	7.09	105.84	81.25	1.04
Willow Creek DS	Willow Creek DS	1055.41*	2 yr	86.00	5613.87	5614.60	5614.58	5614.82	0.024809	3.78	22.76	43.81	0.92
Willow Creek DS	Willow Creek DS	1055.41*	5 yr	166.00	5613.87	5614.86	5614.86	5615.22	0.024840	4.75	34.93	47.67	0.98
Willow Creek DS	Willow Creek DS	1055.41*	10 yr	238.00	5613.87	5615.08	5615.08	5615.50	0.023035	5.23	45.47	50.68	0.97
Willow Creek DS	Willow Creek DS	1055.41*	25 yr	333.00	5613.87	5615.30	5615.30	5615.83	0.022745	5.84	57.03	53.41	1.00
Willow Creek DS	Willow Creek DS	1055.41*	50 yr	411.00	5613.87	5615.49	5615.49	5616.06	0.021361	6.06	67.86	57.38	0.98
Willow Creek DS	Willow Creek DS	1055.41*	100 yr	497.00	5613.87	5615.58	5615.66	5616.30	0.025684	6.85	72.59	58.62	1.08
Willow Creek DS	Willow Creek DS	1055.41*	500 yr	728.00	5613.87	5616.10	5616.11	5616.83	0.017893	6.87	111.00	100.17	0.95
Willow Creek DS	Willow Creek DS	1014.89*	2 yr	86.00	5612.89	5613.70	5613.64	5613.91	0.020338	3.72	23.09	39.09	0.85
Willow Creek DS	Willow Creek DS	1014.89*	5 yr	166.00	5612.89	5614.04	5613.94	5614.35	0.018114	4.46	37.25	44.14	0.85
Willow Creek DS	Willow Creek DS	1014.89*	10 yr	238.00	5612.89	5614.25	5614.18	5614.65	0.019020	5.05	47.16	48.08	0.90
Willow Creek DS	Willow Creek DS	1014.89*	25 yr	333.00	5612.89	5614.50	5614.43	5614.99	0.018479	5.59	59.59	50.99	0.91
Willow Creek DS	Willow Creek DS	1014.89*	50 yr	411.00	5612.89	5614.67	5614.61	5615.23	0.018513	6.00	68.54	52.79	0.93
Willow Creek DS	Willow Creek DS	1014.89*	100 yr	497.00	5612.89	5614.79	5614.79	5615.48	0.020760	6.63	74.93	54.04	0.99
Willow Creek DS	Willow Creek DS	1014.89*	500 yr	728.00	5612.89	5615.17	5615.27	5616.05	0.020381	7.56	101.59	92.66	1.02
Willow Creek DS	Willow Creek DS	974.38	2 yr	86.00	5611.91	5612.73	5612.70	5613.01	0.024701	4.22	20.39	33.11	0.95
Willow Creek DS	Willow Creek DS	974.38	5 yr	166.00	5611.91	5613.06	5613.06	5613.47	0.025241	5.14	32.28	39.54	1.00
Willow Creek DS	Willow Creek DS	974.38	10 yr	238.00	5611.91	5613.30	5613.30	5613.79	0.022865	5.64	42.23	41.83	0.99
Willow Creek DS	Willow Creek DS	974.38	25 yr	333.00	5611.91	5613.56	5613.56	5614.16	0.021895	6.23	53.45	44.05	1.00
Willow Creek DS	Willow Creek DS	974.38	50 yr	411.00	5611.91	5613.77	5613.77	5614.43	0.020492	6.54	62.84	45.77	0.98
Willow Creek DS	Willow Creek DS	974.38	100 yr	497.00	5611.91	5614.01	5614.12	5614.71	0.017930	6.68	78.56	137.48	0.94
Willow Creek DS	Willow Creek DS	974.38	500 yr	728.00	5611.91	5614.29	5614.55	5615.22	0.020519	7.95	123.41	169.58	1.03
Willow Creek DS	Willow Creek DS	930.657*	2 yr	86.00	5610.74	5611.63	5611.61	5611.90	0.025902	4.19	20.52	34.86	0.96
Willow Creek DS	Willow Creek DS	930.657*	5 yr	166.00	5610.74	5611.94	5611.96	5612.35	0.025924	5.14	32.28	40.36	1.01
Willow Creek DS	Willow Creek DS	930.657*	10 yr	238.00	5610.74	5612.12	5612.17	5612.68	0.028354	6.00	39.69	42.10	1.09
Willow Creek DS	Willow Creek DS	930.657*	25 yr	333.00	5610.74	5612.34	5612.45	5613.05	0.028959	6.79	49.01	43.76	1.13
Willow Creek DS	Willow Creek DS	930.657*	50 yr	411.00	5610.74	5612.47	5612.61	5613.34	0.030794	7.45	55.14	44.82	1.18
Willow Creek DS	Willow Creek DS	930.657*	100 yr	497.00	5610.74	5612.61	5612.92	5613.63	0.032799	8.12	61.20	45.85	1.24
Willow Creek DS	Willow Creek DS	930.657*	500 yr	728.00	5610.74	5613.04	5613.38	5614.20	0.026540	8.73	98.61	119.28	1.16
Willow Creek DS	Willow Creek DS	886.935*	2 yr	86.00	5609.58	5610.55	5610.53	5610.80	0.024346	3.97	21.64	38.01	0.93
Willow Creek DS	Willow Creek DS	886.935*	5 yr	166.00	5609.58	5610.83	5610.84	5611.23	0.025428	5.06	32.81	41.42	1.00
Willow Creek DS	Willow Creek DS	886.935*	10 yr	238.00	5609.58	5610.98	5611.04	5611.56	0.029849	6.06	39.25	42.54	1.11
Willow Creek DS	Willow Creek DS	886.935*	25 yr	333.00	5609.58	5611.31	5611.33	5611.91	0.022647	6.25	53.31	44.85	1.01
Willow Creek DS	Willow Creek DS	886.935*	50 yr	411.00	5609.58	5611.51	5611.52	5612.18	0.020941	6.56	63.21	73.71	0.99
Willow Creek DS	Willow Creek DS	886.935*	100 yr	497.00	5609.58	5611.67	5611.79	5612.43	0.020912	7.05	78.24	105.54	1.01
Willow Creek DS	Willow Creek DS	886.935*	500 yr	728.00	5609.58	5611.88	5612.24	5613.05	0.027433	8.82	102.42	120.42	1.18
Willow Creek DS	Willow Creek DS	843.212*	2 yr	86.00	5608.41	5609.42	5609.42	5609.67	0.027368	4.04	21.28	39.82	0.97
Willow Creek DS	Willow Creek DS	843.212*	5 yr	166.00	5608.41	5609.69	5609.72	5610.10	0.026594	5.11	32.51	41.84	1.02
Willow Creek DS	Willow Creek DS	843.212*	10 yr	238.00	5608.41	5609.89	5609.93	5610.42	0.026607	5.82	40.88	43.17	1.05
Willow Creek DS	Willow Creek DS	843.212*	25 yr	333.00	5608.41	5610.09	5610.19	5610.79	0.028757	6.73	49.46	44.46	1.13
Willow Creek DS	Willow Creek DS	843.212*	50 yr	411.00	5608.41	5610.23	5610.47	5611.07	0.029858	7.34	56.12	53.71	1.17
Willow Creek DS	Willow Creek DS	843.212*	100 yr	497.00	5608.41	5610.38	5610.65	5611.34	0.029692	7.88	68.85	106.01	1.18
Willow Creek DS	Willow Creek DS	843.212*	500 yr	728.00	5608.41	5610.72	5611.07	5611.87	0.027861	8.84	108.17	128.64	1.19
Willow Creek DS	Willow Creek DS	799.49	2 yr	86.00	5607.24	5608.35	5608.28	5608.55	0.020126	3.65	23.57	40.76	0.85
Willow Creek DS	Willow Creek DS	799.49	5 yr	166.00	5607.24	5608.64	5608.58	5608.97	0.019884	4.64	35.78	42.65	0.89
Willow Creek DS	Willow Creek DS	799.49	10 yr	238.00	5607.24	5608.77	5608.81	5609.28	0.025352	5.72	41.62	43.48	1.03
Willow Creek DS	Willow Creek DS	799.49	25 yr	333.00	5607.24	5609.03	5609.12	5609.64	0.023195	6.28	54.36	80.07	1.02
Willow Creek DS	Willow Creek DS	799.49	50 yr	411.00	5607.24	5609.17	5609.33	5609.89	0.023491	6.82	68.72	112.18	1.05
Willow Creek DS	Willow Creek DS	799.49	100 yr	497.00	5607.24	5609.29	5609.53	5610.12	0.025013	7.45	82.16	118.78	1.09
Willow Creek DS	Willow Creek DS	799.49	500 yr	728.00	5607.24	5609.54	5609.86	5610.67	0.028695	8.88	114.60	136.47	1.20
Willow Creek DS	Willow Creek DS	764.03*	2 yr	86.00	5606.61	5607.58	5607.54	5607.79	0.023034	3.65	23.57	45.20	0.89
Willow Creek DS	Willow Creek DS	764.03*	5 yr	166.00	5606.61	5607.82	5607.82	5608.17	0.025909	4.77	34.79	48.72	0.99
Willow Creek DS	Willow Creek DS	764.03*	10 yr	238.00	5606.61	5607.97	5608.03	5608.46	0.029132	5.61	42.40	50.78	1.08
Willow Creek DS	Willow Creek DS	764.03*	25 yr	333.00	5606.61	5608.20	5608.28	5608.77	0.025188	6.11	58.75	80.99	1.05
Willow Creek DS	Willow Creek DS	764.03*	50 yr	411.00	5606.61	5608.33	5608.44	5609.00	0.025814	6.67	69.52	89.22	1.08

Willow Creek DS	Willow Creek DS	764.03*	100 yr	497.00	5606.61	5608.48	5608.59	5609.22	0.024508	7.04	83.07	91.05	1.07
Willow Creek DS	Willow Creek DS	764.03*	500 yr	728.00	5606.61	5608.85	5608.97	5609.73	0.021349	7.75	119.00	100.62	1.04
Willow Creek DS	Willow Creek DS	728.57	2 yr	86.00	5605.97	5606.93	5606.84	5607.08	0.017062	3.09	27.80	54.59	0.76
Willow Creek DS	Willow Creek DS	728.57	5 yr	166.00	5605.97	5607.20	5607.12	5607.42	0.014817	3.75	48.99	85.76	0.76
Willow Creek DS	Willow Creek DS	728.57	10 yr	238.00	5605.97	5607.39	5607.28	5607.65	0.014112	4.24	64.95	87.65	0.77
Willow Creek DS	Willow Creek DS	728.57	25 yr	333.00	5605.97	5607.62	5607.46	5607.94	0.012673	4.66	86.24	96.19	0.76
Willow Creek DS	Willow Creek DS	728.57	50 yr	411.00	5605.97	5607.80	5607.60	5608.15	0.011650	4.91	103.68	99.06	0.74
Willow Creek DS	Willow Creek DS	728.57	100 yr	497.00	5605.97	5607.99	5607.75	5608.37	0.010734	5.14	122.62	103.43	0.73
Willow Creek DS	Willow Creek DS	728.57	500 yr	728.00	5605.97	5608.44	5608.11	5608.88	0.009143	5.63	171.81	111.91	0.70
Willow Creek DS	Willow Creek DS	702.95*	2 yr	86.00	5605.49	5606.31	5606.29	5606.53	0.027534	3.77	22.81	47.63	0.96
Willow Creek DS	Willow Creek DS	702.95*	5 yr	166.00	5605.49	5606.55	5606.54	5606.90	0.027584	4.76	35.14	54.36	1.02
Willow Creek DS	Willow Creek DS	702.95*	10 yr	238.00	5605.49	5606.74	5606.74	5607.17	0.024021	5.26	46.39	59.02	0.99
Willow Creek DS	Willow Creek DS	702.95*	25 yr	333.00	5605.49	5606.95	5606.95	5607.49	0.022681	5.90	59.12	62.11	1.00
Willow Creek DS	Willow Creek DS	702.95*	50 yr	411.00	5605.49	5607.12	5607.12	5607.72	0.021078	6.27	69.87	64.98	0.99
Willow Creek DS	Willow Creek DS	702.95*	100 yr	497.00	5605.49	5607.29	5607.29	5607.96	0.019937	6.64	81.22	68.21	0.98
Willow Creek DS	Willow Creek DS	702.95*	500 yr	728.00	5605.49	5607.73	5607.73	5608.53	0.016757	7.29	116.56	89.98	0.94
Willow Creek DS	Willow Creek DS	677.33	2 yr	86.00	5605.00	5605.82		5605.98	0.016298	3.25	30.75	58.94	0.76
Willow Creek DS	Willow Creek DS	677.33	5 yr	166.00	5605.00	5606.12		5606.35	0.015494	4.05	49.26	68.55	0.79
Willow Creek DS	Willow Creek DS	677.33	10 yr	238.00	5605.00	5606.30	5606.17	5606.62	0.015926	4.70	62.45	74.09	0.83
Willow Creek DS	Willow Creek DS	677.33	25 yr	333.00	5605.00	5606.54	5606.41	5606.92	0.014993	5.24	80.39	78.17	0.83
Willow Creek DS	Willow Creek DS	677.33	50 yr	411.00	5605.00	5606.68	5606.55	5607.14	0.015368	5.72	92.09	80.00	0.86
Willow Creek DS	Willow Creek DS	677.33	100 yr	497.00	5605.00	5606.87	5606.71	5607.37	0.014510	6.04	107.02	82.27	0.85
Willow Creek DS	Willow Creek DS	677.33	500 yr	728.00	5605.00	5607.14	5606.99	5607.95	0.018638	7.63	133.81	110.73	0.99
Willow Creek DS	Willow Creek DS	636.875*	2 yr	86.00	5603.96	5604.81	5604.81	5605.11	0.028831	4.40	19.56	33.54	1.01
Willow Creek DS	Willow Creek DS	636.875*	5 yr	166.00	5603.96	5605.17	5605.16	5605.55	0.025370	4.98	33.32	43.02	1.00
Willow Creek DS	Willow Creek DS	636.875*	10 yr	238.00	5603.96	5605.42	5605.40	5605.85	0.022018	5.30	46.04	57.58	0.96
Willow Creek DS	Willow Creek DS	636.875*	25 yr	333.00	5603.96	5605.63	5605.63	5606.18	0.021859	5.97	59.05	63.08	0.99
Willow Creek DS	Willow Creek DS	636.875*	50 yr	411.00	5603.96	5605.81	5605.81	5606.42	0.019935	6.29	70.93	67.00	0.97
Willow Creek DS	Willow Creek DS	636.875*	100 yr	497.00	5603.96	5605.96	5605.96	5606.66	0.020220	6.80	81.00	70.13	0.99
Willow Creek DS	Willow Creek DS	636.875*	500 yr	728.00	5603.96	5606.42	5606.42	5607.23	0.016589	7.40	118.72	89.15	0.94
Willow Creek DS	Willow Creek DS	596.42	2 yr	86.00	5602.93	5603.90	5603.82	5604.15	0.018883	3.95	21.77	31.80	0.84
Willow Creek DS	Willow Creek DS	596.42	5 yr	166.00	5602.93	5604.25	5604.19	5604.63	0.020452	4.92	33.74	37.62	0.92
Willow Creek DS	Willow Creek DS	596.42	10 yr	238.00	5602.93	5604.49	5604.46	5604.96	0.021828	5.51	43.19	42.67	0.97
Willow Creek DS	Willow Creek DS	596.42	25 yr	333.00	5602.93	5604.83	5604.74	5605.33	0.018447	5.64	59.01	49.73	0.91
Willow Creek DS	Willow Creek DS	596.42	50 yr	411.00	5602.93	5604.97	5604.93	5605.57	0.020525	6.25	65.83	52.97	0.97
Willow Creek DS	Willow Creek DS	596.42	100 yr	497.00	5602.93	5605.10	5605.12	5605.82	0.021352	6.81	74.42	66.80	1.01
Willow Creek DS	Willow Creek DS	596.42	500 yr	728.00	5602.93	5605.42	5605.56	5606.42	0.023057	8.09	97.52	80.85	1.08
Willow Creek DS	Willow Creek DS	547.132*	2 yr	86.00	5601.95	5602.87	5602.82	5603.14	0.022306	4.22	20.37	30.55	0.91
Willow Creek DS	Willow Creek DS	547.132*	5 yr	166.00	5601.95	5603.28	5603.20	5603.63	0.019798	4.78	34.75	39.57	0.90
Willow Creek DS	Willow Creek DS	547.132*	10 yr	238.00	5601.95	5603.56	5603.46	5603.96	0.018140	5.09	46.76	45.34	0.88
Willow Creek DS	Willow Creek DS	547.132*	25 yr	333.00	5601.95	5603.72	5603.72	5604.31	0.022941	6.17	54.05	48.88	1.01
Willow Creek DS	Willow Creek DS	547.132*	50 yr	411.00	5601.95	5603.92	5603.92	5604.57	0.020169	6.45	65.67	63.02	0.98
Willow Creek DS	Willow Creek DS	547.132*	100 yr	497.00	5601.95	5604.09	5604.11	5604.82	0.019554	6.87	77.34	72.70	0.98
Willow Creek DS	Willow Creek DS	547.132*	500 yr	728.00	5601.95	5604.51	5604.60	5605.40	0.017812	7.70	115.97	130.85	0.97
Willow Creek DS	Willow Creek DS	497.845*	2 yr	86.00	5600.96	5601.95		5602.17	0.017005	3.74	23.27	36.98	0.80
Willow Creek DS	Willow Creek DS	497.845*	5 yr	166.00	5600.96	5602.24	5602.21	5602.61	0.021824	4.88	35.45	46.49	0.94
Willow Creek DS	Willow Creek DS	497.845*	10 yr	238.00	5600.96	5602.43	5602.42	5602.92	0.024073	5.69	44.62	58.26	1.01
Willow Creek DS	Willow Creek DS	497.845*	25 yr	333.00	5600.96	5602.72	5602.72	5603.25	0.018661	5.95	65.81	74.08	0.93
Willow Creek DS	Willow Creek DS	497.845*	50 yr	411.00	5600.96	5602.80	5602.89	5603.50	0.023020	6.87	71.53	75.11	1.04
Willow Creek DS	Willow Creek DS	497.845*	100 yr	497.00	5600.96	5602.94	5603.16	5603.75	0.023854	7.45	81.94	83.21	1.08
Willow Creek DS	Willow Creek DS	497.845*	500 yr	728.00	5600.96	5603.22	5603.63	5604.33	0.026445	8.83	117.81	142.58	1.17
Willow Creek DS	Willow Creek DS	448.557*	2 yr	86.00	5599.98	5600.80	5600.68	5601.08	0.029639	4.37	24.30	53.70	1.02
Willow Creek DS	Willow Creek DS	448.557*	5 yr	166.00	5599.98	5601.13	5601.13	5601.47	0.024382	4.97	43.73	67.84	0.98
Willow Creek DS	Willow Creek DS	448.557*	10 yr	238.00	5599.98	5601.33	5601.33	5601.74	0.023056	5.55	57.91	73.17	0.99
Willow Creek DS	Willow Creek DS	448.557*	25 yr	333.00	5599.98	5601.43	5601.43	5602.07	0.031735	6.96	65.35	74.09	1.18
Willow Creek DS	Willow Creek DS	448.557*	50 yr	411.00	5599.98	5601.65	5601.78	5602.30	0.025032	7.01	89.85	126.49	1.08
Willow Creek DS	Willow Creek DS	448.557*	100 yr	497.00	5599.98	5601.77	5601.94	5602.50	0.026062	7.57	104.82	133.47	1.12
Willow Creek DS	Willow Creek DS	448.557*	500 yr	728.00	5599.98	5602.04	5602.12	5602.96	0.027382	8.72	144.18	160.13	1.18
Willow Creek DS	Willow Creek DS	399.27	2 yr	86.00	5599.00	5599.65		5599.77	0.022907	3.35	35.89	59.69	0.87
Willow Creek DS	Willow Creek DS	399.27	5 yr	166.00	5599.00	5599.96	5599.69	5600.16	0.021319	4.30	56.41	70.94	0.90
Willow Creek DS	Willow Creek DS	399.27	10 yr	238.00	5599.00	5600.18	5599.92	5600.45	0.020164	5.00	83.55	135.09	0.91
Willow Creek DS	Willow Creek DS	399.27	25 yr	333.00	5599.00	5600.41	5600.29	5600.70	0.017126	5.33	115.18	147.31	0.87

Willow Creek DS	Willow Creek DS	399.27	50 yr	411.00	5599.00	5600.49	5600.42	5600.85	0.020253	6.05	126.97	153.26	0.96
Willow Creek DS	Willow Creek DS	399.27	100 yr	497.00	5599.00	5600.60	5600.54	5601.02	0.020953	6.53	145.60	169.95	0.99
Willow Creek DS	Willow Creek DS	399.27	500 yr	728.00	5599.00	5600.71	5600.85	5601.43	0.033934	8.72	163.16	177.97	1.28
Willow Creek DS	Willow Creek DS	350.817*	2 yr	86.00	5597.75	5598.55	5598.50	5598.74	0.022535	3.78	29.43	57.64	0.89
Willow Creek DS	Willow Creek DS	350.817*	5 yr	166.00	5597.75	5598.80	5598.77	5599.12	0.024716	4.90	44.79	64.38	0.98
Willow Creek DS	Willow Creek DS	350.817*	10 yr	238.00	5597.75	5598.99	5598.99	5599.40	0.025607	5.62	57.62	72.95	1.03
Willow Creek DS	Willow Creek DS	350.817*	25 yr	333.00	5597.75	5599.19	5599.19	5599.73	0.025879	6.43	73.30	86.06	1.07
Willow Creek DS	Willow Creek DS	350.817*	50 yr	411.00	5597.75	5599.43	5599.43	5599.94	0.019361	6.34	99.78	130.24	0.96
Willow Creek DS	Willow Creek DS	350.817*	100 yr	497.00	5597.75	5599.62	5599.62	5600.15	0.017448	6.55	125.41	144.99	0.93
Willow Creek DS	Willow Creek DS	350.817*	500 yr	728.00	5597.75	5600.02	5600.02	5600.57	0.014458	6.95	205.30	257.36	0.88
Willow Creek DS	Willow Creek DS	302.365*	2 yr	86.00	5596.49	5597.28	5597.28	5597.55	0.026955	4.18	21.06	40.30	0.98
Willow Creek DS	Willow Creek DS	302.365*	5 yr	166.00	5596.49	5597.61	5597.61	5597.98	0.023203	4.92	37.03	59.82	0.96
Willow Creek DS	Willow Creek DS	302.365*	10 yr	238.00	5596.49	5597.81	5597.83	5598.26	0.022340	5.48	50.05	68.22	0.97
Willow Creek DS	Willow Creek DS	302.365*	25 yr	333.00	5596.49	5598.01	5598.03	5598.58	0.023667	6.23	64.90	81.42	1.03
Willow Creek DS	Willow Creek DS	302.365*	50 yr	411.00	5596.49	5598.10	5598.25	5598.84	0.028127	7.12	72.05	92.94	1.13
Willow Creek DS	Willow Creek DS	302.365*	100 yr	497.00	5596.49	5598.22	5598.44	5599.08	0.029045	7.72	84.19	100.03	1.17
Willow Creek DS	Willow Creek DS	302.365*	500 yr	728.00	5596.49	5598.53	5598.88	5599.60	0.028537	8.79	120.89	149.73	1.20
Willow Creek DS	Willow Creek DS	253.912*	2 yr	86.00	5595.23	5596.00	5595.98	5596.26	0.026367	4.11	20.94	37.16	0.96
Willow Creek DS	Willow Creek DS	253.912*	5 yr	166.00	5595.23	5596.26	5596.30	5596.69	0.030948	5.29	31.37	42.92	1.09
Willow Creek DS	Willow Creek DS	253.912*	10 yr	238.00	5595.23	5596.45	5596.52	5597.00	0.030688	6.00	40.01	50.12	1.12
Willow Creek DS	Willow Creek DS	253.912*	25 yr	333.00	5595.23	5596.68	5596.80	5597.34	0.027960	6.53	53.51	61.86	1.11
Willow Creek DS	Willow Creek DS	253.912*	50 yr	411.00	5595.23	5596.89	5596.99	5597.57	0.023916	6.66	68.80	80.32	1.05
Willow Creek DS	Willow Creek DS	253.912*	100 yr	497.00	5595.23	5597.06	5597.17	5597.80	0.023275	7.02	82.78	89.50	1.05
Willow Creek DS	Willow Creek DS	253.912*	500 yr	728.00	5595.23	5597.37	5597.64	5598.33	0.023861	8.12	121.01	157.36	1.10
Willow Creek DS	Willow Creek DS	205.46	2 yr	86.00	5593.98	5594.70	5594.69	5594.96	0.027036	4.10	20.99	38.09	0.97
Willow Creek DS	Willow Creek DS	205.46	5 yr	166.00	5593.98	5594.95	5595.02	5595.39	0.032535	5.32	31.21	43.98	1.11
Willow Creek DS	Willow Creek DS	205.46	10 yr	238.00	5593.98	5595.22	5595.23	5595.67	0.023993	5.39	46.02	58.87	1.00
Willow Creek DS	Willow Creek DS	205.46	25 yr	333.00	5593.98	5595.39	5595.46	5596.00	0.026989	6.29	56.30	61.87	1.08
Willow Creek DS	Willow Creek DS	205.46	50 yr	411.00	5593.98	5595.48	5595.62	5596.25	0.031214	7.09	62.25	63.55	1.18
Willow Creek DS	Willow Creek DS	205.46	100 yr	497.00	5593.98	5595.63	5595.82	5596.49	0.030978	7.55	71.65	66.43	1.19
Willow Creek DS	Willow Creek DS	205.46	500 yr	728.00	5593.98	5595.98	5596.26	5597.04	0.029199	8.41	102.14	118.12	1.20
Side Channel	Side Channel	1587.33	2 yr	7.00	5722.10	5722.60	5722.60	5722.76	0.036192	4.21	3.08	9.97	1.09
Side Channel	Side Channel	1587.33	5 yr	14.00	5722.10	5722.80	5722.80	5723.03	0.035226	5.29	5.38	13.25	1.14
Side Channel	Side Channel	1587.33	10 yr	20.00	5722.10	5722.95	5722.95	5723.21	0.031584	5.74	7.61	16.54	1.12
Side Channel	Side Channel	1587.33	25 yr	28.00	5722.10	5723.10	5723.10	5723.37	0.028664	6.13	10.36	19.15	1.10
Side Channel	Side Channel	1587.33	50 yr	35.00	5722.10	5723.21	5723.21	5723.50	0.027938	6.48	12.44	20.63	1.10
Side Channel	Side Channel	1587.33	100 yr	43.00	5722.10	5723.31	5723.31	5723.62	0.027759	6.86	14.57	21.86	1.12
Side Channel	Side Channel	1587.33	500 yr	64.00	5722.10	5723.51	5723.51	5723.90	0.030160	7.94	19.21	24.71	1.20
Side Channel	Side Channel	1538.86*	2 yr	7.00	5719.35	5719.77	5719.88	5720.11	0.090030	5.95	2.13	8.32	1.68
Side Channel	Side Channel	1538.86*	5 yr	14.00	5719.35	5719.93	5720.09	5720.42	0.089318	7.47	3.64	10.42	1.77
Side Channel	Side Channel	1538.86*	10 yr	20.00	5719.35	5720.02	5720.22	5720.66	0.099355	8.72	4.66	11.95	1.91
Side Channel	Side Channel	1538.86*	25 yr	28.00	5719.35	5720.12	5720.39	5720.91	0.106122	9.92	5.92	13.30	2.03
Side Channel	Side Channel	1538.86*	50 yr	35.00	5719.35	5720.20	5720.49	5721.08	0.105518	10.63	7.12	14.71	2.06
Side Channel	Side Channel	1538.86*	100 yr	43.00	5719.35	5720.30	5720.61	5721.23	0.101786	11.21	8.56	16.37	2.06
Side Channel	Side Channel	1538.86*	500 yr	64.00	5719.35	5720.51	5720.84	5721.50	0.089807	12.09	12.41	19.82	2.00
Side Channel	Side Channel	1490.40*	2 yr	7.00	5716.59	5717.11	5717.14	5717.32	0.038801	4.51	2.72	8.92	1.14
Side Channel	Side Channel	1490.40*	5 yr	14.00	5716.59	5717.30	5717.36	5717.61	0.039229	5.69	4.75	11.78	1.21
Side Channel	Side Channel	1490.40*	10 yr	20.00	5716.59	5717.44	5717.51	5717.79	0.037413	6.28	6.50	14.00	1.22
Side Channel	Side Channel	1490.40*	25 yr	28.00	5716.59	5717.59	5717.67	5717.99	0.036373	6.91	8.77	16.92	1.24
Side Channel	Side Channel	1490.40*	50 yr	35.00	5716.59	5717.69	5717.80	5718.13	0.036742	7.42	10.61	19.18	1.27
Side Channel	Side Channel	1490.40*	100 yr	43.00	5716.59	5717.78	5717.92	5718.27	0.037775	7.96	12.46	20.88	1.30
Side Channel	Side Channel	1490.40*	500 yr	64.00	5716.59	5717.97	5718.11	5718.56	0.040882	9.14	16.60	23.50	1.39
Side Channel	Side Channel	1441.94*	2 yr	7.00	5713.83	5714.26	5714.38	5714.66	0.082421	5.48	1.77	7.15	1.59
Side Channel	Side Channel	1441.94*	5 yr	14.00	5713.83	5714.43	5714.63	5715.00	0.076686	6.81	3.18	9.36	1.63
Side Channel	Side Channel	1441.94*	10 yr	20.00	5713.83	5714.55	5714.79	5715.25	0.076174	7.73	4.40	12.42	1.68
Side Channel	Side Channel	1441.94*	25 yr	28.00	5713.83	5714.66	5714.93	5715.48	0.076044	8.60	5.99	15.47	1.72
Side Channel	Side Channel	1441.94*	50 yr	35.00	5713.83	5714.75	5715.02	5715.62	0.074356	9.12	7.42	17.57	1.73
Side Channel	Side Channel	1441.94*	100 yr	43.00	5713.83	5714.83	5715.12	5715.75	0.072232	9.58	8.99	19.04	1.74
Side Channel	Side Channel	1441.94*	500 yr	64.00	5713.83	5715.02	5715.34	5716.01	0.067106	10.44	12.88	21.58	1.73
Side Channel	Side Channel	1393.48	2 yr	7.00	5711.08	5711.58	5711.70	5711.83	0.042217	4.31	2.16	7.43	1.16
Side Channel	Side Channel	1393.48	5 yr	14.00	5711.08	5711.76	5711.88	5712.15	0.044996	5.60	4.29	16.54	1.27
Side Channel	Side Channel	1393.48	10 yr	20.00	5711.08	5711.84	5711.97	5712.30	0.047382	6.30	5.84	17.93	1.33

Side Channel	Side Channel	1393.48	25 yr	28.00	5711.08	5711.94	5712.10	5712.46	0.049020	7.01	7.68	19.21	1.39
Side Channel	Side Channel	1393.48	50 yr	35.00	5711.08	5712.02	5712.19	5712.59	0.050470	7.55	9.14	20.36	1.43
Side Channel	Side Channel	1393.48	100 yr	43.00	5711.08	5712.09	5712.27	5712.72	0.051802	8.07	10.63	20.86	1.47
Side Channel	Side Channel	1393.48	500 yr	64.00	5711.08	5712.25	5712.47	5713.00	0.054761	9.21	14.06	21.96	1.55
Side Channel	Side Channel	1345.26*	2 yr	7.00	5708.78	5709.18	5709.23	5709.39	0.061247	4.73	2.75	12.00	1.37
Side Channel	Side Channel	1345.26*	5 yr	14.00	5708.78	5709.32	5709.43	5709.62	0.060332	5.87	4.73	16.77	1.44
Side Channel	Side Channel	1345.26*	10 yr	20.00	5708.78	5709.43	5709.53	5709.77	0.056647	6.48	6.86	20.72	1.44
Side Channel	Side Channel	1345.26*	25 yr	28.00	5708.78	5709.53	5709.63	5709.90	0.055701	7.06	8.92	22.22	1.46
Side Channel	Side Channel	1345.26*	50 yr	35.00	5708.78	5709.60	5709.71	5710.00	0.055173	7.48	10.53	23.01	1.48
Side Channel	Side Channel	1345.26*	100 yr	43.00	5708.78	5709.68	5709.78	5710.10	0.054189	7.87	12.32	23.92	1.49
Side Channel	Side Channel	1345.26*	500 yr	64.00	5708.78	5709.85	5709.96	5710.34	0.052628	8.75	16.60	25.93	1.51
Side Channel	Side Channel	1297.05*	2 yr	7.00	5706.49	5706.84	5706.85	5706.96	0.041523	3.57	3.67	17.57	1.11
Side Channel	Side Channel	1297.05*	5 yr	14.00	5706.49	5706.96	5706.98	5707.14	0.043289	4.52	5.99	20.85	1.19
Side Channel	Side Channel	1297.05*	10 yr	20.00	5706.49	5707.03	5707.00	5707.28	0.052155	5.47	7.60	24.62	1.34
Side Channel	Side Channel	1297.05*	25 yr	28.00	5706.49	5707.13	5707.18	5707.39	0.047637	5.85	10.02	26.06	1.32
Side Channel	Side Channel	1297.05*	50 yr	35.00	5706.49	5707.19	5707.25	5707.48	0.048219	6.28	11.68	26.89	1.35
Side Channel	Side Channel	1297.05*	100 yr	43.00	5706.49	5707.25	5707.31	5707.58	0.049337	6.75	13.42	27.80	1.38
Side Channel	Side Channel	1297.05*	500 yr	64.00	5706.49	5707.40	5707.48	5707.81	0.051389	7.74	17.50	29.56	1.45
Side Channel	Side Channel	1248.84*	2 yr	7.00	5704.19	5704.47	5704.50	5704.59	0.059359	3.65	3.76	22.60	1.27
Side Channel	Side Channel	1248.84*	5 yr	14.00	5704.19	5704.58	5704.59	5704.73	0.057893	4.51	6.17	24.78	1.33
Side Channel	Side Channel	1248.84*	10 yr	20.00	5704.19	5704.66	5704.66	5704.83	0.048926	4.78	8.47	29.25	1.26
Side Channel	Side Channel	1248.84*	25 yr	28.00	5704.19	5704.73	5704.77	5704.95	0.053345	5.52	10.66	30.97	1.35
Side Channel	Side Channel	1248.84*	50 yr	35.00	5704.19	5704.79	5704.82	5705.03	0.052929	5.89	12.43	31.59	1.37
Side Channel	Side Channel	1248.84*	100 yr	43.00	5704.19	5704.85	5704.89	5705.11	0.052078	6.25	14.36	32.26	1.38
Side Channel	Side Channel	1248.84*	500 yr	64.00	5704.19	5704.99	5705.02	5705.31	0.051180	7.06	18.92	33.96	1.42
Side Channel	Side Channel	1200.63	2 yr	7.00	5701.89	5702.13	5702.14	5702.21	0.041469	2.54	4.02	28.05	1.01
Side Channel	Side Channel	1200.63	5 yr	14.00	5701.89	5702.22	5702.23	5702.34	0.042768	3.27	6.45	30.01	1.09
Side Channel	Side Channel	1200.63	10 yr	20.00	5701.89	5702.26	5702.29	5702.43	0.050442	3.92	7.79	31.61	1.22
Side Channel	Side Channel	1200.63	25 yr	28.00	5701.89	5702.33	5702.33	5702.54	0.047100	4.32	10.16	35.29	1.22
Side Channel	Side Channel	1200.63	50 yr	35.00	5701.89	5702.38	5702.43	5702.62	0.047274	4.70	12.04	36.65	1.24
Side Channel	Side Channel	1200.63	100 yr	43.00	5701.89	5702.43	5702.48	5702.70	0.048171	5.08	13.77	37.18	1.28
Side Channel	Side Channel	1200.63	500 yr	64.00	5701.89	5702.54	5702.61	5702.89	0.049147	5.86	17.90	38.42	1.33
Side Channel	Side Channel	1156.61*	2 yr	7.00	5699.86	5700.11	5700.13	5700.21	0.049545	2.92	3.76	25.89	1.12
Side Channel	Side Channel	1156.61*	5 yr	14.00	5699.86	5700.21	5700.23	5700.35	0.047694	3.64	6.21	27.77	1.17
Side Channel	Side Channel	1156.61*	10 yr	20.00	5699.86	5700.28	5700.29	5700.44	0.040966	3.92	8.38	29.33	1.13
Side Channel	Side Channel	1156.61*	25 yr	28.00	5699.86	5700.35	5700.37	5700.55	0.043180	4.49	10.39	30.64	1.19
Side Channel	Side Channel	1156.61*	50 yr	35.00	5699.86	5700.40	5700.43	5700.64	0.043041	4.85	12.12	31.51	1.21
Side Channel	Side Channel	1156.61*	100 yr	43.00	5699.86	5700.47	5700.49	5700.72	0.042029	5.18	14.07	32.47	1.22
Side Channel	Side Channel	1156.61*	500 yr	64.00	5699.86	5700.60	5700.63	5700.93	0.040583	5.89	18.72	34.57	1.24
Side Channel	Side Channel	1112.59*	2 yr	7.00	5697.83	5698.12	5698.13	5698.21	0.041922	3.02	4.03	24.21	1.06
Side Channel	Side Channel	1112.59*	5 yr	14.00	5697.83	5698.22	5698.23	5698.36	0.042762	3.81	6.52	26.01	1.14
Side Channel	Side Channel	1112.59*	10 yr	20.00	5697.83	5698.27	5698.30	5698.46	0.049446	4.51	7.94	26.98	1.25
Side Channel	Side Channel	1112.59*	25 yr	28.00	5697.83	5698.35	5698.38	5698.57	0.046762	4.95	10.20	28.14	1.25
Side Channel	Side Channel	1112.59*	50 yr	35.00	5697.83	5698.41	5698.44	5698.66	0.047139	5.36	11.82	28.76	1.28
Side Channel	Side Channel	1112.59*	100 yr	43.00	5697.83	5698.47	5698.51	5698.75	0.047578	5.77	13.54	29.40	1.31
Side Channel	Side Channel	1112.59*	500 yr	64.00	5697.83	5698.61	5698.66	5698.97	0.048486	6.66	17.60	30.85	1.37
Side Channel	Side Channel	1068.57*	2 yr	7.00	5695.81	5696.10	5696.12	5696.21	0.049156	3.25	3.56	21.96	1.15
Side Channel	Side Channel	1068.57*	5 yr	14.00	5695.81	5696.20	5696.23	5696.37	0.047677	4.04	5.90	23.58	1.20
Side Channel	Side Channel	1068.57*	10 yr	20.00	5695.81	5696.28	5696.31	5696.47	0.041918	4.36	7.93	24.91	1.17
Side Channel	Side Channel	1068.57*	25 yr	28.00	5695.81	5696.36	5696.39	5696.59	0.043205	4.94	9.86	25.60	1.22
Side Channel	Side Channel	1068.57*	50 yr	35.00	5695.81	5696.42	5696.45	5696.68	0.043101	5.33	11.48	26.16	1.24
Side Channel	Side Channel	1068.57*	100 yr	43.00	5695.81	5696.49	5696.52	5696.78	0.042188	5.68	13.29	26.78	1.25
Side Channel	Side Channel	1068.57*	500 yr	64.00	5695.81	5696.65	5696.68	5697.01	0.041137	6.48	17.54	28.18	1.28
Side Channel	Side Channel	1024.55	2 yr	7.00	5693.78	5694.08	5694.09	5694.19	0.043181	2.83	3.24	19.85	1.06
Side Channel	Side Channel	1024.55	5 yr	14.00	5693.78	5694.18	5694.20	5694.35	0.044140	3.65	5.25	21.19	1.14
Side Channel	Side Channel	1024.55	10 yr	20.00	5693.78	5694.23	5694.28	5694.47	0.048963	4.30	6.49	21.98	1.23
Side Channel	Side Channel	1024.55	25 yr	28.00	5693.78	5694.31	5694.37	5694.59	0.047345	4.80	8.28	22.75	1.25
Side Channel	Side Channel	1024.55	50 yr	35.00	5693.78	5694.38	5694.44	5694.70	0.046607	5.17	9.68	23.17	1.27
Side Channel	Side Channel	1024.55	100 yr	43.00	5693.78	5694.43	5694.51	5694.81	0.047436	5.61	11.06	23.65	1.30
Side Channel	Side Channel	1024.55	500 yr	64.00	5693.78	5694.58	5694.68	5695.06	0.047270	6.48	14.51	24.82	1.35
Side Channel	Side Channel	978.235*	2 yr	7.00	5690.93	5691.27	5691.34	5691.50	0.080755	3.96	2.10	13.19	1.45
Side Channel	Side Channel	978.235*	5 yr	14.00	5690.93	5691.39	5691.48	5691.72	0.074188	4.93	3.74	15.78	1.49

Side Channel	Side Channel	978.235*	10 yr	20.00	5690.93	5691.47	5691.57	5691.85	0.064987	5.36	5.12	16.67	1.45
Side Channel	Side Channel	978.235*	25 yr	28.00	5690.93	5691.55	5691.69	5692.02	0.065029	6.03	6.54	17.52	1.49
Side Channel	Side Channel	978.235*	50 yr	35.00	5690.93	5691.62	5691.76	5692.15	0.064495	6.51	7.71	18.19	1.51
Side Channel	Side Channel	978.235*	100 yr	43.00	5690.93	5691.69	5691.86	5692.27	0.062161	6.92	9.04	18.65	1.52
Side Channel	Side Channel	978.235*	500 yr	64.00	5690.93	5691.85	5692.06	5692.58	0.059969	7.88	12.12	19.67	1.54
Side Channel	Side Channel	931.92	2 yr	7.00	5688.09	5688.59	5688.61	5688.77	0.044608	3.65	2.49	11.14	1.14
Side Channel	Side Channel	931.92	5 yr	14.00	5688.09	5688.72	5688.79	5689.01	0.046732	4.73	4.14	12.52	1.24
Side Channel	Side Channel	931.92	10 yr	20.00	5688.09	5688.80	5688.90	5689.19	0.051048	5.52	5.18	13.00	1.33
Side Channel	Side Channel	931.92	25 yr	28.00	5688.09	5688.91	5689.03	5689.38	0.050078	6.18	6.62	13.62	1.36
Side Channel	Side Channel	931.92	50 yr	35.00	5688.09	5689.00	5689.13	5689.53	0.049631	6.67	7.78	14.11	1.38
Side Channel	Side Channel	931.92	100 yr	43.00	5688.09	5689.08	5689.24	5689.69	0.050069	7.20	8.97	14.54	1.41
Side Channel	Side Channel	931.92	500 yr	64.00	5688.09	5689.28	5689.48	5690.05	0.049497	8.28	11.93	15.56	1.45
Side Channel	Side Channel	894.9*	2 yr	7.00	5685.23	5685.58	5685.71	5686.00	0.145284	5.40	1.57	9.21	1.96
Side Channel	Side Channel	894.9*	5 yr	14.00	5685.23	5685.70	5685.87	5686.29	0.127051	6.64	2.85	11.70	1.96
Side Channel	Side Channel	894.9*	10 yr	20.00	5685.23	5685.79	5685.99	5686.46	0.111977	7.21	3.89	12.41	1.91
Side Channel	Side Channel	894.9*	25 yr	28.00	5685.23	5685.87	5686.12	5686.69	0.111149	8.09	5.00	13.11	1.96
Side Channel	Side Channel	894.9*	50 yr	35.00	5685.23	5685.94	5686.22	5686.86	0.109478	8.70	5.91	13.67	1.98
Side Channel	Side Channel	894.9*	100 yr	43.00	5685.23	5686.02	5686.32	5687.04	0.106088	9.26	6.95	14.26	1.99
Side Channel	Side Channel	894.9*	500 yr	64.00	5685.23	5686.18	5686.57	5687.45	0.102084	10.53	9.42	15.46	2.02
Side Channel	Side Channel	857.88*	2 yr	7.00	5682.37	5682.75	5682.79	5682.94	0.051192	3.72	2.40	11.22	1.21
Side Channel	Side Channel	857.88*	5 yr	14.00	5682.37	5682.87	5682.96	5683.19	0.056916	4.93	3.85	12.65	1.35
Side Channel	Side Channel	857.88*	10 yr	20.00	5682.37	5682.95	5683.07	5683.37	0.061658	5.75	4.86	13.56	1.44
Side Channel	Side Channel	857.88*	25 yr	28.00	5682.37	5683.04	5683.20	5683.57	0.062776	6.52	6.19	14.56	1.50
Side Channel	Side Channel	857.88*	50 yr	35.00	5682.37	5683.11	5683.30	5683.73	0.063980	7.10	7.26	15.22	1.54
Side Channel	Side Channel	857.88*	100 yr	43.00	5682.37	5683.19	5683.40	5683.90	0.065724	7.71	8.37	15.94	1.59
Side Channel	Side Channel	857.88*	500 yr	64.00	5682.37	5683.35	5683.66	5684.28	0.068504	9.01	11.11	17.67	1.68
Side Channel	Side Channel	820.86	2 yr	7.00	5679.51	5679.77	5679.87	5680.07	0.130919	4.34	1.65	9.94	1.78
Side Channel	Side Channel	820.86	5 yr	14.00	5679.51	5679.88	5680.02	5680.32	0.109720	5.39	2.81	11.94	1.76
Side Channel	Side Channel	820.86	10 yr	20.00	5679.51	5679.96	5680.12	5680.49	0.099649	5.99	3.77	13.36	1.75
Side Channel	Side Channel	820.86	25 yr	28.00	5679.51	5680.04	5680.23	5680.70	0.097243	6.74	4.88	14.63	1.78
Side Channel	Side Channel	820.86	50 yr	35.00	5679.51	5680.10	5680.34	5680.86	0.094806	7.26	5.81	15.39	1.80
Side Channel	Side Channel	820.86	100 yr	43.00	5679.51	5680.16	5680.44	5681.02	0.092398	7.77	6.84	16.24	1.81
Side Channel	Side Channel	820.86	500 yr	64.00	5679.51	5680.31	5680.67	5681.39	0.088923	8.88	9.36	18.25	1.85
Side Channel	Side Channel	779.64*	2 yr	7.00	5676.94	5677.30	5677.30	5677.42	0.036897	2.81	2.66	12.38	1.00
Side Channel	Side Channel	779.64*	5 yr	14.00	5676.94	5677.41	5677.45	5677.62	0.041715	3.81	4.11	14.29	1.13
Side Channel	Side Channel	779.64*	10 yr	20.00	5676.94	5677.48	5677.54	5677.77	0.044781	4.47	5.18	15.57	1.20
Side Channel	Side Channel	779.64*	25 yr	28.00	5676.94	5677.56	5677.66	5677.94	0.046344	5.12	6.56	16.98	1.26
Side Channel	Side Channel	779.64*	50 yr	35.00	5676.94	5677.63	5677.75	5678.07	0.047680	5.61	7.66	17.96	1.30
Side Channel	Side Channel	779.64*	100 yr	43.00	5676.94	5677.69	5677.84	5678.21	0.049003	6.10	8.85	19.10	1.34
Side Channel	Side Channel	779.64*	500 yr	64.00	5676.94	5677.84	5678.08	5678.54	0.051422	7.18	11.92	24.02	1.43
Side Channel	Side Channel	738.42*	2 yr	7.00	5674.38	5674.66	5674.75	5674.96	0.109925	4.55	1.82	10.96	1.69
Side Channel	Side Channel	738.42*	5 yr	14.00	5674.38	5674.78	5674.91	5675.19	0.087968	5.46	3.38	13.90	1.63
Side Channel	Side Channel	738.42*	10 yr	20.00	5674.38	5674.87	5675.02	5675.34	0.079215	5.99	4.62	15.41	1.60
Side Channel	Side Channel	738.42*	25 yr	28.00	5674.38	5674.96	5675.14	5675.52	0.075411	6.64	6.10	17.03	1.61
Side Channel	Side Channel	738.42*	50 yr	35.00	5674.38	5675.03	5675.19	5675.65	0.072626	7.10	7.38	18.52	1.62
Side Channel	Side Channel	738.42*	100 yr	43.00	5674.38	5675.11	5675.31	5675.79	0.070404	7.55	8.80	20.08	1.62
Side Channel	Side Channel	738.42*	500 yr	64.00	5674.38	5675.28	5675.61	5676.12	0.066420	8.54	12.77	26.92	1.64
Side Channel	Side Channel	697.2*	2 yr	7.00	5671.81	5672.15	5672.17	5672.30	0.041422	3.08	2.54	12.31	1.06
Side Channel	Side Channel	697.2*	5 yr	14.00	5671.81	5672.26	5672.32	5672.52	0.048121	4.19	4.02	14.89	1.22
Side Channel	Side Channel	697.2*	10 yr	20.00	5671.81	5672.33	5672.43	5672.67	0.052383	4.91	5.11	16.37	1.31
Side Channel	Side Channel	697.2*	25 yr	28.00	5671.81	5672.41	5672.54	5672.85	0.054668	5.62	6.52	18.01	1.37
Side Channel	Side Channel	697.2*	50 yr	35.00	5671.81	5672.48	5672.68	5672.99	0.056776	6.17	7.67	19.59	1.42
Side Channel	Side Channel	697.2*	100 yr	43.00	5671.81	5672.54	5672.83	5673.13	0.058180	6.69	8.94	20.90	1.47
Side Channel	Side Channel	697.2*	500 yr	64.00	5671.81	5672.69	5672.97	5673.48	0.061105	7.86	12.57	28.97	1.56
Side Channel	Side Channel	655.98	2 yr	7.00	5669.25	5669.53	5669.61	5669.78	0.097098	4.15	1.95	11.08	1.58
Side Channel	Side Channel	655.98	5 yr	14.00	5669.25	5669.66	5669.77	5670.01	0.078155	5.04	3.49	13.91	1.53
Side Channel	Side Channel	655.98	10 yr	20.00	5669.25	5669.74	5669.87	5670.16	0.071124	5.58	4.75	15.84	1.51
Side Channel	Side Channel	655.98	25 yr	28.00	5669.25	5669.83	5669.98	5670.34	0.067956	6.21	6.28	17.92	1.53
Side Channel	Side Channel	655.98	50 yr	35.00	5669.25	5669.90	5670.18	5670.47	0.066087	6.66	7.58	19.55	1.54
Side Channel	Side Channel	655.98	100 yr	43.00	5669.25	5669.97	5670.25	5670.61	0.064713	7.12	9.05	21.56	1.55
Side Channel	Side Channel	655.98	500 yr	64.00	5669.25	5670.14	5670.37	5670.93	0.062298	8.14	15.35	51.94	1.58
Side Channel	Side Channel	616.922*	2 yr	7.00	5667.40	5667.73	5667.73	5667.85	0.033462	2.73	2.80	14.19	0.95

Side Channel	Side Channel	616.922*	5 yr	14.00	5667.40	5667.85	5667.88	5668.04	0.033876	3.55	4.74	18.21	1.02
Side Channel	Side Channel	616.922*	10 yr	20.00	5667.40	5667.92	5667.96	5668.17	0.036669	4.14	6.08	19.88	1.09
Side Channel	Side Channel	616.922*	25 yr	28.00	5667.40	5668.00	5668.05	5668.32	0.038587	4.76	7.77	22.02	1.15
Side Channel	Side Channel	616.922*	50 yr	35.00	5667.40	5668.07	5668.15	5668.44	0.040226	5.22	9.17	24.21	1.20
Side Channel	Side Channel	616.922*	100 yr	43.00	5667.40	5668.13	5668.23	5668.56	0.041108	5.67	10.89	28.02	1.24
Side Channel	Side Channel	616.922*	500 yr	64.00	5667.40	5668.27	5668.47	5668.83	0.044155	6.66	15.54	46.39	1.32
Side Channel	Side Channel	577.865*	2 yr	7.00	5665.54	5665.82	5665.86	5665.99	0.071070	3.39	2.23	14.56	1.33
Side Channel	Side Channel	577.865*	5 yr	14.00	5665.54	5665.91	5666.01	5666.19	0.069754	4.37	3.89	19.53	1.41
Side Channel	Side Channel	577.865*	10 yr	20.00	5665.54	5665.98	5666.09	5666.31	0.063471	4.81	5.33	20.89	1.40
Side Channel	Side Channel	577.865*	25 yr	28.00	5665.54	5666.06	5666.18	5666.45	0.060215	5.34	7.06	23.15	1.40
Side Channel	Side Channel	577.865*	50 yr	35.00	5665.54	5666.13	5666.26	5666.56	0.057821	5.71	8.59	26.60	1.41
Side Channel	Side Channel	577.865*	100 yr	43.00	5665.54	5666.19	5666.34	5666.67	0.056912	6.10	10.36	31.80	1.42
Side Channel	Side Channel	577.865*	500 yr	64.00	5665.54	5666.32	5666.48	5666.90	0.055943	6.93	14.95	39.36	1.46
Side Channel	Side Channel	538.807*	2 yr	7.00	5663.69	5663.99	5663.99	5664.08	0.035143	2.39	3.29	21.17	0.94
Side Channel	Side Channel	538.807*	5 yr	14.00	5663.69	5664.08	5664.09	5664.22	0.036979	3.15	5.32	25.18	1.03
Side Channel	Side Channel	538.807*	10 yr	20.00	5663.69	5664.14	5664.17	5664.33	0.040031	3.68	6.93	30.15	1.10
Side Channel	Side Channel	538.807*	25 yr	28.00	5663.69	5664.20	5664.25	5664.44	0.042371	4.23	8.89	32.89	1.16
Side Channel	Side Channel	538.807*	50 yr	35.00	5663.69	5664.24	5664.32	5664.53	0.044878	4.66	10.40	34.85	1.22
Side Channel	Side Channel	538.807*	100 yr	43.00	5663.69	5664.29	5664.38	5664.63	0.046078	5.05	12.14	36.93	1.25
Side Channel	Side Channel	538.807*	500 yr	64.00	5663.69	5664.40	5664.52	5664.83	0.047870	5.86	16.44	41.74	1.32
Side Channel	Side Channel	499.75	2 yr	7.00	5661.83	5662.08	5662.11	5662.20	0.068847	2.97	2.92	22.46	1.28
Side Channel	Side Channel	499.75	5 yr	14.00	5661.83	5662.16	5662.21	5662.35	0.064425	3.76	4.86	24.92	1.32
Side Channel	Side Channel	499.75	10 yr	20.00	5661.83	5662.22	5662.27	5662.45	0.058123	4.14	6.47	26.41	1.30
Side Channel	Side Channel	499.75	25 yr	28.00	5661.83	5662.29	5662.36	5662.56	0.054952	4.60	8.38	28.18	1.31
Side Channel	Side Channel	499.75	50 yr	35.00	5661.83	5662.35	5662.42	5662.65	0.051814	4.90	10.03	29.57	1.30
Side Channel	Side Channel	499.75	100 yr	43.00	5661.83	5662.41	5662.49	5662.74	0.050337	5.24	11.74	30.96	1.31
Side Channel	Side Channel	499.75	500 yr	64.00	5661.83	5662.53	5662.65	5662.96	0.048376	5.97	15.88	34.07	1.33
Side Channel	Side Channel	461.497*	2 yr	7.00	5659.87	5660.15	5660.17	5660.27	0.038777	2.80	3.13	19.10	1.01
Side Channel	Side Channel	461.497*	5 yr	14.00	5659.87	5660.26	5660.29	5660.43	0.040460	3.63	5.17	20.92	1.10
Side Channel	Side Channel	461.497*	10 yr	20.00	5659.87	5660.32	5660.36	5660.55	0.043451	4.21	6.52	21.66	1.17
Side Channel	Side Channel	461.497*	25 yr	28.00	5659.87	5660.40	5660.47	5660.69	0.044323	4.79	8.29	23.67	1.22
Side Channel	Side Channel	461.497*	50 yr	35.00	5659.87	5660.45	5660.54	5660.80	0.045798	5.25	9.66	24.97	1.26
Side Channel	Side Channel	461.497*	100 yr	43.00	5659.87	5660.52	5660.61	5660.91	0.046147	5.67	11.26	26.61	1.29
Side Channel	Side Channel	461.497*	500 yr	64.00	5659.87	5660.66	5660.77	5661.16	0.046245	6.53	15.25	30.11	1.34
Side Channel	Side Channel	423.245*	2 yr	7.00	5657.91	5658.15	5658.19	5658.31	0.070337	3.26	2.32	13.57	1.32
Side Channel	Side Channel	423.245*	5 yr	14.00	5657.91	5658.25	5658.32	5658.50	0.064616	4.12	3.83	15.85	1.35
Side Channel	Side Channel	423.245*	10 yr	20.00	5657.91	5658.33	5658.41	5658.63	0.057979	4.57	5.12	17.70	1.33
Side Channel	Side Channel	423.245*	25 yr	28.00	5657.91	5658.41	5658.51	5658.78	0.056157	5.13	6.59	18.97	1.35
Side Channel	Side Channel	423.245*	50 yr	35.00	5657.91	5658.47	5658.58	5658.90	0.054001	5.50	7.85	19.86	1.36
Side Channel	Side Channel	423.245*	100 yr	43.00	5657.91	5658.54	5658.68	5659.02	0.053037	5.91	9.15	20.75	1.37
Side Channel	Side Channel	423.245*	500 yr	64.00	5657.91	5658.69	5658.82	5659.31	0.050947	6.77	12.65	25.51	1.40
Side Channel	Side Channel	384.992*	2 yr	7.00	5655.94	5656.18	5656.21	5656.35	0.067030	3.36	2.21	11.96	1.30
Side Channel	Side Channel	384.992*	5 yr	14.00	5655.94	5656.33	5656.35	5656.54	0.041029	3.79	4.16	13.99	1.12
Side Channel	Side Channel	384.992*	10 yr	20.00	5655.94	5656.40	5656.47	5656.69	0.044596	4.45	5.19	14.99	1.20
Side Channel	Side Channel	384.992*	25 yr	28.00	5655.94	5656.48	5656.58	5656.86	0.045445	5.09	6.55	16.19	1.25
Side Channel	Side Channel	384.992*	50 yr	35.00	5655.94	5656.55	5656.64	5656.99	0.046290	5.57	7.65	17.02	1.29
Side Channel	Side Channel	384.992*	100 yr	43.00	5655.94	5656.62	5656.79	5657.13	0.045967	6.00	8.91	17.91	1.31
Side Channel	Side Channel	384.992*	500 yr	64.00	5655.94	5656.73	5656.79	5657.53	0.059019	7.55	11.11	22.17	1.52
Side Channel	Side Channel	346.74	2 yr	7.00	5653.98	5654.25	5654.26	5654.38	0.040480	2.99	2.53	11.13	1.05
Side Channel	Side Channel	346.74	5 yr	14.00	5653.98	5654.33	5654.40	5654.62	0.061702	4.46	3.48	11.87	1.36
Side Channel	Side Channel	346.74	10 yr	20.00	5653.98	5654.42	5654.52	5654.78	0.055656	4.96	4.58	12.72	1.34
Side Channel	Side Channel	346.74	25 yr	28.00	5653.98	5654.51	5654.65	5654.97	0.053618	5.58	5.86	13.68	1.36
Side Channel	Side Channel	346.74	50 yr	35.00	5653.98	5654.59	5654.74	5655.11	0.051882	6.01	6.94	14.45	1.37
Side Channel	Side Channel	346.74	100 yr	43.00	5653.98	5654.67	5654.83	5655.26	0.051466	6.48	8.06	15.17	1.39
Side Channel	Side Channel	346.74	500 yr	64.00	5653.98	5654.83	5654.83	5654.94	0.012646	3.71	29.29	39.55	0.71
Side Channel	Side Channel	308.747*	2 yr	7.00	5652.47	5652.74	5652.74	5652.85	0.036509	2.64	2.66	11.70	0.97
Side Channel	Side Channel	308.747*	5 yr	14.00	5652.47	5652.88	5652.88	5653.04	0.032932	3.24	4.32	13.01	0.99
Side Channel	Side Channel	308.747*	10 yr	20.00	5652.47	5652.96	5652.97	5653.17	0.032336	3.70	5.43	13.83	1.01
Side Channel	Side Channel	308.747*	25 yr	28.00	5652.47	5653.04	5653.07	5653.33	0.034336	4.31	6.62	14.68	1.08
Side Channel	Side Channel	308.747*	50 yr	35.00	5652.47	5653.11	5653.15	5653.46	0.035748	4.76	7.57	15.33	1.12
Side Channel	Side Channel	308.747*	100 yr	43.00	5652.47	5653.17	5653.26	5653.59	0.036879	5.21	8.61	15.99	1.16
Side Channel	Side Channel	308.747*	500 yr	64.00	5652.47	5653.21	5653.38	5654.03	0.067470	7.32	9.19	16.35	1.58

Side Channel	Side Channel	270.755*	2 yr	7.00	5650.96	5651.23	5651.23	5651.35	0.036051	2.78	2.68	12.08	0.98
Side Channel	Side Channel	270.755*	5 yr	14.00	5650.96	5651.33	5651.37	5651.56	0.046653	3.94	3.90	13.07	1.18
Side Channel	Side Channel	270.755*	10 yr	20.00	5650.96	5651.40	5651.48	5651.71	0.047224	4.54	4.94	13.90	1.23
Side Channel	Side Channel	270.755*	25 yr	28.00	5650.96	5651.51	5651.59	5651.88	0.043030	5.02	6.45	15.04	1.22
Side Channel	Side Channel	270.755*	50 yr	35.00	5650.96	5651.59	5651.67	5652.01	0.041257	5.39	7.66	15.88	1.22
Side Channel	Side Channel	270.755*	100 yr	43.00	5650.96	5651.67	5651.77	5652.14	0.039633	5.76	9.01	16.74	1.22
Side Channel	Side Channel	270.755*	500 yr	64.00	5650.96	5651.84	5651.93	5652.47	0.040410	6.72	11.96	18.59	1.28
Side Channel	Side Channel	232.762*	2 yr	7.00	5649.45	5649.70	5649.72	5649.83	0.044732	2.91	2.52	12.36	1.08
Side Channel	Side Channel	232.762*	5 yr	14.00	5649.45	5649.84	5649.86	5650.03	0.035005	3.53	4.33	13.89	1.03
Side Channel	Side Channel	232.762*	10 yr	20.00	5649.45	5649.92	5649.96	5650.17	0.035043	4.06	5.52	14.79	1.07
Side Channel	Side Channel	232.762*	25 yr	28.00	5649.45	5650.01	5650.08	5650.34	0.038538	4.75	6.75	15.68	1.15
Side Channel	Side Channel	232.762*	50 yr	35.00	5649.45	5650.07	5650.15	5650.47	0.040547	5.26	7.76	16.38	1.21
Side Channel	Side Channel	232.762*	100 yr	43.00	5649.45	5650.13	5650.26	5650.61	0.042590	5.77	8.83	17.08	1.26
Side Channel	Side Channel	232.762*	500 yr	64.00	5649.45	5650.30	5650.45	5650.93	0.042785	6.71	11.76	18.87	1.31
Side Channel	Side Channel	194.77	2 yr	7.00	5647.94	5648.11	5648.20	5648.44	0.206637	4.66	1.58	11.77	2.16
Side Channel	Side Channel	194.77	5 yr	14.00	5647.94	5648.31	5648.35	5648.53	0.046526	3.88	4.06	14.05	1.18
Side Channel	Side Channel	194.77	10 yr	20.00	5647.94	5648.38	5648.45	5648.67	0.045754	4.43	5.21	14.99	1.21
Side Channel	Side Channel	194.77	25 yr	28.00	5647.94	5648.48	5648.55	5648.83	0.042524	4.92	6.75	16.13	1.21
Side Channel	Side Channel	194.77	50 yr	35.00	5647.94	5648.56	5648.65	5648.96	0.040902	5.29	8.01	17.00	1.21
Side Channel	Side Channel	194.77	100 yr	43.00	5647.94	5648.64	5648.74	5649.09	0.039284	5.65	9.42	17.91	1.21
Side Channel	Side Channel	194.77	500 yr	64.00	5647.94	5648.80	5648.95	5649.40	0.039968	6.59	12.50	19.76	1.27
Side Channel	Side Channel	157.42*	2 yr	7.00	5646.62	5646.94	5646.94	5647.04	0.031716	2.63	2.79	12.54	0.93
Side Channel	Side Channel	157.42*	5 yr	14.00	5646.62	5647.02	5647.07	5647.25	0.047946	3.91	3.86	13.60	1.19
Side Channel	Side Channel	157.42*	10 yr	20.00	5646.62	5647.17	5647.17	5647.38	0.027292	3.77	6.02	15.51	0.96
Side Channel	Side Channel	157.42*	25 yr	28.00	5646.62	5647.26	5647.28	5647.54	0.029430	4.39	7.46	16.64	1.02
Side Channel	Side Channel	157.42*	50 yr	35.00	5646.62	5647.33	5647.38	5647.67	0.030906	4.84	8.62	17.51	1.07
Side Channel	Side Channel	157.42*	100 yr	43.00	5646.62	5647.40	5647.46	5647.80	0.032325	5.31	9.87	18.40	1.11
Side Channel	Side Channel	157.42*	500 yr	64.00	5646.62	5647.57	5647.68	5648.10	0.032868	6.18	13.19	20.49	1.16
Side Channel	Side Channel	120.07*	2 yr	7.00	5645.31	5645.65	5645.64	5645.77	0.034439	2.77	2.58	11.43	0.97
Side Channel	Side Channel	120.07*	5 yr	14.00	5645.31	5645.73	5645.80	5645.99	0.051578	4.10	3.61	12.80	1.24
Side Channel	Side Channel	120.07*	10 yr	20.00	5645.31	5645.83	5645.90	5646.13	0.042636	4.44	4.98	14.29	1.18
Side Channel	Side Channel	120.07*	25 yr	28.00	5645.31	5645.94	5646.01	5646.30	0.039633	4.93	6.55	15.81	1.18
Side Channel	Side Channel	120.07*	50 yr	35.00	5645.31	5646.02	5646.11	5646.42	0.037772	5.27	7.88	16.97	1.18
Side Channel	Side Channel	120.07*	100 yr	43.00	5645.31	5646.10	5646.20	5646.56	0.036429	5.63	9.34	18.17	1.18
Side Channel	Side Channel	120.07*	500 yr	64.00	5645.31	5646.28	5646.44	5646.86	0.036174	6.49	12.72	20.61	1.22
Side Channel	Side Channel	82.72	2 yr	7.00	5643.99	5644.35	5644.35	5644.48	0.034868	2.84	2.47	9.85	0.98
Side Channel	Side Channel	82.72	5 yr	14.00	5643.99	5644.42	5644.52	5644.74	0.066496	4.55	3.15	10.98	1.40
Side Channel	Side Channel	82.72	10 yr	20.00	5643.99	5644.61	5644.63	5644.85	0.028107	4.01	5.55	14.29	0.98
Side Channel	Side Channel	82.72	25 yr	28.00	5643.99	5644.71	5644.74	5645.02	0.029999	4.64	7.01	15.98	1.04
Side Channel	Side Channel	82.72	50 yr	35.00	5643.99	5644.77	5644.85	5645.16	0.031887	5.14	8.16	17.19	1.09
Side Channel	Side Channel	82.72	100 yr	43.00	5643.99	5644.85	5644.95	5645.30	0.033372	5.62	9.45	18.45	1.14
Side Channel	Side Channel	82.72	500 yr	64.00	5643.99	5645.02	5645.17	5645.61	0.033837	6.51	13.00	21.78	1.19

Profile Output Table - Standard Table 2

River	Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Willow Creek US	Willow Creek US	3994.06	2 yr	5686.02	5686.00	0.03	0.38	0.00	66.49	12.51		90.49
Willow Creek US	Willow Creek US	3994.06	5 yr	5686.14	5686.06	0.08	0.96	0.00	121.72	28.14	3.14	115.25
Willow Creek US	Willow Creek US	3994.06	10 yr	5686.30	5686.18	0.12	0.89	0.00	161.00	49.05	7.95	117.48
Willow Creek US	Willow Creek US	3994.06	25 yr	5686.53	5686.36	0.17	0.87	0.00	205.10	81.72	17.18	120.92
Willow Creek US	Willow Creek US	3994.06	50 yr	5686.70	5686.50	0.20	0.86	0.00	240.31	109.21	25.48	123.43
Willow Creek US	Willow Creek US	3994.06	100 yr	5686.87	5686.63	0.24	0.85	0.00	278.56	139.52	34.92	125.91
Willow Creek US	Willow Creek US	3994.06	500 yr	5687.29	5686.96	0.33	0.85	0.01	379.01	222.94	62.05	132.20
Willow Creek US	Willow Creek US	3957.73*	2 yr	5685.04	5685.00	0.04	0.32	0.00	50.56	28.44		81.88
Willow Creek US	Willow Creek US	3957.73*	5 yr	5685.18	5685.06	0.12	0.97	0.01	89.06	53.89	10.05	106.42
Willow Creek US	Willow Creek US	3957.73*	10 yr	5685.42	5685.28	0.14	1.02	0.02	115.06	83.59	19.35	109.65
Willow Creek US	Willow Creek US	3957.73*	25 yr	5685.66	5685.46	0.20	1.01	0.02	152.38	120.92	30.70	112.27
Willow Creek US	Willow Creek US	3957.73*	50 yr	5685.83	5685.59	0.24	1.00	0.02	182.75	151.87	40.38	114.27
Willow Creek US	Willow Creek US	3957.73*	100 yr	5686.02	5685.73	0.28	0.98	0.02	215.16	186.35	51.50	116.80
Willow Creek US	Willow Creek US	3957.73*	500 yr	5686.43	5686.03	0.40	0.96	0.02	303.85	277.97	82.18	121.13
Willow Creek US	Willow Creek US	3921.40*	2 yr	5684.36	5683.95	0.41	0.65	0.04	0.00	79.00		24.86

Willow Creek US	Willow Creek US	3921.40*	5 yr	5684.19	5684.01	0.18	0.77	0.00	59.45	76.60	16.95	98.79
Willow Creek US	Willow Creek US	3921.40*	10 yr	5684.38	5684.05	0.32	0.91	0.03	84.06	109.10	24.84	99.76
Willow Creek US	Willow Creek US	3921.40*	25 yr	5684.63	5684.23	0.40	0.83	0.04	114.69	151.70	37.61	103.19
Willow Creek US	Willow Creek US	3921.40*	50 yr	5684.81	5684.35	0.46			140.22	186.40	48.38	105.55
Willow Creek US	Willow Creek US	3921.40*	100 yr	5685.00	5684.48	0.52	0.84	0.05	168.31	224.36	60.34	107.92
Willow Creek US	Willow Creek US	3921.40*	500 yr	5685.45	5684.81	0.64	0.78	0.05	246.61	323.19	94.19	111.79
Willow Creek US	Willow Creek US	3885.08	2 yr	5683.17	5682.78	0.39	1.19	0.01		79.00		23.14
Willow Creek US	Willow Creek US	3885.08	5 yr	5683.22	5683.02	0.20	0.73	0.01	34.71	94.83	23.45	96.83
Willow Creek US	Willow Creek US	3885.08	10 yr	5683.45	5683.22	0.23	0.69	0.01	55.21	129.34	33.45	99.64
Willow Creek US	Willow Creek US	3885.08	25 yr	5683.73	5683.46	0.27	0.68	0.02	82.57	174.26	47.18	105.10
Willow Creek US	Willow Creek US	3885.08	50 yr	5683.92	5683.59	0.33	0.67	0.02	104.69	212.00	58.31	108.20
Willow Creek US	Willow Creek US	3885.08	100 yr	5684.12	5683.75	0.37	0.68	0.02	130.34	252.31	70.35	112.82
Willow Creek US	Willow Creek US	3885.08	500 yr	5684.59	5684.13	0.46	0.68	0.02	200.06	356.43	107.51	121.41
Willow Creek US	Willow Creek US	3845.91*	2 yr	5682.18	5681.85	0.33	0.93	0.01		78.50	0.50	32.99
Willow Creek US	Willow Creek US	3845.91*	5 yr	5682.48	5682.17	0.31	0.76	0.01	22.59	125.61	4.80	83.48
Willow Creek US	Willow Creek US	3845.91*	10 yr	5682.75	5682.38	0.37	0.78	0.01	37.60	170.24	10.16	94.73
Willow Creek US	Willow Creek US	3845.91*	25 yr	5683.03	5682.56	0.47	0.66	0.01	58.85	227.24	17.91	102.97
Willow Creek US	Willow Creek US	3845.91*	50 yr	5683.23	5682.75	0.48	0.63	0.00	82.51	267.01	25.48	107.03
Willow Creek US	Willow Creek US	3845.91*	100 yr	5683.42	5682.88	0.55	0.59	0.02	107.39	312.49	33.11	108.84
Willow Creek US	Willow Creek US	3845.91*	500 yr	5683.89	5683.22	0.68	0.67	0.01	179.56	430.06	54.38	114.31
Willow Creek US	Willow Creek US	3806.74*	2 yr	5681.22	5680.93	0.28	0.97	0.00		79.00		26.87
Willow Creek US	Willow Creek US	3806.74*	5 yr	5681.64	5681.22	0.43	0.83	0.01	9.98	142.92	0.10	56.17
Willow Creek US	Willow Creek US	3806.74*	10 yr	5681.95	5681.44	0.51	0.81	0.01	20.15	197.22	0.63	82.90
Willow Creek US	Willow Creek US	3806.74*	25 yr	5682.27	5681.73	0.54	0.75	0.01	40.08	260.53	3.40	111.71
Willow Creek US	Willow Creek US	3806.74*	50 yr	5682.48	5681.85	0.62	0.74	0.01	60.09	309.06	5.86	116.27
Willow Creek US	Willow Creek US	3806.74*	100 yr	5682.66	5682.19	0.47	0.67	0.05	102.00	338.38	12.62	121.21
Willow Creek US	Willow Creek US	3806.74*	500 yr	5683.12	5682.33	0.79	0.76	0.01	163.10	479.33	21.57	122.84
Willow Creek US	Willow Creek US	3767.57	2 yr	5680.25	5679.93	0.32	1.16	0.01		79.00		28.29
Willow Creek US	Willow Creek US	3767.57	5 yr	5680.70	5680.26	0.45	0.94	0.00	4.87	148.02	0.12	51.27
Willow Creek US	Willow Creek US	3767.57	10 yr	5681.02	5680.44	0.58	0.92	0.01	12.17	205.45	0.38	53.01
Willow Creek US	Willow Creek US	3767.57	25 yr	5681.40	5680.65	0.75	0.86	0.02	23.63	279.48	0.88	55.09
Willow Creek US	Willow Creek US	3767.57	50 yr	5681.65	5680.89	0.76	0.82	0.01	36.73	336.59	1.68	58.62
Willow Creek US	Willow Creek US	3767.57	100 yr	5681.93	5681.00	0.94	0.78	0.12	47.97	402.48	2.56	60.28
Willow Creek US	Willow Creek US	3767.57	500 yr	5682.24	5681.28	0.96	0.86	0.02	146.99	511.48	5.53	126.30
Willow Creek US	Willow Creek US	3725.33*	2 yr	5678.98	5678.64	0.34	1.27	0.00		79.00		28.96
Willow Creek US	Willow Creek US	3725.33*	5 yr	5679.46	5678.89	0.57	1.24	0.01	2.40	150.57	0.03	52.72
Willow Creek US	Willow Creek US	3725.33*	10 yr	5679.78	5679.07	0.70	1.24	0.01	9.03	208.81	0.16	54.79
Willow Creek US	Willow Creek US	3725.33*	25 yr	5680.14	5679.28	0.86	1.25	0.01	20.36	283.13	0.51	57.02
Willow Creek US	Willow Creek US	3725.33*	50 yr	5680.44	5679.39	1.05	1.17	0.03	29.44	344.71	0.85	58.21
Willow Creek US	Willow Creek US	3725.33*	100 yr	5680.70	5679.56	1.14	1.21	0.02	42.50	409.09	1.40	60.63
Willow Creek US	Willow Creek US	3725.33*	500 yr	5681.04	5679.78	1.27	1.17	0.03	134.67	526.59	2.74	123.61
Willow Creek US	Willow Creek US	3683.10*	2 yr	5677.71	5677.42	0.29	1.26	0.02		79.00		31.29
Willow Creek US	Willow Creek US	3683.10*	5 yr	5678.14	5677.71	0.43	1.27	0.04	4.09	148.87	0.04	56.69
Willow Creek US	Willow Creek US	3683.10*	10 yr	5678.45	5677.88	0.57	1.30	0.04	10.91	206.93	0.16	58.79
Willow Creek US	Willow Creek US	3683.10*	25 yr	5678.80	5678.06	0.74	1.31	0.04	22.17	281.41	0.43	61.18
Willow Creek US	Willow Creek US	3683.10*	50 yr	5678.82	5678.38	0.44	0.61	0.00	78.22	295.83	0.95	124.19
Willow Creek US	Willow Creek US	3683.10*	100 yr	5679.18	5678.20	0.99	1.48	0.04	72.73	379.43	0.84	122.23
Willow Creek US	Willow Creek US	3683.10*	500 yr	5679.58	5678.50	1.07	1.40	0.06	155.04	506.92	2.04	127.21
Willow Creek US	Willow Creek US	3640.87*	2 yr	5676.45	5676.13	0.31	1.26	0.00		79.00		31.90
Willow Creek US	Willow Creek US	3640.87*	5 yr	5676.89	5676.39	0.51	1.24	0.01	2.53	150.46	0.01	59.35
Willow Creek US	Willow Creek US	3640.87*	10 yr	5677.19	5676.56	0.62	1.26	0.01	9.61	208.30	0.08	61.91
Willow Creek US	Willow Creek US	3640.87*	25 yr	5677.55	5676.72	0.83	1.29	0.00	19.52	284.25	0.24	65.94
Willow Creek US	Willow Creek US	3640.87*	50 yr	5677.47	5677.05	0.42	0.66	0.01	86.58	287.79	0.63	127.29
Willow Creek US	Willow Creek US	3640.87*	100 yr	5677.73	5676.94	0.79	1.39	0.06	93.07	359.33	0.60	126.33
Willow Creek US	Willow Creek US	3640.87*	500 yr	5678.19	5677.17	1.03	1.37	0.01	169.99	492.62	1.39	128.46
Willow Creek US	Willow Creek US	3598.64	2 yr	5675.19	5674.87	0.32	1.29	0.01		79.00		33.06
Willow Creek US	Willow Creek US	3598.64	5 yr	5675.60	5675.19	0.41	1.27	0.03	4.44	148.55	0.01	64.75
Willow Creek US	Willow Creek US	3598.64	10 yr	5675.95	5675.25	0.71	1.20	0.06	8.31	209.66	0.04	65.86
Willow Creek US	Willow Creek US	3598.64	25 yr	5676.03	5675.41	0.63	1.46	0.06	52.12	251.76	0.12	127.93
Willow Creek US	Willow Creek US	3598.64	50 yr	5676.36	5675.41	0.95	1.06	0.05	64.56	310.29	0.15	127.94
Willow Creek US	Willow Creek US	3598.64	100 yr	5676.38	5675.61	0.77	1.35	0.01	105.91	346.74	0.35	129.70
Willow Creek US	Willow Creek US	3598.64	500 yr	5676.78	5675.87	0.91	1.38	0.03	191.32	471.71	0.97	132.14

Willow Creek US	Willow Creek US	3555.19*	2 yr	5674.05	5673.75	0.30				79.00		30.89
Willow Creek US	Willow Creek US	3555.19*	5 yr	5674.49	5674.08	0.42	1.11	0.00	2.66	150.33	0.01	62.02
Willow Creek US	Willow Creek US	3555.19*	10 yr	5674.76	5674.35	0.40	1.11	0.09	15.07	202.81	0.13	103.74
Willow Creek US	Willow Creek US	3555.19*	25 yr	5675.03	5674.57	0.46	0.95	0.05	37.35	266.27	0.38	120.61
Willow Creek US	Willow Creek US	3555.19*	50 yr	5675.22	5674.71	0.51	1.03	0.14	59.55	314.78	0.67	124.19
Willow Creek US	Willow Creek US	3555.19*	100 yr	5675.40	5674.86	0.54	0.91	0.07	88.11	363.77	1.11	126.10
Willow Creek US	Willow Creek US	3555.19*	500 yr	5675.83	5675.19	0.64	0.88	0.08	167.85	493.32	2.82	130.54
Willow Creek US	Willow Creek US	3511.74*	2 yr	5672.92	5672.63	0.28	1.12	0.01		79.00		28.99
Willow Creek US	Willow Creek US	3511.74*	5 yr	5673.39	5672.95	0.44	1.10	0.00	1.18	151.81	0.00	57.42
Willow Creek US	Willow Creek US	3511.74*	10 yr	5673.73	5673.06	0.66	1.00	0.03	4.88	213.10	0.03	63.14
Willow Creek US	Willow Creek US	3511.74*	25 yr	5674.07	5673.27	0.79	0.93	0.03	16.48	287.32	0.20	73.19
Willow Creek US	Willow Creek US	3511.74*	50 yr	5674.29	5673.44	0.85	0.89	0.03	30.74	343.78	0.49	86.54
Willow Creek US	Willow Creek US	3511.74*	100 yr	5674.52	5673.61	0.91	0.84	0.04	45.95	406.03	1.03	99.88
Willow Creek US	Willow Creek US	3511.74*	500 yr	5675.02	5673.99	1.02	0.77	0.04	105.27	555.32	3.41	120.20
Willow Creek US	Willow Creek US	3468.29*	2 yr	5671.79	5671.45	0.33	1.09	0.01		79.00		26.22
Willow Creek US	Willow Creek US	3468.29*	5 yr	5672.29	5671.83	0.45	1.10	0.00	1.00	152.00	0.00	44.70
Willow Creek US	Willow Creek US	3468.29*	10 yr	5672.60	5672.10	0.50	1.08	0.05	7.66	210.25	0.10	68.99
Willow Creek US	Willow Creek US	3468.29*	25 yr	5672.94	5672.30	0.64	1.09	0.05	20.66	282.96	0.38	71.41
Willow Creek US	Willow Creek US	3468.29*	50 yr	5673.19	5672.44	0.75	1.07	0.03	32.88	341.33	0.79	73.31
Willow Creek US	Willow Creek US	3468.29*	100 yr	5673.45	5672.55	0.90	1.08	0.00	46.60	405.03	1.36	75.01
Willow Creek US	Willow Creek US	3468.29*	500 yr	5674.04	5672.95	1.09	0.97	0.01	89.76	569.12	5.12	102.74
Willow Creek US	Willow Creek US	3424.84	2 yr	5670.69	5670.24	0.45	1.20	0.00		79.00		23.28
Willow Creek US	Willow Creek US	3424.84	5 yr	5671.20	5670.71	0.49	1.09	0.00	0.77	152.23		40.21
Willow Creek US	Willow Creek US	3424.84	10 yr	5671.56	5670.89	0.66	1.02	0.02	3.65	214.33	0.02	60.83
Willow Creek US	Willow Creek US	3424.84	25 yr	5671.91	5671.13	0.78	1.01	0.01	15.22	288.47	0.30	68.32
Willow Creek US	Willow Creek US	3424.84	50 yr	5672.16	5671.29	0.87	1.02	0.01	28.24	345.96	0.80	70.76
Willow Creek US	Willow Creek US	3424.84	100 yr	5672.40	5671.47	0.94	1.04	0.00	44.59	406.59	1.82	73.14
Willow Creek US	Willow Creek US	3424.84	500 yr	5673.01	5671.81	1.21	1.02	0.01	89.62	568.22	6.16	77.04
Willow Creek US	Willow Creek US	3386.86*	2 yr	5669.87	5669.64	0.23	0.77	0.00		79.00		30.49
Willow Creek US	Willow Creek US	3386.86*	5 yr	5670.35	5669.97	0.38	0.81	0.00		153.00		33.86
Willow Creek US	Willow Creek US	3386.86*	10 yr	5670.68	5670.19	0.50	0.83	0.01	0.00	217.98	0.02	36.69
Willow Creek US	Willow Creek US	3386.86*	25 yr	5671.07	5670.38	0.68	0.86	0.05	0.99	302.78	0.23	52.17
Willow Creek US	Willow Creek US	3386.86*	50 yr	5671.36	5670.52	0.84	0.87	0.04	3.41	370.98	0.61	57.57
Willow Creek US	Willow Creek US	3386.86*	100 yr	5671.59	5670.88	0.71	0.75	0.07	15.15	435.02	2.82	77.89
Willow Creek US	Willow Creek US	3386.86*	500 yr	5672.17	5671.31	0.86	0.74	0.10	48.07	606.76	9.17	83.79
Willow Creek US	Willow Creek US	3348.89*	2 yr	5669.10	5668.87	0.23	0.67	0.02		79.00		35.40
Willow Creek US	Willow Creek US	3348.89*	5 yr	5669.54	5669.17	0.37	0.70	0.03		153.00		38.17
Willow Creek US	Willow Creek US	3348.89*	10 yr	5669.85	5669.37	0.48	0.72	0.04		218.00		40.07
Willow Creek US	Willow Creek US	3348.89*	25 yr	5670.21	5669.58	0.63	0.86	0.02	0.04	303.87	0.09	44.88
Willow Creek US	Willow Creek US	3348.89*	50 yr	5670.48	5669.77	0.71	0.86	0.05	0.62	373.90	0.48	49.95
Willow Creek US	Willow Creek US	3348.89*	100 yr	5670.78	5669.82	0.96	0.79	0.02	1.05	451.16	0.78	52.21
Willow Creek US	Willow Creek US	3348.89*	500 yr	5671.42	5670.23	1.18	0.73	0.03	7.57	651.40	5.03	63.63
Willow Creek US	Willow Creek US	3310.92*	2 yr	5668.41	5668.26	0.16	0.73	0.01		79.00		41.56
Willow Creek US	Willow Creek US	3310.92*	5 yr	5668.81	5668.55	0.26	0.75	0.01		153.00		44.10
Willow Creek US	Willow Creek US	3310.92*	10 yr	5669.09	5668.74	0.35	0.76	0.01	0.00	218.00	0.00	46.08
Willow Creek US	Willow Creek US	3310.92*	25 yr	5669.41	5668.75	0.66	0.88	0.02	0.00	303.99	0.01	46.26
Willow Creek US	Willow Creek US	3310.92*	50 yr	5669.65	5669.05	0.60	0.79	0.00	0.27	374.23	0.50	53.37
Willow Creek US	Willow Creek US	3310.92*	100 yr	5669.91	5669.10	0.82	0.90	0.07	0.47	451.73	0.80	54.48
Willow Creek US	Willow Creek US	3310.92*	500 yr	5670.50	5669.57	0.93	0.84	0.08	4.35	653.70	5.95	66.39
Willow Creek US	Willow Creek US	3272.95	2 yr	5667.68	5667.47	0.21	0.89	0.01		79.00		46.16
Willow Creek US	Willow Creek US	3272.95	5 yr	5668.05	5667.71	0.34	0.91	0.02		153.00		48.12
Willow Creek US	Willow Creek US	3272.95	10 yr	5668.32	5667.89	0.43	0.92	0.02		218.00		49.61
Willow Creek US	Willow Creek US	3272.95	25 yr	5668.63	5668.11	0.52	0.90	0.02	0.01	303.96	0.03	52.49
Willow Creek US	Willow Creek US	3272.95	50 yr	5668.86	5668.27	0.60	0.85	0.02	0.07	374.61	0.32	56.33
Willow Creek US	Willow Creek US	3272.95	100 yr	5669.11	5668.34	0.77	0.86	0.05	0.19	452.14	0.67	58.06
Willow Creek US	Willow Creek US	3272.95	500 yr	5669.68	5668.71	0.97	0.82	0.00	1.81	657.72	4.47	66.53
Willow Creek US	Willow Creek US	3235.06*	2 yr	5666.79	5666.63	0.16	0.90	0.00		79.00		52.73
Willow Creek US	Willow Creek US	3235.06*	5 yr	5667.12	5666.85	0.27	0.92	0.00		153.00		54.98
Willow Creek US	Willow Creek US	3235.06*	10 yr	5667.36	5667.00	0.36	0.93	0.00		218.00		56.61
Willow Creek US	Willow Creek US	3235.06*	25 yr	5667.65	5667.12	0.53	0.98	0.00		304.00		57.85
Willow Creek US	Willow Creek US	3235.06*	50 yr	5667.87	5667.22	0.66	0.99	0.01		375.00		58.92
Willow Creek US	Willow Creek US	3235.06*	100 yr	5668.08	5667.39	0.69	1.00	0.02	0.03	452.86	0.11	62.59
Willow Creek US	Willow Creek US	3235.06*	500 yr	5668.65	5667.62	1.02	1.03	0.00	0.51	662.49	1.01	67.33

Willow Creek US	Willow Creek US	3197.17*	2 yr	5665.89	5665.71	0.18	0.84	0.02		79.00		58.68
Willow Creek US	Willow Creek US	3197.17*	5 yr	5666.20	5665.91	0.29	0.86	0.02		153.00		60.36
Willow Creek US	Willow Creek US	3197.17*	10 yr	5666.44	5666.07	0.36	0.88	0.02		218.00		62.51
Willow Creek US	Willow Creek US	3197.17*	25 yr	5666.71	5666.18	0.53	1.00	0.03		304.00		64.05
Willow Creek US	Willow Creek US	3197.17*	50 yr	5666.91	5666.30	0.61	1.03	0.05		375.00		65.53
Willow Creek US	Willow Creek US	3197.17*	100 yr	5667.10	5666.52	0.58	0.95	0.03	0.00	452.99	0.01	68.65
Willow Creek US	Willow Creek US	3197.17*	500 yr	5667.58	5666.83	0.75	0.99	0.08	0.55	662.72	0.72	75.90
Willow Creek US	Willow Creek US	3159.28*	2 yr	5665.03	5664.91	0.12	0.87	0.00		79.00		65.64
Willow Creek US	Willow Creek US	3159.28*	5 yr	5665.32	5665.11	0.21	0.89	0.00		153.00		67.21
Willow Creek US	Willow Creek US	3159.28*	10 yr	5665.53	5665.24	0.29	0.90	0.00		218.00		69.26
Willow Creek US	Willow Creek US	3159.28*	25 yr	5665.78	5665.40	0.38	0.90	0.00		304.00		71.81
Willow Creek US	Willow Creek US	3159.28*	50 yr	5665.96	5665.50	0.46	0.91	0.00		375.00		73.27
Willow Creek US	Willow Creek US	3159.28*	100 yr	5666.15	5665.59	0.56	0.94	0.01		453.00		74.48
Willow Creek US	Willow Creek US	3159.28*	500 yr	5666.62	5665.82	0.80	0.96	0.00	0.08	663.86	0.06	80.59
Willow Creek US	Willow Creek US	3121.39	2 yr	5664.15	5663.98	0.17	1.16	0.00		79.00		67.11
Willow Creek US	Willow Creek US	3121.39	5 yr	5664.43	5664.17	0.26	1.08	0.00		153.00		73.08
Willow Creek US	Willow Creek US	3121.39	10 yr	5664.63	5664.31	0.33	1.01	0.00		218.00		74.14
Willow Creek US	Willow Creek US	3121.39	25 yr	5664.87	5664.48	0.40	0.93	0.00		304.00		76.96
Willow Creek US	Willow Creek US	3121.39	50 yr	5665.05	5664.60	0.45	0.47	0.06		375.00		79.37
Willow Creek US	Willow Creek US	3121.39	100 yr	5665.22	5664.70	0.53	0.94	0.02		453.00		80.92
Willow Creek US	Willow Creek US	3121.39	500 yr	5665.69	5665.25	0.44	0.15	0.09	1.10	662.46	0.44	98.49
Willow Creek US	Willow Creek US	3084.36*	2 yr	5663.00	5662.81	0.19	0.32	0.04		79.00		57.17
Willow Creek US	Willow Creek US	3084.36*	5 yr	5663.31	5663.01	0.30	1.12	0.00		153.00		63.01
Willow Creek US	Willow Creek US	3084.36*	10 yr	5663.54	5663.14	0.40	1.09	0.01		218.00		64.95
Willow Creek US	Willow Creek US	3084.36*	25 yr	5663.80	5663.29	0.51	1.07	0.01		304.00	0.00	68.71
Willow Creek US	Willow Creek US	3084.36*	50 yr	5664.11	5663.87	0.24	0.08	0.05	1.98	370.30	2.72	90.13
Willow Creek US	Willow Creek US	3084.36*	100 yr	5664.49	5664.30	0.19	0.06	0.04	6.03	439.80	7.17	104.60
Willow Creek US	Willow Creek US	3084.36*	500 yr	5665.45	5665.31	0.15	0.04	0.02	28.57	614.16	21.27	132.54
Willow Creek US	Willow Creek US	3047.33	2 yr	5662.03	5661.99	0.05	0.09	0.01	0.02	71.76	7.21	80.12
Willow Creek US	Willow Creek US	3047.33	5 yr	5662.67	5662.62	0.05	0.06	0.03	1.90	134.87	16.23	90.25
Willow Creek US	Willow Creek US	3047.33	10 yr	5663.15	5663.11	0.05	0.04	0.03	4.99	188.97	24.04	108.76
Willow Creek US	Willow Creek US	3047.33	25 yr	5663.56	5663.50	0.06	0.05	0.08	12.04	258.58	33.38	115.45
Willow Creek US	Willow Creek US	3047.33	50 yr	5663.98	5663.92	0.06	0.05	0.10	20.26	313.04	41.71	122.87
Willow Creek US	Willow Creek US	3047.33	100 yr	5664.39	5664.32	0.07	0.04	0.11	27.04	374.21	51.75	142.63
Willow Creek US	Willow Creek US	3047.33	500 yr	5665.39	5665.32	0.07	0.03	0.13	53.58	526.33	84.10	207.88
Willow Creek US	Willow Creek US	3001.56		Bridge								
Willow Creek US	Willow Creek US	2976.42	2 yr	5660.99	5660.59	0.40	1.08	0.00		79.00		19.07
Willow Creek US	Willow Creek US	2976.42	5 yr	5661.60	5661.07	0.53	0.97	0.00	0.04	152.96	0.00	25.80
Willow Creek US	Willow Creek US	2976.42	10 yr	5662.03	5661.39	0.64	0.80	0.02	1.07	216.78	0.15	32.27
Willow Creek US	Willow Creek US	2976.42	25 yr	5662.49	5661.53	0.96	0.93	0.01	8.26	295.24	0.50	53.36
Willow Creek US	Willow Creek US	2976.42	50 yr	5662.83	5661.67	1.16	0.99	0.01	15.75	357.70	1.55	65.13
Willow Creek US	Willow Creek US	2976.42	100 yr	5663.20	5661.79	1.42	1.01	0.03	24.42	424.93	3.65	72.34
Willow Creek US	Willow Creek US	2976.42	500 yr	5664.09	5662.08	2.02	1.06	0.06	47.78	599.53	16.69	102.76
Willow Creek US	Willow Creek US	2933.67*	2 yr	5659.64	5659.10	0.53	1.34	0.01		79.00		19.01
Willow Creek US	Willow Creek US	2933.67*	5 yr	5660.28	5659.47	0.80	1.29	0.03		153.00		23.03
Willow Creek US	Willow Creek US	2933.67*	10 yr	5660.74	5659.69	1.06	1.24	0.04	0.02	217.98	0.00	26.22
Willow Creek US	Willow Creek US	2933.67*	25 yr	5661.16	5660.01	1.15	1.32	0.02	5.44	298.32	0.24	50.98
Willow Creek US	Willow Creek US	2933.67*	50 yr	5661.47	5660.19	1.28	1.36	0.01	14.17	360.08	0.74	56.92
Willow Creek US	Willow Creek US	2933.67*	100 yr	5661.77	5660.37	1.39	1.42	0.01	25.96	424.56	2.49	66.00
Willow Creek US	Willow Creek US	2933.67*	500 yr	5662.47	5660.78	1.69	1.53	0.10	59.70	590.92	13.38	91.72
Willow Creek US	Willow Creek US	2890.92*	2 yr	5658.33	5657.96	0.37	0.95	0.03		79.00		22.50
Willow Creek US	Willow Creek US	2890.92*	5 yr	5658.90	5658.39	0.51	1.30	0.09	0.04	152.95	0.01	29.38
Willow Creek US	Willow Creek US	2890.92*	10 yr	5659.26	5658.61	0.65	1.36	0.12	5.36	212.45	0.19	53.06
Willow Creek US	Willow Creek US	2890.92*	25 yr	5659.70	5658.76	0.94	1.39	0.06	13.14	290.17	0.69	57.63
Willow Creek US	Willow Creek US	2890.92*	50 yr	5660.02	5658.90	1.12	1.41	0.05	22.46	350.90	1.64	63.92
Willow Creek US	Willow Creek US	2890.92*	100 yr	5660.33	5659.05	1.28	1.41	0.04	34.54	414.67	3.79	67.12
Willow Creek US	Willow Creek US	2890.92*	500 yr	5661.05	5659.41	1.64	1.40	0.01	68.94	582.69	12.37	85.23
Willow Creek US	Willow Creek US	2848.17	2 yr	5657.14	5656.88	0.26	0.67	0.00		79.00		26.49
Willow Creek US	Willow Creek US	2848.17	5 yr	5657.67	5657.03	0.64	1.21	0.01	1.66	151.33	0.02	51.48
Willow Creek US	Willow Creek US	2848.17	10 yr	5658.02	5657.22	0.79	1.22	0.01	8.86	208.82	0.32	56.46
Willow Creek US	Willow Creek US	2848.17	25 yr	5658.37	5657.47	0.91	1.32	0.01	22.58	279.47	1.95	62.37

Willow Creek US	Willow Creek US	2848.17	50 yr	5658.65	5657.62	1.03	1.35	0.03	35.19	336.30	3.51	66.92
Willow Creek US	Willow Creek US	2848.17	100 yr	5658.92	5657.78	1.14	1.37	0.04	50.30	396.31	6.38	69.70
Willow Creek US	Willow Creek US	2848.17	500 yr	5659.59	5658.13	1.46	1.41	0.06	90.38	558.03	15.59	84.84
Willow Creek US	Willow Creek US	2810.59*	2 yr	5656.47	5656.22	0.25	0.67	0.00	0.19	78.81	0.00	41.85
Willow Creek US	Willow Creek US	2810.59*	5 yr	5656.95	5656.54	0.40	0.67	0.00	7.37	145.37	0.26	55.63
Willow Creek US	Willow Creek US	2810.59*	10 yr	5657.27	5656.77	0.50	0.63	0.01	18.05	198.79	1.16	61.79
Willow Creek US	Willow Creek US	2810.59*	25 yr	5657.64	5657.08	0.56	0.59	0.00	35.20	265.44	3.36	77.62
Willow Creek US	Willow Creek US	2810.59*	50 yr	5657.88	5657.27	0.62	0.56	0.01	52.94	315.95	6.11	81.18
Willow Creek US	Willow Creek US	2810.59*	100 yr	5658.13	5657.52	0.61	0.63	0.03	77.63	365.35	10.02	89.44
Willow Creek US	Willow Creek US	2810.59*	500 yr	5658.73	5657.91	0.82	0.72	0.21	126.10	514.61	23.29	126.25
Willow Creek US	Willow Creek US	2773.02*	2 yr	5655.80	5655.52	0.28	0.66	0.00	0.55	78.45	0.00	43.53
Willow Creek US	Willow Creek US	2773.02*	5 yr	5656.28	5655.87	0.41	0.65	0.01	9.46	143.21	0.33	57.19
Willow Creek US	Willow Creek US	2773.02*	10 yr	5656.60	5656.09	0.51	0.67	0.00	21.32	195.59	1.09	68.77
Willow Creek US	Willow Creek US	2773.02*	25 yr	5656.95	5656.27	0.68	0.67	0.01	39.80	261.63	2.57	72.10
Willow Creek US	Willow Creek US	2773.02*	50 yr	5657.20	5656.44	0.76	0.66	0.01	58.91	311.73	4.36	80.19
Willow Creek US	Willow Creek US	2773.02*	100 yr	5657.47	5656.57	0.90	0.62	0.12	79.10	368.04	5.86	96.65
Willow Creek US	Willow Creek US	2773.02*	500 yr	5658.03	5656.93	1.10	0.67	0.03	136.92	504.89	22.18	138.35
Willow Creek US	Willow Creek US	2735.45*	2 yr	5655.14	5654.88	0.26	0.69	0.00	1.81	77.16	0.03	50.77
Willow Creek US	Willow Creek US	2735.45*	5 yr	5655.59	5655.16	0.42	0.69	0.00	13.60	138.18	1.21	70.15
Willow Creek US	Willow Creek US	2735.45*	10 yr	5655.88	5655.35	0.53	0.72	0.00	28.43	185.62	3.95	89.11
Willow Creek US	Willow Creek US	2735.45*	25 yr	5656.18	5655.60	0.58	0.75	0.03	52.70	240.54	10.76	116.21
Willow Creek US	Willow Creek US	2735.45*	50 yr	5656.41	5655.72	0.69	0.78	0.02	69.01	287.68	18.30	127.41
Willow Creek US	Willow Creek US	2735.45*	100 yr	5656.60	5655.86	0.74	0.81	0.05	94.79	330.52	27.68	143.62
Willow Creek US	Willow Creek US	2735.45*	500 yr	5657.09	5656.08	1.01	0.91	0.03	156.74	448.32	58.94	160.58
Willow Creek US	Willow Creek US	2697.88	2 yr	5654.44	5654.15	0.29	0.71	0.01	4.81	74.16	0.02	59.72
Willow Creek US	Willow Creek US	2697.88	5 yr	5654.85	5654.46	0.39	0.73	0.01	24.94	127.64	0.42	74.05
Willow Creek US	Willow Creek US	2697.88	10 yr	5655.13	5654.68	0.45	0.73	0.02	46.51	170.31	1.18	83.47
Willow Creek US	Willow Creek US	2697.88	25 yr	5655.44	5654.86	0.58	0.74	0.00	77.16	224.51	2.33	85.69
Willow Creek US	Willow Creek US	2697.88	50 yr	5655.65	5655.07	0.58	0.73	0.03	108.46	262.68	3.85	88.79
Willow Creek US	Willow Creek US	2697.88	100 yr	5655.87	5655.27	0.60	0.58	0.01	142.69	304.38	5.93	91.84
Willow Creek US	Willow Creek US	2697.88	500 yr	5655.86	5655.45	0.42	0.49	0.02	163.20	320.43	180.37	173.95
Willow Creek US	Willow Creek US	2664.50*	2 yr	5653.51	5653.09	0.42	0.92	0.01	0.77	78.23		40.66
Willow Creek US	Willow Creek US	2664.50*	5 yr	5653.97	5653.38	0.58	0.87	0.02	10.54	142.40	0.06	80.82
Willow Creek US	Willow Creek US	2664.50*	10 yr	5654.25	5653.54	0.71	0.86	0.03	27.26	190.44	0.30	84.10
Willow Creek US	Willow Creek US	2664.50*	25 yr	5654.52	5653.74	0.79	0.89	0.02	55.63	247.34	1.03	87.48
Willow Creek US	Willow Creek US	2664.50*	50 yr	5654.76	5653.85	0.90	0.85	0.03	78.40	294.79	1.81	89.61
Willow Creek US	Willow Creek US	2664.50*	100 yr	5655.00	5653.97	1.02	0.83	0.04	104.06	346.08	2.86	93.17
Willow Creek US	Willow Creek US	2664.50*	500 yr	5655.26	5654.50	0.76	0.57	0.03	187.11	435.81	41.08	161.01
Willow Creek US	Willow Creek US	2631.13*	2 yr	5652.51	5652.25	0.26	0.78	0.01	2.39	76.61		59.26
Willow Creek US	Willow Creek US	2631.13*	5 yr	5652.91	5652.50	0.41	1.00	0.05	14.55	138.44	0.01	73.19
Willow Creek US	Willow Creek US	2631.13*	10 yr	5653.18	5652.69	0.49	1.00	0.07	29.08	188.72	0.20	89.01
Willow Creek US	Willow Creek US	2631.13*	25 yr	5653.47	5652.86	0.61	1.00	0.05	53.16	250.05	0.79	95.82
Willow Creek US	Willow Creek US	2631.13*	50 yr	5653.68	5653.02	0.67	1.00	0.07	74.17	299.10	1.73	104.54
Willow Creek US	Willow Creek US	2631.13*	100 yr	5653.88	5653.15	0.73	1.02	0.09	100.43	349.61	2.96	110.27
Willow Creek US	Willow Creek US	2631.13*	500 yr	5654.41	5653.39	1.02	0.84	0.03	168.99	487.91	7.10	134.73
Willow Creek US	Willow Creek US	2597.76	2 yr	5651.55	5651.24	0.32	0.96	0.01	3.77	75.23		56.57
Willow Creek US	Willow Creek US	2597.76	5 yr	5651.92	5651.49	0.43	0.99	0.00	17.16	135.84		66.65
Willow Creek US	Willow Creek US	2597.76	10 yr	5652.19	5651.64	0.55	0.98	0.01	29.48	188.52	0.00	77.92
Willow Creek US	Willow Creek US	2597.76	25 yr	5652.49	5651.84	0.65	0.98	0.00	49.36	254.45	0.19	99.73
Willow Creek US	Willow Creek US	2597.76	50 yr	5652.73	5651.99	0.74	0.95	0.01	62.47	311.71	0.83	120.37
Willow Creek US	Willow Creek US	2597.76	100 yr	5652.92	5652.10	0.82	0.96	0.01	87.93	363.25	1.82	127.86
Willow Creek US	Willow Creek US	2597.76	500 yr	5653.35	5652.37	0.98	1.05	0.01	163.05	493.64	7.32	139.37
Willow Creek US	Willow Creek US	2564.22*	2 yr	5650.77	5650.52	0.24	0.83	0.00		79.00		33.87
Willow Creek US	Willow Creek US	2564.22*	5 yr	5651.18	5650.85	0.33	0.67	0.00	4.45	148.55	0.00	82.87
Willow Creek US	Willow Creek US	2564.22*	10 yr	5651.45	5650.98	0.47	0.79	0.05	11.94	205.97	0.08	97.42
Willow Creek US	Willow Creek US	2564.22*	25 yr	5651.69	5651.26	0.44	0.74	0.07	38.04	264.68	1.28	134.25
Willow Creek US	Willow Creek US	2564.22*	50 yr	5651.90	5651.29	0.62	0.62	0.05	49.70	323.45	1.84	138.95
Willow Creek US	Willow Creek US	2564.22*	100 yr	5652.07	5651.53	0.53	0.76	0.09	79.80	368.30	4.90	161.31
Willow Creek US	Willow Creek US	2564.22*	500 yr	5652.46	5651.79	0.67	0.80	0.09	155.24	497.49	11.27	169.83
Willow Creek US	Willow Creek US	2530.68*	2 yr	5649.95	5649.69	0.26				79.00		35.35
Willow Creek US	Willow Creek US	2530.68*	5 yr	5650.37	5649.94	0.43	0.80	0.01	0.58	152.42		63.11
Willow Creek US	Willow Creek US	2530.68*	10 yr	5650.63	5650.16	0.47	0.81	0.00	7.45	210.40	0.15	89.49

Willow Creek US	Willow Creek US	2530.68*	25 yr	5650.94	5650.29	0.65	0.73	0.02	18.09	285.10	0.81	103.89
Willow Creek US	Willow Creek US	2530.68*	50 yr	5651.12	5650.49	0.63	0.79	0.00	34.36	338.27	2.37	137.64
Willow Creek US	Willow Creek US	2530.68*	100 yr	5651.33	5650.56	0.76	0.71	0.02	49.83	399.55	3.62	154.31
Willow Creek US	Willow Creek US	2530.68*	500 yr	5651.71	5650.86	0.86	0.72	0.02	118.10	536.56	9.34	176.31
Willow Creek US	Willow Creek US	2497.14	2 yr	5649.14	5648.94	0.19	0.83	0.00	1.94	77.06		47.29
Willow Creek US	Willow Creek US	2497.14	5 yr	5649.50	5649.25	0.25	0.75	0.01	11.39	141.60	0.01	85.20
Willow Creek US	Willow Creek US	2497.14	10 yr	5649.73	5649.43	0.30	0.68	0.01	22.53	194.92	0.55	90.99
Willow Creek US	Willow Creek US	2497.14	25 yr	5650.01	5649.63	0.37	0.64	0.01	37.58	264.52	1.90	104.35
Willow Creek US	Willow Creek US	2497.14	50 yr	5650.20	5649.80	0.40	0.61	0.02	54.00	317.47	3.52	134.18
Willow Creek US	Willow Creek US	2497.14	100 yr	5650.40	5649.97	0.43	0.58	0.02	73.71	373.50	5.78	162.27
Willow Creek US	Willow Creek US	2497.14	500 yr	5650.89	5650.58	0.30	0.45	0.07	177.45	471.88	14.67	198.07
Willow Creek US	Willow Creek US	2457.54*	2 yr	5648.29	5648.05	0.24	0.92	0.01		79.00		32.91
Willow Creek US	Willow Creek US	2457.54*	5 yr	5648.74	5648.38	0.36	0.87	0.00		153.00		38.53
Willow Creek US	Willow Creek US	2457.54*	10 yr	5649.04	5648.63	0.41	0.84	0.01	1.13	216.81	0.06	67.51
Willow Creek US	Willow Creek US	2457.54*	25 yr	5649.35	5648.87	0.49	0.75	0.01	7.26	294.91	1.83	77.28
Willow Creek US	Willow Creek US	2457.54*	50 yr	5649.58	5649.02	0.55	0.67	0.00	13.34	357.18	4.48	79.34
Willow Creek US	Willow Creek US	2457.54*	100 yr	5649.80	5649.18	0.62	0.67	0.00	20.78	424.15	8.06	82.15
Willow Creek US	Willow Creek US	2457.54*	500 yr	5650.37	5649.36	1.01	0.68	0.13	38.44	609.41	16.16	100.11
Willow Creek US	Willow Creek US	2417.95*	2 yr	5647.37	5647.08	0.30	0.98	0.01		79.00		27.42
Willow Creek US	Willow Creek US	2417.95*	5 yr	5647.86	5647.46	0.41	0.93	0.01		153.00		33.73
Willow Creek US	Willow Creek US	2417.95*	10 yr	5648.20	5647.69	0.51	0.88	0.00		217.63	0.37	42.27
Willow Creek US	Willow Creek US	2417.95*	25 yr	5648.55	5647.94	0.61	0.79	0.01		301.13	2.87	55.60
Willow Creek US	Willow Creek US	2417.95*	50 yr	5648.80	5648.12	0.68	0.77	0.01	0.56	367.81	6.63	75.75
Willow Creek US	Willow Creek US	2417.95*	100 yr	5649.03	5648.27	0.76	0.76	0.01	3.02	437.43	12.55	81.54
Willow Creek US	Willow Creek US	2417.95*	500 yr	5649.34	5648.62	0.73	0.96	0.01	13.30	561.33	89.37	151.30
Willow Creek US	Willow Creek US	2378.35*	2 yr	5646.38	5646.03	0.35	0.85	0.02		79.00		23.27
Willow Creek US	Willow Creek US	2378.35*	5 yr	5646.93	5646.45	0.48	0.84	0.01		153.00		29.46
Willow Creek US	Willow Creek US	2378.35*	10 yr	5647.29	5646.73	0.56	0.91	0.01		218.00		32.66
Willow Creek US	Willow Creek US	2378.35*	25 yr	5647.69	5647.03	0.66	0.88	0.00		304.00		35.94
Willow Creek US	Willow Creek US	2378.35*	50 yr	5647.98	5647.25	0.73	0.84	0.00		375.00		38.39
Willow Creek US	Willow Creek US	2378.35*	100 yr	5647.80	5647.64	0.16	0.37	0.07	0.23	279.49	173.28	157.63
Willow Creek US	Willow Creek US	2378.35*	500 yr	5647.92	5647.47	0.45	0.24	0.11		417.22	246.78	144.52
Willow Creek US	Willow Creek US	2338.76	2 yr	5645.37	5645.08	0.29	0.76	0.00		79.00		23.19
Willow Creek US	Willow Creek US	2338.76	5 yr	5645.94	5645.51	0.43	0.80	0.01		153.00		26.87
Willow Creek US	Willow Creek US	2338.76	10 yr	5646.33	5645.67	0.66	0.96	0.01		218.00		28.91
Willow Creek US	Willow Creek US	2338.76	25 yr	5646.76	5645.98	0.78	0.92	0.01		304.00		31.98
Willow Creek US	Willow Creek US	2338.76	50 yr	5647.06	5646.20	0.86	0.90	0.01		375.00		33.90
Willow Creek US	Willow Creek US	2338.76	100 yr	5647.36	5646.53	0.83	0.82	0.01		453.00		36.74
Willow Creek US	Willow Creek US	2338.76	500 yr	5647.10	5647.01	0.09	0.17	0.02	0.00	270.13	393.87	161.44
Willow Creek US	Willow Creek US	2297.49*	2 yr	5644.61	5644.34	0.27	0.86	0.00		79.00		25.30
Willow Creek US	Willow Creek US	2297.49*	5 yr	5645.13	5644.72	0.41	0.90	0.00		153.00		30.97
Willow Creek US	Willow Creek US	2297.49*	10 yr	5645.48	5644.98	0.51	0.92	0.00		218.00		33.73
Willow Creek US	Willow Creek US	2297.49*	25 yr	5645.88	5645.24	0.64	0.88	0.01		304.00		36.29
Willow Creek US	Willow Creek US	2297.49*	50 yr	5646.17	5645.36	0.81	0.93	0.04		375.00		37.48
Willow Creek US	Willow Creek US	2297.49*	100 yr	5646.46	5645.57	0.89	0.90	0.01		453.00		39.47
Willow Creek US	Willow Creek US	2297.49*	500 yr	5646.27	5645.93	0.34	0.43	0.03	0.34	423.66	240.00	160.54
Willow Creek US	Willow Creek US	2256.23*	2 yr	5643.76	5643.49	0.27	0.92	0.01		79.00		30.25
Willow Creek US	Willow Creek US	2256.23*	5 yr	5644.23	5643.82	0.41	0.96	0.01		153.00		34.33
Willow Creek US	Willow Creek US	2256.23*	10 yr	5644.56	5644.03	0.53	0.97	0.02		218.00		36.62
Willow Creek US	Willow Creek US	2256.23*	25 yr	5644.94	5644.28	0.66	0.94	0.00		304.00		39.35
Willow Creek US	Willow Creek US	2256.23*	50 yr	5645.21	5644.46	0.75	0.97	0.03	0.00	374.99	0.01	42.67
Willow Creek US	Willow Creek US	2256.23*	100 yr	5645.38	5644.50	0.88	1.07	0.00	0.00	430.23	22.76	75.83
Willow Creek US	Willow Creek US	2256.23*	500 yr	5645.81	5645.17	0.64	0.57	0.01	5.10	571.86	87.04	141.58
Willow Creek US	Willow Creek US	2214.97*	2 yr	5642.83	5642.59	0.23	1.01	0.00		79.00		34.23
Willow Creek US	Willow Creek US	2214.97*	5 yr	5643.27	5642.88	0.38	1.03	0.00		153.00		37.81
Willow Creek US	Willow Creek US	2214.97*	10 yr	5643.57	5643.11	0.46	0.90	0.01		217.49	0.51	51.98
Willow Creek US	Willow Creek US	2214.97*	25 yr	5643.92	5643.29	0.62	1.01	0.01	0.09	300.56	3.35	65.61
Willow Creek US	Willow Creek US	2214.97*	50 yr	5644.17	5643.41	0.76	1.04	0.00	0.64	367.31	7.05	68.95
Willow Creek US	Willow Creek US	2214.97*	100 yr	5644.38	5643.66	0.72	0.96	0.05	2.75	433.51	16.74	74.05
Willow Creek US	Willow Creek US	2214.97*	500 yr	5645.02	5643.85	1.17	0.74	0.05	6.45	625.24	32.31	77.86
Willow Creek US	Willow Creek US	2173.71	2 yr	5641.82	5641.56	0.26	1.44	0.02		79.00		36.87
Willow Creek US	Willow Creek US	2173.71	5 yr	5642.24	5641.85	0.39	1.39	0.03		153.00		40.94

Willow Creek US	Willow Creek US	2173.71	10 yr	5642.54	5642.02	0.52	1.03	0.01	0.07	217.72	0.22	55.47
Willow Creek US	Willow Creek US	2173.71	25 yr	5642.88	5642.23	0.65	1.04	0.00	1.36	300.13	2.50	59.93
Willow Creek US	Willow Creek US	2173.71	50 yr	5643.12	5642.39	0.73	1.05	0.01	3.18	366.23	5.58	63.30
Willow Creek US	Willow Creek US	2173.71	100 yr	5643.39	5642.48	0.91	0.97	0.02	4.85	439.75	8.41	65.14
Willow Creek US	Willow Creek US	2173.71	500 yr	5643.95	5642.92	1.02	1.03	0.04	14.03	625.50	24.47	74.44
Willow Creek DS	Willow Creek DS	2039.61	2 yr	5638.79	5638.28	0.52	2.99	0.03		86.00		56.37
Willow Creek DS	Willow Creek DS	2039.61	5 yr	5639.28	5638.40	0.87	2.91	0.05		166.00		58.37
Willow Creek DS	Willow Creek DS	2039.61	10 yr	5639.58	5638.52	1.06	2.91	0.05		238.00		60.12
Willow Creek DS	Willow Creek DS	2039.61	25 yr	5639.99	5638.63	1.37	2.81	0.07		333.00		61.82
Willow Creek DS	Willow Creek DS	2039.61	50 yr	5640.31	5638.70	1.60	2.72	0.09		411.00		63.05
Willow Creek DS	Willow Creek DS	2039.61	100 yr	5640.48	5638.83	1.65	2.83	0.07		497.00		64.73
Willow Creek DS	Willow Creek DS	2039.61	500 yr	5641.31	5639.00	2.30	2.51	0.13		728.00		67.24
Willow Creek DS	Willow Creek DS	1999.64*	2 yr	5637.72	5637.55	0.17	0.91	0.01		86.00		51.41
Willow Creek DS	Willow Creek DS	1999.64*	5 yr	5638.08	5637.81	0.27	0.86	0.01		166.00		55.21
Willow Creek DS	Willow Creek DS	1999.64*	10 yr	5638.34	5638.00	0.34	0.83	0.01		238.00		57.63
Willow Creek DS	Willow Creek DS	1999.64*	25 yr	5638.64	5638.20	0.44	0.79	0.01	0.00	332.96	0.04	59.15
Willow Creek DS	Willow Creek DS	1999.64*	50 yr	5638.87	5638.33	0.54	0.76	0.01	0.02	410.83	0.16	60.05
Willow Creek DS	Willow Creek DS	1999.64*	100 yr	5639.10	5638.46	0.64	0.74	0.00	0.07	496.54	0.39	60.91
Willow Creek DS	Willow Creek DS	1999.64*	500 yr	5639.66	5638.84	0.83			0.56	725.60	1.84	63.33
Willow Creek DS	Willow Creek DS	1959.68*	2 yr	5636.80	5636.57	0.23	0.85	0.01		86.00		42.70
Willow Creek DS	Willow Creek DS	1959.68*	5 yr	5637.21	5636.85	0.35	0.79	0.01		166.00		46.50
Willow Creek DS	Willow Creek DS	1959.68*	10 yr	5637.50	5637.06	0.44	0.74	0.01		238.00	0.00	48.91
Willow Creek DS	Willow Creek DS	1959.68*	25 yr	5637.84	5637.30	0.54	0.71	0.00	0.01	332.79	0.20	51.16
Willow Creek DS	Willow Creek DS	1959.68*	50 yr	5638.10	5637.50	0.60	0.68	0.00	0.10	410.19	0.72	52.89
Willow Creek DS	Willow Creek DS	1959.68*	100 yr	5638.36	5637.72	0.65	0.65	0.01	0.34	494.93	1.73	54.44
Willow Creek DS	Willow Creek DS	1959.68*	500 yr	5639.01	5638.26	0.75	0.59	0.03	2.18	719.95	5.87	57.92
Willow Creek DS	Willow Creek DS	1919.71*	2 yr	5635.95	5635.74	0.21	0.82	0.01		86.00		35.81
Willow Creek DS	Willow Creek DS	1919.71*	5 yr	5636.41	5636.09	0.32	0.74	0.01		165.98	0.02	40.49
Willow Creek DS	Willow Creek DS	1919.71*	10 yr	5636.75	5636.34	0.41	0.70	0.02	0.02	237.51	0.47	43.66
Willow Creek DS	Willow Creek DS	1919.71*	25 yr	5637.13	5636.60	0.53	0.65	0.01	0.18	330.97	1.86	46.30
Willow Creek DS	Willow Creek DS	1919.71*	50 yr	5637.41	5636.78	0.63	0.63	0.01	0.54	407.03	3.43	48.42
Willow Creek DS	Willow Creek DS	1919.71*	100 yr	5637.70	5636.96	0.74	0.62	0.01	1.26	490.20	5.53	49.97
Willow Creek DS	Willow Creek DS	1919.71*	500 yr	5638.40	5637.38	1.01	0.60	0.01	3.85	711.86	12.30	57.96
Willow Creek DS	Willow Creek DS	1879.75	2 yr	5635.12	5634.81	0.31	1.00	0.01		86.00		27.56
Willow Creek DS	Willow Creek DS	1879.75	5 yr	5635.65	5635.19	0.46	0.94	0.00	0.00	165.32	0.68	37.52
Willow Creek DS	Willow Creek DS	1879.75	10 yr	5636.03	5635.46	0.58	0.82	0.01	0.07	234.28	3.65	43.27
Willow Creek DS	Willow Creek DS	1879.75	25 yr	5636.46	5635.79	0.68	0.74	0.01	0.94	321.32	10.74	50.55
Willow Creek DS	Willow Creek DS	1879.75	50 yr	5636.77	5636.03	0.74	0.72	0.00	2.08	390.05	18.87	56.50
Willow Creek DS	Willow Creek DS	1879.75	100 yr	5637.07	5636.26	0.81	0.67	0.00	4.41	462.83	29.76	58.95
Willow Creek DS	Willow Creek DS	1879.75	500 yr	5637.77	5636.73	1.04	0.63	0.00	13.94	653.70	60.35	70.78
Willow Creek DS	Willow Creek DS	1836.33*	2 yr	5634.12	5633.82	0.30	1.01	0.00		86.00		27.37
Willow Creek DS	Willow Creek DS	1836.33*	5 yr	5634.66	5634.14	0.51	1.00	0.00	0.00	165.61	0.39	37.85
Willow Creek DS	Willow Creek DS	1836.33*	10 yr	5635.05	5634.36	0.69	0.98	0.01	0.07	235.00	2.93	48.66
Willow Creek DS	Willow Creek DS	1836.33*	25 yr	5635.49	5634.57	0.92	0.95	0.02	0.67	322.34	9.99	53.99
Willow Creek DS	Willow Creek DS	1836.33*	50 yr	5635.81	5634.71	1.10	0.92	0.04	1.34	391.77	17.90	56.32
Willow Creek DS	Willow Creek DS	1836.33*	100 yr	5636.13	5634.88	1.24	0.90	0.04	2.92	465.49	28.59	58.49
Willow Creek DS	Willow Creek DS	1836.33*	500 yr	5636.84	5635.30	1.53	0.88	0.05	10.28	655.09	62.63	68.72
Willow Creek DS	Willow Creek DS	1792.92*	2 yr	5633.11	5632.78	0.33	1.03	0.01		86.00		26.61
Willow Creek DS	Willow Creek DS	1792.92*	5 yr	5633.64	5633.16	0.48	1.01	0.01	0.01	164.29	1.70	52.69
Willow Creek DS	Willow Creek DS	1792.92*	10 yr	5633.99	5633.39	0.60	1.03	0.03	0.37	228.48	9.15	56.97
Willow Creek DS	Willow Creek DS	1792.92*	25 yr	5634.38	5633.65	0.73	1.05	0.06	1.80	308.67	22.54	61.54
Willow Creek DS	Willow Creek DS	1792.92*	50 yr	5634.66	5633.83	0.83	1.08	0.08	3.58	372.71	34.71	66.60
Willow Creek DS	Willow Creek DS	1792.92*	100 yr	5634.95	5634.00	0.95	1.09	0.09	6.61	441.73	48.66	70.47
Willow Creek DS	Willow Creek DS	1792.92*	500 yr	5635.65	5634.37	1.28	1.11	0.08	15.19	625.31	87.50	87.80
Willow Creek DS	Willow Creek DS	1749.51	2 yr	5632.08	5631.77	0.30	1.18	0.01		83.54	2.46	43.72
Willow Creek DS	Willow Creek DS	1749.51	5 yr	5632.56	5632.04	0.51	1.09	0.00	0.00	154.66	11.33	59.37
Willow Creek DS	Willow Creek DS	1749.51	10 yr	5632.89	5632.23	0.66	1.09	0.01	0.40	214.02	23.58	69.55
Willow Creek DS	Willow Creek DS	1749.51	25 yr	5633.26	5632.41	0.85	1.12	0.01	1.51	287.58	43.91	72.41
Willow Creek DS	Willow Creek DS	1749.51	50 yr	5633.53	5632.54	0.98	1.13	0.02	2.96	345.94	62.10	74.54
Willow Creek DS	Willow Creek DS	1749.51	100 yr	5633.79	5632.69	1.10	1.14	0.02	5.46	407.85	83.69	76.14
Willow Creek DS	Willow Creek DS	1749.51	500 yr	5634.43	5633.02	1.41	1.21	0.01	12.03	571.19	144.78	86.30
Willow Creek DS	Willow Creek DS	1700.51*	2 yr	5630.55	5630.18	0.37	1.52	0.01		86.00		36.23

Willow Creek DS	Willow Creek DS	1700.51*	5 yr	5630.98	5630.48	0.50	1.57	0.01		166.00		40.53
Willow Creek DS	Willow Creek DS	1700.51*	10 yr	5631.30	5630.68	0.62	1.58	0.01	0.01	237.99		43.92
Willow Creek DS	Willow Creek DS	1700.51*	25 yr	5631.67	5630.91	0.76	1.57	0.03	0.65	332.21	0.14	50.51
Willow Creek DS	Willow Creek DS	1700.51*	50 yr	5631.94	5631.07	0.87	1.56	0.04	1.98	407.98	1.05	66.24
Willow Creek DS	Willow Creek DS	1700.51*	100 yr	5632.20	5631.22	0.98	1.54	0.04	4.32	488.68	4.00	71.85
Willow Creek DS	Willow Creek DS	1700.51*	500 yr	5632.83	5631.55	1.27	1.57	0.04	14.89	695.73	17.38	87.50
Willow Creek DS	Willow Creek DS	1651.51*	2 yr	5629.10	5628.85	0.25	1.38	0.03		86.00		46.62
Willow Creek DS	Willow Creek DS	1651.51*	5 yr	5629.47	5629.10	0.37	1.50	0.05		166.00		52.73
Willow Creek DS	Willow Creek DS	1651.51*	10 yr	5629.73	5629.30	0.43	1.51	0.06	0.00	238.00		58.19
Willow Creek DS	Willow Creek DS	1651.51*	25 yr	5630.05	5629.43	0.62	1.58	0.04	0.17	332.82	0.01	62.89
Willow Creek DS	Willow Creek DS	1651.51*	50 yr	5630.30	5629.52	0.79	1.62	0.02	0.63	410.33	0.05	68.60
Willow Creek DS	Willow Creek DS	1651.51*	100 yr	5630.56	5629.62	0.93	1.63	0.01	1.69	495.16	0.15	79.19
Willow Creek DS	Willow Creek DS	1651.51*	500 yr	5631.15	5629.88	1.27	1.68	0.00	11.64	715.54	0.82	87.28
Willow Creek DS	Willow Creek DS	1602.51	2 yr	5627.68	5627.51	0.17	0.89	0.00	5.57	80.43		76.99
Willow Creek DS	Willow Creek DS	1602.51	5 yr	5627.98	5627.77	0.21	0.88	0.00	16.06	149.94		92.53
Willow Creek DS	Willow Creek DS	1602.51	10 yr	5628.20	5627.96	0.23	0.87	0.01	25.72	212.28		110.92
Willow Creek DS	Willow Creek DS	1602.51	25 yr	5628.43	5628.12	0.31	0.86	0.01	36.49	296.51	0.01	124.64
Willow Creek DS	Willow Creek DS	1602.51	50 yr	5628.59	5628.24	0.35	0.83	0.01	50.12	360.84	0.04	125.66
Willow Creek DS	Willow Creek DS	1602.51	100 yr	5628.75	5628.36	0.39	0.81	0.01	65.58	431.31	0.12	126.65
Willow Creek DS	Willow Creek DS	1602.51	500 yr	5629.15	5628.66	0.49	0.76	0.02	109.62	617.80	0.57	129.23
Willow Creek DS	Willow Creek DS	1559.06*	2 yr	5626.78	5626.63	0.15	0.97	0.01	0.28	85.72		64.92
Willow Creek DS	Willow Creek DS	1559.06*	5 yr	5627.10	5626.86	0.24	0.95	0.01	2.59	163.40	0.01	96.11
Willow Creek DS	Willow Creek DS	1559.06*	10 yr	5627.31	5626.98	0.33			7.86	230.07	0.07	98.81
Willow Creek DS	Willow Creek DS	1559.06*	25 yr	5627.56	5627.16	0.40			17.87	314.83	0.30	102.36
Willow Creek DS	Willow Creek DS	1559.06*	50 yr	5627.75	5627.29	0.46	0.86	0.00	27.22	383.15	0.62	105.64
Willow Creek DS	Willow Creek DS	1559.06*	100 yr	5627.93	5627.42	0.51	0.83	0.00	38.67	457.21	1.12	107.78
Willow Creek DS	Willow Creek DS	1559.06*	500 yr	5628.38	5627.72	0.66	0.80	0.00	72.18	652.66	3.15	111.67
Willow Creek DS	Willow Creek DS	1515.61*	2 yr	5625.81	5625.61	0.21	1.10	0.03		85.97	0.03	54.11
Willow Creek DS	Willow Creek DS	1515.61*	5 yr	5626.15	5625.85	0.30	0.97	0.03	2.82	162.24	0.94	91.83
Willow Creek DS	Willow Creek DS	1515.61*	10 yr	5626.38	5626.03	0.35	0.93	0.00	9.16	225.29	3.55	100.03
Willow Creek DS	Willow Creek DS	1515.61*	25 yr	5626.64	5626.20	0.44	0.92	0.00	17.98	306.53	8.49	104.79
Willow Creek DS	Willow Creek DS	1515.61*	50 yr	5626.83	5626.32	0.51	0.91	0.01	25.93	371.52	13.55	107.86
Willow Creek DS	Willow Creek DS	1515.61*	100 yr	5627.02	5626.45	0.58	0.89	0.01	35.32	441.53	20.16	110.98
Willow Creek DS	Willow Creek DS	1515.61*	500 yr	5627.48	5626.75	0.74	0.88	0.01	61.62	625.28	41.11	118.10
Willow Creek DS	Willow Creek DS	1472.16	2 yr	5624.68	5624.57	0.11	0.87	0.00	0.39	59.40	26.21	98.42
Willow Creek DS	Willow Creek DS	1472.16	5 yr	5624.97	5624.79	0.18	0.84	0.00	3.54	114.86	47.60	102.92
Willow Creek DS	Willow Creek DS	1472.16	10 yr	5625.18	5624.93	0.25	0.83	0.00	7.28	164.16	66.56	105.80
Willow Creek DS	Willow Creek DS	1472.16	25 yr	5625.43	5625.11	0.32	0.81	0.00	13.20	228.58	91.22	111.15
Willow Creek DS	Willow Creek DS	1472.16	50 yr	5625.61	5625.24	0.37	0.81	0.01	20.06	280.06	110.88	112.00
Willow Creek DS	Willow Creek DS	1472.16	100 yr	5625.80	5625.39	0.41	0.79	0.01	28.32	336.34	132.34	112.92
Willow Creek DS	Willow Creek DS	1472.16	500 yr	5626.26	5625.75	0.51	0.77	0.02	52.30	485.52	190.18	114.69
Willow Creek DS	Willow Creek DS	1429.51*	2 yr	5623.81	5623.67	0.14	0.87	0.00		73.79	12.21	75.52
Willow Creek DS	Willow Creek DS	1429.51*	5 yr	5624.11	5623.89	0.22	0.87	0.00	0.07	144.00	21.92	84.46
Willow Creek DS	Willow Creek DS	1429.51*	10 yr	5624.34	5624.06	0.29	0.87	0.00	0.70	206.28	31.01	89.33
Willow Creek DS	Willow Creek DS	1429.51*	25 yr	5624.61	5624.25	0.36	0.87	0.01	2.07	287.32	43.61	93.06
Willow Creek DS	Willow Creek DS	1429.51*	50 yr	5624.80	5624.37	0.43	0.86	0.01	3.14	353.58	54.28	96.36
Willow Creek DS	Willow Creek DS	1429.51*	100 yr	5625.00	5624.50	0.50	0.86	0.01	4.38	426.65	65.97	102.61
Willow Creek DS	Willow Creek DS	1429.51*	500 yr	5625.48	5624.79	0.69	0.85	0.00	10.73	620.04	97.23	113.70
Willow Creek DS	Willow Creek DS	1386.87*	2 yr	5622.94	5622.80	0.14	0.95	0.00		86.00	0.00	66.63
Willow Creek DS	Willow Creek DS	1386.87*	5 yr	5623.24	5623.01	0.23	0.97	0.00		165.90	0.10	70.19
Willow Creek DS	Willow Creek DS	1386.87*	10 yr	5623.47	5623.15	0.32	0.98	0.00	0.04	237.66	0.31	72.30
Willow Creek DS	Willow Creek DS	1386.87*	25 yr	5623.73	5623.30	0.43	1.00	0.01	0.29	331.96	0.76	75.31
Willow Creek DS	Willow Creek DS	1386.87*	50 yr	5623.93	5623.44	0.49	0.96	0.01	0.92	408.77	1.32	77.24
Willow Creek DS	Willow Creek DS	1386.87*	100 yr	5624.13	5623.56	0.57	0.93	0.02	1.86	493.06	2.08	77.95
Willow Creek DS	Willow Creek DS	1386.87*	500 yr	5624.63	5623.90	0.72	0.85	0.02	5.37	717.72	4.91	80.04
Willow Creek DS	Willow Creek DS	1344.23	2 yr	5622.00	5621.85	0.15	1.04	0.00		86.00		75.96
Willow Creek DS	Willow Creek DS	1344.23	5 yr	5622.28	5622.04	0.24	1.03	0.00		166.00	0.00	79.37
Willow Creek DS	Willow Creek DS	1344.23	10 yr	5622.48	5622.18	0.30	1.01	0.00		237.98	0.02	80.90
Willow Creek DS	Willow Creek DS	1344.23	25 yr	5622.73	5622.33	0.40			0.00	332.88	0.12	82.50
Willow Creek DS	Willow Creek DS	1344.23	50 yr	5622.91	5622.42	0.50	1.02	0.00	0.03	410.74	0.23	83.38
Willow Creek DS	Willow Creek DS	1344.23	100 yr	5623.10	5622.51	0.59	1.04	0.00	0.13	496.47	0.40	84.40
Willow Creek DS	Willow Creek DS	1344.23	500 yr	5623.58	5622.73	0.84	1.03	0.01	0.68	726.22	1.10	88.00

Willow Creek DS	Willow Creek DS	1302.67*	2 yr	5620.96	5620.82	0.15	1.05	0.00		86.00		71.42
Willow Creek DS	Willow Creek DS	1302.67*	5 yr	5621.25	5621.02	0.24	1.04	0.00		166.00		74.60
Willow Creek DS	Willow Creek DS	1302.67*	10 yr	5621.47	5621.15	0.32	1.03	0.00		238.00		77.21
Willow Creek DS	Willow Creek DS	1302.67*	25 yr	5621.72	5621.31	0.40	1.02	0.00		332.99	0.01	79.99
Willow Creek DS	Willow Creek DS	1302.67*	50 yr	5621.90	5621.39	0.51	1.05	0.01		410.97	0.03	81.33
Willow Creek DS	Willow Creek DS	1302.67*	100 yr	5622.09	5621.51	0.58	1.04	0.02	0.02	496.88	0.11	83.25
Willow Creek DS	Willow Creek DS	1302.67*	500 yr	5622.55	5621.80	0.75	1.05	0.05	0.59	726.83	0.58	88.71
Willow Creek DS	Willow Creek DS	1261.11*	2 yr	5619.92	5619.76	0.16	1.07	0.00		86.00		67.63
Willow Creek DS	Willow Creek DS	1261.11*	5 yr	5620.22	5619.95	0.27	1.05	0.00		166.00		70.16
Willow Creek DS	Willow Creek DS	1261.11*	10 yr	5620.44	5620.10	0.34	1.05	0.00		238.00		72.15
Willow Creek DS	Willow Creek DS	1261.11*	25 yr	5620.70	5620.26	0.44	1.02	0.00		333.00		74.38
Willow Creek DS	Willow Creek DS	1261.11*	50 yr	5620.90	5620.32	0.58	1.09	0.01		411.00		76.32
Willow Creek DS	Willow Creek DS	1261.11*	100 yr	5621.08	5620.52	0.56	1.03	0.02		496.99	0.01	80.88
Willow Creek DS	Willow Creek DS	1261.11*	500 yr	5621.54	5620.81	0.72	1.01	0.01	0.30	727.48	0.21	87.24
Willow Creek DS	Willow Creek DS	1219.56*	2 yr	5618.85	5618.69	0.17	1.09	0.00		86.00		61.95
Willow Creek DS	Willow Creek DS	1219.56*	5 yr	5619.17	5618.90	0.26	1.06	0.00		166.00		67.09
Willow Creek DS	Willow Creek DS	1219.56*	10 yr	5619.40	5619.05	0.35				238.00		68.58
Willow Creek DS	Willow Creek DS	1219.56*	25 yr	5619.67	5619.23	0.44	1.03	0.00		333.00		70.55
Willow Creek DS	Willow Creek DS	1219.56*	50 yr	5619.87	5619.36	0.51	0.96	0.00		411.00		71.77
Willow Creek DS	Willow Creek DS	1219.56*	100 yr	5620.07	5619.50	0.56	1.01	0.00		497.00		75.74
Willow Creek DS	Willow Creek DS	1219.56*	500 yr	5620.53	5619.79	0.74	1.01	0.00	0.03	727.95	0.03	84.48
Willow Creek DS	Willow Creek DS	1178.00*	2 yr	5617.77	5617.58	0.19	1.08	0.00		86.00		55.26
Willow Creek DS	Willow Creek DS	1178.00*	5 yr	5618.11	5617.81	0.30	1.07	0.00		166.00		62.17
Willow Creek DS	Willow Creek DS	1178.00*	10 yr	5618.35	5617.98	0.37	1.05	0.00		238.00		65.47
Willow Creek DS	Willow Creek DS	1178.00*	25 yr	5618.63	5618.14	0.48	1.04	0.00		333.00		66.99
Willow Creek DS	Willow Creek DS	1178.00*	50 yr	5618.83	5618.28	0.56	1.03	0.00		411.00		68.17
Willow Creek DS	Willow Creek DS	1178.00*	100 yr	5619.04	5618.41	0.63	1.02	0.01		497.00		69.33
Willow Creek DS	Willow Creek DS	1178.00*	500 yr	5619.52	5618.78	0.74	1.01	0.00	1.60	726.40		84.91
Willow Creek DS	Willow Creek DS	1136.45	2 yr	5616.69	5616.50	0.19	0.93	0.00		86.00		53.65
Willow Creek DS	Willow Creek DS	1136.45	5 yr	5617.03	5616.73	0.30	0.90	0.01		166.00		58.23
Willow Creek DS	Willow Creek DS	1136.45	10 yr	5617.29	5616.91	0.37	0.89	0.00		238.00		61.66
Willow Creek DS	Willow Creek DS	1136.45	25 yr	5617.57	5617.09	0.48	1.06	0.00	0.17	332.83		68.97
Willow Creek DS	Willow Creek DS	1136.45	50 yr	5617.78	5617.22	0.56	1.05	0.00	0.80	410.20		70.75
Willow Creek DS	Willow Creek DS	1136.45	100 yr	5617.99	5617.36	0.64	1.04	0.00	1.86	495.14		72.56
Willow Creek DS	Willow Creek DS	1136.45	500 yr	5618.50	5617.66	0.85	1.02	0.01	5.74	722.26		76.43
Willow Creek DS	Willow Creek DS	1095.93*	2 yr	5615.75	5615.57	0.18	0.93	0.00		86.00		49.28
Willow Creek DS	Willow Creek DS	1095.93*	5 yr	5616.12	5615.84	0.28	0.90	0.01		166.00		53.76
Willow Creek DS	Willow Creek DS	1095.93*	10 yr	5616.39	5616.03	0.36	0.87	0.01		238.00		56.61
Willow Creek DS	Willow Creek DS	1095.93*	25 yr	5616.70	5616.11	0.60	0.97	0.00		333.00		57.84
Willow Creek DS	Willow Creek DS	1095.93*	50 yr	5616.92	5616.29	0.64	0.94	0.00		411.00		59.39
Willow Creek DS	Willow Creek DS	1095.93*	100 yr	5617.15	5616.47	0.68	0.92	0.01	0.18	496.82		66.23
Willow Creek DS	Willow Creek DS	1095.93*	500 yr	5617.65	5616.88	0.78	0.89	0.05	4.11	723.89		81.25
Willow Creek DS	Willow Creek DS	1055.41*	2 yr	5614.82	5614.60	0.22	0.91	0.00		86.00		43.81
Willow Creek DS	Willow Creek DS	1055.41*	5 yr	5615.22	5614.86	0.35				166.00		47.67
Willow Creek DS	Willow Creek DS	1055.41*	10 yr	5615.50	5615.08	0.43	0.85	0.01		238.00		50.68
Willow Creek DS	Willow Creek DS	1055.41*	25 yr	5615.83	5615.30	0.53	0.83	0.01		333.00		53.41
Willow Creek DS	Willow Creek DS	1055.41*	50 yr	5616.06	5615.49	0.57				411.00		57.38
Willow Creek DS	Willow Creek DS	1055.41*	100 yr	5616.30	5615.58	0.73	0.92	0.01		497.00		58.62
Willow Creek DS	Willow Creek DS	1055.41*	500 yr	5616.83	5616.10	0.73	0.81	0.01	3.11	724.88	0.01	100.17
Willow Creek DS	Willow Creek DS	1014.89*	2 yr	5613.91	5613.70	0.22	0.91	0.01		86.00		39.09
Willow Creek DS	Willow Creek DS	1014.89*	5 yr	5614.35	5614.04	0.31	0.86	0.01		166.00		44.14
Willow Creek DS	Willow Creek DS	1014.89*	10 yr	5614.65	5614.25	0.40	0.84	0.01		238.00		48.08
Willow Creek DS	Willow Creek DS	1014.89*	25 yr	5614.99	5614.50	0.48	0.81	0.01		333.00		50.99
Willow Creek DS	Willow Creek DS	1014.89*	50 yr	5615.23	5614.67	0.56	0.79	0.01		411.00		52.79
Willow Creek DS	Willow Creek DS	1014.89*	100 yr	5615.48	5614.79	0.68	0.68	0.03		497.00		54.04
Willow Creek DS	Willow Creek DS	1014.89*	500 yr	5616.05	5615.17	0.88	0.77	0.02	3.62	724.34	0.04	92.66
Willow Creek DS	Willow Creek DS	974.38	2 yr	5613.01	5612.73	0.28	1.11	0.00		86.00		33.11
Willow Creek DS	Willow Creek DS	974.38	5 yr	5613.47	5613.06	0.41	1.07	0.01		166.00		39.54
Willow Creek DS	Willow Creek DS	974.38	10 yr	5613.79	5613.30	0.49	1.02	0.00		238.00		41.83
Willow Creek DS	Willow Creek DS	974.38	25 yr	5614.16	5613.56	0.60	0.95	0.00		333.00		44.05
Willow Creek DS	Willow Creek DS	974.38	50 yr	5614.43	5613.77	0.66	0.93	0.00		411.00		45.77
Willow Creek DS	Willow Creek DS	974.38	100 yr	5614.71	5614.01	0.69	0.78	0.00	1.22	495.77	0.00	137.48
Willow Creek DS	Willow Creek DS	974.38	500 yr	5615.22	5614.29	0.94	0.83	0.01	34.16	693.73	0.12	169.58

Willow Creek DS	Willow Creek DS	930.657*	2 yr	5611.90	5611.63	0.27	1.10	0.01		86.00		34.86
Willow Creek DS	Willow Creek DS	930.657*	5 yr	5612.35	5611.94	0.41	1.12	0.00		166.00		40.36
Willow Creek DS	Willow Creek DS	930.657*	10 yr	5612.68	5612.12	0.56	1.11	0.01		238.00		42.10
Willow Creek DS	Willow Creek DS	930.657*	25 yr	5613.05	5612.34	0.72	1.10	0.01		333.00		43.76
Willow Creek DS	Willow Creek DS	930.657*	50 yr	5613.34	5612.47	0.86	1.09	0.02		411.00		44.82
Willow Creek DS	Willow Creek DS	930.657*	100 yr	5613.63	5612.61	1.02	1.04	0.03		497.00		45.85
Willow Creek DS	Willow Creek DS	930.657*	500 yr	5614.20	5613.04	1.16	1.00	0.02	15.69	712.19	0.12	119.28
Willow Creek DS	Willow Creek DS	886.935*	2 yr	5610.80	5610.55	0.25	1.13	0.00		86.00		38.01
Willow Creek DS	Willow Creek DS	886.935*	5 yr	5611.23	5610.83	0.40	1.12	0.00		166.00		41.42
Willow Creek DS	Willow Creek DS	886.935*	10 yr	5611.56	5610.98	0.57	1.17	0.01		238.00		42.54
Willow Creek DS	Willow Creek DS	886.935*	25 yr	5611.91	5611.31	0.61	1.12	0.03		333.00		44.85
Willow Creek DS	Willow Creek DS	886.935*	50 yr	5612.18	5611.51	0.67	1.10	0.06	0.10	410.90	0.00	73.71
Willow Creek DS	Willow Creek DS	886.935*	100 yr	5612.43	5611.67	0.76	1.13	0.08	4.90	492.08	0.02	105.54
Willow Creek DS	Willow Creek DS	886.935*	500 yr	5613.05	5611.88	1.17	1.16	0.00	25.36	702.47	0.17	120.42
Willow Creek DS	Willow Creek DS	843.212*	2 yr	5609.67	5609.42	0.25	1.02	0.01		86.00		39.82
Willow Creek DS	Willow Creek DS	843.212*	5 yr	5610.10	5609.69	0.40	1.14	0.00		166.00		41.84
Willow Creek DS	Willow Creek DS	843.212*	10 yr	5610.42	5609.89	0.53	1.15	0.03		238.00		43.17
Willow Creek DS	Willow Creek DS	843.212*	25 yr	5610.79	5610.09	0.70	1.11	0.01		333.00		44.46
Willow Creek DS	Willow Creek DS	843.212*	50 yr	5611.07	5610.23	0.84	1.08	0.02	0.03	410.97		53.71
Willow Creek DS	Willow Creek DS	843.212*	100 yr	5611.34	5610.38	0.96	1.08	0.02	3.52	493.47	0.01	106.01
Willow Creek DS	Willow Creek DS	843.212*	500 yr	5611.87	5610.72	1.15	1.18	0.00	37.92	689.84	0.24	128.64
Willow Creek DS	Willow Creek DS	799.49	2 yr	5608.55	5608.35	0.21	0.76	0.00		86.00		40.76
Willow Creek DS	Willow Creek DS	799.49	5 yr	5608.97	5608.64	0.33	0.80	0.00		166.00		42.65
Willow Creek DS	Willow Creek DS	799.49	10 yr	5609.28	5608.77	0.51	1.14	0.01		238.00		43.48
Willow Creek DS	Willow Creek DS	799.49	25 yr	5609.64	5609.03	0.61	1.13	0.03	0.40	332.60	0.00	80.07
Willow Creek DS	Willow Creek DS	799.49	50 yr	5609.89	5609.17	0.71	1.15	0.04	5.71	405.28	0.01	112.18
Willow Creek DS	Willow Creek DS	799.49	100 yr	5610.12	5609.29	0.83	1.18	0.04	15.78	481.17	0.05	118.78
Willow Creek DS	Willow Creek DS	799.49	500 yr	5610.67	5609.54	1.13	1.19	0.01	54.73	672.96	0.31	136.47
Willow Creek DS	Willow Creek DS	764.03*	2 yr	5607.79	5607.58	0.21	0.70	0.02		86.00		45.20
Willow Creek DS	Willow Creek DS	764.03*	5 yr	5608.17	5607.82	0.35	0.68	0.04		166.00		48.72
Willow Creek DS	Willow Creek DS	764.03*	10 yr	5608.46	5607.97	0.49	0.86	0.02		238.00		50.78
Willow Creek DS	Willow Creek DS	764.03*	25 yr	5608.77	5608.20	0.57	0.86	0.01	3.32	329.66	0.03	80.99
Willow Creek DS	Willow Creek DS	764.03*	50 yr	5609.00	5608.33	0.68	0.87	0.01	8.32	402.58	0.10	89.22
Willow Creek DS	Willow Creek DS	764.03*	100 yr	5609.22	5608.48	0.74	0.88	0.03	17.93	478.81	0.26	91.05
Willow Creek DS	Willow Creek DS	764.03*	500 yr	5609.73	5608.85	0.87	0.87	0.08	49.98	676.97	1.05	100.62
Willow Creek DS	Willow Creek DS	728.57	2 yr	5607.08	5606.93	0.15	0.55	0.01		86.00		54.59
Willow Creek DS	Willow Creek DS	728.57	5 yr	5607.42	5607.20	0.21	0.51	0.01	3.52	162.45	0.03	85.76
Willow Creek DS	Willow Creek DS	728.57	10 yr	5607.65	5607.39	0.27	0.47	0.02	9.97	227.88	0.15	87.65
Willow Creek DS	Willow Creek DS	728.57	25 yr	5607.94	5607.62	0.32	0.43	0.02	19.23	313.27	0.50	96.19
Willow Creek DS	Willow Creek DS	728.57	50 yr	5608.15	5607.80	0.35	0.40	0.03	30.10	379.96	0.94	99.06
Willow Creek DS	Willow Creek DS	728.57	100 yr	5608.37	5607.99	0.38	0.37	0.03	42.18	453.15	1.67	103.43
Willow Creek DS	Willow Creek DS	728.57	500 yr	5608.88	5608.44	0.44	0.32	0.04	80.06	643.12	4.82	111.91
Willow Creek DS	Willow Creek DS	702.95*	2 yr	5606.53	5606.31	0.22	0.53	0.02		86.00		47.63
Willow Creek DS	Willow Creek DS	702.95*	5 yr	5606.90	5606.55	0.35	0.51	0.03	0.00	165.86	0.14	54.36
Willow Creek DS	Willow Creek DS	702.95*	10 yr	5607.17	5606.74	0.43	0.49	0.03	0.15	236.98	0.87	59.02
Willow Creek DS	Willow Creek DS	702.95*	25 yr	5607.49	5606.95	0.54	0.46	0.05	0.75	329.60	2.65	62.11
Willow Creek DS	Willow Creek DS	702.95*	50 yr	5607.72	5607.12	0.60	0.45	0.04	1.62	404.72	4.66	64.98
Willow Creek DS	Willow Creek DS	702.95*	100 yr	5607.96	5607.29	0.67	0.42	0.05	3.05	486.73	7.22	68.21
Willow Creek DS	Willow Creek DS	702.95*	500 yr	5608.53	5607.73	0.79	0.45	0.00	11.71	700.37	15.92	89.98
Willow Creek DS	Willow Creek DS	677.33	2 yr	5605.98	5605.82	0.15	0.86	0.01		79.60	6.40	58.94
Willow Creek DS	Willow Creek DS	677.33	5 yr	5606.35	5606.12	0.23	0.79	0.02	0.01	151.95	14.05	68.55
Willow Creek DS	Willow Creek DS	677.33	10 yr	5606.62	5606.30	0.31	0.75	0.01	0.10	216.25	21.65	74.09
Willow Creek DS	Willow Creek DS	677.33	25 yr	5606.92	5606.54	0.39	0.73	0.02	0.44	297.57	34.99	78.17
Willow Creek DS	Willow Creek DS	677.33	50 yr	5607.14	5606.68	0.45	0.70	0.01	0.86	363.56	46.59	80.00
Willow Creek DS	Willow Creek DS	677.33	100 yr	5607.37	5606.87	0.50	0.69	0.02	1.58	434.80	60.62	82.27
Willow Creek DS	Willow Creek DS	677.33	500 yr	5607.95	5607.14	0.80	0.71	0.00	3.62	644.69	79.69	110.73
Willow Creek DS	Willow Creek DS	636.875*	2 yr	5605.11	5604.81	0.30	0.93	0.02		86.00		33.54
Willow Creek DS	Willow Creek DS	636.875*	5 yr	5605.55	5605.17	0.39	0.92	0.00		166.00		43.02
Willow Creek DS	Willow Creek DS	636.875*	10 yr	5605.85	5605.42	0.43	0.89	0.00		237.34	0.66	57.58
Willow Creek DS	Willow Creek DS	636.875*	25 yr	5606.18	5605.63	0.55	0.81	0.02	0.03	329.42	3.55	63.08
Willow Creek DS	Willow Creek DS	636.875*	50 yr	5606.42	5605.81	0.60	0.82	0.00	0.26	403.36	7.38	67.00
Willow Creek DS	Willow Creek DS	636.875*	100 yr	5606.66	5605.96	0.70	0.82	0.00	0.71	484.52	11.76	70.13

Willow Creek DS	Willow Creek DS	636.875*	500 yr	5607.23	5606.42	0.81	0.69	0.00	3.86	692.98	31.16	89.15
Willow Creek DS	Willow Creek DS	596.42	2 yr	5604.15	5603.90	0.24	1.01	0.00		86.00		31.80
Willow Creek DS	Willow Creek DS	596.42	5 yr	5604.63	5604.25	0.38	0.99	0.01		166.00		37.62
Willow Creek DS	Willow Creek DS	596.42	10 yr	5604.96	5604.49	0.47	0.98	0.02		238.00		42.67
Willow Creek DS	Willow Creek DS	596.42	25 yr	5605.33	5604.83	0.49	1.01	0.01		333.00	0.00	49.73
Willow Creek DS	Willow Creek DS	596.42	50 yr	5605.57	5604.97	0.61	1.00	0.00		410.95	0.05	52.97
Willow Creek DS	Willow Creek DS	596.42	100 yr	5605.82	5605.10	0.72	0.84	0.00	0.52	496.21	0.28	66.80
Willow Creek DS	Willow Creek DS	596.42	500 yr	5606.42	5605.42	1.00	0.79	0.02	6.41	719.44	2.15	80.85
Willow Creek DS	Willow Creek DS	547.132*	2 yr	5603.14	5602.87	0.28	0.96	0.02		86.00		30.55
Willow Creek DS	Willow Creek DS	547.132*	5 yr	5603.63	5603.28	0.35	1.02	0.00		166.00		39.57
Willow Creek DS	Willow Creek DS	547.132*	10 yr	5603.96	5603.56	0.40	1.02	0.01		238.00		45.34
Willow Creek DS	Willow Creek DS	547.132*	25 yr	5604.31	5603.72	0.59	1.02	0.02		332.97	0.03	48.88
Willow Creek DS	Willow Creek DS	547.132*	50 yr	5604.57	5603.92	0.64	0.94	0.01	0.04	409.86	1.10	63.02
Willow Creek DS	Willow Creek DS	547.132*	100 yr	5604.82	5604.09	0.73	1.01	0.00	0.50	492.24	4.25	72.70
Willow Creek DS	Willow Creek DS	547.132*	500 yr	5605.40	5604.51	0.89	0.99	0.04	7.24	700.90	19.86	130.85
Willow Creek DS	Willow Creek DS	497.845*	2 yr	5602.17	5601.95	0.22	1.08	0.01		85.87	0.13	36.98
Willow Creek DS	Willow Creek DS	497.845*	5 yr	5602.61	5602.24	0.37	1.13	0.01		164.43	1.57	46.49
Willow Creek DS	Willow Creek DS	497.845*	10 yr	5602.92	5602.43	0.50	1.16	0.02		234.94	3.06	58.26
Willow Creek DS	Willow Creek DS	497.845*	25 yr	5603.25	5602.72	0.53	1.17	0.01	0.03	320.28	12.69	74.08
Willow Creek DS	Willow Creek DS	497.845*	50 yr	5603.50	5602.80	0.70	1.06	0.01	0.08	392.05	18.87	75.11
Willow Creek DS	Willow Creek DS	497.845*	100 yr	5603.75	5602.94	0.81	1.06	0.01	0.22	467.53	29.25	83.21
Willow Creek DS	Willow Creek DS	497.845*	500 yr	5604.33	5603.22	1.10	1.06	0.02	3.00	661.51	63.49	142.58
Willow Creek DS	Willow Creek DS	448.557*	2 yr	5601.08	5600.80	0.27	1.26	0.05		79.20	6.80	53.70
Willow Creek DS	Willow Creek DS	448.557*	5 yr	5601.47	5601.13	0.34	1.11	0.04		146.22	19.78	67.84
Willow Creek DS	Willow Creek DS	448.557*	10 yr	5601.74	5601.33	0.42	1.05	0.05	0.00	204.63	33.37	73.17
Willow Creek DS	Willow Creek DS	448.557*	25 yr	5602.07	5601.43	0.65	1.11	0.11	0.01	282.66	50.33	74.09
Willow Creek DS	Willow Creek DS	448.557*	50 yr	5602.30	5601.65	0.65	1.18	0.02	0.12	344.54	66.34	126.49
Willow Creek DS	Willow Creek DS	448.557*	100 yr	5602.50	5601.77	0.73	1.22	0.02	0.43	404.61	91.95	133.47
Willow Creek DS	Willow Creek DS	448.557*	500 yr	5602.96	5602.04	0.92	1.32	0.06	3.28	556.23	168.50	160.13
Willow Creek DS	Willow Creek DS	399.27	2 yr	5599.77	5599.65	0.12	1.02	0.01		45.40	40.60	59.69
Willow Creek DS	Willow Creek DS	399.27	5 yr	5600.16	5599.96	0.20	1.04	0.01		100.16	65.84	70.94
Willow Creek DS	Willow Creek DS	399.27	10 yr	5600.45	5600.18	0.26	1.03	0.02	0.01	152.59	85.40	135.09
Willow Creek DS	Willow Creek DS	399.27	25 yr	5600.70	5600.41	0.28	0.94	0.03	0.41	202.04	130.55	147.31
Willow Creek DS	Willow Creek DS	399.27	50 yr	5600.85	5600.49	0.36	0.89	0.02	1.10	245.06	164.84	153.26
Willow Creek DS	Willow Creek DS	399.27	100 yr	5601.02	5600.60	0.41	0.86	0.01	2.92	289.47	204.60	169.95
Willow Creek DS	Willow Creek DS	399.27	500 yr	5601.43	5600.71	0.73	1.47	0.06	8.01	415.56	304.43	177.97
Willow Creek DS	Willow Creek DS	350.817*	2 yr	5598.74	5598.55	0.19	1.17	0.01		73.15	12.85	57.64
Willow Creek DS	Willow Creek DS	350.817*	5 yr	5599.12	5598.80	0.32	1.14	0.01		139.10	26.90	64.38
Willow Creek DS	Willow Creek DS	350.817*	10 yr	5599.40	5598.99	0.42	1.11	0.00		198.96	39.04	72.95
Willow Creek DS	Willow Creek DS	350.817*	25 yr	5599.73	5599.19	0.54	1.13	0.00	0.20	276.53	56.27	86.06
Willow Creek DS	Willow Creek DS	350.817*	50 yr	5599.94	5599.43	0.51	0.89	0.00	2.20	332.09	76.71	130.24
Willow Creek DS	Willow Creek DS	350.817*	100 yr	5600.15	5599.62	0.53	0.80	0.01	7.85	390.02	99.14	144.99
Willow Creek DS	Willow Creek DS	350.817*	500 yr	5600.57	5600.02	0.55	0.64	0.00	35.15	521.32	171.53	257.36
Willow Creek DS	Willow Creek DS	302.365*	2 yr	5597.55	5597.28	0.27	1.29	0.00		85.64	0.36	40.30
Willow Creek DS	Willow Creek DS	302.365*	5 yr	5597.98	5597.61	0.37	1.19	0.00		162.96	3.04	59.82
Willow Creek DS	Willow Creek DS	302.365*	10 yr	5598.26	5597.81	0.45	1.14	0.00	0.11	228.65	9.24	68.22
Willow Creek DS	Willow Creek DS	302.365*	25 yr	5598.58	5598.01	0.57	1.15	0.00	1.26	313.57	18.18	81.42
Willow Creek DS	Willow Creek DS	302.365*	50 yr	5598.84	5598.10	0.74	1.09	0.02	2.60	384.06	24.34	92.94
Willow Creek DS	Willow Creek DS	302.365*	100 yr	5599.08	5598.22	0.86	1.04	0.03	5.18	458.87	32.94	100.03
Willow Creek DS	Willow Creek DS	302.365*	500 yr	5599.60	5598.53	1.06	0.92	0.05	19.42	642.42	66.16	149.73
Willow Creek DS	Willow Creek DS	253.912*	2 yr	5596.26	5596.00	0.26	1.29	0.00		86.00		37.16
Willow Creek DS	Willow Creek DS	253.912*	5 yr	5596.69	5596.26	0.43	1.29	0.01		166.00		42.92
Willow Creek DS	Willow Creek DS	253.912*	10 yr	5597.00	5596.45	0.56	1.25	0.01	0.14	237.86		50.12
Willow Creek DS	Willow Creek DS	253.912*	25 yr	5597.34	5596.68	0.66	1.24	0.01	2.62	330.33	0.05	61.86
Willow Creek DS	Willow Creek DS	253.912*	50 yr	5597.57	5596.89	0.68	1.24	0.02	6.51	402.57	1.92	80.32
Willow Creek DS	Willow Creek DS	253.912*	100 yr	5597.80	5597.06	0.74	1.24	0.04	10.91	480.26	5.83	89.50
Willow Creek DS	Willow Creek DS	253.912*	500 yr	5598.33	5597.37	0.96	1.24	0.03	30.14	680.26	17.60	157.36
Willow Creek DS	Willow Creek DS	205.46	2 yr	5594.96	5594.70	0.26				86.00		38.09
Willow Creek DS	Willow Creek DS	205.46	5 yr	5595.39	5594.95	0.44	1.36	0.02		166.00		43.98
Willow Creek DS	Willow Creek DS	205.46	10 yr	5595.67	5595.22	0.45	1.31	0.03	1.76	236.24		58.87
Willow Creek DS	Willow Creek DS	205.46	25 yr	5596.00	5595.39	0.61	1.33	0.02	4.93	328.07		61.87
Willow Creek DS	Willow Creek DS	205.46	50 yr	5596.25	5595.48	0.77	1.32	0.01	7.74	403.26		63.55

Willow Creek DS	Willow Creek DS	205.46	100 yr	5596.49	5595.63	0.86	1.29	0.01	12.07	484.93		66.43
Willow Creek DS	Willow Creek DS	205.46	500 yr	5597.04	5595.98	1.06	1.27	0.01	30.17	697.82	0.01	118.12
Side Channel	Side Channel	1587.33	2 yr	5722.76	5722.60	0.16	1.67	0.00	2.64	3.73	0.63	9.97
Side Channel	Side Channel	1587.33	5 yr	5723.03	5722.80	0.23	1.61	0.00	5.53	6.73	1.74	13.25
Side Channel	Side Channel	1587.33	10 yr	5723.21	5722.95	0.26	1.53	0.00	8.14	8.95	2.91	16.54
Side Channel	Side Channel	1587.33	25 yr	5723.37	5723.10	0.27	1.40	0.00	12.16	11.37	4.47	19.15
Side Channel	Side Channel	1587.33	50 yr	5723.50	5723.21	0.29	1.38	0.00	15.82	13.32	5.86	20.63
Side Channel	Side Channel	1587.33	100 yr	5723.62	5723.31	0.31	1.34	0.00	20.11	15.42	7.47	21.86
Side Channel	Side Channel	1587.33	500 yr	5723.90	5723.51	0.39	1.39	0.00	31.23	20.91	11.86	24.71
Side Channel	Side Channel	1538.86*	2 yr	5720.11	5719.77	0.35	2.63	0.02	2.20	4.05	0.74	8.32
Side Channel	Side Channel	1538.86*	5 yr	5720.42	5719.93	0.49	2.58	0.03	4.84	7.19	1.97	10.42
Side Channel	Side Channel	1538.86*	10 yr	5720.66	5720.02	0.64	2.50	0.04	7.05	9.79	3.17	11.95
Side Channel	Side Channel	1538.86*	25 yr	5720.91	5720.12	0.79	2.41	0.05	10.32	12.84	4.84	13.30
Side Channel	Side Channel	1538.86*	50 yr	5721.08	5720.20	0.87	2.36	0.06	13.22	15.34	6.44	14.71
Side Channel	Side Channel	1538.86*	100 yr	5721.23	5720.30	0.93	2.32	0.06	16.68	17.98	8.34	16.37
Side Channel	Side Channel	1538.86*	500 yr	5721.50	5720.51	0.99	2.34	0.06	26.34	23.85	13.82	19.82
Side Channel	Side Channel	1490.40*	2 yr	5717.32	5717.11	0.22	2.74	0.04	1.36	4.51	1.13	8.92
Side Channel	Side Channel	1490.40*	5 yr	5717.61	5717.30	0.31	2.75	0.06	3.19	7.99	2.81	11.78
Side Channel	Side Channel	1490.40*	10 yr	5717.79	5717.44	0.35	2.79	0.09	5.20	10.59	4.20	14.00
Side Channel	Side Channel	1490.40*	25 yr	5717.99	5717.59	0.40	2.81	0.12	7.76	13.76	6.48	16.92
Side Channel	Side Channel	1490.40*	50 yr	5718.13	5717.69	0.44	2.82	0.13	10.04	16.34	8.62	19.18
Side Channel	Side Channel	1490.40*	100 yr	5718.27	5717.78	0.48	2.83	0.13	12.58	19.02	11.40	20.88
Side Channel	Side Channel	1490.40*	500 yr	5718.56	5717.97	0.59	2.83	0.12	19.36	25.34	19.30	23.50
Side Channel	Side Channel	1441.94*	2 yr	5714.66	5714.26	0.40	2.65	0.02	0.46	5.91	0.63	7.15
Side Channel	Side Channel	1441.94*	5 yr	5715.00	5714.43	0.57	2.59	0.03	1.36	10.78	1.86	9.36
Side Channel	Side Channel	1441.94*	10 yr	5715.25	5714.55	0.71	2.51	0.04	2.41	14.83	2.76	12.42
Side Channel	Side Channel	1441.94*	25 yr	5715.48	5714.66	0.82	2.46	0.04	4.06	19.38	4.56	15.47
Side Channel	Side Channel	1441.94*	50 yr	5715.62	5714.75	0.88	2.46	0.04	5.41	22.84	6.75	17.57
Side Channel	Side Channel	1441.94*	100 yr	5715.75	5714.83	0.92	2.47	0.04	6.83	26.40	9.77	19.04
Side Channel	Side Channel	1441.94*	500 yr	5716.01	5715.02	0.98	2.50	0.04	10.72	34.61	18.67	21.58
Side Channel	Side Channel	1393.48	2 yr	5711.83	5711.58	0.25	2.78	0.04	0.23	6.08	0.68	7.43
Side Channel	Side Channel	1393.48	5 yr	5712.15	5711.76	0.39	2.80	0.05	0.77	11.18	2.05	16.54
Side Channel	Side Channel	1393.48	10 yr	5712.30	5711.84	0.46	2.87	0.07	1.36	14.44	4.21	17.93
Side Channel	Side Channel	1393.48	25 yr	5712.46	5711.94	0.52	2.92	0.09	2.20	18.34	7.46	19.21
Side Channel	Side Channel	1393.48	50 yr	5712.59	5712.02	0.57	2.94	0.09	2.94	21.61	10.46	20.36
Side Channel	Side Channel	1393.48	100 yr	5712.72	5712.09	0.63	2.95	0.09	3.70	25.01	14.29	20.86
Side Channel	Side Channel	1393.48	500 yr	5713.00	5712.25	0.75	2.93	0.07	5.89	33.43	24.68	21.96
Side Channel	Side Channel	1345.26*	2 yr	5709.39	5709.18	0.22	2.43	0.01	0.75	4.06	2.19	12.00
Side Channel	Side Channel	1345.26*	5 yr	5709.62	5709.32	0.30	2.50	0.03	1.90	7.04	5.06	16.77
Side Channel	Side Channel	1345.26*	10 yr	5709.77	5709.43	0.34	2.49	0.04	3.07	9.44	7.49	20.72
Side Channel	Side Channel	1345.26*	25 yr	5709.90	5709.53	0.37	2.52	0.04	4.55	11.84	11.60	22.22
Side Channel	Side Channel	1345.26*	50 yr	5710.00	5709.60	0.40	2.54	0.05	5.82	13.78	15.39	23.01
Side Channel	Side Channel	1345.26*	100 yr	5710.10	5709.68	0.42	2.55	0.06	7.18	15.91	19.91	23.92
Side Channel	Side Channel	1345.26*	500 yr	5710.34	5709.85	0.49	2.59	0.08	10.81	21.17	32.02	25.93
Side Channel	Side Channel	1297.05*	2 yr	5706.96	5706.84	0.12	2.41	0.03	0.97	3.85	2.17	17.57
Side Channel	Side Channel	1297.05*	5 yr	5707.14	5706.96	0.17	2.45	0.04	2.22	6.73	5.04	20.85
Side Channel	Side Channel	1297.05*	10 yr	5707.28	5707.03	0.25	2.43	0.02	3.43	9.41	7.16	24.62
Side Channel	Side Channel	1297.05*	25 yr	5707.39	5707.13	0.26	2.48	0.03	4.92	11.91	11.17	26.06
Side Channel	Side Channel	1297.05*	50 yr	5707.48	5707.19	0.29	2.48	0.03	6.28	14.10	14.62	26.89
Side Channel	Side Channel	1297.05*	100 yr	5707.58	5707.25	0.33	2.49	0.03	7.78	16.57	18.65	27.80
Side Channel	Side Channel	1297.05*	500 yr	5707.81	5707.40	0.41	2.51	0.02	11.65	22.66	29.69	29.56
Side Channel	Side Channel	1248.84*	2 yr	5704.59	5704.47	0.11	2.37	0.00	1.52	3.36	2.12	22.60
Side Channel	Side Channel	1248.84*	5 yr	5704.73	5704.58	0.16	2.40	0.01	3.16	5.78	5.06	24.78
Side Channel	Side Channel	1248.84*	10 yr	5704.83	5704.66	0.17	2.05	0.01	4.58	7.60	7.82	29.25
Side Channel	Side Channel	1248.84*	25 yr	5704.95	5704.73	0.21	2.43	0.01	6.52	10.19	11.29	30.97
Side Channel	Side Channel	1248.84*	50 yr	5705.03	5704.79	0.24	2.43	0.02	8.10	12.08	14.82	31.59
Side Channel	Side Channel	1248.84*	100 yr	5705.11	5704.85	0.26	2.44	0.02	9.90	14.16	18.94	32.26
Side Channel	Side Channel	1248.84*	500 yr	5705.31	5704.99	0.32	2.47	0.03	14.54	19.49	29.97	33.96
Side Channel	Side Channel	1200.63	2 yr	5702.21	5702.13	0.08	2.37	0.01	0.25	5.30	1.45	28.05
Side Channel	Side Channel	1200.63	5 yr	5702.34	5702.22	0.12	2.38	0.01	0.61	9.77	3.62	30.01
Side Channel	Side Channel	1200.63	10 yr	5702.43	5702.26	0.17	2.39	0.00	0.94	13.55	5.51	31.61
Side Channel	Side Channel	1200.63	25 yr	5702.54	5702.33	0.20	2.41	0.00	1.44	18.23	8.33	35.29

Side Channel	Side Channel	1200.63	50 yr	5702.62	5702.38	0.24	2.41	0.00	1.92	22.45	10.63	36.65
Side Channel	Side Channel	1200.63	100 yr	5702.70	5702.43	0.27	2.41	0.00	2.44	26.78	13.78	37.18
Side Channel	Side Channel	1200.63	500 yr	5702.89	5702.54	0.35	2.42	0.00	3.89	37.82	22.29	38.42
Side Channel	Side Channel	1156.61*	2 yr	5700.21	5700.11	0.10	1.99	0.00	0.53	4.99	1.48	25.89
Side Channel	Side Channel	1156.61*	5 yr	5700.35	5700.21	0.14	1.99	0.00	1.27	8.95	3.78	27.77
Side Channel	Side Channel	1156.61*	10 yr	5700.44	5700.28	0.16	2.00	0.00	1.96	12.09	5.96	29.33
Side Channel	Side Channel	1156.61*	25 yr	5700.55	5700.35	0.20	1.98	0.00	2.86	16.29	8.85	30.64
Side Channel	Side Channel	1156.61*	50 yr	5700.64	5700.40	0.23	1.98	0.00	3.67	19.80	11.52	31.51
Side Channel	Side Channel	1156.61*	100 yr	5700.72	5700.47	0.26	1.98	0.00	4.63	23.71	14.66	32.47
Side Channel	Side Channel	1156.61*	500 yr	5700.93	5700.60	0.32	1.96	0.01	7.25	33.68	23.07	34.57
Side Channel	Side Channel	1112.59*	2 yr	5698.21	5698.12	0.09	2.00	0.00	0.82	4.33	1.86	24.21
Side Channel	Side Channel	1112.59*	5 yr	5698.36	5698.22	0.14	1.99	0.00	1.90	7.62	4.47	26.01
Side Channel	Side Channel	1112.59*	10 yr	5698.46	5698.27	0.19	1.98	0.00	2.84	10.40	6.75	26.98
Side Channel	Side Channel	1112.59*	25 yr	5698.57	5698.35	0.22	1.98	0.00	4.13	13.75	10.11	28.14
Side Channel	Side Channel	1112.59*	50 yr	5698.66	5698.41	0.25	1.98	0.00	5.26	16.63	13.11	28.76
Side Channel	Side Channel	1112.59*	100 yr	5698.75	5698.47	0.28	1.97	0.00	6.57	19.85	16.58	29.40
Side Channel	Side Channel	1112.59*	500 yr	5698.97	5698.61	0.37	1.95	0.00	10.11	28.08	25.81	30.85
Side Channel	Side Channel	1068.57*	2 yr	5696.21	5696.10	0.12	1.99	0.00	0.66	4.81	1.53	21.96
Side Channel	Side Channel	1068.57*	5 yr	5696.37	5696.20	0.17	1.99	0.00	1.71	8.44	3.85	23.58
Side Channel	Side Channel	1068.57*	10 yr	5696.47	5696.28	0.19	2.00	0.00	2.69	11.29	6.02	24.91
Side Channel	Side Channel	1068.57*	25 yr	5696.59	5696.36	0.23	1.98	0.00	3.94	15.03	9.04	25.60
Side Channel	Side Channel	1068.57*	50 yr	5696.68	5696.42	0.26	1.98	0.00	5.04	18.19	11.77	26.16
Side Channel	Side Channel	1068.57*	100 yr	5696.78	5696.49	0.29	1.97	0.00	6.34	21.71	14.96	26.78
Side Channel	Side Channel	1068.57*	500 yr	5697.01	5696.65	0.37	1.96	0.00	9.87	30.72	23.41	28.18
Side Channel	Side Channel	1024.55	2 yr	5694.19	5694.08	0.11	2.03	0.00	0.22	6.03	0.75	19.85
Side Channel	Side Channel	1024.55	5 yr	5694.35	5694.18	0.17	2.02	0.00	0.73	11.21	2.05	21.19
Side Channel	Side Channel	1024.55	10 yr	5694.47	5694.23	0.23	1.99	0.00	1.20	15.56	3.24	21.98
Side Channel	Side Channel	1024.55	25 yr	5694.59	5694.31	0.28	1.99	0.01	1.90	21.03	5.07	22.75
Side Channel	Side Channel	1024.55	50 yr	5694.70	5694.38	0.32	1.97	0.01	2.51	25.71	6.77	23.17
Side Channel	Side Channel	1024.55	100 yr	5694.81	5694.43	0.37	1.97	0.01	3.21	31.05	8.74	23.65
Side Channel	Side Channel	1024.55	500 yr	5695.06	5694.58	0.49	1.94	0.01	5.18	44.71	14.10	24.82
Side Channel	Side Channel	978.235*	2 yr	5691.50	5691.27	0.23	2.67	0.01	0.29	6.58	0.13	13.19
Side Channel	Side Channel	978.235*	5 yr	5691.72	5691.39	0.33	2.61	0.02	1.24	12.18	0.58	15.78
Side Channel	Side Channel	978.235*	10 yr	5691.85	5691.47	0.38	2.60	0.01	2.29	16.51	1.20	16.67
Side Channel	Side Channel	978.235*	25 yr	5692.02	5691.55	0.46	2.55	0.02	3.70	22.22	2.09	17.52
Side Channel	Side Channel	978.235*	50 yr	5692.15	5691.62	0.53	2.52	0.02	4.97	27.06	2.96	18.19
Side Channel	Side Channel	978.235*	100 yr	5692.27	5691.69	0.58	2.50	0.02	6.47	32.36	4.17	18.65
Side Channel	Side Channel	978.235*	500 yr	5692.58	5691.85	0.73	2.46	0.02	10.42	46.00	7.58	19.67
Side Channel	Side Channel	931.92	2 yr	5688.77	5688.59	0.18	2.72	0.01	0.68	6.11	0.21	11.14
Side Channel	Side Channel	931.92	5 yr	5689.01	5688.72	0.29	2.69	0.01	2.12	11.33	0.55	12.52
Side Channel	Side Channel	931.92	10 yr	5689.19	5688.80	0.38	2.66	0.00	3.53	15.58	0.89	13.00
Side Channel	Side Channel	931.92	25 yr	5689.38	5688.91	0.46	2.63	0.00	5.61	20.96	1.43	13.62
Side Channel	Side Channel	931.92	50 yr	5689.53	5689.00	0.53	2.61	0.00	7.49	25.55	1.96	14.11
Side Channel	Side Channel	931.92	100 yr	5689.69	5689.08	0.61	2.58	0.00	9.64	30.71	2.65	14.54
Side Channel	Side Channel	931.92	500 yr	5690.05	5689.28	0.77	2.52	0.00	15.48	43.84	4.68	15.56
Side Channel	Side Channel	894.9*	2 yr	5686.00	5685.58	0.42	2.73	0.02	0.49	6.47	0.03	9.21
Side Channel	Side Channel	894.9*	5 yr	5686.29	5685.70	0.60	2.68	0.03	1.79	11.99	0.22	11.70
Side Channel	Side Channel	894.9*	10 yr	5686.46	5685.79	0.67	2.69	0.03	3.32	16.19	0.49	12.41
Side Channel	Side Channel	894.9*	25 yr	5686.69	5685.87	0.81	2.66	0.04	5.38	21.70	0.93	13.11
Side Channel	Side Channel	894.9*	50 yr	5686.86	5685.94	0.92	2.62	0.04	7.25	26.36	1.40	13.67
Side Channel	Side Channel	894.9*	100 yr	5687.04	5686.02	1.02	2.61	0.04	9.43	31.53	2.05	14.26
Side Channel	Side Channel	894.9*	500 yr	5687.45	5686.18	1.27	2.55	0.05	15.11	44.70	4.18	15.46
Side Channel	Side Channel	857.88*	2 yr	5682.94	5682.75	0.19	2.98	0.07	0.74	6.17	0.10	11.22
Side Channel	Side Channel	857.88*	5 yr	5683.19	5682.87	0.32	3.02	0.08	2.03	11.54	0.43	12.65
Side Channel	Side Channel	857.88*	10 yr	5683.37	5682.95	0.42	3.01	0.07	3.21	15.95	0.84	13.56
Side Channel	Side Channel	857.88*	25 yr	5683.57	5683.04	0.53	3.03	0.09	4.83	21.57	1.60	14.56
Side Channel	Side Channel	857.88*	50 yr	5683.73	5683.11	0.61	3.04	0.09	6.24	26.36	2.40	15.22
Side Channel	Side Channel	857.88*	100 yr	5683.90	5683.19	0.71	3.05	0.09	7.88	31.74	3.38	15.94
Side Channel	Side Channel	857.88*	500 yr	5684.28	5683.35	0.94	3.07	0.10	12.50	45.33	6.17	17.67
Side Channel	Side Channel	820.86	2 yr	5680.07	5679.77	0.29	2.87	0.01	0.00	6.97	0.03	9.94
Side Channel	Side Channel	820.86	5 yr	5680.32	5679.88	0.44	2.85	0.01	0.05	13.67	0.28	11.94
Side Channel	Side Channel	820.86	10 yr	5680.49	5679.96	0.54	2.86	0.01	0.15	19.18	0.67	13.36

Side Channel	Side Channel	820.86	25 yr	5680.70	5680.04	0.67	2.86	0.01	0.34	26.25	1.41	14.63
Side Channel	Side Channel	820.86	50 yr	5680.86	5680.10	0.76	2.86	0.01	0.56	32.22	2.22	15.39
Side Channel	Side Channel	820.86	100 yr	5681.02	5680.16	0.86	2.86	0.01	0.89	38.88	3.23	16.24
Side Channel	Side Channel	820.86	500 yr	5681.39	5680.31	1.08	2.88	0.01	2.11	55.79	6.11	18.25
Side Channel	Side Channel	779.64*	2 yr	5677.42	5677.30	0.12	2.60	0.05	0.00	6.84	0.16	12.38
Side Channel	Side Channel	779.64*	5 yr	5677.62	5677.41	0.22	2.63	0.07	0.05	13.37	0.57	14.29
Side Channel	Side Channel	779.64*	10 yr	5677.77	5677.48	0.29	2.65	0.07	0.15	18.81	1.05	15.57
Side Channel	Side Channel	779.64*	25 yr	5677.94	5677.56	0.38	2.67	0.09	0.35	25.77	1.88	16.98
Side Channel	Side Channel	779.64*	50 yr	5678.07	5677.63	0.45	2.69	0.09	0.60	31.71	2.69	17.96
Side Channel	Side Channel	779.64*	100 yr	5678.21	5677.69	0.52	2.71	0.10	0.95	38.37	3.68	19.10
Side Channel	Side Channel	779.64*	500 yr	5678.54	5677.84	0.70	2.74	0.11	2.04	55.47	6.49	24.02
Side Channel	Side Channel	738.42*	2 yr	5674.96	5674.66	0.30	2.44	0.02	0.35	6.54	0.11	10.96
Side Channel	Side Channel	738.42*	5 yr	5675.19	5674.78	0.41	2.41	0.02	1.23	12.20	0.56	13.90
Side Channel	Side Channel	738.42*	10 yr	5675.34	5674.87	0.47	2.41	0.02	2.25	16.65	1.10	15.41
Side Channel	Side Channel	738.42*	25 yr	5675.52	5674.96	0.56	2.40	0.02	3.71	22.33	1.96	17.03
Side Channel	Side Channel	738.42*	50 yr	5675.65	5675.03	0.62	2.40	0.02	5.01	27.12	2.87	18.52
Side Channel	Side Channel	738.42*	100 yr	5675.79	5675.11	0.69	2.40	0.02	6.54	32.42	4.04	20.08
Side Channel	Side Channel	738.42*	500 yr	5676.12	5675.28	0.84	2.40	0.01	10.39	46.10	7.51	26.92
Side Channel	Side Channel	697.2*	2 yr	5672.30	5672.15	0.14	2.62	0.05	0.26	6.72	0.02	12.31
Side Channel	Side Channel	697.2*	5 yr	5672.52	5672.26	0.25	2.62	0.05	0.87	12.96	0.18	14.89
Side Channel	Side Channel	697.2*	10 yr	5672.67	5672.33	0.34	2.63	0.04	1.57	18.04	0.39	16.37
Side Channel	Side Channel	697.2*	25 yr	5672.85	5672.41	0.43	2.63	0.04	2.70	24.51	0.79	18.01
Side Channel	Side Channel	697.2*	50 yr	5672.99	5672.48	0.52	2.64	0.03	3.69	30.08	1.22	19.59
Side Channel	Side Channel	697.2*	100 yr	5673.13	5672.54	0.59	2.63	0.03	5.10	36.13	1.77	20.90
Side Channel	Side Channel	697.2*	500 yr	5673.48	5672.69	0.79	2.62	0.01	8.29	52.11	3.60	28.97
Side Channel	Side Channel	655.98	2 yr	5669.78	5669.53	0.25	2.50	0.01	0.49	6.50	0.01	11.08
Side Channel	Side Channel	655.98	5 yr	5670.01	5669.66	0.35	2.49	0.01	1.44	12.42	0.14	13.91
Side Channel	Side Channel	655.98	10 yr	5670.16	5669.74	0.42	2.50	0.01	2.46	17.17	0.37	15.84
Side Channel	Side Channel	655.98	25 yr	5670.34	5669.83	0.51	2.50	0.01	4.01	23.21	0.78	17.92
Side Channel	Side Channel	655.98	50 yr	5670.47	5669.90	0.57	2.52	0.01	5.51	28.26	1.23	19.55
Side Channel	Side Channel	655.98	100 yr	5670.61	5669.97	0.64	2.53	0.00	7.28	33.89	1.83	21.56
Side Channel	Side Channel	655.98	500 yr	5670.93	5670.14	0.79	2.54	0.00	11.60	48.65	3.74	51.94
Side Channel	Side Channel	616.922*	2 yr	5667.85	5667.73	0.11	1.33	0.00	0.11	6.84	0.06	14.19
Side Channel	Side Channel	616.922*	5 yr	5668.04	5667.85	0.18	1.92	0.05	0.62	13.09	0.29	18.21
Side Channel	Side Channel	616.922*	10 yr	5668.17	5667.92	0.24	1.94	0.05	1.29	18.14	0.57	19.88
Side Channel	Side Channel	616.922*	25 yr	5668.32	5668.00	0.31	1.96	0.06	2.33	24.63	1.04	22.02
Side Channel	Side Channel	616.922*	50 yr	5668.44	5668.07	0.37	1.98	0.06	3.31	30.19	1.51	24.21
Side Channel	Side Channel	616.922*	100 yr	5668.56	5668.13	0.43	1.99	0.06	4.55	36.39	2.07	28.02
Side Channel	Side Channel	616.922*	500 yr	5668.83	5668.27	0.56	2.03	0.07	8.42	51.66	3.93	46.39
Side Channel	Side Channel	577.865*	2 yr	5665.99	5665.82	0.18	1.84	0.01	0.08	6.86	0.06	14.56
Side Channel	Side Channel	577.865*	5 yr	5666.19	5665.91	0.28	1.84	0.01	0.61	13.09	0.30	19.53
Side Channel	Side Channel	577.865*	10 yr	5666.31	5665.98	0.32	1.85	0.01	1.53	17.86	0.61	20.89
Side Channel	Side Channel	577.865*	25 yr	5666.45	5666.06	0.39	1.86	0.01	2.80	24.10	1.10	23.15
Side Channel	Side Channel	577.865*	50 yr	5666.56	5666.13	0.43	1.87	0.01	4.06	29.35	1.59	26.60
Side Channel	Side Channel	577.865*	100 yr	5666.67	5666.19	0.48	1.88	0.01	5.64	35.10	2.27	31.80
Side Channel	Side Channel	577.865*	500 yr	5666.90	5666.32	0.58	1.93	0.00	10.34	48.84	4.82	39.36
Side Channel	Side Channel	538.807*	2 yr	5664.08	5663.99	0.09	1.89	0.03	0.28	6.72	0.00	21.17
Side Channel	Side Channel	538.807*	5 yr	5664.22	5664.08	0.14	1.93	0.04	1.14	12.80	0.06	25.18
Side Channel	Side Channel	538.807*	10 yr	5664.33	5664.14	0.19	1.94	0.04	1.86	17.85	0.30	30.15
Side Channel	Side Channel	538.807*	25 yr	5664.44	5664.20	0.24	1.96	0.04	2.99	24.17	0.84	32.89
Side Channel	Side Channel	538.807*	50 yr	5664.53	5664.24	0.29	1.98	0.04	4.07	29.51	1.42	34.85
Side Channel	Side Channel	538.807*	100 yr	5664.63	5664.29	0.33	1.99	0.04	5.42	35.38	2.20	36.93
Side Channel	Side Channel	538.807*	500 yr	5664.83	5664.40	0.43	2.02	0.05	9.33	50.03	4.64	41.74
Side Channel	Side Channel	499.75	2 yr	5662.20	5662.08	0.12	1.87	0.00	0.74	6.25	0.01	22.46
Side Channel	Side Channel	499.75	5 yr	5662.35	5662.16	0.19	1.87	0.00	2.08	11.85	0.07	24.92
Side Channel	Side Channel	499.75	10 yr	5662.45	5662.22	0.22	1.87	0.00	3.51	16.34	0.15	26.41
Side Channel	Side Channel	499.75	25 yr	5662.56	5662.29	0.27	1.88	0.00	5.50	22.19	0.31	28.18
Side Channel	Side Channel	499.75	50 yr	5662.65	5662.35	0.30	1.88	0.00	7.36	27.15	0.49	29.57
Side Channel	Side Channel	499.75	100 yr	5662.74	5662.41	0.34	1.88	0.00	9.56	32.72	0.71	30.96
Side Channel	Side Channel	499.75	500 yr	5662.96	5662.53	0.43	1.88	0.00	15.68	46.90	1.42	34.07
Side Channel	Side Channel	461.497*	2 yr	5660.27	5660.15	0.11	1.93	0.00	0.39	6.37	0.25	19.10
Side Channel	Side Channel	461.497*	5 yr	5660.43	5660.26	0.18	1.92	0.00	1.50	11.80	0.70	20.92

Side Channel	Side Channel	461.497*	10 yr	5660.55	5660.32	0.23	1.90	0.00	2.61	16.26	1.13	21.66
Side Channel	Side Channel	461.497*	25 yr	5660.69	5660.40	0.29	1.87	0.00	4.06	22.16	1.78	23.67
Side Channel	Side Channel	461.497*	50 yr	5660.80	5660.45	0.34	1.85	0.00	5.50	27.13	2.36	24.97
Side Channel	Side Channel	461.497*	100 yr	5660.91	5660.52	0.39	1.83	0.01	7.29	32.68	3.03	26.61
Side Channel	Side Channel	461.497*	500 yr	5661.16	5660.66	0.50	1.79	0.01	12.33	46.50	5.17	30.11
Side Channel	Side Channel	423.245*	2 yr	5658.31	5658.15	0.16	1.95	0.00	0.26	6.74		13.57
Side Channel	Side Channel	423.245*	5 yr	5658.50	5658.25	0.25	1.92	0.01	0.79	13.19	0.01	15.85
Side Channel	Side Channel	423.245*	10 yr	5658.63	5658.33	0.30	1.90	0.01	1.36	18.56	0.08	17.70
Side Channel	Side Channel	423.245*	25 yr	5658.78	5658.41	0.37	1.89	0.01	2.37	25.41	0.22	18.97
Side Channel	Side Channel	423.245*	50 yr	5658.90	5658.47	0.42	1.89	0.01	3.40	31.21	0.39	19.86
Side Channel	Side Channel	423.245*	100 yr	5659.02	5658.54	0.48	1.88	0.01	4.67	37.72	0.61	20.75
Side Channel	Side Channel	423.245*	500 yr	5659.31	5658.69	0.62	1.84	0.01	7.81	54.72	1.47	25.51
Side Channel	Side Channel	384.992*	2 yr	5656.35	5656.18	0.17	2.00	0.01	0.05	6.83	0.11	11.96
Side Channel	Side Channel	384.992*	5 yr	5656.54	5656.33	0.21	1.94	0.01	0.30	13.30	0.40	13.99
Side Channel	Side Channel	384.992*	10 yr	5656.69	5656.40	0.29	1.93	0.00	0.57	18.74	0.69	14.99
Side Channel	Side Channel	384.992*	25 yr	5656.86	5656.48	0.37	1.92	0.00	1.04	25.78	1.18	16.19
Side Channel	Side Channel	384.992*	50 yr	5656.99	5656.55	0.44	1.90	0.00	1.54	31.80	1.66	17.02
Side Channel	Side Channel	384.992*	100 yr	5657.13	5656.62	0.51	1.88	0.00	2.22	38.52	2.26	17.91
Side Channel	Side Channel	384.992*	500 yr	5657.53	5656.73	0.79	1.19	0.12	4.07	56.80	3.13	22.17
Side Channel	Side Channel	346.74	2 yr	5654.38	5654.25	0.13	1.96	0.01	0.12	6.75	0.12	11.13
Side Channel	Side Channel	346.74	5 yr	5654.62	5654.33	0.30	1.90	0.01	0.33	13.34	0.33	11.87
Side Channel	Side Channel	346.74	10 yr	5654.78	5654.42	0.36	1.90	0.01	0.59	18.81	0.60	12.72
Side Channel	Side Channel	346.74	25 yr	5654.97	5654.51	0.45	1.88	0.01	1.00	25.97	1.03	13.68
Side Channel	Side Channel	346.74	50 yr	5655.11	5654.59	0.52	1.87	0.01	1.44	32.09	1.47	14.45
Side Channel	Side Channel	346.74	100 yr	5655.26	5654.67	0.60	1.86	0.01	1.99	38.97	2.03	15.17
Side Channel	Side Channel	346.74	500 yr	5654.94	5654.83	0.12	0.31	0.01	1.77	27.61	34.62	39.55
Side Channel	Side Channel	308.747*	2 yr	5652.85	5652.74	0.11	1.37	0.00		7.00		11.70
Side Channel	Side Channel	308.747*	5 yr	5653.04	5652.88	0.16	1.21	0.00		14.00	0.00	13.01
Side Channel	Side Channel	308.747*	10 yr	5653.17	5652.96	0.21	1.57	0.04	0.00	19.98	0.01	13.83
Side Channel	Side Channel	308.747*	25 yr	5653.33	5653.04	0.29	1.59	0.05	0.03	27.91	0.06	14.68
Side Channel	Side Channel	308.747*	50 yr	5653.46	5653.11	0.35	1.60	0.05	0.08	34.78	0.14	15.33
Side Channel	Side Channel	308.747*	100 yr	5653.59	5653.17	0.42	1.62	0.05	0.17	42.56	0.26	15.99
Side Channel	Side Channel	308.747*	500 yr	5654.03	5653.21	0.82	0.84	0.07	0.33	63.20	0.47	16.35
Side Channel	Side Channel	270.755*	2 yr	5651.35	5651.23	0.12	1.37	0.00	0.09	6.83	0.08	12.08
Side Channel	Side Channel	270.755*	5 yr	5651.56	5651.33	0.23	1.47	0.01	0.29	13.45	0.26	13.07
Side Channel	Side Channel	270.755*	10 yr	5651.71	5651.40	0.31	1.46	0.01	0.54	19.00	0.46	13.90
Side Channel	Side Channel	270.755*	25 yr	5651.88	5651.51	0.37	1.44	0.01	0.99	26.18	0.83	15.04
Side Channel	Side Channel	270.755*	50 yr	5652.01	5651.59	0.42	1.44	0.01	1.45	32.34	1.21	15.88
Side Channel	Side Channel	270.755*	100 yr	5652.14	5651.67	0.47	1.43	0.01	2.07	39.23	1.70	16.74
Side Channel	Side Channel	270.755*	500 yr	5652.47	5651.84	0.63	1.58	0.09	3.90	56.99	3.12	18.59
Side Channel	Side Channel	232.762*	2 yr	5649.83	5649.70	0.13	1.51	0.00	0.07	6.89	0.04	12.36
Side Channel	Side Channel	232.762*	5 yr	5650.03	5649.84	0.19	1.51	0.01	0.29	13.51	0.20	13.89
Side Channel	Side Channel	232.762*	10 yr	5650.17	5649.92	0.24	1.52	0.02	0.57	19.06	0.38	14.79
Side Channel	Side Channel	232.762*	25 yr	5650.34	5650.01	0.33	1.52	0.01	0.98	26.36	0.65	15.68
Side Channel	Side Channel	232.762*	50 yr	5650.47	5650.07	0.40	1.53	0.01	1.41	32.65	0.94	16.38
Side Channel	Side Channel	232.762*	100 yr	5650.61	5650.13	0.48	1.53	0.00	1.96	39.73	1.31	17.08
Side Channel	Side Channel	232.762*	500 yr	5650.93	5650.30	0.64	1.54	0.00	3.75	57.73	2.52	18.87
Side Channel	Side Channel	194.77	2 yr	5648.44	5648.11	0.33	1.60	0.00	0.06	6.84	0.10	11.77
Side Channel	Side Channel	194.77	5 yr	5648.53	5648.31	0.22	1.51	0.00	0.39	13.22	0.39	14.05
Side Channel	Side Channel	194.77	10 yr	5648.67	5648.38	0.29	1.49	0.00	0.72	18.63	0.65	14.99
Side Channel	Side Channel	194.77	25 yr	5648.83	5648.48	0.35	1.51	0.00	1.29	25.64	1.07	16.13
Side Channel	Side Channel	194.77	50 yr	5648.96	5648.56	0.40	1.51	0.00	1.87	31.65	1.48	17.00
Side Channel	Side Channel	194.77	100 yr	5649.09	5648.64	0.45	1.52	0.01	2.62	38.37	2.01	17.91
Side Channel	Side Channel	194.77	500 yr	5649.40	5648.80	0.59	1.52	0.01	4.81	55.65	3.54	19.76
Side Channel	Side Channel	157.42*	2 yr	5647.04	5646.94	0.11			0.06	6.90	0.04	12.54
Side Channel	Side Channel	157.42*	5 yr	5647.25	5647.02	0.23	1.32	0.02	0.21	13.63	0.17	13.60
Side Channel	Side Channel	157.42*	10 yr	5647.38	5647.17	0.21	1.27	0.02	0.57	18.98	0.45	15.51
Side Channel	Side Channel	157.42*	25 yr	5647.54	5647.26	0.28	1.27	0.02	1.02	26.17	0.81	16.64
Side Channel	Side Channel	157.42*	50 yr	5647.67	5647.33	0.34	1.28	0.02	1.49	32.33	1.18	17.51
Side Channel	Side Channel	157.42*	100 yr	5647.80	5647.40	0.40	1.28	0.01	2.09	39.26	1.65	18.40
Side Channel	Side Channel	157.42*	500 yr	5648.10	5647.57	0.53	1.29	0.02	4.05	56.74	3.21	20.49
Side Channel	Side Channel	120.07*	2 yr	5645.77	5645.65	0.12	1.29	0.00	0.01	6.98	0.01	11.43

Side Channel	Side Channel	120.07*	5 yr	5645.99	5645.73	0.26	1.33	0.02	0.09	13.79	0.11	12.80
Side Channel	Side Channel	120.07*	10 yr	5646.13	5645.83	0.30	1.24	0.01	0.29	19.36	0.35	14.29
Side Channel	Side Channel	120.07*	25 yr	5646.30	5645.94	0.36	1.24	0.01	0.66	26.57	0.77	15.81
Side Channel	Side Channel	120.07*	50 yr	5646.42	5646.02	0.41	1.24	0.01	1.08	32.68	1.24	16.97
Side Channel	Side Channel	120.07*	100 yr	5646.56	5646.10	0.45	1.24	0.01	1.65	39.50	1.85	18.17
Side Channel	Side Channel	120.07*	500 yr	5646.86	5646.28	0.59	1.23	0.01	3.44	56.78	3.78	20.61
Side Channel	Side Channel	82.72	2 yr	5644.48	5644.35	0.13	2.17	0.01	0.00	7.00	0.00	9.85
Side Channel	Side Channel	82.72	5 yr	5644.74	5644.42	0.32	1.36	0.02	0.02	13.95	0.03	10.98
Side Channel	Side Channel	82.72	10 yr	5644.85	5644.61	0.24	1.26	0.02	0.24	19.41	0.35	14.29
Side Channel	Side Channel	82.72	25 yr	5645.02	5644.71	0.32	1.26	0.01	0.56	26.66	0.79	15.98
Side Channel	Side Channel	82.72	50 yr	5645.16	5644.77	0.39	1.26	0.01	0.90	32.84	1.26	17.19
Side Channel	Side Channel	82.72	100 yr	5645.30	5644.85	0.46	1.26	0.00	1.38	39.71	1.91	18.45
Side Channel	Side Channel	82.72	500 yr	5645.61	5645.02	0.59	1.25	0.00	2.89	56.84	4.27	21.78

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APPENDIX K

ENGINEERING COST ESTIMATES

TABLE K-1. ALTERNATIVE 1 COST ESTIMATE
BLACK PINE MINE

Notes:

Alternative 1 Cost Estimate

Activity/Material/Description		Quantity	Unit	Unit Price	Sub-item Cost	Cost (rounded)
TOTAL CAPITAL COST						***$0***
ANNUAL O+M COSTS						
Inspections (1/yr)		1	EA	$3,600		$3,600
Sampling and Analysis (1/yr)		1	EA	$3,500		$3,500
TOTAL ANNUAL O+M COST						***$7,100***
Present Value of O+M cost (2013)		30	yr			$139,200
TOTAL PRESENT VALUE COST						**$139,200**

TABLE K-2. ALTERNATIVE 2 COST ESTIMATE
BLACK PINE MINE

Notes:
1. Repository quantities are based off initial repository footprint of 14 acres.
2. Quantities are rolled up by task and assigned unit price for the entire task. Sub-tasks are added together and divided by the task quantity to create the unit price.

Alternative 2 Cost Estimate

Activity/Material/Description		Quantity	Unit	Unit Price	Sub-item Cost	Cost (rounded)
CAPITAL COSTS						
Mobilization/Demobilization (not to exceed 10% of Capital Costs)		1	LS	$1,215,080		$1,215,100
Clearing and Grubbing		40	AC	$5,300		$211,900
BMPs		1	LS	$64,935		$65,000
Temporary Fencing		7,023	LF	$5		$36,600
Signage		1	LS	$234		$300
Road Improvements		15,890	LF	$14		$222,500
Provide Water		14,400	Kgal	$50		$720,000
Repository Excavation and Embankment		270,185	CY	$4		$1,095,000
	Excavation	208,100	CY	$4	$738,160	
	Prepare Subgrade Soil	59,470	SY	$3	$178,410	
	Grading/Compaction	59,470	SY	$3	$178,410	
Repository Cover		75,235	SY	$22		$1,669,500
	Drain System/Layer	75,235	SY	$10	$752,350	
	Surface Water Diversion Ditch	3,291	LF	$10	$32,915	
	Geomembrane Liner	75,235	SY	$8	$601,880	
	Cover Soil Placement	56,467	CY	$5	$282,335	
Removal of Contaminated Material		336,500	CY	$15		$5,202,000
	Contaminated Material Excavation, Haul, Placement, and Compaction	336,500	CY	$15	$5,201,978	
Removal of Dispersed Contaminated Material		19,700	CY	$22		$429,700
	Dispersed Contaminated Material Excavation, Haul, Placement, and Compaction	19,700	CY	$22	$429,677	
In-Place Capping		53,240	SY	$8		$426,300
	Surface Water Diversion Ditch	2,769	LF	$10	$26,913	
	Soil Cover Cap	53,240	CY	$8	$399,300	
Borrow		7,529	CY	$15		$110,700
	Onsite Borrow - Load, haul, place	7,529	CY	$4	$30,116	
	Offsite Borrow	7,529	CY	$11	$80,499	
Rock Cover		22,587	CY	$30		$679,600
	Screening	1	LS	$559,359	$559,359	
	Haul and Place	33,880	CY	$4	$120,177	
Cover Soil Replacement at Combination Mine		29,000	CY	$5		$145,000
Relocation and Reconstruction of SFLWC and Mill Creek		1	LS	$460,416		$460,500
	Water Management	1	LS	$54,873	$54,873	
	BMPs	1	LS	$10,400	$10,400	
	Channel Excavation	5,700	CY	$13	$73,416	
	SFLWC Channel Reconstruction	3,000	LF	$95	$283,877	
	Mill Creek Channel Reconstruction	400	LF	$95	$37,850	
Seeding and Soil Amendments		87	AC	$3,243		$282,000
Planting		76	AC	$4,795		$364,200
	Lodgepole Pine Planting	73	AC	$4,095	$300,181	
	Willow Planting	3	AC	$24,200	$64,000	
Building Demolition, Maintenance, and Protection		1	LS	$29,927		$30,000
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587	
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295	
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980	
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786	
	Demolition and Disposal of Select Buildings and Rubble	199	CY	$107	$21,280	
Subtotal						$13,365,900
TOTAL CAPITAL COST						***$13,365,900***
ANNUAL O+M COSTS						
Inspections (1/yr)		1	EA	$3,600		$3,600
Sampling and Analysis (1/yr)		1	EA	$3,500		$3,500
Maintenance		1	LS	$6,207		$6,300
TOTAL ANNUAL O+M COST						***$13,400***
Present Value of O+M cost (2013)		30	yr			$262,700
TOTAL PRESENT VALUE COST						**$13,628,600**

TABLE K-3. ALTERNATIVE 3 COST ESTIMATE
BLACK PINE MINE

Notes:
1. Quantities are rolled up by task and assigned unit price for the entire task. Sub-tasks are added together and divided by the task quantity to create the unit price.

Alternative 3 Cost Estimate

Activity/Material/Description		Quantity	Unit	Unit Price	Sub-item Cost	Cost (rounded)
CAPITAL COSTS						
Mobilization/Demobilization (not to exceed 10% of Capital		1	LS	$2,089,110		$2,089,200
Clearing and Grubbing		26	AC	$5,300		$137,700
BMPs		1	LS	$54,368		$54,400
Temporary Fencing		3,899	LF	$5		$20,000
Signage		1	LS	$130		$200
Road Improvements		15,890	LF	$14		$222,500
Provide Water		14,400	Kgal	$50		$720,000
Removal of Contaminated Material		336,500	CY	$4		$1,488,800
	Excavation	336,500	CY	$4	$1,488,763	
Removal of Dispersed Contaminated Material		19,700	CY	$9		$177,200
	Dispersed Contaminated Material Excavation	19,700	CY	$9	$177,103	
Offsite Disposal of Contaminated and Dispersed Contaminated Material		356,200	CY	$46		$16,360,100
	Offsite Haul	1	LS	$5,522,754	$5,522,754	
	Landfill Disposal Cost	541,866	TN	$20	$10,837,314	
In-Place Capping		53,240	SY	$8		$426,300
	Surface Water Diversion Ditch	2,769	LF	$10	$26,913	
	Soil Cover Cap	53,240	CY	$8	$399,300	
Borrow		538	CY	$4		$2,200
	Onsite Borrow - Load, haul, place	538	CY	$4	$2,151	
	Offsite Borrow		CY	$11	$0	
Cover Soil Replacement at Combination Mine		29,000	CY	$5		$145,000
Relocation and Reconstruction of SFLWC and Mill Creek		1	LS	$460,416		$460,500
	Water Management	1	LS	$54,873	$54,873	
	BMPs	1	LS	$10,400	$10,400	
	Channel Excavation	5,700	CY	$13	$73,416	
	SFLWC Channel Reconstruction	3,000	LF	$95	$283,877	
	Mill Creek Channel Reconstruction	400	LF	$95	$37,850	
Seeding and Soil Amendments		87	AC	$3,243		$282,000
Planting		76	CY	$4,795		$364,200
	Lodgepole Pine Planting	73	AC	$4,095	$300,181	
	Willow Planting	3	AC	$24,200	$64,000	
Building Demolition, Maintenance, and Protection		1	LS	$29,927		$30,000
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587	
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295	
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980	
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786	
	Demolition and Disposal of Select Buildings and Rubble	199	CY	$107	$21,280	
Subtotal						$22,980,300
TOTAL CAPITAL COST						***$22,980,300***
ANNUAL O+M COSTS						
Inspections (1/yr)		1	EA	$3,600		$3,600
Sampling and Analysis (1/yr)		1	EA	$3,500		$3,500
Maintenance		1	LS	$5,625		$5,700
TOTAL ANNUAL O+M COST						***$12,800***
Present Value of O+M cost (2013)		30	yr			$250,900
TOTAL PRESENT VALUE COST						**$23,231,200**

TABLE K-4. ALTERNATIVE 4 COST ESTIMATE
BLACK PINE MINE

Notes:
1. Repository quantities are based off initial repository footprint of 15 acres.
2. Quantities are rolled up by task and assigned unit price for the entire task. Sub-tasks are added together and divided by the task quantity to create the unit price.

Alternative 4 Cost Estimate

Activity/Material/Description		Quantity	Unit	Unit Price	Sub-item Cost	Cost (rounded)
CAPITAL COSTS						
Mobilization/Demobilization (not to exceed 10% of		1	LS	$1,239,050		$1,239,100
Clearing and Grubbing		39	AC	$5,300		$207,900
BMPs		1	LS	$65,690		$65,700
Temporary Fencing		3,233	LF	$5		$16,600
Signage		1	LS	$108		$200
Road Improvements		15,890	LF	$14		$222,500
Provide Water		14,400	Kgal	$50		$720,000
Repository Excavation and Embankment		270,185	CY	$4		$1,095,000
	Excavation	208,100	CY	$4	$738,160	
	Prepare Subgrade Soil	59,470	SY	$3	$178,410	
	Grading/Compaction	59,470	SY	$3	$178,410	
Repository Cover		75,235	SY	$24		$1,838,900
	Drain System/Layer	75,235	SY	$10	$752,350	
	Surface Water Diversion Ditch	3,291	LF	$10	$32,915	
	Geomembrane Liner	75,235	SY	$8	$601,880	
	Cover Soil Placement	90,347	CY	$5	$451,735	
Removal of Contaminated Material		372,500	CY	$15		$5,736,900
	Contaminated Material Excavation, Haul, Placement, and Compaction	371,100	CY	$15	$5,736,862	
Removal of Dispersed Contaminated Material		19,700	CY	$22		$429,700
	Dispersed Contaminated Material Excavation, Haul, Placement, and Compaction	19,700	CY	$22	$429,677	
Borrow		538	CY	$4		$2,200
	Onsite Borrow - Load, haul, place	538	CY	$4	$2,151	
	Offsite Borrow		CY	$11	$0	
Rock Cover		24,200	CY	$30		$728,100
	Screening	1	LS	$599,313	$599,313	
	Haul and Place	36,300	CY	$4	$128,761	
Cover Soil Replacement at Combination Mine		29,000	CY	$5		$145,000
Relocation and Reconstruction of SFLWC and Mill Creek		1	LS	$460,416		$460,500
	Water Management	1	LS	$54,873	$54,873	
	BMPs	1	LS	$10,400	$10,400	
	Channel Excavation	5,700	CY	$13	$73,416	
	SFLWC Channel Reconstruction	3,000	LF	$95	$283,877	
	Mill Creek Channel Reconstruction	400	LF	$95	$37,850	
Seeding and Soil Amendments		87	AC	$3,243		$282,000
Planting		87	AC	$4,707		$409,300
	Lodgepole Pine Planting	84	AC	$4,095	$345,226	
	Willow Planting	3	AC	$24,200	$64,000	
Building Demolition, Maintenance, and Protection		1	LS	$29,927		$30,000
	Removal and Disposal of Hazards Within Central Processing Building	30	CY	$120	$3,587	
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295	
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980	
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786	
	Demolition and Disposal of Select Buildings and Rubble	199	CY	$107	$21,280	
Subtotal						$13,629,600
TOTAL CAPITAL COST						***$13,629,600***
ANNUAL O+M COSTS						
Inspections (1/yr)		1	EA	$3,600		$3,600
Sampling and Analysis (1/yr)		1	EA	$3,500		$3,500
Maintenance		1	LS	$5,625		$5,700
TOTAL ANNUAL O+M COST						***$12,800***
Present Value of O+M cost (2013)		30	yr			$250,900
TOTAL PRESENT VALUE COST						**$13,880,500**

TABLE K-5. ALTERNATIVE 5 COST ESTIMATE
BLACK PINE MINE

Notes:
1. Quantities are rolled up by task and assigned unit price for the entire task. Sub-tasks are added together and divided by the task quantity to create the unit price.

Alternative 5 Cost Estimate

Activity/Material/Description		Quantity	Unit	Unit Price	Sub-item Cost	Cost (rounded)
CAPITAL COSTS						
Mobilization/Demobilization (not to exceed 10% of Capital		1	LS	$2,243,190		$2,243,200
Clearing and Grubbing		26	AC	$5,300		$137,700
BMPs		1	LS	$54,368		$54,400
Road Improvements		15,890	LF	$14		$222,500
Provide Water		14,400	Kgal	$50		$720,000
Removal of Contaminated Material		372,500	CY	$4		$1,648,100
	Excavation	372,500	CY	$4	$1,648,037	
Removal of Dispersed Contaminated Material		19,700	CY	$9		$177,200
	Dispersed Contaminated Material Excavation	19,700	CY	$9	$177,103	
Offsite Disposal of Contaminated and Dispersed Contaminated	Material	392,200	CY	$46		$18,143,000
	Offsite Haul	1	LS	$6,080,921	$6,080,921	
	Landfill Disposal Cost	603,102	TN	$20	$12,062,034	
Borrow		538	CY	$4		$2,200
	Onsite Borrow - Load, haul, place	538	CY	$4	$2,151	
	Offsite Borrow		CY	$11	$0	
Cover Soil Replacement at Combination Mine		29,000	CY	$5		$145,000
Relocation and Reconstruction of SFLWC and Mill Creek		1	LS	$460,416		$460,500
	Water Management	1	LS	$54,873	$54,873	
	BMPs	1	LS	$10,400	$10,400	
	Channel Excavation	5,700	CY	$13	$73,416	
	SFLWC Channel Reconstruction	3,000	LF	$95	$283,877	
	Mill Creek Channel Reconstruction	400	LF	$95	$37,850	
Seeding and Soil Amendments		87	AC	$3,243		$282,000
Planting		87	AC	$4,707		$409,300
	Lodgepole Pine Planting	84	AC	$4,095	$345,226	
	Willow Planting	3	AC	$24,200	$64,000	
Building Demolition, Maintenance, and Protection		1	LS	$29,927		$30,000
	Removal and Disposal of Hazards Within Central Processing Buildi	30	CY	$120	$3,587	
	Removal and Disposal of Hazards Within North Building	15	CY	$153	$2,295	
	Relocation of Core Samples Within Lewis Shaft Garage	1	LS	$1,980	$1,980	
	Removal and Metal Salvage of Harper Shaft Blower	3	TN	$237	$786	
	Demolition and Disposal of Select Buildings and Rubble	199	CY	$107	$21,280	
Subtotal						$24,675,100
TOTAL CAPITAL COST						***$24,675,100***
ANNUAL O+M COSTS						
Inspections (1/yr)		1	EA	$3,600		$3,600
Sampling and Analysis (1/yr)		1	EA	$3,500		$3,500
Maintenance		1	LS	$5,625		$5,700
TOTAL ANNUAL O+M COST						***$12,800***
Present Value of O+M cost (2013)		30	yr			$250,900
TOTAL PRESENT VALUE COST						**$24,926,000**