Final Site Discovery Report
Cache Creek Watershed
Lake, Yolo, Colusa Counties, California

Prepared by:
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1.0 Introduction

The Department of Toxic Substances Control (DTSC) began the Cache Creek Discovery Project under the Fiscal Year (FY) 2009-2010 Preliminary Assessment/Site Inspection (PA/SI) Cooperative Agreement between DTSC and the United States Environmental Protection Agency (USEPA). This Discovery Project was proposed because mercury contamination found in the Cache Creek Watershed may pose a risk to human health and the environment. To this end, DTSC has evaluated various sources of information for use in developing this Cache Creek Discovery Report.

1.1 Purpose

This report is designed to summarize the available information about mercury contamination located within the Cache Creek Watershed and identify mine sites which are sources of that contamination and are contributing to the mercury load moving from the watershed down to the Sacramento River and into the Sacramento-San Joaquin Delta and San Francisco Bay. Mine sites that are identified as sources or potential sources of mercury contamination will be evaluated further by DTSC under the USEPA PA/SI Cooperative Agreement. Site Screening Assessments will be conducted on those mine sites to determine whether they may be contributing to the overall mercury problem and whether more investigation and cleanup of the sites must occur under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Site Screening Assessment is the first step in the USEPA Superfund process. DTSC will submit the Site Screening Assessment report to USEPA, and then USEPA will determine whether the site needs further evaluation under CERCLA. Information for this report was obtained following DTSC's *Abandoned Mine Lands Site Discovery Process*. This process was developed utilizing an earlier PASI Cooperative Agreement with USEPA.

1.2 Apparent Problem

The Cache Creek Watershed is an area of California that contains significant amounts of mercury. The basic process of extracting mercury from ore is to crush the ore and roast it to release the elemental mercury vapor, and then to cool and condense it. Mercury mining began in the 1850s to assist with removal of gold which was being discovered throughout northern California and later the entire western North American Continent. Gold was obtained by hardrock or placer mining using a variety of techniques to free the gold particles from the hardrock ore. Once the gold bearing ores or deposits were processed, mercury was added to chemically bind with the gold to form a gold-mercury amalgam. The mercury was later removed leaving the gold behind. Mining and production of the mercury and its use in gold mining has resulted in large areas of California, including many streams, lakes, and rivers, being contaminated with mercury.

Within the Cache Creek Watershed, rain and seasonal flooding carry the mercury in the sediments from the mountain mines down through the watershed. This has resulted in an accumulation of mercury in the environment, especially within the Sacramento-San Joaquin River Delta and San Francisco Bay. It must be noted that because mercury is a naturally occurring substance, not all of the mercury entering the environment is the result of human activities. In the environment, the mercury is processed by bacteria into a form called

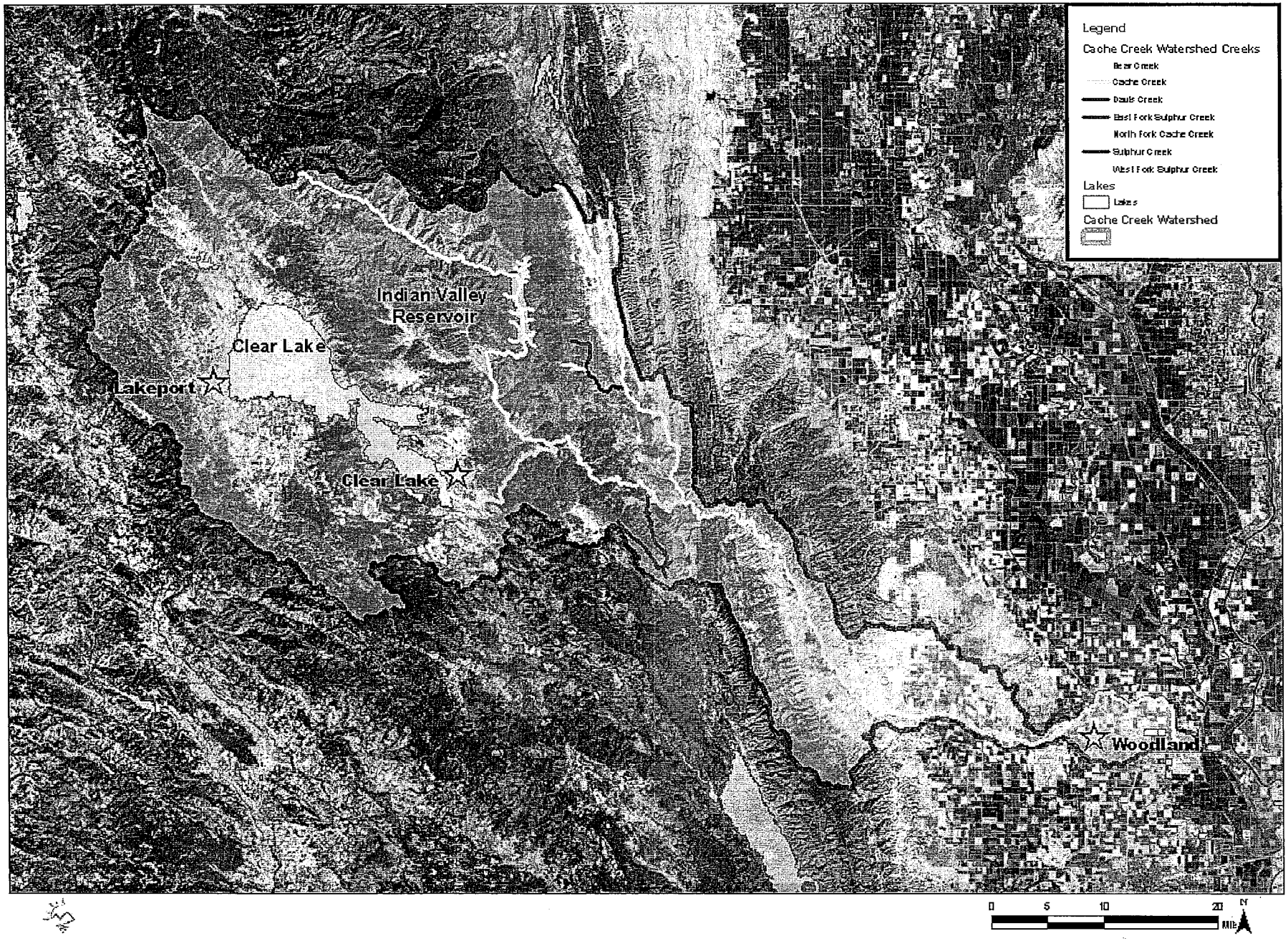
methylmercury. This form of mercury then begins to accumulate in the food chain reaching higher concentrations in different organisms as they consume each other. This "bioaccumulation" of mercury within the food chain eventually leads to humans consuming animals such as fish and shellfish with high levels of mercury. Mercury is known to be a neurological and developmental toxicant to humans and other species. State and federal agencies such as the California State and Regional Water Quality Control Boards (SWRCB and RWQCB), DTSC, California Department of Fish and Game (DFG), USEPA, United States Geological Survey (USGS), United States Fish & Wildlife Service (USFWS), Department of the Interior-Bureau of Land Management (BLM), and others have documented the occurrence of mercury and its bioaccumulation within the environment.

2.0 Site Description

2.1 Study Area Location

The area covered by this project is the Cache Creek Watershed which is located in the eastern side of California's Coast Range. The main stem of Cache Creek is fed by the waters of Clear Lake and flows in a southeasterly direction. The north fork begins northwest of Indian Valley Reservoir with water flowing into the reservoir and then south until it joins with the main stem. Tributary waterways are fed from many smaller tributary creeks and streams originating in the mountains of Lake and parts of Colusa, Napa, and Yolo Counties. Cache Creek flows down through the Capay Valley to the Central Valley near the City of Woodland. Water is often diverted for use in agricultural irrigation. The waters flow to an area east of Woodland known as the Cache Creek Settling Basin. During high rain and water flow events, sediments are washed into the basin and deposited. When the basin fills with water, it begins to spill over an outlet weir carrying some sediment with it. Approximately 50 percent of the sediment settles in the basin when it is full of water. Water and sediment from the settling basin move into the Yolo Bypass which is a flood control basin designed to protect Sacramento from flooding. Waters in the Bypass eventually enter the Sacramento River south of the City of West Sacramento. Figure 1 depicts the Cache Creek Watershed and the area covered by this Discovery Project.

Figure 1: Cache Creek Discovery Study Area



2.2 Study Area Description and Operational History

The specific categories of mines in the Cache Creek Watershed that this Site Discovery will focus on are mercury mines and mines that used mercury to extract a desired substance from ore such as gold. Between 1850 and 1981, mercury mining produced approximately 220 million pounds of mercury from mines located in California's Coast Range. Peak production occurred in the 1870s. Much of the quicksilver (liquid mercury) was produced at the mine sites or the ore was collected and transported to nearby processing locations to produce the quicksilver. A review of maps and databases produced by agencies such as the USGS, California Geological Survey, and the California Department of Water Resources show the mines and mining features such as mill locations, waste rock and tailings piles, and exploratory pits, tunnels, and adits.

Gold has also been mined within the watershed. Gold is mined from either hardrock (lode veins) or placer (unconsolidated gravel) deposits within the Coast Range. The vast majority of mercury that was used in California gold mining came from the mining of placer deposits. Miners added mercury, or quicksilver, to the mixture of water, sand and gravel to help settle out the gold. Tunnels were used as sluices to help separate the gold bearing material from waste rock. A typical sluice may have had several hundred pounds of mercury added at startup. Multiple 76 pound flasks were typically added weekly or monthly. Mercury was lost from the sluices by turbulent water washing away the finer particles, by leaking from the bottom of the sluice onto underlying soils, and from being removed with the placer mining tailings. Under average operating conditions, sluices lost about 25% of the added mercury every year; 10% annually under the best conditions. Along with the mercury releases from placer deposit mines, hardrock deposit mines also lost a substantial amount of mercury.

2.3 Regulatory Involvement

A significant number of studies have been conducted on the effects of mining and the impacts of mercury which was mined and used for gold extraction in the area at other mines. The studies reviewed have focused on the impacts to water quality and to biota. Some of those studies are summarized below and together, provide an overview of the extent of the impacts from mining activities and their effects on human health, water quality, and the biological environment. The studies summarized in this section are listed below in section *7.0 References*.

Much of the work has been completed as part of the federal-State of California partnership known as the CALFED Bay-Delta Program. The program is a unique collaboration among 25 state and federal agencies that came together with a mission: to improve California's water supply and the ecological health of the San Francisco Bay/Sacramento-San Joaquin River Delta. CALFED was created because of the importance of the Delta to California. The majority of the state's water runs through the Delta and into aqueducts and pipelines that distribute it to 25 million Californians throughout the state, making it the single largest and most important source of water for drinking, irrigation and industry.

One of the significant projects of the CALFED program is the CALFED Mercury Project which is designed to assess the ecological and human health impacts to the Bay-Delta Watershed. Many of the studies cited below were conducted by the partner agencies and contractors as part

of the CALFED Mercury Project.

Note: These summaries generally consist of the abstract, introduction, results and/or conclusions and recommendations sections of the reports only. In many cases, the information here has been edited for brevity by removing detailed discussions of the findings. References cited for other studies which have been used for general and background information or comparative purposes in the report/study have also been removed from these summaries. In other cases, minor edits were made for ease of reading or syntax because the document was summarized.

The reader is reminded to read the entire original report or study in order to accurately understand the entire scope, procedures, results, discussion, conclusions, and recommendations of each study or report. The following summaries are provided to help the reader develop a basic understanding of the scope of findings for work completed within the watershed and the impacts to human health and the environment from mercury contamination.

As part of the review, the sampling from the studies was reviewed for comparison to screening levels utilized in the PASI Assessment process or to health advisories for consumption of fish or invertebrates. These comparisons are done to identify areas where further site assessment may be warranted by USEPA. Some of the data from References 1-13 has been mapped to provide an indication of where sampling has occurred within the watershed. The maps can be found in Appendix 7.

2.3.1 United States Environmental Protection Agency (USEPA)

USEPA's Site Assessment program works with states and tribes to assess and prioritize hazardous waste sites for cleanup. Sites are evaluated to determine whether they qualify for listing on the National Priorities List (NPL). This Discovery report and the Site Screening Assessments listed in Appendix 6 are activities performed under USEPA's Site Assessment program.

Site assessments may also result in a site being referred to USEPA's Removal program for immediate or time-critical action to protect public health or stabilize a site which may be releasing hazardous substances into the environment. USEPA has provided oversight for a responsible party Removal Action at the Abbott Turkey Run mine which was completed in 2007.

One site within the Cache Creek Watershed has been placed on the NPL. The USEPA is currently conducting a sitewide Removal Action at the Sulphur Bank Mercury mine. Additional studies and potential remedies for addressing the contamination at the site are also currently underway.

USEPA also works with states to evaluate the water quality status of waters within the states under the Clean Water Act. Section 305(b) of the Clean Water Act requires states to assess and report on the water quality status of waters within the states. Section 303(d) requires states to list waters that are not attaining water quality standards. This is also known as the list of impaired waters. Under this act, USEPA has worked with the California Regional Water Quality Control

Board (RWQCB) to develop Total Maximum Daily Loads (TMDLs) for contaminants which result in impairment of the water bodies. Within the Cache Creek Watershed, the RWQCB has developed and USEPA has approved TMDLs for Sulphur Creek (see Reference 14).

2.3.2 United States Fish and Wildlife Service (USFWS)

The USFWS is a trustee for natural resources in the United States. Through the natural resource damage assessment and restoration (NRDAR) process USFWS quantifies the natural resource injuries and, with public input, determines the appropriate restoration projects. USFWS will be conducting the NRDAR process within the Cache Creek Watershed for sites which have contributed to the mercury contamination affecting the watershed and its natural resources.

The USFWS also provides technical support both within the Service and externally on a number of ecological issues. These include endangered species listing and recovery, refuge land acquisitions and cleanups, and hazardous waste site remediation. USFWS is actively involved with state and other federal agencies in evaluating the effects of mercury mining within the watershed.

USFWS also performs field studies to determine sources of pollution, to investigate pollution effects on fish and wildlife and their habitat, and to investigate fish and wildlife die-offs. One study produced by the USFWS was reviewed as part of this project.

Cache Creek Mercury Investigation, USFWS Final Report, July 2001 **(Reference 10)**
This report represents an independent effort by the Fish and Wildlife Service to quantify mercury bioaccumulation in the Cache Creek watershed. The evaluation of mercury concentrations in biota focused upon the downstream hydrological region of Cache Creek, the upstream portion of the North fork of Cache Creek, and Bear Creek above and below inputs from Sulphur Creek; but did not include sampling in Clear Lake.

Since 1976, the State of California's Toxic Substances Monitoring Program has consistently reported high mercury concentrations in Cache Creek. Within the Cache Creek Watershed several water bodies (Cache Creek, Clear Lake and Sulphur Creek) are listed by EPA as impaired due to mercury contamination. During the 1995 and 1997 floods in Northern California, very high mercury concentrations were measured in water samples in lower Cache Creek, the Yolo Bypass, and the Sacramento Delta. Data indicated that large-scale, downstream movements of mercury were occurring in the Cache Creek watershed. Despite documentation of elevated mercury in water, the ecological risks of mercury upon the fish and wildlife species inhabiting Cache Creek watershed itself have remained poorly characterized.

While water monitoring by the Regional Water Quality Control Board has indicated Cache Creek tributaries within the North Fork and South Fork of Cache Creek sub-basins are responsible for the extraordinary exports of mercury loads to the Cache Creek Settling Basin and the Yolo bypass during the winter, Bear Creek appears to experience the greatest mercury bioaccumulation hazard. Bioaccumulation is enhanced in the Bear Creek sub-basin during the summer months and increases with distance downstream from Sulphur Creek. This may imply

additional sources to Bear Creek besides Sulphur Creek, or enhanced bioavailability of mercury in downstream waters, or both. Source characterization and patterns of methylmercury formation in the Cache Creek watershed particularly within the instream environment of Bear Creek during the summer season are deserving of further study to assess the potential effectiveness of upstream and or downstream sediment source control in the Wilbur Mining District. A Total Maximum Daily Load strategy that seeks to reduce biological hazards of mercury within the Cache Creek basin should focus primarily upon the Bear Creek sub-basin.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 25 sets of fish data (composites of varying numbers of fish per composite) analyzed for total mercury. The means of these sets showed a range of 0.054 to 1.655 parts per million (ppm) with 12 of the 24 sets exceeding the USEPA health advisory level of 0.3 ppm for fish and invertebrates tissue. 11 of the sets were also analyzed for methylmercury and ranged from 0.058-0.99 ppm with four of the 11 sets exceeding the 0.3 ppm screening level.

The study also shows that 33 composite samples taken of invertebrates (aquatic insects) and analyzed for total mercury ranged from 0.0057 parts per million (ppm) to 1.515 ppm. 29 of those samples were also analyzed for methylmercury which ranged from 0.0045 to 0.259 ppm. While a health-based screening level of 0.3 ppm has been developed for fish and invertebrates being consumed as food, there is no health-based mercury or methylmercury screening levels identified for these insect invertebrates.

2.3.3 United States Bureau of Land Management (BLM)

BLM is working to investigate and remediate the Clyde Mine and the Rathburn-Petray Mercury Mine Complex in the Sulphur Creek Mining District within the Cache Creek Watershed. The work is being conducted under the oversight of the California Regional Water Quality Control Board (RWQCB). Additional information about the sites, including links to information on the BLM and RWQCB websites can be found in Appendix 4. Other information on studies conducted evaluating the effects of contamination from the Rathburn and Rathburn-Petray mines can be found in Section 2.3.4 below (see Reference 11).

2.3.4 United States Geological Survey (USGS)

The USGS has conducted a significant number of studies within the Cache Creek Watershed. The purposes of the studies includes identifying areas impacted by mining activities; measuring the nature and concentrations of contaminants and other important geochemical components within soil, sediment, water, and biota; and assessing the impacts from the environmental contaminants; including the amount of mercury entering the watershed and traveling down into the Sacramento River Watershed, the Sacramento-San Joaquin Delta, and San Francisco Bay.

Mercury Contamination from Historical Gold Mining in California **(Reference 28)**

This document provides a good overview of gold mining in California and the mining and use of mercury. It discusses the processes by which mercury was utilized to extract gold from ore from the various forms of mining (hydraulic, hardrock) and provides examples of quantities of

mercury used and why it has become such a significant problem in our water bodies and a threat to human health and the environment.

PASI Discovery Project Data Review: This reference provides general and historical information about mining. There are no data summaries for site assessment purposes.

Mercury and Methylmercury Concentrations and Loads in the Cache Creek Basin, January 2000 through May 2001. **(Reference 3)** This is a Cal Fed Mercury Project Report. The primary purpose of this report is to present the concentrations and mass loads of mercury and methylmercury for selected surface water sites in the Cache Creek drainage basin during January 2000 through May 2001, to relate the loads to sources of mercury and methylmercury, and to explain the seasonal variation in concentrations and mass loads. The report also provides chemical data for mercury and methylmercury, for selected trace elements, and for stable isotopes of hydrogen and oxygen in water molecules within the Cache Creek drainage basin for the same time period. The report provides data and interpretations for part of a larger study, funded by the CALFED Bay–Delta Program, of the impact of mercury in the Bay–Delta drainage basin on ecology and human health.

The study showed that the loads from geothermal sources of mercury and methylmercury were greater than those from abandoned mining sources. The streambed sediments of the larger streams, such as Cache Creek, also are a significant source of mercury due to re-suspension of Cache Creek streambed sediment and its transport of the load downstream.

Water from the geothermal and mining locations had different geochemical signatures, especially for stable isotopes of water and other aqueous constituents such as boron, chloride, sulfate, and lithium. The discharges from Clear Lake and Sulphur Creek have distinct stable isotope signatures caused by evaporation and the interaction of water and rock, but these signatures are lost by dilution in lower Cache Creek. It is hypothesized that dissolved mercury from the geothermal sources is largely adsorbed onto fine-grained sediments in Sulphur Creek and lower Bear Creek. Mercury transport in the tributaries dominated by geothermal sources is highly episodic; much of the transport is related to the re-suspension of previously deposited sediment. Mercury transport in tributaries dominated by mining sources such as Harley Gulch is also related to sediment transport mechanisms, as the main form of mercury is hypothesized to be particles of mercury sulfide (cinnabar and metacinnabar).

Concentrations and mass loads of total mercury and methylmercury in streams draining geochemical signatures from stable isotopes and trace-element concentrations may be useful as tracers of total mercury or methylmercury from specific locations.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 133 water samples taken and analyzed for total mercury and 132 water samples taken and analyzed for methylmercury. The samples consisted of both filtered and unfiltered samples. The samples were compared to the USEPA's Criterion Continuous Concentration (CCC) screening value for

freshwater. The CCC is defined as the estimate of the highest concentration of a material in surface water in which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. For total mercury, the analysis of the filtered samples showed a range of 0.30 nanograms per liter (ng/L) to 3,070 ng/L. Five of the samples were above the USEPA's CCC of 0.77 micrograms per liter (ug/L) or 770 ng/L. For the filtered samples, the range was from 0.24 ng/L to 399 ng/L. None of the filtered samples exceeded the CCC for total mercury. For methylmercury, the unfiltered samples ranged from <0.013 ng/L to 8.26 ng/L and the filtered samples ranged from 0.02 ng/L to 7.05 ng/L. There is no established CCC screening level for methylmercury.

Summary and Synthesis of Mercury Studies in the Cache Creek Watershed, California, 2000-01. **(Reference 17)** This is a Cal Fed Mercury Project Report.
This report summarizes the principal findings of the Cache Creek, California, components of the CALFED Bay–Delta Program entitled "An Assessment of Ecological and Human Health Impacts of Mercury in the Bay–Delta Watershed." The purpose is to help the regulatory community and other stakeholders decide if mine remediation or even control of natural sources of mercury, or other constituents such as sulfate, within the Cache Creek watershed will result in an eventual reduction of fish mercury concentrations in downstream water bodies. The goal was to explore and document the locations and potential remediation of mine wastes; to document the current loads of both total mercury and methylmercury from major anthropogenic and natural point sources; to test the potential for exporting sediment that contains mercury, which transform to methylmercury in downstream environments; and to explore the factors controlling bioaccumulation of mercury in aquatic organisms within the Cache Creek watershed.

Some of the generalized hypotheses reached by the study include:
1. Mine sites and geothermal sources are major sources of mercury, and potentially of methylmercury, to creeks and streams; and that sediments in Cache Creek below the mine sites and geothermal sources are also a source of mercury and methylmercury.
2. The abundance and characteristics of mercury in mine-site materials and estimates of mine-site mercury contributions to waterways suggests that effective mine-site remediation should be based on general-site erosion-control measures.
3. Much of the cinnabar-based minesite materials appear to be relatively unavailable for conversion to toxic methylmercury, but these sites and the geothermal sites also discharge more unstable forms of mercury.
4. Some portion of the mercury derived from the identified point sources can be methylated within the watershed, particularly in the upper tributary environments.
5. Clear Lake and Indian Valley Reservoir do not contribute high concentrations of bioavailable mercury to the aquatic environment.
6. The aquatic food chain below mine sites and geothermal sources is greatly affected by accumulation of methylmercury; a predictive relation exists between unfiltered methylmercury in the water and methylmercury bioaccumulation in invertebrates and small fish; and mercury in lower-trophic-level bioindicator organisms is predictive of mercury bioaccumulation in large fish.

PASI Discovery Project Data Review: There was no sampling completed as part of this study.

Mercury, Methylmercury, and Other Constituents in Sediment and Water from Seasonal and Permanent Wetlands in the Cache Creek Settling Basin and Yolo Bypass, Yolo County, California, 2005-06 **(Reference 9)**

This report presents surface water and surface (top 0-2 cm) sediment geochemical data collected during 2005-2006, as part of a larger study of mercury dynamics in seasonal and permanently flooded wetland habitats within the lower Sacramento River basin, Yolo County, California. The study was conducted in two phases. Phase I represented reconnaissance sampling and included three locations within the Cache Creek drainage basin; two within the Cache Creek Nature Preserve (CCNP) and one in the Cache Creek Settling Basin (CCSB) within the creek's main channel near the southeast outlet to the Yolo Bypass. Two additional downstream sites within the Yolo Bypass Wildlife Area (YBWA) were also sampled during Phase I, including one permanently flooded wetland and one seasonally flooded wetland, which had began being flooded only 1–2 days before Phase I sampling. Phase II sampling did not include the original three Cache Creek sites, but instead focused on the original two sites within the YBWA and a similarly paired set of seasonally and permanently flooded wetland sites within the CCSB.

The primary goal of the current study was to examine mercury cycling in two contrasting wetland types (seasonally and permanently flooded) and in two different hydrologic units (Cache Creek and the Yolo Bypass) within the lower Sacramento River basin in the Central Valley region of California. Specifically, mercury speciation and concentration in sediment and water, methylmercury production rates in sediment, and a suite of additional sediment and surface-water quality measures, near the onset and towards the end of the seasonal flooding period (October 2005 through May 2006) were examined.

Data collected as part of the current study provide a detailed temporal and spatial geochemical snapshot of conditions as they vary in surface water and sediment within and among a suite of permanently and seasonally flooded wetlands in the lower Sacramento River drainage basin. Strong spatial differences were observed, with wetlands associated with the Yolo Bypass Wildlife Area (YBWA) prone to higher concentrations of methylmercury in both sediment and water compared to the Cache Creek Settling Basin (CCSB). Furthermore, the seasonal wetland in YBWA showed a significant increase in sediment methylmercury concentrations approximately 3-4 weeks after initially flooding, followed by a decline to levels comparable to the YBWA permanent wetland by the end of the flooding period. Similar seasonal differences between the two habitat types (seasonal versus permanent wetland) were not as pronounced within the CCSB.

The current data set provides a foundation for ongoing and future studies focused on determining the key parameters mediating methylmercury production in this geographic area and provides ecosystem managers fundamental geochemical data on which to base management strategies aimed at achieving the goal of substantially reducing the amount of methylmercury being produced within, and exported from, these wetland environments.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were seven unfiltered water samples analyzed for total mercury which ranged from 6.3 ng/L to 83.7 ng/L and four filtered water samples analyzed for total mercury which ranged from 0.6 ng/L to 1.1 ng/L, none of which exceeded the CCC of 770 ng/L. There were also seven soil sediment samples analyzed for total mercury which ranged from 0.074 mg/kg to 0.959 mg/kg. None of the soil sediment samples exceeded the National Oceanographic and Atmospheric Administration's (NOAA's) Probable Effects Concentration (PEC) screening level of 1.060 mg/kg for total mercury. The PEC is defined as the level of a concentration in the media (surface water, sediment, soil) to which a plant or animal is directly exposed that is likely to cause an adverse effect. There were also seven soil sediment samples analyzed for methylmercury which ranged from 0.023 mg/kg to 0.6 mg/kg. There is no established PEC soil sediment screening level for methylmercury.

Mercury Release from the Rathburn Mine, Petray Mine, and Bear Valley Saline Springs, Colusa County, California, 2004-2006 **(Reference 11)**

The Rathburn and Petray mercury deposits are the northernmost and youngest mercury deposits in the Coast Range mercury mineral belt and are located in the Bear Creek portion of the Cache Creek watershed. The Rathburn mercury mine is relatively small, having operated from 1892-1893. Mining in the late 1960s and early 1970s occurred at the Petray open pit mines located immediately to the north of the Rathburn Mine. The Petray open pits caused considerable surface disturbance and contributed mine waste material to the headwaters of several small tributaries to Bear Creek located to the east. The mines are located on federal land managed by the U.S. Bureau of Land Management (BLM). The BLM requested that the U.S. Geological Survey (USGS) measure and characterize mercury and geochemical constituents in tailings, sediment, and water at the Rathburn and Petray Mines, tributaries draining the mine area, and within Bear Valley west of Bear Creek. This request was made in response to a California State Water Board mandate that the BLM conduct an Engineering Evaluation/Cost Analysis (EE/CA) of "non-time-critical removal actions" at the Rathburn and Petray Mines as a means of reducing mercury transport to Bear Creek.

The following were the objectives of this study:

1. Determine all potential natural and anthropogenic sources of mercury to Bear Creek.
2. Evaluate the extent to which mercury is transported to Bear Creek from all sources.
3. Identify physicochemical and biogeochemical processes affecting the transport of mercury based on existing (preremediation) field conditions.

This report summarizes data obtained from field sampling of mine tailings and waste rock at the Rathburn and Petray Mines that was initiated in July 17, 2001 and water and sediment in regional springs and tributaries that drain from the mine area into Bear Creek on December 14, 2004 and February 16 and May 27, 2005. Although it was initially assumed that the mines were the cause of elevated levels of monomethyl mercury measured by the Central Regional Water Quality Control Board in tributaries near their confluence with Bear Creek, it became apparent during

this study that ground water springs were also potential sources of mercury. In addition to sampling of springs in May 2005, saline ground water seepage along an unnamed fault on the west side of Bear Valley was sampled on December 13-14, 2006. Water and sediment was not sampled in Bear Creek during this study. The results permit a preliminary assessment of mining and natural sources of mercury and associated chemical constituents that could elevate levels of monomethyl mercury in Bear Creek.

The report concluded that the Rathburn and Petray Mines and saline spring waters are sources of mercury to Bear Creek. While the Petray Mine and, to a lesser extent the Rathburn Mine, have the potential to yield mobile forms of mercury to Bear Creek tributaries, saline ground water is an appreciable and possibly dominant source of mercury. The geochemical characteristics of water and sediment seem to indicate that carbonate plays a major role in the physicochemical transport of mercury, but the data are not adequately sensitive to discern the relative contributions of drainage from the mined area versus saline ground water sources of mercury to Bear Creek. The results of this study provide a basis for developing a conceptual model to effectively reinvestigate the Bear Valley region in order to predict the effects of cleanup of the Rathburn and Petray Mines on Bear Creek. Further study of the Bear Valley drainage basin in light of the conclusions provided in the report is required to develop an effective remediation plan.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 34 soil samples analyzed for total mercury which ranged from 0.01 ppm to 2490 ppm. 24 of the samples exceed the USEPA Regional Screening Level for residential soil of 5.6 ppm and 22 samples exceed the industrial soil level of 34 ppm.

Water samples were also collected from the mine sites and nearby water bodies and analyzed for total mercury and methylmercury. 24 unfiltered water samples ranged from 1.1 ng/L to 860 ng/L and 20 filtered water samples ranged from 0.9 ng/L to 440 ng/L of total mercury. One of the unfiltered and none of the filtered water samples exceeded the CCC of 770 ng/L for mercury. 11 unfiltered samples were analyzed for methylmercury and ranged from <0.02 ng/L to 0.33 ng/L. There is no established CCC for methylmercury.

30 soil sediment samples were collected and analyzed for total mercury. They ranged from 0.02 ppm to 408 ppm dry weight of mercury. 20 of the soil samples exceeded the National Oceanographic and Atmospheric Administration's (NOAA's) Probable Effects Concentration (PEC) screening level of 1.060 mg/kg for total mercury. 14 sediment samples were analyzed for methylmercury and ranged from <0.00001 ppm to 0.068 ppm. There is no established PEC for methylmercury.

2.3.5 California Central Valley Regional Water Quality Control Board (RWQCB)

The RWQCB has been the lead state agency investigating and remediating mercury contamination within the Cache Creek Watershed. The RWQCB is working with responsible parties on eleven mine sites conducting investigations and remediation. Information about those sites and the activities completed or underway, along with links to the RWQCB's Geotracker

website for more information can be found in Appendix 4.

Section 303(d) of the federal Clean Water Act requires the Regional Boards to submit lists of impaired water bodies to USEPA for their approval. Contaminant load reduction plans, called Total Maximum Daily Loads or TMDLs, are required to be developed for all listed water bodies. The requirements for TMDLs are consistent with responsibilities for protecting water quality under state law. The elements of a TMDL include a problem statement, numeric target, source analysis, allocations, description of how allocations relate to meeting targets, margin of safety, and an implementation plan, including monitoring. High priority has been placed on completing TMDLs in the major rivers and the Delta. The main focus in the Sacramento River watershed is mercury, heavy metals, and pesticides. In the Delta the focus is also on mercury, organophosphorus pesticides and low dissolved oxygen. The RWQCB issued Resolution No. R5-2005-0416 on October 21, 2005 that amended the 1975 Water Quality Control Plan for the Sacramento River and San Joaquin River Basins. The amendment required the plan to include commercial and sport fishing as a beneficial use, to establish site-specific numeric water quality objectives for methylmercury, and to establish a water quality management strategy to reduce mercury and methylmercury loads in Cache Creek, Bear Creek, Sulphur Creek, and Harley Gulch. The TMDLs for the Cache Creek Watershed have been approved by the USEPA.

The Board has conducted several studies within the watershed to evaluate general impacts. Some of the general watershed studies are summarized below.

Bear Creek Mercury Inventory **(Reference 1)**
A Basin Plan amendment to control mercury in the Cache Creek watershed was adopted by the Central Valley Regional Water Quality Control Board as required by the State of California Porter-Cologne Water Quality Control Act. This mercury inventory is in response to the Basin Plan which commits Regional Board staff to complete "assessments...to determine whether responsible parties should be required to conduct feasibility studies to evaluate methods to control sources of mercury...Assessments are needed of stream beds and banks in...Bear Creek south of the Bear Valley Road crossing...". The two objectives of this report were to provide an initial survey of the major tributaries to Bear Creek to identify if any of these tributaries are mercury sources, and to estimate the amount of mercury stored in the depositional areas, stream beds, and banks of Bear Creek available for downstream transport. During the fall of 2006, Regional Board staff collected sediment samples from point bars, depositional areas, instream sediments and from the mouth of major tributary creeks. Depositional areas and tributaries were identified from aerial photographs of Bear Creek provided by the National Agriculture Imagery Program (USDA, 2005) and field verified. The samples were sieved into three grain-size fractions and analyzed for mercury by Moss Landing Marine Laboratories.

Of the ten tributaries to Bear Creek that were sampled, Sulphur Creek had the highest sediment mercury concentrations. These high concentrations were not surprising since the Sulphur Creek watershed has geothermal springs with high mercury concentrations, naturally mercury-enriched soils, and experienced much mercury mining activity. Excluding Sulphur Creek, only Tributary 2 had a mercury concentration greater than 0.40 ppm in one of its three size fractions. The Basin

Plan's Cache Creek Watershed Mercury Program defines enriched sediment as having an average mercury concentration of 0.4 ppm, dry weight in the <63 μm fraction. The tributaries that drain the Rathburn-Petray mercury mine complex were not sampled during this survey; however, a study done by the U.S. Geological Survey indicated that mercury concentrations of water and sediment from some of the tributaries and springs downstream of these mines were high.

Regional Board staff identified 40 depositional areas along Bear Creek south of the Bear Valley Road crossing which contain approximately 114 million kg of sediment. The study estimates that 91 kg of mercury are present in these deposits within this 16 mile stretch of Bear Creek. This is about 24 times less than the 2,200 kg present in the 15-mile Cache Creek canyon from Harley Gulch to Bear Creek. Uncertainty about the estimate for Bear Creek may range between 46 to 182 kg. The lower value is estimated from observations that up to half the sediment in depositional areas may be cobble and larger sized material and has little or no associated mercury. The upper value results from the fact that nine of the identified depositional zones were not included in this estimate, and almost none of the smaller depositional piles were assessed. Sulphur Creek is a major mercury source to Bear Creek as mercury concentrations in depositional areas and instream sediments downstream of its confluence were higher than upstream concentrations for all three size fractions. About 78% of the total mass of sediment deposited along Bear Creek is above Sulphur Creek, but this material only accounts for 15% of the estimated total mercury mass. In contrast, depositional areas below Sulphur Creek only contain 22% of the total mass of sediment inventoried, but account for 85% of the mercury mass due to their higher mercury concentrations.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 24 soil samples collected and divided by grain size into three groups and analyzed for total mercury. The group of samples with grain sizes < 63 microns (um) in diameter showed a range of 0.07 ppm to 91.80 ppm. Six of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and two samples were above the screening level of 34 ppm for industrial soil. Samples with a grain size from 63 um to 1000 um ranged from 0.03 ppm to 212.0 ppm. Four of these samples were above the residential soil screening level and one was above the industrial soil screening level. Samples with a grain size from 1000 um to 3800 um ranged from 0.04 ppm to 21.90 ppm. One sample was above the residential soil screening level for mercury.

Sulphur Creek TMDL for Mercury **(Reference 14)**

The Central Valley Regional Water Quality Control Board has determined that Sulphur Creek is impaired due to elevated levels of mercury. Because of this impairment, Staff has prepared a Total Maximum Daily Load (TMDL) water quality management strategy. The Sulphur Creek TMDL includes: water quality numeric targets, assessment of mercury sources, linkage between the numeric target and loads, allocation of acceptable loads, a margin of safety, and an implementation plan. The goal of this TMDL is to lower mercury and methylmercury levels in Sulphur Creek such that loads of mercury entering Bear Creek are reduced and beneficial uses of Sulphur Creek and downstream water bodies are protected. The TMDL Report and associated Basin Plan Amendments satisfy TMDL requirements for lower Sulphur Creek, which is the

approximately two-mile reach between the Schoolhouse Canyon and the confluence with Bear Creek. The load allocations and implementation plan address mines and mercury enriched soil in the upper watershed as well.

Sulphur Creek was sampled during winter storms and non-storm events between 1998 and 2004. Most mercury in Sulphur Creek is transported during storms and associated runoff. The years of study are not classified as "wet" years. Larger or more frequent storm events could remobilize and transport even larger mercury loads. On an average annual basis, Sulphur Creek contributed 48% of the mercury and 41% of the methylmercury loads to Bear Creek.

Concentrations of mercury and suspended solids were sampled at multiple sites in the watershed on six occasions. These data were used to develop load estimates for tributaries and subwatersheds of Sulphur Creek. Tributaries associated with mines (Clyde, Elgin, Empire and Wide Awake Mines) contribute 44% of the mercury loads. The upper watershed provides about 10% of the loads, which are from contaminated in-stream sediment, erosion of background soil, and unidentified geothermal springs. Mercury loads in lower Sulphur Creek between West End mine and Wilbur Hot Springs account for 56% of the total loads. Sources in this area include geothermal springs, contaminated stream sediment, and erosion from mines.

This TMDL sets forth numeric targets for mercury in water and sediment based on natural or background concentrations. These targets should protect all wildlife, aquatic life, stock watering and human contact and non-contact recreational beneficial uses of Sulphur Creek. Fish or other organisms consumable by humans have not been observed in the creek. Staff proposes that the Central Valley Water Board adopt these targets as site-specific water quality objectives.

Mercury concentrations vary with flow. In summer and fall, creek flow is typically low and contains high concentrations of mercury from thermal springs. Under low flow conditions (defined as less than three cubic feet per second); the target is the maximum concentration of mercury in Sulphur Creek water of 1,800 ng/L, unfiltered. In winter and spring, the creek also contains mercury from runoff. The high flow target is the concentration of mercury in suspended sediment that is expected to be present in the creek when discharges from the mine sites are controlled. Because the most contaminated soil comes from the mine sites, control of runoff at these sites will decrease the overall level of mercury in creek sediment. The high flow target is 35 mg/kg mercury in fine-grained sediment and is represents as the ratio of concentration of mercury to concentration of suspended sediment in water, or mercury/suspended sediment ratio. This target is calculated by applying the expected reduction in mercury loads (75% through load allocations) to the maximum mercury to suspended sediment ratio.

Methylmercury production is controlled by multiple factors, with a primary factor being inorganic mercury concentrations in sediment. Studies conducted in the Cache Creek watershed and elsewhere have shown statistically significant relationships between methyl and total mercury, where methylmercury in sediment is a function of its total mercury content. This pattern is also seen in Sulphur Creek. Total mercury loads enter Sulphur Creek, which result in increased instream methylmercury production. As a consequence, Sulphur Creek exports considerable

loads of mercury and methylmercury to Bear Creek. Reducing total mercury loads from identified sources will lead to reduced methylmercury loads in Sulphur and Bear creeks.

Sulphur Creek is assigned load allocations for total mercury and methylmercury. The load allocations and implementation plan were adopted by the Central Valley Water Board as part of the implementation plan for control of mercury in the Cache Creek watershed. This TMDL identifies the reductions in total mercury loads needed to eliminate inputs related to mining and other anthropogenic activities and restore the watershed to its estimated pre-mining conditions. Geothermal springs are considered to be natural sources of mercury. Inactive mine sites are allocated 5% of existing mine-related loads entering the creek from each site.

Sulphur Creek is also assigned a methylmercury allocation of 10% of existing loads, which is equivalent to an average of 0.8 g methylmercury/year. Methylmercury loads are expected to vary naturally by flow and other factors. The Sulphur Creek methylmercury allocation was calculated to meet methylmercury objectives in fish tissue in Bear Creek. The goals of the implementation plan are to reduce the mercury concentration in sediment within Sulphur Creek and to reduce the loads of mercury and methylmercury discharged to Bear Creek.

Components of the implementation program are:
1) Reduce total mercury discharges from the mercury mine sites;
2) Reduce the concentration of mercury in Sulphur Creek sediment adjacent to and downstream of the mercury mines; and
3) Control erosion of contaminated sediments within the Sulphur Creek watershed where the total mercury sediment concentrations are greater than 0.4 mg/kg, dry weight.

The Sulphur Creek TMDL is enacted when amended into the Water Quality Control Plan for the Central Valley Region (Basin Plan). The Central Valley Water Board considers adoption of amendments to the Basin Plan after a public review process. Basin Planning for the Sulphur Creek TMDL occurred in two parts.

Basin Planning Part 1. Staff combined mercury reduction in Sulphur Creek with mercury strategies for Cache Creek, Harley Gulch and Bear Creek in one Basin Plan Amendment that includes load allocations and an implementation plan for all four water bodies. The Central Valley Water Board adopted the Cache Creek Watershed Mercury Basin Plan Amendment in October 2005. The State Water Resources Control Board and State Office of Administrative Law approved the amendment in 2006.

Basin Planning Part 2. Water quality objectives for mercury in fish tissue adopted in Basin Plan Amendment for the Cache Creek Watershed do not apply to Sulphur Creek because the creek does not support fish. Applicable human health criteria for drinking water, however, are not attained in Sulphur Creek because of naturally occurring concentrations of mercury and total dissolved solids. The second Basin Plan Amendment will modify the beneficial uses and set site-specific water quality objectives for Sulphur Creek based on naturally occurring concentrations of mercury. The load allocations described in this report are intended to meet the site-specific

objectives. Adoption of the second Basin Plan Amendment will complete the federal requirements for a TMDL for Sulphur Creek.

PASI Discovery Project Data Review: There was no specific sampling completed as part of the development of the TMDLs for Sulphur Creek.

Mercury Inventory In The Cache Creek Canyon **(Reference 4)**
Methyl mercury is a developmental toxin for both humans and wildlife. The primary route of exposure is through consumption of fish. Advisories have been issued for Cache Creek and the Sacramento-San Joaquin Delta Estuary recommending limited human consumption of sport fish because of elevated methyl mercury levels. Methyl mercury in fish is produced by sulfate reducing bacteria in sediment. The inorganic mercury concentration of sediment is an important factor controlling methyl mercury production by sulfate reducing bacteria. The Cache Creek watershed is about 2 percent of the landmass of the Central Valley but exports about sixty percent of the mercury. Half of the mercury from Cache Creek is trapped in the Cache Creek Settling Basin and the remainder is exported to the Delta. Therefore, understanding sources and distribution of mercury in Cache Creek and developing control programs to reduce exports is a high priority for the State of California.

The purpose of this study was threefold. First, conduct a survey of tributaries and flood plains in the Cache Creek canyon to ascertain the spatial distribution of mercury in their sediment. Second, use this information, if possible, to identify source(s). Finally, estimate the amount of mercury stored in the Canyon and available for downstream transport to the Cache Creek Settling Basin and the Delta.

The strategy for determining mercury sources was to identify tributaries with both elevated sediment mercury levels and higher concentrations downstream of their confluence with Cache Creek than above. One hundred and five sediment samples were collected and analyzed for mercury in the Cache Creek watershed between Clear Lake, Indian Valley Reservoir and the confluence of Bear Creek. There was no statistical difference in mercury concentration in sediment collected in the North Fork between Indian Valley Reservoir and the confluence with Cache Creek, between Clear Lake and the confluence with the North Fork and between the confluence of the North Fork of Cache Creek and Harley Gulch. The average background mercury concentration in sediment from the three areas was 0.06, 0.10, and 0.09-ppm in silt, sand and gravel sized material, respectively. Mercury concentration in Cache Creek increased statistically below Harley Gulch compared with upstream background concentrations. The average mercury concentration in 78 sediment samples collected in Cache Creek between Harley Gulch and Bear Creek was 0.98, 0.77 and 0.89-ppm in silt, sand, and gravel sized material, respectively. This represents an 8 to16-fold increase when compared with background levels above Harley Gulch. Sediment from the Harley Gulch delta, Crack Canyon and Davis Creek had statistically higher mercury concentrations than background material collected in Cache Creek above Harley Gulch. Mercury concentrations in silt and sand sized material from the Harley Gulch delta averaged 4.83 and 4.20 ppm, respectively. This is 81 and 42 times higher than background concentrations in similar sized material from above Harley Gulch. No gravel-sized

material was collected in Harley Gulch.

The average mercury concentration in sand from Davis Creek was 0.84 ppm. Harley Gulch and Davis Creek are the only tributaries in the Cache Creek canyon with mercury mines. The source of contamination in Crack Canyon is not known but warrants investigation.

The mass of mercury in the Cache Creek canyon was calculated by multiplying the volume of sediment in depositional areas by its surface mercury concentration. Twenty-two hundred kg of mercury are calculated to be present in the 15-miles of canyon between Harley Gulch and Bear Creek. Eight hundred and fifty-five kg are estimated to be in depositional piles between Harley Gulch and Crack Canyon. The origin of this material is most likely from Abbott and Turkey Run mines in Harley Gulch as no other upstream source has been identified. The source of mercury in sediment below Davis Creek is likely a combination of inputs from mines in Harley Gulch and Davis Creek and from the unknown source in Crack canyon.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 151 total sediment samples, including replicates, taken and analyzed for total mercury at numerous locations within the watershed. Each sample was divided into three types: silt, sand and gravel and analyzed. Only 123 of the samples were analyzed under the gravel category. The silt samples ranged from 0.03 ppm to 10.05 ppm with 43 samples above NOAA's PEC of 1.060 ppm. The sand samples ranged from 0.02 ppm to 23.6 ppm with 32 samples exceeding the PEC of 1.060 ppm. The gravel samples ranged from 0.03 ppm to 11.84 ppm with 21 of the samples exceeding the PEC.

MERCURY CONCENTRATIONS AND LOADS FROM THE SACRAMENTO RIVER AND FROM CACHE CREEK TO THE SACRAMENTO-SAN JOAQUIN DELTA ESTUARY **(Reference 5)**

A portion of this study is concerned with mercury contamination from the Cache Creek Watershed. Only that portion of the study discussing the Cache Creek Watershed is briefly summarized in this document.

Exceedance of U.S. EPA recommended water quality criteria in both the Sacramento River and in the Yolo Bypass during high flow events suggested that there might be multiple upstream sources. Special studies were undertaken to ascertain the source of the mercury in both the upper Sacramento River and in the Yolo Bypass. Mercury concentrations were measured at 12 sites between Shasta Dam and Greene's Landing during the largest storm of the year. Elevated concentrations of mercury were observed in the Yolo Bypass on 10 and 11 January 1995 (696 and 553 ng/l) suggesting a possible local source. The principal tributaries to the Yolo Bypass were sampled during two storms in 1995. The highest concentrations of mercury were consistently observed in Cache Creek implying that the watershed was a major source of mercury.

A follow-up study was initiated in Cache Creek with three objectives. First, confirm that the Basin was a major source of mercury during another water year. Second, measure mercury

concentrations seasonally in the lower Basin to determine the extent of the exceedance of US.EPA criteria and to ascertain bulk mercury transport from the watershed. Finally, identify, if exceedances of U.S. EPA criteria were observed, the principal source(s) of the metal.

Studies conducted between 1996 and 1998 confirmed that Cache Creek was a major source of mercury. A correlation was noted between total mercury concentration at Road 102 and flow immediately upstream at the Town of Yolo. The relationship was employed to estimate both the frequency of exceedance of U.S. EPA criteria in the lower watershed and to determine bulk mercury exports. The correlation suggested that the U.S. EPA criteria were exceeded in the lower Basin when Cache Creek flows were greater than 100 CFS.

Cache Creek is diverted into the Settling Basin before discharge to the Yolo Bypass. Bulk mercury loads from the watershed to the Settling Basin were estimated at 980 kg/yr for water year 1995. Similarly, export to the Yolo Bypass from the Settling Basin was 495 kg/yr.

The third objective of the Cache Creek study was to determine major sources of mercury. The Cache Creek watershed is naturally divided into three sub-basins: the north and south forks of Cache Creek and Bear Creek. All three water bodies flow year-round. Thirteen mercury surveys were conducted during two hydrologic cycles and three general mercury loading patterns were observed: summer irrigation, winter non-storm runoff, and winter storm runoff events. The irrigation season occurs during the seven month period between April and October. Mercury export rates from the upper basin (above Rumsey) were on the order of 10-50 g/day with most of the metal and water coming from Clear Lake. Mercury export from the lower Basin is usually much less as most of the water (and mercury) is diverted for irrigation. The winter non-storm period is the next most common event and occurs between November and March. This study was characterized by wet winters. Mercury export rates from the upper Basin were on the order of 100-1000 g/day. Much of the mercury appeared to originate from the North Fork of Cache Creek. Finally, storm periods were least common and occurred with a frequency of 4-1 0 times per year. All sub-basins exported significant amounts of mercury but the majority of the metal appeared to come from the Cache Creek canyon downstream of the confluence of the North and South forks but above Bear Creek. Storm export rates were on the order of 5,000-1 00,000 gallons/day. Overall, runoff from storms accounted for the majority of the mercury exported from the Basin.

Five intensive surveys were conducted during storms to attempt to identify major mercury sources in each sub-basin of the Cache Creek Watershed. Three were in Bear Creek and in the North Fork and two were float trips down the inaccessible section of Cache Creek canyon between the confluence of the North and South Forks and Bear Creek. The major source of mercury to the Bear was Sulfur Creek. Sulfur Creek drains the inactive Central, Wide Awake, Elgin, and Manzanita mercury mines and also has potentially significant natural sources of mercury from hot springs. The major sources of mercury to the North Fork were Benmore Canyon and Grizzly Creek. Both drain seven to eight square mile watersheds on the western slope of the Sulfur Creek mercury mining district. Finally, Harley Gulch was identified as a large source of mercury to the canyon area downstream of the confluence of the North and South Forks but above Bear Creek. Harley Gulch drains the inactive Abbott and Turkey Run Mines.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 90 water and 88 sediment samples collected and analyzed for total mercury. The water samples ranged from 1.51 ng/L to 359,448 ng/L. 16 of the samples exceeded the USEPA's CCC of 770 ng/L for mercury. The range of the sediment samples was 0.0 ppm to 53.6 ppm. 12 of the samples exceeded the NOAA PEC of 1.060 for sediment.

Cache Creek Settling Basin Sediment Mercury Waste Characterization: A Small-Scale Preliminary Assessment **(Reference 13)**

The Cache Creek Settling Basin (CCSB) is a 3,600 acre structure located at the base of the Cache Creek watershed just west of the Sacramento Airport. The basin was constructed in 1937 to contain sediment that would otherwise build up in the Yolo Bypass and decrease the Yolo Bypass' ability to protect the Sacramento region from flooding. The basin was modified in 1993 to increase its sediment trapping efficiency. It currently traps about 64% of the sediment and mercury mass inputs from the watershed. Even though the basin traps a little more than half the mercury that comes into it, the Cache Creek Watershed still accounts for about 60% of all inorganic mercury that enters the Yolo Bypass and is the largest single source of mercury-contaminated sediment to the Delta.

The basin has a United States Army Corp of Engineers (USACE) designed project life of 50 years with an average sediment volume trapping efficiency of about 50% over the entire project life. The sediment trapping efficiency of the basin will decrease as it fills. The basin will fill to its design capacity in about 33 years, and its trapping efficiency may reach zero in about 50 years, unless a long-term maintenance program is established. At this time, the only maintenance program in effect for the basin is for the purpose of flood control upstream of the basin. USACE's draft sediment management plan includes the following activities to maintain the current 50% trapping efficiency over the 50-year life of the basin: construction and maintenance of a training channel and levee; incremental removal of the existing training levee; and raising the outlet weir in year 25 (approximately 2018). Although the USACE's draft sediment management plan for the basin has not been finalized, DWR has done some maintenance activities in the settling basin including vegetation clearing, levee maintenance, and minor sediment removal projects. The basin is expected to be filled to design capacity at the end of the project life (50 years) in approximately 2042. No program is in effect for the purpose of maintaining the trapping efficiency or extending the life of the basin beyond the USACE-designed project life of 50 years.

The draft Basin Plan amendment for the Delta methylmercury TMDL proposes that responsible agencies develop and evaluate alternatives and implement plans for improvements to the CCSB to reduce mercury exports from the basin. One of the possible improvements to increase the sediment capturing ability of the basin is to perform more or earlier excavation of the accumulated sediment in the basin than proposed in the UACE draft sediment management plan. The draft Basin Plan amendment contains a proposed schedule to start planning for the improvements. If sediment were removed from the basin, there is the question of where the

material could be disposed such that ground and surface water quality at the disposal site is not impacted. This involves sampling and analyzing the material for a variety of metals, in addition to mercury, that would be expected to be derived from mine wastes (from mercury mines in the upper Cache Creek watershed) to determine if the removed sediment would be classified as hazardous waste. The purpose of the sediment sampling and analysis outlined in this study was to provide a preliminary small-scale assessment of the CCSB material and its waste classification. This report does not provide recommendations for waste disposal classifications at off-site sediment disposal locations.

This report will only summarize the characterization of mercury in the basin. The criterion to designate the waste as hazardous for mercury contamination is 20 ppm, wet weight. The remaining metals are needed for the Regional Board's Title 27 program, and will be accessed, as necessary, by its program staff.

The conclusions of the report are:

1. Sediment mercury concentrations may possibly be a function of depth in the Cache Creek Settling Basin. Any area targeted for excavation may need further characterization to determine if excavation actions would expose sediments containing higher levels of mercury, which could possibly increase methylmercury production in the settling basin.

2. Mercury concentrations are statistically greater than background concentrations found in the upper Cache Creek Watershed.

3. Mercury appears to be spatially heterogeneously distributed in the Settling Basin. The mercury concentration exhibited high variability across the basin and may need further studies to understand the distribution of sediment deposition when the settling basin is flooded.

4. None of the samples exceed 20 ppm mercury dry weight, so the material is not classified as hazardous.

5. This study has conducted a preliminary characterization of a variety of metals of the sediment located within the Cache Creek Settling Basin. The possibility of disposal of excavated sediments from the basin will be determined by, whether or not; the disposal will pose a threat to water quality at the disposal site. This data can be used to determine the possibility of a threat to water quality, once a disposal site is located and characterized.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 10 composite sediment samples collected for each of two depths (surface and approximately two feet below the surface) in the settling basin and analyzed for total mercury. The results for the surface samples ranged from <0.1 ppm to 0.8 ppm and the subsurface samples ranged from 0.17 ppm to 1.4 ppm. None of the surface sediment samples and three of the subsurface sediment samples exceeded NOAA's PEC of 1.060 ppm.

2.3.6 California Department of Toxic Substances Control (DTSC)

DTSC regulates the generation, transport, treatment, and disposal of hazardous wastes in California. It also provides oversight for the investigation and cleanup of sites contaminated with hazardous substances.

***Targeted Site Investigation Report, Cache Creek Canyon Regional Park, Rumsey, California* (Reference 31)**

DTSC has signed "Letters of Intent" with the California Indian Environmental Health Alliance (CIEA), Big Valley Rancheria, Elem Indian Colony, Middletown Rancheria of Pomo Indians, and Robinson Rancheria to study mercury contamination within the basin and how it may be affecting tribal member's health and the effects upon the tribe's environment. Utilizing a USEPA Brownfields Targeted Site Investigation (TSI) Grant, DTSC is working to determine the uptake of metals into flora from sediment that has been deposited in Cache Creek from historical mercury and gold mining activities in the Cache Creek watershed at two locations: Cache Creek Canyon Regional Park and Cowboy Camp. The CIEA is interested in gathering information because Tribal communities gather flora and fauna in the Cache Creek Watershed for various purposes, including ceremonial uses; medicinal uses; food sources; and arts and crafts (e.g., basket making) resulting in potential exposures to the users. DTSC is also collecting soil/sediment and water samples from areas that the general public may come into contact with while using the Park. In addition, DTSC has an ongoing effort to work with the tribes and tribal organizations on mapping and protection of culturally sensitive areas within the Cache Creek Watershed.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 21 soil samples obtained and analyzed during the study which ranged from 0.0644 ppm to 11.7 ppm for total mercury. One sample exceeded the USEPA Regional Screening Level for residential soil of 5.6 ppm for total mercury and none of the samples exceeded the industrial soil screening level of 34 ppm. The 21 samples were also analyzed for methylmercury and had a range of 0.000079 ppm to 0.00141 ppm, none of which exceeded the USEPA residential soil screening level of 7.8 ppm. Note: DTSC used the California Human Health Screening Level (CHHSL) of 18 ppm for mercury as its screening level in this study. This is a State of California developed screening level and is not utilized for federal site assessment purposes.

14 biota samples were collected and analyzed for total mercury which ranged from 0.002 ppm to 0.042 ppm. One sample was analyzed for methylmercury which showed 0.0012 ppm. There are currently no screening levels for flora established.

Four surface water and one groundwater well samples were also collected and analyzed. None of the samples showed mercury at or above the reporting limit (RL) of 0.0002 nanograms per liter (ng/L). None of the surface water samples exceeded the USEPA CCC for surface water or the Maximum Contaminant Level (MCL) of two micrograms per liter (ug/L) for drinking water. None of the water samples was analyzed for methylmercury.

DTSC has also completed this Discovery Project and the Site Screening Assessments (SSAs) listed in Appendix 6 as part of its efforts under its Preliminary Assessment/Site Assessment (PA/SI) grant with USEPA. Nine sites were selected for SSAs based upon the findings of the Discovery Report and the recommendations of other state and federal agencies. Those recommendations were based upon concern regarding direct contact with contaminants by users of the watershed, effects on water quality from mercury entering the system, and ingestion of mercury which has bioaccumulated within the system. Concerns regarding direct contact include tribal members gathering plants for traditional crafts such as basket-making and for ceremonial purposes; recreational users such as hikers, campers, hunters, and persons fishing; and for one site which is proposed for development as a spa and resort. Concerns regarding water quality caused by mercury from these sites entering the watershed include loss of beneficial use for drinking water and agricultural production. Additionally, there is a direct concern regarding bioaccumulation of mercury within the system which poses a direct threat to wildlife and humans who may be ingesting mercury from fish and other animals and plants.

The nine sites selected for SSAs are the Central, Cherry Hill, Elgin, Empire Sulphur Creek, Manzanita, West End, and Wide Awake mines along Sulphur Creek; the Utopia Mine along Clear Lake which is proposed for development; and the Cache Creek Settling Basin through which all drainage from the watershed passes on its way to the Sacramento River, Sacramento-San Joaquin Delta and San Francisco Bay. Links to the individual sites for which SSAs have been completed are listed in Appendix 4.

2.3.7 California Department of Conservation – California Geological Survey (CGS)

The mission of CGS is to provide scientific products and services about the state's geology, seismology and mineral resources including their related hazards that affect the health, safety, and business interests of the people of California. CGS is regarded as the primary source of geological and seismological products and services for decision making by California's government agencies, its businesses and the public.

An Assessment of the Ecological and Human Health Impacts of Mercury in the Bay-Delta Watershed: Task 5C1: Assessment of the Feasibility of Remediation of Mercury Mine Sources in the Cache Creek Watershed **(Reference 2)** This is a Cal Fed Mercury Project Report. Fourteen historic mercury and gold mines in the Sulphur Creek mining district were examined to evaluate their mercury contributions to the Cache Creek watershed. During field examinations, mine site materials were inventoried and samples collected for laboratory analysis to establish the concentration and characteristics of mercury in these materials. In situations where mine materials were eroding, estimates of erosion rates were made. The estimated erosion rates and mercury concentrations for mine materials were then used to estimate the average annual mercury contributions from the mine site materials to local waterways. Information compiled from previous published and unpublished studies was used to make preliminary estimates of mercury availability from non-mine sources in the project area for comparison with mercury contributions from mine-site sources. Finally, general recommendations are made for mine-site remediation approaches, which are developed in more detail and evaluated for engineering

feasibility, effectiveness and cost in the Task 5C2 final report by Tetra Tech EM, Inc.

Mercury concentration data and erosion rate estimates for mine site materials were used to estimate average annual mercury contributions from mine sites to the Sulphur Creek, Harley Gulch and Bear Creek sub-watersheds. The resulting estimates of annual mine site mercury contributions due to erosion are 4.4 to 18.6 kg per year to Sulphur Creek and 1.2 to 10.2 kg per year to Harley Gulch. In the Bear Creek watershed, it is estimated that 0.7 to 23.5 kg per year of mercury is moving offsite from mine waste piles into immediately adjacent dry ravines annually. It is uncertain how much, if any of this waste pile material from the mines in the Bear Creek watershed actually reaches Bear Creek, which is several miles to the east. A future project should be undertaken to sample the sediments along the drainages between the ravines and Bear Creek.

Estimates of the annual amounts of regional background mercury mobilized within these watersheds have been made for comparison with the estimates for mine materials and are as follows: 0.45 to 9.8 kg for Sulphur Creek, 0.04 to 0.8 kg for Harley Gulch (west tributary), and 3.7 to 74.7 kg for Bear Creek. These regional mercury contributions assume minimum and maximum annual erosion rates of 0.5 and 10 tons per acre per year applied over the entire watershed areas. The amount of regional background mercury actually entering waterways in the project area on an annual basis is unknown, and these estimates should be viewed as upper limits.

The focus of this study is on mine site materials as sources of mercury in the Sulphur Creek, Harley Gulch and Bear Creek watersheds. However, additional sources of mercury are present in these watersheds: thermal spring waters and associated precipitates, deposits of elevated-mercury sediments along stream beds and banks, soil mercury emissions to the air (local sources) and atmospheric mercury (regional-global sources). The annual mercury contributions from these sources to waterways in the project area are incompletely or poorly known and should be considered for investigation in future studies. Available information from previous studies within the project area, and from the nearby Knoxville mercury district, suggest that the significance of these sources is as follows:

- Thermal spring waters probably contribute only a few hundred grams of mercury annually to the watersheds, but contribute large amounts of sulfate (50 to 160 metric tons to Harley Gulch and 7 to 16 metric tons to Sulphur Creek).
- Precipitates deposited in mud at thermal springs contain 10s to 100s of ppm mercury. However, the annual rate of production of these precipitates is unknown and, therefore, the amount of mercury they add to watershed loads is unknown.
- Stream bank alluvium and streambed sediment near mines or other mercury source areas may contain 10s of ppm mercury. Virtually no information is currently available on the location, extent, or conditions necessary for erosion and downstream transport of these sediments.
- Preliminary estimates suggest the total annual mercury emissions to the air from all mine site material occurrences in the project area are about 3 to 4 kg.
- Estimates of mercury emissions from elevated mercury soils developed in mineralized areas may exceed mine materials emissions by 10 times or more. These soil occurrences may constitute an important watershed mercury source if a significant percentage of this mercury is deposited in waterways.

• If atmospheric mercury deposition occurs in the study area at about the same rate as in the San Francisco area (2.2 ng/m2/hr), then the annual mercury contribution from this source is relatively small compared to the previously mentioned sources, about 0.55 kg to Sulphur Creek and the Harley Gulch (west tributary area) watersheds combined, and 4.6 kg to the Bear Creek watershed).

Information developed by this project regarding the abundance and characteristics of mercury in mine site materials and estimates of mine site mercury contributions to waterways, suggests that effective mine site remediation should be based on general site erosion control and mine waste isolation measures. Because of the important role hypothesized for sulfate-reducing bacteria in the methylation of inorganic mercury, measures to reduce the amount of sulfate entering waterways from thermal springs and to reduce interaction between sulfate-rich thermal spring water and mine materials should also be considered.

Based on the findings of Task 5C1 the following recommendations are made regarding reclamation activities to reduce or eliminate mine site mercury contributions to Harley Gulch, Sulphur Creek and Bear Creek:

1) For sites where reclamation is needed, the principle approach should involve erosion control activities to prevent mine materials and enriched mercury soil from entering waterways. Specific activities may involve but are not limited to the following:
• Relocating material piles away from waterways
• Placing barriers, such as grass covered berms, between mine materials and waterways
• Recontouring and revegetation of material piles and areas of surface disturbance by mining activity to reduce erosion
• Redirection of storm runoff around material piles and areas of surface disturbance to reduce erosion
• Stabilization of stream banks containing enriched mercury alluvium to minimize erosion during storm events
• Containment of thermal spring mud (precipitates) to prevent transport to waterways, possibly by creating settling basins near spring sites
• Approaches to reduce sulfate contributions from thermal springs should be evaluated and possibly implemented, if feasible.

2. Suggested areas for reclamation activity to reduce mercury contributions to Harley Gulch and Sulphur Creek are:
• The area of calcined tailings at the Abbott mine site, including the large calcined tailings pile, smaller tailings deposits near the old brick furnace, and the tailings covered pad between these two areas (erosion control, removal away from the tributary to Harley Gulch, or other approach to prevent transport of the material to the waterway).
• The ore bin pile at the Turkey Run mine and the immediately adjacent eroding pad area (removal of the ore pile or in-place isolation from thermal spring water and storm runoff). Thermal spring water exiting the Turkey Run mine needs to be prevented from interaction with local mine site materials.

• Upper Abbott-Turkey Run mine site areas (for storm water redirection/control).
• The portion of Sulphur Creek stream bank between the Cherry Hill and the Manzanita mine (for erosion control).
• The waste rock pile at the West End mine (erosion control in-place, removal, or other approach to isolate it from Sulphur Creek).
• Consideration of storm water control/redirection for the upper portions of the Central mine.
• The mixed waste rock and calcined tailings pile at the Wide Awake mine.
• At this time no remediation activities appear necessary for the Cherry Hill mine and mill site or the Empire mine. However, the material pile north of the Cherry Hill on the south bank of Sulphur Creek should be considered for removal.

3. Reclamation activities at the Rathburn-Petray, Clyde and Elgin mine sites:
• No specific reclamation recommendations are suggested for the Rathburn-Petray area mine sites because it has not yet been shown that they are contributing mercury to Bear Creek. If this situation changes, reclamation approaches would probably involve storm-runoff-control and revegetation activities.
• Although a tailings pile is actively eroding to a small tributary to Sulphur Creek at the Clyde mine site, the tailings appear to be relatively low in mercury content and not contributing significant amounts of mercury to the Sulphur Creek watershed. Consequently, remediation activities here will likely have little impact on lowering mercury contributions to Sulphur Creek but should be considered for other reasons.
• Mercury contributions from the Elgin mine site to a Sulphur Creek tributary are uncertain but may be significant. Reclamation activities may be difficult here because mine waste, interacting with thermal spring water, lies on a very long steep slope between the upper mine area and the tributary. Tetra Tech EM Inc. will discuss possible reclamation activities for this site in their Task 5C2 final report.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were soil samples collected at 11 mine sites and analyzed for total mercury.

Abbott Mine: 37 samples were analyzed and ranged from <10 ppm to 1530 ppm. 35 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 28 were above the screening level of 34 ppm for industrial soil.

Turkey Run Mine: 28 samples were analyzed and ranged from 0.11 ppm to 3510 ppm. 22 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 19 were above the screening level of 34 ppm for industrial soil.

Wide Awake Mine: 18 samples were analyzed and ranged from 0.13 ppm to 1040 ppm. 13 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 9 were above the screening level of 34 ppm for industrial soil.

West End Mine: 5 samples were analyzed and ranged from 4.91ppm to 300 ppm. 4 of the

samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 4 were above the screening level of 34 ppm for industrial soil.

Cherry Hill Mine: 10 samples were analyzed and ranged from 0.02 ppm to 280 ppm. 7 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 6 were above the screening level of 34 ppm for industrial soil.

Manzanita Mine: 20 samples were analyzed and ranged from <0.01 ppm to 560 ppm. 17 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 15 were above the screening level of 34 ppm for industrial soil.

Empire Mine: 7 samples were analyzed and ranged from 0.03 ppm to 420 ppm. 5 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 2 were above the screening level of 34 ppm for industrial soil.

Central Mine: 11 samples were analyzed and ranged from 0.03 ppm to 420 ppm. 5 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 2 were above the screening level of 34 ppm for industrial soil.

Elgin Mine: 17 samples were analyzed and ranged from 0.22 ppm to 3300 ppm. 13 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 11 were above the screening level of 34 ppm for industrial soil.

Clyde Mine: 3 samples were analyzed and ranged from 4.98 ppm to 40 ppm. 2 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 1 was above the screening level of 34 ppm for industrial soil.

Rathburn Mine: 23 samples were analyzed and ranged from <0.001 ppm to 990 ppm. 14 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 14 were above the screening level of 34 ppm for industrial soil.

Petray Mine: 17 samples were analyzed and ranged from 1.79 ppm to 14,270 ppm. 14 of the samples were above the USEPA Regional Screening Level of 5.6 ppm for residential soil and 12 were above the screening level of 34 ppm for industrial soil.

2.3.8 California Department of Water Resources (DWR)

The Department of Water Resources (DWR) operates flood control facilities on Cache Creek and its tributaries in two separate areas, those of the Middle Creek Project upstream from Clear Lake, and those along Cache Creek near the Yolo Bypass. The Cache Creek Settling Basin and adjoining levees are important flood control facilities that reduce sediment and debris transport into the Yolo Bypass that could compromise its water carrying capacity; and are also intended to reduce the flood risk to Woodland and adjoining agricultural lands.

Cache Creek has been identified as a major source of mercury-contaminated sediments to the

Yolo Bypass and the Sacramento River and San Francisco Bay Delta. This contamination has been linked to increased methylmercury exports from the Yolo Bypass during high flow conditions. Of particular interest, wetlands within the Cache Creek watershed have been identified as localized "hotspots," where mercury concentrations in fish are elevated. The Cache Creek Settling Basin was designed to capture mercury-contaminated sediments in a wetland-like environment, and is thought to be a location that could influence the formation of methylmercury. Recent estimates indicate that the Cache Creek Settling Basin releases 160 grams of methylmercury annually to the Yolo Bypass, representing a significant point source for the Sacramento River and the San Francisco Bay Delta.

DWR has partnered with the other agencies such as USGS and the RWQCB to study the Settling Basin and its contribution of mercury and methylmercury downstream. Summaries of these studies can be found in Sections 2.3.4 and 2.3.5 above.

2.3.9 Other Studies

The studies summarized below were completed by a private contractor or were published by individuals in scientific journals.

An Assessment of the Ecological and Human Health Impacts of Mercury in the Bay-Delta Watershed: Task 5C2: Final Report: Final Engineering Evaluation and Cost Analysis for the Sulphur Creek Mining District, Colusa and Lake Counties, California. **(Reference 29)** This is a Cal Fed Mercury Project Report.

This engineering evaluation/cost analysis (EE/CA) was performed under contract to the San Jose State University Foundation (SJSUF) with technical direction from the California Department of Conservation, California Geologic Survey (CGS). This work is being performed in support of SJSUF's U.S. Bureau of Reclamation Cooperative Agreement Number 99FC200241, identified as "Assessment of Ecological and Human Health Impacts of Mercury in the Bay-Delta Watershed." This cooperative agreement is part of the California Bay-Delta Authority (CBDA) (formerly CALFED) Ecosystem Restoration Program (ERP). The ERP is intended to improve water quality of the San Francisco Bay-Sacramento/San Joaquin Delta (Bay-Delta). Multiple abandoned mines and geothermal springs in the Sulphur Creek Mining District (District) discharge mercury to the Cache Creek watershed, a tributary to the Bay-Delta. Implementation of mitigation alternatives identified in this EE/CA is intended to result in a relatively rapid decrease in the mercury load in surface water and sediment from the District to the Cache Creek watershed. A decrease in mercury load to surface water and sediment from mining sources may ultimately result in a decrease of mercury in fish tissue close to mining sources and a slow, gradual mercury reduction in fish stocks throughout the Bay-Delta.

The purpose of this EE/CA is to present a detailed analysis of mine-site mitigation alternatives that CBDA, regulatory agencies, and the scientific community can use for decision-making. This EE/CA presents background information (Section 2); summarizes prior investigations (Section 3); Summarizes mining impacts to the watershed (Section 4); describes applicable or relevant and appropriate requirements (ARAR) (Section 5); identifies preliminary mitigation objectives and goals (Section 6); identifies and screens response actions, technology types, and process

options (Section 7); provides a detailed analysis of mitigation alternatives (Section 8); and describes a comparative analysis of mitigation alternatives (Section 9).

The data and background information utilized in this EE/CA is based on and builds on the work of CGS and other investigators. This EE/CA identifies, screens, and evaluates technologies that may be implemented to reduce mercury loads to the Cache Creek watershed from the mine sites and thermal springs.

Recommended mitigation strategies that can be used by property owners and other stakeholders to reduce contaminant loads at each mine site are described in the remainder of this executive summary. The reader is referred to the sections identified above for a detailed explanation of how these mitigation strategies were identified. Mitigation strategies are presented for both interim and final mitigation activities. The focus of interim mitigation activities is on mercury load reduction in support of and consistent with attainment of preliminary mitigation objectives (PMO) and preliminary mitigation goals (PMG) over the long term. Final mitigation activities address both mercury load and risk reduction and meet regulatory requirements in support of site closure. The scope of and decision to implement a mitigation strategy should be made by each property owner in conjunction with CBDA and other stakeholders.

In order to assist the property owner and other stakeholders in the selection of the most cost-effective method of mercury load reduction in each watershed, interim and final mitigation alternatives have been ranked on Table ES-1 in order of anticipated load reduction and projected costs. A detailed description of mitigation strategy components, including assumptions used to support cost estimates, is presented on the Appendix A CDROM by mine site.

PASI Discovery Project Data Review: There was no site specific sampling conducted for this report.

CALFED – CACHE CREEK STUDY (TASK 5A: FINAL REPORT), January 2000- July 2002, MERCURY LOADING AND SOURCE BIOAVAILABILITY FROM THE UPPER CACHE CREEK MINING DISTRICTS. **(Reference 12)** This is a Cal Fed Mercury Project Report.
Mercury (Hg) loading from upstream mining and geothermal spring sites in the Upper Cache Creek region may contribute significantly to Hg bioaccumulation in the San Francisco Bay-Delta Complex. The goal of this study was to evaluate Hg concentrations in upstream waters and estimate potential loading from both anthropogenic mining related sites and natural geothermal springs in the Upper Cache Creek region. Potential methyl Hg production from sediments or in-stream flocculent precipitates was also evaluated in a series of laboratory based slurry and microcosm experiments.

In order to estimate maximum potential Hg loading, water from streams and geothermal springs was collected during February (the winter rainy season) in both 2000 and 2001 from two regions: (1) the Harley Gulch Mining Region, and (2) the Sulphur Creek Mining Region. Total Hg and methyl Hg was analyzed from RAW (unfiltered) and FILTERED (0.45 μm pore size) water

samples. Stream flow was typically two times higher in Sulphur Creek compared with Harley Gulch and was 5-10 fold lower on the sampling dates in 2001 than in 2000. Total Hg in RAW water ranged from 4-39,700 ng/L (parts per trillion), with the lowest concentrations obtained in the geothermal spring in the Harley Gulch region, and the highest concentrations obtained in the geothermal spring in the Sulphur Creek region. Stream waters that passed through or nearby abandoned mine sites typically ranged from ca. 1,000 - 6,800 ng/L total Hg in RAW water, whereas total Hg in FILTERED water ranged from ca. 100 - 2,000 ng/L from those same sites, with the dissolved fraction of the Hg comprising ca. 5-30% in the year 2000 and ca. 30-70% in 2001. Methyl Hg in RAW water (which was analyzed for only a subset of samples) ranged from 0.15-20.40 ng/L, with the highest values again obtained from the geothermal spring in the Sulphur Creek region. Methyl Hg in FILTERED water ranged from 0.12-14.40 ng/L with comparably high values at the geothermal spring in the Sulphur Creek region.

Hg loading (daily, monthly, annually) was calculated using the aqueous Hg concentrations (above) multiplied times stream flow rates for specific regions and sites within regions. Local stream flow rates from specific mining sites were obtained by hand, whereas regional flow rates were obtained from automated USGS gauging stations. Based on stream data collected in February 2000, Harley Gulch produced projected total Hg loading estimates of up to ca. 0.02 kg/d, whereas estimated loading from 2001 data yielded only ca. 0.0013 kg/d. Using the USGS flow rates from the gauged stations, monthly and annual estimates of Hg loading from Harley Gulch yielded maximum values of ca. 0.65 kg/month and 1.2 kg/yr using 2000 data. Hg loading projected from Sulphur Creek sites using year 2000 data yielded a maximum monthly value of ca. 5 kg/month and a maximum annual value of ca. 10 kg/yr. Comparable data from year 2001 yielded maximum loading estimates of 0.1 kg/day, 9.5 kg/month and 16 kg/yr. Thus, estimates of Hg loading from the Sulphur Creek region were about 10 times greater than those from the Harley Gulch region. In the long-term context of watershed Hg loading influenced by erosion from rainfall events, the stream flow rates during the two years in this study were only 55% of the long-term average. Thus, during much heavier rainfall we might predict that more Hg-laden erodible materials would be mobilized and transported downstream. However, within the flow rates observed during this study, no statistically significant relationships were documented between flow rates and total Hg or methyl Hg in RAW water or FILTERED water. Thus, we do not have estimates of how those more extreme events would affect long-term Hg loading and cannot use other years' flow data to predict loading in higher precipitation years which would produce higher flow rates.

A 5-day laboratory microcosm experiment (used previously at Clear Lake), designed to test the potential of a flocculent precipitate found within Sulphur Creek to produce methyl Hg, yielded virtually no net production of methyl Hg.

Because mine-derived Hg-contaminated soils/sediments could become mobilized and transported downstream, ultimately contaminating distant stream and estuary sites, a series of laboratory-based methylation trials (using slurries) were designed to evaluate the potential of upstream SOURCE materials (e.g. mine-derived soils/sediments) to produce methyl Hg in downstream RECEIVING sediments. A preliminary trial conducted in November 2000 at U.C. Davis yielded

encouraging results, suggesting potentially significant differences in methyl Hg production from different source materials such as mercuric chloride, Abbott Mine tailings and Sulphur Creek floc. These preliminary results provided the foundation for the development of a more in depth trial involving several mine-derived and geothermal spring related floc SOURCE materials and downstream sediments from Cache Creek. These laboratory trials were conducted at Frontier Geosciences laboratory in Seattle. Results of these trials can be found in N. Bloom's report.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 47 unfiltered water samples collected and analyzed for total and methylmercury. All 47 samples were analyzed for total mercury which ranged from 4.32 ng/L to 39,700 ng/L. 19 of the samples exceeded the USEPA CCC of 770 ng/L. 12 of the samples were analyzed for methylmercury. They ranged from 0.149 ng/L to 20.4 ng/L. There is no CCC established for methylmercury.

46 filtered water samples were collected and analyzed for mercury and methylmercury. All 46 of the samples were analyzed for total mercury which ranged from 2.13 ng/L to 9880 ng/L. Nine of the samples exceeded the USEPA CCC of 770 ng/L. 12 of the samples were analyzed for methylmercury. They ranged from 0.0776 ng/L to 14.4 ng/L. There is no CCC established for methylmercury.

Mercury and Trace Elements in Crayfish from Northern California **(Reference 6)**
The Cache Creek and Putah Creek watersheds, located within California's North Coast Range, include areas with abundant geologic sources of mercury (Hg) and a long history of Hg contamination. Waterways in the two watersheds that have been listed as impaired by Hg contamination under Section 303(d) of the Clean Water Act include: Cache Creek from Clear Lake Dam to the Cache Creek Settling Basin and Putah Creek from Solano Lake to the Putah Creek sinks. Sources of Hg in the Coast Range include geothermal springs, agricultural runoff, erosion of naturally Hg-enriched soils, and atmospheric deposition, but most of the Hg exported from both the Cache Creek and Putah Creek watersheds originates from historic Hg mining operations.

Crayfish have been used as bioindicators of Hg in the environment because they accumulate Hg, primarily as methylmercury (MeHg). The omnivorous diet of the crayfish commonly includes algae and other plant material, aquatic insects, snails, and detritus. Crayfish are eaten by fish, mammals, birds, and humans. Recent health advisories for Putah and Cache Creeks provide guidelines for consumption of crayfish potentially contaminated with Hg.

We evaluated the bioaccumulation of Hg and other elements in signal crayfish (Pacifastacus leniusculus) and red swamp crayfish (Procambarus clarkii) to estimate the potential hazard of this intermediate component of the food web. Prior to this study, data were not available on Hg or other toxic elements in crayfish in Cache or Putah creeks. Focusing on mercury, we sought to characterize trends in crayfish tissue concentrations by site, species, crayfish size, or sex. The signal crayfish, native to the Pacific Northwest, including a small portion of northern California, has been introduced throughout California. The red swamp

crayfish, native to northeastern Mexico and south-central United States, is an introduced species to California.

Methylmercury accounted for nearly 100% of total Hg burdens from crayfish at all four sites (Table 1). As found by Pennuto et al. (2005), concentrations of both Hg and MeHg were higher in the tail than in the remainder of the carcass. Mercury in the tails comprised from 80.6% (Putah Creek) to 87.5% (Cache Creek Settling Basin) of the Hg in the total body. This is important because the tail of the crayfish is most commonly consumed by humans.

Total Hg and MeHg did not significantly differ between any of the four sites in either tails or carcasses. With data from all four sites pooled, two-way ANOVA detected no significant sex or species effect in total Hg or MeHg in the tail. Although total Hg in the carcass was higher in signal crayfish (0.046 vs. 0.034 ug/g, $p = 0.004$), carcass MeHg did not differ by sex or species. Signal crayfish were larger than red swamp crayfish (p\0.01) in both mean carapace length (58.1 vs. 49.8 mm, respectively) and mean body mass (59.2 vs. 30.1 g, respectively). Neither measure of crayfish size, however, was strongly correlated with tissue concentrations of total Hg or MeHg.

Within sex, the only difference was for red swamp crayfish. The mean MeHg concentration in the tails of males from the Cache Creek Settling Basin (0.25 ug/g) were higher than that in males from the Yolo Basin Wildlife Area (0.11 ug/g). Only two sex effects were detected within sites. At the Yolo Basin Wildlife Area, the mean MeHg concentration in the tail of female red swamp crayfish (0.22 ug/g) was significantly higher than in males (0.11 ug/g). This difference was expected because the females were larger (mean carapace length = 50.1 vs. 45.4 mm) and heavier (mean mass = 30.3 vs. 22.9 g) than the males at this site. At the Putah Creek site, however, the mean total Hg in carcasses of female signal crayfish was higher than in the males (mean = 0.061 vs. 0.035 ug/g), even though mean length (62.5 vs. 57.9 mm) and mean mass (66.7 vs. 67.9 g) were not different between the sexes.

Mean MeHg concentrations in crayfish tails at all four sites (Table 1) were higher than the average reported in crayfish for the January 2005 Cache Creek health advisory for fish consumption. The Cache Creek Settling Basin (0.241 ug/g) and Putah Creek (0.256 ug/g) sites had the highest MeHg concentrations in crayfish tails, 1.3–1.8 times higher than the concentrations reported in the Cache Creek (0.14 ug/g) and Mokelumne River (0.18 ug/g) health advisories, and similar to those in health advisories for Putah Creek (0.21 ug/g) and the Consumnes River (0.29 ug/g). Mean MeHg concentrations found in crayfish at Buck Island (0.171 ug/g) and the Yolo Basin Wildlife Area (0.156 ug/g) were similar to the Cache Creek and Mokelumne River advisory concentrations.

Although wildlife tend to consume the whole crayfish, humans normally consume only the tail muscle. Thus, those elements that accumulate in the tail are most likely to affect humans adversely. Besides Hg, elements of concern found in the sampled crayfish, including As, Cd, Cr, Ni, Pb, Zn, and Se, were generally not concentrated in the tail, and concentrations were lower than those considered harmful to human or crayfish health.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 10 crayfish samples taken and the analyzed for mercury and methylmercury in the Cache Creek Settling Basin. The mean total mercury for the 10 samples ranged from 0.080 to 0.260 ppm depending on the portion of the body analyzed. The mean samples did not exceed the USEPA health advisory for fish and invertebrates of 0.3 ppm. The samples were also analyzed for methylmercury and the mean ranged from 0.034 ppm to 0.24 ppm. The mean samples did not exceed the health advisory of 0.3 ppm for mercury.

Samples of 6 crayfish were also taken at Buck Island upstream of the settling basin and analyzed for mercury and methylmercury. The mean mercury concentration ranged from 0.046 ppm to 0.254 ppm and the mean methylmercury ranged from 0.055 ppm to 0.256 ppm. None of these samples exceeded the USEPA health advisory for fish and invertebrates of 0.3 ppm.

Mercury Contamination in Three Species of Anuran Amphibians from the Cache Creek Watershed, California, USA **(Reference 7)**
The information provided in this summary was taken from the "pre-published" version of the study.

Amphibians may be adversely affected by exposure to environmental mercury (Hg), especially in its more bioavailable form, methylmercury (MeHg). As shown in laboratory studies with southern leopard frog (Rana sphenocephala) larvae, amphibian development may be adversely affected, and survival through metamorphosis may be decreased by dietary Hg. Other effects may include impaired reproduction, growth inhibition, behavioral modification, and various sublethal effects. Of Hg, cadmium, copper, manganese, and zinc, Jayaprakash and Madhyastha (1987) found that Hg was the most toxic to larval ornate narrow-mouthed toads (Microhyla ornata). Teratogenic and lethal effects of Hg have also been documented for other larval amphibians. In addition to being at risk for Hg toxicity themselves, amphibians may play a role in the transport of Hg from the aquatic to the terrestrial environment as well as the conversion of elemental Hg to the more bioavailable MeHg.

There is growing evidence that some amphibians are declining or have disappeared from significant parts of their historical ranges in the western United States. Of most concern in the Cache Creek Watershed is the effect of Hg on the native foothill yellow-legged frog (Rana boylii), a California species of special concern.

Waterways in the Cache Creek Watershed listed as impaired by Hg contamination by Section 303(d) of the Clean Water Act include: lower Cache Creek, Clear Lake, Davis Creek Reservoir, Harley Gulch, Bear Creek, and Sulphur Creek. Studies conducted by the California Regional Water Quality Control Board during 1996-1998 confirmed that Cache Creek was a major source of Hg to the Sacramento-San Joaquin River Delta and San Francisco Bay Estuary. Sources of Hg in the Cache Creek Watershed include geothermal springs, agricultural runoff, erosion of naturally Hg- enriched soils, and atmospheric deposition, but the majority of the Hg exported

from the watershed originates from historic Hg mining operations in the upper watershed.

Information on the concentrations of Hg in water, sediments, invertebrates, and fish from the Cache Creek Watershed has helped define the sources of Hg in the watershed and the magnitude of its contamination. However, more information on Hg concentrations in the upper trophic levels, especially amphibians, is needed. Amphibians may be useful indicators of metals contamination, especially where fish cannot survive. They bioaccumulate and are particularly sensitive to metals, have obligate aquatic larval stages, and sometimes spend their entire life cycle in a given pond or reach of a stream.

This study of Hg bioaccumulation in amphibians was part of a larger study conducted in cooperation with the U.S. Fish and Wildlife Service that evaluated Hg bioaccumulation by macroinvertebrates, amphibians, fish, and insectivorous birds from the Cache Creek Watershed. In this paper, we focus on an evaluation of Hg in three species of amphibians. The objectives of this part of the study were to: (1) Quantify Hg bioaccumulation in larval, juvenile, and adult amphibians inhabiting the watershed, (2) Relate Hg bioaccumulation by these amphibians to sources of Hg within the watershed, and (3) Evaluate Hg and MeHg concentrations in various tissues of American bullfrogs (Lithobates catesbeianus) collected from the watershed.

Mercury deposits are present throughout the California Coast Range, and, as expected, Hg was detected in all anurans collected from the Cache Creek Watershed, including those from reference sites. Sample sizes, however, were limited by available funding, restrictions on take by the California Department of Fish and Game, and availability at specific sites. As a result, THg concentrations within sites were often highly variable, making among-site comparisons difficult. An extreme example of high variability occurred at one Bear Creek site (BEARTHOM), where THg concentrations in bullfrogs ranged from a low of 0.07 μg /g to 2.78 μg/g, which was the highest concentration observed in any frog in this study.

In 1997, bullfrog adults were consistently more contaminated with Hg than were the larvae. This difference was attributed to differences in food habits, with the larvae feeding on a wide variety of items, including algae, senesced vegetation, bacteria, fungi, zooplankton, and animal flesh, and the adults feeding at a higher trophic level. There were also interspecific differences among the adult amphibians. Based on analyses of stomach contents, adult bullfrogs should be better biomonitors of Hg contamination because their foods are more closely tied to the aquatic ecosystem (74% of the prey items were aquatic) than either the yellow-legged frogs (28% aquatic) or treefrogs (5% aquatic).

The high THg concentrations found in amphibians from Sulphur Creek, Harley Gulch, Davis Creek, and other sites close to Hg sources (Mine region), as well as sites not far downstream from Hg sources (Canyon region), confirm the findings of Slotton et al. (1997) who sampled invertebrates from the same sites. Concentrations were generally lower in the Valley region and were lowest in the Reference regions. Mercury concentrations in anurans collected from downstream sites depended on both their proximity to Hg sources and on the presence of conditions that favored methylation. For example, anurans from BEARTHOM (See Fig. 1) had

mean and maximum values for both ranid species that were higher than at BEAR<SUL, a site located on Bear Creek about 11.5 km upstream at the confluence with the highly contaminated Sulphur Creek. The numerous pools in bedrock in the relatively low-gradient stream at BEARTHOM likely accumulated sediments contaminated with Hg, which was later methylated and ultimately bioaccumulated by amphibians and their prey.

The toxicity of Hg and MeHg to amphibians is not well documented, and we did not evaluate the toxicity to anurans in this study. However, THg concentrations in certain anurans were high enough to pose a potential hazard to human or wildlife consumption, with the total Hg concentration exceeding the FDA criterion (1.0 μg/g) for regulation of commercial fish in at least one sample at 20% of the bullfrog sites and 24% of the yellow-legged frog sites. In addition, the mean THg concentrations in bullfrogs at five sites (25% of the total) and in yellow-legged frogs at 13 of the sites (62%) exceeded the EPA Hg criterion (0.3 μg/g) for issuance of health advisories for fish consumption.

In summary, anurans from throughout the Cache Creek Watershed bioaccumulated Hg and MeHg, with concentrations dependent on proximity to Hg sources. Mercury concentrations were commonly higher than the EPA criterion for issuance of health advisories for fish consumption and were often higher than the FDA's criterion for commercial fish. The bullfrog is a sport species with no limits on when, where, or how many can be collected under a sport fishing license (California Department of Fish and Game 2003). The amount of THg in bullfrog carcasses is important when evaluating impacts to predators and the food web, and Hg concentration in the whole body was a reliable predictor of THg concentrations in leg muscle. Since the legs of bullfrogs are frequently consumed by humans, the elevated concentrations found in bullfrogs may pose a risk to human health. A health advisory for consuming bullfrogs within the Cache Creek Watershed, therefore, would seem appropriate.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 59 composited samples of three kinds of frogs and larvae collected from sites within the Cache Creek Watershed and analyzed for total mercury. Total mean mercury ranged from 0.023 ppm to 1.7 ppm. 20 of the samples exceed the USEPA health advisory level of 0.3 ppm established for consumption of these animals.

10 composited samples were taken along Bear Creek and analyzed for mercury and methylmercury. The mean range for total mercury ranged from 0.21 ppm to 5.87 ppm and from 0.23 ppm to 1.48 ppm for methylmercury for measurements of the carcass, liver, muscle, and total body. Eight of the "Total Body" samples analyzed for total mercury and nine of the samples analyzed for methyl mercury exceeded the USEPA health advisory level of 0.3 ppm established for consumption of these animals.

Cliff Swallows "Petrochelidon pyrrhonota" as Bioindicators of Environmental Mercury, Cache Creek Watershed, California **(Reference 8)**
To evaluate mercury (Hg) and other element exposure in cliff swallows (Petrochelidon

pyrrhonota), eggs were collected from 16 sites within the mining-impacted Cache Creek watershed, Colusa, Lake, and Yolo counties, California, USA, in 1997–1998. Nestlings were collected from seven sites in 1998. Geometric mean total Hg (THg) concentrations ranged from 0.013 to 0.208 ug/g wet weight (ww) in cliff swallow eggs and from 0.047 to 0.347 ug/g ww in nestlings. Mercury detected in eggs generally followed the spatial distribution of Hg in the watershed based on proximity to both anthropogenic and natural sources. Mean Hg concentrations in samples of eggs and nestlings collected from sites near Hg sources were up to five and seven times higher, respectively, than in samples from reference sites within the watershed. Concentrations of other detected elements, including aluminum, beryllium, boron, calcium, manganese, strontium, and vanadium, were more frequently elevated at sites near Hg sources. Overall, Hg concentrations in eggs from Cache Creek were lower than those reported in eggs of tree swallows (Tachycineta bicolor) from highly contaminated locations in North America. Total Hg concentrations were lower in all Cache Creek egg samples than adverse effects levels established for other species. Total Hg concentrations in bullfrogs (Rana catesbeiana) and foothill yellowlegged frogs (Rana boylii) collected from 10 of the study sites were both positively correlated with THg concentrations in cliff swallow eggs. Our data suggest that cliff swallows are reliable bioindicators of environmental Hg.

Prior to this study, the bioaccumulation of Hg in insectivorous birds, namely, the cliff swallow (Petrochelidon pyrrhonota), had not been evaluated. The foothill yellow-legged frog (Rana boylii) is native to the Cache Creek watershed and is common in the upper reaches, while the bullfrog (Rana catesbeiana), an introduced species to California, is common in suitable habitat throughout the watershed (Kupferberg 1997). The objectives of this study were (1) to quantify and compare the bioaccumulation of Hg and other elements detected in cliff swallow eggs and nestlings collected from the Cache Creek watershed, (2) to relate these accumulations to Hg sources, and (3) to evaluate the suitability of cliff swallows as biomonitors by comparing bioaccumulation of Hg by cliff swallows with that of amphibians collected from the same sites.

Although Hg bioaccumulation is a dynamic process influenced by multiple variables, the relationship between Hg in cliff swallow eggs and nestlings in the Cache Creek watershed and the sources (abandoned mines and geothermal sources) is strong. One site-specific variable is the degree of Hg methylation, which is primarily controlled by hydrological and biogeochemical factors and the presence of methylating bacteria. As expected, egg THg concentrations were low at reference sites and higher near mine sites. It was surprising, however, that THg concentrations in both eggs and amphibians from the upper valley sites were relatively low and were similar to those found at the reference sites. These upper valley sites were likely not significant methylation areas. However, farther downstream, at the lower valley sites (Fig. 2), intermediate to high egg THg concentrations were detected (Table 2). Water flow rates at these sites were visibly reduced compared to those at the upper valley sites. The Yolo Bypass Wildlife Area (site 16) receives floodwaters from upstream, including Cache Creek, and is on the west side of the Yolo Bypass, where flows originating in the Cache Creek watershed are most likely to drop sediments contaminated with Hg. Under the lentic conditions present at the lower valley sites (especially 14 and 16), it is assumed that THg was more likely to be deposited and then transformed to MeHg, thus increasing its bioavailability to the swallows.

Other Elements in Eggs

Comparisons of THg and MeHg in composite egg samples confirmed that most of the Hg in the eggs was in the methylated form. Several elements that could potentially adversely affect swallow reproduction (Cd, Cr, Mo, Pb, As, and Ni) were either at background levels or not detected. In general, higher concentrations of other metals were most frequently associated with mine sites. With the exception of Ca, which was elevated in eggs from two of the mine sites (Table 4), the essential elements were similar among all sites. Concentrations of Se from Cache Creek swallow eggs were higher than the means reported for barn swallows from reference sites in the San Joaquin Valley. However, all values from Cache Creek were lower than the mean concentration observed at Kesterson Reservoir (4.37 ug/g), a site with significant embryo mortality and deformities in other species.

Correlations with Amphibians

Mercury residues in amphibians from the Cache Creek watershed provided a useful comparison for the cliff swallow results. Based on the 1997 data, trends in THg concentrations in frogs generally followed those in swallows. Mean THg concentrations (ug/g, ww) in all frogs were low at sites above known contamination sources and higher at or just below those locations. In 1997, only foothill yellow-legged frogs were found at three sites in the upper reaches of Cache Creek (sites 1, 5, and 9). Foothill yellow-legged frogs were sympatric with bullfrogs at certain sites (sites 2, 4, and 7), but only bullfrogs were present in the lower reaches of Cache Creek (sites 10 and 12–14). The diets of the swallows were assumed to be primarily emergent aquatic insects. Both species of frogs were observed to feed on insects, but the bullfrogs also fed on vertebrates, including fish, snakes, and other frogs. Although we did not observe frogs feeding on birds, Longcore (personal communication) reported bullfrogs with nestling tree swallows in their stomachs in Maine. We found that bioaccumulation in swallows, as reflected by their eggs, was closely correlated with the carcasses of the resident amphibians. This indicates that prey consumed by both swallows and amphibians were similarly contaminated with Hg at individual sites and that bioaccumulation by both taxa was reflective of the level of contamination at those sites.

This study demonstrates the transfer of Hg from the aquatic food web to the terrestrial food web. We conclude that THg concentrations in cliff swallow eggs collected from the Cache Creek watershed in 1997 and 1998 generally followed the assumed spatial distribution of Hg in the watershed, based on proximity to both anthropogenic and natural sources. Additionally, depositional areas for Hg, such as the lower valley sites, may have elevated THg even though they are farther removed from Hg sources. Furthermore, THg concentrations in cliff swallow eggs were correlated with concentrations in bullfrogs and foothill yellow-legged frogs collected from the same sites. Overall, the general patterns of THg concentrations in cliff swallows and amphibians confirm the findings of other studies in that a portion of the Hg transported from abandoned mine sites and geothermal sources (particularly in Sulfur and Bear creeks) is bioavailable and continues to contaminate biota in the watershed. We recommend the use of cliff

swallow eggs and nestlings to test the effectiveness of future remedial measures.

PASI Discovery Project Data Review: A review of this study's sampling data for site assessment purposes, conducted as part of this Discovery Project, shows that there were 16 sites sampled for eggs and 7 sites sampled for nestlings and analyzed for total mercury. The means of the egg samples ranged from 0.013 ppm to 0.208 ppm. The means of the nestlings' mercury concentration ranged from 0.047 ppm to 0.347 ppm. There is no health advisory level established for consumption of these animals.

3.0 Investigative Efforts

3.1 Sources of Information

Studies documenting the mercury problem in the watershed conducted by state and federal agencies have been reviewed to get a sense of the magnitude of the problem. Information from these studies has been used to develop the sections regarding mining history, environmental contamination, and bioaccumulation within various species. Information regarding investigations of individual mines or mine groups has also been obtained from these studies, along with information from site-specific (mine site) investigations conducted by the USEPA, BLM, RWQCB, and DTSC.

3.2 Review of Federal, State, County, and City Agency Files and Records

No formal on-site review of agency files and records located within their offices was completed as part of this project. The information summarized in this report was provided by agency personnel or was obtained from the department's or agency's web site. As the sites identified by this effort are selected for further action (Site Screening Assessments by DTSC or Preliminary Assessments by USEPA) an in depth review of all agency records and files for those sites will be conducted.

4.0 Hazard Ranking System Factors

4.1 Sources of Contamination

The primary sources of contamination associated with the Cache Creek Watershed are from mercury and other metals mining within the area. Waste rock and tailings piles, and milling and retort areas for extracting and purifying the mercury are all sources of the mercury and methylmercury contamination reaching the streams, creeks, lakes, rivers, delta, and bay. Acid Mine Drainage from the mines may be a source of contamination affecting water quality and biota within the watershed.

Naturally occurring mercury, especially from geothermal sources, is also a major source of mercury within the watershed. Many geothermal springs in the area are contributing mercury to the watershed on a continual basis. However, CERCLA excludes naturally occurring substances from assessment and remediation. A significant issue in identifying the scope of the contamination is assessing the contribution from naturally occurring sources versus that contributed from anthropogenic activities such as mining and ore processing.

4.2 Groundwater Pathway

None of the information reviewed to date has indicated the presence of ground water contamination and the completion of the ground water pathway. Orders issued by the RWQCB do require evaluation of the ground water to determine whether it is contaminated.

4.3 Surface Water Pathway

The surface water pathway has clearly been impacted by mining activities within the watershed. Studies conducted by the USGS, USFWS, RWQCB, and others have clearly established the effect on the watershed, both on water quality and the threat to human health and wildlife. The watershed is used as a food and water source, for recreational activities, and for tribal gathering of plants and other materials for traditional and ceremonial purposes.

The California Office of Environmental Health Hazard Assessment (OEHHA) whose purpose is to evaluate the toxicity of hazardous substances and their threat to human health and the environment currently has fish consumption guidelines for Clear Lake, Cache Creek, and Bear Creek: For women 18-45 and children 1-17: crayfish may be consumed at 2 servings a week; Blackfish, Bluegill and other sunfish, Carp, Hardhead, Hitch, and Sucker may be consumed at 1 serving a week; and it is advised to not eat Bass, Pikeminnow, Catfish, or Crappie. For men over 17 and women over 45: crayfish may be consumed at 4 servings a week; Blackfish, Bluegill and other sunfish, Carp, Hardhead, Hitch, and Sucker may be consumed at 2 servings a week; and Bass, Pikeminnow, Catfish, and Crappie may be consumed at 1 serving a week.

Additional exposure to contaminants may occur by direct contact and incidental ingestion of contaminated water or sediments by recreational users and by tribal members who may be gathering materials or using the creeks for traditional or ceremonial purposes.

4.4 Soil Exposure and Air Migration Pathways

The threat to human health through the soil pathway exists by direct contact and incidental ingestion and inhalation of contaminated soil. Hikers and others attracted by the historic nature of the mining features could enter the contaminated mine sites. Other users could be exposed by blowing dust from the sites. While some of the studies conducted have estimated the emissions to air from the soil (both from waste areas and from naturally occurring sources) and the corresponding fall out to surface water, no information has been found relating to how these airborne concentrations may be contributing directly to exposure from inhalation.

5.0 Emergency Response Considerations

No conditions requiring the need for state or federal agencies to take emergency action have been identified at this time. The need for emergency response or time-critical removal actions will be identified on a site-by-site basis during the Site Screening Assessments and Preliminary Assessments that will be conducted in the future.

6.0 Summary and Recommendations

DTSC has also completed this Discovery Project and the Site Screening Assessments (SSAs) listed in Appendix 6 as part of its efforts under its Preliminary Assessment/Site Assessment

(PA/SI) grant with USEPA. Nine sites were selected for SSAs based upon the findings of the Discovery Report and the recommendations of other state and federal agencies. Those recommendations were based upon concern regarding direct contact with contaminants by users of the watershed, effects on water quality from mercury entering the system, and ingestion of mercury which has bioaccumulated within the system. Concerns regarding direct contact include tribal members gathering plants for traditional crafts such as basket-making and for ceremonial purposes; recreational users such as hikers, campers, hunters, and persons fishing; and for one site which is proposed for development as a spa and resort. Concerns regarding water quality caused by mercury from these sites entering the watershed include loss of beneficial use for drinking water and agricultural production. Additionally, there is a direct concern regarding bioaccumulation of mercury within the system which poses a direct threat to wildlife and humans who may be ingesting mercury from fish and other animals and plants.

The nine sites selected for SSAs are the Central, Cherry Hill, Elgin, Empire Sulphur Creek, Manzanita, West End, and Wide Awake mines along Sulphur Creek; the Utopia Mine along Clear Lake which is proposed for development; and the Cache Creek Settling Basin through which all drainage from the watershed passes on its way to the Sacramento River, Sacramento-San Joaquin Delta and San Francisco Bay. Links to the individual sites for which SSAs have been completed are listed in Appendix 4.

The review of the studies and mine site-specific information completed under this project show the following significant impacts from mining in the area:

1. Contamination and ongoing releases of mercury from mining activities have contaminated the soil and surface water and continue to move down through the watershed. The amount of mercury entering the creek system from mining activities appears to be influenced by storm events with large amounts of mine waste and mercury entering the creek during periods of high rainfall.

2. The degree to which the air and ground water pathways may be affected by mercury and the impact to human health and the environment from these pathways is not clear.

3. Naturally occurring mercury is contributing a significant amount of mercury to the total amount of mercury entering the creek system and the impacts from human-caused activities versus the mercury from naturally occurring sources is not well differentiated. The amount of mercury entering the creek system from natural sources appears to be steadier than from mine sites due to flows from springs not being affected as much by storm events. However, mercury from both sources which has entered the creek system is moved downstream by the same high-flow storm events.

4. Site surveys and general water quality sampling studies have identified the areas and sites within the watershed which appear to be contributing the greatest amounts of mercury from mining activities. Site-specific investigative and cleanup efforts undertaken to date have been focused toward controlling sources of mercury entering Cache Creek and its

tributaries to reduce the mercury load entering the creek system.

5. Investigation and remediation of the mine sites as sources of mercury will reduce the future mercury load entering the watershed but will not address mercury which has already entered the system. Much of the mercury entering the creek system will eventually reach the Cache Creek Settling Basin. Requirements for remediating mercury which has already entered the creek system have not been evaluated.

6. Bioaccumulation of mercury is occurring and presents a threat to human health and other animal species within the watershed and down through the Sacramento River, Sacramento-San Joaquin Delta, and San Francisco Bay.

Specific recommendations for addressing the mercury problem are beyond the scope of this project. However, some general observations to keep in mind include:

1. Controlling ongoing releases from mine sites is essential prior to attempting to clean up the creek system below the release points. However, agencies must take into account the historic uncontrolled release of mercury from mine sites that has negatively impacted the downstream areas and is accumulating in the Cache Creek Settling Basin and ultimately the San Francisco Bay.

2. The Cache Creek Settling Basin provides a good point for evaluating and controlling the amount of mercury leaving the watershed and travelling downstream to the Sacramento River and on into the San Francisco Bay. It is necessary for agencies to understand the mercury impacts on this area, specifically and especially before undertaking any large wetlands restoration projects.

3. It is necessary to further characterize the sources and releases of mercury within the system. Evaluating the contributions of mercury to the creek system from mining activities versus naturally occurring sources should be conducted concurrently with the mine site source control activities so that the creek system can be addressed as mine site sources are remediated. These evaluations need to address whether the chemical nature of the mercury from mine sites is substantially different from naturally occurring sources and whether the differences, if significant, contribute to migration of the mercury and methylation and bioaccumulation of mercury within the food chain.

4. Agencies and tribes need to continue collaborating with each other in a joint effort to address the watershed by characterizing the contamination, identifying responsible parties, and considering potential cleanup actions for abandoned mercury mines, for mercury hot spots within Cache Creek proper, and at the eastern terminus of the creek, at Cache Creek Settling Basin and the Yolo Bypass.

5. No other sites listed in Appendix 4- Table of Potential Sources & Mine Site Information, other than the nine sites which have been screened as part of this project, are currently

recommended for Site Screening Assessments based upon the information available at this time.

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Appendices
Appendix 1 – Transmittal List

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Appendix 2 – Contact Log and Contact Reports

Cache Creek Discovery Project				
Contact Name	**Affiliation**	**Telephone Number**	**Date**	**Discussion**
Cache Creek Mercury Contamination Meeting	Various state and federal agencies working on mercury issue in Cache Creek Watershed.	Various	12-11-08	Meeting among agencies to discuss work being conducted in the watershed and possible solutions to address mercury problem.
California Indian Environmental Alliance	Indian tribes working on environmental issues	Various	4-23-09	Discuss concerns of tribes in the Cache Creek Watershed and proposed Cache Creek Watershed Discovery Project.
Cache Creek Mercury Contamination Meeting	Various state and federal agencies working on mercury issue in Cache Creek Watershed.	Various	7-27-09	Meeting among agencies to discuss status of various agencies work and the PASI Cache Creek Discovery Project to be conducted during the year.
Cache Creek Mercury Contamination Meeting	Various state and federal agencies working on mercury issue in Cache Creek Watershed.	Various	3-2-10	Meeting state and federal agencies to discuss status of the PASI Cache Creek Discovery Project and receive information on studies and mine sites, and comments on draft PASI Discovery Report outline.

Appendix 3 – Standard Environmental Record Sources

Standard Environmental Record Sources

National Priorities List (NPL)

The NPL is a list of the sites the USEPA considers to be the most contaminated and which present the greatest threat to human health and the environment. Sites which are listed on the NPL contain information about current and planned investigation and cleanup activities, contaminants and their possible health effects, and reuse of the land. The Sulphur Bank Mercury Mine http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0902228 located along Clear Lake in Lake County is the only site within the Cache Creek Watershed currently listed on the NPL.

Comprehensive Environmental Response Compensation & Liability Information System (CERCLIS)

CERCLIS is USEPA's database for information on sites where releases are known to have occurred. Activities and dates for the start and completion of those activities are listed for the sites in the database. Sites which are also listed on the NPL contain more information about current and planned investigation and cleanup activities, contaminants and their possible health effects, and reuse of the land. There are currently eleven sites within the Cache Creek Watershed listed in CERCLIS. They include the Abbott Turkey Run mines and the Sulphur Bank Mercury mine and the nine sites listed in Appendix 6. Information about sites listed in the database can be obtained at the following link: http://cfpub.epa.gov/supercpad/cursites/srchsites.cfm

EnviroStor

DTSC maintains the EnviroStor database which serves as an on-line public information repository. DTSC is not actively working on any sites within the Cache Creek Watershed except for the Sulphur Bank Mercury Mine site. DTSC has added additional mine sites to EnviroStor as part of this Discovery Project. Those sites, with a link to EnviroStor are listed below in section *3.4 Mine Site Information*. DTSC information about any of these sites can be viewed at: http://www.envirostor.dtsc.ca.gov/public/search.asp. Many of the site entries also have a link from the EnviroStor data base to the RWQCB's Geotracker database.

Geotracker

The SWRCB maintains the Geotracker database http://www.geotracker.swrcb.ca.gov/search.asp which also serves as an on-line public information repository. Geotracker had information on site investigations and cleanups and copies of reports and other documents available for review. The RWQCB also maintains a Discharger-Specific Orders database that lists orders that have been adopted by the Board. The database http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/index.shtml lists orders for a number of mines in the Cache Creek Watershed. Links to those orders can be found for each mine site in section 3.4 below. Each of these orders describes in some detail the history, problems, investigative results, and requirements for investigation and monitoring of the sites. As part of the amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins mentioned in Section 2.3.4 above, several inactive mines are scheduled to have orders adopted by the Board to address contamination of the watershed.

Appendix 4 – Table of Potential Sources & Mine Site Information

SITE NAME	APNS/ADDRESS	LATITUDE	LONGITUDE	COUNTY
Abbot Mine	006-020-10	39.0206	-122.4439	Lake
Baker Mine	122-310-04	38.88768	-122.5296	Lake
Baxter Prospect	009-022-83	38.92833	-122.758	Lake
Canary Hill Deposit	006-008-19	39.07098	-122.5791	Lake
Central Mine	018-200-002, -004 to -007, and -013 to -018	39.037722	-122.430604	Colusa
Cherry Hill	018-200-002, -004 to -007, and -013 to -018	39.032825	-122.432332	Colusa
Cherry Hill Deposit	Not Identified	39.03463	-122.4283	Colusa
Christienson Tract	010-041-10 or 010-005-70	38.97431	-122.6458	Lake
Clyde Mine	018-010-010	39.07208	-122.4816	Colusa
Elgin	018-100-002, -003, -004	39.05596	-122.47222	Colusa
Empire Mine	018-200-002, -004 to -007, and -013 to -018	39.034249	-122.426021	Colusa
Gordon Springs	013-003-77	38.8369	-122.7111	Lake
Grover Herring Mine	Off Walker Ridge, W.S.	Not Identified	Not Identified	Colusa
Harrison	018-340-04	38.85127	-122.3749	Yolo
Judy	Not Identified	39.086458	-122.44973	Colusa
Juniper	Not Identified	39.0906	-122.4547	Colusa
Konocti Mine	036-231-15	38.99481	-122.7056	Lake
Lucitta	009-003-39	38.95667	-122.7569	Lake
Manzanita Mine	018-200-002,0-004 to -007, -013 to -018	39.034544	-122.429844	Colusa
Petray North	Not Identified	39.088472	-122.45168	Colusa
Petray South	Not Identified	39.085641	-122.451797	Colusa
Rathburn	Not Identified	39.076454	-122.448383	Colusa
Rathburn-Petray Mine	018-020-001	39.07694	-122.4486	Colusa
Red Rock & Silver Rock Claims	012-069-30	38.89981	-122.4914	Lake
Reddington (Knoxville)	015100001000, 015100012000	38.8246	-122.3389	Napa
Reed Mine	018-340-21	38.86319	-122.37056	Yolo
Shamrock	010-012-16, 010-012-17	38.95516	-122.4846	Lake
Shamrock Prospect	010-012-16	38.9619	-122.4919	Lake

Soda Springs	018-340-09	38.85322	-122.3705	Yolo
Sulphur Bank	End of Sulphur Bank Road	39.003888	-122.664722	Lake
Turkey Run	006-020-10	39.0186	-122.4353	Colusa
Utopia	004-018-19	39.11972	-122.8088	Lake
Weiper Mine	122-300-06 or 122-310-04	38.88961	-122.5239	Lake
West End	018-200-02, -004 to -007, and -013 to -018	39.034919	-122.435147	Colusa
Wide Awake	018-200-002, -004 to -007, and -013 to -018	39.028273	-122.428757	Colusa
Wilbur Hill	Not Identified	39.0325	-122.4172	Colusa
Wilbur Springs-Abbot Mine	Not Identified	39.06457	-122.41667	Colusa
White Elephant	012-006-09	38.8529	-122.6606	Lake
White Elephant Prospect	012-006-09 or 012-006-46	38.85958	-122.6588	Lake
Unnamed Quarry	018-330-20	38.8708	-122.3811	Yolo
Unknown	012-018-28	38.84402	-122.40083	Lake
Unnamed Location	012-018-28	38.84601	-122.3994	Lake
Unknown	012-065-12	38.85874	-122.43778	Lake
Unnamed Location	012-065-12	38.86101	-122.4431	Lake
Unnamed Location	012-006-45	38.86401	-122.68	Lake
Unnamed Quarry	018-330-20	38.86871	-122.3811	Lake
Unnamed Location	Not Identified	38.87231	-122.6956	Lake
Unnamed Location	Not Identified	38.91461	-122.4736	Lake
Unnamed Location	012-014-08 or 012-014-26	38.91681	-122.4375	Lake
Unnamed Location	010-014-11 or 012-069-06	38.92931	-122.5103	Lake
Unknown	010-014-11 or 010-013-21	38.93041	-122.51083	Lake
Unnamed Location	006-020-11 or 006-018-32	39.0298	-122.4547	Lake
Unknown	006-020-11 or 006-018-32	39.03207	-122.45639	Lake
Unnamed Location	016-022-16, 016-022-16, 016-029-01, 016-029-05, 016-028-07	39.0854	-122.5658	Lake
Unknown	016-022-16, 016-022-16, 016-029-01, 016-029-05, 016-028-07	39.08901	-122.56694	Lake

Mine Site Information

The following mine site information was found during the database review. There are many unnamed locations where mining activities have occurred. While some have been included in the list of sites for this report, no significant information has been found about them and no descriptions are included in this section. In addition, information on history and impacts to human health and the environment have not been found for some of the named mine sites included in this section. They have been listed so that the reader is aware of the information available about them. Where available, links to DTSC's EnviroStor web site for additional information has been provided. For sites appearing in both EnviroStor and the RWQCB's Geotracker web site, a link called "Associated Geotracker Projects" between sites has been established in EnviroStor to take the reader directly to the corresponding Geotracker page. One location, the Cache Creek Settling Basin, is not an actual mine site but is a sediment settling basin utilized for flood control purposes. It is included at the end of this section because it is a significant deposit location for mercury-containing silt traveling down through the watershed on its way to the Sacramento River, Sacramento-San Joaquin River Delta, and San Francisco Bay.

Abbott-Turkey Run Mines

The Abbott and Turkey Run Mines are located in Lake County along State Highway 20 about 24 miles west of Williams. The Abbott Mine was located in 1862 with the first reported production occurring in 1870. The mine has been operated intermittently from the 1870s to 1971. Total production over the life of the mine is estimated to be between 50,000 and 60,000 flasks of mercury. Extensive underground workings extend to a depth of 500 feet with lateral runs that extend up to 3000 feet. Up to six furnaces have been used on site along with retorts and condensers over the life of the mine.

The estimated mercury load from the Abbott Mine is approximately 0.8 to 3.5 kilograms per year (kg/yr) or 34.3% of total mine related mercury load into Harley Gulch. The estimated runoff from Turkey Run Mine is 0.43 to 6.7 kg/yr or 65.7% of the mine related mercury load into Harley Gulch (1.2 to 10.2 kg/yr total for the mine complex).

The RWQCB is the lead agency for the Abbott-Turkey Run Mines. It is in the process of stabilizing the site to prevent additional releases of mercury to Harley Gulch and Cache Creek. The USEPA has also conducted removal activities at the site in 2006 and 2007.

DTSC information about the site can be viewed at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=17100002

There is a link from the EnviroStor data base to the RWQCB's Geotracker database.

RWQCB information about the site can be viewed at:
http://www.geotracker.swrcb.ca.gov/profile_report.asp?global_id=T10000001798.

Information can also be found on the United States Environmental Protection Agency (USEPA)

web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0908401

Baker Mine
The Baker Mine was first worked in 1870. It was worked intermittently until approximately 1933. Its workings included a 100 foot incline shaft with a 700 foot adit. A seven pipe retort was also on site. There was also some surface working to the northwest of the shaft. Total production was approximately 80 flasks.

Baxter Prospect
The site has not been definitively located. It may be located in the McIntire Creek subwatershed near the McIntire Ranch and drains into Thurston Creek. The mine is thought to have operated briefly from 1917 to 1918 with a 200 ft adit and some trenches. It may have been owned by G. L. Hildebrand at some time and by W. C. Baxter in 1965. It may also be known as the G. L. Hildebrand Prospect as discussed in the 1921 California State Mining Report. It is thought to have produced only 2 to 3 flasks of mercury.

Canary Hill Deposit
No significant information was found for this site.

Central Mine
A Site Screening Assessment (SSA) was completed as part of the Discovery Process for this site. The SSA can be found on DTSC's EnviroStor web site at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60001304

The Central Valley Regional Water Quality Control Board's Order for the site can be viewed at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/colusa/r5-2010-0048.pdf.

Information can also be found on the United States Environmental Protection Agency (USEPA) web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0908932

Cherry Hill Mine
A Site Screening Assessment (SSA) was completed as part of the Discovery Process for this site. The SSA can be found on DTSC's EnviroStor web site at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60001303

The Central Valley Regional Water Quality Control Board's Order for the site can be viewed at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/colusa/r5-2010-0048.pdf.

Information can also be found on the United States Environmental Protection Agency (USEPA) web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0908933

Cherry Hill Deposit
No information was found about this site during the review.

Christianson Tract
No information was found about this site during the review.

Clyde Mine
The mine is located about three miles northwest of Wilbur Springs near the head of Sulphur Creek. The mine was discovered some time in the 1860s or 1870s and was first worked in 1886 or 1887 and worked sporadically until the 1890s. The mine was worked as a gold mine and no evidence of it being worked as a mercury mine has been found. There are 3 adits on site, one at creek level, and two farther up the hill. There have been at least two mills at the site in the 1800s and it appears the tailings may have been reprocessed using a placer type of system in the 1970s. It appears that approximately 15 acres at the site have been disturbed.

The Central Valley RWQCB has issued Cleanup and Abatement Order R5-2009-0072 to the United States Bureau of Land Management for the site. Mining waste at the site, including tailings, and mine cuts and mine openings are suspected of being the source of mercury from the processing that occurred to remove the gold. The total mass of mercury estimated to be at the site is approximately 140 kilograms, nearly all of it in the tailings which erode into a tributary to Sulphur Creek during storm events. The mercury load from the site is estimated to be from 0.4 to 0.7 kg/yr of the total of 4.4 to 18.6 kg/yr entering into Sulphur Creek. The link to the order for the Clyde Mine can be found at:
http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/colusa/r5-2009-0072.pdf

Elgin Mercury Mine
A Site Screening Assessment (SSA) was completed as part of the Discovery Process for this site. The SSA can be found on DTSC's EnviroStor web site at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=06100004

The Central Valley Regional Water Quality Control Board's Order for the site can be viewed at:
http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/colusa/r5-2009-0071.pdf

Information can also be found on the United States Environmental Protection Agency (USEPA) web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0908934

Empire Mine Sulphur Creek
A Site Screening Assessment (SSA) was completed as part of the Discovery Process for this site. The SSA can be found on DTSC's EnviroStor web site at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=06100001

The Central Valley Regional Water Quality Control Board's Order for the site can be viewed at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/colusa/r5-2010-0048.pdf.

Information can also be found on the United States Environmental Protection Agency (USEPA) web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0908941

Gordon Springs
No information was found about this site during the review.

Grover Herring Mine
DTSC has little information about this site, including its exact location. The EnviroStor listing can be found on DTSC's EnviroStor web site at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=06100003

Judy Mine
There is little information about this mine. Based on its geographical location, it has been assessed as part of the Rathburn-Petray group of mines and may just be a marker of an ore deposit.

Konocti Mine
No information was found about this site during the review.

Lucitta Mine
This mine was a small mercury producer with 1,500 feet of tunnels and drifts. It is listed as idle in the State Mineralogist's Report of 1918 which describes the mine as being idle and unproductive for several years past.

Manzanita Mine
A Site Screening Assessment (SSA) was completed as part of the Discovery Process for this site. The SSA can be found on DTSC's EnviroStor web site at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=06100002

The Central Valley Regional Water Quality Control Board's Order for the site can be viewed at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/colusa/r5-2010-0048.pdf.

Information can also be found on the United States Environmental Protection Agency (USEPA) web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0908935

Petray North Mine
See description for Rathburn and Rathburn-Petray Mines below.

Petray South Mine
See description for Rathburn and Rathburn-Petray Mines below.

Rathburn Mine and Rathburn-Petray Mine
The mines are located in the Sulphur Creek Mining District. The mercury mines were worked prior to 1892, with the greatest activity reported between 1892 and 1893 for use in gold mining operations in California. Minor production also occurred in the late 1960's and early 1970's when Homestake Mining Company, Yellow Strike Exploration, Cypress Gold Exploration, and the Petray Family operated the mines.

Mercury-bearing material is exposed in cuts, slopes, open pits, mine waste piles, and storm water retention ponds. Ash from a brick retort at the Rathburn mine also contains elevated levels of mercury. Waste piles at Rathburn and Rathburn-Petray Mines collectively contain approximately 101,500 cubic yards of mercury-bearing waste material.

Surface water runoff during storm events erodes waste and tailings piles, overflows retention ponds, and transports mercury-laden sediment into drainage swales and unnamed tributaries of Bear Creek. Bear Creek is a tributary of Cache Creek and contributes an estimated 17% of methylmercury and 4% of the total mercury load to Cache Creek. Mercury loads from upper Bear Creek range from 6.8 to 53.1 kg/year.

Mine waste at the sites contains mercury that may pose a threat to human health due to exposure (dermal, ingestion, and inhalation) through recreation (hiking, camping, fishing, and hunting) or work at the mine sites. Monitoring of surface water, sediment and aquatic life in the Bear Creek watershed show mercury concentrations in the tissue of fish taken from Bear Creek ranged up to 6.0 ppm. The USEPA guidelines for consumption of locally caught fish correspond to a safe concentration of mercury in fish tissue of 0.3 ppm.

The Central Valley Regional Water Quality Control Board has issued Cleanup and Abatement Order No. R5-2005-0722 to the United States Bureau of Land Management for the mines to conduct an investigation and cleanup to abate the effects of the mine wastes. The order can be viewed at:
http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/colusa/r5-2005-0722_cao.pdf

Information about the activities completed to date at the mine sites can be found on the Bureau of Land Managements website at:

http://www.blm.gov/ca/st/en/prog/aml/project_page/rathburn_petray.html

Rathburn-Petray Mine
See description for Rathburn and Rathburn-Petray Mines above.

Red Rock and Silver Rock Mines
No information was found about these sites during the review.

Reddington Mine
No information was found about this site during the review.

Reed Mine
First mentioned as operational in 1870, it is listed as producing 5,653 flasks of mercury between 1876 and 1880. It was inactive for a long period following, and many of the buildings were destroyed by fire. It was reopened in 1940 and produced 16,000 flasks through 1947, when the price of mercury dropped. In 1958-61, approximately 4700 feet of exploratory drilling was done. The mine has extensive underground workings, with shafts and numerous adits, along with bulldozer trenches. 13 and 40 ton furnaces may still be onsite. This 370 acre site produced around 27,000 flasks of mercury in total.

Information can also be found on the United States Environmental Protection Agency (USEPA) web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0903425

Shamrock Prospect
No information was found about this site during the review.

Soda Springs
No information was found about this site during the review.

Sulphur Bank Mercury Mine
The Sulphur Bank Mercury mine is on the federal Superfund National Priorities List.
Information about the site can be found on DTSC's EnviroStor web site at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=17100001

Information can also be found on the United States Environmental Protection Agency (USEPA) web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0902228

Turkey Run Mine
See Abbott-Turkey Run Mines description above.

Utopia Mine
This mine was operated in the late 1890s and maybe in the early 1900s. There were probably two tunnels of approximately 150 feet and 120 feet in length. Intrusion of water from Clear Lake appears to have flooded the mine. The tunnels appear to have been closed, possibly by Caltrans when Highway 20 was constructed through the area in the 1960s. No information about mercury production was found and the site shows little evidence of mining activity other than the plugged adit.
Information about the site can be found on DTSC's EnviroStor web site at:

http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60001421

Weiper Mine
No information was found about this site during the review.

West End Mine
A Site Screening Assessment (SSA) was completed as part of the Discovery Process for this site. The SSA can be found on DTSC's EnviroStor web site at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60001305

The Central Valley Regional Water Quality Control Board's Order for the site can be viewed at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/colusa/r5-2010-0048.pdf.

Information can also be found on the United States Environmental Protection Agency (USEPA) web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0908937

Wide Awake Mine
A Site Screening Assessment (SSA) was completed as part of the Discovery Process for this site. The SSA can be found on DTSC's EnviroStor web site at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=06100005

The RWQCB's order for the Wide Awake Mine can be viewed at:
http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/colusa/r5-2010-0049.pdf

Information can also be found on the United States Environmental Protection Agency (USEPA) web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0908936

Wilbur Hill Mine
Located between Manzanita Mine and Wilbur Hot Springs on Sulphur Creek. A small producer with unknown workings. Small out put was recorded in 1916 with a small retort and concentrator. Went idle in 1918. Possibly absorbed by the Manzanita Mine, but not indicated on Cal Fed Assessment Map.

Wilbur Springs-Abbott Mine
No information was found about this site during the review.

White Elephant Mine
An occurrence that has 200 feet of underground workings that including two 40 foot cross cuts and drifts. A retort was built in 1917 but no ore was reported as produced.

White Elephant Prospect

No information was found about this site during the review.

Cache Creek Settling Basin
A Site Screening Assessment (SSA) was completed as part of the Discovery Process for this site. The SSA can be found on DTSC's EnviroStor web site at:
http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=60001306

Information can also be found on the United States Environmental Protection Agency (USEPA) web site at: http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0908940

Appendix 5 – Pre-CERCLIS Screening Assessment and Data Entry Forms

PRE-CERCLIS SCREENING ASSESSMENT FORM

Preparer Name: Tim Miles	**Date:** 6/21/2010
Agency: Department of Toxic Substances Control	
Address: 8800 Cal Center Drive, Sacramento, CA 95826	
Phone: (916) 255 - 3710 Ext.	**E-Mail:** tmiles@dtsc.ca.gov

SECTION A.

Site Name: Cache Creek Settling Basin		
Previous Names: None		
Site Location: Yolo County east of the City of Woodland		
City: Woodland	**St:** CA	**Zipcode:** 95776-
CA DTSC Region: Sacramento	**CA DTSC Region #:** 1	
CA RWQCB Region: Central Valley	**CA RWQCB Region #:** 5	

	Complete the following checklist. If Ayes@ is marked, please explain below.	YES	NO
1.	Does the site already appear in CERCLIS?	☐	☒
2.	Is the release from products that are part of the structure of, and result in exposure within, residential buildings or businesses or community structures?	☐	☒
3.	Does the site consist of a release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found?	☐	☒
4.	Is the release into a public or private drinking water supply due to deterioration of the system through ordinary use?	☐	☒
5.	Is some other program actively involved with the site (i.e., another Federal, State, or Tribal program)?	☐	☒
6.	Are the hazardous substances potentially released at the site regulated under a statutory exclusion (i.e., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?	☐	☒
7.	Are the hazardous substances potentially released at the site excluded by policy considerations (e.g., deferral to RCRA Corrective Action)?	☐	☒
8.	Is there sufficient documentation that clearly demonstrates that there is no potential for a release that could cause adverse environmental or human health impacts (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, documentation showing that no hazardous substance releases have occurred, EPA approved risk assessment completed)?	☐	☒

Briefly explain all "yes" answers in section B.

PRE-CERCLIS SCREENING ASSESSMENT FORM

SECTION B.
Site Determination:

Site is eligible for CERCLA: ☒
(Further assessment is recommended. / Non NPL Status = PA Needed / NPL Status = N)

The site is not eligible for CERCLA: ☐
NPL Status = O for all options below
(Pick one below:)
Non-NPL Status = Not a Valid Site : ☐
Non-NPL Status = Not a Valid Site - RCRA Lead: ☐
Non-NPL Status = Not a Valid Site - NRC Lead: ☐
Non-NPL Status = Not a Valid Site - State Lead: ☐

Site is part of a NPL site: ☐
(NPL Status = A)

DECISION/DISCUSSION/RATIONALE/SITE ACTION COMMENTS:
The site is contaminated with mercury transported from mercury and gold mines down through the Cache Creek Watershed.

Regional EPA Reviewer:_____ **Date:**_____

State Agency/Tribe:_____ **Date:**_____

Date Submitted to IMC: _____

PRE-CERCLIS SCREENING ASSESSMENT FORM
DATA ENTRY FORM FOR DISCOVERY OF SITE

FED FAC IND	☐Federal Facility	☒Not a Federal Facility	☐Status Undetermined

SITE TYPES (Check all secondary subcategories that apply. Designate one subcategory as primary)

Manufacturing/Processing/Maintenance (Subcategory) Primary	Secondary	
☐	☐	Chemicals and allied products
☐	☐	Coal gasification
☐	☐	Coke production
☐	☐	Electric power generation and distribution
☐	☐	Electronic/electrical equipment
☐	☐	Fabrics/textiles
☐	☐	Lumber and wood products/pulp and paper
☐	☐	Lumber and wood products/wood preserving/treatment
☐	☐	Metal fabrication/finishing/coating and allied industries
☐	☐	Oil and gas
☐	☐	Ordnance production
☐	☐	Plastics and rubber products
☐	☐	Primary metals/minerals processing
☐	☐	Radioactive products
☐	☐	Tanneries
☐	☐	Trucks/ships/trains/aircraft and related components

Waste Management (Subcategory) Primary	Secondary	
☐	☐	Radioactive waste treatment, storage, disposal
☐	☐	Municipal solid waste landfill
☐	☐	Mine tailings disposal
☐	☐	Industrial waste landfill
☐	☐	Industrial waste facility (non generator)
☐	☐	Illegal disposal/open dump
☐	☐	Co-disposal landfill (municipal and industrial)

Other (Subcategory) Primary	Secondary	
☐	☐	Agricultural
☒	☐	Contaminated sediment site with no identifiable source
☐	☐	Dust control
☐	☐	Ground water plume site with no identifiable source
☐	☐	Military/other ordinance
☐	☐	Product storage/distribution
☐	☐	Research, development, and testing facility
☐	☐	Retail/commercial
☐	☐	Spill or other one time event
☐	☐	Transportation (e.g. railroad yards, airports, barge docking site
☐	☐	Treatment works/septic tanks/other sewage treatment

Mining (Subcategory) Primary	Secondary	
☐	☐	Coal
☐	☐	Metals
☐	☐	Non-metals minerals
☐	☐	Oil and gas

Recycling (Subcategory) Primary	Secondary	
☐	☐	Automobiles/tires
☐	☐	Batteries/scrap metals/secondary smelting/precious metal recovery
☐	☐	Chemicals/chemicals waste (e.g. solvent recovery)
☐	☐	Drums/tanks
☐	☐	Waste/used oil

PREPARED BY:		*DATE:*	
IMC:	*DATE:*	*ISS:*	*DATE:*
QA/QC:		*DATE:*	

BOLD AND ITALIC FIELDS ARE REQUIRED

PRE-CERCLIS SCREENING ASSESSMENT FORM

Preparer Name: Tim Miles	**Date:** 5/19/2010
Agency: Department of Toxic Substances Control	
Address: 8800 Cal Center Drive, Sacramento, CA 95826	
Phone: (916) 255 - 3710 Ext.	**E-Mail:** tmiles@dtsc.ca.gov

SECTION A.

Site Name: Central Mine		
Previous Names:		
Site Location: Colusa Co. APNs 018-200-002, -004 to -007, and -013 to -018		
City: Wilbur Springs	**St:** CA	**Zipcode:** 95987-

CA DTSC Region: Sacramento	**CA DTSC Region #:** 1
CA RWQCB Region: Central Valley	**CA RWQCB Region #:** 5

Complete the following checklist. If Ayes@ is marked, please explain below.		**YES**	**NO**
1.	Does the site already appear in CERCLIS?	☐	☒
2.	Is the release from products that are part of the structure of, and result in exposure within, residential buildings or businesses or community structures?	☐	☒
3.	Does the site consist of a release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found?	☐	☒
4.	Is the release into a public or private drinking water supply due to deterioration of the system through ordinary use?	☐	☒
5.	Is some other program actively involved with the site (i.e., another Federal, State, or Tribal program)?	☒	☐
6.	Are the hazardous substances potentially released at the site regulated under a statutory exclusion (i.e., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?	☐	☒
7.	Are the hazardous substances potentially released at the site excluded by policy considerations (e.g., deferral to RCRA Corrective Action)?	☐	☒
8.	Is there sufficient documentation that clearly demonstrates that there is no potential for a release that could cause adverse environmental or human health impacts (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, documentation showing that no hazardous substance releases have occurred, EPA approved risk assessment completed)?	☐	☒

Briefly explain all "yes" answers in section B.

PRE-CERCLIS SCREENING ASSESSMENT FORM

SECTION B.
Site Determination:

Site is eligible for CERCLA: ☒
(Further assessment is recommended. / Non NPL Status = PA Needed / NPL Status = N)

The site is not eligible for CERCLA: ☐
NPL Status = O for all options below
(Pick one below:)
Non-NPL Status = Not a Valid Site : ☐
Non-NPL Status = Not a Valid Site - RCRA Lead: ☐
Non-NPL Status = Not a Valid Site - NRC Lead: ☐
Non-NPL Status = Not a Valid Site - State Lead: ☐

Site is part of a NPL site: ☐
(NPL Status = A)

DECISION/DISCUSSION/RATIONALE/SITE ACTION COMMENTS:
This is part of a group of mercury and gold mines that have released mine waste into Sulphur Creek. The California Regional Water Quality Control Board is discussing a technical and monitoring report order with the potentially responsible parties.

Regional EPA Reviewer:_____ Date:_____

State Agency/Tribe:_____ Date:_____

Date Submitted to IMC: _____

PRE-CERCLIS SCREENING ASSESSMENT FORM
DATA ENTRY FORM FOR DISCOVERY OF SITE

FED FAC IND	☐Federal Facility	☒Not a Federal Facility	☐Status Undetermined

SITE TYPES (Check all secondary subcategories that apply. Designate one subcategory as primary)

Manufacturing/Processing/Maintenance		
(Subcategory) Primary	Secondary	
☐	☐	Chemicals and allied products
☐	☐	Coal gasification
☐	☐	Coke production
☐	☐	Electric power generation and distribution
☐	☐	Electronic/electrical equipment
☐	☐	Fabrics/textiles
☐	☐	Lumber and wood products/pulp and paper
☐	☐	Lumber and wood products/wood preserving/treatment
☐	☐	Metal fabrication/finishing/coating and allied industries
☐	☐	Oil and gas
☐	☐	Ordnance production
☐	☐	Plastics and rubber products
☐	☐	Primary metals/minerals processing
☐	☐	Radioactive products
☐	☐	Tanneries
☐	☐	Trucks/ships/trains/aircraft and related components

Waste Management		
(Subcategory) Primary	Secondary	
☐	☐	Radioactive waste treatment, storage, disposal
☐	☐	Municipal solid waste landfill
☐	☒	Mine tailings disposal
☐	☐	Industrial waste landfill
☐	☐	Industrial waste facility (non generator)
☐	☐	Illegal disposal/open dump
☐	☐	Co-disposal landfill (municipal and industrial)

Other		
(Subcategory) Primary	Secondary	
☐	☐	Agricultural
☐	☐	Contaminated sediment site with no identifiable source
☐	☐	Dust control
☐	☐	Ground water plume site with no identifiable source
☐	☐	Military/other ordinance
☐	☐	Product storage/distribution
☐	☐	Research, development, and testing facility
☐	☐	Retail/commercial
☐	☐	Spill or other one time event
☐	☐	Transportation (e.g. railroad yards, airports, barge docking site
☐	☐	Treatment works/septic tanks/other sewage treatment

Mining		
(Subcategory) Primary	Secondary	
☐	☐	Coal
☒	☐	Metals
☐	☐	Non-metals minerals
☐	☐	Oil and gas

Recycling		
(Subcategory) Primary	Secondary	
☐	☐	Automobiles/tires
☐	☐	Batteries/scrap metals/secondary smelting/precious metal recovery
☐	☐	Chemicals/chemicals waste (e.g. solvent recovery)
☐	☐	Drums/tanks
☐	☐	Waste/used oil

PREPARED BY:		*DATE:*	
IMC:	*DATE:*	*ISS:*	*DATE:*
QA/QC:		*DATE:*	

BOLD AND ITALIC FIELDS ARE REQUIRED

PRE-CERCLIS SCREENING ASSESSMENT FORM

Preparer Name: Tim Miles	**Date:** 5/19/2010
Agency: Department of Toxic Substances Control	
Address: 8800 Cal Center Drive, Sacramento, CA 95826	
Phone: (916) 255 - 3710 Ext.	**E-Mail:** tmiles@dtsc.ca.gov

SECTION A.

Site Name: Cherry Hill Mine		
Previous Names:		
Site Location: Colusa Co. APNs 018-200-002, -004 to -007, and -013 to -018		
City: Wilbur Springs	**St:** CA	**Zipcode:** 95987-
CA DTSC Region: Sacramento	**CA DTSC Region #:** 1	
CA RWQCB Region: Central Valley	**CA RWQCB Region #:** 5	

Complete the following checklist. If Ayes@ is marked, please explain below.		**YES**	**NO**
1.	Does the site already appear in CERCLIS?	☐	☒
2.	Is the release from products that are part of the structure of, and result in exposure within, residential buildings or businesses or community structures?	☐	☒
3.	Does the site consist of a release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found?	☐	☒
4.	Is the release into a public or private drinking water supply due to deterioration of the system through ordinary use?	☐	☒
5.	Is some other program actively involved with the site (i.e., another Federal, State, or Tribal program)?	☒	☐
6.	Are the hazardous substances potentially released at the site regulated under a statutory exclusion (i.e., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?	☐	☒
7.	Are the hazardous substances potentially released at the site excluded by policy considerations (e.g., deferral to RCRA Corrective Action)?	☐	☒
8.	Is there sufficient documentation that clearly demonstrates that there is no potential for a release that could cause adverse environmental or human health impacts (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, documentation showing that no hazardous substance releases have occurred, EPA approved risk assessment completed)?	☐	☒

Briefly explain all "yes" answers in section B.

PRE-CERCLIS SCREENING ASSESSMENT FORM

SECTION B.
Site Determination:

Site is eligible for CERCLA: ☒
(Further assessment is recommended. / Non NPL Status = PA Needed / NPL Status = N)

The site is not eligible for CERCLA: ☐
NPL Status = O for all options below
(Pick one below:)
Non-NPL Status = Not a Valid Site : ☐
Non-NPL Status = Not a Valid Site - RCRA Lead: ☐
Non-NPL Status = Not a Valid Site - NRC Lead: ☐
Non-NPL Status = Not a Valid Site - State Lead: ☐

Site is part of a NPL site: ☐
(NPL Status = A)

DECISION/DISCUSSION/RATIONALE/SITE ACTION COMMENTS:
This is part of a group of mercury and gold mines that have released mine waste into Sulphur Creek. The California Regional Water Quality Control Board is discussing a technical and monitoring report order with the potentially responsible parties.

Regional EPA Reviewer:_____ Date:_____

State Agency/Tribe:_____ Date:_____

Date Submitted to IMC: _____

PRE-CERCLIS SCREENING ASSESSMENT FORM
DATA ENTRY FORM FOR DISCOVERY OF SITE

FED FAC IND	☐Federal Facility	☒Not a Federal Facility	☐Status Undetermined

SITE TYPES (Check all secondary subcategories that apply. Designate one subcategory as primary)

Manufacturing/Processing/Maintenance		
(Subcategory) Primary	Secondary	
☐	☐	Chemicals and allied products
☐	☐	Coal gasification
☐	☐	Coke production
☐	☐	Electric power generation and distribution
☐	☐	Electronic/electrical equipment
☐	☐	Fabrics/textiles
☐	☐	Lumber and wood products/pulp and paper
☐	☐	Lumber and wood products/wood preserving/treatment
☐	☐	Metal fabrication/finishing/coating and allied industries
☐	☐	Oil and gas
☐	☐	Ordnance production
☐	☐	Plastics and rubber products
☐	☐	Primary metals/minerals processing
☐	☐	Radioactive products
☐	☐	Tanneries
☐	☐	Trucks/ships/trains/aircraft and related components

Waste Management		
(Subcategory) Primary	Secondary	
☐	☐	Radioactive waste treatment, storage, disposal
☐	☐	Municipal solid waste landfill
☐	☒	Mine tailings disposal
☐	☐	Industrial waste landfill
☐	☐	Industrial waste facility (non generator)
☐	☐	Illegal disposal/open dump
☐	☐	Co-disposal landfill (municipal and industrial)

Other		
(Subcategory) Primary	Secondary	
☐	☐	Agricultural
☐	☐	Contaminated sediment site with no identifiable source
☐	☐	Dust control
☐	☐	Ground water plume site with no identifiable source
☐	☐	Military/other ordinance
☐	☐	Product storage/distribution
☐	☐	Research, development, and testing facility
☐	☐	Retail/commercial
☐	☐	Spill or other one time event
☐	☐	Transportation (e.g. railroad yards, airports, barge docking site
☐	☐	Treatment works/septic tanks/other sewage treatment

Mining		
(Subcategory) Primary	Secondary	
☐	☐	Coal
☒	☐	Metals
☐	☐	Non-metals minerals
☐	☐	Oil and gas

Recycling		
(Subcategory) Primary	Secondary	
☐	☐	Automobiles/tires
☐	☐	Batteries/scrap metals/secondary smelting/precious metal recovery
☐	☐	Chemicals/chemicals waste (e.g. solvent recovery)
☐	☐	Drums/tanks
☐	☐	Waste/used oil

PREPARED BY:		***DATE:***	
IMC:	***DATE:***	***ISS:***	***DATE:***
QA/QC:		***DATE:***	

BOLD AND ITALIC FIELDS ARE REQUIRED

PRE-CERCLIS SCREENING ASSESSMENT FORM

Preparer Name: Tim Miles	**Date:** 5/19/2010
Agency: Department of Toxic Substances Control	
Address: 8800 Cal Center Drive, Sacramento, CA 95826	
Phone: (916) 255 - 3710 Ext.	**E-Mail:** tmiles@dtsc.ca.gov

SECTION A.

Site Name: The Elgin Mercury Mine		
Previous Names:		
Site Location: Colusa County APNs 018-100-002, -003, -004		
City: Wilbur Springs	**St:** CA	**Zipcode:** 95987-
CA DTSC Region: Sacramento	**CA DTSC Region #:** 1	
CA RWQCB Region: Central Valley	**CA RWQCB Region #:** 5	

Complete the following checklist. If Ayes@ is marked, please explain below.		YES	NO
1.	Does the site already appear in CERCLIS?	☐	☒
2.	Is the release from products that are part of the structure of, and result in exposure within, residential buildings or businesses or community structures?	☐	☒
3.	Does the site consist of a release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found?	☐	☒
4.	Is the release into a public or private drinking water supply due to deterioration of the system through ordinary use?	☐	☒
5.	Is some other program actively involved with the site (i.e., another Federal, State, or Tribal program)?	☒	☐
6.	Are the hazardous substances potentially released at the site regulated under a statutory exclusion (i.e., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?	☐	☒
7.	Are the hazardous substances potentially released at the site excluded by policy considerations (e.g., deferral to RCRA Corrective Action)?	☐	☒
8.	Is there sufficient documentation that clearly demonstrates that there is no potential for a release that could cause adverse environmental or human health impacts (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, documentation showing that no hazardous substance releases have occurred, EPA approved risk assessment completed)?	☐	☒

Briefly explain all "yes" answers in section B.

PRE-CERCLIS SCREENING ASSESSMENT FORM

SECTION B.
Site Determination:

Site is eligible for CERCLA: ☒
(Further assessment is recommended. / Non NPL Status = PA Needed / NPL Status = N)

The site is not eligible for CERCLA: ☐
NPL Status = O for all options below
(Pick one below:)
Non-NPL Status = Not a Valid Site : ☐
Non-NPL Status = Not a Valid Site - RCRA Lead: ☐
Non-NPL Status = Not a Valid Site - NRC Lead: ☐
Non-NPL Status = Not a Valid Site - State Lead: ☐

Site is part of a NPL site: ☐
(NPL Status = A)

DECISION/DISCUSSION/RATIONALE/SITE ACTION COMMENTS:
The site is contaminated with mercury from historic mercury mining activities which has resulted in the release of mine waste into Sulphur Creek. The California Regional Water Quality Control Board has issued a Cleanup and Abatement Order to the potentially responsible party.

Regional EPA Reviewer:_____ Date:_____

State Agency/Tribe:_____ Date:_____

Date Submitted to IMC: _____

PRE-CERCLIS SCREENING ASSESSMENT FORM
DATA ENTRY FORM FOR DISCOVERY OF SITE

FED FAC IND ☐Federal Facility ☒Not a Federal Facility ☐Status Undetermined

SITE TYPES (Check all secondary subcategories that apply. Designate one subcategory as primary)

Manufacturing/Processing/Maintenance (Subcategory) Primary	Secondary	
☐	☐	Chemicals and allied products
☐	☐	Coal gasification
☐	☐	Coke production
☐	☐	Electric power generation and distribution
☐	☐	Electronic/electrical equipment
☐	☐	Fabrics/textiles
☐	☐	Lumber and wood products/pulp and paper
☐	☐	Lumber and wood products/wood preserving/treatment
☐	☐	Metal fabrication/finishing/coating and allied industries
☐	☐	Oil and gas
☐	☐	Ordnance production
☐	☐	Plastics and rubber products
☐	☐	Primary metals/minerals processing
☐	☐	Radioactive products
☐	☐	Tanneries
☐	☐	Trucks/ships/trains/aircraft and related components

Waste Management (Subcategory) Primary	Secondary	
☐	☐	Radioactive waste treatment, storage, disposal
☐	☐	Municipal solid waste landfill
☐	☒	Mine tailings disposal
☐	☐	Industrial waste landfill
☐	☐	Industrial waste facility (non generator)
☐	☐	Illegal disposal/open dump
☐	☐	Co-disposal landfill (municipal and industrial)

Other (Subcategory) Primary	Secondary	
☐	☐	Agricultural
☐	☐	Contaminated sediment site with no identifiable source
☐	☐	Dust control
☐	☐	Ground water plume site with no identifiable source
☐	☐	Military/other ordinance
☐	☐	Product storage/distribution
☐	☐	Research, development, and testing facility
☐	☐	Retail/commercial
☐	☐	Spill or other one time event
☐	☐	Transportation (e.g. railroad yards, airports, barge docking site
☐	☐	Treatment works/septic tanks/other sewage treatment

Mining (Subcategory) Primary	Secondary	
☐	☐	Coal
☒	☐	Metals
☐	☐	Non-metals minerals
☐	☐	Oil and gas

Recycling (Subcategory) Primary	Secondary	
☐	☐	Automobiles/tires
☐	☐	Batteries/scrap metals/secondary smelting/precious metal recovery
☐	☐	Chemicals/chemicals waste (e.g. solvent recovery)
☐	☐	Drums/tanks
☐	☐	Waste/used oil

PREPARED BY:		***DATE:***	
IMC:	***DATE:***	***ISS:***	***DATE:***
QA/QC:		***DATE:***	

BOLD AND ITALIC FIELDS ARE REQUIRED

PRE-CERCLIS SCREENING ASSESSMENT FORM

Preparer Name: Tim Miles	**Date:** 5/19/2010
Agency: Department of Toxic Substances Control	
Address: 8800 Cal Center Drive, Sacramento, CA 95826	
Phone: (916) 255 - 3710 Ext.	**E-Mail:** tmiles@dtsc.ca.gov

SECTION A.

Site Name: Empire Mine Sulphur Creek		
Previous Names:		
Site Location: Colusa Co. APNs 018-200-002, -004 to -007, and -013 to -018		
City: Wilbur Springs	**St:** CA	**Zipcode:** 95987-
CA DTSC Region: Sacramento	**CA DTSC Region #:** 1	
CA RWQCB Region: Central Valley	**CA RWQCB Region #:** 5	

Complete the following checklist. If Ayes@ is marked, please explain below.		**YES**	**NO**
1.	Does the site already appear in CERCLIS?	☐	☒
2.	Is the release from products that are part of the structure of, and result in exposure within, residential buildings or businesses or community structures?	☐	☒
3.	Does the site consist of a release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found?	☐	☒
4.	Is the release into a public or private drinking water supply due to deterioration of the system through ordinary use?	☐	☒
5.	Is some other program actively involved with the site (i.e., another Federal, State, or Tribal program)?	☒	☐
6.	Are the hazardous substances potentially released at the site regulated under a statutory exclusion (i.e., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?	☐	☒
7.	Are the hazardous substances potentially released at the site excluded by policy considerations (e.g., deferral to RCRA Corrective Action)?	☐	☒
8.	Is there sufficient documentation that clearly demonstrates that there is no potential for a release that could cause adverse environmental or human health impacts (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, documentation showing that no hazardous substance releases have occurred, EPA approved risk assessment completed)?	☐	☒

Briefly explain all "yes" answers in section B.

PRE-CERCLIS SCREENING ASSESSMENT FORM

SECTION B.
Site Determination:

Site is eligible for CERCLA: ☒
(Further assessment is recommended. / Non NPL Status = PA Needed / NPL Status = N)

The site is not eligible for CERCLA: ☐
NPL Status = O for all options below
(Pick one below:)
Non-NPL Status = Not a Valid Site : ☐
Non-NPL Status = Not a Valid Site - RCRA Lead: ☐
Non-NPL Status = Not a Valid Site - NRC Lead: ☐
Non-NPL Status = Not a Valid Site - State Lead: ☐

Site is part of a NPL site: ☐
(NPL Status = A)

DECISION/DISCUSSION/RATIONALE/SITE ACTION COMMENTS:
This is part of a group of mercury and gold mines that have released mine waste into Sulphur Creek. The California Regional Water Quality Control Board is discussing a technical and monitoring report order with the potentially responsible parties.

Regional EPA Reviewer:_____ Date:_____

State Agency/Tribe:_____ Date:_____

Date Submitted to IMC: _____

PRE-CERCLIS SCREENING ASSESSMENT FORM
DATA ENTRY FORM FOR DISCOVERY OF SITE

FED FAC IND	☐Federal Facility	☒Not a Federal Facility	☐Status Undetermined

SITE TYPES (Check all secondary subcategories that apply. Designate one subcategory as primary)

Manufacturing/Processing/Maintenance (Subcategory)		
Primary	Secondary	
☐	☐	Chemicals and allied products
☐	☐	Coal gasification
☐	☐	Coke production
☐	☐	Electric power generation and distribution
☐	☐	Electronic/electrical equipment
☐	☐	Fabrics/textiles
☐	☐	Lumber and wood products/pulp and paper
☐	☐	Lumber and wood products/wood preserving/treatment
☐	☐	Metal fabrication/finishing/coating and allied industries
☐	☐	Oil and gas
☐	☐	Ordnance production
☐	☐	Plastics and rubber products
☐	☐	Primary metals/minerals processing
☐	☐	Radioactive products
☐	☐	Tanneries
☐	☐	Trucks/ships/trains/aircraft and related components

Waste Management (Subcategory)		
Primary	Secondary	
☐	☐	Radioactive waste treatment, storage, disposal
☐	☐	Municipal solid waste landfill
☐	☒	Mine tailings disposal
☐	☐	Industrial waste landfill
☐	☐	Industrial waste facility (non generator)
☐	☐	Illegal disposal/open dump
☐	☐	Co-disposal landfill (municipal and industrial)

Other (Subcategory)		
Primary	Secondary	
☐	☐	Agricultural
☐	☐	Contaminated sediment site with no identifiable source
☐	☐	Dust control
☐	☐	Ground water plume site with no identifiable source
☐	☐	Military/other ordinance
☐	☐	Product storage/distribution
☐	☐	Research, development, and testing facility
☐	☐	Retail/commercial
☐	☐	Spill or other one time event
☐	☐	Transportation (e.g. railroad yards, airports, barge docking site.
☐	☐	Treatment works/septic tanks/other sewage treatment

Mining (Subcategory)		
Primary	Secondary	
☐	☐	Coal
☒	☐	Metals
☐	☐	Non-metals minerals
☐	☐	Oil and gas

Recycling (Subcategory)		
Primary	Secondary	
☐	☐	Automobiles/tires
☐	☐	Batteries/scrap metals/secondary smelting/precious metal recovery
☐	☐	Chemicals/chemicals waste (e.g. solvent recovery)
☐	☐	Drums/tanks
☐	☐	Waste/used oil

PREPARED BY:		***DATE:***	
IMC:	***DATE:***	***ISS:***	***DATE:***
QA/QC:		***DATE:***	

BOLD AND ITALIC FIELDS ARE REQUIRED

PRE-CERCLIS SCREENING ASSESSMENT FORM

Preparer Name: Tim Miles	**Date:** 5/19/2010
Agency: Department of Toxic Substances Control	
Address: 8800 Cal Center Drive, Sacramento, CA 95826	
Phone: (916) 255 - 3710 Ext.	**E-Mail:** tmiles@dtsc.ca.gov

SECTION A.

Site Name: Manzanita Mine		
Previous Names:		
Site Location: Colusa Co. APNs 018-200-002, -004 to -007, and -013 to -018		
City: Wilbur Springs	**St:** CA	**Zipcode:** 95987-
CA DTSC Region: Sacramento	**CA DTSC Region #:** 1	
CA RWQCB Region: Central Valley	**CA RWQCB Region #:** 5	

Complete the following checklist. If Ayes@ is marked, please explain below.		YES	NO
1.	Does the site already appear in CERCLIS?	☐	☒
2.	Is the release from products that are part of the structure of, and result in exposure within, residential buildings or businesses or community structures?	☐	☒
3.	Does the site consist of a release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found?	☐	☒
4.	Is the release into a public or private drinking water supply due to deterioration of the system through ordinary use?	☐	☒
5.	Is some other program actively involved with the site (i.e., another Federal, State, or Tribal program)?	☒	☐
6.	Are the hazardous substances potentially released at the site regulated under a statutory exclusion (i.e., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?	☐	☒
7.	Are the hazardous substances potentially released at the site excluded by policy considerations (e.g., deferral to RCRA Corrective Action)?	☐	☒
8.	Is there sufficient documentation that clearly demonstrates that there is no potential for a release that could cause adverse environmental or human health impacts (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, documentation showing that no hazardous substance releases have occurred, EPA approved risk assessment completed)?	☐	☒

Briefly explain all "yes" answers in section B.

PRE-CERCLIS SCREENING ASSESSMENT FORM

SECTION B.
Site Determination:

Site is eligible for CERCLA: ☒
(Further assessment is recommended. / Non NPL Status = PA Needed / NPL Status = N)

The site is not eligible for CERCLA: ☐
NPL Status = O for all options below
(Pick one below:)
Non-NPL Status = Not a Valid Site : ☐
Non-NPL Status = Not a Valid Site - RCRA Lead: ☐
Non-NPL Status = Not a Valid Site - NRC Lead: ☐
Non-NPL Status = Not a Valid Site - State Lead: ☐

Site is part of a NPL site: ☐
(NPL Status = A)

DECISION/DISCUSSION/RATIONALE/SITE ACTION COMMENTS:
This is part of a group of mercury and gold mines that have released mine waste into Sulphur Creek. The California Regional Water Quality Control Board is discussing a technical and monitoring report order with the potentially responsible parties.

Regional EPA Reviewer:_____ Date:_____

State Agency/Tribe:_____ Date:_____

Date Submitted to IMC: _____

PRE-CERCLIS SCREENING ASSESSMENT FORM
DATA ENTRY FORM FOR DISCOVERY OF SITE

FED FAC IND	☐Federal Facility	☒Not a Federal Facility	☐Status Undetermined

SITE TYPES (Check all secondary subcategories that apply. Designate one subcategory as primary)

Manufacturing/Processing/Maintenance (Subcategory)		
Primary	Secondary	
☐	☐	Chemicals and allied products
☐	☐	Coal gasification
☐	☐	Coke production
☐	☐	Electric power generation and distribution
☐	☐	Electronic/electrical equipment
☐	☐	Fabrics/textiles
☐	☐	Lumber and wood products/pulp and paper
☐	☐	Lumber and wood products/wood preserving/treatment
☐	☐	Metal fabrication/finishing/coating and allied industries
☐	☐	Oil and gas
☐	☐	Ordnance production
☐	☐	Plastics and rubber products
☐	☐	Primary metals/minerals processing
☐	☐	Radioactive products
☐	☐	Tanneries
☐	☐	Trucks/ships/trains/aircraft and related components

Waste Management (Subcategory)		
Primary	Secondary	
☐	☐	Radioactive waste treatment, storage, disposal
☐	☐	Municipal solid waste landfill
☐	☒	Mine tailings disposal
☐	☐	Industrial waste landfill
☐	☐	Industrial waste facility (non generator)
☐	☐	Illegal disposal/open dump
☐	☐	Co-disposal landfill (municipal and industrial)

Other (Subcategory)		
Primary	Secondary	
☐	☐	Agricultural
☐	☐	Contaminated sediment site with no identifiable source
☐	☐	Dust control
☐	☐	Ground water plume site with no identifiable source
☐	☐	Military/other ordinance
☐	☐	Product storage/distribution
☐	☐	Research, development, and testing facility
☐	☐	Retail/commercial
☐	☐	Spill or other one time event
☐	☐	Transportation (e.g. railroad yards, airports, barge docking site
☐	☐	Treatment works/septic tanks/other sewage treatment

Mining (Subcategory)		
Primary	Secondary	
☐	☐	Coal
☒	☐	Metals
☐	☐	Non-metals minerals
☐	☐	Oil and gas

Recycling (Subcategory)		
Primary	Secondary	
☐	☐	Automobiles/tires
☐	☐	Batteries/scrap metals/secondary smelting/precious metal recovery
☐	☐	Chemicals/chemicals waste (e.g. solvent recovery)
☐	☐	Drums/tanks
☐	☐	Waste/used oil

PREPARED BY:		*DATE:*	
IMC:	*DATE:*	*ISS:*	*DATE:*
QA/QC:		*DATE:*	

BOLD AND ITALIC FIELDS ARE REQUIRED

PRE-CERCLIS SCREENING ASSESSMENT FORM

Preparer Name: Tim Miles	**Date:** 5/19/2010
Agency: Department of Toxic Substances Control	
Address: 8800 Cal Center Drive, Sacramento, CA 95826	
Phone: (916) 255 - 3710 Ext.	**E-Mail:** tmiles@dtsc.ca.gov

SECTION A.

Site Name: West End Mine		
Previous Names:		
Site Location: Colusa Co. APNs 018-200-002, -004 to -007, and -013 to -018		
City: Wilbur Springs	**St:** CA	**Zipcode:** 95987-
CA DTSC Region: Sacramento	**CA DTSC Region #:** 1	
CA RWQCB Region: Central Valley	**CA RWQCB Region #:** 5	

Complete the following checklist. If Ayes@ is marked, please explain below.		YES	NO
1.	Does the site already appear in CERCLIS?	☐	☒
2.	Is the release from products that are part of the structure of, and result in exposure within, residential buildings or businesses or community structures?	☐	☒
3.	Does the site consist of a release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found?	☐	☒
4.	Is the release into a public or private drinking water supply due to deterioration of the system through ordinary use?	☐	☒
5.	Is some other program actively involved with the site (i.e., another Federal, State, or Tribal program)?	☒	☐
6.	Are the hazardous substances potentially released at the site regulated under a statutory exclusion (i.e., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?	☐	☒
7.	Are the hazardous substances potentially released at the site excluded by policy considerations (e.g., deferral to RCRA Corrective Action)?	☐	☒
8.	Is there sufficient documentation that clearly demonstrates that there is no potential for a release that could cause adverse environmental or human health impacts (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, documentation showing that no hazardous substance releases have occurred, EPA approved risk assessment completed)?	☐	☒

Briefly explain all "yes" answers in section B.

PRE-CERCLIS SCREENING ASSESSMENT FORM

SECTION B.
Site Determination:

Site is eligible for CERCLA: ☒
(Further assessment is recommended. / Non NPL Status = PA Needed / NPL Status = N)

The site is not eligible for CERCLA: ☐
NPL Status = O for all options below
(Pick one below:)
Non-NPL Status = Not a Valid Site : ☐
Non-NPL Status = Not a Valid Site - RCRA Lead: ☐
Non-NPL Status = Not a Valid Site - NRC Lead: ☐
Non-NPL Status = Not a Valid Site - State Lead: ☐

Site is part of a NPL site: ☐
(NPL Status = A)

DECISION/DISCUSSION/RATIONALE/SITE ACTION COMMENTS:
This is part of a group of mercury and gold mines that have released mine waste into Sulphur Creek. The California Regional Water Quality Control Board is discussing a technical and monitoring report order with the potentially responsible parties.

Regional EPA Reviewer:_____ Date:_____

State Agency/Tribe:_____ Date:_____

Date Submitted to IMC:_____

PRE-CERCLIS SCREENING ASSESSMENT FORM
DATA ENTRY FORM FOR DISCOVERY OF SITE

FED FAC IND ☐Federal Facility ☒Not a Federal Facility ☐Status Undetermined

SITE TYPES (Check all secondary subcategories that apply. Designate one subcategory as primary)

Manufacturing/Processing/Maintenance

(Subcategory) Primary	Secondary	
☐	☐	Chemicals and allied products
☐	☐	Coal gasification
☐	☐	Coke production
☐	☐	Electric power generation and distribution
☐	☐	Electronic/electrical equipment
☐	☐	Fabrics/textiles
☐	☐	Lumber and wood products/pulp and paper
☐	☐	Lumber and wood products/wood preserving/treatment
☐	☐	Metal fabrication/finishing/coating and allied industries
☐	☐	Oil and gas
☐	☐	Ordnance production
☐	☐	Plastics and rubber products
☐	☐	Primary metals/minerals processing
☐	☐	Radioactive products
☐	☐	Tanneries
☐	☐	Trucks/ships/trains/aircraft and related components

Waste Management

(Subcategory) Primary	Secondary	
☐	☐	Radioactive waste treatment, storage, disposal
☐	☐	Municipal solid waste landfill
☐	☒	Mine tailings disposal
☐	☐	Industrial waste landfill
☐	☐	Industrial waste facility (non generator)
☐	☐	Illegal disposal/open dump
☐	☐	Co-disposal landfill (municipal and industrial)

Other

(Subcategory) Primary	Secondary	
☐	☐	Agricultural
☐	☐	Contaminated sediment site with no identifiable source
☐	☐	Dust control
☐	☐	Ground water plume site with no identifiable source
☐	☐	Military/other ordinance
☐	☐	Product storage/distribution
☐	☐	Research, development, and testing facility
☐	☐	Retail/commercial
☐	☐	Spill or other one time event
☐	☐	Transportation (e.g. railroad yards, airports, barge docking site
☐	☐	Treatment works/septic tanks/other sewage treatment

Mining

(Subcategory) Primary	Secondary	
☐	☐	Coal
☒	☐	Metals
☐	☐	Non-metals minerals
☐	☐	Oil and gas

Recycling

(Subcategory) Primary	Secondary	
☐	☐	Automobiles/tires
☐	☐	Batteries/scrap metals/secondary smelting/precious metal recovery
☐	☐	Chemicals/chemicals waste (e.g. solvent recovery)
☐	☐	Drums/tanks
☐	☐	Waste/used oil

PREPARED BY:		*DATE:*	
IMC:	*DATE:*	*ISS:*	*DATE:*
QA/QC:		*DATE:*	

BOLD AND ITALIC FIELDS ARE REQUIRED

PRE-CERCLIS SCREENING ASSESSMENT FORM

Preparer Name: Tim Miles		**Date:** 5/19/2010
Agency: Department of Toxic Substances Control		
Address: 8800 Cal Center Drive, Sacramento, CA 95826		
Phone: (916) 255 - 3710 Ext.	**E-Mail:** tmiles@dtsc.ca.gov	

SECTION A.

Site Name: Wide Awake Mercury Mine		
Previous Names:		
Site Location: Colusa County Assessor Parcel Numbers 018-200-010, -011, and -012		
City: Wilbur Springs	**St:** CA	**Zipcode:** 95987-

CA DTSC Region: Sacramento	**CA DTSC Region #:** 1
CA RWQCB Region: Central Valley	**CA RWQCB Region #:** 5

Complete the following checklist. If Ayes@ is marked, please explain below.		YES	NO
1.	Does the site already appear in CERCLIS?	☐	☒
2.	Is the release from products that are part of the structure of, and result in exposure within, residential buildings or businesses or community structures?	☐	☒
3.	Does the site consist of a release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found?	☐	☒
4.	Is the release into a public or private drinking water supply due to deterioration of the system through ordinary use?	☐	☒
5.	Is some other program actively involved with the site (i.e., another Federal, State, or Tribal program)?	☒	☐
6.	Are the hazardous substances potentially released at the site regulated under a statutory exclusion (i.e., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?	☐	☒
7.	Are the hazardous substances potentially released at the site excluded by policy considerations (e.g., deferral to RCRA Corrective Action)?	☐	☒
8.	Is there sufficient documentation that clearly demonstrates that there is no potential for a release that could cause adverse environmental or human health impacts (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, documentation showing that no hazardous substance releases have occurred, EPA approved risk assessment completed)?	☐	☒

Briefly explain all "yes" answers in section B.

PRE-CERCLIS SCREENING ASSESSMENT FORM

SECTION B.
Site Determination:

Site is eligible for CERCLA: ☒
(Further assessment is recommended. / Non NPL Status = PA Needed / NPL Status = N)

The site is not eligible for CERCLA: ☐
NPL Status = O for all options below
(Pick one below:)
Non-NPL Status = Not a Valid Site : ☐
Non-NPL Status = Not a Valid Site - RCRA Lead: ☐
Non-NPL Status = Not a Valid Site - NRC Lead: ☐
Non-NPL Status = Not a Valid Site - State Lead: ☐

Site is part of a NPL site: ☐
(NPL Status = A)

DECISION/DISCUSSION/RATIONALE/SITE ACTION COMMENTS:
The site is contaminated with mercury from historic mercury mining activities which has resulted in the release of mine waste into Sulphur Creek. The California Regional Water Quality Control Board is discussing a technical and monitoring report order with the potentially responsible parties.

Regional EPA Reviewer:_____ Date:_____

State Agency/Tribe:_____ Date:_____

Date Submitted to IMC: _____

PRE-CERCLIS SCREENING ASSESSMENT FORM
DATA ENTRY FORM FOR DISCOVERY OF SITE

FED FAC IND	☐Federal Facility	☒Not a Federal Facility	☐Status Undetermined

SITE TYPES (Check all secondary subcategories that apply. Designate one subcategory as primary)

Manufacturing/Processing/Maintenance (Subcategory)		
Primary	Secondary	
☐	☐	Chemicals and allied products
☐	☐	Coal gasification
☐	☐	Coke production
☐	☐	Electric power generation and distribution
☐	☐	Electronic/electrical equipment
☐	☐	Fabrics/textiles
☐	☐	Lumber and wood products/pulp and paper
☐	☐	Lumber and wood products/wood preserving/treatment
☐	☐	Metal fabrication/finishing/coating and allied industries
☐	☐	Oil and gas
☐	☐	Ordnance production
☐	☐	Plastics and rubber products
☐	☐	Primary metals/minerals processing
☐	☐	Radioactive products
☐	☐	Tanneries
☐	☐	Trucks/ships/trains/aircraft and related components

Other (Subcategory)		
Primary	Secondary	
☐	☐	Agricultural
☐	☐	Contaminated sediment site with no identifiable source
☐	☐	Dust control
☐	☐	Ground water plume site with no identifiable source
☐	☐	Military/other ordinance
☐	☐	Product storage/distribution
☐	☐	Research, development, and testing facility
☐	☐	Retail/commercial
☐	☐	Spill or other one time event
☐	☐	Transportation (e.g. railroad yards, airports, barge docking site
☐	☐	Treatment works/septic tanks/other sewage treatment

Mining (Subcategory)		
Primary	Secondary	
☐	☐	Coal
☒	☐	Metals
☐	☐	Non-metals minerals
☐	☐	Oil and gas

Waste Management (Subcategory)		
Primary	Secondary	
☐	☐	Radioactive waste treatment, storage, disposal
☐	☐	Municipal solid waste landfill
☐	☒	Mine tailings disposal
☐	☐	Industrial waste landfill
☐	☐	Industrial waste facility (non generator)
☐	☐	Illegal disposal/open dump
☐	☐	Co-disposal landfill (municipal and industrial)

Recycling (Subcategory)		
Primary	Secondary	
☐	☐	Automobiles/tires
☐	☐	Batteries/scrap metals/secondary smelting/precious metal recovery
☐	☐	Chemicals/chemicals waste (e.g. solvent recovery)
☐	☐	Drums/tanks
☐	☐	Waste/used oil

PREPARED BY:		*DATE:*	
IMC:	*DATE:*	*ISS:*	*DATE:*
QA/QC:		*DATE:*	

BOLD AND ITALIC FIELDS ARE REQUIRED

PRE-CERCLIS SCREENING ASSESSMENT FORM

Preparer Name: Tim Miles	Date: 3/3/2011
Agency: Department of Toxic Substances Control	
Address: 8800 Cal Center Drive, Sacramento, CA 95826	
Phone: (916) 255 - 3710 Ext.	E-Mail: tmiles@dtsc.ca.gov

SECTION A.

Site Name: Utopia Mine		
Previous Names:		
Site Location: 5610 E Highway 20		
City: Lucerne	St: CA	Zipcode: 95464-

CA DTSC Region: Sacramento	CA DTSC Region #: 1
CA RWQCB Region: Central Valley	CA RWQCB Region #: 5

Complete the following checklist. If Ayes@ is marked, please explain below.		YES	NO
1.	Does the site already appear in CERCLIS?	☐	☒
2.	Is the release from products that are part of the structure of, and result in exposure within, residential buildings or businesses or community structures?	☐	☒
3.	Does the site consist of a release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found?	☐	☒
4.	Is the release into a public or private drinking water supply due to deterioration of the system through ordinary use?	☐	☒
5.	Is some other program actively involved with the site (i.e., another Federal, State, or Tribal program)?	☐	☒
6.	Are the hazardous substances potentially released at the site regulated under a statutory exclusion (i.e., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?	☐	☒
7.	Are the hazardous substances potentially released at the site excluded by policy considerations (e.g., deferral to RCRA Corrective Action)?	☐	☒
8.	Is there sufficient documentation that clearly demonstrates that there is no potential for a release that could cause adverse environmental or human health impacts (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, documentation showing that no hazardous substance releases have occurred, EPA approved risk assessment completed)?	☐	☒

Briefly explain all "yes" answers in section B.

PRE-CERCLIS SCREENING ASSESSMENT FORM

SECTION B.
Site Determination:

Site is eligible for CERCLA: ☒
(Further assessment is recommended. / Non NPL Status = PA Needed / NPL Status = N)

The site is not eligible for CERCLA: ☐
NPL Status = O for all options below
(Pick one below:)
Non-NPL Status = Not a Valid Site : ☐
Non-NPL Status = Not a Valid Site - RCRA Lead: ☐
Non-NPL Status = Not a Valid Site - NRC Lead: ☐
Non-NPL Status = Not a Valid Site - State Lead: ☐

Site is part of a NPL site: ☐
(NPL Status = A)

DECISION/DISCUSSION/RATIONALE/SITE ACTION COMMENTS:
This is a former mercury mine located adjacent to Clear Lake that is proposed for development as a residential spa. The county has designated the lands around the site for future residential development. The mine site is also suspected of contributing to the mercury concentrations in Clear Lake that exceeds the Total Maximum Daily Load (TMDL).

Regional EPA Reviewer:_____ Date:_____

State Agency/Tribe:_____ Date:_____

Date Submitted to IMC: _____

PRE-CERCLIS SCREENING ASSESSMENT FORM
DATA ENTRY FORM FOR DISCOVERY OF SITE

FED FAC IND ☐Federal Facility ☒Not a Federal Facility ☐Status Undetermined

SITE TYPES (Check all secondary subcategories that apply. Designate one subcategory as primary)

Manufacturing/Processing/Maintenance

(Subcategory) Primary	Secondary	
☐	☐	Chemicals and allied products
☐	☐	Coal gasification
☐	☐	Coke production
☐	☐	Electric power generation and distribution
☐	☐	Electronic/electrical equipment
☐	☐	Fabrics/textiles
☐	☐	Lumber and wood products/pulp and paper
☐	☐	Lumber and wood products/wood preserving/treatment
☐	☐	Metal fabrication/finishing/coating and allied industries
☐	☐	Oil and gas
☐	☐	Ordnance production
☐	☐	Plastics and rubber products
☐	☐	Primary metals/minerals processing
☐	☐	Radioactive products
☐	☐	Tanneries
☐	☐	Trucks/ships/trains/aircraft and related components

Waste Management

(Subcategory) Primary	Secondary	
☐	☐	Radioactive waste treatment, storage, disposal
☐	☐	Municipal solid waste landfill
☒	☐	Mine tailings disposal
☐	☐	Industrial waste landfill
☐	☐	Industrial waste facility (non generator)
☐	☐	Illegal disposal/open dump
☐	☐	Co-disposal landfill (municipal and industrial)

Other

(Subcategory) Primary	Secondary	
☐	☐	Agricultural
☐	☐	Contaminated sediment site with no identifiable source
☐	☐	Dust control
☐	☐	Ground water plume site with no identifiable source
☐	☐	Military/other ordinance
☐	☐	Product storage/distribution
☐	☐	Research, development, and testing facility
☐	☐	Retail/commercial
☐	☐	Spill or other one time event
☐	☐	Transportation (e.g. railroad yards, airports, barge docking site
☐	☐	Treatment works/septic tanks/other sewage treatment

Mining

(Subcategory) Primary	Secondary	
☐	☐	Coal
☐	☒	Metals
☐	☐	Non-metals minerals
☐	☐	Oil and gas

Recycling

(Subcategory) Primary	Secondary	
☐	☐	Automobiles/tires
☐	☐	Batteries/scrap metals/secondary smelting/precious metal recovery
☐	☐	Chemicals/chemicals waste (e.g. solvent recovery)
☐	☐	Drums/tanks
☐	☐	Waste/used oil

PREPARED BY:		*DATE:*	
IMC:	*DATE:*	*ISS:*	*DATE:*
QA/QC:		*DATE:*	

BOLD AND ITALIC FIELDS ARE REQUIRED

Appendix 6 – Site Screening Assessments Completed Spring 2010 & 2011

Site Name	Associated Mines/AKAs	Owner	Regulatory Involvement	Rational for Selection
Cache Creek Settling Basin	None identified.	Private, DWR	None known	Accumulation point for sediment from Cache Creek Watershed. Possible point of methylation of mercury.
Central Mine	The Central Mine Group, Dewey Mine, Little Giant Mines	Private	RWQCB Order issued May 27, 2010	Major visible AML impacted land in area
Cherry Hill Mine	Manzanita Mine Group	Private	RWQCB Order issued May 27, 2010	Major visible AML impacted land in area
Elgin Mercury Mine	Elgin Prospect, New Elgin Mine	Private	RWQCB Order issued August 13, 2009	Major visible AML impacted land in area
Empire Mine Sulphur Creek	Empire Mine, The Empire Mine Group, Mercury Queen, Mercury King, Hidden Treasure Mines	Private	RWQCB Order issued May 27, 2010	Major visible AML impacted land in area
Manzanita Mine	The Manzanita Mine Group (including West End, North Star, Monticello, Oak Tree, Cherry Hill, and Hughes Mill Site)	Private	RWQCB Order issued May 27, 2010	Major visible AML impacted land in area
West End Mine	The Manzanita Mine Group	Private	RWQCB Order issued May 27, 2010	Major visible AML impacted land in area
Wide Awake	Wide Awake Mine, Wide Awake Consolidated, Buckeye, Buckeye Quicksilver Mine, Jefferson Mines	Private	RWQCB Order issued May 27, 2010	Major visible AML impacted land in area
Utopia Mine	Proposed Knolls Resort & Spa	Private & State of California	County is reviewing development application	Site is proposed for residential development.

Appendix 7 – Sample Data Maps

Note: Due to the file size of the maps they are not included within this document in electronic form. The maps consist of a base map of the Cache Creek Watershed with 16 sub-maps within the water shed. The maps show the locations of mine sites, sample results from various studies (which are summarized in this report), and other information such as assessor parcels, watershed sub-basins, and water bodies. They are available electronically in *.pdf* format.