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**Remedial Site Investigation
Reports**

**Contact Mercury Mine Site
Sonoma County, California
Removal Site Investigation Report
Final**

**Forest Service Regional Environmental Response Action Contract # AG-91S8-0-07-003
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**Prepared for:
United States Bureau of Land Management
California State Office
2800 Cottage Way, Suite W-1834
Sacramento, CA 95825-1886**

**Prepared by:
Weston Solutions, Inc.
1340 Treat Blvd., Suite 210
Walnut Creek, California 94597**

Table of Contents

	Page
1.0 INTRODUCTION.....	1
2.0 SITE DESCRIPTION	2
2.1 Location and Topography	2
2.2 Climate	2
2.3 Geology and Soils	2
2.4 Hydrology and Hydrogeology	3
2.5 Vegetation and Wildlife	3
2.6 Cultural Resources	4
2.7 Land Use and Population	5
2.8 Mine History and Description	6
2.9 Sources	6
3.0 ENVIRONMENTAL RELEASE ASSESSMENT.....	7
3.1 Previous Environmental Investigations	7
4.0 STREAMLINED RISK ASSESSMENT.....	8
4.1 Risk Assessment Results	9
4.2 Regulatory Framework Conclusions	10
5.0 BASIS FOR REMOVAL ACTION.....	13
5.1 Potential Human Impacts of Mercury Exposure	13
5.2 Potential Ecological Impacts of Mercury Exposure	13
5.3 NCP Removal Action Criteria	14
6.0 PRELIMINARY REMOVAL ACTION OBJECTIVES AND GOALS	15
7.0 DATA GAPS AND AREAS OF ADDITIONAL INVESTIGATION	18
8.0 REFERENCES	20

FIGURES

- Figure 2-1** Contact Mercury Mine Site Location Map
- Figure 2-2** Contact Mercury Mine Site Layout Map
- Figure 3-1** Contact Mercury Mine Sample Location Map
- Figure 3-2** Contact Mercury Mine Area Sample Locations

TABLES

- Table 3-1** Contact Mercury Mine 2001 to 2003 Sediment Samples Results (mg/kg)
- Table 3-2** Contact Mercury Mine - 2003 Sampling Results for Biological Samples - Fish (µg/g)
- Table 3-3** Contact Mercury Mine - 2003 Sampling Results for Biological Samples - Invertebrates (µg/g)
- Table 4-1** Contact Mercury Mine - 2001 to 2003 Surface Water Sample Results (µg/L)
- Table 4-2** Contact Mercury Mine - 2001 to 2003 Soil Sample Results (mg/kg)
- Table 6-1** Anticipated Contact Mercury Mine Removal Action Schedule

APPENDICES

- Appendix A** Site Photographs

LIST OF ACRONYMS

ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
$\mu\text{g/g}$	Microgram per Gram
$\mu\text{g/L}$	Microgram per Liter
mg/kg	Milligram per Kilogram
NOAA	National Oceanic and Atmospheric Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PRG	Preliminary Remediation Goal
RMC	Risk Management Criteria
RSI	Removal Site Investigation
SQuiRTs	Screening Quick Reference Tables
USGS	U.S. Geological Survey
WESTON	Weston Solutions, Inc.

1.0 INTRODUCTION

The United States Bureau of Land Management (BLM) tasked Weston Solutions, Inc. (WESTON®) to conduct a Removal Site Investigation (RSI) following a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Non-Time Critical Removal Process for the Contact Mercury Mine (Site), under contract AG-91S8-0-07-003. The site is located in the Pine Flat Mining District of northeastern Sonoma County, California.

The remainder of this report consists of Section 2.0 Site Description, Section 3.0 Environmental Release Assessment, Section 4.0 Streamlined Risk Assessment, Section 5.0 Basis for Removal Action, Section 6.0 Preliminary Removal Action Objectives and Goals, and Section 7.0 Data Gaps and Areas of Additional Investigation. Section 8.0 provides references used in the preparation of the RSI report.

This RSI report summarizes sample data collected by the United States Geological Survey (USGS) as well as a Biological/Botanical Resource Inventory Report and Cultural Resource Inventory Report developed by the BLM. The purpose of this RSI is to assess the potential threat to human health and the environment, and to determine if there is a need for further action. The objectives of this investigation are as follows:

- Identify and characterize sources of contamination at the Site,
- To determine whether or not sources of contamination at the site pose a viable threat to human health or the environment,
- To identify the presence of potential migration pathways of contamination at the Site, and
- Recommend further actions if needed.

2.0 SITE DESCRIPTION

2.1 Location and Topography

The Site is located on Pine Flat Road in the Pine Flat Mining District approximately 11 miles northeast from the town of Healdsburg, California. The Site location is shown in Figure 2-1. The Site is located in the southeastern part of Sonoma County in the Geysers 7.5 minute USGS Quadrangle. The Site is situated on the western slopes of the Mayacamas Mountains at elevations ranging from 2,440 to 2,840 feet above sea level in the Pine Flat Mining District. The Mayacamas Mountains are located west of Anderson Valley and rise to a maximum elevation of 4,724 feet above sea level at Cobb Mountain. The Mayacamas Mountains are part of the Coast Ranges geomorphic province which consists of northwest trending ridges between the Pacific Ocean and California's Central Valley. This portion of the Coast Ranges is dominated by moderately steep to steep slopes and summits with narrow valleys. Several tributaries to Little Sulphur Creek originate in the Pine Flats Mining District. Little Sulphur Creek is part of the Russian River Watershed (BLM 2008a, 2008b).

2.2 Climate

The climate in the area of the Site is characterized by moderate temperature and precipitation. Average annual precipitation is 41 inches and occurs mainly from November to March each year. The nearby city of Healdsburg receives an average of less than one inch of snow per year; however the Mayacamas Mountains receive more snow at higher elevations. Average maximum and minimum daily temperatures in Healdsburg were 74 degrees Fahrenheit and 45 degrees Fahrenheit, respectively (Western Regional Climate Center, 2009).

2.3 Geology and Soils

The Site is located in the western part of the late-Pliocene to early Holocene Clear Lake volcanic field. The Clear Lake volcanic field is located within the San Andreas transform fault system. The volcanoes in the Clear Lake volcanic field are largely non-explosive. The latest eruptive activity, forming maars and cinder cones along the shores of Clear Lake, continued until about 10,000 years ago. A large silicic magma chamber provides the heat source for the Geysers, the world's largest producing geothermal field (USGS 2009).

Soil at the Site is primarily Maymen-Los Gatos Complex with 30 to 70 percent slopes. The Site is located on a south-facing slope. The Site is located in a serpentine environment. Serpentine soils are

generally nutrient poor and as a result the plants within serpentine ecosystems are usually stunted. Plants consist of Cypress, Manzanita, Leather Oak, Scrub Oak, and Gray Pine. Large chunks of green serpentine are strewn about the Site (BLM 2008a).

The mercury deposits at the Site are among the youngest mercury deposits in the Coast Range mineral belt. The underground workings at the Site explored a north-dipping sheared contact between serpentine and sandstone containing local bodies of silica-carbonate rock. The silica-carbonate ore contains cinnabar. The sandstone ore contained disseminated native mercury in pores of carbonate veins and well-formed cinnabar crystals. Mercury ore was also found in serpentine (USGS 2008).

2.4 Hydrology and Hydrogeology

The Site is located in the Russian River watershed in the Big Sulphur Creek Sub-basin. Big Sulphur Creek drains 80 square miles of northeastern Sonoma County. The sub-basin is bound to the east by the Mayacamas Mountain Range and the west by Alexander Valley. Elevations in the watershed range from up to 4,000 feet mean sea level along the border between Sonoma and Lake Counties to approximately 400 feet mean sea level at the confluence of Big Sulphur Creek and the Russian River. Major streams and tributaries within the Subbasin include Big Sulphur Creek, Little Sulphur Cree, Squaw Creek, Cobb Creek, Alder Creek, and Frasier Creek. The historic Geysers Resort is located in the Big Sulphur Creek sub-basin. The Site is located in Section 5, Township 10 North, Range 8 West, Mount Diablo Basin and Meridian at an elevation ranging from 2507 feet above mean sea level to 2748 feet above mean sea level (BLM 2008a).

A seep originating from a collapsed adit is located on the southwestern part of the Site. The seep sustains a marshy area for approximately 100 feet at the Site that is seasonally connected to Anna Belcher Creek. There are no thermal springs on the Site. The headwaters of Anna Belcher Creek, which drains to Little Sulphur Creek, are located on the Site (BLM 2008a).

2.5 Vegetation and Wildlife

There are several plant communities located on the Site including mixed chaparral, wet meadow seep, and mixed hardwood. Within the mixed chaparral, species documented include coffeeberry, buckbrush, gray pine, chamise, scrub oak, yerba santa, and wild oats. Within the wet meadow seep,

species noted include rush, thistle, seep spring monkey flower, mint, fern, and horsetail. The hardwoods documented on-site include black oak and bay laurel (BLM 2008a).

The California Natural Diversity Database special status species records show five species located within 2.5 miles of the Site. No special status species were recorded on the Site. Geysers dichanthelium, a State Endangered species, was documented on private land 1.3 miles northeast of the Site. Cobb Mountain Lupine, a BLM Sensitive Plant, was documented 1.4 miles northeast of the Site on private land. Socrates Mine Jewelflower, BLM Sensitive Plant, was documented at three sites located 0.5 mile, 1.1 miles, and 1.6 miles from the Site. Purple Martin has been documented at one site located 0.8 miles from the Site. The species is a State Sensitive Candidate. The Foothill Yellow-Legged Frog has been documented in Little Sulphur Creek, 1 mile southwest, and downstream, of the Contact Mine. The species is a BLM Sensitive Species (BLM 2008a).

Signs of wildlife include deer tracks and scat and coyote scat (BLM 2008a).

2.6 Cultural Resources

In October 2008 the BLM conducted a cultural resources survey of the Site. The Site has three prominent flats connected by several dirt road segments. The Site Layout is shown in Figure 2-2. The road segments are severely deteriorated due to lack of use. The upper flat is approximately 250 feet by 110 feet and consists of mining equipment that is not *in situ*. The mining equipment includes a brick furnace with a concrete pad, corrugated sheet metal, and a boom for hoisting. During WESTON's site visit, the bricks had been neatly stacked on the concrete surface. An adit is located to the northeast of the concrete pad and an ore cart protrudes from the portal. Rusted tin cans with crimped seams were found at the upper flat. One can is labeled "Root Beer Taste" and has crimped seams. "Church keys" (i.e. can openers) were in use beginning in the 1930s and canned soda became popular in the 1950s. A September 2004 fire has impacted the vegetation at the upper flat as well as throughout the Site (BLM 2008b).

The center flat is connected to the upper flat by a 980 foot long access road. There is a one-acre tailing and waste-rock pile that continues downhill to the lower flat. The lower flat is connected to the center flat by a 1,050 foot access road (BLM 2008b).

The lower flat is approximately 255 feet by 75 feet. The lower flat contains an adit with a dilapidated portal. A seep runs from the adit creating a marshy area discussed in Sections 2.4 and 2.5. An in-situ

set of 60 foot long ore-cart rails are located to the southwest of the adit. Two pipes that were probably used to pump air into the adit are cantilevered over the edge of a small cliff. The remains of a furnace are located to the north of the adit. The furnace area contains corrugated sheet metal with bricks underneath. One brick is inscribed "LACLEDE/SPALLAC." The inscription refers to the Laclede-Christy Clay company, which began making bricks suitable for use at high temperatures in 1844 in St. Louis, Missouri. Laclede-Christy Clay also opened a factory in Fremont, California in 1948. The brick is likely associated with the Fremont factory (BLM 2008b).

To the northeast of the furnace area is a tailings pile that has cemented together to form a continuous sheet. The tailings are cemented by magnesite and individual particles of the tailings are cemented by material that is largely composed of magnesite. Eighteen vent pipes are located on the lower flat. A square bin with the inscription "L.P. McNear No. 26" is located on a road that connects the lower flat to the Sonoma Mercury Mine. The E. B. McNear Brick Company operated in San Francisco from 1921 to 1961. In 1961, it became the L. P. McNear Brick Company. Mine tailings may be located below the lower flat, but revegetation in the area makes identification of features in the area difficult (BLM 2008b, USGS 2008).

The Contact Mercury Mine was in operation from the late 1880s to 1956. Currently, there are no standing structures and limited mining equipment including an ore cart and piping. There are no other forms of associated historical artifacts, other than the brick scatter. As a result, the mining complex holds no integrity to the period of significant mercury mining in this area (BLM 2008b).

The cultural resources recorded during 2008 BLM survey were evaluated for their eligibility for inclusion on the National Register of Historic Places. This mining complex was evaluated using criteria found in the National Historic Preservation Act of 1966 and the Code of Regulations, Title 36, Part 60. According to the BLM Contact Mercury Mine does not meet any of the National Register criteria for inclusion in the National Register of Historic Places, and therefore is not eligible for nomination (BLM 2008b).

2.7 Land Use and Population

The nearest city to the Site is Healdsburg, which is approximately 11 miles southwest. Healdsburg has a population of approximately 11,000. There are several thermal spring resorts within 5 to 10 miles to the northwest of the Site. The primary land use is recreation. Spent shells, aluminum cans,

and makeshift targets were located at the adjacent Sonoma Mercury Mine, indicating use for target shooting.

2.8 Mine History and Description

The Contact Mercury Mine was in operation from the late 1880s to 1956. The Site is located in the Pine Flat Mining District, which was one of Sonoma County's earliest and most important mining districts. Work in the Pine Flat mining District began in the 1860s and the first recorded processing of mercury was at the Sonoma Mine, located approximately 2,000 feet downhill from the Site, in 1873. Mercury mining in the Pine Flat Mining District waned by 1880. Mines located within the Pine Flat Mining District were reopened and old equipment refurbished during World War I and World War II efforts. Often old tailings and old equipment was processed for residual mercury as well. Most mercury mines in the area closed by the 1960s due to stricter environmental regulations and a drop in mercury demand. (BLM 2008b).

Specifically at the Site, J. E. Grover submitted the first proof of labor document in 1929. He owned the Contact Mercury Mine until his death in 1932. Sixteen flasks of mercury were produced between 1933 and 1936. The Contact Mercury Mines Company took over operations from J.E. Grover and produced 325 flasks between 1939 and 1942. Forest Filey held the claims for the Site from 1944 until 1950. Charles R. Hubbard and Stanley Buckman of Buckman Laboratories held the claims for the Site 1951 to 1952. The claims for the Site were held by Harvey and Ruth Blair during 1954 to 1965. Edward J. Clark held the claims for the Site during 1962 to 1963. During 1964-65 the claims for the Site were sold to Uno. G. Ikola and Ralph E. Davis, who formed the Davis-Ikola Mercury Mines Company (BLM 2008c).

The Site occupies approximately 11 acres and is located near other mercury mines including the Rattlesnake Mine, Crystal Mine, Eureka Mine, Socrates Mine, Missouri Mine, Culver-Bear Mine, and Sonoma Mine. The Site consists of two adits, a large tailings pile, several smaller tailings piles, and miscellaneous structural debris such as bricks and corrugated sheet metal. The Site is located entirely on public land overseen by the BLM (BLM 2008b, Sonoma County Tax Assessor 2008).

2.9 Sources

Potential sources of mercury contamination at the Site consist of two adits, several mine tailings, and areas where mining operations occurred such as the furnace areas in the upper and lower flats. Photographs in Appendix A document site conditions during the August 29, 2008 site visit by

WESTON. Primary contamination sources at the Site mine are mine tailings. Contaminated sediment is present within the headwater of Anna Belcher Creek (USGS 2008).

3.0 ENVIRONMENTAL RELEASE ASSESSMENT

3.1 Previous Environmental Investigations

The USGS conducted an ongoing study from 2001 to 2003 in order to determine whether the Site caused elevated levels of methyl mercury in biota and tributaries to the Russian River Watershed. The USGS conducted sampling at the site during a storm event on April 20, 2001 as well as additional sampling on April 1, 2003. Sediment, soil, and surface water samples were collected during both sampling events. Biological samples were also collected on April 1, 2003. An additional sediment sample was collected on July 31, 2002. The samples were analyzed for various elements including mercury as well as methyl mercury, calcium carbonate, and sulfates. Sample locations for samples collected on the Site are shown in Figure 3-1. Sample locations for samples collected on the Site as well as downstream from the Site are shown in Figure 3-2. The results are discussed below (USGS 2008).

Mercury was detected in sediment samples at the Site and downstream from the Site at concentrations three times the background level. The background sample was collected approximately 1 mile upstream from the Anna Belcher Creek and Little Sulphur Creek confluence. The Site therefore meets the criteria for a documented release of mercury based upon CERCLA requirements. Sediment sample results are shown in Table 3-1. Mercury was detected at a maximum concentration of 34.2 milligrams per kilogram (mg/kg) in the Anna Belcher headwaters located on the Site. Mercury was detected further downstream from the Site at a maximum concentration of approximately 10 mg/kg. However, as discussed above, the Sonoma Mercury Mine also drains to Anna Belcher Creek. The Sonoma Mercury Mine boundaries are shown in Figure 3-2. Mercury contaminated soil and water from the Sonoma Mercury Mine may contribute to the mercury load from Anna Belcher Creek to Little Sulphur Creek (USGS 2008).

Methyl Mercury was detected in the two samples collected at the Site at a maximum concentration of 0.0008 mg/kg. Methyl mercury was analyzed in five of the eight samples collected downstream of

the Site and Sonoma Mercury Mine. Methyl mercury was detected in all samples at a maximum concentration of 0.0026 mg/kg (USGS 2008).

Biological samples including rainbow trout and invertebrates were collected and compared to background concentrations from a location in the Sierra Foothills. For CERCLA purposes, the biological samples are not used to document a release because background samples were not collected in similar enough conditions. However, the biological results as well as background results reported by the USGS are provided for reference. The rainbow trout sample results are shown in Table 3-2. All rainbow trout samples were collected downstream from both the Site as well as Sonoma Mercury Mine. Mercury was detected in rainbow trout samples at a maximum concentration of 0.219 microgram per gram ($\mu\text{g/g}$). Mercury was detected at or above the BLM Human Health Risk Management Criteria (RMC) for Campers of 0.048 $\mu\text{g/g}$ in all ten rainbow trout samples collected (USGS 2008, BLM 2008d).

The invertebrate sample results for water striders, Dobson flies, dragonflies, and stoneflies are shown in Table 3-3. Unlike the rainbow trout samples, water strider and Dobson fly samples were collected on Site as well as downstream from both the Site and Sonoma Mercury Mine. Mercury and methyl mercury were detected in water striders collected from the Site at maximum concentrations of 0.131 $\mu\text{g/g}$ and 0.116 $\mu\text{g/g}$, respectively. Mercury and methyl mercury were detected in Dobson flies collected at the Site at maximum concentrations of 0.429 $\mu\text{g/g}$ and 0.253 $\mu\text{g/g}$, respectively (USGS 2008).

Background samples were not collected for soil and surface water samples. Soil and surface water samples are discussed in Section 4.0, Streamlined Risk Assessment, and compared to relevant exposure criteria (USGS 2008).

4.0 STREAMLINED RISK ASSESSMENT

According to Section 300.410 (b) of the National Contingency Plan (NCP), a removal site evaluation includes evaluation by agencies of the threat to public health, and evaluation of the magnitude of risk. WESTON has conducted streamlined surface water and soil pathway risk assessments in accordance with EPA's guidance for conducting non-time critical removal actions (EPA, 1993).

The primary objective of this section is to perform a streamlined risk assessment for the site and to establish the potential risk to human health and wildlife. In order to evaluate the potential threat to

human health and the environment, sediment, surface water, soil, and biological sample results have been compared against applicable Risk Management Criteria for Metals at BLM Mining Sites, National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRTs) Threshold Effect Levels, EPA Preliminary Remediation Goals (PRGs) for industrial soil, and EPA Ambient Water Quality Criteria (AWQC).

4.1 Risk Assessment Results

Sediment:

Mercury was detected above the NOAA SQuiRTs Threshold Effects Level of 0.174 mg/kg in both sediment samples collected at the Site as well as in all eight of the samples collected downstream of the Site and Sonoma Mercury Mine. In addition, arsenic, chromium, copper, and nickel were detected at respective concentrations above the NOAA SQuiRTs Threshold Effects Levels. Arsenic was detected at concentrations ranging above the Threshold Effects Level of 5.9 mg/kg at concentrations ranging from 6.8 to 10.1 mg/kg. Chromium was detected well above the NOAA SQuiRTs Threshold Effects Level of 37.3 mg/kg at concentrations ranging from 475 mg/kg to 3,050 mg/kg. Copper was detected above the NOAA SQuiRTs Threshold Effects Level of 35.7 mg/kg at concentrations ranging from 37.2 to 131 mg/kg. Nickel was also detected well above the NOAA SQuiRTs Threshold Effects Level of 18 mg/kg in all samples at concentrations ranging from 191 mg/kg to 447 mg/kg (BLM 2008d, NOAA 2008, USGS 2008).

Mercury was detected above the BLM Human Health RMC for campers of 40 mg/kg in two of the eight sediment samples collected downstream of the Site and Sonoma Mercury Mine. Arsenic and nickel were detected below BML Human Health RMC for campers in all samples. NOAA SQuiRTS and BLM RMC criteria are included in Table 3-1 for reference when available (USGS 2008).

Surface Water:

Surface Water sample results are shown in Table 4-1. Two surface water samples were collected at the Site. Lead was detected in one of the two samples above the EPA AWQC Chronic value of 2.5 micrograms per liter ($\mu\text{g/L}$) at a concentration of 3 $\mu\text{g/L}$. Mercury was detected in the surface water samples collected on Site at a maximum concentration of 0.181 $\mu\text{g/L}$, which is well below the EPA AWQC Chronic value of 2.5 $\mu\text{g/L}$. Four additional samples were collected downstream from both the Site and Sonoma Mercury Mine. Methyl Mercury was detected well below the EPA AWQC

Human Health for consumption of organism only value of 0.3 µg/L at a maximum concentration of 0.000131 µg/L (NOAA 2008, USGS 2008).

Biological:

As discussed in Section 3, rainbow trout samples collected downstream of the Site and Sonoma Mercury Mine contained mercury at or above the BLM Human Health RMC of 0.048 µg/g in all 10 samples collected (BLM 2008d, USGS 2008).

Soil:

Soil samples results are shown in Table 4-2. A total of 12 surface soil samples were collected at the Site. Mercury was detected in all samples at concentrations ranging from 3.73 mg/kg to 17,000 mg/kg. Ten of the soil samples contained mercury at concentrations above the BLM Median Wildlife RMC of 8 mg/kg. Two soil samples contained mercury at concentrations above the BLM Human Health RMC of 46 mg/kg. Three samples contained mercury above EPA PRGs for Industrial Soil of 28 mg/kg. Arsenic was detected above the Cal-modified EPA PRG for Industrial Soil of 0.24 mg/kg in 11 of the 12 samples. Arsenic was detected at a maximum concentration of 8.2 mg/kg. Chromium was detected above EPA PRG for Industrial Soil of 1,400 mg/kg in 4 of the 12 samples collected. Chromium was detected at a maximum concentration of 2,490 mg/kg (BLM 2008d, EPA 2008, USGS 2008).

The streamlined risk screening indicates that several State and Federal criteria/goals established for mercury as well as other contaminants in sediment, surface water, fish, and soil are exceeded at the Site or downstream of the Site in Anna Belcher Creek. Mine tailings are the primary source of contamination. Overland flow and surface water runoff are the primary release mechanisms. Recreational and ecological receptors are subject to potential exposure via ingestion and/or dermal contact.

4.2 Regulatory Framework Conclusions

According to Section 300.410 (b) of the National Contingency Plan (NCP), a removal site evaluation includes evaluation by agencies of factors necessary to determine whether a removal action is necessary. In addition, a determination must be made as to whether a non-federal party is responsible for undertaking or assisting with a cleanup.

The project was developed by the BLM using its delegated authority under CERCLA to assess impacts to human health and the environment posed by the tailings and to determine whether a removal action is warranted. BLM has elected to use its CERCLA authority for the Site to determine if a release of hazardous substances has occurred or if potential exists for a release or threat of a release of CERCLA hazardous substances. In accordance with Section 300.415(b)(2)(i-viii) of the NCP, a removal action is selected when one of the following criteria is satisfied:

- Actual or potential exposure to nearby populations, animals or the food chain from hazardous substances, pollutants or contaminants:

There is a viable potential for exposure to mercury by human (recreational) and aquatic receptors. Analytical evidence shows that surface soil contains mercury at levels above BLM Median Wildlife RMC, BLM Human Health RMC for campers, and the Cal-modified EPA Industrial PRG. Chromium and arsenic are also present in soils on-site above EPA Industrial PRGs. Mercury is found in sediment samples above BLM Human Health RMCs for campers and NOAA SQuiRT's Threshold Effects Levels.

- Actual or potential contamination of drinking water supplies or sensitive ecosystems:

There is analytical evidence that mercury contamination is migrating offsite and downstream to Anna Belcher Creek and then to the Little Sulphur Creek. The Little Sulphur Creek flows to Big Sulphur Creek and then to the Russian River. These water courses are used each year by rainbow trout and provide spawning habitat.

- Hazardous substances in drums, barrels, tanks or other bulk containers that may pose a threat of release:

There is no evidence of containers at the Site.

- High levels of hazardous substances, pollutants, or contaminants in soils largely at or near the surface that may migrate:

Soil samples collected at the Site exceed BLM RMC Criteria as well as EPA PRGs for Industrial Soil.

- Weather conditions that may promote migration of hazardous substances:

During the high flow season, elevated concentrations of mercury may migrate from the mine area downstream to Anna Belcher Creek within the Russian River Watershed.

- Threat of fire or explosion:

There is no known threat of fire or explosion.

- Availability of other appropriate Federal or State response mechanisms to respond to the release:

Developed partnerships include the California Water Resources Division, California Regional Water Quality Control Board, and the USGS-Geologic Division. Local watershed stakeholder groups and the California State Water Quality Board also support the project.

- Other situations or factors that may pose threats to public health, welfare or the environment:

As discussed above, soil samples collected at the Site exceed BLM RMC Criteria as well as EPA PRGs for Industrial Soil.

In order to prevent ongoing releases of mercury to the Russian River Watershed, measures should be taken to prevent further mercury migration off of the Site. Potential remediation activities to reduce mercury in the Russian River Watershed include surface water controls, waste consolidation and containment, and sediment excavation. This may include localized retention of sediment that has previously discharged from the mine sites and is now in the creeks. In addition, mercury in mine tailings at the Site poses a threat to wildlife and humans during recreational use. It is known that recreational use occurs in the vicinity of the Site. It is recommended that a non-time critical action be taken for the Contact Mercury Mine and that an Engineering Evaluation/Cost Analysis (EE/CA) be prepared to fully develop remedial action objectives, alternatives, and feasibility.

5.0 BASIS FOR REMOVAL ACTION

Mercury in sediment at the Contact Mercury Mine Site poses a threat to human health and ecological receptors. Ingestion of mercury-impacted fauna also poses a threat to human health and other ecological receptors. Sediment and soil at the Site contain mercury above soil screening concentrations for protection of potential ecological receptors. Potential impacts to human and ecological receptors due to exposure to mercury are described below, followed by a summary of removal action criteria from the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) that are met at the Site.

5.1 Potential Human Impacts of Mercury Exposure

Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, uncoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage. Effects of exposure to mercury on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems. Methyl mercury and metallic mercury vapors are more harmful than other forms, because mercury in these forms more readily reaches the brain. Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation (ATSDR 1999).

5.2 Potential Ecological Impacts of Mercury Exposure

In the environment, inorganic mercury can be methylated by microorganisms to produce methyl mercury. Methyl mercury will accumulate in the tissues of organisms. The animals at the top of the food chain tend to accumulate the most methyl mercury in their bodies. Any source of mercury release to the environment may, therefore, lead to increased levels of methyl mercury in tissues of large fish, reptiles, birds, and mammals. Mercury affects the reproduction and foraging ability of fish and is also neurotoxic to fish. Exposure to mercury can impair reproduction of birds, cause mortality of bird eggs, and is related to the impaired feeding ability of birds. Exposure effects of mammals to mercury are similar to effects in humans and include lethargy, tremors, convulsions, and mortality (ASTDR 1999).

5.3 NCP Removal Action Criteria

The potential risks to humans and ecological receptors described above document attainment of the following NCP removal action factors found at 40 Code of Federal Regulations (CFR) Section 300.415(b)(2):

- Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.
- Actual or potential contamination of drinking water supplies or sensitive ecosystems.
- High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate.
- Weather conditions that may cause hazardous substances or pollutants to migrate or be released.

Based upon these three NCP factors, a removal action is necessary at the Site to prevent human and ecological exposure to high levels of mercury, to prevent accumulation of mercury in the food chain, and to prevent the continued migration of mercury from the Site into the Russian River watershed.

6.0 PRELIMINARY REMOVAL ACTION OBJECTIVES AND GOALS

This section of the RSI report identifies removal action objectives and associated clean up levels, statutory limits on removal, the removal action scope, and a preliminary removal action schedule. These objectives and goals will be finalized after the evaluation of applicable or relevant and appropriate requirements (ARAR) completed as part of the EE/CA.

Removal Action Objective: Removal action objectives are intended to remove the site conditions that create the NCP factors for a removal action. These factors are:

- 1) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants. Fresh water organisms contain elevated mercury-in-tissue and pose a risk to both human and wildlife receptors. Humans are exposed to high levels of mercury when they disturb site soils or sediment in the Russian River Watershed during recreational activities.
- 2) Actual or potential contamination of drinking water supplies or sensitive ecosystems. Mercury containing sediment from the site discharges ultimately to Little Sulphur Creek, which is part of the Russian River watershed. Surface runoff from the Site contains mercury which becomes methylated and bioconcentrates in the food chain. Humans and upper trophic level fauna may be exposed to harmful levels of mercury by consuming mercury-containing organisms and water.
- 3) High levels of hazardous substances, pollutants, or contaminants in soils largely at or near the surface that may migrate. Mercury in surface water runoff migrates from the Site to Anna Belcher Creek.

Based on these NCP removal action factors the following removal action objectives are identified for the Site:

- 1) Prevent the migration of mercury from the Site into Anna Belcher Creek by minimizing the flow of water and sediment from the Site.
- 2) Minimize the hazards associated with mine tailings containing elevated levels of mercury. Currently, soils at the Site contain mercury at concentrations above the BLM Median

Wildlife RMC, the BLM Human Health RMC for campers, and EPA PRGs for Industrial Soil.

Attaining these objectives is expected to result in mitigation of NCP removal action factors, protection of human and ecological receptors, and protection of water quality at the Site. There are no known specific cleanup levels applicable to the Site. Therefore, the removal action will reduce the amount of mercury in sediment and soils available for transport, dissolution, volatilization, methylation, and bioaccumulation.

Statutory Limits on Removal Action. Statutory limitations on response are found at Section 104 of the CERCLA. Limitations at CERCLA Section 104(a)(3) prevent removal actions in response to a release or threat of release:

(A) Of naturally occurring substances in their unaltered form (or that have been altered solely through natural processes);

(B) From products which are part of the structure of and result in exposure within, residential buildings or business or community structures;

(C) Into public or private drinking water supplies due to deterioration of the system through ordinary use.

None of the preceding statutory limitations apply to the Site. Limitations at CERCLA Section 104(c)(1) prohibit expenditure of more than \$2,000,000.00 or a removal duration of more than 12 months for Time Critical actions funded out of the Superfund account. This limit on funds and duration does not apply to removal actions at the Site because this action is not financed by the Superfund account. However, time limits are generally used to help determine Time Critical Removal Actions.

The NCP at Section 300.410(b)(3) provides for the completion of an EE/CA whenever a planning period of at least 6 months exists before on-site activities must be initiated. BLM intends to complete an EE/CA for removal actions at Site.

The NCP at Section 300.410(f) specifies that if the removal action does not fully address threats posed by the release, an orderly transition from removal to remedial response activities will be

provided. BLM will provide for an orderly transition to remedial response if removal actions do not fully address threats posed by the release.

The NCP at Section 300.410(i) requires that Fund financed removal actions attain ARARs to the extent practicable and considering the exigencies of the situation. While this is not a Superfund financed action, this requirement is normally adhered to for removal actions completed under the NCP.

The NCP at Section 300.410(k) encourages provision for post-removal site controls for Superfund financed removal actions. The purpose of post-removal site controls includes actions necessary to ensure the effectiveness and integrity of the Time Critical removal action after completion, or after the \$2,000,000 and 12 month limits are reached. While this is not a Superfund financed action, post removal site controls are normally applied after removal actions completed under the NCP

Removal Action Scope. The removal action is intended to address mercury discharging from sediment suspended in runoff from the Site as well as to remove threats to ecological receptors and humans from the mine tailings located at the Site. To effectively address mercury in surface water runoff, the sources of mercury need to be removed or release mechanisms interrupted. Remedial activities at the site should include consolidating and covering mine tailings in order to reduce human and wildlife contact. Restoration options could include covering the exposed mine tailings with a geotechnical membrane, gravel, mulch or bark, and/or sealing the two open mine adits. The actual methods used to attain removal action objectives will be identified in an EE/CA.

Removal Action Schedule. Table 6-1 identifies a removal action schedule based on the completion of the EE/CA. Completion of the EE/CA is currently anticipated in September 2009.

7.0 DATA GAPS AND AREAS OF ADDITIONAL INVESTIGATION

For the purpose of the Contact Mercury Mine RSI a data gap is information needed to assess whether a release to the environment has occurred at the Contact Mercury Mine site as well as information required to delineate the source area. In addition, data that is required to quantify the volume of the source (mine tailings) is discussed below.

Appropriate background samples were not collected per EPA CERCLA requirements to document a release as follows:

- A background sample was not collected for soil samples.
- The background biological sample used in the USGS report may not be acceptable as it was not collected upstream of the site per CERCLA requirements. There were no suitable background locations for biological samples in Anna Belcher Creek as the Site is located in the headwaters of Anna Belcher Creek. Biological samples were not collected upstream of the confluence Anna Belcher Creek and Little Sulphur Creek.
- Sediment samples have suitable background data as one background sample was collected. However, only one background sediment sample was collected approximately 1 mile upstream of the Anna Belcher and Little Sulphur Creek confluence. In general, it is better to have several background samples in order to ensure that samples are being compared to a range of values. Sediment samples were not all collected during the same sampling events per CERCLA requirements. Background samples were collected in April 2001. Other samples were collected from April 2001 to April 2003. WESTON takes the view that because the release in concern is comprised of heavy metals, and metals do not degrade in the manner that organics do, it is acceptable that the background samples and samples used to document a release were collected within two years of each other. Based upon sediment soil sample results a release is documented for the Contact Mercury Mine site.

Using data collected by the BLM and USGS, source areas at the Site are suitably delineated. However, there is not currently suitable information to quantify the removal volume. Additional sampling and surveying is required to quantify mine tailings at the Site.

Analytical results show sediment on-site and downstream from the Sonoma Mercury Mine is contaminated with mercury. Surface water samples collected at the Sonoma Mercury Mine site
Further sampling is required to quantify sediment contamination at the Site and downstream of the Site.

8.0 REFERENCES

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USGS 2008, Environmental Impact of Contact and Sonoma Mercury Mines on water, sediment, and biota in Anna Belcher and Little Sulphur Creek watersheds, Draft, Sonoma County, California, 2008.

Western Regional Climate Center 2009, <http://www.wrcc.dri.edu/index.html>, Data accessed on January 15, 2009.

Appendix A

Site Photographs

Photo 1: Remains of brick furnace on concrete pad.

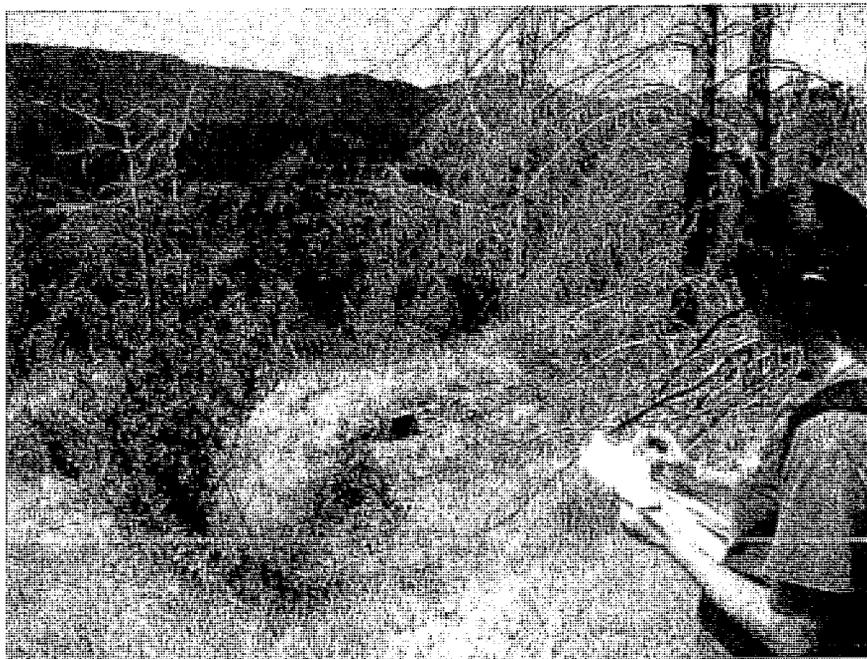


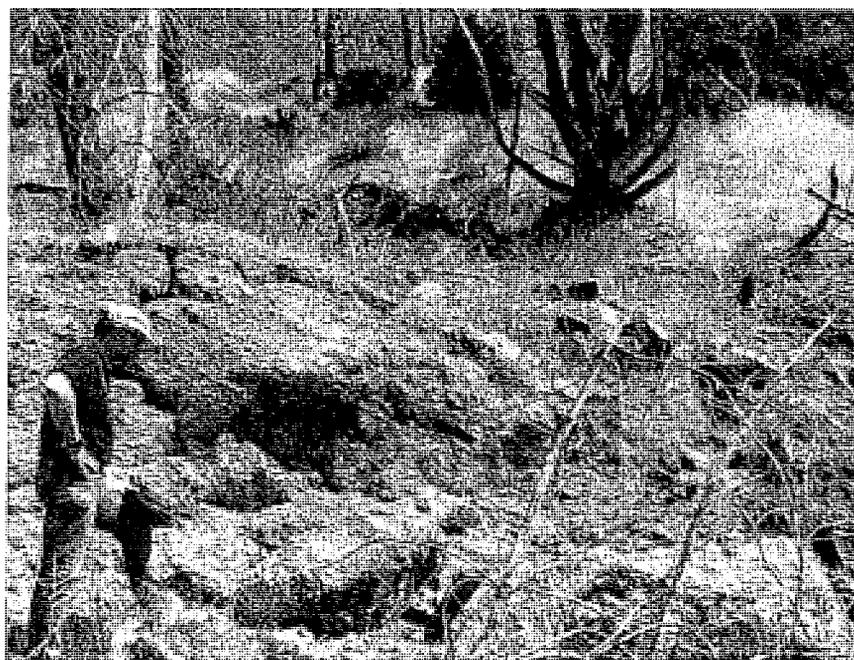
Photo 2: Cemented mine tailings.

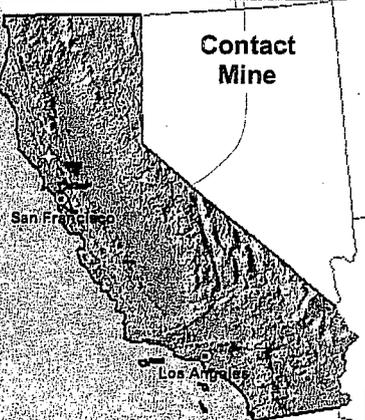
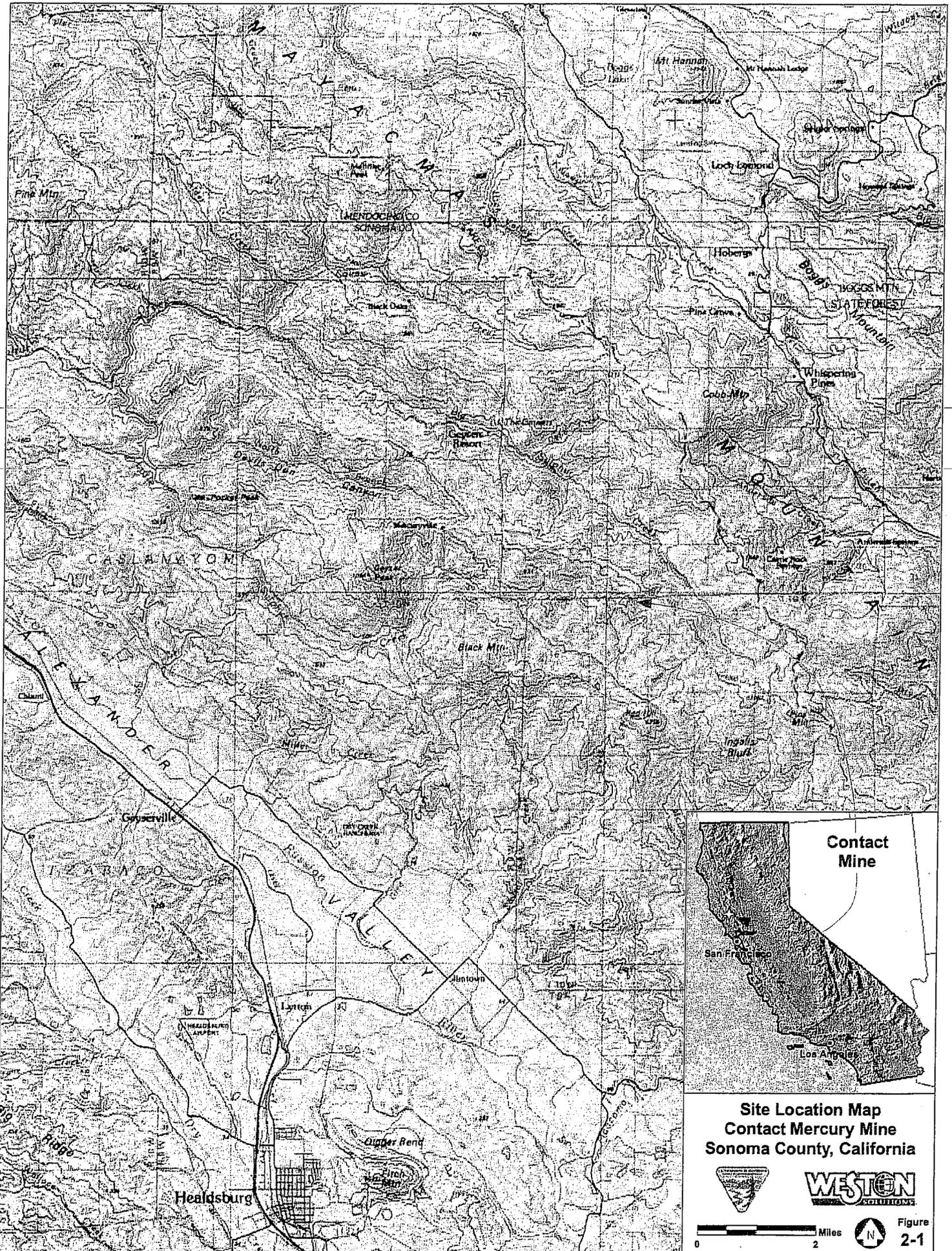


Photo 3: Additional mine tailings.



Photo 4: Additional mine tailings.



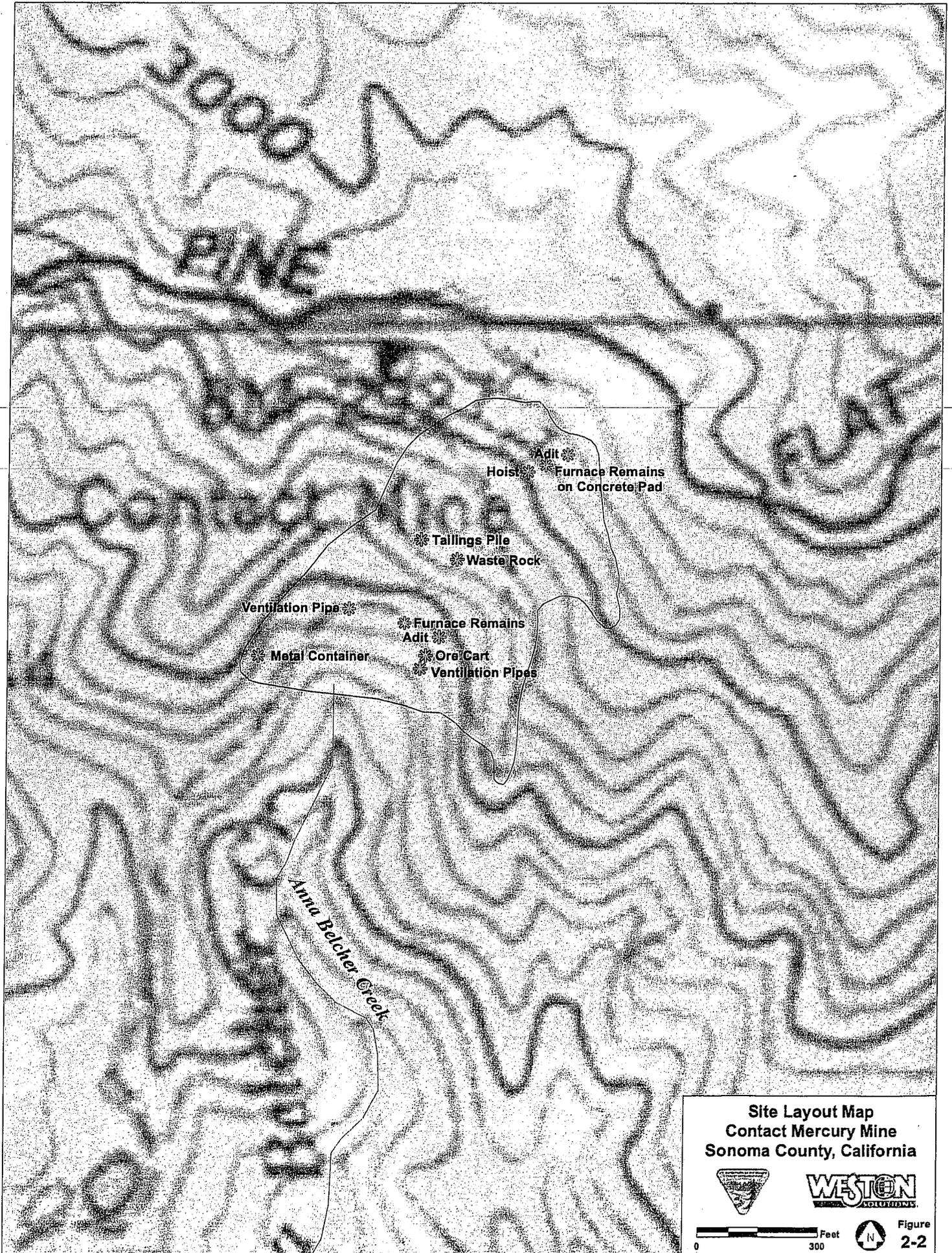


Site Location Map
Contact Mercury Mine
Sonoma County, California

WESTON SOLUTIONS

0 2 Miles

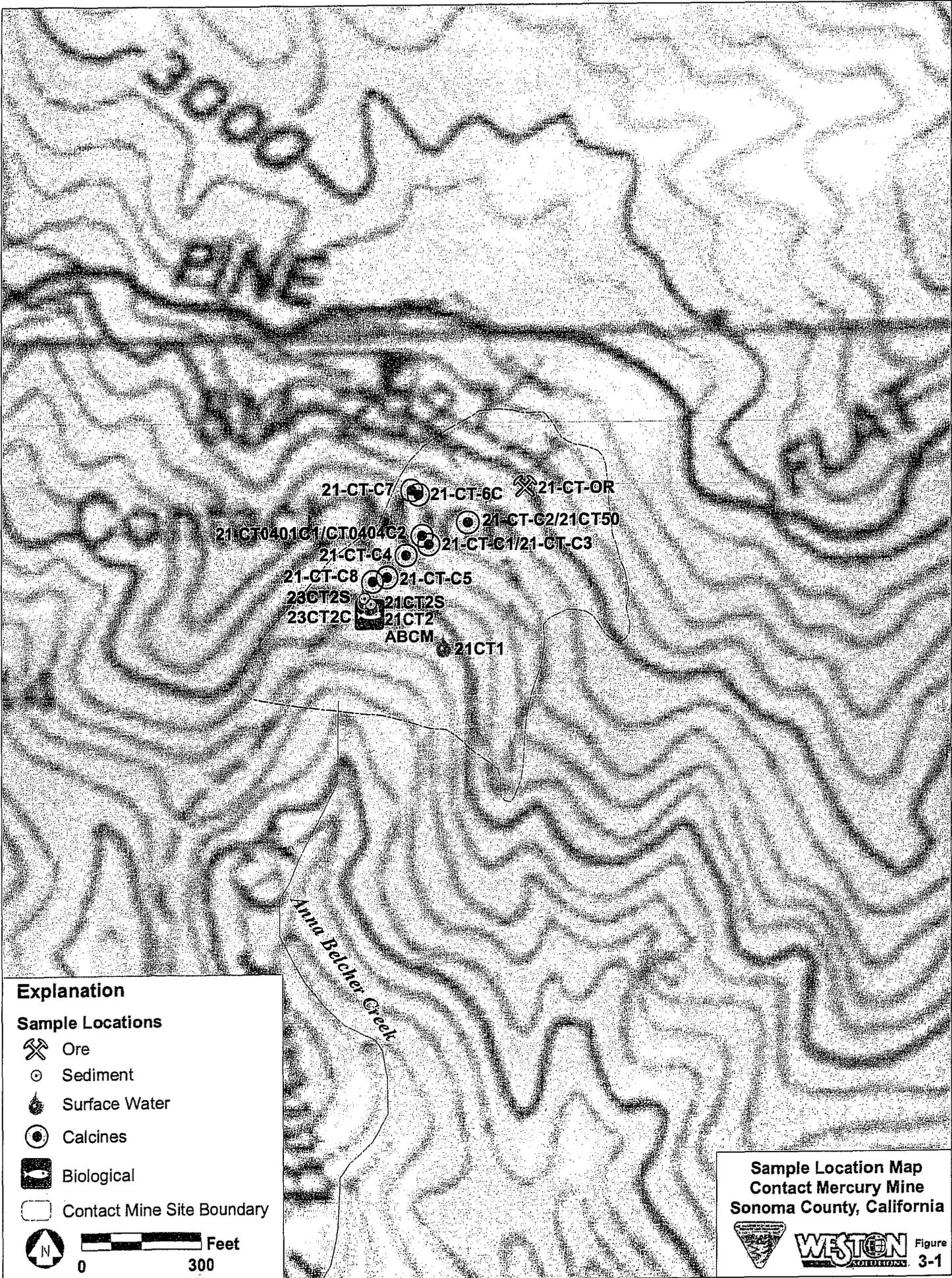
Figure 2-1



Site Layout Map
Contact Mercury Mine
Sonoma County, California



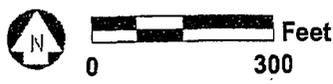
Figure
2-2



Explanation

Sample Locations

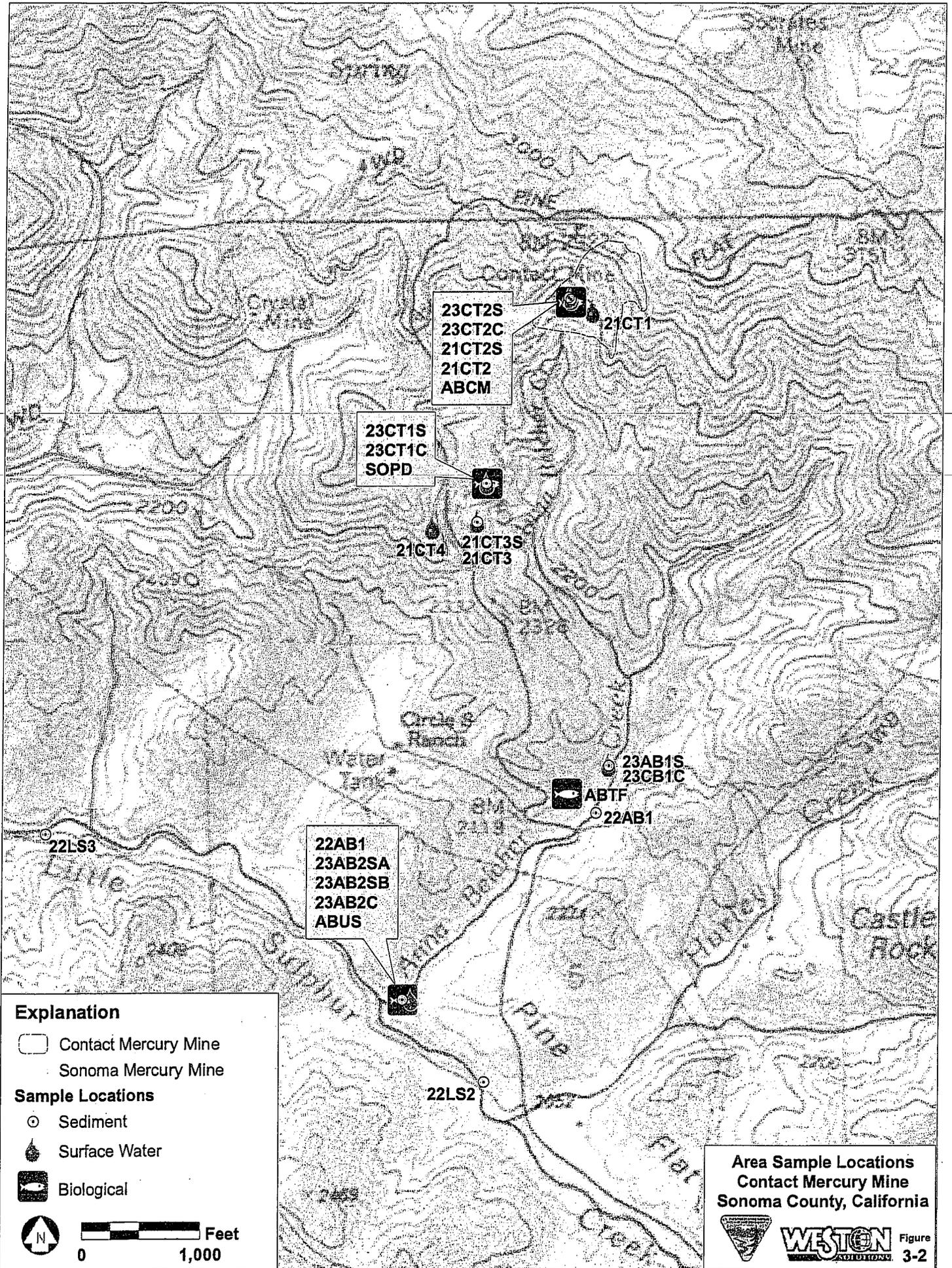
-  Ore
-  Sediment
-  Surface Water
-  Calcines
-  Biological
-  Contact Mine Site Boundary



Anna Belcher Creek

21-CT-C7 21-CT-6C  21-CT-OR
 21-CT-0401C1/CT0404C2  21-CT-C2/21CT50
 21-CT-C4  21-CT-C1/21-CT-C3
 21-CT-C8  21-CT-C5
 23CT2S  21CT2S
 23CT2C  21CT2
 ABCM  21CT1

**Sample Location Map
Contact Mercury Mine
Sonoma County, California**



Explanation

-  Contact Mercury Mine
-  Sonoma Mercury Mine

Sample Locations

-  Sediment
-  Surface Water
-  Biological



**Area Sample Locations
Contact Mercury Mine
Sonoma County, California**



Sample Location	Sample Date	Location Description	Mercury	Methyl Mercury	Antimony	Strontium	Tantalum	Tellurium	Thallium	Thorium	Tin	Tungsten	Uranium	Vanadium	Yttrium	Zinc
NOAA SQUIRTs - Threshold Effects Level			0.174	--	--	--	--	--	--	--	--	--	--	--	--	123
BLM Human Health RMC - Camper			40	--	50	--	--	--	--	--	--	--	--	--	--	40000
22 LS 2	4/20/2001	≈ 1 mile Upstream of Little Sulphur Creek and Anna Belcher Confluence	0.43	--	0.6	36	0.15	ND (0.05)	0.32	5.4	1.2	0.6	1.5	103	12.9	90
21CT 2S	4/20/2001	Sand in Anna Belcher Creek on Contact Mercury Mine Site	<u>34.2</u>	0.0008	0.7	3.6	0.45	<u>0.3</u>	0.28	4.6	1.4	ND (0.1)	1.1	102	11.5	78
23CT 2S	4/1/2003	Unnamed Stream on Contact Mercury Mine Site	<u>14.05</u>	0.0005	0.91	5.4	0.19	<u>0.05</u>	0.33	5.1	1.5	0.7	1.1	131	13.3	86
23AB 1S	4/1/2003	Anna Belcher Creek downstream of Contact Mercury Mine and Sonoma Mercury Mine	<u>5.57</u>	0.0004	0.84	0.3	0.22	<u>0.05</u>	0.3	5	1.4	0.8	1.2	114	12	79
22AB 1	7/31/2002	Anna Belcher Creek - Downstream of Contact and Sonoma Sites	<u>50</u>	0.0026	0.85	1.5	0.25	ND (0.05)	0.28	5.8	3	0.7	1.5	115	13.3	94
22AB 2	7/31/2002	Downstream of 22AB 1	<u>12.12</u>	--	0.65	1.9	0.25	ND (0.05)	0.26	4.8	1.6	0.7	1.3	94	11.6	74
23AB 2SA	4/1/2003	Little Sulphur Creek and Anna Belcher Confluence	<u>≥100</u>	0.0026	0.68	1.3	0.13	ND (0.05)	0.34	5.9	2.4	0.7	1.5	138	15	106
23AB 2SB	4/1/2003	Field Duplicate of 23AB 2SA	<u>4.76</u>	--	0.71	2	0.09	ND (0.05)	0.3	5	1.2	0.7	1.2	112	11.8	77
22LS3	4/20/2001	Little Sulphur Creek - Downstream of Anna Belcher Creek Confluence	<u>9.67</u>	--	0.5	1	0.15	ND (0.05)	0.26	6.2	1	0.5	1.5	122	11.3	82
22LS 1SB	4/20/2001	Little Sulphur Creek - Downstream of Anna Belcher Creek Confluence	<u>2.94</u>	0.0001	0.7	1.9	0.25	ND (0.05)	0.24	5	1.2	0.9	1.4	98	10.6	78
22LS 1SA	4/20/2001	Little Sulphur Creek - Downstream of Anna Belcher Creek Confluence	<u>1.47</u>	0.0001	0.7	6	0.25	ND (0.05)	0.3	5.8	1.2	0.8	1.5	113	12.7	90

-- = Analysis not performed on sample
NOAA SQUIRTs - Threshold Effects Level - National Oceanic and Atmospheric Administration
mg/kg = milligrams per kilogram
ND () = Analyte not detected above the reported sample quantitation limit. The number in parentheses is the detection limit.

¹ = An analyte is considered to be present at a concentration significantly above background if the analyte is detected in the site-related sample when not detected in the background samples, or if the analyte is detected in the site-related sample at a concentration three times the maximum background level when detected in the background samples.

Sample Location	Sample Date	Location Description	Vanadium - filtered	Vanadium	Vanadium - filtered	Yttrium	Yttrium - filtered	Ytterbium
EPA AWQC Chronic			--	--	--	--	--	--
EPA AWQC - Human Health for consumption of organism only			--	--	--	--	--	--
21CT1	4/20/2001	Contract Sonoma Drainage Adit	--	2	--	0.2	--	ND (0.01)
21CT2	4/20/2001	Anna Belcher Creek beyond Contact Lowest Tailings	--	1	--	0.03	--	ND (0.01)
23CT2	4/1/2003	Unnamed Stream on Contract Mercury Mine Site	0.011	0.64	0.75	0.057	ND (0.03)	ND (0.01)
23AB1	4/1/2003	Anna Belcher Creek downstream of Contact Mercury Mine and Sonoma Mercury Mine	0.027	0.66	0.6	0.044	ND (0.03)	ND (0.01)
23AB2	4/1/2003	Downstream of 23AB1C	0.011	2.1	2	0.02	0.94	ND (0.01)
22LS1C	4/20/2001	Little Sulphur Creek - 3 miles downstream of Anna Belcher Confluence	0.018	2.1	2.1	0.026	0.022	ND (0.01)

ered"



(µg/L)
 (underlined)

filtered	Chromium*	Chromium - filtered	Cobalt	Cobalt - filtered	Copper	Copper - filtered	Germanium	Iron	Iron - filtered	Lanthanum - filtered	Lithium
---	11	--	--	--	9.0	--		--	--	--	--
---	--	--	--	--	--	--		--	--	--	--

Background Sample - Not collected

Surface Water Samples

---	3	--	ND (0.02)	--	ND (0.5)	--	0.07	ND (0.02)	--	--	4.1
---	6	--	ND (0.02)	--	0.5	--	ND (0.02)	ND (0.02)	--	--	0.4
1)	3.6	4.1	0.092	ND (0.02)	0.64	0.5	ND (0.02)	0.079	12	0.017	0.6
12	1.6	1.4	ND (0.02)	ND (0.02)	ND (0.5)	ND (0.5)	ND (0.02)	ND (0.02)	25	0.019	1.2
1)	7.8	7.5	ND (0.02)	ND (0.02)	ND (0.5)	ND (0.5)	ND (0.02)	ND (0.02)	22	ND (0.01)	ND (0.01)
2	ND (1)	ND (1)	0.022	0.022	ND (0.5)	ND (0.5)	ND (0.02)	ND (0.02)	28	0.04	0.21

ed contract required quantitation limit.

example, the value located in the "Mercury, filtered"

met

at a concentration equal to or greater than

**Table 3-1
Contact Mercury Mine - 2001 to 2003 Sediment Samples Results (mg/kg)**
(results¹ significantly above background are bolded and (results¹ significantly above background are bolded and underlined)

Sample Location	Sample Date	Location Description	Mercury	Methyl Mercury	Antimony	Arsenic	Barium	Beryllium	Cadmium	Cerium	Chromium	Cesium	Cobalt	Copper	Gallium	Germanium	Hafnium	Indium	Lanthanum	Lead	Lithium	Manganese	Molybdenum	Niobium	Nickel	Phosphorous	Rhenium	Rubidium	Selenium	Silver	Strontium	Tantalum	Tellurium	Thallium	Thorium	Tin	Tungsten	Uranium	Vanadium	Yttrium	Zinc
NOAA SQiRTs - Threshold Effects Level			0.174	--	--	5.9	--	--	0.596	--	37.3	--	--	35.7	--	--	--	--	--	--	--	--	--	--	18.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	123
BLM Human Health RMC - Camper			40	--	50	20	--	--	70	--	--	--	--	5,000	--	--	--	--	--	1000	--	--	--	--	2700	--	--	--	700	700	--	--	--	--	--	--	--	--	--	--	40000
Background Sample																																									
22 LS 2	4/20/2001	≈ 1 mile Upstream of Little Sulphur Creek and Anna Belcher Confluence	0.43	--	0.6	7.2	469	1	0.08	31	1510	2.55	31	48.8	14.1	0.3	1.7	0.045	16.5	11	30.6	750	1	5.3	248	420	0.004	49.9	1	0.02	96	0.15	ND (0.05)	0.32	5.4	1.2	0.6	1.5	103	12.9	90
Sediment Samples																																									
21CT 2S	4/20/2001	Sand in Anna Belcher Creek on Contact Mercury Mine Site	34.2	0.0008	0.7	7.4	371.5	0.95	0.12	24.3	475	2	29.8	40	10.85	0.25	1.3	0.055	13	13	29	585	0.6	5.5	447	420	ND (0.002)	44.8	ND (1)	0.32	83.8	0.45	0.3	0.28	4.6	1.4	ND (0.1)	1.1	102	11.5	78
23CT 2S	4/1/2003	Unnamed Stream on Contact Mercury Mine Site	14.05	0.0005	0.91	8.5	460	0.94	0.12	32.5	496	2.51	36.2	40.5	13.9	0.16	1.9	0.036	13.9	10.6	36.3	820	0.74	6.1	476	500	ND (0.002)	59.3	ND (1)	0.07	75.4	0.19	0.05	0.33	5.1	1.5	0.7	1.1	131	13.3	86
23AB 1S	4/1/2003	Anna Belcher Creek downstream of Contact Mercury Mine and Sonoma Mercury Mine	5.57	0.0004	0.84	10.1	560	0.97	0.12	33.1	528	2.62	32.3	131	13.75	0.13	2.1	0.035	12.9	10.6	34.9	667	0.87	5.2	306	420	ND (0.002)	56.4	ND (1)	0.29	80.3	0.22	0.05	0.3	5	1.4	0.8	1.2	114	12	79
22AB 1	7/31/2002	Anna Belcher Creek - Downstream of Contact and Sonoma Sites	50	0.0026	0.85	8.6	1144	1.15	0.12	37.4	2,050	2.6	34.3	44.8	14.2	0.25	1.7	0.04	20.5	17.5	33.4	730	1.55	6.8	309	490	0.002	48.3	1	0.02	111.5	0.25	ND (0.05)	0.28	5.8	3	0.7	1.5	115	13.3	94
22AB 2	7/31/2002	Downstream of 22AB 1	12.12	--	0.65	7	594.3	1.1	0.08	22.8	709	2.3	22.8	37.2	12.65	0.3	1.5	0.035	15.5	11	30.2	570	1.55	6.4	221	450	0.002	45.2	1	0.02	97.9	0.25	ND (0.05)	0.26	4.8	1.6	0.7	1.3	94	11.6	74
23AB 2SA	4/1/2003	Little Sulphur Creek and Anna Belcher Confluence	≥100	0.0026	0.68	8.8	990	1.08	0.13	42.4	528	3.22	32.3	47.6	14.85	0.15	2	0.037	12.9	11.8	35.6	797	0.8	5.1	275	520	ND (0.002)	61.3	1	0.12	91.3	0.13	ND (0.05)	0.34	5.9	2.4	0.7	1.5	138	15	106
23AB 2SB	4/1/2003	Field Duplicate of 23AB 2SA	4.76	--	0.71	7.9	430	0.99	0.1	28.4	3,050	2.48	26.8	39.8	13.1	0.13	1.6	0.028	17.3	9	33.5	651	0.78	4.8	314	430	ND (0.002)	55.6	ND (1)	0.06	72	0.09	ND (0.05)	0.3	5	1.2	0.7	1.2	112	11.8	77
22LS3	4/20/2001	Little Sulphur Creek - Downstream of Anna Belcher Creek Confluence	9.67	--	0.5	7	447	1.05	0.08	33.4	1070	2.3	19.1	35.6	12.8	0.25	1.6	0.04	18	10.5	28.4	510	0.75	5.1	191	450	0.002	45.9	1	0.02	101	0.15	ND (0.05)	0.26	6.2	1	0.5	1.5	122	11.3	82
22LS 1SB	4/20/2001	Little Sulphur Creek - Downstream of Anna Belcher Creek Confluence	2.94	0.0001	0.7	6.8	405	1.05	0.08	26.5	653	2.1	26.5	32.2	12.7	0.3	1.5	0.035	14	9	27	535	0.75	6.9	264	370	0.002	45.7	1	ND (0.02)	92.9	0.25	ND (0.05)	0.24	5	1.2	0.9	1.4	98	10.6	78
22LS 1SA	4/20/2001	Little Sulphur Creek - Downstream of Anna Belcher Creek Confluence	1.47	0.0001	0.7	6.8	702.8	1.1	0.12	35.1	883	2.5	34.5	42	14.25	0.3	1.6	0.04	19.5	12.5	30	945	3.2	6.6	352	530	0.004	51	1	0.02	116	0.25	ND (0.05)	0.3	5.8	1.2	0.8	1.5	113	12.7	90

-- = Analysis not performed on sample

NOAA SQiRTs - Threshold Effects Level - National Oceanic and Atmospheric Administration Screening Quick Reference Tables Threshold Effects Level revised in November 2006

mg/kg = milligrams per kilogram

ND () = Analyte not detected above the reported sample quantitation limit. The number in parentheses represents the associated contract required quantitation limit.

¹ = An analyte is considered to be present at a concentration significantly above background if one of the following two criteria is met

1) the analyte is detected in the site-related sample when not detected in the background samples or 2) the analyte is reported at a concentration equal to or greater than three times the maximum background level when detected in the background samples.

Table 3-2
Contact Mercury Mine - 2003 Sampling Results for Biological Samples - Fish ($\mu\text{g/g}$)
results¹ significantly above background are bolded and underlined)

Sample Location	Sample Type	Sample Date	Location Description	Mercury
Biological Samples Fish- BLM Human Health RMC - Camper				0.048
Background Sample				
BR20-R-075	Biological - Fish	8/26/1999	Bear River at Hwy 20	0.063
BR20-R-076	Biological - Fish	8/26/1999	Bear River at Hwy 20	0.050
BR20-R-077	Biological - Fish	8/26/1999	Bear River at Hwy 20	0.083
BR20-F-029	Biological - Fish	8/26/1999	Bear River at Hwy 20	0.095
Biological - Fish Samples				
ABTF-001F	Biological - Fish	4/1/2003	Anna Belcher Creek downstream of Contact and Sonoma Mercury Mines	0.048
ABTF-002F	Biological - Fish	4/1/2003	Anna Belcher Creek downstream of Contact and Sonoma Mercury Mines	<u>0.221</u>
ABTF-003F	Biological - Fish	4/1/2003	Anna Belcher Creek downstream of Contact and Sonoma Mercury Mines	<u>0.219</u>
ABTF-004F	Biological - Fish	4/1/2003	Anna Belcher Creek downstream of Contact and Sonoma Mercury Mines	<u>0.172</u>
ABTF-005F	Biological - Fish	4/1/2003	Anna Belcher Creek downstream of Contact and Sonoma Mercury Mines	<u>0.200</u>
ABUS-001F	Biological - Fish	4/1/2003	Anna Belcher above Little Sulphur Creek Confluence	<u>0.145</u>
ABUS-002F	Biological - Fish	4/1/2003	Anna Belcher above Little Sulphur Creek Confluence	<u>0.171</u>
ABUS-003F	Biological - Fish	4/1/2003	Anna Belcher above Little Sulphur Creek Confluence	<u>0.180</u>
ABUS-004F	Biological - Fish	4/1/2003	Anna Belcher above Little Sulphur Creek Confluence	<u>0.171</u>
ABUS-005F	Biological - Fish	4/1/2003	Anna Belcher above Little Sulphur Creek Confluence	<u>0.180</u>

-- = Analysis not performed on sample

mg/kg = milligrams per kilogram

ND () = Analyte not detected above the reported sample quantitation limit.
The number in parentheses represents the associated contract required quantitation limit.

¹ = An analyte is considered to be present at a concentration significantly above background if one of the following two criteria is met 1) the analyte is detected in the site-related sample when not detected not detected in the background samples or 2) the analyte is reported at a concentration equal to or greater than three times the maximum background level when detected in the background samples.

Table 3-3
Contact Mercury Mine - 2003 Sampling Results for Biological Samples - Invertebrates (µg/g)
(results¹ significantly above background are bolded and underlined)

Sample Location	Sample Type	Sample Date	Location Description	Mercury	Methyl Mercury
Background Sample					
BR20-R-075	Biological - Water Strider	1999-2002	Bear River at Hwy 20	0.0284-0.0695	0.0270-0.0498
BR20-R-076	Biological - Dobsonflies	2000-2002	Bear River at Hwy 20	0.0354-0.0501	0.0289-0.0478
BR20-R-077	Biological - Dragonfly	2001-2002	Bear River at Hwy 20	0.0219-0.0239	0.0141-0.0478
BR20-F-029	Biological - Stoneflies	1999-2002	Bear River at Hwy 20	0.0373-0.0758	0.0385-0.675
Biological - Invertebrate Samples					
ABCM	Biological - Water Strider	4/1/2003	Contact Mine	<u>0.131</u>	<u>0.116</u>
ABCM	Biological - Dobsonflies	4/1/2003	Contact Mine	<u>0.199-0.429</u>	<u>0.092-0.253</u>
ABTF	Biological - Water Striders	4/1/2003	Anna Belcher Creek downstream of Contact and Sonoma Mercury Mines	<u>0.137-0.142</u>	<u>0.128-0.144</u>
ABTF	Biological - Dobsonflies	4/1/2003	Anna Belcher Creek downstream of Contact and Sonoma Mercury Mines	<u>0.692</u>	<u>0.495</u>
ABTF	Biological - Dragonfly	4/1/2003	Anna Belcher Creek downstream of Contact and Sonoma Mercury Mines	<u>0.207-0.368</u>	<u>0.192-0.258</u>
ABTF	Biological - Stoneflies	4/1/2003	Anna Belcher Creek downstream of Contact and Sonoma Mercury Mines	<u>0.141-0.222</u>	<u>0.139-0.174</u>
ABUS	Biological - Water Striders	4/1/2003	Anna Belcher above Little Sulphur Creek Confluence	<u>0.139</u>	<u>0.124</u>
ABUS	Biological - Dragonfly	4/1/2003	Anna Belcher above Little Sulphur Creek Confluence	<u>0.202-0.243</u>	<u>0.172-0.195</u>

-- = Analysis not performed on sample

mg/kg = milligrams per kilogram

ND () = Analyte not detected above the reported sample quantitation limit.

The number in parentheses represents the associated contract required quantitation limit.

¹ = An analyte is considered to be present at a concentration significantly above background if one of the following two criteria is met 1) the analyte is detected in the site-related sample when not detected - not detected in the background samples or 2) the analyte is reported at a concentration equal to or greater than three times the maximum background level when detected in the background samples.

Table 4-1 continued
Contact Mercury Mine - 2001 to 2003 Surface Water Sample Results (µg/L)
(results significantly¹ above background levels are bolded and underlined)

Sample Location	Sample Date	Location Description	Lead	Lead - filtered	Magnesium - filtered	Manganese	Manganese - filtered	Molybdenum	Molybdenum - filtered	Neodymium - filtered	Nickel	Nickel - filtered	Potassium	Potassium - filtered	Rubidium	Rubidium - filtered	Sodium	Sodium - filtered	Strontium	Strontium - filtered	Tungsten	Tungsten - filtered	Uranium	Uranium - filtered	Vanadium	Vanadium - filtered	Yttrium	Yttrium - filtered	Ytterbium
EPA AWQC Chronic			2.5	--	--	--	--	--	--	--	52	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
EPA AWQC - Human Health for consumption of organism only			--	--	--	--	--	--	--	--	4,600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
21CT1	4/20/2001	Contract Sonoma Drainage Adit	2	--	--	0.1	--	0.96	--	--	0.7	--	0.85	--	0.61	--	8.9	--	930	--	0.07	--	0.04	--	2	--	0.2	--	ND (0.01)
21CT2	4/20/2001	Anna Belcher Creek beyond Contact-Lowest Tailings	<u>3</u>	--	--	0.07	--	0.53	--	--	1.8	--	0.39	--	0.1	--	3	--	180	--	0.04	--	0.03	--	1	--	0.03	--	ND (0.01)
23CT2	4/1/2003	Unnamed Stream on Contract Mercury Mine Site	ND (3)	ND (0.05)	27.9	ND (10)	0.04	0.92	0.31	0.019	3	2.3	0.39	250	0.16	0.14	2.8	2.7	160	160	0.05	ND (0.03)	0.017	0.011	0.64	0.75	0.057	ND (0.03)	ND (0.01)
23AB1	4/1/2003	Anna Belcher Creek downstream of Contact Mercury Mine and Sonoma Mercury Mine	ND (3)	ND (0.05)	20.5	ND (10)	0.33	0.68	0.29	0.017	1.3	1.2	0.66	410	0.16	0.17	4.4	4.2	260	270	0.04	ND (0.03)	0.031	0.027	0.66	0.6	0.044	ND (0.03)	ND (0.01)
23AB2	4/1/2003	Downstream of 23AB1C	ND (3)	ND (0.05)	20.6	ND (10)	0.45	5.2	1.4	ND (0.01)	0.9	0.92	0.7	410	0.16	0.17	4.3	4.3	220	230	1.5	0.94	0.024	0.011	2.1	2	0.02	0.94	ND (0.01)
22LS1C	4/20/2001	Little Sulphur Creek - 3 miles downstream of Anna Belcher Confluence	ND (3)	ND (0.05)	16.2	ND (10)	1.4	0.2	0.1	0.05	0.98	0.88	0.31	190	0.12	0.11	5.6	5.7	160	160	0.04	ND (0.03)	0.019	0.018	2.1	2.1	0.026	0.022	ND (0.01)

EPA AWQC = Environmental Protection Agency Ambient Water Quality Criteria - Revised May 25, 2005

-- = Analysis not performed on sample

µg/L = micrograms per liter

ND () = Analyte not detected above the reported sample quantitation limit. The number in parentheses represents the associated contract required quantitation limit.

* = The value AQWC CCC value for Chromium is for Chromium VI, as a value for total chromium is not available.

. = The values located in the "Mercury, filtered" row are for the filtered sample taken at the sampling location in the column. For example, the value located in the "Mercury, filtered" column and the SCD-SW-2 row is the sample result for the filtered sample SCD-SW-2F.

¹ = An analyte is considered to be present at a concentration significantly above background if one of the following two criteria is met

1) the analyte is detected in the site-related sample when not detected in the background samples or 2) the analyte is reported at a concentration equal to or greater than three times the maximum background level when detected in the background samples.

**Table 4-1
Contact Mercury Mine - 2001 to 2003 Surface Water Sample Results (µg/L)
(results significantly¹ above background levels are bolded and underlined)**

Sample Location	Sample Date	Location Description	Mercury	Mercury, filtered**	Methyl mercury	Aluminum	Aluminum - filtered	Antimony	Barium	Barium - Filtered	Boron	Boron - filtered	Cadmium	Cadmium - filtered	Cerium	Cerium - filtered	Chromium*	Chromium - filtered	Cobalt	Cobalt - filtered	Copper	Copper - filtered	Germanium	Iron	Iron - filtered	Lanthanum - filtered	Lithium
EPA AWQC Chronic			2.5	--	--	--	--	124	--	--	--	--	0.25	--	--	--	11	--	--	--	9.0	--		--	--	--	--
EPA AWQC - Human Health for consumption of organism only			--	--	0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	--
Background Sample - Not collected																											
Surface Water Samples																											
21CT1	4/20/2001	Contract Sonoma Drainage Adit	0.181	0.0317	0.000102	ND (0.1)	--	0.2	250	--	98	--	40	--	ND (0.01)	--	3	--	ND (0.02)	--	ND (0.5)	--	0.07	ND (0.02)	--	--	4.1
21CT2	4/20/2001	Anna Belcher Creek beyond Contact Lowest Tailings	0.104	0.000846	0.000046	ND (0.1)	--	0.08	99	--	34	--	15	--	ND (0.01)	--	6	--	ND (0.02)	--	0.5	--	ND (0.02)	ND (0.02)	--	--	0.4
23CT2	4/1/2003	Unnamed Stream on Contract Mercury Mine Site	0.041	0.00647	ND (0.000025)	0.066	0.8	0.2	17	97	99	26	12.3	11.7	0.064	ND (0.01)	3.6	4.1	0.092	ND (0.02)	0.64	0.5	ND (0.02)	0.079	12	0.017	0.6
23AB1	4/1/2003	Anna Belcher Creek downstream of Contact Mercury Mine and Sonoma Mercury Mine	0.00921	0.00564	0.000088	0.011	2	ND (0.1)	58	110	110	20	21	20.1	0.022	0.012	1.6	1.4	ND (0.02)	ND (0.02)	ND (0.5)	ND (0.5)	ND (0.02)	ND (0.02)	25	0.019	1.2
23AB2	4/1/2003	Downstream of 23AB1C	0.0137	0.00548	0.000131	0.028	ND (0.5)	ND (0.1)	57	19	17	19	21	20.7	ND (0.01)	ND (0.01)	7.8	7.5	ND (0.02)	ND (0.02)	ND (0.5)	ND (0.5)	ND (0.02)	ND (0.02)	22	ND (0.01)	ND (0.01)
22LS1C	4/20/2001	Little Sulphur Creek - 3 miles downstream of Anna Belcher Confluence	0.00245	0.00161	0.0000408	0.012	0.7	ND (0.1)	57	57	13	15	21	23.2	0.02	0.22	ND (1)	ND (1)	0.022	0.022	ND (0.5)	ND (0.5)	ND (0.02)	ND (0.02)	28	0.04	0.21

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* = The value AQWC CCC value for Chromium is for Chromium VI, as a value for total chromium is not available.

** = The values located in the "Mercury, filtered" row are for the filtered sample taken at the sampling location in the column. For example, the value located in the "Mercury, filtered" column and the SCD-SW-2 row is the sample result for the filtered sample SCD-SW-2F.

¹ = An analyte is considered to be present at a concentration significantly above background if one of the following two criteria is met

1) the analyte is detected in the site-related sample when not detected in the background samples or 2) the analyte is reported at a concentration equal to or greater than three times the maximum background level when detected in the background samples.

Table 4-2
Contact Mercury Mine - 2001 to 2003 Soil Sample Results (mg/kg)
(results above the BLM Median Wildlife RMC are bolded and underlined)

Sample Location	Sample Date	Location Description	Mercury	Antimony	Arsenic	Barium	Beryllium	Cadmium	Cerium	Chromium	Cesium	Cobalt	Copper	Gallium	Germanium	Hafnium	Indium	Lanthanum	Lead	Lithium	Molybdenum	Manganese
BLM Human Health RMC			46	62	46	--	--	155	--	--	--	--	5,745	--	--	--	--	--	1000	--	--	--
BLM Median Wildlife RMC			8	--	275	--	--	3	--	--	--	--	136	--	--	--	--	--	125	--	--	--
EPA Preliminary Remediation Goals - Industrial Soil			28	410	0.24*	190,000	2,000	810	--	1,400	--	300	41,000	--	--	--	--	--	800	2,000	5,100	--
Background Sample - Not collected																						
Soil Samples																						
21-CT-OR	4/20/2001	Waste Rock Dump with Low Carbonate - HgS Veins	<u>17,000</u>	0.25	1.6	91.5	0.05	ND (0.02)	0.12	1,020	0.2	33.4	8.6	0.7	0.3	ND (0.1)	0.01	ND (0.5)	1	11.2	0.25	405
21-CT-C1	4/20/2001	Well Bedded Magnesite Cemented Middle Calcine	<u>200</u>	0.75	3.8	186	0.1	0.02	3.65	1,175	0.45	62	15	2.2	0.25	ND (0.1)	0.015	2	6.5	12.4	0.3	625
21-CT-C2	4/20/2001	Upper Most Calcine Along Stone Wall	<u>65.1</u>	0.3	2	139	ND (0.05)	ND (0.02)	1.24	1,610	0.25	88.3	14	1.65	0.25	ND (0.1)	0.015	0.5	2	19.8	0.2	660
21-CT-C3	4/20/2001	Middle Pile Channel Sample	<u>14.45</u>	0.9	4.4	226	0.35	0.02	10.75	1,325	1.05	69.2	23.4	5.6	0.3	0.5	0.035	6	6	21.8	0.45	655
21-CT-C4	4/20/2001	Sand in Anna Belcher Creek	<u>16.21</u>	0.45	1.4	159	0.25	0.02	2.67	1,620	0.35	87.8	16	2.3	0.15	ND (0.1)	0.01	1.5	6	18.2	0.4	650
21-CT-C5	4/20/2001	Lowest Calcine At Stream Cut On Waste Rock	<u>19.34</u>	0.55	ND (0.02)	164.5	0.25	0.02	3.7	1,380	0.45	81.6	16.4	2.5	0.3	ND (0.1)	0.02	2	3.5	16.4	0.3	635
21-CT-C6	4/20/2001	Lowest Calcine Above 21-CT-C4	3.73	0.55	3.8	346	0.55	0.08	13.45	1,275	0.7	67.9	41	6.7	0.25	0.6	0.035	7	7.5	14	0.7	785
21-CT-C7	4/20/2001	Lowest Calcine Above 21-CT-C4	5.78	1	8	507.3	0.75	0.1	26.2	438	1.85	28.9	41	13.3	0.35	1.5	0.045	15.5	9.5	20.2	0.65	615
21-CT-C8	4/20/2001	Calcine in Unnamed Creek on Contact Mercury Mine Site	<u>23.9</u>	1.1	8.2	304	1.05	0.14	22.1	2,490	2.3	222.5	43.2	10.1	0.65	0.7	0.04	11	9.5	30	0.6	1,595
21-CT0401C1	4/20/2001	Middle Upper Calcine Pile	<u>26.2</u>	1.2	4.2	184	0.45	0.04	5.5	1,710	0.55	94	22.8	3.7	0.4	0.2	0.02	3	9.5	17.4	0.35	730
CT0404C2	4/20/2001	Channel 0.5 m Cemented Fine and Coarse	<u>8.35</u>	0.35	0.8	187.5	0.15	ND (0.02)	2.36	1,165	0.3	79.8	14.4	2.1	0.05	ND (0.1)	0.015	1.5	3.5	13.8	0.4	590
21-CT 50	4/20/2001	Selected Fines from Coarse Grained Calcine	<u>11.8</u>	1.05	5	302.5	0.6	0.08	22.1	811	1.3	54.9	30.2	8.6	0.1	1	0.03	10.5	9	14.4	0.7	755

Notes:

EPA Preliminary Remediation Goals - Industrial Soil revised in October 2004

-- = Analysis not performed on sample

mg/kg = milligrams per kilogram

ND () = Analyte not detected above the reported sample quantitation limit. quantitation limit.

The number in parentheses represents the associated contract required

* - California Modified PRG

Table 4-2 continued
Contact Mercury Mine - 2001 to 2003 Soil Sample Results (mg/kg)
(results above the BLM Median Wildlife RMC are bolded and underlined)

Sample Location	Sample Date	Location Description	Niobium	Nickel	Phosphorous	Rhenium	Rubidium	Selenium	Silver	Strontium	Tantalum	Tellurium	Thallium	Thorium	Tin	Tungsten	Uranium	Vanadium	Yttrium	Zinc
BLM Human Health RMC			--	3094	--	--	--	774	774	--	--	--	--	--	--	--	--	--	--	46455
BLM Median Wildlife RMC			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	307
EPA Preliminary Remediation Goals - Industrial Soil			--	20,000	--	--	--	5,100	5,100	610,000	--	--	92	--	610,000	--	180	7,200	--	310,000
21-CT-OR	4/20/2001	Waste Rock Dump with Low Carbonate - HgS Veins	ND (0.1)	810	ND (10)	ND (0.002)	0.5	ND (1)	0.06	73.3	ND (0.05)	0.25	ND (0.2)	0.16	0.8	ND (0.1)	ND (0.1)	19	0.5	22
21-CT-C1	4/20/2001	Well Bedded Magnesite Cemented Middle Calcine	0.7	1,255	50	ND (0.002)	4.2	1	0.12	354	ND (0.05)	1.35	0.4	0.12	1	ND (0.1)	0.1	36	1.7	36
21-CT-C2	4/20/2001	Upper Most Calcine Along Stone Wall	0.3	1,705	40	0.002	2	ND (1)	0.06	186.5	ND (0.05)	0.9	ND (0.2)	0.1	1	ND (0.1)	ND (0.1)	34	0.9	36
21-CT-C3	4/20/2001	Middle Pile Channel Sample	2.7	1,455	180	0.002	19.3	ND (1)	0.16	122	0.2	1.95	2	0.24	1.2	ND (0.1)	0.6	68	4.3	58
21-CT-C4	4/20/2001	Sand in Anna Belcher Creek	0.7	1,755	40	ND (0.002)	4.1	1	0.12	264	ND (0.05)	1.4	0.2	0.14	0.4	ND (0.1)	0.1	38	1.5	40
21-CT-C5	4/20/2001	Lowest Calcine At Stream Cut On Waste Rock	0.8	1,655	50	ND (0.002)	4.8	ND (1)	0.1	232	ND (0.05)	2.8	0.2	0.14	0.4	ND (0.1)	0.1	40	1.7	36
21-CT-C6	4/20/2001	Lowest Calcine Above 21-CT-C4	3.4	1,255	200	ND (0.002)	8.6	ND (1)	0.2	180.5	0.25	1.45	2.2	0.2	1.2	ND (0.1)	0.4	79	6	70
21-CT-C7	4/20/2001	Lowest Calcine Above 21-CT-C4	6.7	377	370	0.002	46.3	ND (1)	0.34	126	0.6	0.35	5	0.28	1.2	ND (0.1)	1.2	112	12.3	74
21-CT-C8	4/20/2001	Calcine in Unnamed Creek on Contact Mercury Mine Site	3.9	2,880	520	ND (0.002)	30.2	1	0.78	42.2	0.3	ND (0.05)	3.2	0.42	1	ND (0.1)	0.6	95	8.3	94
21-CT0401C1	4/20/2001	Middle Upper Calcine Pile	1.3	1,875	70	ND (0.002)	8.7	ND (1)	0.08	179.5	0.05	2.1	0.8	0.14	1.8	ND (0.1)	0.2	53	2.8	58
CT0404C2	4/20/2001	Channel 0.5 m Cemented Fine and Coarse	0.6	1,590	30	0.002	3.9	ND (1)	0.16	242	ND (0.05)	0.8	0.2	0.1	0.2	ND (0.1)	ND (0.1)	33	1.2	34
21 CT 50	4/20/2001	Selected Fines from Coarse Grained Calcine	4.9	906	270	0.002	22.1	ND (1)	0.02	260	0.35	ND (0.05)	2.8	0.26	1.2	0.6	0.7	90	8.4	60

Notes:

EPA Preliminary Remediation Goals - Industrial Soil revised in October 2004

-- = Analysis not performed on sample

mg/kg = milligrams per kilogram

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The number in parentheses represents the associated contract required

* - California Modified PRG

Table 6-1 Anticipated Contact Mercury Mine Removal Action Schedule

Activity	Anticipated Start	Anticipated Completion
Engineering Evaluation / Cost Analysis	March 2009	September 2009
Public Meeting and Comment Period	September 2009	September 2009
Action Memorandum	November 2009	November 2009
Removal Design	December 2010	December 2009
Procure Contractor	February 2010	February 2010
Mobilization	Spring 2010	Spring 2010
Implement Removal Action	Spring 2010	Spring 2010
AML Coordinator Report	Summer 2010	Summer 2010