Figure 11. Suspended Solids Loads During High Runoff
(March 1995; metric tons/day)

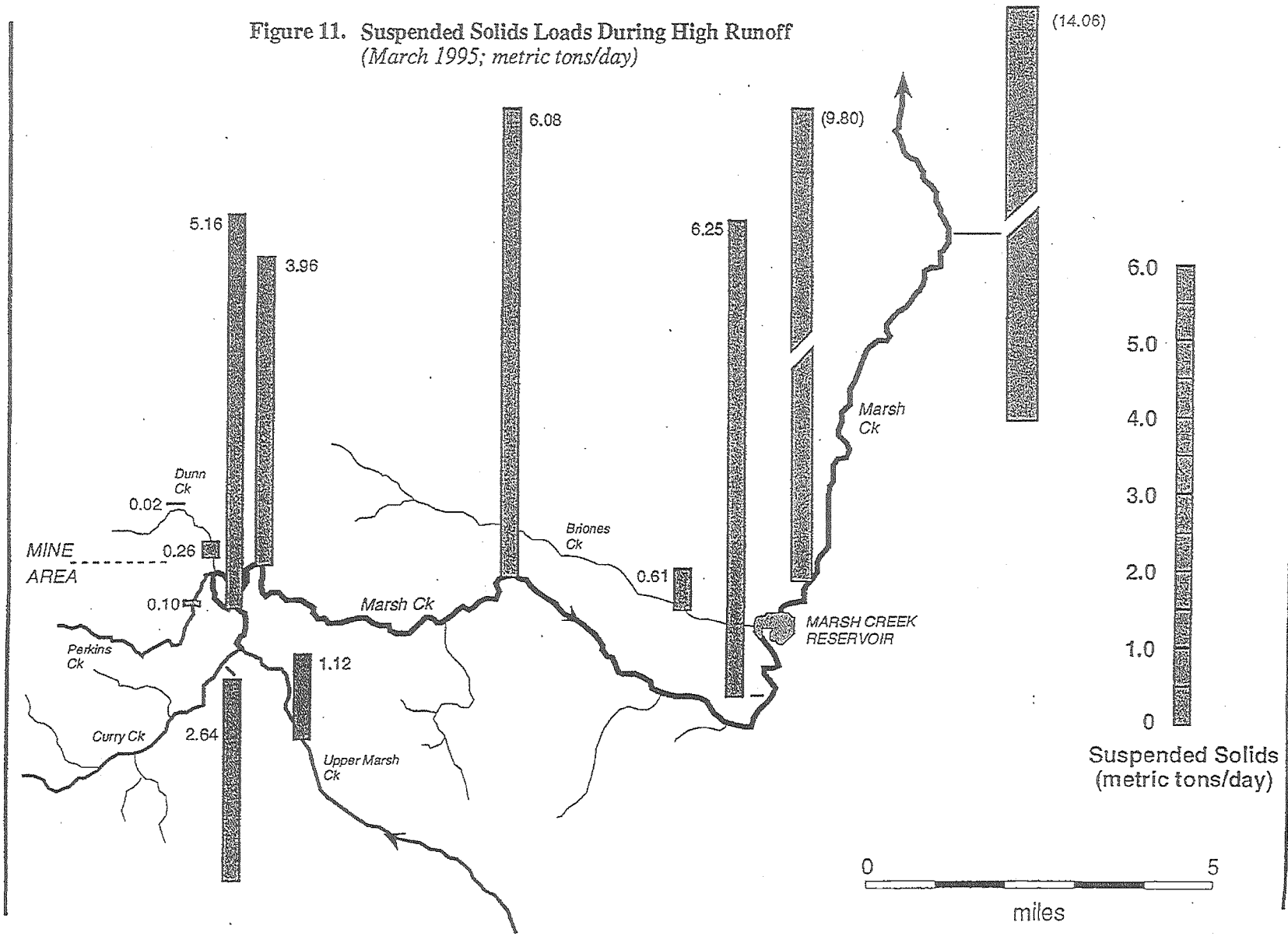
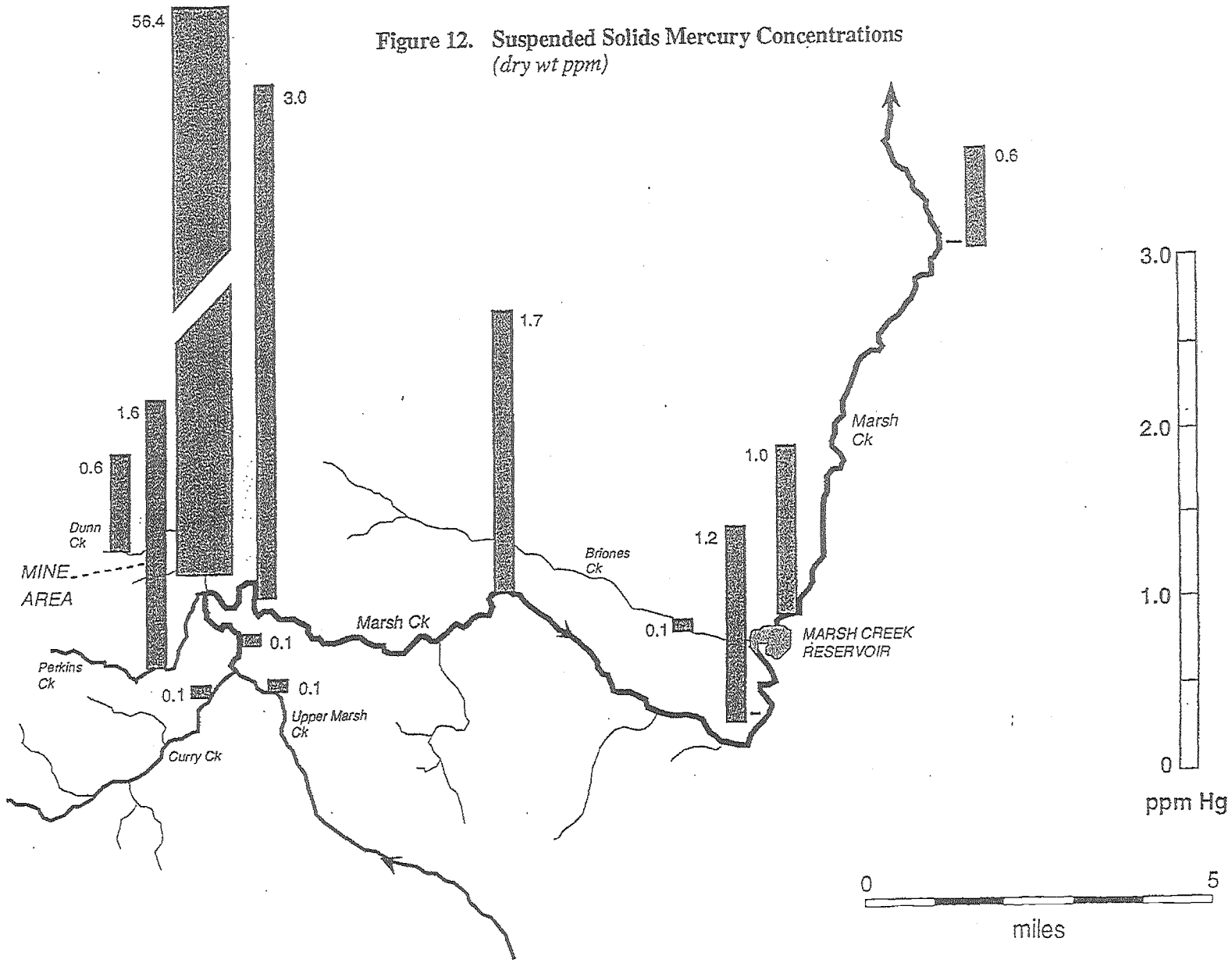


Figure 12. Suspended Solids Mercury Concentrations
(dry wt ppm)



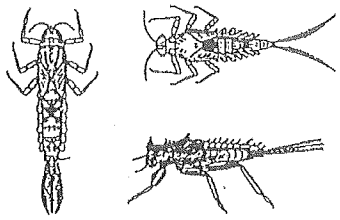
storm seasons should plummet in average mercury concentration, as the great majority of sediment transported in this drainage has been shown to be quite low in mercury content. This material can then form a natural, lower mercury "treatment" for the Marsh Creek Reservoir bottom sediments in future years.

3.1.2 Stream Invertebrates

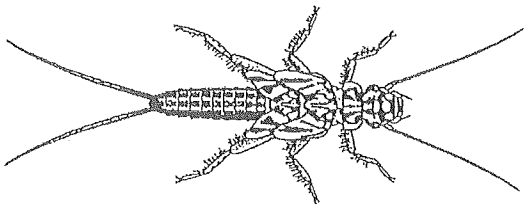
Stream invertebrates that were analyzed for this project are illustrated in Figure 13. The mercury data for the watershed invertebrate samples are presented in Table 7 and in Figures 14 and 15. Native in-stream invertebrate species have proven to be excellent monitors of mercury bioavailability in California streams and rivers (Slotton et al. 1995a). Because they incorporate mercury into their bodies throughout their lives, they can provide a time-integrated measure of stream conditions, as compared to standard "point-in-time" grab sampling for water. The mercury incorporated into local aquatic biota is, by definition, specifically the bioavailable fraction, which can be of paramount importance for management considerations. Additionally, many of these species are ideal indicators of highly localized conditions, as compared to fish which can and often do migrate extensively. The benthic invertebrate species we focused on in this work typically remain within a very limited area throughout their lives. They thus function as relatively static biological probes of the fraction of mercury in the water that is bioavailable.

At the majority of sampling stations, we were able to collect specimens from three distinct trophic feeding levels of invertebrates in sufficient quantity for mercury analysis. Macro-invertebrates were not present in the smaller, more ephemeral flows in the immediate mine region. Near the base of the aquatic food chain were mayfly nymphs (Ephemeroptera) from several herbivorous genera. Perlodid stoneflies were also taken at most of the sites. These are medium-sized invertebrate predators which feed on small to medium invertebrates. At the top of the invertebrate food chain in the upper watershed are the large-jawed hellgrammites (Corydalidae), which can reach several inches in length and are voracious predators of all other co-occurring species. We additionally took samples of aquatic "hair worms" of the order Nematomorpha. These organisms have a complex life cycle, deriving from the terrestrial ecosystem, and do not feed while in the stream. They thus provide limited information, presumably linked to direct uptake of mercury from the water. The majority of biotic mercury is typically accumulated through the food chain in the diet, particularly in the higher trophic levels (Lindberg et al. 1987, Gill and Bruland 1990).

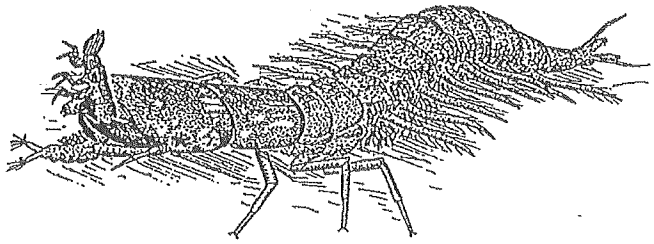
Figure 13. Stream Invertebrates Analyzed in This Project
(illustrations taken from McCafferty 1981, Goldman 1981)



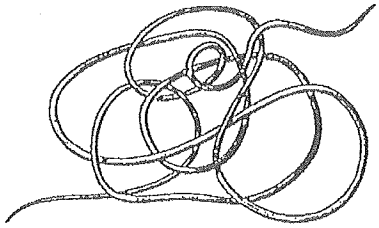
Mayflies (Ephemeroptera)
(~1/2 inch)
Siphloneuridae
Baetidae
Ephemerellidae



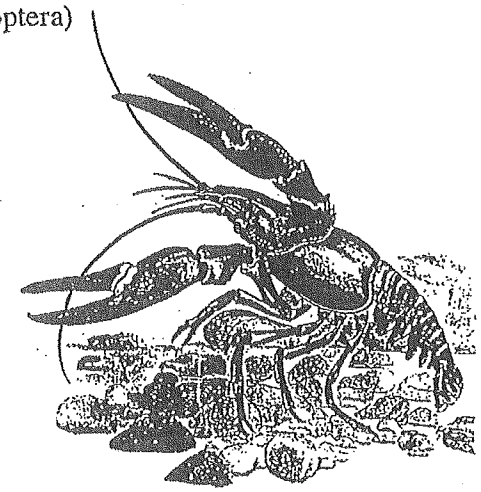
Stoneflies (Plecoptera)
Perlodidae (~1 inch)



Hellgrammites (Megaloptera)
Corydalidae (2-4 inches)



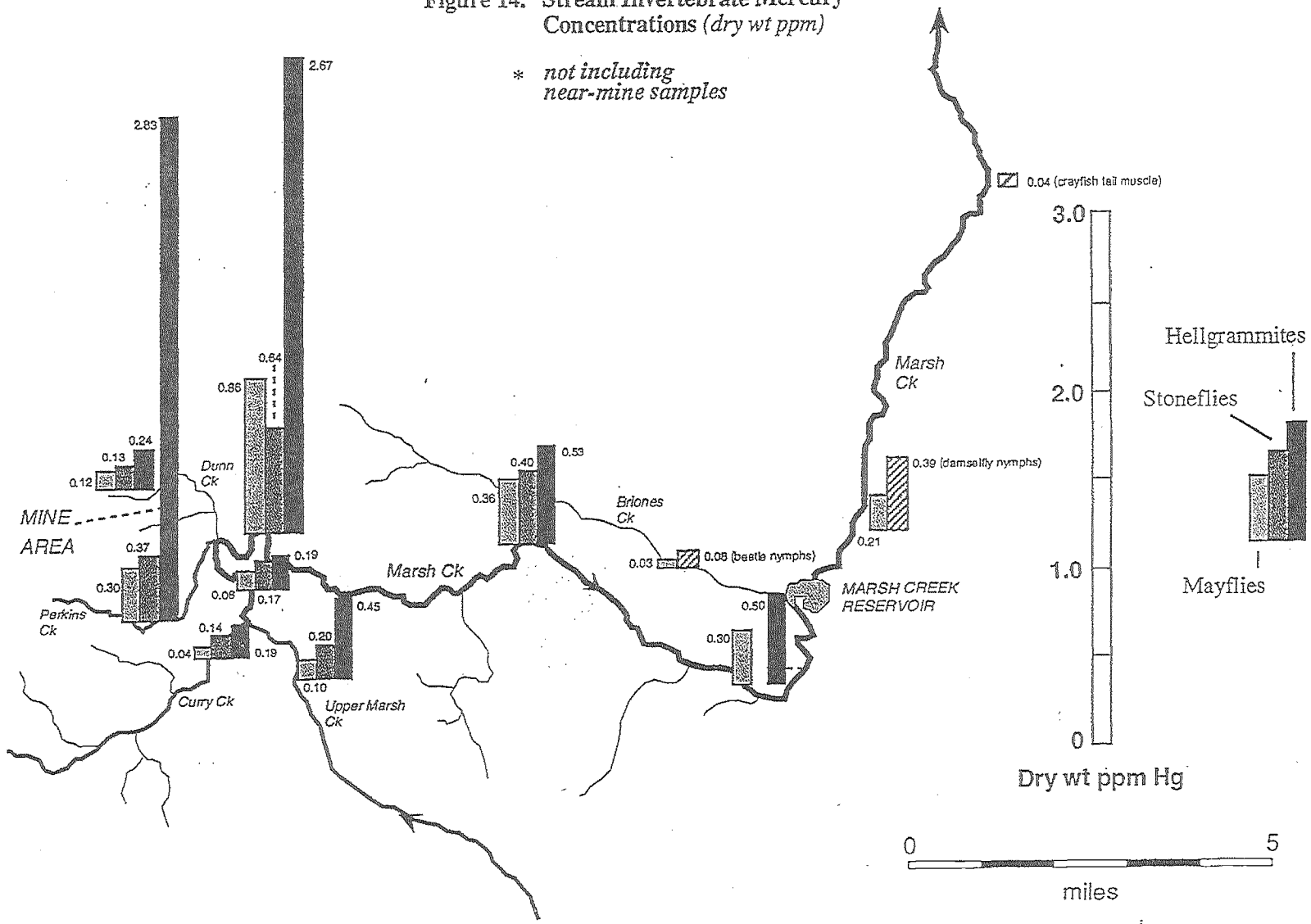
Horsehair Worms
(Nematomorpha)

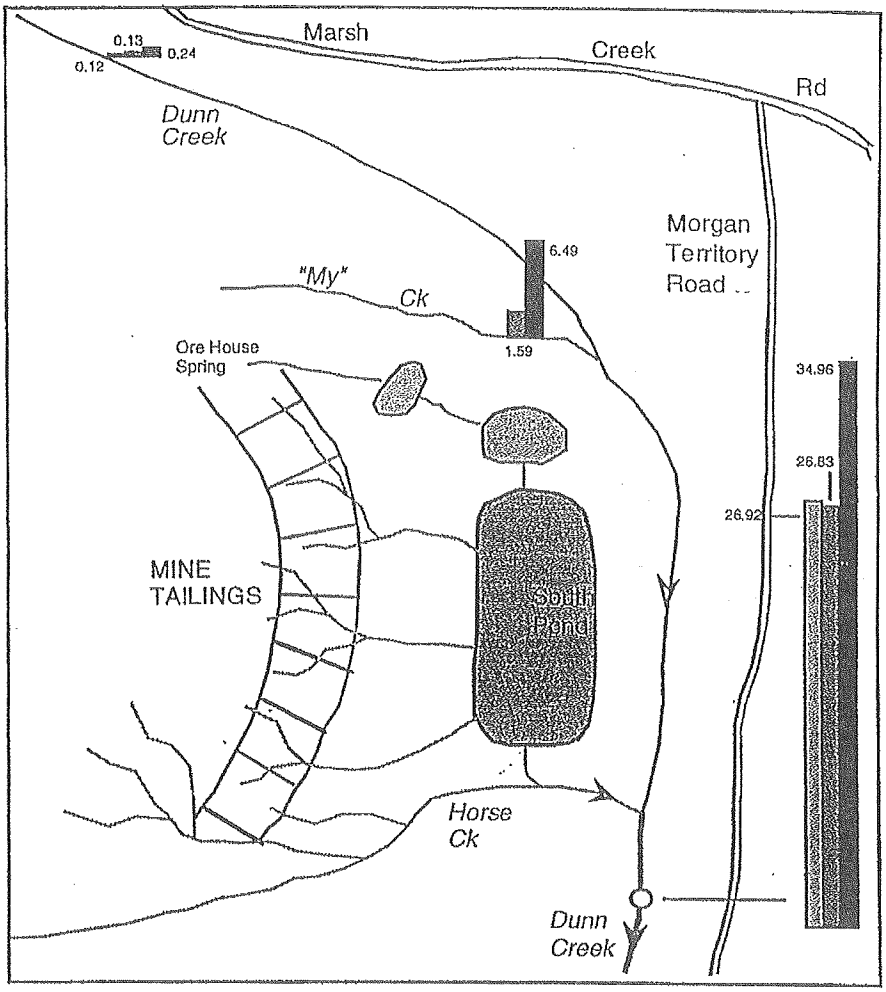


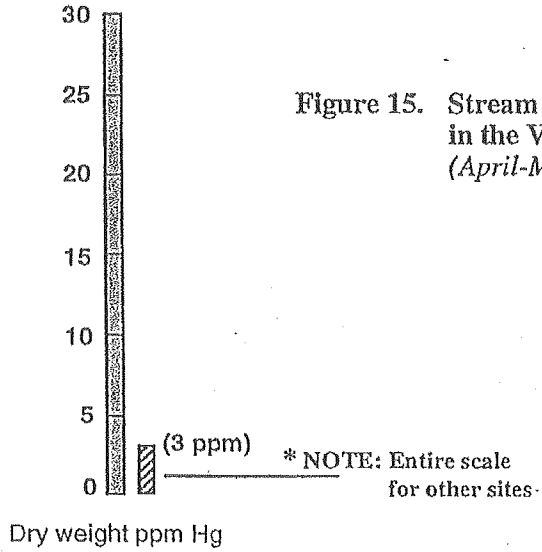
Crayfish (Decapoda)
Pacifasticus

Figure 14. Stream Invertebrate Mercury Concentrations *(dry wt ppm)*

* *not including near-mine samples*







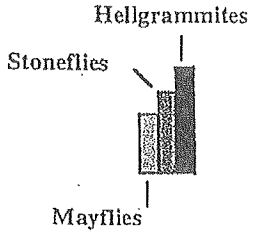


Figure 15. Stream Invertebrate Mercury in the Vicinity of the Mt. Diablo Mine *(April-May, 1995)*

Table 7. Stream Invertebrate Mercury Concentrations *(dry weight ppm)*

SITE	Nematomorpha	Ephemeroptera	Plecoptera	Megaloptera
	Horsehair Worms	Mixed Mayflies	Perlodid Stoneflies	Medium Hellgrammites
	Water Uptake Only	*Herbivores*	*First Order Predators*	*Second Order Predators*
Upper Marsh Creek	0.06	0.10	0.20	0.45
Curry Creek	0.10	0.04	0.14	0.19
Marsh Ck above Dunn Ck	0.06	0.08	0.17	0.19
Perkins Creek	0.38	0.30	0.37	2.83
Upper (clean) Dunn Creek	0.06	0.12	0.13	0.24
"My" Creek	0.32		1.59 §	6.49
Dunn Creek below Mine		13.80	16.00	23.80
Marsh Ck below Dunn Ck	0.29	0.52	0.64	2.67
Middle Marsh Creek	0.09	0.36	0.40	0.53
Briones Creek		0.05	0.08 ¥	
Marsh Ck above Reservoir		0.30		0.50
Marsh Ck below Reservoir		0.21	0.39 †	

Alternate 1° predators: § Rhyacophyllid caddis larvae
¥ Predaceous beetle nymphs
† Damselfly nymphs

The invertebrate mercury data indicate that the trend within the watershed for bioavailable mercury generally parallels that seen for aqueous mercury concentrations (section 3.1.1). Massive spike concentrations were apparent in Dunn Creek invertebrates immediately below the inflows from the mine site (27-35 ppm, dry weight). Biota from "My" Creek and Perkins Creek were also relatively elevated, though to a lesser degree, as were aqueous mercury concentrations in these streams. In particular, the hellgrammite samples from Perkins Creek (2.83 ppm) and "My" Creek (6.49 ppm) were significantly elevated. Concentrations were low throughout the invertebrate food chain at most sites upstream and away from the mine influence. Samples from upper Dunn Creek, above the mine, were two orders of magnitude lower in accumulated mercury than near-mine samples, at 0.06-0.24 ppm. Levels from upper Marsh Creek, Curry Creek, and Briones Creek were in a similar low range.

Along Marsh Creek, invertebrate mercury concentrations were dramatically higher downstream of the Dunn Creek confluence as compared to the relative "control" levels seen upstream of this point. Concentrations generally declined with increasing distance downstream from the mine. Comparable samples were not available at the downstream site near Oakley, though we were able to take several crayfish, which we analyzed for tail

muscle mercury (Table 9, Fig. 14). These were quite low at ~0.04 ppm wet wt, ~0.18 ppm dry wt.

Within each site, mercury concentrations in the various trophic groups generally increased with feeding level, with predatory stoneflies typically containing higher levels than herbivorous mayflies, and the large predatory hellgrammites generally having the greatest concentrations.

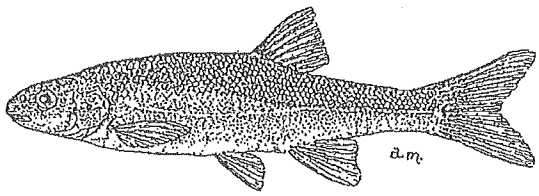
We again point out that both the aqueous concentration data and these data from bioindicator stream organisms provide information on relative localized water quality in the various tributaries. For questions of absolute, bulk contributions of mercury from each of the streams to the entire watershed, the bulk loading/mass balance types of information are more relevant (section 3.1.1.4 - 3.1.1.5). Both approaches provide important, though potentially very different, information.

3.1.3 Stream Fish

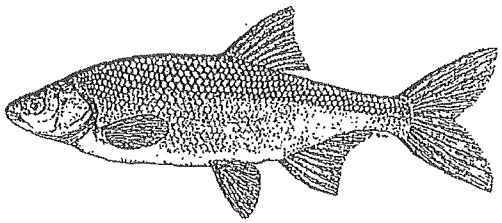
Illustrations of the stream fishes collected in this project can be found in Figure 16. Data collected from the in-stream fish samples are presented in Tables 8 and 9 and Figure 17. Fish were present at a subset of the sampling sites, primarily in the main channel of Marsh Creek downstream of Dunn Creek. Fish were not present in smaller upstream tributaries, presumably due to annual dry-season losses of water. While larger fish were found in Marsh Creek within a mile above the reservoir, upstream fish were limited to "minnows". These small species consisted of California roach (*Hesperoleucus symmetricus*), mixed with juvenile hitch (*Lavinia exilicauda*) closer to the reservoir. Below the reservoir, the character of the creek changes such that roach and hitch are no longer present. Fish taken downstream of the reservoir consisted of small bluegill (*Lepomis macrochirus*), together with a collection of juvenile (parr) Chinook salmon (*Oncorhynchus tshawytscha*) taken near Oakley.

The California roach and juvenile hitch were prepared for mercury analysis in the form of whole fish, multiple individual composites (Table 8). This is the technique typically used for roach in other metals biomonitoring work in California (Hellawell 1986, Reuter et al. 1989,1995, Bodega Research Associates 1995). Composites were made of similar sized individuals, with up to five different size classes composited separately for each site, depending on the range of sizes taken. The much larger hitch individuals taken just upstream of the reservoir were analyzed for muscle mercury rather than whole body composite concentrations. A subset of the fish taken downstream of the reservoir were also analyzed for muscle mercury, in addition to whole fish composite mercury. Muscle

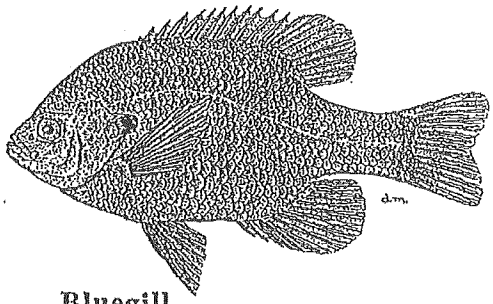
Figure 16. Stream Fish Species Sampled in This Project
(illustrations taken from Moyle 1976)



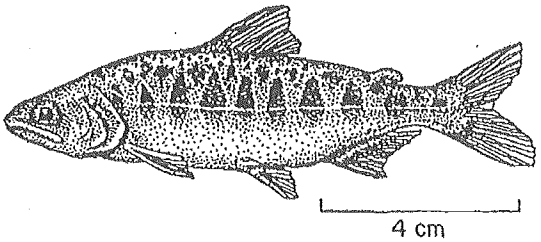
California Roach
Hesperoleucus symmetricus
(2-5 inches)



Hitch
Lavinia exilicauda
(juveniles 2-5 inches + 7-8")



Bluegill
Lepomis macrochirus
(2-5 inches)



juvenile (parr) Chinook Salmon
Oncorhynchus tshawytscha
(juveniles 2-4 inches)

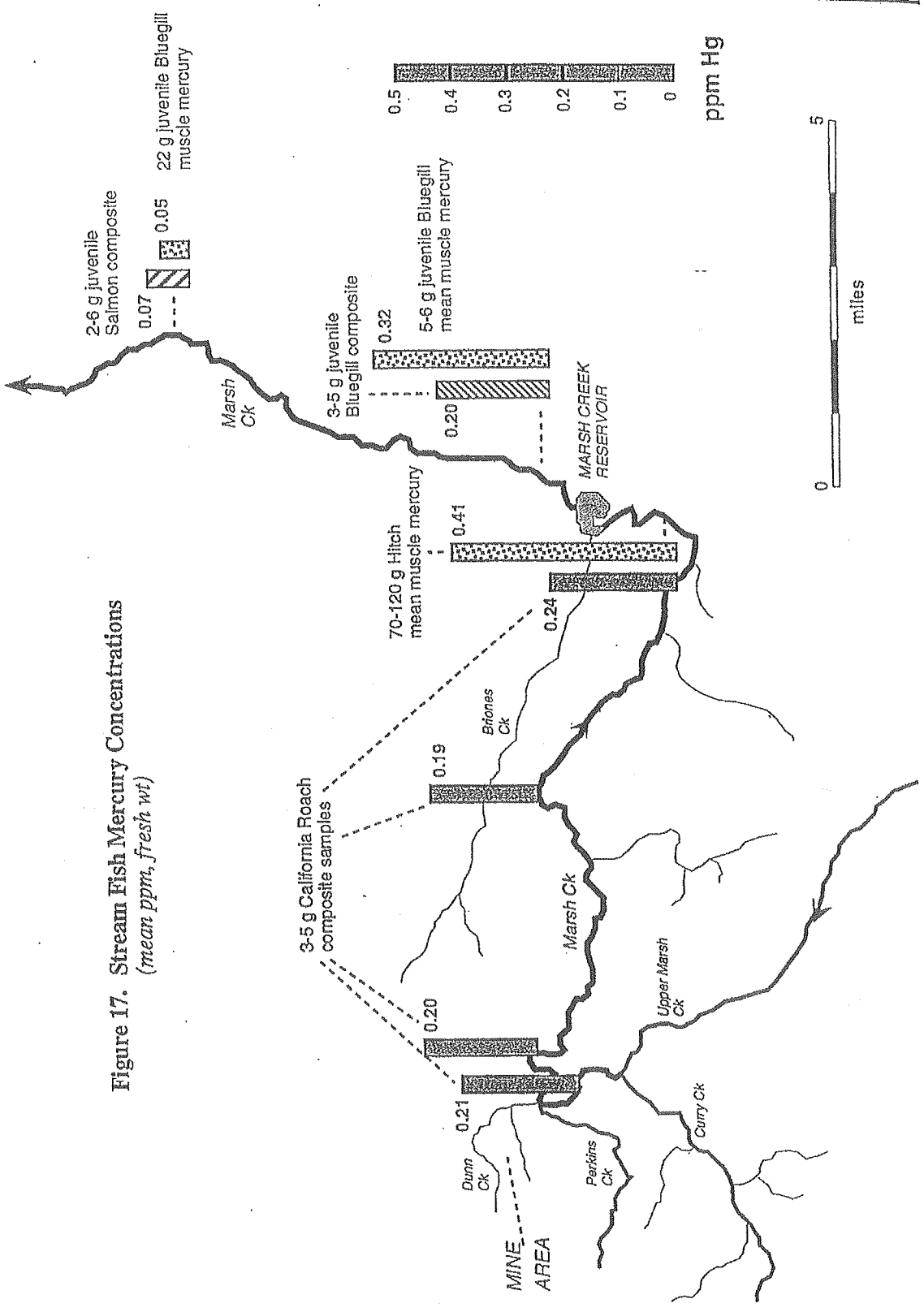


Figure 17. Stream Fish Mercury Concentrations *(mean ppm, fresh wt)*

mercury analyses (Table 9) were conducted on those fish for which the majority of comparative information exists in the form of muscle mercury concentrations.

Because fish were basically absent in the watershed upstream of the Dunn Creek confluence, it was not possible to use them as indicators of water quality differences between mine-impacted and control waters. Also, because fish are free to migrate up and down the creeks on each side of the reservoir, their accumulated mercury cannot be definitively linked with the location of capture. Additionally, the presence of different fish species above as compared to below the reservoir introduces a level of uncertainty to comparisons of fish mercury levels between these two areas. Consequently, the information provided by the stream fish data is somewhat limited. Because of these considerations, we supplemented fish collections with the invertebrate mercury work, described in section 3.1.2. However, some useful conclusions may be drawn from the stream fish data.

Mercury concentrations in the composite fish samples from spring 1995 (Table 8) were quite similar among the Marsh Creek sites between upper Marsh Creek and just below the reservoir. Among similar sized fish (2-5 g) including California roach, juvenile hitch, and juvenile bluegill, mercury concentrations were within the comparatively narrow range of 0.13-0.25 ppm. Except for a single, anomalously higher mercury individual roach from upper Marsh Creek, composites of all sizes (2-19 g) from these sites had mercury concentrations that fell within this range. There is no indication of a size vs mercury trend in this small-fish composite data.

Only a single individual roach was collected upstream of the Dunn Creek confluence, approximately one half mile upstream of Perkins Creek in Marsh Creek, despite repeated sampling efforts over several days. The similar mercury level in this fish (0.21 ppm) as compared to the range of levels seen downstream (0.13-0.25 ppm) suggests that this fish may have been a migrant from downstream. The lack of additional fish here indicates that the site was above the normal range of fish in the creek, a function of the annual disappearance of surface water each dry season. Therefore, it is likely that the individual roach taken here may have been a relatively recent migrant--and its mercury content may not reflect local conditions. Based on the aqueous mercury concentration data and the stream invertebrate findings, fish residing throughout the year in Marsh Creek above the Dunn Creek confluence would be expected to have significantly lower mercury than downstream fish.

Of the minnow composite samples, only a single individual roach exhibited a mercury concentration greater than 0.25 ppm. This 9 g individual had anomalously higher mercury concentration, at 0.71 ppm, nearly three-fold greater than the next highest values. As this

fish was collected from the site 1 mile below the Dunn Creek confluence, we hypothesize that it may have lived much of its life within the immediate influence of the Dunn Creek mine-impacted flows.

Table 8. Marsh Creek Fish Composite Samples (Whole Fish) Mercury Concentrations *(fresh/wet weight ppm Hg)*

Species	Weight (g)	Length (mm)	Individuals in Comp.	Hg (wet wt ppm)
1 mile above Dunn Ck Confluence				
California Roach	4.2	72	n=1	0.21
1 mile below Dunn Ck Confluence				
California Roach	4.1	72	n=2	0.20
" "	9.0	93	n=1	0.71
~5 miles below Dunn Ck confluence				
California Roach	1.5	52	n=11	0.25
and	2.2	63	n=16	0.23
juvenile Hitch	4.0	72	n=19	0.19
" "	7.5	85	n=5	0.18
" "	19.2	115	n=1	0.24
1 mile above Marsh Ck Reservoir				
California Roach	2.8	65	n=5	0.13
" "	4.0	76	n=3	0.24
" "	6.9	84	n=2	0.15
0.5 mile below Marsh Ck Reservoir				
juvenile Bluegill	1.7	50	n=9	0.24
" "	3.4	61	n=3	0.19
" "	5.4	70	n=3	0.21
Downstream near Oakley				
juvenile Salmon	3.6	70	n=5	0.07

A collection of larger hitch individuals (72-117 g, 1-3 yrs) was made one mile above the reservoir. We also noted several large goldfish in the creek at this location, which were likely the grown results of earlier releases by the public. Large fish were not found in the creek upstream of this region. Muscle mercury concentrations in the 8 larger hitch taken upstream of Marsh Creek Reservoir, at 0.29-0.51 ppm (Table 9), were very similar to levels measured in adult hitch within the reservoir (section 3.2.3, Table 11).

The juvenile bluegill samples taken immediately below the reservoir were similar in both size and mercury concentration to upstream roach and juvenile hitch, on a whole body

Table 9. Marsh Creek Fish Muscle (Fillet) Mercury Concentrations
(fresh/wet weight ppm Hg)

Identification	Weight (g)	Length (mm)	Muscle Hg (wet wt ppm)
1 mile above Marsh Ck Reservoir			
Hitch	72	177	0.44
"	73	181	0.30
"	88	194	0.40
"	90	196	0.35
"	97	197	0.51
"	106	208	0.51
"	114	205	0.46
"	117	205	0.29
0.5 mile below Marsh Ck Reservoir			
juvenile Bluegill	5.2	68	0.22
" "	5.3	71	0.35
" "	5.8	71	0.40
Downstream near Oakley			
juvenile Salmon	2.2	60	0.01
" "	2.5	63	0.01
" "	3.9	72	0.06
" "	4.0	72	0.06
" "	5.6	80	0.02
1 yr Bluegill	22	113	0.05
Crayfish (tail meat)	8.5	39¥	0.04
" "	12.2	39¥	0.03
" "	16.8	41¥	0.04

¥ Lengths for crayfish are standard carapace lengths, not total lengths.

composite basis (1.7-5.4 g, 0.19-0.24 ppm Hg). While these are quite different fish species, at this small size their feeding habits are relatively similar, with food items dominated by small in-stream invertebrates. The similar mercury concentrations measured at this time indicate that bioavailable mercury had been moving out of and/or through the reservoir in previous months. The aqueous mercury data (section 3.1.1.2) indicates that this was clearly the case under post-storm, high flow conditions. In addition to whole body composites, we analyzed muscle mercury in several 5-6 g juvenile bluegill taken downstream of the reservoir (Table 9). Muscle concentrations were somewhat higher than the whole body levels (0.22-0.40 ppm muscle vs 0.19-0.24 whole body). This is often the case. In ongoing research at the University of California, we repeatedly find muscle tissue to be the major repository for mercury in fish (Reuter et al. 1989, Slotton 1991, Suchanek et al. 1993, Slotton et al. 1996).

The samples taken from downstream Marsh Creek near Oakley provide some interesting comparative information. Here, we collected five small parr salmon (2-6 g), a one year old bluegill (22 g), and several adult crayfish. Muscle mercury in all of these samples, as well as composite mercury in the parr salmon, was significantly lower than that seen in fish from upstream Marsh Creek and the reservoir. Concentrations were all ≤ 0.07 ppm Hg. Once again, while the upstream roach and juvenile hitch are very different fish than the juvenile salmon, at this small size they are quite similar in body form and in the diet imposed by their size. Salmon parr such as these were almost certainly born in the only gravel spawning areas available on Marsh Creek downstream of the reservoir; i.e. just below the reservoir. As they only migrate downstream at this life stage (Moyle 1976), they could not have originated from outside of the watershed. Therefore, the mercury in these samples provides a reasonable measure of mercury bioavailability in downstream Marsh Creek, as compared to upper watershed roach and juvenile hitch of the same size. The levels were approximately one third of concentrations seen upstream.

While the direct comparison between parr salmon and roach of the same size may be complicated by the fact that roach of the same size can be considerably older, we found the same trend in the other samples. The bluegill taken near Oakley was also very low in mercury (0.05 ppm), despite being considerably larger than the comparative samples from just below the reservoir. Similarly, the crayfish tail meat samples were all very low, at 0.03-0.04 ppm Hg. These organisms are relatively sedentary as compared to fish, and can thus provide a good measure of localized conditions, integrated over their lifespans. In our work with crayfish throughout the Sierra Nevada, we have consistently found them to contain mercury at levels greater even than co-occurring hellgrammites, with concentrations generally similar to those of local fish (Slotton et al. 1995a). This results from their consumption of dead fish, the preferred food of these scavengers. On a comparable dry weight basis, the crayfish tail meat concentrations near Oakley were 0.15-0.20 ppm Hg. This is considerably lower than invertebrate samples of any trophic level taken between the Mt. Diablo mine area and the reservoir, and much lower than the hellgrammite mercury concentrations, which ranged from 0.50 ppm to far greater levels.

3.2 Marsh Creek Reservoir

3.2.1 Reservoir Sediment

Table 10. Marsh Creek Reservoir Sediment Laboratory Data

Identification	Sediment Depth (cm)	Sediment Depth (inches)	Hg (dry wt ppm)	% Water	% Organic (dry wt)
Surficial Sediment-- Large (East) Basin					
SW Quadrant	(surficial sediment)		0.49	75.1%	5.8%
SE Quadrant	(surficial sediment)		0.35	69.5%	4.7%
NE Quadrant	(surficial sediment)		0.46	70.6%	4.3%
NW Quadrant	(surficial sediment)		0.44	67.0%	5.6%
Center	(surficial sediment)		0.47	70.6%	4.3%
Surficial Sediment-- Small (West) Basin					
N Side	(surficial sediment)		0.39	50.9%	4.2%
S Side	(surficial sediment)		0.46	53.1%	4.5%
Center	(surficial sediment)		0.49	48.4%	3.9%
Core 1: Large (East) Basin--Center					
section 1	5	2	0.53	53.4%	5.7%
section 2	24	9	0.54	46.5%	4.3%
section 3	42	17	0.71	54.8%	5.9%
section 4	60	24	0.64	53.7%	4.4%
section 5	78	31	0.80	40.7%	3.8%
section 6	97	38	1.48	51.4%	6.4%
section 7	115	45	0.58	49.2%	4.0%
section 8	129	51	0.68	40.0%	3.4%
section 9	139	55	0.36	35.3%	3.4%
section 10	148	58	0.24	21.8%	1.2%
Core 2: Small (West) Basin--Center					
section 1	5	2	0.58	49.7%	5.5%
section 2	23	9	0.52	46.4%	6.0%
section 3	41	16	0.51	40.6%	5.4%
section 4	57	22	0.41	34.7%	5.5%
section 5	77	30	0.36	33.7%	5.3%
section 6	100	39	0.71	49.8%	6.4%
section 7	122	48	0.52	38.5%	4.4%
section 8	145	57	1.03	39.7%	5.3%

We characterized the current mercury concentrations in Marsh Creek Reservoir bottom sediments by sampling surficial bottom sediment at 8 locations distributed throughout the reservoir. The record of historic mercury deposition in the reservoir was determined by taking extended sediment cores into the bottom at the centers of each of the two main

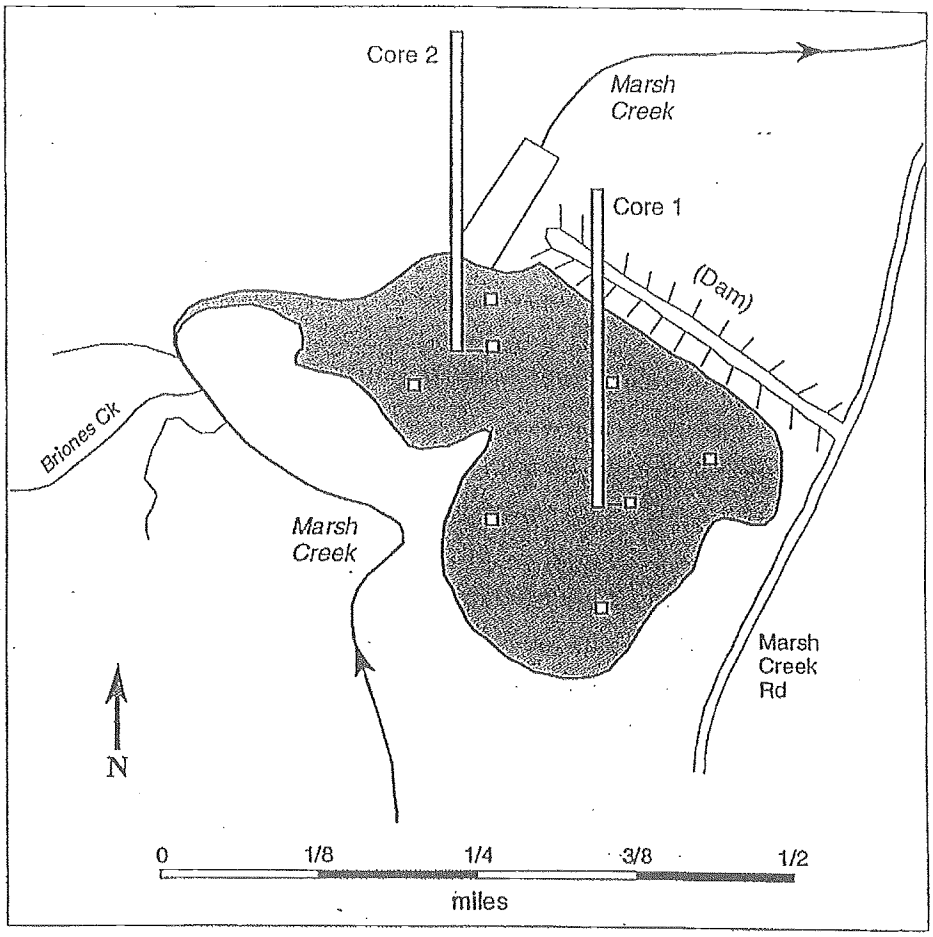


Figure 18. Marsh Creek Reservoir Sediment Sampling Sites
(September 1995)

□ -- Surficial sediment sampling sites

basins. These cores were sectioned and analyzed throughout their lengths for mercury and general sediment parameters. The reservoir sediment data is presented in Table 10. Sampling locations are displayed in Figure 18. Graphic representations of the core data are shown in Figures 19 and 20.

Surficial sediment mercury concentrations, which correspond to the most recent deposition from the watershed, were very similar throughout the reservoir at 0.35-0.49 ppm (mean = 0.44 ppm). This is very comparable to the 0.40 ppm result obtained by Levine-Fricke (1993a) for a sediment sample taken within the water line of the reservoir in July 1993. While mercury levels were relatively uniform, the sediment character was somewhat different between the two basins. The surficial sediment in the larger, eastern basin was higher in moisture content and somewhat higher in the percentage of organic matter. This is consistent with the smaller, western basin being the location of the direct inflows from Marsh Creek. The associated inputs of new sediment from the watershed will initially be of larger grain size and lower moisture percentage near the inflow, as that is where the heavier material will drop out of the water as the current slows. New deposition in other areas of the lake, further away from the inflow, will be dominated by the fine particulates which remain suspended in the water long enough to reach those areas. Subsequent increases in organic percentage and moisture content are particularly likely where there is extensive weed growth, as has been the case in this shallow reservoir.

The core taken in the center of the large, eastern basin (Core 1) reached all the way to the original terrestrial bottom material, which was nearly five feet beneath the current sediment/water interface. As the reservoir was built in 1963, this profile includes the entire 32 year history of sediment deposition from 1963 to 1995. The underlying terrestrial material was distinctive in its orange/tan coloration, crumbly texture, and dryness, as compared to the gray to black, fine sediments that constituted the subsequent aquatic sediment deposition.

Core sub-samples for laboratory analysis were taken within homogeneous sections of the core, rather than at specific intervals. Different periods of deposition were apparent in the core record as distinct color and textural shifts, with uniform bands of gray, black, and intermediate shades. The underlying terrestrial soil was quite different visually from any of the overlying material. The profiles of laboratory analytical parameters show this as well (Fig. 19). The values for mercury concentration, moisture content, and organic percentage were notably lower in the terrestrial material, as compared to the overlying aquatic sections of the core. Within the aquatic sediment layers, values of all three parameters varied within relatively narrow ranges. In the top 4.5 feet of the Core 1 sediment, mercury ranged between 0.5 and 1.5 ppm, moisture content was 40-55%, and organic percentage ranged

Figure 19. Marsh Creek Reservoir 1995 Sediment Core 1: Larger, Eastern Basin Profiles

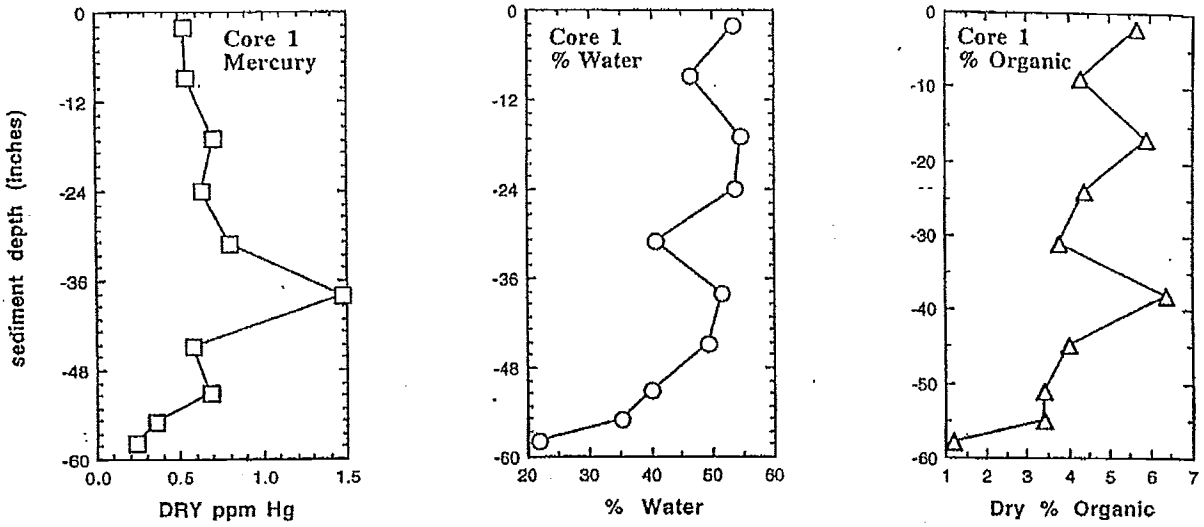
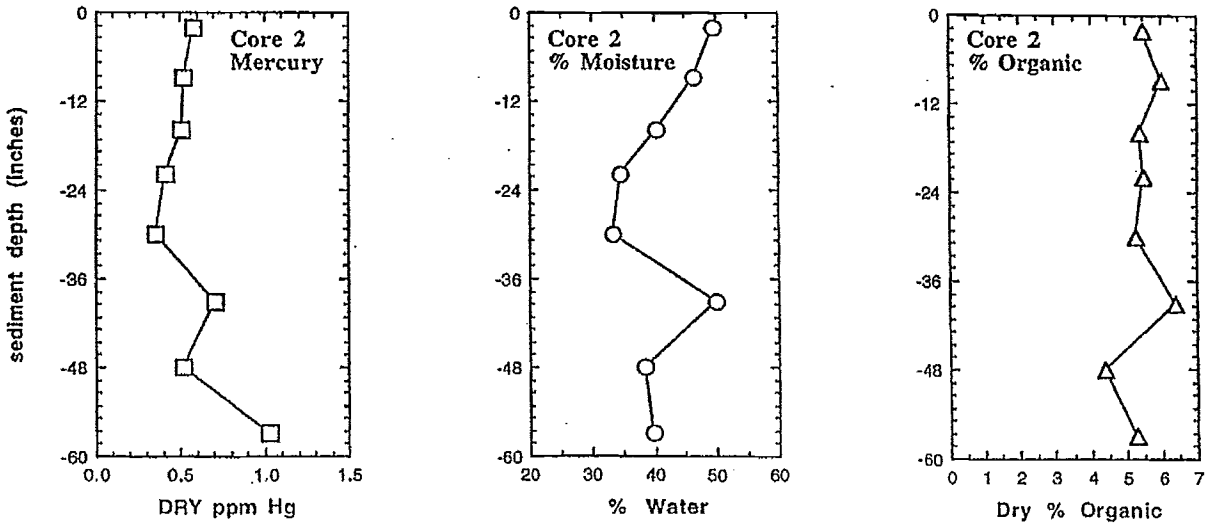


Figure 20. Marsh Creek Reservoir 1995 Sediment Core 2: Western (Inflow) Basin Profiles



between 3.5% and 6.5%. This record indicates that, over the 30+ year history of Marsh Creek Reservoir, depositional sediments from the upper watershed remained fairly consistent in their character. In fact, with the exception of the 1.5 ppm mercury value at approximately 3 foot depth in the core, the mercury levels in this sediment were remarkably uniform, at 0.53-0.80 ppm. It is interesting to note that the underlying soil was significantly lower in mercury, at 0.24 ppm.

Core 2, from the western basin of the reservoir, was taken to a similar depth of approximately 5 feet (Fig. 20). However, in this core we were not able to reach an underlying terrestrial layer. This was apparent both visually and in the laboratory parameters. Color varied between light gray through black zones throughout the core, including the bottom layers. Texture varied between clays, silts, and sands throughout, all of which are depositional materials. Moisture and organic contents did not show a notable change at the bottom. Moisture varied between 33% and 50% throughout the core, while organic percentage ranged between 4.4% and 6.4%.

Similar to Core 1, mercury concentrations in Core 2 were very steady at 0.36-0.71 ppm, with a higher excursion to 1.03 ppm near the 5 foot depth. These levels are similar to concentrations found in earlier sampling from this basin of the reservoir. Levine-Fricke conducted limited sediment core work near the inflowing delta in October 1993, taking 10 replicate samples of surficial delta sediment and 10 replicate samples from approximately 3 foot depth in the sediment (Levine-Fricke 1993b). Mercury concentrations from that sampling ranged between 0.12 and 0.40 ppm (mean = 0.23 ppm) in the surficial sediment and between 0.24 and 0.48 ppm (mean = 0.35 ppm) in the samples from 3 foot depth. Our Core 2, taken at the center of the western basin from a boat, was presumably composed of smaller grain-sized deposition as compared to delta deposits. The somewhat lower mercury results in the delta samples may be partly a function of grain size. We have found that, similar to other metals, mercury concentrations in particulate depositional material typically rises exponentially with decreasing grain size (Slotton and Reuter 1995).

The slight historic increase at 5 foot depth in Core 2 may correspond to the 1.5 ppm mercury spike seen in Core 1 at 3 feet. As Core 2 was taken near the inflow from Marsh Creek, it would be expected to receive greater vertical accumulations of depositional material than the (offset) eastern basin. This is where the bulk of the heavier particles will fall out of the current, upon reaching the still waters of the reservoir, in the natural process of delta formation. Significant layers of fine to medium sand were indeed present in Core 2. This, in fact, is what limited the depth to which we could drive the core. Because the depositional rate at this site was greater than in the east basin clays/silts, the mercury increase at 5 feet could easily correspond to the peak seen at 3 foot depth in Core 1. In any

case, mercury levels in both of the core profiles fell within a quite narrow range of concentrations.

The similar mercury levels found across the 32 year reservoir depositional sediment record are consistent with the upstream mine having remained in a similar state of mercury loading to the watershed throughout this period. Another conclusion to be drawn from the uniform depositional mercury levels is that the construction of the settling basin beneath the mine tailings in ~1980 has apparently not resulted in a significant decrease in depositional mercury in the downstream reservoir.

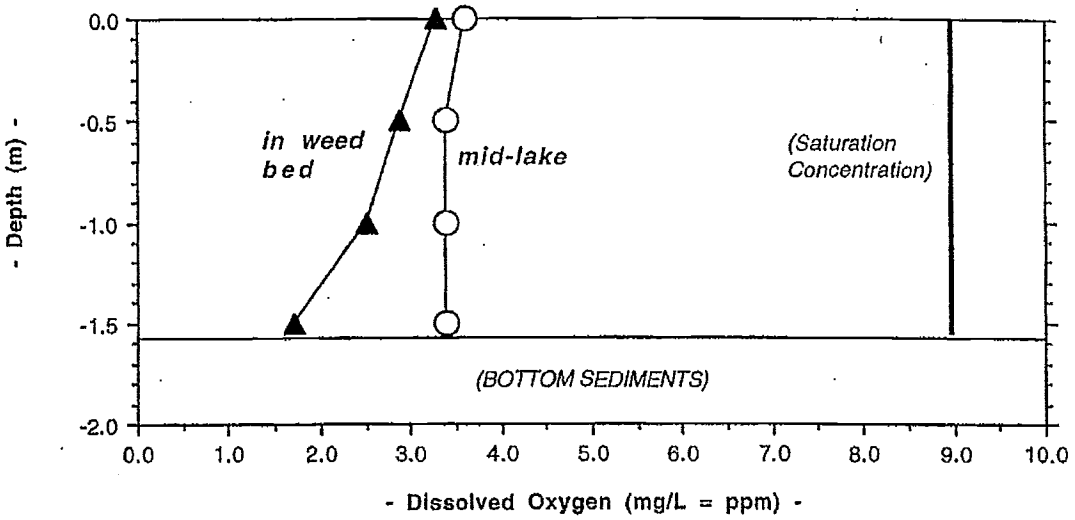
3.2.2 Reservoir General Limnology

In the course of sampling the reservoir with a variety of techniques, we were able to characterize the fish populations present, as well as the general limnology of the system. In the sediment core studies (section 3.2.1) we found that the reservoir has already filled in with depositional sediment to a depth of approximately 5 feet. At the time of our reservoir work (September 1995), the resulting water column was found to be quite shallow throughout, with depths of 6 feet or less. Consequently, aquatic macrophytes (large aquatic plants) have been able to establish dense weed beds over large areas of the reservoir. The genus *Potamogeton* dominated at this time, with a dense fringe of cattail (*Typha*) and bullrush (*Scirpus*) around the margins. The water was quite turbid, with a Secchi visibility consistently under 0.5 m (< 20 inches). The turbidity was apparently largely due to brown, organic staining of the water.

While the dense weed growth will produce oxygen during the day it, together with general organic metabolism, will consume oxygen during dark hours when photosynthesis ceases. We took early morning oxygen and temperature profiles through the water column on a mid-September date to investigate the potential for significant oxygen depletion in the reservoir water (Fig. 21). Temperature at this time was very uniform at 20.9-21.5 °C (69.6-70.7 °F), indicating no appreciable thermal stratification. Indeed, during the previous night, strong breezes had stirred the waters of the reservoir. Despite being well mixed and uniform at the midlake, open water location, morning oxygen levels were quite low from surface to bottom, at approximately 3.5 ppm. This was only 39% of the normal solubility (saturation) level for oxygen at this elevation and water temperature (8.9 ppm). Within a representative aquatic weed bed, oxygen was at a similar level near the surface (3.2 ppm), while concentrations dropped steadily toward the bottom, to a level of 1.7 ppm, or 19% of normal solubility. Most fish cannot live under extended periods with oxygen below approximately 1-2 ppm (Moyle 1976). It is very likely that during mid-summer,

with greater temperatures, increased biological respiration rates, and calmer weather, extensive anoxia may be a routine condition, particularly in the bottom waters of the reservoir.

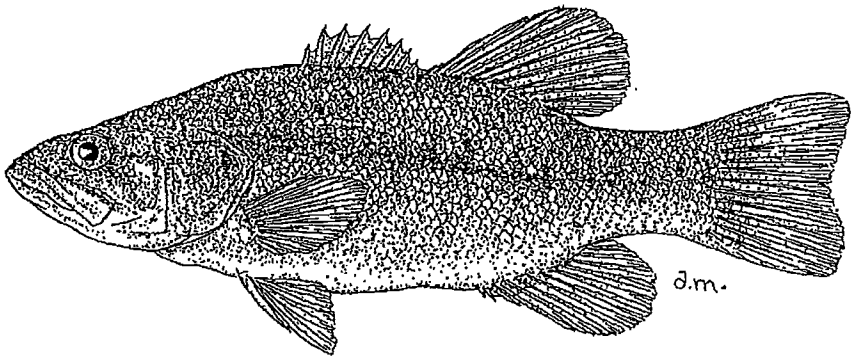
Figure 21. Marsh Creek Reservoir Dissolved Oxygen Profiles
(September 17, 1995; early morning profiles)



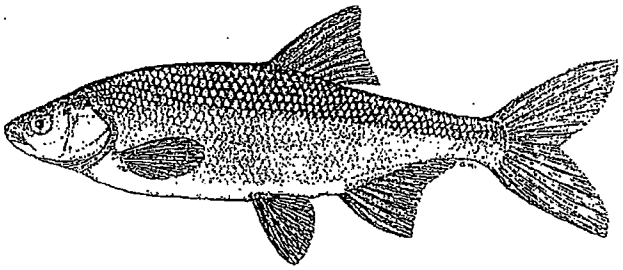
This finding of potentially prohibitively low oxygen occurrences is consistent with the variety of fish species found to inhabit the reservoir at this time. No bottom dwelling fish were taken, despite repeated sampling efforts with a variety of gill nets and set lines that have proven quite effective in other systems. Common bottom fish that would otherwise be likely to occur include catfish and bullhead, native suckers, and carp. The absence of these fish in our sampling indicates either that they were never introduced or that they may be unable to maintain significant numbers within the bottom waters of the reservoir under current conditions.

Of the four fish populations that were found, all were midwater and surface species (Fig. 22). Fish of any significant size, in terms of angling, included hitch (*Lavinia exilicauda*), a native planktivore that reaches approximately 1.5 pounds and 14 inches, and largemouth black bass (*Micropterus salmoides*), a prized gamefish that can reach over 5 pounds. Hitch inhabited the open areas of the reservoir in fairly abundant numbers, while the bass mainly stayed in open channels among the weed beds. Juvenile bass were prevalent, in addition to moderate numbers of adult bass in a range of sizes and ages. The

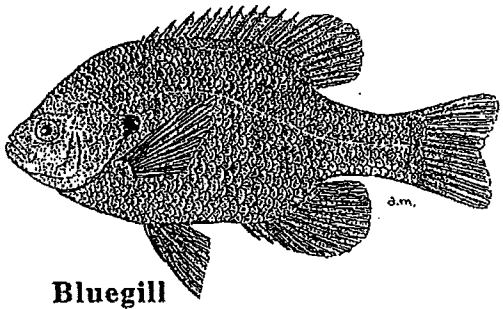
Figure 22. Marsh Creek Reservoir Fish Species Sampled in 1995
(illustrations taken from Moyle 1976)



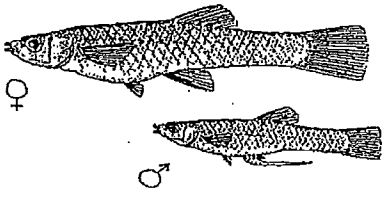
Largemouth Black Bass
Micropterus salmoides
(11-16 inches)



Hitch
Lavinia exilicauda
(10-13 inches)



Bluegill
Lepomis macrochirus
(to 8 inches)



Mosquito Fish
Gambusia affinis
1-2 inches)

other two fish species included mosquito fish (*Gambusia affinis*) and bluegill sunfish (*Lepomis macrochirus*). The surface-feeding mosquito fish were numerous at the shoreline and within the weed beds. These are very small fish, generally under 2 inches in length. The bluegill population was fairly dense and was characterized by stunted growth; i.e. a large number of very small fish. This is a frequent competitive outcome for bluegill in small, shallow water bodies (Moyle 1976). We only sampled a single bluegill of a size likely to be kept by anglers (8 inches, 1/2 pound). The great majority of bluegill were under 5 inches in length. We conclude that, under current reservoir conditions, adult largemouth bass are likely to be the only fish potentially sought for and taken by anglers.

The results of this 1995 fish assessment, as compared to that by the California Department of Fish and Game in 1980, differ in that redear sunfish and catfish were noted in 1980 but not in 1995 (Contra Costa County 1994). Additionally, the bass in the reservoir were reported to be smallmouth black bass in 1980, whereas they were clearly largemouths in 1995. This may reflect either a change in populations due to stocking or, more likely, an earlier misprint.

3.2.3 Reservoir Biota Mercury

A key component of this project was to assess the current levels of mercury contamination in Marsh Creek Reservoir biota, with the primary focus being fish within the range of sizes and types likely to be taken by anglers. For our assessment, we kept 10 "keeper" largemouth bass in a variety of sizes and ages for analysis. We also took 14 adult hitch, 1 large bluegill, and a range of additional biota samples that provide data comparable to other mercury work conducted throughout the state by our research group at the University of California and by state agencies.

In Table 11, the muscle mercury concentrations from sampled adult reservoir fish are presented, together with weight and length data. Liver mercury was also analyzed from a subset of the fish. The muscle mercury results are plotted graphically against fish size in Fig. 23. For both of the larger species, hitch and largemouth bass, muscle mercury levels demonstrated typical patterns of increasing mercury concentrations with increasing size/age of fish. Hitch, within the range of adult sizes common in the reservoir, varied in muscle mercury concentration from approximately 0.3 ppm at 0.6 pounds to approximately 0.5 ppm at 1.0 pounds. Adult largemouth bass muscle mercury ranged from just over 0.6 ppm at 1 pound to approximately 1.0 ppm at 3 pounds. These relationships were quite consistent across the 14 adult hitch and 10 adult largemouth bass sampled in this work. The single sampled bluegill individual that was potentially of angling size had muscle

mercury at 0.63 ppm, intermediate between the adult hitch and adult largemouth bass levels. As hitch consume low trophic level foods (primarily algae and zooplankton), they will generally accumulate less mercury than the piscivorous (fish eating) largemouth bass. The bluegill diet consists mainly of small invertebrates, which are trophically intermediate relative to the diets of the other two species.

Table 11. Marsh Creek Reservoir Adult Fish Tissue Mercury Concentrations *(fresh/wet weight ppm Hg)*

	Weight (g)	Length (mm)	Muscle Hg (wet wt ppm)	Liver Hg
Hitch				
	285	266	0.26	0.33
	298	280	0.37	
	310	270	0.31	
	313	283	0.33	
	346	292	0.50	
	350	290	0.46	
	350	301	0.41	
	370	295	0.48	
	380	303	0.41	
	402	309	0.48	
	406	316	0.47	
	420	310	0.55	
	437	301	0.43	0.45
	480	322	0.48	
Bluegill				
	215	196	0.63	0.77
Largemouth Bass				
	412	283	0.64	0.55
	480	295	0.66	
	560	302	0.59	
	815	348	0.86	
	870	344	0.71	0.36
	930	343	0.72	
	1,030	372	0.84	
	1,040	362	0.90	0.58
	1,160	387	0.92	
	1,155	403	1.04	1.21

The U.S. FDA health standard for mercury in fish flesh is 1.0 ppm. However, the criterion recommended by the U.S. Academy of Sciences, the California Department of Health Services, and the great majority of other nations internationally is 0.5 ppm (TSMP 1990). In Fig. 20, the reservoir fish muscle mercury concentrations are compared to the 0.5 ppm criterion. The levels clearly straddle the line, with the "keeper" sized bluegill and largemouth bass all being well above the 0.5 ppm level. The bass ranged up to and even

Figure 23. Mercury Concentrations in Adult Fish From Marsh Creek Reservoir *(fish collected September 1995)*

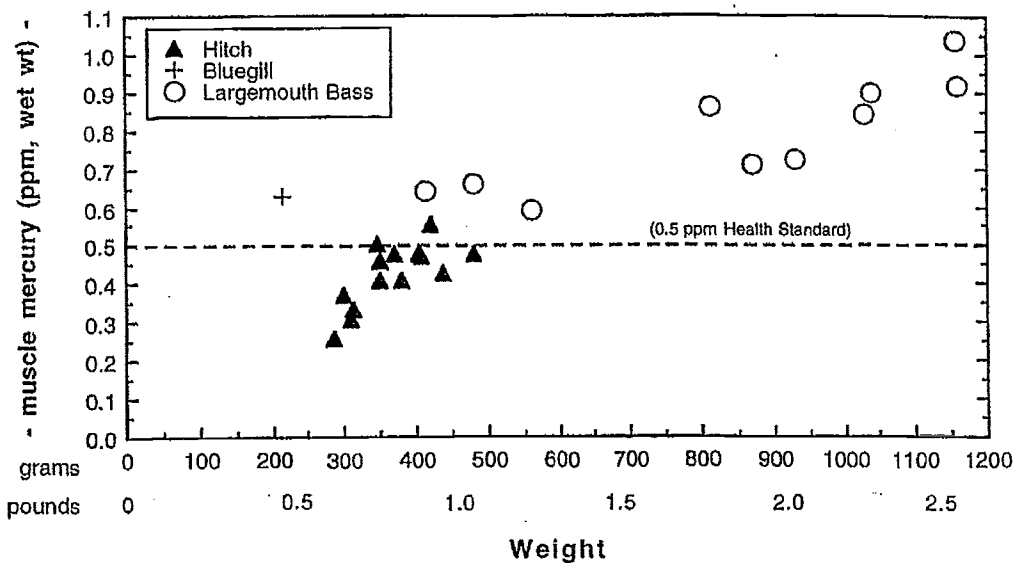
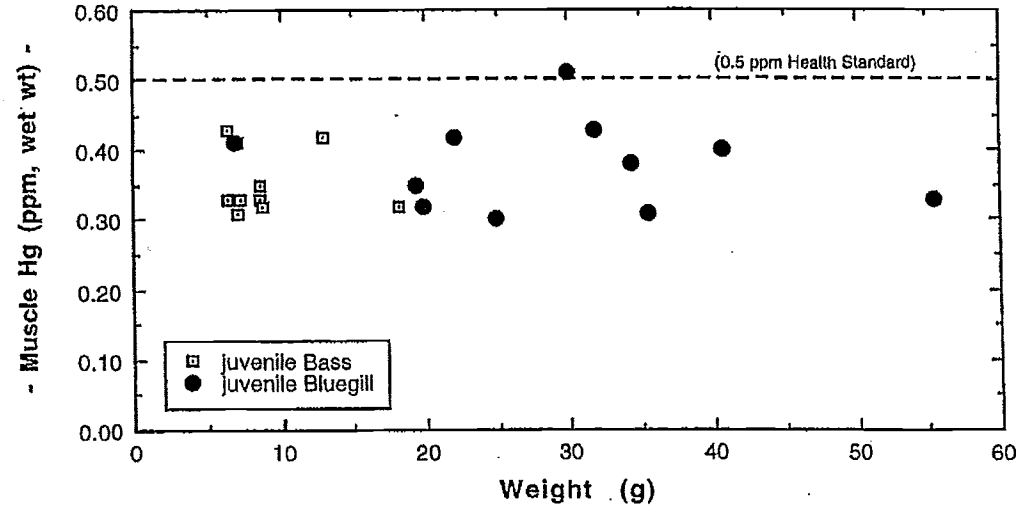


Figure 24. Mercury Concentrations in Juvenile Fish From Marsh Creek Reservoir *(fish collected September 1995)*



above the FDA 1.0 ppm standard in the larger individuals. These concentrations are clearly high. However, while of concern, they are not exceptionally high for this region of California, where mercury contamination is widespread. In our own research and that of other institutions and government agencies, similar levels have been reported from other water bodies directly impacted by mercury mines, including Lake Nacimiento and Lake Herman (TSMP 1990). Depending on the characteristics of the lake, some mine impacted sites have lower fish mercury levels, such as Clear Lake (Suchanek et al. 1993, Slotton et al. 1996), while others have higher levels, such as Davis Creek Reservoir north of Lake Berryessa (Reuter et al. 1989, Slotton et al. 1995b) and the small reservoirs near the New Almaden mine (TSMP 1990). Fish mercury levels nearly as high as those in Marsh Creek Reservoir can also be found in a number of the Sierra Nevada foothill reservoirs which have trapped mercury dating from the gold mining era of the 19th century (TSMP 1990, Slotton et al. unpublished data).

The muscle mercury concentrations in Marsh Creek Reservoir fish in 1995 can thus be considered to be too high for regular consumption, but not exceptionally high for northern California. An important consideration is that the levels were close enough to the health criteria that, if bioavailable mercury in the reservoir could be lowered by a significant fraction, future reservoir fish might be brought well under the guideline levels.

In addition to the large fish, we collected extensive samples of juvenile bass, juvenile bluegill, mosquito fish, and reservoir invertebrates. These types of samples will be extremely useful as bioindicators of potential year-to-year changes in mercury bioavailability in the reservoir, in conjunction with any mitigation trials upstream at the Mt. Diablo mine and/or in the reservoir itself. While the "bottom line" test of effectiveness for mitigation work will ultimately be determined by significant declines in muscle (fillet) mercury in the larger, edible fish of the reservoir, the larger fish accumulate their mercury over several to many years time. Because of this, their mercury concentrations can change only slightly within time scales of a year or two, even with major changes in environmental mercury. They generally do not show significant corresponding changes in their tissue mercury levels until they have lived the greater proportion of their lives under the new conditions (Slotton et al. 1995b). A major research focus of the senior author over the past decade has involved working with alternate bioindicator organisms, supplemental to adult fish, to develop approaches that can determine changes in pollutant exposure at a much finer scale, in terms of both time and location. We are using some of those tools in this project, including the invertebrate work in the upper watershed and the juvenile fish and invertebrate work in Marsh Creek Reservoir.

The young-of-year bass and small bluegill will be particularly useful (Table 12, Fig. 24). Muscle mercury concentrations in these small fish were quite consistent across the range of sizes present, falling between 0.30 ppm and 0.43 ppm in all 10 of the sampled juvenile bass (mean = 0.36 ppm) and in 10 of the 11 sampled small bluegill (mean = 0.37 ppm). One bluegill was somewhat higher, at 0.51 ppm. Because the young-of-year fish can have only accumulated mercury in the year they are sampled, these consistent 1995 levels can be compared in future years to corresponding levels in new young-of-year fish, to determine relative changes in exposure.

Table 12. Marsh Creek Reservoir Juvenile Fish Muscle (Fillet) Mercury Concentrations *(fresh/wet weight ppm Hg)*

Juvenile Bluegill Muscle Mercury			Juvenile Largemouth Bass Muscle Mercury		
Weight *(g)*	Length *(mm)*	Hg *(ppm)*	Weight *(g)*	Length *(mm)*	Hg *(ppm)*
6.9	72	0.41	6.4	78	0.33
19.4	99	0.35	6.4	80	0.43
19.8	100	0.32	7.0	80	0.41
22.0	104	0.42	7.1	80	0.31
24.9	104	0.30	7.3	82	0.33
30.0	112	0.51	8.5	87	0.35
31.7	114	0.43	8.6	89	0.33
34.3	117	0.38	8.7	89	0.32
35.4	118	0.31	12.9	98	0.42
40.7	124	0.40	18.2	111	0.32
55.4	131	0.33			

In addition to the small fish muscle mercury samples, we made composite, whole body samples of young-of-year bass and mosquito fish (Table 13). These composites, grouped by size class for each species, provide additional measures of short term reservoir mercury bioavailability. They also can be compared to the composite small fish data generated in the watershed work (section 3.1.3). As seen for muscle, whole body mercury concentrations in the juvenile bass were very similar among the range of sizes present, at 0.23-0.29 ppm. The levels in whole body composites were somewhat lower than those analyzed in muscle tissue. This is frequently the case, as muscle is the major site of mercury accumulation in fish (Reuter et al. 1989, Slotton 1991, Suchanek et al. 1993, Slotton et al. 1996). The tiny mosquito fish were also consistent in their whole body composite mercury levels, at 0.15-0.20 ppm among the dominant range of sizes. A single much larger individual, potentially several years old, had anomalously higher mercury concentration, at 0.57 ppm.

Table 13. Marsh Creek Reservoir Biota Composite Samples (Whole) Mercury *(wet wt ppm Hg, fish; dry wt, invertebrates) September 1995*

Identification	Weight (g)	Length (mm) In Comp.	Individuals	Hg (ppm)
Juvenile Largemouth Bass	(6.9)	(78)	n=5	0.29
Whole Fish Composite Samples	(8.6)	(88)	n=3	0.26
" " "	12.9	98	n=1	0.24
" " "	18.2	111	n=1	0.23
Gambusia (Mosquito Fish)	(0.1)	(20)	n=62	0.20
Whole Fish Composite Samples	(0.2)	(30)	n=32	0.15
" " "	0.5	38	n=1	0.15
" " "	2.1	57	n=1	0.57
Predatory Invertebrate Composite Samples (*dry* weight ppm Hg)				
Coenagrionid Damselflies	(winged adults)		n=25	0.09
Aeschnid Dragonflies	(winged adults)		n=4	0.27
Libellulid Dragonflies	(winged adults)		n=2	0.39

As final bioindicators of reservoir mercury, we took reservoir damselflies (Coenagrionidae) and two types of dragonfly (Aeschnidae and Libellulidae) in composite samples of winged adults (Table 13, Fig. 25). These were dried and powdered, similar to the watershed invertebrate samples. Damselflies and dragonflies are good indicators of reservoir conditions as they spend the majority of their lives in the aquatic stage, consuming other aquatic invertebrates, and continue to consume primarily reservoir-derived invertebrates even after becoming winged adults. The dragonfly composites contained 0.27 ppm mercury for one type and 0.39 ppm for the other. The smaller damselflies had a lower level of 0.09 ppm.

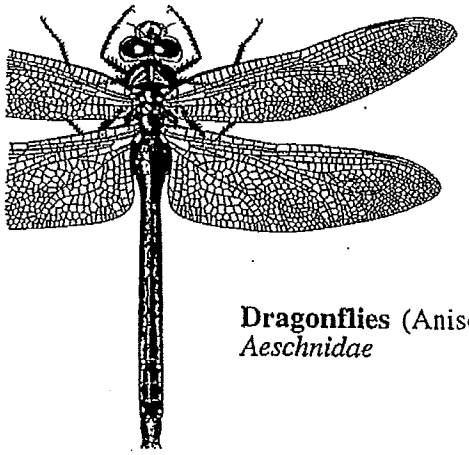
All of these samples provide initial baseline data of current mercury bioavailability in the reservoir. They can be compared to similar collections in future years, to determine the extent of potential changes in mercury availability.

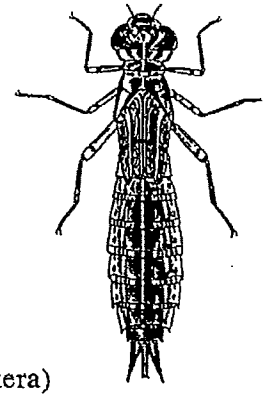
Figure 25. Marsh Creek Reservoir Invertebrates Sampled in This Project

(winged adults taken, adults and aquatic stages shown)

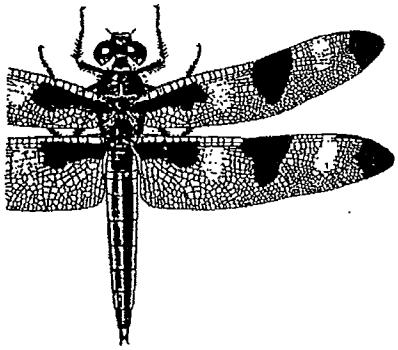
(illustrations taken from McCafferty 1981)

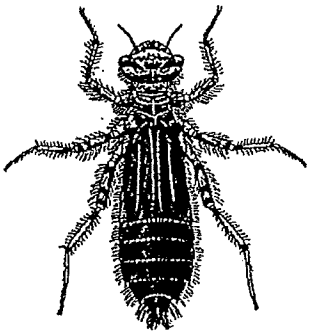
Damselflies (Zygoptera)
Coenagrionidae





Dragonflies (Anisoptera)
Aeschnidae





Dragonflies (Anisoptera)
Libellulidae

4. DISCUSSION AND CONCLUSIONS

Prior to this study, the Mt. Diablo Mercury Mine was generally assumed to be the dominant source of mercury to the Marsh Creek watershed. However, data was not available to quantify this input, rank the mine against other potential mercury sources, or rule out the possibility of a generalized source of mercury in this mercury-enriched watershed. Now, with the 1995 watershed mercury information assembled here, we can establish that the mine site does indeed represent the overwhelming source of mercury to the watershed. By collecting consistent, above detection aqueous mercury concentration data, together with accompanying flow information, from all major source areas, it has been possible to rank the various inputs on a mass balance basis. While the various loading values measured were specific to the particular flow regime during the sampling period, the relative contributions are of greater importance.

Both the aqueous mercury data and those from the invertebrate bioindicator organisms strongly implicate the mine region as being the dominant source of mercury in the Marsh Creek watershed. The aqueous mercury mass balance calculations indicate that approximately 95% of the total input of mercury to the upper watershed derives from Dunn Creek. The mine area itself was the clear source region for the mercury, with an estimated 88% of the total input of mercury to the upper watershed traceable specifically to the current exposed tailings piles. This is a remarkably high percentage, particularly in light of the geologically mercury-rich nature of the watershed in general, and indicates that the mercury in exposed, processsed, cinnabar tailings material is exceptionally available for aqueous transport downstream.

The data indicates that the great majority of the mercury load eminating from the tailings is initially mobilized in the dissolved state. This dissolved mercury rapidly partitions onto particles as it moves downstream. The bulk of downstream mercury transport is thus particle-associated.

In marked contrast to the massive mercury loads carried by lower Dunn Creek, this small tributary delivered less than 7% of the watershed's total flow and less than 4% of the suspended solids load. As downstream mercury accumulations are greatly dominated by the sediment burden, a lowering of mercury concentrations in the downstream surficial sediments would almost certainly help to drive down both the aqueous mercury concentrations and the corresponding flux of mercury into biota. With 95% of the mercury originating from the Mt. Diablo Mine area, but 95% of the watershed's suspended sediment load deriving from non-mine, low mercury source regions, any significant decrease in the export of mercury from the immediate mine site should result in a corresponding decline in

surficial sediment mercury concentrations downstream and in Marsh Creek Reservoir. With an estimated 88% of the currently exported mercury linked directly to the tailings piles themselves, mercury source mitigation work within the watershed would clearly be best directed toward this localized source.

Though mitigation recommendations were not a part of our scope of work, we have several comments on the subject that may help to both clarify the task and direct the planning process:

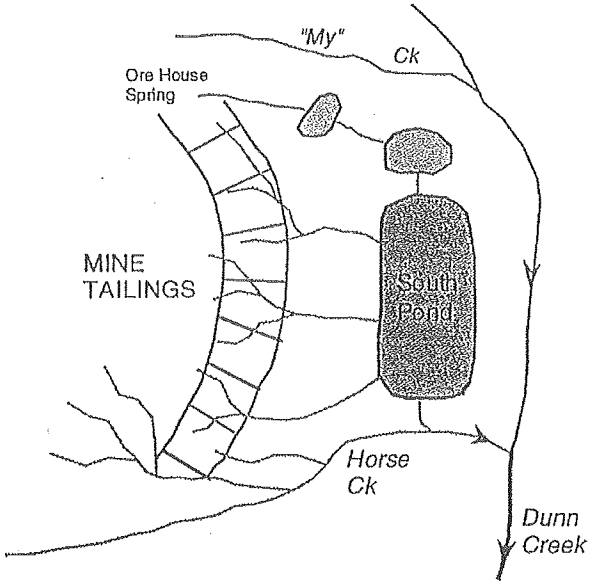
1. In order to reduce the downstream export of mercury from the Mt. Diablo Mercury Mine, we believe that the major mitigation focus should be directed toward source reduction from the tailings piles themselves, with subsequent containment of the remaining mobile mercury fraction being a secondary consideration.

2. The data we have assembled here indicate that source reduction of mobile mercury from the tailings will best be accomplished by diminishing the flow of water through the tailings. Rather than being a problem of direct erosion of tailings material, in solid particle form, to downstream, it appears that the predominant mode of mercury mobilization from the tailings involves the acidification of runoff/seepage water by the processed, high sulfur ore material, and the subsequent dissolution of mercury from the ore into the acidic water. Very similar trends are concurrently being found at the EPA Superfund site at Clear Lake's Sulfur Bank Mercury Mine.

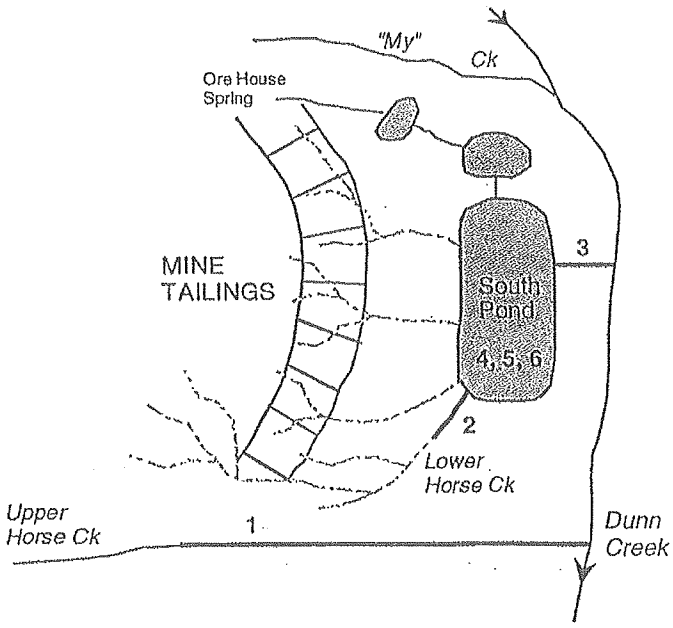
3. Lowering the flow of water through the tailings can be accomplished by (a) diverting any runoff that originates from outside of the tailings zone and (b) diminishing the movement of direct precipitation into and through the tailings. Diversion of upslope surface and groundwater flows away from the tailings will likely be the simplest and most cost-effective procedure to begin with. As part of this operation, upper Horse Creek should be diverted directly to Dunn Creek, bypassing the tailings (Fig. 26).

4. Direct water inputs to the tailings from precipitation are more problematical, but can be significantly lessened with a variety of revegetation schemes. Central to the most effective of these techniques is the application of a soil cover over the tailings that is sufficiently thick and porous to hold the average winter precipitation. Through the careful revegetation of the slope with appropriate, hardy plant species, much of this soil water can be annually soaked up and removed to the atmosphere through evapotranspiration. While grasses may be most efficient at initially stabilizing the slope, perennial shrubs and trees exhibit the greatest rates of evapotranspiration and

Figure 26. Current Mine Site Creek and Settling Pond Configurations vs Modification Options



a. Current configuration



b. Potential modifications

1. Pipe upper Horse Ck past tailings directly to Dunn Ck.
2. Divert lower Horse Ck into South Pond.
3. Construct new South Pond outlet on east side.
4. Deepen South Pond.
5. Periodically lime South Pond.
6. Periodically dredge South Pond.

have thus been found to be the most effective in removing accumulated soil water (Mary Ann Showers, California Department of Conservation, personal communication).

5. Any containment/treatment scheme for the remaining mobile mercury eminating from the tailings region will be enhanced by source reduction. Because the current principal sediment settling basin does not appear to be providing the desired level of effectiveness, we would suggest some modifications (also shown in Fig. 26):

   (a) As lower Horse Creek contained the majority of the mercury loads eminating from the tailings, it should be diverted into the pond.
   (b) Because much of the tailings inflow enters the pond near the southwest corner, the outflow should be relocated to a part of the pond distant from the inflow, i.e. to the east side of the pond. This will be even more essential if lower Horse Creek is diverted into the pond.
   (c) Consider deepening the pond, making more room for the deposition of precipitating solids and rendering them less susceptible to sediment resuspension.
   (d) Consider periodic liming of the pond to lower the acidity of the water and promote the rapid precipitation and deposition of dissolved metals.
   (e) Occasional dredging out of the accumulated depositional material may be necessary. This could be accomplished with minimal consequences to downstream by working in the dry season and temporarily sealing the outflow for the operation.

   Again, all aspects of secondary containment will be enhanced by source reduction of water, sediment, and associated mercury from the tailings.

Mercury in Marsh Creek Reservoir edible fish flesh was above the health standard concentration of 0.5 ppm in all samples of "keeper" sized bass and bluegill, with the larger bass ranging up to and slightly over 1.0 ppm muscle mercury. Fish accumulate mercury in their muscle (fillet) tissue almost entirely in the methyl form. Methyl mercury is naturally produced from inorganic mercury mainly as a metabolic byproduct of certain bacteria (Gill and Bruland 1990). As methyl mercury was measured to be quite low in storm runoff inflows to the reservoir (0.20 ng/L, Table 4), it is likely that a significant proportion of the methyl mercury accumulating in Marsh Creek Reservoir fish is produced within the reservoir from inorganic mercury associated with depositional sediments. Any lowering of the reservoir depositional sediment mercury concentration, through upstream mine site mitigation work, should act to reduce the rate of mercury methylation in the reservoir.

warranted, it may be possible to further reduce mercury methylation rates within the reservoir through water column manipulation to minimize anoxia. This is an area that we are currently investigating in our mercury biogeochemical research work.

With this 1995 watershed mercury assessment, a comprehensive, accurate data base has been initiated for the County, describing mercury conditions throughout the major components of the system. This includes mercury concentration, loading, and relative mass balance data for water and suspended sediment from all major tributaries, biota mercury levels from throughout the watershed, and depositional sediment and biota mercury concentrations from Marsh Creek Reservoir. The utility of these data for use as a general baseline could be substantially increased with the sampling of selected parameters in the current water year (1996), prior to any mitigation work, to help account for natural inter-annual variability. We note that 1995 was an extremely wet, high-runoff year, while 1996 is more of an average water year. It is our strong recommendation that the County obtain as extensive and varied a baseline data record as possible prior to mitigation, and maintain selective monitoring of key sites and parameters throughout and following mitigation work. Ongoing monitoring of carefully chosen indicator samples, both at the mine and in downstream receiving waters, will play an integral role in guiding and assessing the effectiveness of any mitigation efforts.

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THIS AGREEMENT, entered into this 1st day of November, 1954, between MT. DIABLO QUICKSILVER COMPANY, LTD., a Nevada corporation, hereinafter referred to as "Lessor", and CORDERO MINING COMPANY, a Nevada corporation, hereinafter referred to as "Lessee",

W I T N E S S E T H:

WHEREAS, Lessor is the owner of the following described mine and mining property, together with all appurtenances:

DESCRIPTION:

The northeast quarter of the southeast quarter of Section 29 and the south half of the southwest quarter of the northeast quarter of Section 29, Township 1 North, Range 1 East, Mount Diablo Base and Meridian, containing 60 acres, more or less;

EXCEPTING THEREFROM: "That certain syphon pipe leading therefrom to a water trough on the northeast quarter of the southeast quarter of said Section Twenty-nine (29), which said water spring, trough, and pipe are excepted from this deed," as provided for in the deed from Edward A. Howard and Daisy B. Howard, his wife, to Mount Diablo Quicksilver Company, Ltd., a corporation, dated December 29, 1933, and recorded Feb. 1, 1934 (File No. 1060);

And

The northwest quarter (N.W.1/4) of the southeast quarter (S.E.1/4) of Section 29, in Township 1 North of Range 1 East, Mount Diablo Base and Meridian. Said property shall not include the following described property, to wit: that land beginning at the northwest corner of the northwest quarter of the southeast quarter of Section 29, Township 1 North, Range 1 East, Mount Diablo Base and Meridian; thence running southerly along the dividing line between the northeast quarter of the southwest quarter and the northwest quarter of the southeast quarter of said Section 29, a distance of 20 chains to the southwest corner of the northwest quarter of the southeast quarter of Section 29; thence running along the southerly line of the northwest quarter of the southeast quarter of Section 29, a distance of 2.924 chains; thence leaving said line, and running in a northerly direction, a distance of 20.23 chains to the point of beginning.

EXCEPTING from the demised premises the house known as the Blomberg house together with the right to use such water as is necessary for domestic purposes. In the event the option to purchase is exercised then this exception will be without effect and title to the Blomberg house shall pass with the other property.

IN ADDITION Lessee shall have the right to any access road over which Lessor has control.

And

WHEREAS, the Lessee desires to lease and to acquire an option to purchase the whole of said mining property above described, which the Lessor is willing to grant upon the terms and subject to the conditions hereinafter set forth,

NOW, THEREFORE, in consideration of the premises and the sum of One Dollar ($1) paid by the Lessee to the Lessor, receipt of which is hereby acknowledged, the Lessor hereby grants and leases to Lessee the above-described property for the purpose of investigating, exploring, prospecting, drilling, mining, producing, milling, and removing ores, metals, minerals, and values of every kind, and for the purpose of erecting thereon mills, plants and other structures in connection with said purposes, for the term of Ten (10) years from the date hereof with right to renew, upon a sixty (60) day prior written notice to Lessor, for an additional Ten (10) years on the same terms, including the right to apply payments made during the first Ten (10) years on the purchas price if said option to purchase is exercised during the second ten (10) years. These rights shall remain in effect during the period of the lease unless sooner terminated as hereinafter provided.

In consideration of said lease, IT IS HEREBY MUTUALLY

AGREED AS FOLLOWS:

1. RENTAL AND ROYALTY: The Lessee shall pay to the Lessor monthly, as rental for said property, a percentage of the proceeds resulting from the operation of said property by Lessee. This percentage shall be ten per cent (10%) of the money received for ores, metals, minerals, and values mined, saved and sold less freight, insurance, and brokerage, or Two Hundred Dollars ($200) per month, whichever is greater.

Unless notified as hereafter set forth, Lessee shall sell all flasks of quicksilver produced from the premises; provided, however, that Lessor shall have the option to receive the percentage royalties in kind, i.e. in flasks of quicksilver -- upon Lessor's giving Lessee a ninety (90) day prior written notice of exercise of such option. Similarly Lessor shall have the option by such a 90-day notice to have Lessee resume the sales of all production. Delivery in kind to Lessor shall be f.o.b. the mining property. Lessee agrees to store for Lessor's account any production taken by Lessor as royalty in kind without charge -- title, however, to such flasks of quicksilver for delivery in kind shall be deemed to pass to Lessor at the time Lessor receives royalty statements therefor from Lessee (for insurance and other purposes). Lessee shall supply Lessor with full and complete supporting data with regard to deliveries in kind.

2. OPTION: The Lessor shall and does hereby give and grant unto the Lessee the sole, exclusive and irrevocable right and option to purchase and acquire the whole of the said mining

property above described, upon the payment of the option price, on or before the termination of this lease, and any renewal, and in the manner and upon the due performance of the covenants to be kept and performed by the Lessee, all as herein provided.

3. PURCHASE PRICE: The Lessee, upon the exercise of said option, shall pay the Lessor as a total purchase price for the above-described property, the sum of One Hundred Seventy Thousand Dollars ($170,000) lawful money of the United States of America. All rental and royalty payments made to Lessor hereunder shall be credited on the purchase price. The balance of the purchase price shall be paid in full upon the exercise of said option and delivery of a good and sufficient deed as herein provided.

For the purpose of crediting royalty payments on the purchase price, in connection with deliveries in kind, the credits shall be based upon the average proceeds per flask sold by Lessee in the particular month involved; provided, however, that if no sales are made by Lessee during any such month, royalty payments as well as credits on the purchase price shall be determined by taking the average of the weekly low quotations for the particular month as set forth in the E. & M. J. Metal and Mineral Markets Magazine (less freight, insurance and brokerage); provided further, that such method shall be applied for the purpose of computing royalties or for any other purpose applicable to the provisions of this agreement.

4. MANNER OF PAYMENT: The royalty payable to Lessor hereunder, shall be payable in monthly installments commencing

on the 15th day of December, 1954, and continuing on the 15th day of each and every month thereafter until the expiration of the term hereof or the earlier termination of this lease. Royalty payments shall be based on receipts from sales of the previous month, on the basis provided for in Paragraph 1 above. Notwithstanding anything to the contrary contained herein, it is agreed that each monthly installment shall be not less than Two Hundred Dollars ($200). The Lessee shall transmit with the royalty check a full and true statement of the production and sales receipts of the previous month. A representative of the Lessor shall at all times have the right during regular business hours to examine the underground operations and the furnace plant.

5. MINING METHODS AND CONDITIONS: Lessee shall be sole judge as to methods of mining and milling, what constitutes ore, when and if ore is extracted or milled and all other phases of operating the property. All operations conducted by the Lessee upon the property shall be performed in accordance with the laws and regulations of the United States and the State of California and in accordance with good practices in workmanship, mining and milling, particularly with regard to the safety and welfare of workers. The Lessee shall at all times during the existence of this lease maintain a watchman on the premises.

6. POSSESSION: Lessee, its agents, representatives or employees may enter in and upon and take possession of the whole or any part of the property above described, at once; and, may then and there commence any work to explore or mine the property,

in keeping with the tenor of this agreement, that it may deem advisable, and for that purpose, may use any buildings, equipment or mining facilities which may now be situated on the premises, and owned by Mt. Diablo Quicksilver Company, Ltd., with the exception of that certain house noted in the above description of the premises.

The Lessee may use, in working on the demised premises, all supplies now on the demised premises, but, in the event he should remove or dispose of said supplies otherwise than in developing the demised premises, he shall pay the Lessor the reasonable value thereof. During the term of this lease the Lessee may use all tools, machinery and equipment of the Lessor now on the demised premises for the purpose of developing the same and operating and maintaining the same, and shall have the privilege of replacing or remodeling the same, and any structures on the demised premises. An inventory enumerating such tools, machinery or equipment and structures, is attached hereto, marked Exhibit "A" and made a part hereof. Lessee shall maintain the same and replace any that are broken, damaged or worn out, normal wear and tear excepted. Such replacements shall become the property of the Lessor. At the expiration of this lease or in the event of the Lessee vacating the demised premises for any reason, Lessee may remove, as provided in Paragraph 14, any portable tools, machinery, or equipment which Lessee has placed upon the property, or any portable structures which Lessee may have placed upon the property, but Lessee may not remove any permanent structures or any repairs or

replacements to units of equipment or machinery now on the property.

7. INDUSTRIAL INSURANCE: Lessee shall comply with the laws of the State of California for the protection of employees against injury and disease and, in that connection, shall save harmless the Lessor against any damage by reason of such claims. Lessee shall provide and maintain at Lessee's expense fire insurance and other appropriate casualty insurance on all of the structures, machinery, equipment and tools covering the full appraised insurable value thereof for the maximum protection of both Lessor and Lessee, as their interests may appear, and Lessee shall furnish to Lessor certificates of such insurance if required, and the same shall be subject to the approval of Lessor for adequacy of protection.

8. PUBLIC LIABILITY: Lessee shall save Lessor harmless from any liability for property damage, personal injury or death arising from the work, mining or acts performed by Lessee and its employees in connection with the lease and option.

9. LIENS: Lessee shall save Lessor harmless from all liens upon the property made or suffered by Lessee, and in that connection shall post the property in accordance with law, noticing owner's (Lessor's) non-responsibility, before commencing any work.

10. TAXES: Lessee agrees to pay, prior to delinquency, all taxes and assessments, including personal property taxes and

net proceeds of mine taxes, to State, County or School District, or any other government subdivision, with the exception of taxes on royalties paid to Lessor. Taxes shall be prorated as of the date hereof.

11. DEFAULT: Time shall be of the essence of this agreement. In the event of default of any of the payments or covenants herein contained, by Lessee, this lease shall terminate, at the option of the Lessor. If Lessor elects to terminate this agreement by reason of Lessee's default, Lessor shall serve notice of his intention by registered mail, or personal service upon Lessee or its duly authorized agent for service of process. Upon service of notice, Lessee shall have sixty (60) days in which to cure said default. If within said sixty (60) day period the default has not been cured, Lessor may terminate this agreement by giving Lessee notice of such termination, and at that time this agreement and all of the rights of Lessee hereunder shall terminate.

12. PURPOSE: This agreement is a lease and option only, and the Lessee shall have the right to surrender this contract and to discontinue any and all work and payments hereunder at any time, without liability therefor, upon giving Lessor thirty (30) days' prior written notice of intention to so terminate, except that Lessee shall be liable for royalties and amounts due and payable at the date of such termination. Upon demand after surrender, Lessee shall execute and deliver to Lessor a good and sufficient surrender and release of all rights hereunder.

Lessee shall control the discharge of water from the

mine properties in such manner as not to pollute any of the wells on any of the adjoining property or the waters of Marsh Creek or Dunn Creek. Lessee is advised of that certain decision and order of the Water Pollution Control Board of the State of California, dated December 14, 1953, and Lessee agrees to comply in all respects with said order, as the same may be modified, amended or altered from time to time, and with any and all other orders, rules and regulations of any governmental authority in respect of discharge of water from the mine properties.

13. INSPECTION: The owner (Lessor) or his duly authorized agents or representatives shall have the right at all reasonable times to enter upon the said property and inspect the work conducted by the Lessee thereon, or records of the production of the mine.

14. REMOVAL OF EQUIPMENT: In the event of termination of this contract, by surrender or default as provided, the Lessee may, within a period of ninety (90) days thereafter, remove any and all machinery, power plant, equipment, building, track, tools, and supplies placed thereon by Lessee except as provided in Paragraph 6 above. In the event of termination Lessee shall provide Lessor with copies of any mine maps of this property which it may have.

15. ASSIGNMENT: Lessee shall not assign this lease or any interest therein and shall not sublease or underlet the premises, or any part thereof, or any right or privilege appurtenant thereto without the written consent of the Lessor -- and such consent shall not be unreasonably withheld. Notices required

hereunder shall be deemed to be completed when made in writing, deposited in the United States mail, registered, postpaid, addressed to

Lessor: MT. DIABLO QUICKSILVER COMPANY, LTD.
Clayton, California

Lessee: CORDERO MINING COMPANY
131 University Avenue
Palo Alto, California

16. On the exercise of the option herein granted to Lessee to purchase certain property, and the payment of the further purchase price therefor, as hereinabove provided, Lessor shall convey said property to Lessee by grant deed. There has been exhibited to Lessee, and Lessee is fully advised of, that certain preliminary title report of California Pacific Title Insurance Company on said property dated October 28, 1954 (Order No. 190821). It is understood and agreed that at any time after the expiration of three (3) years from the date hereof, or upon payment by Lessee to Lessor of one-half (1/2) of the said purchase price -- whichever event is earlier -- on demand by Lessee to Lessor, Lessor shall take such steps and commence such legal proceedings as it may be advised necessary to clear the title of said land of the exceptions appearing on said title report, and Lessor shall thereafter prosecute said proceedings with all reasonable diligence.

IN WITNESS WHEREOF, Lessor and Lessee have caused these presents to be executed by their officers thereunto

duly authorized, the day and year first above written.

MT. DIABLO QUICKSILVER COMPANY, LTD.

By Vic Blomberg
Vic Blomberg
President

By Harold Blomberg
Harold Blomberg
Secretary

(Corporate Seal)

LESSOR

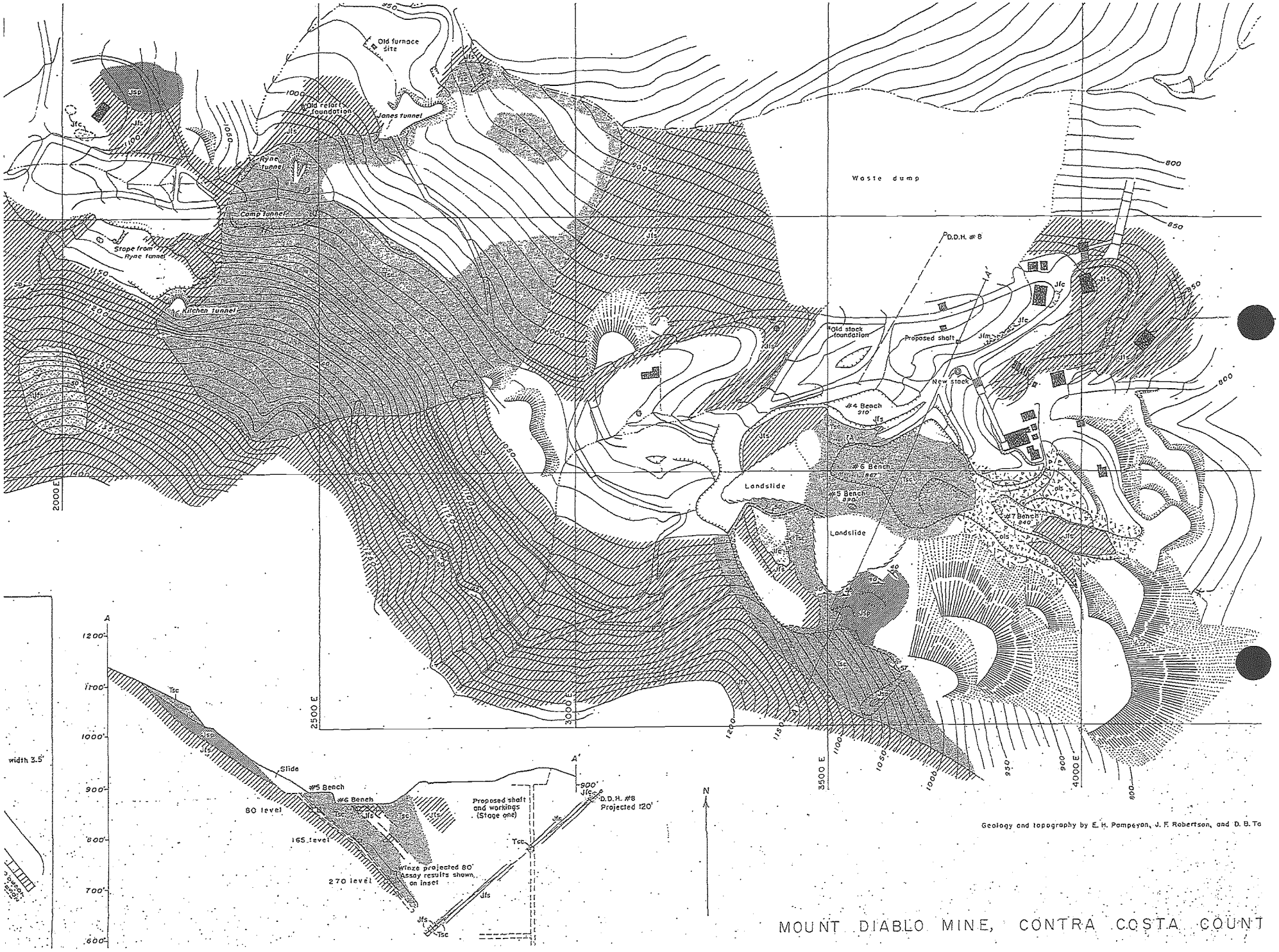
CORDERO MINING COMPANY

By S. H. Williston
S. H. Williston
Vice President

E. A. Williston
Asst. Secretary

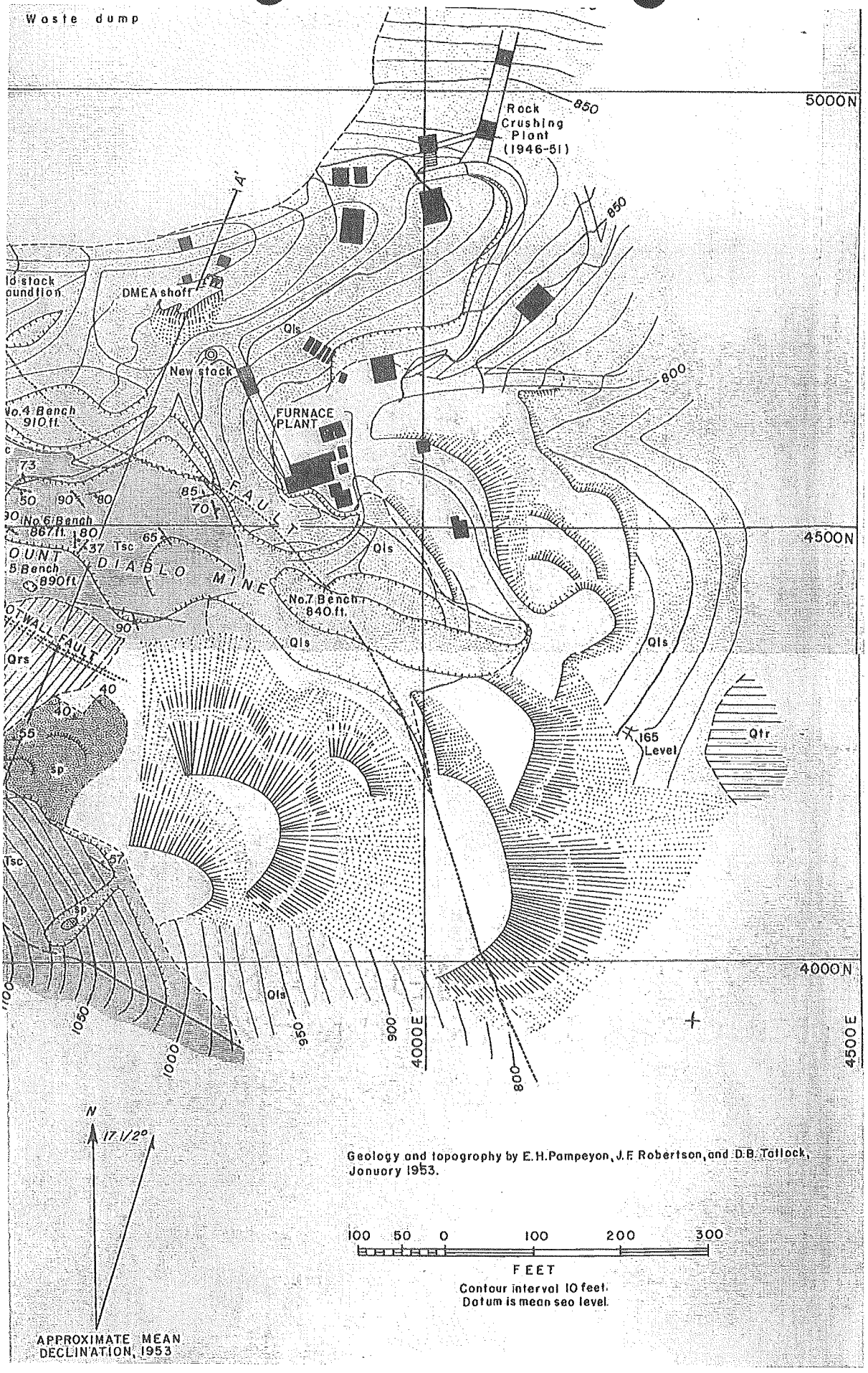
(Corporate Seal)

LESSEE



Geology and topography by E. H. Pampeyan, J. F. Robertson, and D. B. To

MOUNT DIABLO MINE, CONTRA COSTA COUNT


Waste dump
5000N
Rock Crushing Plant (1946-51)
850
A'
DMEA shaft
Old stack foundation
New stack
Qls
FURNACE PLANT
800
No.4 Bench 910 ft.
No.6 Bench 867 ft.
No.5 Bench 890 ft.
FAULT
DIABLO MINE
4500N
No.7 Bench 840 ft.
Qrs
FOOTWALL FAULT
Tsc
Qtr
165 Level
4000N
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4500E
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1000
950
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17 1/2°
APPROXIMATE MEAN DECLINATION, 1953
Geology and topography by E.H.Pampeyon, J.F.Robertson, and D.B.Tallock, January 1953.
100 50 0 100 200 300
FEET
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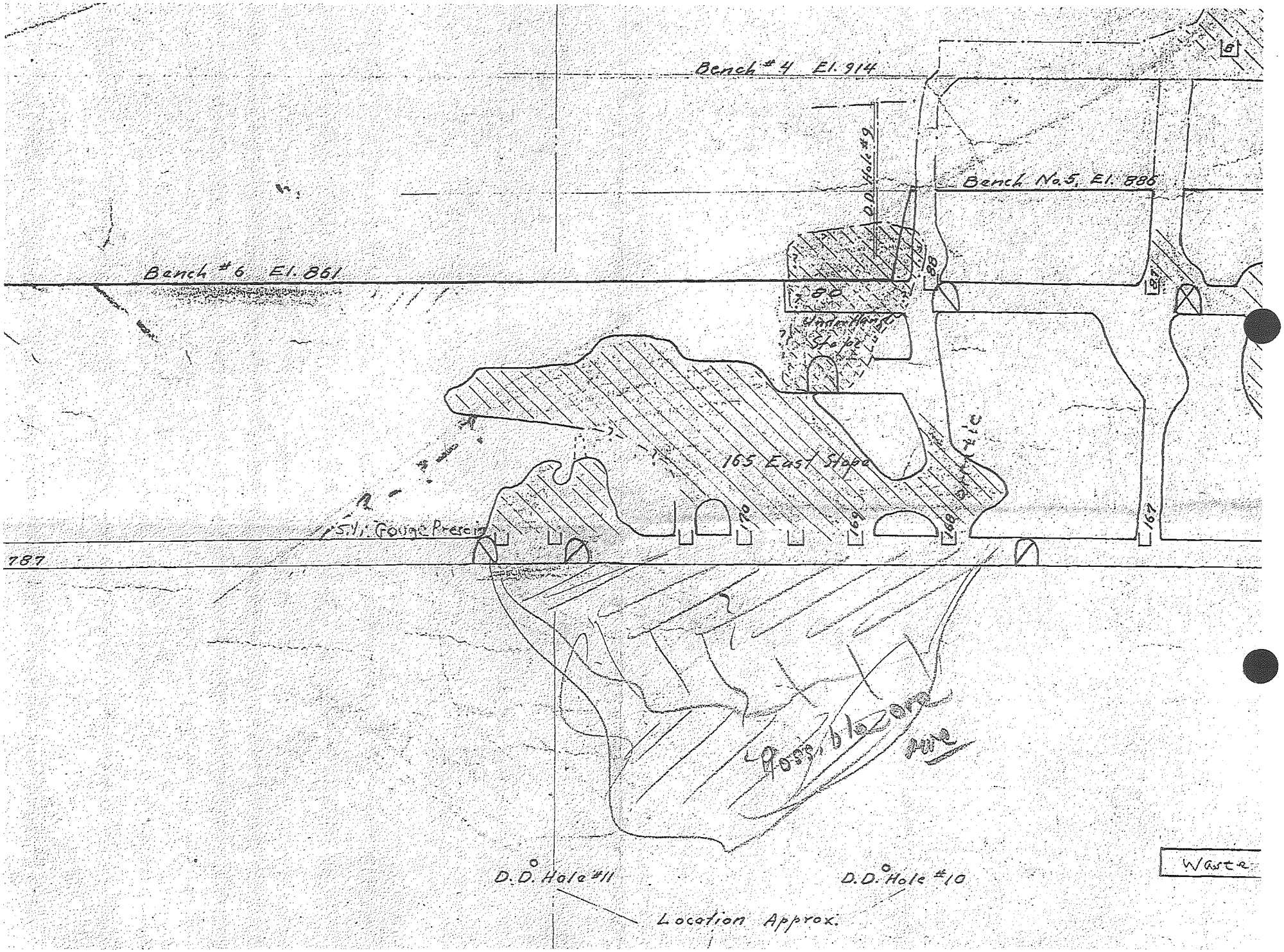
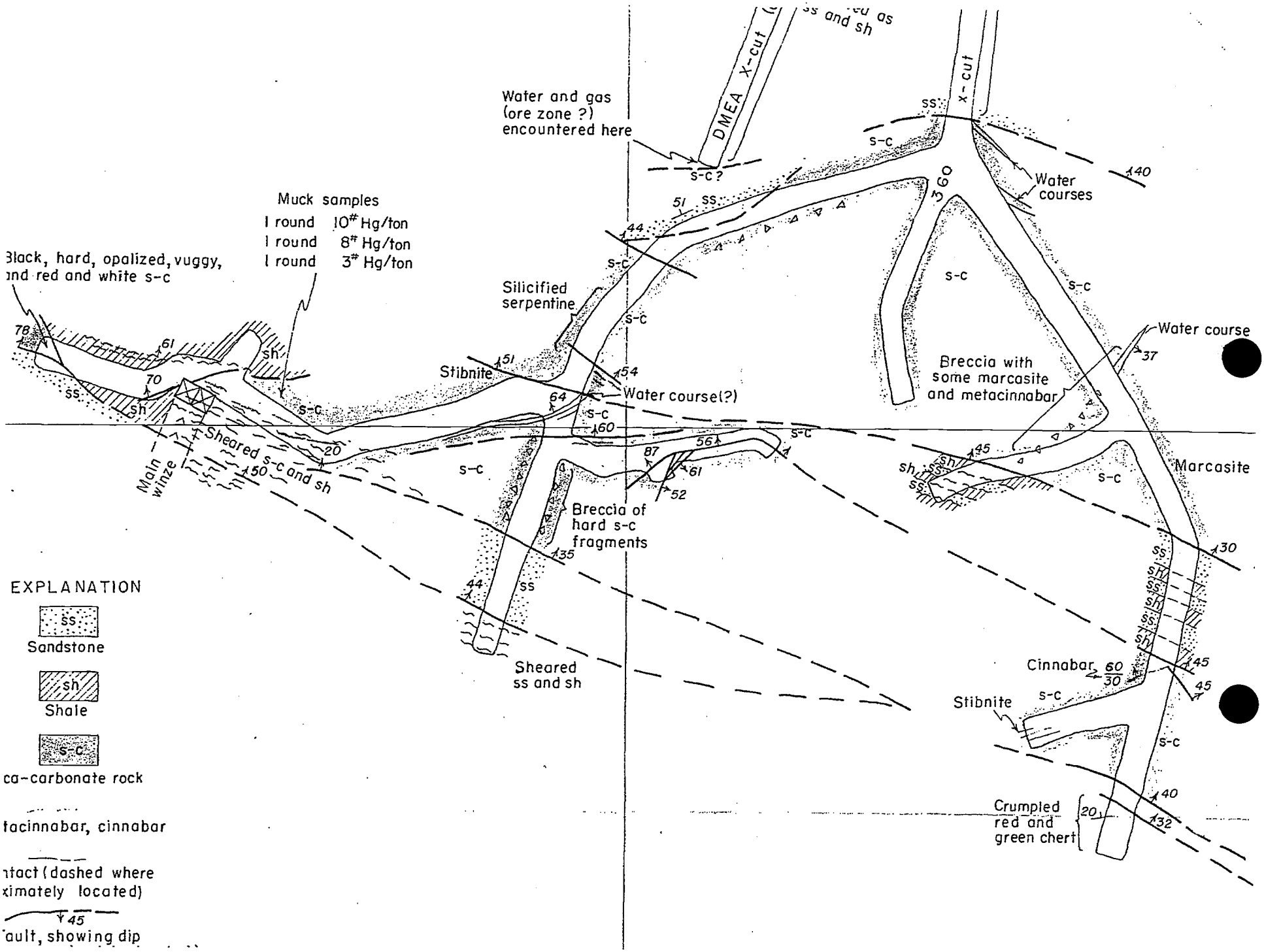
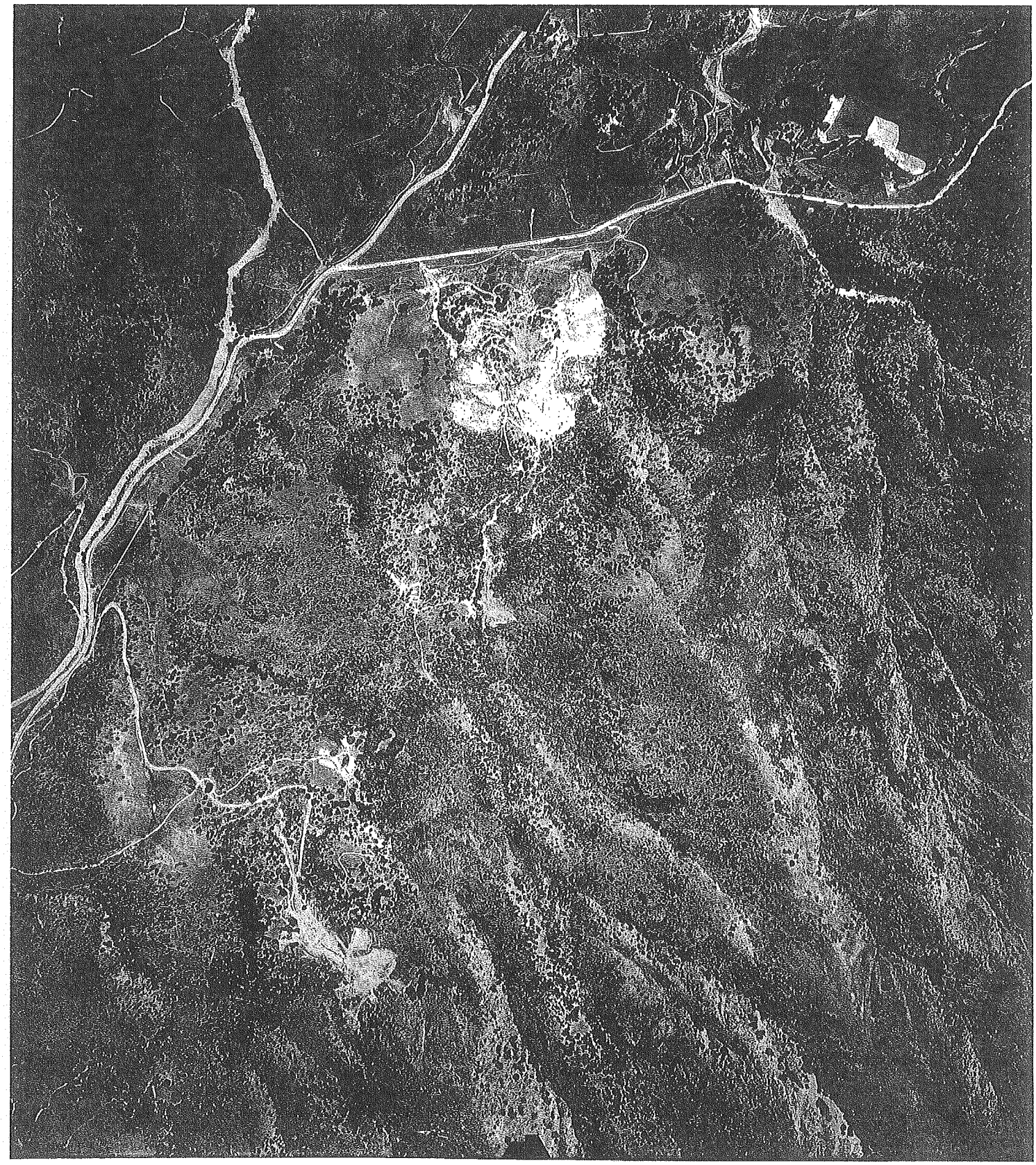
Datum is mean sea level.


Bench #4 El. 914
Bench #6 El. 861
Bench No. 5, El. 886
D.D. Hole #9
80
Underhand Stope
165 East Stope
787
Waste
D.D. Hole #11
D.D. Hole #10
Location Approx.


Water and gas (ore zone ?) encountered here
DMEA X-cut
x-cut
Water courses
Muck samples
1 round 10# Hg/ton
1 round 8# Hg/ton
1 round 3# Hg/ton
Black, hard, opalized, vuggy, and red and white s-c
Silicified serpentine
Stibnite
Water course(?)
Water course
Breccia with some marcasite and metacinnabar
Marcasite
Main winze
Sheared s-c and sh
Breccia of hard s-c fragments
Sheared ss and sh
Cinnabar
Stibnite
Crumpled red and green chert
EXPLANATION
Sandstone
Shale
ca-carbonate rock
tacinnabar, cinnabar
ntact (dashed where ximately located)
Fault, showing dip



Docket copy

PROJECT SUMMARY REPORT

By: Stephen P. Holt November 25, 1960

1. Docket DMEA-2448 (Mercury)
Contract Idm-E544

Property - Mt. Diablo Quicksilver Mine
Contra Costa County, California

Operator - John L. Jonas and John E. Johnson
Assignees of Ronnie E. Smith, Jene Harper, and
James F. Dunnigan

Operator's Property Rights -

The Operator controlled, by assignment of a mining lease from the owners, Mt. Diablo Quicksilver Company, Ltd., Clayton, California, patented land described as: the N½ of the SE¼, and the S½ of the SW¼ of the NE¼, sec. 29, T. 1 N., R. 1 E., M.D.B. and M., Contra Costa County, California, excepting a certain area described in Annex II and shown on map, USGS Bull. 922, Plate 6, attached to the contract. Owner's Consent to Lien and Assignment of Contract accompany the contract.

2. Contract: Dated June 5, 1953, on Long Form, MF-200 (Revised Feb. 1952).

Work Authorized:

1. Level shaft site, erect headframe and ore pocket, install hoist, build tram from headframe to dump.

2. Sink 2-compartment timbered shaft 330 feet.

3. At depth approximately 300 feet below shaft collar, crosscut approximately 200 feet southerly through vein structure on hanging-wall side of fault, and from sides of crosscut drift in opposite directions along fault a total of approximately 425 feet.

4. Sample and assay vein material encountered. Estimated 125 samples to be assayed for mercury.

Estimated Total Cost of Project	$73,571.00
Government Participation @ 75%	$55,178.25

Amendments -

No. 1, dated July 14, 1953, extended the starting date from July 20 to August 15, 1953.

No. 2, dated April 22, 1954, authorized use of funds originally intended for crosscutting and drifting, for pumping and water treatment.

No. 3, dated November 19, 1954, corrected the effective date of Amendment No. 2 from April 22, 1954, to February 18, 1954, the day on which the mine workings were flooded.

Work under the contract started August 15, 1953, was interrupted by flooding of the mine on February 18, 1954, and again by a fatal accident March 4, 1954. All work was discontinued and the Operator surrendered its lease on March 11, 1954. Cordero Mining Company leased the property in November 1954, and conducted further exploration work without assistance from the Government. Cordero's operations were not successful, and that company discontinued work at the property early in 1956.

Work Completed -

Crosscutting and drifting,	120 feet
Shaft sinking,	324 feet

Total Accepted Cost of the Contract	$44,340.04
Government participation @ 75%	$33,255.03

2-A. Reports -

The final report of the Field Team, dated January 30, 1957, was received February 5, 1957. No Operator's final report was submitted and the Field Team recommended that the requirement for such a report be waived.

3. Audits -

Audit Certificate, dated May 18, 1956, showed:

Total cost billed by contractor		$53,330.59
Exceptions during this audit	$6,009.79	
Less additional costs allowed by this audit	19.24	5,990.55
Total Accepted Cost		$47,340.04
Less salvage value of project property		3,000.00
Net Total Accepted Cost		$44,340.04
Government Contribution @ 75%		$33,255.03

4. Certification -

No certification of discovery or development was issued. The contract was terminated by a Termination Agreement dated November 30, 1956, effective as of March 31, 1954.

5. Comments --

The purpose of the project was to explore the downward continuation of a mineralized zone exposed in the Mill Workings of the Mt. Diablo Quicksilver mine, where mercury ore occurs as fracture fillings and disseminations of cinnabar and metacinnabarite in a tabular body of silica-carbonate rock in massive poorly-bedded silicified sandstone and graywacke, with lesser amounts of sheared shale and thin-bedded chert, all of the Franciscan group of Jurassic (?) age, which are cut by a few lenticular bodies of serpentine, probably post-Pliocene in age.

The work of the project, interrupted by the flooding of the mine and other causes, did not attain its objective, and no reserves of mercury ore were discovered by project work.

Stephen P. Holt

Stephen P. Holt

SPHolt/gla
11-28-60
cc to: Director's Reading File
Docket
Chron

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

CLEAN-UP AND ABATEMENT ORDER
FOR
MOUNT DIABLO QUICKSILVER MINE
CONTRA COSTA COUNTY

The California Regional Water Quality Control Board, Central Valley Region, (hereafter Board), finds that:

1. The Mount Diablo Quicksilver Mine was operated intermittently from 1870 to 1970. It is now owned by Jack and Carolyn Wessman. Surface water drainage from the site is to Dunn Creek thence to Marsh Creek a tributary of the Sacramento-San Joaquin Delta.

2. The Board on 8 September 1978 adopted Waste Discharge Requirements, Order No. 78-114 which includes Discharge Prohibition A.1. "The direct discharge of waste to surface waters or surface water drainage courses is prohibited", and A.2. "Previously deposited sediment in the reservoir shall not be discharged".

3. On 13 July 1978 staff conducted an inspection in company with representatives of the Department of Fish and Game and Mr. Jack Wessman. During this inspection, Mr. Wessman indicated that he would divert springs polluted by overburden material from the mine around the storage reservoir through which they presently flowed. The Department of Fish and Game and staff agreed that this work should not be done and so informed Mr. Wessman.

4. The Department of Fish and Game in a letter dated 18 August 1978 found the discharge from the mine property to be "extremely lethal" to aquatic life.

5. A staff inspection conducted 3 August 1978 revealed that Mr. Wessman had diverted the polluted springs from the mine around the storage reservoir.

6. The diverted springs constituted a point source discharge of pollutants for which no NPDES permit has been obtained or applied for.

7. Mr. Wessman submitted a conceptual plan to comply with Discharge Prohibition A.2 dated 24 October 1978. The compliance date as stated in the requirements was 15 September 1978.

8. Construction, as per the submitted conceptual plan, was to be complete by 1 November 1978. To date no work has been performed.

9. Waste Discharge Requirements require a conceptual plan to comply with Discharge Prohibition A.1 by 15 November 1978. On 15 November 1978, Mr. Wessman indicated, by phone, that he would not comply with this provision.

10. There is great potential for further degradation of Dunn Creek and Marsh Creek during the upcoming wet season. Winter rains may result in the discharge of large quantities of sediment and increase the volume of discharge of acidic water from the mine property.

11. Section 13304 (a) of the California Water Code provides that "Any person who... intentionally or negligently causes or permits any waste to be discharged or deposited where it is, or probably will be discharged into waters of the State and creates or threatens to create, a condition of pollution or nuisance shall upon order of the regional board clean-up or abate the effects thereof or, in the case of threatened pollution or nuisance, take other necessary remedial action.....".

12. Issuance of this Order is exempt from the provisions of the California Environmental Quality Act (Public Resources Code Section 21000, et seq.) in accordance with Section 15121, Chapter 3, Title 14, California Administrative Code.

IT IS HEREBY ORDERED, that pursuant to California Water Code Section 13304, the Mt. Diablo Mine, owned by Jack and Carolyn Wessman, shall:

1. By 30 November 1978 redivert the springs from the mine overburden and other worked areas of the mine back to the storage reservoir to abate further direct discharge.

2. By 30 November 1978 complete the repair of the storage reservoir so as to comply with Discharge Prohibition A.2 of Order No. 78-114.

3. Comply with the time schedule presented in Provision C.2 to insure compliance with Discharge Prohibition A.1 of Order No. 78-114.

DATED: 20 November 1978

Ordered by _____
JAMES A. ROBERTSON, Executive Officer

CAH/gs

SUMMARY OF STAFF CONTACTS, MOUNT DIABLO MINE

1.	13 July 1978	Made inspection of mine. Present were Chris Haynes, Richard Rose, Mike Rugg (DFG), Tom Kasnic(DFG) and Mr. Wessman (owner). Told Mr. Wessman not to divert the springs.
2.	20 July 1978	Sampled drainage from the overburdan and surrounding watershed.
3.	3 August 1978	Inspected mine, present were Jim Parsons (State geologist), Chris Haynes and Mr. Wessman. Discussed Tentative Requirements briefly.
4.	9 August 1978	Inspected mine for possible control measures, present were Chris Haynes, Bob Roan, and Bill Morgan(SCS)
5.	8 September 1978	Requirements adopted by the Board.
6.	2 October 1978	Spoke with Mr. Wessman by phone to discuss WDR and compliance dates.
7.	10 October 1978	Spoke with Mr. Wessman by phone about compliance dates and contents of his plans.
8.	3 November 1978	Called Mr. Wessman to give our reluctant acceptance of his conceptual plan and our comments; letter sent that same day. Told him we believe that his plan would hinder runoff control efforts.
9.	14 November 1978	Inspection made; no work completed; found in violation of WDR.
10.	15 November 1978	Spoke with Mr. Wessman by phone. He stated that work will be complete by 28 November 1978. He has no intention of doing any additional work to comply with Discharge Prohibition A.1.

MEMORANDUM

TO: Richard Rose
FROM: Chris Haynes
SUBJECT: Mount Diablo Quicksilver Mine

On 15 November 1978, I received a call from Mr. Wessman. He said that his contractor would be starting work on 24 November 1978. Our requirements are that work should be completed by 1 November 1978. At this point we have no assurance that Mr. Wessman has actually hired a contractor. It is Mr. Wessman's intention to complete the work as per the submitted conceptual plan without consideration of our comments.

I asked about the conceptual plan for the containment of all surface drainage, due 15 November 1978. Mr. Wessman stated that he has no intention of submitting any further plans for the site. He does not have any intention of complying with Discharge Limitation A.1. Our efforts to control the discharge will be hindered by the work which Mr. Wessman proposes.

Mr. Wessman mentioned that he would be spending $10,000 (seems a bit high) for the required work. I believe that the work required for the containment of the sediment would take only one day with a D-8 "CAT". Ted Fenner of this office recently used a "CAT" at Penn Mine for a total cost of $950 for two days. My estimate is $1000, somewhat less than Mr. Wessman's.

Chris A. Haynes

CHRIS A. HAYNES
Staff Engineer

CAH/gs 11/17/78

cc: DFG, Region III, Mike Rugg
SWRCB, Legal, Buck Taylor
Mr. Jack Wessman

Enclosure

MEMORANDUM

TO: Richard Rose
FROM: Chris Haynes
SUBJECT: Mount Diablo Mine

On 14 November 1978, I inspected the subject facility to ascertain compliance with Board Order No. 78-114. The inspection was made alone.

No work had been accomplished to comply with Discharge Prohibition A.2. This work was to be complete by 1 November 1978. Drainage from the mine overburdan was flowing directly to Horse Creek thence Dunn Creek. The drainage was completely by-passing the storage reservoir. Pictures were taken and will be incorporated into the file. There appeared to be more sediment in Dunn Creek than was observed in my last inspection. The flows from the overburdan material and other worked areas had increased as a result of our recent rains.

I find the subject mine not in compliance with Board Order No. 78-114, Dicharge Prohibition A.2. that states:

> "A.2 Previously deposited sediment in the reservoir shall not be discharged."

Chris A. Haynes
CHRIS A. HAYNES
Staff Engineer

CAH/gs 11/17/78

cc: DFG, Region III, Mike Rugg
SWRCB, Legal, Buck Taylor
Mr. Jack Wessman

Not sent

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX

IN THE MATTER OF:	)
	)
Sunoco, Inc.	)
	)
	) U.S. EPA Docket No. 9-2009-02
	) UNILATERAL ADMINISTRATIVE
	) ORDER FOR THE PERFORMANCE
	) OF A REMOVAL ACTION
Proceeding Under Section 106(a)	)
of the Comprehensive Environmental	)
Response, Compensation, and	)
Liability Act of 1980,	)
42 U.S.C. § 9606(a).	)
	)

This Order pertains to mining property located on Morgan Territory Road in the city of Clayton, California. The Property consists of the Mt. Diablo Mercury workings including tailings, ore piles and waste rock. This Order requires Sunoco, Inc. ("Respondent") to conduct Removal Actions described herein to abate an imminent and substantial endangerment to the public health, welfare or the environment that may be presented by the actual or threatened release of hazardous substances at or from the Property.

I. AUTHORITY

1. This Unilateral Administrative Order ("Order") is issued pursuant to the authority vested in the President of the United States by Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. § 9606(a), as amended by the Superfund Amendments and Reauthorization Act of 1986, and the Small Business Liability Relief and Brownfields Revitalization Act of 2002 ("CERCLA"). The

President delegated this authority to the Administrator of the United States Environmental Protection Agency ("EPA" or "Agency") by Executive Order 12580, January 23, 1987, 52 Fed. Reg. 2923, and further delegated it to the Assistant Administrator for Solid Waste and Emergency Response and the Regional Administrators by EPA Delegation Nos. 14-14-A and 14-14-B. This authority has been duly redelegated to the Branch Chief, Superfund Division, EPA Region 9 ("Branch Chief"), by delegations dated September 29, 1997, and November 16, 2001.

II. PARTIES BOUND

2. This Order shall apply to and be binding on Respondent. Respondent is jointly and severally responsible for carrying out all activities required by this Order. This Order shall be binding on Respondent and any agents, officers, employees, successors and assigns. Notwithstanding the terms of any contract or agreement, Respondent is responsible for compliance with this Order and for ensuring that their employees, contractors, and agents comply with this Order. Respondent is jointly and severally liable for carrying out all activities required by this Order.

3. No change in ownership or operational status will alter Respondent's obligations under this Order.

4. Notwithstanding the terms of any contract or agreement, Respondent is responsible for compliance with this Order and for ensuring that all employees, contractors, and agents comply with this Order. Respondent shall provide a copy of this Order to all contractors, subcontractors, and consultants that are retained by them to perform the work required by this Order within 2 working days after the Effective Date of this Order or within 2 working days of retaining their services, whichever is later.

5. Respondent may not convey any title, easement, or other interest that they may

have in any property comprising the Site, as the term "Site" is defined below, without a provision permitting the continuous implementation of the provisions of this Order. If Respondent wishes to transfer any title, easement, or other interest that they may have in any property comprising the Site, Respondent shall provide a copy of this Order to any subsequent owner(s) or successor(s) before any ownership rights are transferred. In such case, Respondent shall advise EPA no less than thirty (30) days prior to any anticipated transfer of interest.

III. DEFINITIONS

6. Unless otherwise expressly provided herein, the terms used in this Order that are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever the terms listed below are used in this Order, or in the exhibits attached hereto and incorporated hereunder, the following definitions shall apply:

"Days" shall mean consecutive calendar days unless expressly stated otherwise. "Working days" shall mean consecutive calendar days other than a Saturday, Sunday, or federal holiday. In computing any period of time under this Order where the last day would fall on a Saturday, Sunday, or federal holiday, the period shall run until the close of business of the next working day.

"CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 and by the Small Business Liability Relief and Brownfields Revitalization Act of 2002.

"EPA" shall mean the United States Environmental Protection Agency and any successor departments or agencies of the United States.

"National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300.

"Paragraph" shall mean a portion of this Order identified by an Arabic numeral.

"Property" shall mean the area in and around what is known as the Mt. Diablo Mercury Mine, Contra Costa County, California.

"Removal Action Memorandum" or "Action Memorandum" shall mean the EPA Region 9 Superfund decision document, dated December 2, 2008 and signed by Daniel A. Meer, which selected CERCLA response actions for the Property. The Removal Action Memorandum is included in this Order as Appendix A.

"Response Action" or "Removal Action" shall be those specific work items Respondent is required to perform at the Site pursuant to this Order, as set forth in Section IX of this Order.

"Section" shall mean a portion of this Order identified by a Roman numeral, unless otherwise stated.

"Site" shall mean the Mt. Diablo Mercury Mine, Contra Costa County, California, in addition to any associated personal property, such as motor vehicles, trailers, containers, and other real property at which hazardous substances exist from the operation of the mines.

"State" shall mean the state of California, and all of its political subdivisions, including the Central Valley Regional Water Quality Control Board.

"Unilateral Order" or "Order" shall mean this Unilateral Administrative Order, EPA docket number 9-2009-02, and any exhibits attached hereto. In the event of a conflict between this Order and any exhibit, this Order shall control.

"United States" shall mean the United States of America.

IV. FINDINGS OF FACT

7. Site description

The Mt. Diablo Mercury Mine, also known as the Mt. Diablo Quicksilver Mine, is located in the town of Clayon, Contra Costa County, California. It is an abandoned mercury mine site that has not operated since the 1970s. The mine is located on the northeast slope of Mount Diablo at the upper end of the Marsh Creek watershed. The mine is located between two tributaries to Marsh Creek, Dunn Creek and Horse Creek. The mine also includes underground workings. In addition, tailings, mine waste piles, abandoned structures and an impoundment pond are located on the surface. Elevated mercury levels are present in mine wastes and tailings at the Site. Analyses of tissue from fish obtained by U.C. Davis researchers from the Marsh Creek Reservoir located downstream of the Site revealed mercury levels in excess of human health standards for consumption of fish. Contaminated mine drainage flows as surface water into Marsh Creek, then down to Marsh Creek reservoir, and flows may reach the San Francisco Bay Estuary.

8. Site ownership and operation

The Mt. Diablo mercury deposit was located in approximately 1863, although native Americans knew of the deposit before that time and used materials from the site for ceremonial purposes. Underground mining began in 1875 and continued for a short period until 1877. After that, the mine lay idle until 1930 when the Mt. Diablo Quicksilver Company acquired the property and began producing some limited volumes of mercury. The largest production occurred between 1936 and 1946 when Bradley Mining Company leased the mine and operated it. After World War II, the price of mercury fell and the mine was idle again until 1951 when the Korean War

generated an increase in the price of mercury. The mine was leased to Ronnie B. Smith who produced mercury from 1951 to 1953. In 1955, Cordero Mining Company, a predecessor company of Sunoco, Inc., reopened the lower level of the mine workings, expanded the lower mine level and found a small volume of ore. In 1956, the Nevada Scheelite Company leased the mine and began to dewater the workings. However, the company was forced to cease operations after acid mine water discharged into Dunn Creek adversely affected ranching operations downstream. The company did produce a small volume of ore from an open pit on the site. The mine was idle from 1956 to 1958. In 1958, John E. Johnson operated the mine until his death in 1958. The last known production from the mine was from 1965 to 1970 when Welty and Randall operated the mine and reworked the mine tailings. In 1974 John (Jack) and Carolyn Wessman purchased the mine property from the previous owner, Guadalupe Mining Co. In 2005, parcel APN 078-060-034 was transferred to the Wessman Family Trust. During the same year, title to parcel APN 078-070-036 was transferred to the Mt. Diablo Springs Improvement Society. Title to the adjacent parcel directly to the south of the impoundment pond, APN 078-070-034, is with the State of California (Mt. Diablo State Park).

9. Release Characteristics

On October 14, 2008, U.S. EPA and START conducted a walkthrough of the Site to identify mine features for screening sampling and analysis. A total of 21 water and sediment samples were collected and submitted for mercury analysis. The range of data reported from 0.35 to 41.8 mg/kg concentration of total mercury. Water samples taken from seeps and the impoundment pond ranged from nondetect in streams above the mine to 130 micrograms per liter in one of the seeps in the mine area.

Mercury is a naturally occurring element, and can be detected in background

concentrations. The mercury analytical values found at the site are many times higher than background. Analytical results indicate that concentrations of heavy metals identified in these media, exceed background and regulatory levels including U.S. EPA's Preliminary Remediation Goals (PRGs). Mercury is a hazardous substance as defined by Section 101(14) of CERCLA. Mercury exposure occurs from breathing air contaminated with mercury, ingesting contaminated water and food. Mercury, at high levels of exposure, may cause damage to the brain, kidneys and developing fetus. Effects on brain functioning may result in irritability, tremors, changes in vision or hearing, and memory problems. The nervous system is very sensitive to all forms of mercury. Short-term exposure to high levels of mercury vapors can cause lung damage, nausea, vomiting, diarrhea, increased blood pressure or heart rate, skin rashes and eye irritation. Young children are more sensitive to mercury than adults (ATSDR 1999.)

The toe of the berm forming the impoundment pond is being actively undercut by Dunn Creek and threatens to release mercury bearing mining waste rock and sediments into the stream. This could result in catastrophic failure of the impoundment berm and cause extensive contamination of mercury contaminated sediments from the impoundment pond downstream to Marsh Creek and to the Marsh Creek Reservoir.

Mine tailings at the Site are readily accessible to persons that utilize the area for recreational purposes. The Site is situated along a well traveled road, Morgan Territory Road. The owner and his family reside on the same parcel where part of the mine is located. Recreational activities in the vicinity of the Site include hiking, biking, and use of all-terrain vehicles. The Site may be considered an attractive nuisance because of its unique appearance and proximity to the public road. Mercury can also be released with dust generated at the site. These air-borne particulates can be deposited into the waterways as well as pose an

inhalation/ingestion risk to human health. Physical characteristics of the Site, such as the possibility of settling pond failure, also pose significant hazards to casual users of the Site.

High concentrations of mercury in sediments has likely manifested in toxic impacts on aquatic life further downstream, particularly in the Contra Costa Flood Control District flood control reservoir, Marsh Creek Reservoir, located downstream on Marsh Creek. A mercury advisory has been issued to the public warning about consumption of fish taken from this reservoir because fish tissue has exceeded the 0.5 ppm health standard. Wildlife may also be exposed to hazardous substances in fine-grained tailings and waste rock via the ingestion and inhalation pathways. Dunn and Horse Creeks empty into Marsh Creek which flows to the San Joaquin River, then to the Sacramento-San Joaquin Bay-Delta, and ultimately to San Francisco Bay.

The administrative record supporting this action will be available for review at the EPA, Region 9 offices located at 75 Hawthorne Street, San Francisco, California.

V. CONCLUSIONS OF LAW

10. The Site is a "facility" as that term is defined in Section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

11. Sunoco, Inc. is a "person" as that term is defined in Section 101(21) of CERCLA, 42 U.S.C. § 9601(21).

12. The Respondent is a responsible party under Section 107(a) of CERCLA, 42 U.S.C. § 9607(a), and is jointly and severally liable for performance of response action and for response costs incurred and to be incurred at the Site. Respondent's company, Cordero Mining Company operated the Site from approximately 1954 to 1956 and was responsible for mining activities carried out at the Mt. Diablo Mine. Respondent is "liable" within the meaning of

Section 107(a) of CERCLA, 42 U.S.C. § 9607(a)(2), and is subject to this Order under Section 106(a) of CERCLA, 42 U.S.C. § 9606(a).

13. The toxic materials identified in the Action Memorandum are "hazardous substances" as that term is defined in Section 101(14) of CERCLA, 42 U.S.C. § 9601(14) and by meeting requirements set forth in 40 C.F.R. § 261.24. Hazardous substances disposed or dumped at or around the Property constitute a "release," as that term is defined in Section 101(22) of CERCLA, 42 U.S.C. § 9601(22).

14. The actual or threatened release of hazardous substances from the Site constitutes an imminent and substantial endangerment to the public health or welfare or the environment, within the meaning of Section 106(a) of CERCLA, 42 U.S.C. § 9606(a).

VI. DETERMINATIONS

Based on the Findings of Fact and the Conclusions of Law stated herein, the Branch Chief has made the following determinations:

15. That an actual or threatened release of hazardous substances from the Site presents an imminent and substantial endangerment to the public health or welfare or the environment.

16. That conditions at the Site constitute a threat to public health or welfare or the environment based on consideration of the factors stated in the NCP at 40 C.F.R. § 300.415(b), and that the actions required by this Order are necessary to protect the public health or welfare or the environment.

17. That the removal action required by this Order, if properly performed, will be consistent with the NCP and CERCLA, and is appropriate to protect the public health or welfare or the environment.

VII. NOTICE TO THE STATE

18. Pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a), EPA has notified the State of the issuance of this Order by providing a copy of this Order.

VIII. EFFECTIVE DATE

19. This Order is deemed effective on receipt (the "Effective Date"), unless a conference is requested as provided herein. If such a conference is requested, this Order shall be effective the second day following the day of such conference unless modified in writing by EPA.

IX. ORDER

20. Based on the Findings of Fact, Conclusions of Law, and Determinations, EPA hereby orders Respondent to perform the specific work set forth below under the direction of the EPA On Scene Coordinator ("OSC"), as designated in Section XIV, and to comply with all requirements of this Order until EPA provides notice that the Response Action is complete.

A. Work to be Performed

21. Respondent shall work with the property owner(s) to restrict access to all work areas of the Property for the duration of the response action required by this Order. Respondent shall not allow any soil or waste material to be removed from or brought into the Property at the Site without prior EPA approval.

22. Within 2 working days after the Effective Date of this Order, Respondent shall submit to EPA for approval, a Work Plan for the removal activities to be performed as set forth in this Order. The Work Plan shall provide a concise description of the activities to be conducted to comply with the requirements of this Order, and shall include a proposed schedule for implementing and completing such activities. The Work Plan, which will be subject to EPA

approval, shall comply with the requirements provided in Paragraphs 24-27 below, and at a minimum, shall require the Respondent to perform and complete the following removal activities beginning within 5 working days of EPA approval of the Work Plan:

A) Respondent shall obtain an access agreement with the current landowner(s) and work with the landowner to restrict unauthorized access to the work area of the Property for the duration of the response action required by this Order. Respondent shall not allow any soil or waste material to be removed from or brought into the Property at the Site without prior EPA approval.

B) Investigate/assess stability of impoundment dam to determine failure potential. Design/build/install appropriate engineered controls to ensure integrity of the impoundment dam during the 2008-2009 winter/spring rainy season

23. Within 3 days of the Effective Date of this Order, the Respondent shall provide EPA with documentation that adequately demonstrates its financial ability to complete the work to be performed pursuant to this Order. Examples of adequate financial documentation that EPA may accept include, but are not limited to, a signed contract or guarantee on the part of the Respondent's contractor that it will complete the work to be performed (including payment terms, such as whether the contract is prepaid), an irrevocable letter of credit payable to EPA from a financial institution, a policy of insurance covering site Response Actions and contingent claims that provides EPA with acceptable rights as a beneficiary thereof, an escrow account for the value of the work to be performed; or a demonstration by the Respondent that they have adequate net worth and /or cash flow to pay for the work to be performed (which may include most recent financial statements, auditors' reports, annual reports, SEC filings and the like).

24. The Work Plan required in Paragraph 22 shall be reviewed by EPA, which may approve, disapprove, require revisions, or modify the Work Plan. Respondent shall prepare the Work Plan elements described below as separate documents for approval by EPA. Once approved, each element of the Work Plan shall be deemed to be incorporated into and made a fully enforceable part of this Order. The Respondent shall implement the Work Plan as finally approved by the EPA. In addition to the requirements listed in Paragraph 22, the Work Plan shall include:

A) A Health & Safety Plan, prepared in accordance with EPA's Superfund Standard Operating Safety Guide, dated June 1992, which complies with all current OSHA regulations applicable to Hazardous Waste Operations and Emergency Response, 29 C.F.R. Part 1910. Respondent shall incorporate all changes to the Health & Safety Plan recommended by EPA and implement the Health & Safety Plan throughout the performance of the removal action; and

B) In the event that the Work Plan includes taking of contaminant samples for analysis, a Quality Assurance Project Plan ("QAPP") that is consistent with EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5); Preparation of a U.S. EPA Region 9 Field Sample Plan for EPA-Lead Superfund Projects (Document Control No.: 9QA-05-93); and Guidance for the Data Quality Objectives Process (EPA QA/G-4). Soil sampling activities shall utilize proper soil assessment techniques as defined in EPA Document SW-846, Chapter 9 (EPA Environmental Response Team Standard Operating Procedures) or appropriate ASTM standards.

25. Respondent shall provide EPA with a written report on completion of any transportation of hazardous substances or wastes for disposal or recycling. This report should

contain a summary of the activities to comply with this Order. Within forty-five (45) days after completing the Response Action, Respondent shall provide EPA with this final summary report, which also shall include all invoices submitted by contractors (which shall identify specific work performed), and copies of all analytical data generated during the response action.

26. All documents, including technical reports, and other correspondence to be submitted by the Respondent pursuant to this Order, shall be sent by over-night mail to the following addressees or to such other addressees as EPA hereafter may designate in writing, and shall be deemed submitted on the date received by EPA.

Janet Yocum, Federal On-Scene Coordinator
US Environmental Protection Agency
EPA, Region 9, SFD-9-2
75 Hawthorne Street
San Francisco, CA 94105

Respondent shall submit two (2) copies of each document to EPA.

27. EPA will review, comment, and approve or disapprove each plan, report, or other deliverable submitted by Respondent. All EPA comments on draft deliverables shall be incorporated by the Respondent. EPA will notify the Respondent in writing of EPA's approval or disapproval of a final deliverable. In the event of any disapproval, EPA will specify the reasons for such disapproval, EPA's required modifications, and a time frame for submission of the revised report, document, or deliverable. If the modified report, document or deliverable is again disapproved by EPA, EPA first shall notify the Respondent of its disapproval of the resubmitted report, document, or deliverable, and then may draft its own report, document or deliverable and incorporate it as part of this Order, may seek penalties from the Respondent for failing to comply with this Order, and may conduct the remaining work required by this Order and seek to recover costs from Respondent.

28. For purposes of this Order, EPA's authorized representatives will include, but not be limited to, consultants and contractors hired by EPA to oversee the activities required by this Order.

B. Selection of Contractor(s) and Subcontractor(s)

29. All work performed by or on behalf of Respondent pursuant to this Order shall be performed by qualified individuals or contractors with expertise in hazardous waste site investigation or remediation, unless agreed otherwise by EPA. Respondent shall, within 3 days after the Effective Date of this Order, notify EPA in writing of the name, title and qualifications of the individual(s) who will be responsible for carrying out the terms of this Order, and the name(s) of any contractor(s) or subcontractor(s). The qualifications of the persons, contractors, and subcontractors undertaking the work for Respondent shall be subject to EPA review and approval.

30. If EPA disapproves of any person's or contractor's technical or work-experience qualifications, EPA will notify the Respondent in writing. Respondent shall, within three (3) working days of Respondent's receipt of EPA's written notice, notify EPA of the identity and qualifications of the replacement(s). Should EPA disapprove of the proposed replacement(s), Respondent shall be deemed to have failed to comply with the Order.

31. Respondent may propose to change the individual(s), contractor(s), or subcontractor(s) retained to direct and supervise the work required by this Order. If Respondent wishes to propose such a change, Respondent shall notify EPA in writing of the name, title, and qualifications of the proposed individual(s), proposed contractor(s), or proposed subcontractor(s), and such individual(s), contractor(s) or subcontractor(s) shall be subject to approval by EPA in accordance with the terms of Paragraphs 29 and 30, above. The naming of

any replacement(s) by Respondent shall not extend any deadlines required by this Order nor relieve the Respondent of any of their obligations to perform the work required by this Order.

32. Respondent will notify EPA of the respective field activities at least seventy-two (72) hours before initiating them so that EPA may adequately schedule oversight tasks.

33. Respondent shall submit to EPA a certification that Respondent or its contractor(s) and subcontractor(s) have adequate insurance coverage or other ability, subject to approval of EPA, to compensate for liabilities for injuries or damages to persons or property that may result from the activities to be conducted by or on behalf of Respondent pursuant to this Order. Adequate insurance shall include comprehensive general liability insurance and automobile insurance with limits of one million dollars, combined single limit. If the Respondent demonstrates by evidence satisfactory to EPA that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering the same risks but in a lesser amount, then the Respondent needs to provide only that portion of the insurance described above that is not maintained by such contractor or subcontractor. Respondent shall ensure that such insurance or indemnification is maintained for the duration of performance of the work required by this Order. Respondent shall ensure that the United States is named as an additional insured on any such insurance policies.

C. General Provisions:

34. All work required by this Order shall be conducted in accordance with: CERCLA; the NCP; EPA Region 9 "Guidance for Preparing Quality Assurance Project Plans for Superfund Remedial Projects" (EPA, November 1992); any final amended or superseding versions of such documents provided by EPA; other applicable EPA guidance documents; any Work Plan or individual components approved pursuant to Paragraph 24 of this Order; and any report,

document or deliverable prepared by EPA because Respondent failed to comply with this Order.

35. All plans, schedules, and other reports that require EPA's approval and are required to be submitted by the Respondent pursuant to this Order shall, after approval by EPA, be incorporated into and enforceable under this Order.

36. EPA will oversee Respondent's activities as specified in Section 104(a)(1) of CERCLA, 42 U.S.C. § 9604(a)(1). Respondent will support EPA's initiation and implementation of activities needed to carry out its oversight responsibilities. Respondent also shall cooperate and coordinate the performance of all work required to be performed under this Order with all other work being performed at the Site, including work performed by EPA, the State, or any other party performing work at the Site with the approval of EPA.

37. Respondent shall perform all actions required pursuant to this Order in accordance with all applicable local, state, and federal laws and regulations, including, but not limited to those set forth in the attached December 2, 2008 Action Memorandum, except as provided in Section 121(e) of CERCLA, 42 U.S.C. § 6921(e), and 40 C.F.R. §§ 300.400(e) and 300.415(j). In accordance with 40 C.F.R. § 300.415(j), all on-Site actions required pursuant to this Order shall, to the extent practicable, as determined by EPA, considering the exigencies of the situation, attain applicable or relevant and appropriate requirements under federal environmental or state environmental or facility siting laws.

X. NOTICE OF INTENT TO COMPLY

38. Respondent shall, within three (3) working days of the Effective Date of this Order, provide written notice to EPA of Respondent's irrevocable intent to comply with this Order. Failure to respond, or failure to agree to comply with this Order, shall be deemed a refusal to comply with this Order. Such written notice shall be sent to:

Larry Bradfish
Office of Regional Counsel
United States Environmental Protection Agency
75 Hawthorne Street, Mailcode ORC-3
San Francisco, CA 94105
Telephone: 415-972-3934
Fax: 415-947-3571

XI. OPPORTUNITY TO CONFER

39. Respondent may, within two (2) working days of receipt of this Order, request a conference with the Section Chief of the Emergency Response Section in the Response, Planning and Assessment Branch in the EPA Region 9 Superfund Division, or whomever the Section Chief may designate. If requested, the conference shall occur within three (3) days of the request, unless extended by mutual agreement of the Parties, at EPA's Regional Office, 75 Hawthorne Street, San Francisco, California.

40. At any conference held pursuant to Respondent's request, the Respondent may appear in person, or be represented by an attorney or other representative. If Respondent desires such a conference, Respondent shall contact Larry Bradfish, Assistant Regional Counsel, at (415) 972-3934.

41. The purpose and scope of any such conference held pursuant to this Order shall be limited to issues involving the implementation of the Response Action required by this Order and the extent to which Respondent intends to comply with this Order. If such a conference is held, the Respondent may present any evidence, arguments or comments regarding this Order, its applicability, any factual determinations on which the Order is based, the appropriateness of any action that the Respondent is ordered to take, or any other relevant and material issue. Any such evidence, arguments or comments should be reduced to writing and submitted to EPA within three (3) days following the conference. This conference is not an evidentiary hearing, and does

not constitute a proceeding to challenge this Order. It does not give Respondent a right to seek review of this Order, or to seek resolution of potential liability, and no official record of the conference will be made. If no conference is requested, any such evidence, arguments or comments must be submitted in writing within three (3) days following the Effective Date of this Order. Any such writing should be directed to the following address:

Larry Bradfish
Office of Regional Counsel
Environmental Protection Agency
75 Hawthorne Street, ORC-3
San Francisco, CA 94105

42. Respondent is hereby placed on notice that EPA will take any action that may be necessary in the opinion of EPA for the protection of public health and welfare and the environment, and Respondent may be liable for the costs of those actions under Section 107(a) of CERCLA, 42 U.S.C. § 9607(a).

XII. ENDANGERMENT AND EMERGENCY RESPONSE

43. In the event of any action or occurrence during the performance of the work that causes or threatens to cause a release of a hazardous substance or that may present an immediate threat to public health or welfare or the environment, Respondent shall immediately take all appropriate action(s) to prevent, abate, or minimize the threat, and shall immediately notify EPA's primary OSC, or, if the primary OSC is unavailable, EPA's alternate OSC, as designated below in Paragraph 49. If neither of these persons is available, Respondent shall notify the EPA Emergency Response Unit, Region 9, by calling (800) 300-2193. Respondent shall take such action(s) in consultation with EPA's OSC and in accordance with all applicable provisions of this Order, including but not limited to the approved Health & Safety Plan.

44. Nothing in the preceding Paragraph shall be deemed to limit any authority of the

United States to take, direct, or order all appropriate action to protect human health and the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances at or from the Site.

XIII. MODIFICATION OF WORK REQUIRED

45. In the event of unanticipated or changed circumstances at the Site, Respondent shall notify the EPA OSC by telephone within twenty-four (24) hours of discovery of the unanticipated or changed circumstances. This verbal notification shall be followed by written notification postmarked no later than within three (3) days of discovery of the unanticipated or changed circumstances.

46. The Branch Chief may determine that in addition to tasks addressed herein, additional work may be required to address the unanticipated or changed circumstances referred to in Paragraphs 43 and 45. Where consistent with Section 106(a) of CERCLA, the Branch Chief may direct, as an amendment to this Order, that Respondent perform these tasks in addition to those required herein. Respondent shall implement the additional tasks that the Branch Chief identifies. The additional work shall be completed according to the standards, specifications, and schedules set forth by the Branch Chief in any modifications to this Order.

XIV. DESIGNATED PROJECT MANAGERS

47. EPA designates Janet Yocum, an employee of EPA Region 9, as its primary OSC and designated representative at the Site, who shall have the authorities, duties, and responsibilities vested in the OSC by the NCP. This includes, but is not limited to, the authority to halt, modify, conduct, or direct any tasks required by this Order or undertake the Response Action (or portions of the Response Action) when conditions at the Site present or may present a threat to public health or welfare or the environment as set forth in the NCP. Within three (3)

days of the Effective Date of this Order, Respondent shall designate a Project Coordinator who shall be responsible for overseeing Respondent' implementation of this Order. To the maximum extent possible, all oral communications between Respondent and EPA concerning the activities performed pursuant to this Order shall be directed through EPA's OSC and Respondent's Project Coordinator. All documents, including progress and technical reports, approvals, and other correspondence concerning the activities performed pursuant to the terms and conditions of this Order, shall be delivered in accordance with Paragraph 26, above.

48. EPA and Respondent may change their respective OSC and Project Coordinator. Notification of such a change shall be made by notifying the other party in writing at least five (5) days prior to the change, except in the case of an emergency, in which case notification shall be made orally followed by written notification as soon as possible.

49. Consistent with the provisions of this Order, the EPA designates Steven Calanog as an alternate OSC, in the event Janet Yocum is not present at the Site or is otherwise unavailable. During such times, Steve Calanog shall have the authority vested in the OSC by the NCP, as set forth in Paragraph 47 above.

50. The absence of the EPA OSC from the Site shall not be cause for the stoppage of work. Nothing in this Order shall limit the authority of the EPA OSC under federal law.

XV. SITE ACCESS

51. Respondent shall permit EPA and its authorized representatives, including its contractors and the State, to have access at all times to the Site to monitor any activity conducted pursuant to this Order and to conduct such tests or investigations as EPA deems necessary. Nothing in this Order shall be deemed a limit on EPA's authority under federal law to gain access to the Site.

52. To the extent that Respondent requires access to property other than Property that they own to carry out the terms of this Order and to the extent that EPA has not already secured access from the property owner(s), Respondent shall, within a reasonable time to implement the requirements of this Order, obtain access for: EPA, its contractors, oversight officials, or other authorized representatives; state oversight officials or contractors; and Respondent and its authorized representatives. If Respondent fails to gain access within the time period necessary to implement the requirements of this Order, Respondent shall continue to use best efforts to obtain access until access is granted. For purposes of this Paragraph, "best efforts" include, but are not limited to, the payment of money as consideration for access. Respondent shall cooperate and use best efforts to coordinate the performance of all work required under this Order with any reasonable access requirements of the landowners. If access is not provided within the time referenced above, EPA may obtain access under Sections 104(e) or 106(a) of CERCLA and recover any costs incurred pursuant to Section XVI of this Order.

XVI. REIMBURSEMENT OF OVERSIGHT COSTS

53. Respondent shall reimburse EPA, on written demand, for all response costs incurred by the United States in overseeing Respondent's implementation of the requirements of this Order, unless otherwise exempted from this requirement by federal law. EPA may submit to Respondent on a periodic basis a bill for all response costs incurred by the United States with respect to this Order. Respondent shall, within thirty (30) days of receipt of the bill, remit by cashier's or certified check for the amount of those costs made payable to the "Hazardous Substance Superfund," to the following address:

U.S. Environmental Protection Agency
Region 9 Superfund
P.O. Box 371099M
Pittsburgh, PA 15251

Respondent shall send a cover letter with any check and the letter shall identify the Mt. Diablo Mine Site by name and make reference to this Order, including the EPA docket number stated above. Respondent shall send notification of any amount paid, including a photocopy of the check, simultaneously to the EPA OSC.

54. Interest at the rate established under Section 107(a) of CERCLA shall begin to accrue on the unpaid balance from the due date of the original demand notwithstanding any dispute or objection to any portion of the costs.

XVII. DELAY IN PERFORMANCE

55. Any delay in the performance of any requirement of this Order that, in the EPA's sole judgment and discretion, is not properly justified by Respondent under the terms of this Section shall be considered a violation of this Order. Any delay in performance of any requirement of this Order shall not affect any other obligation of Respondent under the terms and conditions of this Order.

56. Respondent shall notify EPA of any delay or anticipated delay in performing any requirement of this Order. Such notification shall be made by telephone to EPA's primary OSC within twenty-four (24) hours after Respondent first knew or should have known that a delay might occur. Respondent shall adopt all reasonable measures to avoid or minimize any such delay. Within three (3) days after notifying EPA by telephone, Respondent shall provide written notification fully describing the nature of the delay, any justification for delay, any reason why the Respondent should not be held strictly accountable for failing to comply with any relevant requirements of this Order, the measures planned and taken to minimize the delay, and a schedule for implementing the measures that will be taken to mitigate the effect of the delay. Increased costs or expenses associated with implementation of the activities called for in this

Order are not justifications for any delay in performance.

57. If Respondent is unable to perform any activity or submit any document within the time required under this Order, the Respondent may, prior to the expiration of the time, request an extension of time in writing. The extension request shall include a justification for the delay. The submission of an extension request shall not itself affect or extend the time to perform any of Respondent's obligations under this Order.

58. If EPA determines that good cause exists for an extension of time, it may grant a request made by Respondent pursuant to Paragraph 57 above, and specify in writing to the Respondent the new schedule for completion of the activity or submission of the document for which the extension was requested.

XVIII. RECORD PRESERVATION

59. Respondent shall maintain, during the pendency of this Order, and for a minimum of five (5) years after EPA provides notice to Respondent that the work has been completed, a depository of the records and documents required to be prepared under this Order. In addition, Respondent shall retain copies of the most recent version of all documents that relate to hazardous substances at the Site and that are in their possession or in the possession of their employees, agents, contractors, or attorneys. After this five-year period, Respondent shall notify EPA at least thirty (30) days before the documents are scheduled to be destroyed. If EPA so requests, Respondent shall provide these documents to EPA.

XIX. ENFORCEMENT AND RESERVATIONS

60. EPA reserves the right to bring an action against Respondent under Section 107 of CERCLA, 42 U.S.C. § 9607, for recovery of any response costs incurred by the United States related to this Order or otherwise incurred at the Site and not reimbursed by Respondent. This

reservation shall include but not be limited to past costs, direct costs, indirect costs, the costs of oversight, and the costs of compiling the cost documentation to support oversight costs, as well as accrued interest as provided in Section 107(a) of CERCLA, 42 U.S.C. § 9607(a).

61. Notwithstanding any other provision of this Order, at any time during the Response Action, EPA may perform its own studies, complete the Response Action (or any portion of the Response Action) and seek reimbursement from Respondent for its costs, or seek any other appropriate relief.

62. Nothing in this Order shall preclude EPA from taking any additional enforcement action, including modification of this Order or issuance of additional Orders, or additional remedial or removal actions as EPA may deem necessary, or from requiring Respondent in the future to perform additional activities pursuant to CERCLA, 42 U.S.C. § 9607(a), et seq., or any other applicable law. Respondent may be liable under CERCLA Section 107(a) for the costs of any such additional actions.

63. Notwithstanding any provision of this Order, the United States hereby retains all of its information gathering, inspection and enforcement authorities and rights under CERCLA, the Resource Conservation and Recovery Act, or any other applicable statutes or regulations.

64. Notwithstanding compliance with the terms of this Order, including the completion of the EPA-approved Response Action, Respondent is not released from liability, if any, for any enforcement actions beyond the terms of this Order taken by EPA.

65. EPA reserves the right to take any enforcement action pursuant to CERCLA or any other legal authority, including the right to seek injunctive relief, monetary penalties, reimbursement of response costs, and punitive damages for any violation of law or this Order.

66. EPA expressly reserves all rights and defenses that it may have, including the

EPA's right both to disapprove of work performed by Respondent and to request the Respondent to perform tasks in addition to those detailed in Section IX of this Order.

67. This Order does not release Respondent from any claim, cause of action or demand in law or equity, including, but not limited to, any claim, cause of action, or demand that lawfully may be asserted by representatives of the United States or the State.

68. No informal advice, guidance, suggestions, or comments by EPA regarding reports, plans, specifications, schedules, and any other writing submitted by Respondent will be construed as relieving Respondent of its obligation to obtain such formal approval as may be required by this Order.

XX. SEVERABILITY

69. If any provision or authority of this Order or the application of this Order to any circumstance is held by a court to be invalid, the application of such provision to other circumstances and the remainder of this Order shall not be affected thereby, and the remainder of this Order shall remain in force.

XXI. DISCLAIMER

70. The United States, by issuance of this Order, assumes no liability for any injuries or damages to persons or property resulting from acts or omissions by Respondent, or its employees, agents, successors, assigns, contractors, or consultants in carrying out any action or activity pursuant to this Order. Neither EPA nor the United States shall be held as a party to any contract entered into by Respondent, or its employees, agents, successors, assigns, contractors, or consultants in carrying out any action or activity pursuant to this Order. This Order does not constitute a pre-authorization of funds under section 111(a)(2) of CERCLA, 42 U.S.C. § 9611(a)(2).

XXII. PENALTIES FOR NONCOMPLIANCE

71. Respondent is advised pursuant to Section 106(b) of CERCLA, 42 U.S.C. § 9606(b), that violation of this Order or subsequent failure or refusal to comply with this Order, or any portion thereof, may subject Respondent to a civil penalty of up to $32,500 per day for each day in which such violation occurs, or such failure to comply continues. Failure to comply with this Order, or any portion thereof, also may subject Respondent to liability for punitive damages in an amount three times the amount of any cost incurred by the government as a result of the failure of Respondent to take proper action, pursuant to Section 107(c)(3) of CERCLA, 42 U.S.C. § 9607(c)(3).

XXIII. TERMINATION AND SATISFACTION

72. The provisions of this Order shall be deemed satisfied on Respondent's receipt of written notice from EPA that Respondent has demonstrated to the satisfaction of EPA that all of the terms of this Order, including any additional tasks that EPA has determined to be necessary, have been completed.

IT IS SO ORDERED:

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

By: _____ Date: 9 December 2008

Daniel A. Meer
Branch Chief, Response, Planning and Assessment Branch
EPA, Region 9

EPA Region 9 Contacts:

Janet Yocum, Federal On-Scene Coordinator
Superfund Division
EPA, Region 9, SFD-9-2
75 Hawthorne Street
San Francisco, CA 94105
(414) 972-3053

Larry Bradfish, Assistant Regional Counsel
Office of Regional Counsel
EPA, Region 9, ORC-3
75 Hawthorne Street
San Francisco, CA 94105
(415) 972-3934

APPENDIX A

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

MEMORANDUM

DATE: DEC 2 2008

SUBJECT: Request for a Time-Critical Removal Action at Mount Diablo Mercury Mine(Marsh Creek Road Abandoned Dump Site), Clayton, Contra Costa County, California

FROM: Janet Yocum, On-Scene Coordinator
Emergency Response Section (SFD-9-2)

THROUGH: Steve Calanog, Chief
Emergency Response Section (SFD-9-2)

TO: Daniel Meer, Chief
Response, Planning & Assessment Branch (SFD-9)

I. PURPOSE

The purpose of this Action Memorandum is to obtain approval to spend up to $205,625 to mitigate threats to human health and the environment posed by mercury mine waste-impacted water, sediments and soil at 2430 Morgan Territory Road ("Site"). The Site is a 109-acre residential parcel that was formerly the Mount Diablo Mercury Mine, in Clayton, Contra Costa County, California. The Site is located on the northeast slope of Mount Diablo, within the Marsh Creek watershed, approximately 10 miles south of the San Joaquin Delta, California. The proposed action is to stabilize the impoundment pond holding hazardous substances and would be taken pursuant to Section 104(a)(1) of the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), 42 U.S.C. § 9604(a)(1), and Section 300.415 of the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 CFR § 300.415.

II. SITE CONDITIONS AND BACKGROUND

Site Status: Non-NPL
Category of Removal: Time-Critical
CERCLIS ID: CAD980736060
SITE ID: TBD

A. Site Description

1. Physical Location

The Site is situated immediately west of Morgan Territory Road, just south of its juncture with Marsh Creek Road, Clayton, Contra Costa County, California. The geographic coordinates of the Site are 37°54'0.99" North latitude and 121°52'27.37" West longitude. See Appendix A, "Figure 1, Site Location Map".

The Site consists of 109 acres on the northeast slope of Mount Diablo. The Site is bordered on the east side by Morgan Territory Road. To the west and south, the Site is bordered by the State of California's Mount Diablo State Park. On the east of the property, between Morgan Territory Road and the Mine Site, is Dunn Creek, a seasonal tributary of Marsh Creek. Horse Creek, another tributary of Marsh Creek, is located on the south side of the property and originates on State Parks land. A number of springs and seeps also exist at the Site. A number of residential structures have been placed at the site by the current owner.

2. Site characteristics

The former Mount Diablo Mercury Mine is located approximately 4 miles southeast of the town of Clayton, Contra Costa County, California. The ore processed at this Site included metacinnabar and cinnabar. The first account of mercury recovery from the ore was approximately 1863, where an individual intersected ore at approximately 30 feet deep and through panning of the soil found at that depth, recovered the mercury. The mine may have produced 1,000 flasks between the period of 1875 and 1877. The mine lay inactive until 1930, when a commercial enterprise reopened the mine. In 1936, Bradley Mining Company took over production at the mine under a lease and operated it until 1946. Additional exploration and small operations continued thereafter, including the Cordero Mining Company until 1956. The mine was operated intermittently thereafter until 1970 or 1971. It was purchased by Jack Wessman, the current property owner in 1974, who uses it as a residential property. In 2005, Wessman created two entities, Mt. Diablo Springs Improvement Society and the Wessman Family Trust and transferred his interest in the property to these entities.

The underground workings of the mine extended 500 feet below surface and filled with water at that time. In 1956, a commercial enterprise attempted to pump the water out of the underground workings using a deep-well pump capable of 550 gallons per minute. This water being pumped out was being directly discharged to the creek on the property and adjacent landowners objected to the discharge of acid mine drainage directly into the creek and the practice was terminated. (Journal of California Mines and Geology, 1958).

There are a number of springs of indeterminate origin on the Site that contribute to surface flow into a series of settling ponds that were constructed on site, the largest of which is located on the southeastern corner of the former mine property and is the subject of this removal action. The Site is fenced and access is controlled from the highway.

There is one large building currently utilized by the property owner that may be associated with former Mine operations, but no other process-related structures or equipment appear in place at the Mill Site.

Calcined tailings and waste rock (overburden) were observed at the Site. In areas around the Site, tailings and overburden may have been covered by the current property owner who imported and placed fill. Some drainage control work has also been completed by the current property owner.

3. Removal site evaluation

Mining waste (inorganic mercury) may become an environmental problem when it contacts water and mercury bound sediments are transported from the site, deposited in waterways where methylation can occur. Mercury can also be transported by air, dissolved in water, bound to sediments and accumulates in tissue of aquatic organisms. Mercury bioaccumulates as it moves up the aquatic food chain, resulting in highest tissue concentrations in high order consumers (predatory fish, humans).

In 1995, University of California, Davis researchers, Darryl G. Slotten et.al were contracted by Contra Costa County Department of Public Works to study the impact of mercury in the Marsh Creek watershed. One study objective was to determine on a mass balance basis, whether the former mine site was the largest contributor to mercury loads in the watershed. The watershed is primarily fed by seasonal tributaries to Marsh Creek located along the eastern flank of Mt. Diablo. Prior to the study, the Regional Water Quality Control Board (RWQCB) had collected samples around the mine site that indicated the mine was contributing to the mercury loading of Marsh Creek and its reservoir. The study collected samples and determined flow levels to calculate mass balance from a number of locations within the watershed. In the course of collecting this data, the researchers determined that Marsh Creek flows at an estimated rate of hundreds of cubic feet per second through winter storm runoff events. This data appears below as Table 1, "Slotten Watershed Flow; Aqueous Mercury and Suspended Solids Concentration Data". (Slotton, et.al, 1995). A figure showing sample locations appears in Appendix A, "Figure 2, Slotten 1995 Sample Locations".

Table 1. Slotten Watershed Flow; Aqueous Mercury and Suspended Solids Concentration Data

Site	Flow (cfs)	Aqueous Total Mercury Raw (ng/L)	Aqueous Total Mercury Filtered (ng/L)	Suspended Solids All (TSS) (mg/L)	Suspended Solids Solids Hg (dry ppm)
Upper Marsh Creek	28.30	3.24	1.29	16.10	0.10
Curry Creek	33.70	5.18	1.49	32.00	0.12
Marsh Ck above Perkins Ck	65.60	4.69	1.34	32.10	0.10
Perkins Creek	13.90	8.89	4.11	3.00	1.59
Upper Dunn Creek	5.20	3.60	2.73	1.50	0.60
Upper Horse Creek	0.08	25.50	16.00	1.10	8.64
"My" Creek	2.10	381.00	28.40	10.90	32.41
OreHouse Spring	0.01	1,940.00	71.00	11.40	164.00
Trickle coming from tailings	0.03	58,400.00	54,100.00	77.20	56.37
South Pond outlet	0.05	59,100.00	59,100.00	26.10	0.00
Horse Creek @ tailings	0.32	25,000.00	21,900.00	104.00	29.8
Dunn Ck below mine confluence	7.80	949.00	226.00	13.50	53.60
Marsh Ck below Dunn Ck conf.	83.60	79.30	21.40	19.40	2.99
Mid Marsh Ck @ rd. crossing	101.00	52.80	10.10	24.60	1.74
Marsh Ck above Reservoir	111.00	37.67	8.80	23.10	1.25
Briones Ck @ Deer Valley Rd.	4.10	5.84	2.03	61.20	0.06
Marsh Ck below Reservoir	116.00	43.70	7.47	34.60	1.05
Marsh Ck @ Delta Rd.	107.00	37.80	6.44	53.80	0.58

	Aqueous Methyl Mercury Raw (ng/L)	Aqueous Methyl Mercury Filtered (ng/L)
Marsh Ck above Reservoir	0.204	0.112

The researchers concluded the Site, through transport of water and sediment in Dunn Creek was a significant contributor to the mercury loads into Marsh Creek, representing 94.5% of the total mercury loads to Marsh Creek. These results are presented in Table 2, "Slotten Calculated Relative Mercury Mass Balance Contributions of Upper Watershed Sources".

Table 2, Slotten Calculated Relative Mercury Mass Balance Contributions of Upper Watershed Sources

Site	*Aqueous Total Hg* Raw (*grams/day*)	Filtered	*Suspended Solids* (TSS) (*kilograms/day*)
Upper Marsh Creek	0.224	0.089	1,110.0
Curry Creek	0.427	0.123	2,640.0
Marsh Ck above Perkins Ck	0.753	0.215	5,160.0
Perkins Creek	0.302	0.140	102.0
Upper Dunn Creek	0.046	0.035	18.4
Upper Horse Creek	0.005	0.003	0.2
"My" Creek	1.960	0.146	55.9
OreHouse Spring	0.048	0.002	0.3
Trickle coming from tailings	4.290	3.970	5.7
South Pond outlet	7.230	7.230	3.2
Horse Creek @ tailings	19.600	17.100	81.2
Dunn Ck below mine confluence	18.100	4.310	257.0
Marsh Ck below Dunn Ck conf.	16.200	4.380	3,960.0
Mid Marsh Ck @ rd. crossing	13.100	2.500	6,070.0
Marsh Ck above Reservoir	10.200	2.380	6,250.0
Briones Ck @ Deer Valley Rd.	0.059	0.020	614.0
Marsh Ck below Reservoir	12.390	2.120	9,800.0
Marsh Ck @ Delta Rd.	9.880	1.680	14,100.0
	Aqueous Methyl Hg Raw (*grams/day*)	Filtered	
Marsh Ck above Reservoir	0.055	0.030	

Based on these data, input from the current owners and interest of stakeholders represented by the Technical Planning Panel (TPP) identified by the US Corps of Engineers under their Restoration of Abandoned Mine Sites (RAMS) program, US EPA participated in a site visit August 2008 . During this site visit, it was visibly apparent that the south settling pond dam was being compromised by the flows of Dunn Creek and possibly Horse Creek. There are no current estimates of the quantities of water or sediment being held in the impoundment. No records have been provided for review that suggests the pond has ever been dredged. Photos appear in Appendix B, "Photographic Log".

On October 14, 2008, U.S. EPA and Superfund Technical Assistance Response Team ("START") conducted a site visit to collect various samples at the south settling pond and various seeps that are inflow sources to the pond. The data is presented below in Table 3, USEPA Removal Site Evaluation Data. A map showing the locations of these samples appears in Appendix A, "Figure 3, US EPA Sampling Locations".

Sample ID	Sample Location	Mercury Result (µg/L)	MCL[1] (µg/L)	USEPA CMC[2] (µg/L)	SF BAY RWQCB Surface Water Screening Levels[3] (µg/L)	SF Bay RWQCB Surface Water Gross Contamination Ceiling Levels[4] (µg/L)
MD-SW-1	Southeast corner of surface impoundment	40.4	2	1.4	0.025	50,000
MD-SW-2	Seep #1	20.6	2	1.4	0.025	50,000
MD-SW-4	Seep #3	130	2	1.4	0.025	50,000
MD-SW-6	Upgradient (Horse Creek)	ND	2	1.4	0.025	50,000
MD-SW-8	Outflow to State Park	0.393 J	2	1.4	0.025	50,000
MD-SW-9	Seep # 1 midpoint	13.8	2	1.4	0.025	50,000
MD-SW-10	Convergence of Seep #1 and impoundment	19.6	2	1.4	0.025	50,000

1: National Primary Drinking Water Standards Maximum Concentration Level
2: USEPA Criterion for Maximum Concentration
3: San Francisco Bay Regional Water Quality Control Board Environmental Screening Levels (May 2008), Surface Water Screening Levels Fresh Water Habitats
4: San Francisco Bay Regional Water Quality Control Board Environmental Screening Levels (May 2008), Surface Water Gross Contamination Ceiling Levels (surface water is not a current or potential source of drinking water)

On November 20, 2008, US EPA Emergency Response Section received a request from the Regional Water Quality Control Board for federal action to mitigate the threat of release of hazardous substances (mercury) associated with mining activities at the Site posed by the imminent failure of the south settling pond dam, located at the

confluence of Horse and Dunn Creeks and the shared State Parks and Site property line. Failure of this impoundment would result in a release of mercury impacted water, sediments and soil as well as acid mine drainage to Marsh Creek and then the San Joaquin Delta, reaching San Francisco Bay and the Pacific Ocean.

4. Release or threatened release into the environment of a hazardous substance, or pollutant or contaminant

Mercury is a hazardous substance as defined by Section 101(14) of CERCLA. Mercury exposure occurs from breathing air contaminated with mercury, ingesting contaminated water and food. Mercury, at high levels of exposure, may cause damage to the brain, kidneys and developing fetus. Effects on brain functioning may result in irritability, tremors, changes in vision or hearing, and memory problems. The nervous system is very sensitive to all forms of mercury. Short-term exposure to high levels of mercury vapors can cause lung damage, nausea, vomiting, diarrhea, increased blood pressure or heart rate, skin rashes and eye irritation. Young children are more sensitive to mercury than adults (ATSDR 1999.)

The southeastern toe of the south settling pond dam is being actively undercut by Horse Creek and Dunn Creek drainages. The south settling pond is the final structure on the Site that retains water from the site, including seeps, contact water (tailings) and non contact water (runoff), including acidic mine drainage. The series of ponds were installed to allow sediment to "drop out," capturing and retaining potentially mercury bound fines that would otherwise be transported into downstream water bodies like Marsh Creek and the San Joaquin Delta. With a broad surface area, the waters held in these ponds can evaporate, reducing the amount of acid mine drainage or mercury impacted waters released to the adjacent creeks (Dunn and Horse). Failure of the south settling pond dam would result in catastrophic release of hazardous substances in the form of mercury bound sediment and mercury impacted waters from the site to Marsh Creek.

Mercury bound sediments can also be released with dust generated at the site. These air borne particulates can be deposited into the waterways as well as pose an inhalation/ingestion risk to human health.

5. NPL status

This Site is not on the National Priorities List (NPL).

B. <u>Other Actions to Date</u>

In 2006, the State Resources Water Control Board, Central Valley Region, proposed Dunn and Marsh Creeks to the 303(d) List as impaired for mercury.

The Regional Water Control Board has prepared a Draft Cleanup and

Abatement Order for the current property owners to compel cleanup at this Site. See Enforcement Addendum.

C. State and Local Authorities Roles

1. State and local actions to date

On November 20, 2008, a formal request for federal action was received by US EPA from the State of California, Regional Water Quality Control Board, Central Valley Region ("RWQCB") for this Site.

2. Potential for Continued State/Local Response

The state has issued Cleanup and Abatement Orders in the past to the current property owner. While Contra Costa County has indicated it has interest in undertaking a cleanup of the site, there are legal and financial constraints that would require resolution before the County would undertake any work on the site. Although those constraints have been identified, no resolution has been developed.

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

Current Site conditions pose the threat of potential future releases of hazardous substances. These substances include mercury present within mine tailings and waste rock, contaminated soils and sediments. The likelihood of direct human exposure, via ingestion and/or inhalation of hazardous substances, and the threat of potential future releases and migration of those substances, pose an imminent and substantial endangerment to public health, and/or welfare, or the environment based on the factors set forth in the NCP, 40 CFR § 300.415(b)(2). These factors include:

1. Actual or potential exposure to hazardous substances or pollutants or contaminants by nearby populations or the food chain

As described in Section II.A.4, high concentrations of mercury, a heavy metal, has been detected in samples at the south settling pond sediments and at various seeps on the site. If the dam should fail there is a potential for release of large quantities of mercury impacted water and sediments to Marsh Creek. Additionally, hazardous substances may be entrained in naturally and mechanically generated dust from the tailings or waste rock at the Site and be transported during high wind or rain events into the adjacent properties.

Analytical results indicate that concentrations of heavy metals identified in these media, exceed regulatory levels including U.S. EPA's Criterion for Maximum

Concentration, a ceiling value set at the point toxic effects to wildlife from contaminants in surface waters. Mercury is a hazardous substance as defined by Section 101(14) of CERCLA. Mercury exposure occurs from breathing air contaminated with mercury, or from ingesting contaminated water and food. Mercury, at high levels of exposure, may cause damage to the brain, kidneys and developing fetus. Effects on brain functioning may result in irritability, tremors, changes in vision or hearing, and memory problems. The nervous system is very sensitive to all forms of mercury. Short-term exposure to high levels of mercury vapors can cause lung damage, nausea, vomiting, diarrhea, increased blood pressure or heart rate, skin rashes and eye irritation. Young children are more sensitive to mercury than adults (ATSDR 1999.)

High concentrations of metals in sediments have already been identified in the downstream Marsh Creek Reservoir, resulting in a fish advisory and closure of the reservoir to public use. Wildlife may also be exposed to hazardous substances in impacted waters, fine-grained tailings and waste rock via the ingestion and inhalation pathways.

2. Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released

Visual observation suggests that the south settling pond dam is being scoured by Dunn Creek at the southeastern corner where Dunn Creek and Horse Creek meet. This scour feature has already resulted in undercutting the dam toe. During a high flow storm event, it is anticipated the scour feature will be worsened.

Additionally, there were seeps observed in the exterior dam face. A full engineering study should be undertaken to better manage the flows from the site and its adjacent water bodies, including a study on whether the settling ponds in their current configuration and locations are best to manage the effluent from the site. However, in light of the upcoming rainy season, it is imperative to stabilize the pond dam's face to prevent catastrophic failure and subsequent release of mercury-contaminated sediments and water.

Overall Site drainage controls should also be assessed and addressed as necessary to reduce inflow to the settling ponds, or to minimize contact with tailings and/or waste rock.

3. Availability of other appropriate Federal or State response mechanisms to respond to the release

The State Regional Water Quality Control Board has stated it is unable to perform removal actions necessary at this Site and has requested federal assistance as described in a Federal Request for Action Letter, dated November 20, 2008.

IV. ENDANGERMENT DETERMINATION

Actual and threatened releases of hazardous substances from this site, if not addressed by implementing a Time-Critical Removal Action may continue to present an imminent and substantial endangerment to public health, or welfare, or the environment.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed action description

U.S. EPA proposes to mitigate imminent and substantial threats to human health, welfare, or the environment by taking steps to prevent the release of hazardous substances in contaminated soil, sediments and acid mine drainage to the surface waters of Marsh Creek and to the surrounding environment where there is a high likelihood of direct human contact. The removal action will include the following objectives:

- Stabilize the south and southeastern corner of the south settling pond dam to mitigate the threat of catastrophic failure by placing rip rap or using other stabilization methods; and

- Undertake limited channel improvements and mitigate scour features.

2. Contribution to remedial performance

Long term remedial actions may include treatment or disposal of contaminated soils, sediments, debris, and surface waters in and around the Site.

The long-term cleanup plan for the site:

It is expected that this removal action will mitigate the threat of release a catastrophic failure of the settling pond dam. Additional engineering studies should be conducted to determine whether the current configuration and or locations of the

settling ponds are the most effective and efficient effluent management practice to minimize impacted waters containing sediments from leaving the Site. It is unknown what the subsurface conditions are and how that effluent could be managed.

Threats that will require attention prior to the start of a long-term cleanup:

The immediate threats that have been identified in this memorandum will be addressed by the proposed removal action.

The extent to which the removal will ensure that threats are adequately abated:

The stabilization of the south settling pond dam face will abate this one current threat posed at the Site. Additional threats may require additional actions not anticipated as part of this removal.

Consistency with the long-term remedy:

U.S. EPA asserts that the Time-Critical Removal proposed for the Site is consistent with addressing mine waste issues within the Marsh Creek Watershed.

3. Description of alternative technologies

Alternative technologies have not been considered.

4. Applicable or relevant and appropriate requirements (ARARs)

Section 300.415(j) of the NCP provides that removal actions must attain ARARs to the extent practicable, considering the exigencies of the situation.Section 300.5 of the NCP defines applicable requirements as cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances at a CERCLA site.

Section 300.5 of the NCP defines relevant and appropriate requirements as cleanup standards, standards of control and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site and are well-suited to the particular site.

Because CERCLA on-site response actions do not require permitting, only substantive requirements are considered as possible ARARs. Administrative requirements such as approval of, or consultation with administrative bodies, issuance

of permits, documentation, reporting, record keeping, and enforcement are not ARARs for the CERCLA sections confined to the site.

The following ARARs have been identified for the proposed response action. All can be attained.

Federal ARARs: The Clean Water Act, 33 U.S.C. Sections 1251, et. seq. and 40 CFR Parts 122, 123 and 124. CERCLA Off-Site Disposal Rule, 42 U.S.C. Section 9621(d)(3) and OSWER Directive 9347.3-8FS; RCRA Land Disposal Restrictions (LDRs) 40 CFR 268.40 ; and the U.S. Department of Transportation of Hazardous Materials Regulations 49 CFR Part 171, 172 and 173.

State ARARs: California Streambed Alteration, Cal. Fish & Game Code § 1602 (potentially applicable).

5. Project schedule

It is estimated that removal activities will take approximately 5 working days to complete.

B. Estimated Costs

Regional Removal Allowance Costs	
Cleanup Contractor	$ 75,000
Extramural Costs Not Funded from the Regional Allowance	
START Contractor	35,000
Extramural Subtotal	$ 110,000
Extramural Contingency (20%)	$ 22,000
TOTAL, Removal Action Project Ceiling	$ 132,000

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Given the site conditions, the nature of the hazardous substances documented on site, and the potential exposure pathways to nearby populations described in Sections III and IV above, actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response actions selected in this Action