FOSTER WHEELER ENVIRONMENTAL CORPORATION

May 10, 1996
FW-YCAPA - 008

Mr. Dave Morrison
Resource Management Coordinator
Yolo County Community Development Agency
292 West Beamer Street
Woodland, California 95695

SUBJECT: COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT (EIR) FOR OFF-CHANNEL MINING PLAN FOR LOWER CACHE CREEK, DATED MARCH 26, 1996

Dear Mr. Morrison:

On behalf of the Yolo County Aggregate Producers Association (YCAPA), Foster Wheeler Environmental Corporation (Foster Wheeler Environmental) has reviewed the subject EIR as it pertains to mercury and offers the following comments enclosed with this letter.

In the detailed comments attached to this letter, we raise a number of key issues. These issues are summarized below with reference to the pertinent comment number(s).

- The EIR proposes a 0.5 mg/kg criterion that is not based on current federal or state standards designed to protect human health and the environment from mercury. The process proposed in the EIR to disapprove wet-pit alternatives or require mitigation or filling of wet pits initiates a new regulatory process that is inconsistent with existing federal and state processes. (Comments 1 and 2). **14-1**

- Data from the Slotton et al. (1996) survey of the Solano Concrete wet pits indicate that, although fish tissue concentrations of mercury exceed 0.5 mg/kg, water concentrations are well within the USEPA ambient water quality criteria for protection of aquatic life and human health. (Comment 3). **14-2**

- Available fish tissue data indicate mercury concentrations observed in fish species sampled from Solano Concrete's wet pits, are common in fish in Cache Creek, elsewhere in Yolo and Solano counties, and throughout the world. The prevalence of elevated mercury levels in fish, and the similarity of levels measured in the initial project survey to background levels, was not discussed in the EIR. Given the prevalence of mercury in excess of the proposed 0.5 mg/kg criteria in fish in Cache Creek and elsewhere in the Yolo County, the EIR should discuss what measures the County may need to take for these existing water bodies in order to be consistent. (Comment 4). **14-3**

2525 NATOMAS PARK DRIVE, SUITE 250, SACRAMENTO, CA 95833-2900
TEL: 916-921-2525 FAX: 916-921-5124

- Groundwater data from the gravel mining area indicates mercury is well below the drinking water standard for mercury. (Comments 5). 14-4

- The EIR should recognize there should be no incremental increase in human health risk from consuming fish from the reclaimed wet pits. (Comment 7). 14-5

Thank you for the opportunity to comment on the EIR. Please call us at 921-2525 should you wish to discuss the above comments.

Sincerely,

Lee Shull, Ph.D.
Corporate Director
Toxicology and Risk Assessment

Richard M. Sitts, Ph.D.
Supervising Scientist

Attachment: *Comments on the Draft Environmental Impact Report for Gravel Mining in Lower Cache Creek, Dated March 26, 1996*

c:
A. Russo
D. Augustine
R. Sitts
M. Jones
M. Bowland
J. Scalmanini

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT (EIR) FOR OFF-CHANNEL MINING PLAN FOR LOWER CACHE CREEK, DATED MARCH 26, 1996

Prepared for

Yolo County Aggregate Producers Association

Prepared by

Foster Wheeler Environmental Corporation
2525 Natomas Park Drive, Suite 250
Sacramento, California 95833

May 10, 1996

COMMENT 1. THE 0.5 MG/KG MERCURY THRESHOLD LEVEL PROPOSED IN THE EIR IS NOT CONSISTENT WITH THE CURRENT FDA CRITERION OF 1.0 MG/KG FOR MERCURY.

On page 4.4-47, paragraph 5, the EIR states:

> *"The Food and Drug Administration set the threshold level of methylmercury* [sic] *in fish consumed by humans at 1.0 mg/kg. However, the National Academy of Sciences recommends a level of 0.5 mg/kg."*

The EIR should reference the specific documents on which these statements are based. We assume the National Academy of Sciences (NAS) recommendation is from its 1973 report, *Water Quality Criteria 1972*. If this is the case, then the NAS recommendation referenced in the EIR is based on the Food and Drug Administration (FDA) threshold of 0.5 mg/kg that existed at the time the 1973 NAS report was published. Enforcement of that threshold in the 1970s ended in litigation over a case involving consumption of swordfish. The courts determined that the studies on which the 0.5 mg/kg threshold was based were atypical and that the exposure and dose/response assumptions used to develop the 0.5 mg/kg fish advisory criterion were overly conservative. A new fish advisory criterion of 1.0 mg/kg was promulgated by the FDA, based on newer exposure and dose/response data from a number of studies (Bolger, personal communication, 1996).

In general, the FDA fish advisory criterion applies only to interstate commerce. Individual states and local agencies are responsible for promulgating fish advisory criteria within their own borders and may choose to adopt the FDA criterion or develop alternative criteria. The State of California has adopted an alternative process that involves risk assessment to identify the need for fish consumption advisories (see Comment 2).

Given the discussion above, the EIR should recognize the current FDA 1.0 mg/kg level, and acknowledge that it applies to human consumption and interstate commerce. Further, since a state process to protect human health is in place, the EIR should switch to the state approach for mercury.

COMMENT 2. THE 0.5 MG/KG MERCURY THRESHOLD LEVEL PROPOSED IN THE EIR IS NOT CONSISTENT WITH CURRENT STATE OF CALIFORNIA PRACTICE AND WOULD CREATE A NEW REGULATORY PROCESS.

On page 4.4-51, the EIR discusses the 0.5 mg/kg criteria.

The EIR should rely on the existing state process for identifying potential health risks related to mercury, instead of creating a new process independent of the state process. The need for Yolo County (County) to adopt its own standard (0.5 mg/kg) for mercury in fish tissue is not apparent, particularly when the proposed standard does not have any basis in current federal or state guidance for mercury. The EIR does not provide a rationale for adopting an alternative standard. If an alternative standard is deemed necessary, the rationale for adopting such a standard should be given.

The State of California has a process in place that is designed to protect human health and the environment from mercury impacts. The Office of Environmental Health Hazard Assessment (OEHHA), California EPA, first determines if fish muscle tissue contains mercury concentrations at levels of potential concern. (A concentration of 0.5 mg/kg has been used as a "red flag" in the past, but as new data on mercury is currently being made available at a rapid rate, this is no longer a "magic number." Rather, conditions of a specific site, including potential exposure scenarios, determine the mercury concentration that is of potential concern at the site.) Where mercury levels are a potential concern, OEHHA, California EPA, will conduct a risk assessment to determine the need for fish consumption advisories.

If necessary, OEHHA issues advisories that are site- and species-specific and are based on mercury levels (total mercury assumed to be 100 percent methyl mercury, as measured in fish tissue samples from a specific water body) and on doses that could cause health effects. Once issued, the State Department of Fish and Game (DFG) is required by legislation to publish advisories in DFG regulations that are available at license vending locations and at all DFG stations. Advisories are also posted in local newspapers and the local health department(s) is notified of their existence. State fish consumption advisories are generally informational and are not enforced at the point of consumption. Staff at OEHHA were not aware of any instances in which a fish consumption advisory led to the fencing of a fishing area or the banning of fishing in an area (G. Pollock, personal communication, 1996; D. Crane, personal communication, 1996).

Specific examples of the use of fish advisories regarding mercury concurrent with sport fishing regulations that allow limited or unlimited fishing include Clear Lake and the San Francisco Bay Delta. Fish consumption advisories and fishing limits are both published in California Sport Fishing Regulations (California Department of Fish and Game [DFG], 1996). In the Clear Lake case, from 0.28 to 0.66 mg/kg mercury has been measured in channel catfish (California Department of Health Services [DHS], 1987). The California Sport Fishing Regulations (DFG, 1996) advise pregnant women and children under six

years of age to not eat catfish from Clear Lake. They advise adults to eat no more than three pounds per month of catfish shorter than 24 inches. Regarding catching catfish, the regulations specify that there is no limit on the number or size of catfish that an angler can catch per day in Clear Lake. Clear Lake largemouth bass have had from 0.31 to 0.97 mg/kg of mercury (DHS, 1987). The advisory to pregnant women and children under six is to not eat largemouth bass from Clear Lake, and for adults to eat no more than two pounds per month. Regarding the limit, up to five largemouth bass all 12 inches or longer can be legally harvested per day from Clear Lake. DFG also published a mercury advisory for San Francisco Bay/Delta striped bass, which have had from 0.15 to 0.44 mg/kg mercury (California State Water Resources Control Board, 1995). The advisory is that no one eat striped bass longer than 35 inches. For striped bass less than 27 inches, pregnant women and children 15 years or younger should not eat more than six ounces per month, others should not eat more than 12 ounces per month. The harvest limit is two striped bass per day 18 inches or longer.

COMMENT 3. MERCURY CONCENTRATIONS IN WATER FROM AN EXISTING WET PIT ARE BELOW USEPA AMBIENT WATER QUALITY CRITERIA TO PROTECT AQUATIC LIFE AND HUMAN HEALTH.

On page 4.4-51, paragraph 1, the EIR states:

> *"The following performance standards shall be added to the OCMP to mitigate for potential for significant adverse impacts associated with the conversion of mercury occurring within the Cache Creek alluvial deposits to methylmercury* [sic]:
>
> *Prior to approval of reclamation of aggregate mining areas to permanent lakes, the County shall commission a sampling and analysis program,.... If the initial sampling indicates either of the following conditions, the County shall perform verification sampling:*
>
> - *Average concentrations of total mercury in excess of 0.000012 mg/L in the water;*
> - *Mercury levels in fish samples in excess of 0.5 mg/kg.*
>
> *If verification sampling indicates exceedance of these mercury standards, the County shall not approve reclamation of mining areas to permanent lakes."*

The 0.000012 mg/L is the U.S. Environmental Protection Agency (USEPA) freshwater chronic ambient water quality criteria for the protection of aquatic life. The 0.5 mg/kg is stated as being based on a NAS recommendation, which was in part based on a now obsolete FDA fish advisory criterion. This issue was already raised in Comments 1 and 2, regarding the appropriateness of a 0.5 mg/kg threshold level for mercury in fish tissue. Further questions regarding this threshold are raised below.

Protection of Aquatic Life. The USEPA has established ambient water quality criteria for mercury and other toxic pollutants that may be considered estimates of "the highest concentration of a substance in water which does not present a significant risk to the aquatic organisms in the water and their uses." On page 4.4-45, the EIR discusses the USEPA ambient water quality criteria to protect aquatic life. The USEPA has established 1-hour acute and 4-day freshwater chronic criteria of 2,400 and 12 nanograms per liter (ng/L), respectively, to protect aquatic life (USEPA 1984). That is, a potentially unacceptable impact to freshwater aquatic organisms may be expected if a 4-day average concentration of 12 ng/L is exceeded more than once in any 3-year period (USEPA, 1986). The 4-day freshwater chronic criterion is essentially a final residue value that was derived from a methyl mercury bioconcentration factor (BCF) of 81,700 for fathead

minnows. BCFs are used to relate pollutant residues in aquatic organisms to the pollutant concentration in ambient waters.

Water quality data for the Solano Concrete wet pits indicate that mercury concentrations in water are below the USEPA ambient water quality criteria for protection of aquatic life. Specifically, data from Slotton et al. (1996) include four observations made from April 4 through April 15, 1996 in the Solano Concrete wet pits. During this period, unfiltered total mercury concentrations ranged from 2 to 3 ng/L, all well below the USEPA criterion of 12 ng/L. Methyl mercury values ranged from 0.01 to 0.04 ng/L, or about 1 percent of the total mercury values.

Protection of Human Health. The EIR does not appear to discuss the USEPA ambient water quality criteria to protect human health from mercury in consumed fish. These criteria are 144 ng/L for consumption of water and fish, and 146 ng/L for consumption of fish only (USEPA, 1992). These criteria attempt to minimize or specify the potential risk of adverse human effects due to mercury in ambient water.

Water quality data for the Solano Concrete wet pit that indicate concentrations of mercury in water are below the USEPA ambient water quality criteria for protection of human health. Specifically, data from Slotton et al. (1996) include four observations made from April 4 through April 15, 1996 in the Solano Concrete wet pits. During this period, total mercury concentrations ranged from 2 to 3 ng/L, all well below the USEPA criteria of 144 to 146 ng/L.

COMMENT 4. MERCURY CONCENTRATIONS EXCEEDING 0.5 MG/KG IN FISH TISSUE ARE COMMON.

On page 4.4-51, the EIR discusses the fish tissue criterion of 0.5 mg/kg mercury, but does not provide any contextual information regarding typical background concentrations in fish populations. In fact, this concentration has been shown to be common in the muscle of a wide range of fish species.

Table 4-1 is a list of ranges of measured concentrations of mercury found in a number of fish species for a number of regions. This table includes Solano Concrete's wet pits data, and state, national, and international data. Comparisons of these data follow.

Mercury Concentrations in Nearby Water Bodies

Mercury concentrations in fish collected from the Solano Concrete wet pits (Slotton et al., 1996) are representative of concentrations commonly observed elsewhere. The wet pit data range from 0.13 to 0.92 mg/kg fresh weight. Mercury concentrations reported for freshwater fish sampled nationally range from 0.02 to 9.5 mg/kg. Reported mercury concentrations in California freshwater fish range from 0.16 to 1.8 mg/kg fresh weight. Measured concentrations in fish from the Solano Concrete ponds are at the low end of these reported ranges.

Mercury concentrations reported in the literature are similar to those measured at the Solano Concrete ponds for similar fish species:

- Mercury concentrations measured in sunfish at the Solano Concrete ponds ranged from 0.16 to 0.3 mg/kg. These concentrations are similar to those measured in lower Cache Creek sunfish and elsewhere in California (0.06 to 0.26 mg/kg).

- Concentrations of mercury in smallmouth bass collected from the Solano Concrete wet pit ranged from 0.19 to 0.9 mg/kg fresh weight. These concentrations are at the lower end of the national range (0.03 to 9.5 mg/kg) and California range (0.1 to 1.8 mg/kg) for largemouth and smallmouth bass.

- Mercury concentrations in catfish collected from the Solano Concrete wet pit (0.13 to 0.92 mg/kg) are in the lower end of the national range (0.02 to 2.5 mg/kg), but exceed the range for lower Cache Creek (0.28 to 0.57 mg/kg) and elsewhere in California (0.02 to 0.34 mg/kg).

Fish have also been collected from other surface water bodies within the Cache Creek watershed (Table 5-1). Two of these water bodies, Davis Creek Reservoir and Clear Lake, are impacted by mercury. Fish advisories have been issued for Clear Lake (see Comment 2); no fish advisories have been issued for Davis Creek Reservoir, which is on private property, nor has this water body been studied by OEHHA (OEHHA, 1987; Pollock, personal communication, 1996). Comparisons of data for similar species of fish

from these water bodies to those collected at the Solano Concrete wet pit are presented below:

- The maximum detected total mercury concentrations in sunfish from the Solano Concrete wet pit (0.3 mg/kg) and lower Cache Creek (0.29 mg/kg) are less than the 95 percent confidence interval of mean concentrations detected in Davis Creek Reservoir sunfish.

- Mercury concentrations of catfish collected at the Solano Concrete ponds and lower Cache Creek are similar to the 95 percent confidence interval of mean concentrations detected in Clear Lake.

- Mercury concentrations in smallmouth bass collected from the Solano Concrete ponds are similar to the 95 percent confidence interval of mean concentrations detected in Clear Lake. Concentrations in the Solano Concrete pond smallmouth bass are less than those for largemouth bass from Davis Creek Reservoir.

The presence of mercury in fish in uncontaminated environments has also been reported in the literature, and can be attributed to "background" sources such as deposition of mercury from the atmosphere, and erosion of natural mercury deposits in soil. For example, fish tissue concentrations in excess of 1.0 mg/kg were common in a survey of more than 10,000 Swedish lakes. In 95 of these lakes, the average mercury concentration in tissue of predatory fish (*e.g.*, pike) was 1.2 mg/kg. These lakes had no known sources of mercury, other than atmospheric sources within their catchments (Anderson and Håkanson, 1992).

Based on this information, it is expected that the creation of permanent lakes from gravel mining activities will not provide conditions resulting in fish mercury concentrations substantially different than mercury concentrations measured in fish from other water bodies in California, the U.S., and other countries. The EIR should acknowledge that these concentrations are commonly observed in support of the County utilizing the advisory process.

Mercury Concentrations in the U.S. Commercial Fish Market

The FDA, in addition to other governmental agencies (*e.g.*, U.S. Department of Commerce [USDC]), conducts surveillance sampling for mercury in fish and seafood available on the commercial market. Data from three of these surveys are presented in Table 5-2. Although the FDA data are more recent (1992-1994), the sample size for each species analyzed is relatively small (reported as "at least five samples") compared to the USDC (1978) data presented by DHS (1987). In addition, the FDA survey did not report all of the species sampled by USDC. The results of these surveys are summarized below and in Table 5-2.

Average mercury concentrations reported in commercially available fish and seafood range from 0.05 mg/kg in shrimp to 1.6 in tilefish (Table 5-2). For catfish, concentrations range from 0.05 to 0.74 mg/kg. Mercury concentrations in fish collected from the Solano Concrete ponds range from 0.13 to 0.92 mg/kg fresh weight. Measured concentrations in fish from the Solano Concrete ponds are within the reported range of commercial fish mercury concentrations.

For the commercially-available species sampled in these surveys, USEPA (1995) reports that the ten highest species-specific mean consumption rates are, in order from highest to lowest, tuna, shrimp, flounder, salmon, cod, trout, catfish, pollock, bass, and crab. The reported mercury concentrations in these commercially available species range from an average of 0.05 mg/kg for salmon to a maximum of 2.0 mg/kg for striped bass. Again, measured concentrations in fish from the Solano Concrete ponds fall within this reported range of commercial fish mercury concentrations.

Based on this information, it is not expected that the creation of permanent lakes from gravel mining activities will provide conditions resulting in fish mercury concentrations substantially different than mercury concentrations measured in fish available on the commercial market.

TABLE 4-1

MERCURY CONCENTRATIONS IN AQUATIC LIFE

Compartment	Region	Mercury (mg/kg fresh weight)	References[a]
Bass, fresh water	National	0.19	Tollefson and Cordle, 1986
Largemouth bass	National	0.03-7.3	Jenkins, 1980; DWR, 1987; SWRCB, 1995
Largemouth bass	California	0.1-1.8	DWR, 1987; SWRCB 1995
Largemouth bass	Davis Creek Reservoir, CA	2.79-4.5	Slotton et al., 1996
Largemouth bass	Davis Creek Reservoir, CA	0.79-1.87	Slotton et al., 1996
Largemouth bass	Clear Lake, CA	0.31-0.97[b]	DHS, 1987
Smallmouth bass	Lake Erie	0.51	Tollefson and Cordle, 1986
Smallmouth bass	Solano Concrete Pond, CA	0.19-0.9	Slotton et al., 1996
Bluegill sunfish	California	0.06-0.26	DWR, 1987; SWRCB, 1995
Bluegill sunfish	Davis Creek Reservoir, CA	2.22-2.81	Slotton et al., 1996
Bluegill sunfish	Davis Creek Reservoir, CA	0.67-1.51	Slotton et al., 1996
Bluegill sunfish	Lower Cache Creek, CA	0.28-0.29	Slotton et al., 1996
Green sunfish	Solano Concrete Pond, CA	0.16-0.3	Slotton et al., 1996
Brown bullhead	Santa Ana River, California	0.13	SWRCB, 1995
Brown bullhead	Lower Cache Creek, CA	0.22-0.31	Slotton et al., 1996
Brown bullhead	Solano Concrete Pond, CA	0.72-0.92	Slotton et al., 1996
Catfish	National	0.02-2.5	Tollefson and Cordle, 1986; Jenkins, 1980; DWR, 1987; SWRCB, 1995a; FDA, 1994
Channel catfish	California	0.02-0.34	DWR, 1987; SWRCB, 1995b
Channel catfish	Clear Lake, CA	0.28-0.66[a]	DHS, 1987
Channel catfish	Lower Cache Creek, CA	0.28-0.57	Slotton et al., 1996
Channel catfish	Solano Concrete Pond, CA	0.13-0.67	Slotton et al., 1996
White catfish	Clear Lake, CA	0.47-0.61	DHS, 1987
Northern pike	Canada	0.1-10.6	Jenkins, 1980
	Lake St. Clair	2.0 - 3.0	Jenkins, 1980
	Norway	0.1	Jenkins, 1980
	Sweden	0.2 - 9.8	Jenkins, 1980
	Wisconsin	0.9 - 1.4	Jenkins, 1980

TABLE 4-1

MERCURY CONCENTRATIONS IN AQUATIC LIFE

Compartment	Region	Mercury (mg/kg fresh weight)	References[a]
Perch	Lake Erie, Lake St. Clair	0.24-0.88	Tollefson and Cordle, 1986
Trout, fresh water	National	0.13-0.6	Tollefson and Cordle, 1986; SWRCB, 1995; Jenkins, 1980
Brown trout	Lake Ontario	0.24-0.26	Gutenmann and Lisk, 1991
	California	0.05-0.34	SWRCB, 1995a
Lake trout	Canada	0.12-10.5	Borgmann and Whittle, 1991; Jenkins, 1980
	New York	0.3 - 0.6	Jenkins, 1980
Striped Bass	National	0.14-9.5	Cooper, 1983; DWR, 1987
Striped Bass	California	0.14-0.44	DWR, 1987; RWQCB, 1995
Tuna	National	0.24- 6.3	Schreiber, 1983; USEPA, 1996a
American lobster	Chesapeake Bay	0.03 - 0.6	Jenkins, 1980
	NW Atlantic	0.25 - 1.6	
	Nova Scotia	0.15 - 1.5	
Spiny lobster	Tyrrhenian Sea	2.9	Schreiber, 1983
Walleye	Lake Erie	0.58	Tollefson and Cordle, 1986

a DHS: California Department of Health Services
DWR: California Department of Water Resources
RWQCB: San Francisco Regional Water Quality Control Board
SWRCB: California State Water Resources Control Board

[b] The full range of detected concentrations was not reported. Values presented here are the upper and lower confidence intervals on the mean and do not represent the true range of concentrations observed in fish from this water body.

TABLE 4-2

MERCURY CONCENTRATIONS IN COMMERCIALLY AVAILABLE FISH AND SEAFOOD

Species	Average Mercury Concentration (mg/kg)	Maximum Mercury Concentration (mg/kg)	References
Domestic			
Bass, freshwater	0.19	0.62	Tollefson and Cordle, 1986
Bass, sea	0.07-0.16	0.25-0.58	DHS, 1987; Tollefson and Cordle, 1986
Bass, striped	0.75	2.0	DHS, 1987
Bluefish	0.19-0.38	0.81-1.23	DHS, 1987; Tollefson and Cordle, 1986
Catfish	<0.10-0.10	0.16-0.74	FDA, 1994; Tollefson and Cordle, 1986
Catfish	--	0.05	This study
Catfish, freshwater	0.15	0.38	DHS, 1987
Catfish, marine	0.48	1.2	DHS, 1987
Cod	0.13-0.15	0.17-0.83	FDA, 1994; Tollefson and Cordle, 1986
Crab	0.13	0.27	FDA, 1994
Crappie	0.2	1.39	DHS, 1987
Flounder	<0.1-0.10	<0.1-0.88	DHS, 1987; FDA, 1994
Grouper	0.6	2.45	DHS, 1987
Hake	<0.1	<0.1	FDA, 1994
Halibut	0.24-0.53	0.51-1.43	DHS, 1987; FDA; 1994, Tollefson and Cordle, 1986
Lobster, Northern	0.51	2.31	DHS, 1987
Perch, freshwater	0.13	0.30	Tollefson and Cordle, 1986
Perch, saltwater	0.17	0.44	Tollefson and Cordle, 1986
Pollock	0.05	<0.1-0.14	FDA, 1994; Tollefson and Cordle, 1986
Salmon	0.05	0.21	DHS 1987
Shark	0.84-1.24	3.52-4.53	DHS 1987; FDA, 1994; Tollefson and Cordle, 1986
Shrimp	0.05	0.33	DHS, 1987
Snapper, red	0.45	2.17	DHS, 1987
Swordfish	0.83-1.27	1.68-2.72	DHS 1987, FDA 1994; Tollefson and Cordle, 1986

TABLE 4-2

MERCURY CONCENTRATIONS IN COMMERCIALLY AVAILABLE FISH AND SEAFOOD

Species	Average Mercury Concentration (mg/kg)	Maximum Mercury Concentration (mg/kg)	References
Tilefish	1.61	3.73	DHS, 1987
Trout, freshwater	0.13-0.42	1.01-1.22	DHS, 1987, Tollefson and Cordle, 1986
Trout, marine	0.09-0.24	0.24-1.19	DHS, 1987; Tollefson and Cordle, 1986
Tuna, canned	0.20	0.34	FDA, 1994
Tuna, fresh or frozen	0.38	0.76	FDA, 1994
Tuna, light skipjack	0.14	0.39	DHS, 1987
Tuna, light yellowfin	0.27	0.87	DHS, 1987
Tuna, white	0.35	0.90	DHS, 1987
Imported			
Pollock	0.16	0.78	FDA, 1994
Shark	0.36	0.70	FDA, 1994
Swordfish	0.86	1.61	FDA, 1994
Tuna, Canned	0.14	0.39	FDA, 1994
Tuna, fresh or frozen	0.27	0.75	FDA, 1994

COMMENT 5. GROUNDWATER MERCURY CONCENTRATIONS AT THE SOLANO CONCRETE WET PITS ARE LESS THAN THE DRINKING WATER MAXIMUM CONTAMINANT LEVEL FOR MERCURY.

In evaluating potential effects on drinking water, the EIR should acknowledge data on mercury concentrations in groundwater in the proposed off-channel gravel mining area. Specifically, concentrations of filtered total mercury and methyl mercury in shallow ground water were determined at existing and planned wet-pit areas within the lower Cache Creek Basin. This groundwater, along with atmospheric deposition, is the source of water for the proposed wet pits. From April 15 through April 17, 1996, groundwater samples were collected from four monitoring wells located at the Solano Concrete site and five wells at the Cache Creek Aggregates site. In conjunction with the groundwater samples collected for mercury analyses, selected samples were also analyzed for general mineral constituents and nitrate. The latter samples were collected to assess water quality correlations between shallow groundwater and Cache Creek and also to assess current environmental conditions related to the speciation of mercury. Details on well location criteria, and sampling procedures and results are provided below.

Criteria for well locations. Groundwater monitoring wells at the two sites were selected using the following criteria:

- *Location of the monitoring well relative to the Creek.* Wells were selected both near to and away from the Creek.

- *Location of monitoring well relative to an existing or planned wet pit mining area.* Wells were selected upgradient and downgradient of mining areas.

- *Completion of the monitoring well near the water table and/or relatively deeper alluvial materials.* One relatively deeper well was sampled at each site.

The monitoring wells selected for sampling included shallow wells OW2s, OW3s, OW8s and deep well OW8d at the Solano Concrete site, and wells MW1, MW3, MW4A (deeper), MW4B (shallower) and MW5 at the Cache Creek Aggregates site. The monitoring well locations are shown on their respective site maps (Figures 5-1 and 5-2). In addition to the groundwater samples, a surface water sample was collected from Cache Creek near the Cache Creek Aggregates site, at the location shown on Figure 5-2.

Sampling Apparatus and Procedures. A portable stainless steel submersible pump was used for groundwater purging and sampling. Separate tubings are attached to the pump for purging and sampling activities. Due to the extremely low detection limits for the mercury analyses, special precautions were employed to ensure ultra-clean sample tubing and related equipment. Teflon-lined polyethylene tubing was pre-cleaned by Frontier Geosciences Laboratory, Seattle, Washington, using an acid cleaning procedure. The tubing was soaked in 4N hydrochloric acid at 70°F. This soaking was followed by

copious rinsing with deionized water known to be low in metals of interest (mercury in particular). Groundwater samples were collected following in-line filtration with high capacity (600 cm^2) 0.45-micrometer (μm) disposable filters having an inherently hydrophilic polysulfane membrane and an outer polycarbonate shell. The filters were also acid-cleaned using the above procedure. Individual tubing/in-line filter units were assembled for each sampling location. Also, quality control samples were collected from two tubing/filter units to assess the concentration of total mercury present as background. The quality control samples showed background concentrations of 0.15 and 0.21 ng/L total mercury.

Each sampling event included extensive purging. A minimum of 40 casing volumes was purged to ensure the collection of representative groundwater samples. During purging, indicator parameters, including specific conductance, pH, temperature and turbidity, were monitored to assess water quality stabilization. Field parameter measurements, and other purging data, are provided in Tables 5-1 and 5-2.

Sample Collection and Analyses. Samples were collected with the assistance of Luhdorff and Scalmanini Consulting Engineers, Woodland, California. Following purging operations, pump flow rates were reduced for sample collection. Groundwater samples for mercury analyses were collected in pre-cleaned Teflon containers using rigorous ultra-clean sampling protocol. Sample collection was conducted by two persons wearing fresh clean-room gloves. The containers are double bagged, and one person was responsible for handing the sample container while still in the outer bag. The other person retrieved the container from the inner bag and collected the sample. The bottle was then re-bagged. Samples for general mineral and nitrate analyses were collected using standard sampling techniques.

Samples were collected for total mercury analyses at all nine monitoring locations. Samples for methyl mercury were collected from three monitoring wells at Solano Concrete (near to and away from Cache Creek), from two monitoring wells at Cache Creek Aggregates (near to and away from Cache Creek), and directly from the Cache Creek. Three field blanks were collected for quality control purposes for total mercury concentrations in particular.

Samples for total and methyl mercury analyses were shipped to Frontier Geoscience Laboratories. Total mercury was analyzed using acid digestion, $SnCl_2$ reduction, dual amalgamation and cold vapor atomic fluorescence (CVAFS) detection. Methyl mercury was determined after distillation using aqueous phase ethylation, gas chromatography separation of the ethyl derivatives, and CVAFS detection. Analytical detection limits for mercury in water were <0.012 ng/L.

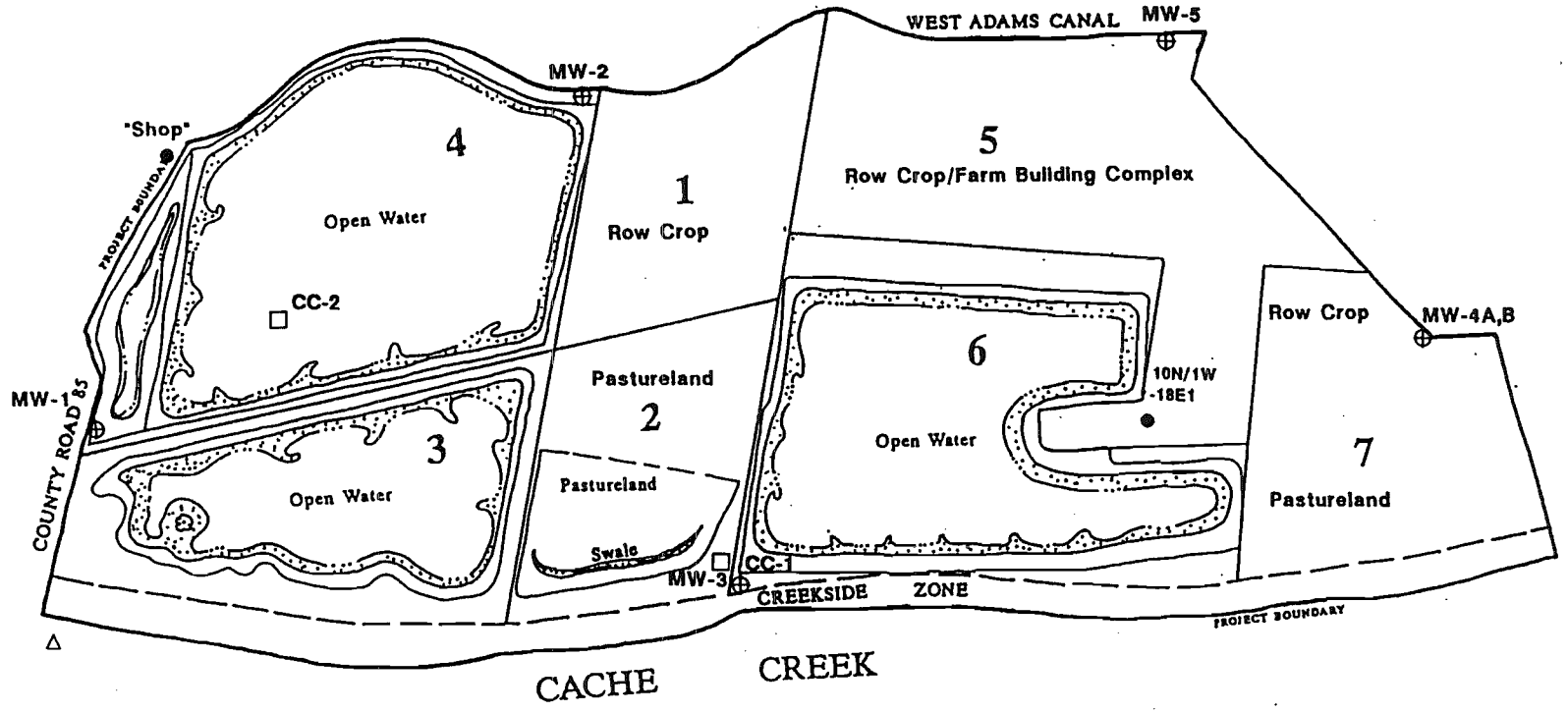
Samples for general mineral and nitrate analyses were collected from four wells at Solano Concrete, two wells at Cache Creek Aggregates, and the Creek. Samples for these analyses were delivered to Sequoia Analytical Laboratories in Sacramento.

Groundwater samples were cooled in an ice chest following collection. Samples for mercury analyses were shipped that day or within 24 hours to Frontier Geosciences. The samples were packed with ice packs and dry ice and shipped overnight to the laboratory. General mineral and nitrate samples were picked up and/or delivered to Sequoia Analytical Laboratories within 24 hours of collection. All samples were transported and/or shipped under chain-of-custody protocol. Between sampling locations, the portable submersible pump was decontaminated using an Alconox rinse, followed by deionized water.

Sampling Results. The results of the total mercury and methyl mercury analyses are summarized in Table 5-3. General mineral and nitrate analytical results are summarized in Table 5-4. The laboratory analytical data sheets are included in Appendix A.

The filtered total mercury values, adjusted for field blank concentrations, among samples at both sites, range from 1 to 3 ng/L, or up to 0.000003 mg/L. Values for filtered methyl mercury ranged from 0.00 to 0.01 ng/L, or up to 0.00000001 mg/L.

The State of California has set a Maximum Contaminant Level (MCL) of 0.002 mg/L for total mercury. MCLs are developed to ensure that contaminant levels in potential drinking water sources do not exceed levels that may pose a health risk to humans. Although Cache Creek has been shown to contain mercury in excess of 0.002 mg/L (EIR, page 4.4-10), the groundwater samples around both proposed mining areas were less than or equal to 0.000003 mg/L, and therefore well below the MCL. These data suggest that water levels in the proposed wet pits would be similar to the groundwater because groundwater is the only known source of incoming mercury besides atmospheric deposition.



LEGEND

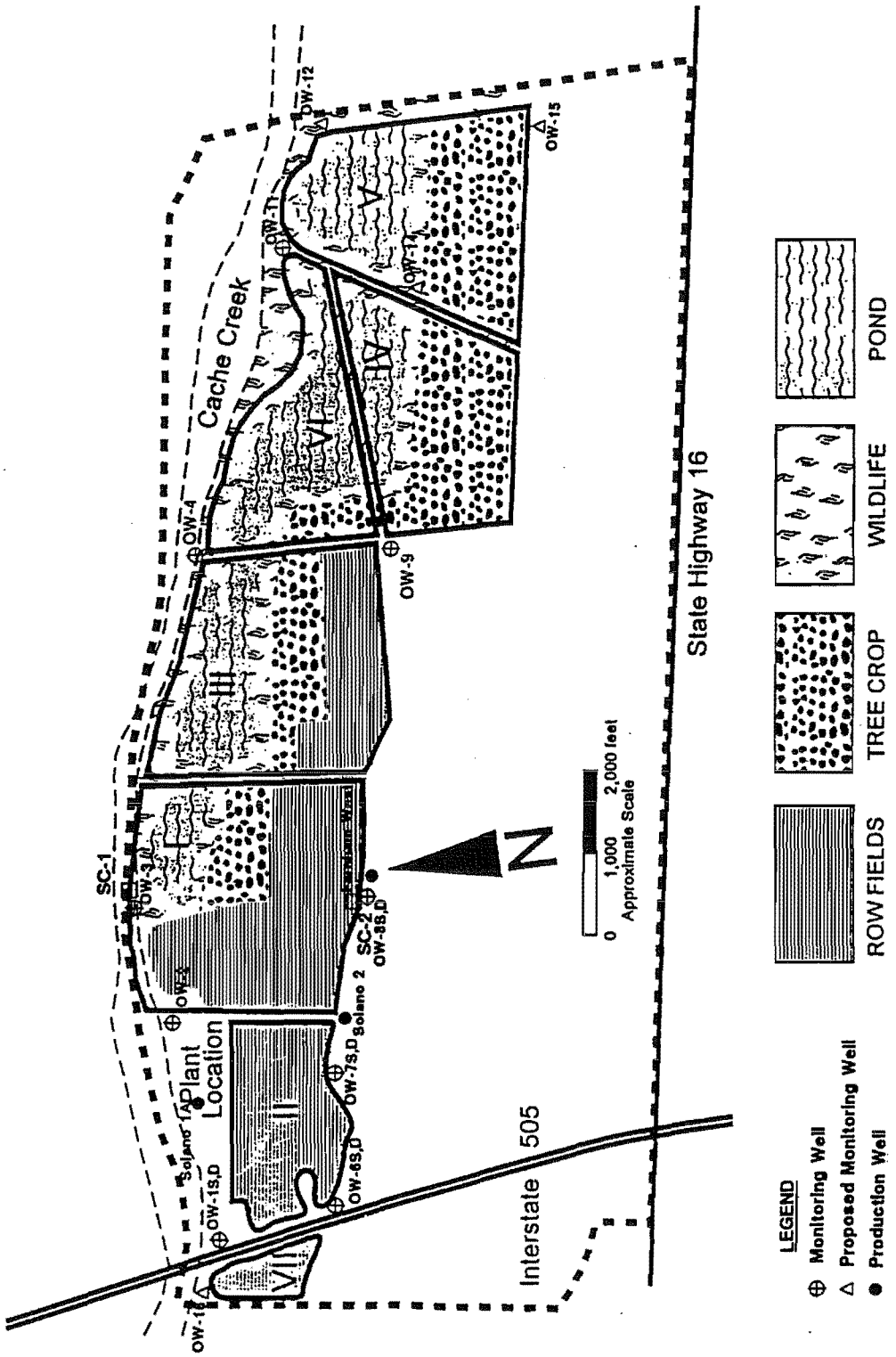
- ● Water-Supply Well
- ⊕ Monitoring Well
- □ Boring
- △ Surface-Water Sampling Point

Adapted From Zentner and Zentner, 1995

CACHE CREEK AGGREGATES
SITE MAP WITH PROPOSED RECLAMATION

FIGURE 5-1

Luhdorff & Scalmanini
Consulting Engineers



SOLANO CONCRETE
SITE MAP WITH PROPOSED RECLAMATION

FIGURE 5-2

Luhdorff & Scalmanini
Consulting Engineers

TABLE 5-1

SUMMARY OF MONITORING PARAMETERS AND RESULTS FOR GROUNDWATER WELLS AT SOLANO CONCRETE, YOLO COUNTY, CA

	Well Identification/Sample Date			
	OW2	OW3	OW8 Shallow	OW8 Deep
Parameters Analyzed	4-16-96	4-16-96	4-15-96	4-15-96
Static Water Level (depth, ft.)	29.91	22.13	24.31	24.26
EC (µmhos/cm), Beginning of Purging	853	655	1,172	1,048
EC (µmhos/cm), End of Purging	853	653	1,198	1,030
pH (pH units), Beginning of Purging	7.12	7.81	7.08	7.30
pH (pH units), End of Purging	7.24	7.61	6.95	7.25
Temperature (°F), Beginning of Purging	65.0	58.3	64.9	63.9
Temperature (°F), End of Purging	65.7	57.7	65.6	64.1
Turbidity (NTU), Beginning of Purging	27.0	37.0	100+	1.0
Turbidity (NTU), End of Purging	0.31	0.20	0.30	0.12
Total Well Depth (ft.)	71.30	71.00	36.75	86.90
Casing Volume (gal.)	6.75	7.97	2.03	10.21
Capacity (gpm)	3.0	3.39	1.0	3.52
Time Purged (min.)	90	90	90	135
Casing Volume Purged	40.28	40.03	44.33	40.80

TABLE 5-2

SUMMARY OF MONITORING PARAMETERS AND RESULTS, CACHE CREEK AGGREGATES, YOLO COUNTY, CALIFORNIA

Parameters Analyzed	Well Identification/Sample Date				
	MW1	MW3	MW4A	MW4B	MW5
	4-16-96	4-16-96	4-17-96	4-17-96	4-17-96
Static Water Level (depth, ft.)	19.81	31.58	32.00	26.98	29.51
EC (µmhos/cm), Beginning of Purging	554	483	694	520	595
EC (µmhos/cm), End of Purging	566	535	662	527	606
pH (pH units), Beginning of Purging	7.50	7.63	7.49	7.20	7.36
pH (pH units), End of Purging	7.41	7.49	7.47	7.62	7.26
Temperature (°F), Beginning of Purging	66.3	66.2	65.7	66.3	66.7
Temperature (°F), End of Purging	67.2	65.9	66.1	66.9	67.0
Turbidity (NTU), Beginning of Purging	100+	53.0	100+	100+	100+
Turbidity (NTU), End of Purging	2.0	2.0	4.1	2.0	6.4
Total Well Depth (ft.)	53.10	73.30	102.87	53.13	82.75
Casing Volume (gal.)	5.43	6.80	11.55	4.26	8.68
Capacity (gpm)	1.92	3.65	3.0	3.0	3.52
Time Purged (min.)	135	90	165	60	105
Casing Volume Purged	44.63	41.18	40.50	4.26	8.68

TABLE 5-3

MERCURY SPECIATION IN FILTERED WELL WATERS FROM SOLANO CONCRETE AND CACHE CREEK AGGREGATES, YOLO COUNTY, CALIFORNIA, APRIL 15-17, 1996.

Sample Location	Sample Date	net [Hg], ng/L	
		Total	Methyl
Solano Concrete OW8-D	4-15-96	0.85	0.023 0.019
Solano Concrete OW8-S	4-15-96	rep 1: 1.33 rep 2: 1.39	0.030
Field Blank	4-15-96	0.34	0.017
Solano Concrete OW-2	4-16-96	3.81	--
Solano Concrete OW-3	4-16-96	1.18	0.020 0.016
Cache Creek Aggregates MW-3	4-16-96	0.65	<0.012
Cache Creek Aggregates MW-1	4-16-96	rep 1: 1.51 rep 2: 1.46	--
Cache Creek -unfiltered	4-16-96	4.53	0.295
Cache Creek -filtered	4-16-96	1.99	0.072
Field Blank	4-16-96	0.34	0.023
Cache Creek Aggregates MW-5	4-17-96	3.03	<0.012
Cache Creek Aggregates MW-4A	4-17-96	rep 1: 1.25 rep 2: 1.02	--
Cache Creek Aggregates MW-4B	4-17-96	1.49	--
Field Blank	4-17-96	0.21	--

TABLE 5-4

GROUNDWATER MONITORING WELLS GENERAL MINERALS AND NITRATE, SOLANO CONCRETE AND CACHE CREEK AGGREGATES, YOLO COUNTY, CALIFORNIA, APRIL 15-17, 1996

Parameter	Solano Concrete OW2	Solano Concrete OW3	Solano Concrete OW8 Shallow	Solano Concrete OW8 Deep	Cache Creek Aggregate MW3	Cache Creek Aggregate MW5	Cache Creek
Bicarbonate	310	210	430	400	220	240	240
Calcium	59	32	82	76	40	42	35
Carbonate Alkalinity	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloride	68	36	89	80	59	39	48
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hardness	340	180	530	430	230	240	240
Hydroxide Alkalinity	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Iron	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.24
Magnesium	46	25	79	59	32	34	37
Manganese	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.011
pH (pH units)	7.4	7.6	7.1	7.4	7.7	7.4	8.4
Potassium	1.9	1.6	1.4	2.4	1.4	1.7	2.0
Sodium	54	43	69	72	50	32	42

TABLE 5-4

GROUNDWATER MONITORING WELLS GENERAL MINERALS AND NITRATE, SOLANO CONCRETE AND CACHE CREEK AGGREGATES, YOLO COUNTY, CALIFORNIA, APRIL 15-17, 1996

Parameter	Solano Concrete OW2	Solano Concrete OW3	Solano Concrete OW8 Shallow	Solano Concrete OW8 Deep	Cache Creek Aggregate MW3	Cache Creek Aggregate MW5	Cache Creek
Specific Conductance (µmhos/cm)	800	550	1,200	1,000	700	600	650
Sulfate	37	24	68	54	35	38	20
Surfactants	0.051	<0.050	<0.050	0.055	0.051	0.12	<0.050
Total dissolved solids (TDS)	480	280	720	620	360	330	340
Zinc	<0.01	<0.01	<0.01	0.01	0.076	<0.01	<0.01
Nitrate	31	18	85	54	7.1	8.3	9.4
Concentration Units - mg/l unless otherwise noted							

COMMENT 7. INCREMENTAL INCREASE IN MERCURY EXPOSURE.

On page 4.4-51, the EIR refers to a 0.5 mg/kg value without regard to whether it would prevent an incremental increase in the exposure of people to mercury.

In order to relate the 0.5 mg/kg value in terms of potential risks to human health, the following discussion outlines the typical methods used to estimate potential risks to human health from consumption of fish containing elevated levels of mercury. Several regulatory agencies have previously evaluated potential risks to human health from the consumption of mercury-contaminated fish. These include both state (e.g., California OEHHA) and federal (e.g., FDA) agencies. In general, the methods used to establish whether a certain level of mercury poses a potential threat to human health follow the basic procedures outlined in the USEPA's *Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual* (USEPA, 1989). There are two integral components to the risk assessment procedure developed by USEPA. These are the exposure assessment step and toxicity assessment step.

The exposure assessment step in a risk assessment combines information about the concentration of mercury in fish with assumptions about how much fish a typical individual consumes. The result is an estimation of a person's rate of intake, or dose, of mercury. This estimation is dependent on a number of different parameters, referred to as exposure parameters. Exposure parameters refer to all of the values used to calculate the daily human dose or intake level variables (e.g., ingestion rate, exposure frequency, and body weight). The average daily dose (ADD) of a non-carcinogenic chemical, such as mercury, is averaged over the estimated period of exposure, referred to as the averaging time. The ADD is expressed in units of milligrams per kilogram per day (mg/kg/d). Equations used for calculating ADDs have been developed by USEPA.

Toxicity values for many chemicals, including mercury, are published by the USEPA in the on-line Integrated Risk Information System (IRIS; USEPA, 1996b). Reference doses (RfDs) for non-carcinogens, such as mercury, are experimentally derived "no-effect" values used to quantify the extent of non-carcinogenic toxic effects from exposure to a chemical. A lower RfD value implies a more potent toxicant.

This concept of risk assessment, relying on both exposure and toxicity information, has been used in the fish consumption advisories previously developed by the State of California. California fish consumption advisories are not based on whether levels of mercury in fish tissue exceeded the FDA action level of 1.0 mg/kg. Fish consumption advisories developed by the state used standard USEPA values for the amount of fish typically consumed and adult body weights. Recommendations in the advisories specified how much fish could be ingested safely, based on the levels of mercury measured in fish tissue.

The present USEPA screening level for mercury is 0.6 mg/kg, based on a modified RfD of 0.06 µg/kg/d (USEPA 1993). As defined by USEPA (1993), screening levels are "concentrations or target analytes (e.g., mercury) in fish or shellfish tissue that are of potential public health concern." They are useful as standards against which levels of contamination in similar tissue collected from the ambient environment can be compared. Screening levels are recommended guidance levels only; they are not regulatory levels and USEPA recognizes that there are many other acceptable approaches and models currently in use. In 1995, USEPA revised the RfD for mercury from the 0.06 µg/kg/d. The revised RfD is based on developmental effects in infants (USEPA, 1996b). However, USEPA has not revised the screening level for mercury, which with the revised RfD (0.1 µg/kg/d), would increase the USEPA screening level for mercury from 0.6 mg/kg to 1.0 mg/kg. Interestingly, this is equal to the FDA action level of 1.0 mg/kg. However, because California has based previous fish consumption advisories on the older RfD, the level of mercury in fish tissue that triggers a fish consumption advisory would be lowered by a factor of 3. The levels of mercury in fish tissue that would trigger a fish consumption advisory will likely be in the neighborhood of 0.2 to 0.3 mg/kg. However, state policy is currently in flux regarding a trigger level for mercury contamination in fish. To date, the state has not formally adopted the use of the new RfD in its development of fish consumption advisories. Based on the discussions above, **if this level is adopted by California, virtually all fish consumed, whether store bought or caught, fresh water or marine, would constitute an unacceptable risk to human health.**

In the absence of any fish advisories applied to the proposed lakes, there are two conditions in which creation of the permanent lakes would pose an incremental risk to human health above typical risks posed by the consumption of fish. The first condition is if the levels of mercury in fish tissue consumed are significantly above those levels typically found in fish in the typical American diet. The second condition is if people fishing in the lakes increase their consumption of fish because the proposed lakes are constructed. This would only apply to an individual who, through the creation of these lakes, would consume more fish in their diet than before the lakes were created. This does not apply to an individual who may already consume more fish than normal, and may use the lakes as an additional or replacement source. That is, unless fish tissue concentrations of mercury in the lakes are significantly above typical levels or an individual consumes more fish in their diet because of the creation of these lakes, the lakes should not pose an incremental increase in the potential risks to human health. This is not to say that there is not a potential human health risk associated with the consumption of fish from the lakes; however, unless the conditions as presented above are met, **there should not be an *incremental* increase in the risks associated with the consumption of fish from the lakes**.

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APPENDIX A

LABORATORY DATA FOR WELL WATER ANALYSES

FRONTIER GEOSCIENCES
ENVIRONMENTAL RESEARCH CORPORATION
414 Pontius North • Seattle, WA 98109
(206) 622-6960 • fax: (206) 622-6870

Rick Sitts
Foster Wheeler Environmental
2525 Natomas Park Drive, #250
Sacramento, CA 95833-2900

April 24, 1996

Dear Mr. Sitts,

Enclosed please find our results for mercury speciation in water, core borings, and fish from your Cache Creek Aggregates project. Samples were handled using ultra-clean protocols--with special attention being paid to the extraction of soils from the core borings only from the center of the sample (material not in contact with the brass core tube walls). In several cases (those indicated in the tables as "gravel/sand/mud," and "muddy sand") the samples were slushy and wet, making it impossible to obtain a sample that had not been in contact with the core barrel. These samples may contain some degree of contamination due to the brass core barrel, although the degree of this is unassessable.

All total Hg were analyzed according to published FGS protocols, using acid digestion, $SnCl_2$ reduction, dual amalgamation and cold vapor atomic fluorescence (CVAFS) detection. Methyl Hg were determined after distillation using aqueous phase ethylation, GC separation of the ethyl derivatives, and CVAFS detection. The dry fraction was determined gravimetrically, after drying at 105°C overnight. No analytical difficulties were encountered, and all raw data has been archived for a year, in case future access is needed. I will note that the fish sample gave unusual results, in that only a small fraction (20%) of the measured total was found to be methyl Hg. Normally, we have found 95-100% of fish muscle Hg in the methylated form. However, most of the fish we have measured have been upper level pecivors, as opposed to your catfish, which feeds on detritus (largely inorganic Hg).

In addition to the chemical data, the following information was obtained on the three sieved samples.

sample ID	percent of mass < 2 mm
CC-1-25	86.0
CC-1-40	58.6
CC-2-16	67.0

In addition to this report, we have, at your request, included copies of the NRCC standard reference materials certificates. The samples will be disposed of in two weeks unless other instructions are given. Please feel free to call if you have any questions or additional analytical needs.

Best Wishes,

Nicolas S Bloom

Mercury Speciation in Filtered Well Waters (Foster Wheeler Corp.)

April 22, 1996

Frontier Geosciences Inc.
414 Pontius North, Suite B
Seattle, WA 98109

bottle	location	net [Hg], ng/L	
		total	methyl
CENT-891	Solono Concrete OW8-D	0.85	0.023 0.019
CENT-769	Solono Concrete OW8-S	rep 1: 1.33 rep 2: 1.39	0.030
CENT-2	field blank	0.34	0.017
CENT-838	Solono Concrete OW-2	3.81	---
CENT-827	Solono Concrete OW-3	1.18	0.020 0.016
CENT-828	Cache Creek Ag. MW-3	0.65	<0.012
CENT-548	Cache Creek Ag. MW-1	rep 1: 1.51 rep 2: 1.46	---
CENT-530	Cache Creek-unfiltered	4.53	0.295
CENT-530 F	Cache Creek-filtered	1.99	0.072
CENT-757	field blank	0.34	0.023
CENT-833	Cache Creek Ag. MW-5	3.03	< 0.012
CENT-537	Cache Creek Ag. MW-4A	rep 1: 1.25 rep 2: 1.02	---
CENT-868	Cache Creek Ag. MW-4B	1.49	---
CENT-754	field blank	0.21	---

Mercury Speciation in Filtered Well Waters --QC Data

parameter	[Hg], ng/L	
	total	methyl
Milli-Q water (sent out for field blanks)	0.23	---
test tubing + filter #1	0.15	---
test tubing + filter #2	0.21	---
blank 1	0.14	0.015
blank 2	0.08	0.022
blank 3	0.14	0.026
blank 4	0.12	0.018
blank 5	0.17	0.019
blank 6	0.07	0.016
mean	0.12	0.019
SD	0.04	0.004
estimated MDL	0.12	0.012
CENT-2 + 1.00 ng/L Hg	1.93 (159%)	---
CENT-868 + 5.00 ng/L Hg	6.52 (101%)	---
CENT-828 + 1.00 ng/L Hg	1.75 (110%)	---
NRCC DORM-2[a] (ng/g)	rep 1: 4,660 rep 2: 4,686	rep 1: 4,872 rep 2: 4,993
certified	4,640 ± 260	4,470 ± 370
CENT-827 + 1.25 ng/L MMHg	---	1.739 (137%)

Mercury Speciation in Fish (Foster Wheeler Corp.)

April 22, 1996

Frontier Geosciences Inc.
414 Pontius North, Suite B
Seattle, WA 98109

sample	[Hg], ng/g (ppb) wet weight basis	
	total	methyl
cat fish muscle (dry fraction = 0.1961)	rep 1: 50.5 rep 2: 30.4	rep 1: 9.3 rep 2: 5.1
blank 1	0.07	0.4
blank 2	0.06	---
blank 3	0.07	---
NRCC DORM-2[a]	4,427	4,892
certified value	4,640 ± 260	4,470 ± 370

Mercury Speciation in Core Borings (Foster Wheeler Corp.)

April 22, 1996

Frontier Geosciences Inc.
414 Pontius North, Suite B
Seattle, WA 98109

sample	soil description	dry fraction	[Hg], ng/g (ppb)	
			wet basis	dry basis
SC-1-2.5	sandy soil	0.8590	766.3	892.1
SC-1-2.5 methyl	sandy soil	0.8590	0.081	0.094
SC-1-16	gravely sand	0.9710	39.8	41.0
SC-1-45	sandy gravel	0.8655	33.4	38.6
SC-1-45 methyl	sandy gravel	0.8655	<0.001	<0.001
SC-1-50	sand	0.8214	40.7	49.5
SC-2-2.5	silty soil	0.8179	86.2	105.4
SC-2-16	sand	0.9676	32.1	33.2
SC-2-35	muddy sand	0.7855	245.5	323.5
SC-2-45	muddy sand	0.7947	153.3	192.9
CC-1-3	gravely sand	0.9731	15.8	16.2
CC-1-25	gravely sand	0.9345	68.4	73.2
CC-1-25	(> 2 mm only)	0.9576	6.1	6.4
CC-1-40	gravel/sand/mud	0.8735	38.2	43.7
CC-1-40	(> 2 mm only)	0.8975	6.9	7.7
CC-1-50	coarse sand	0.8881	36.9	41.5
CC-2-3	silty soil	0.9118	43.5 67.7	61.0
CC-2-16	gravely sand	0.9622	21.2	22.0
CC-2-16	(> 2 mm only)	0.9242	3.9	4.2
CC-2-40	gravel/sand/mud	0.8660	40.4	46.7
CC-2-50	coarse sand	0.8472	35.3	41.7

10^{-9} g / ?

2040.6/19 = 107.4

Mercury Speciation in Core Borings--QC Data

parameter	[Hg], ng/g	
	wet basis	dry basis
blank-1[c]	0.37	---
blank 2[c]	0.02	---
blank-3[c]	0.53	---
blank-4[c]	0.15	---
blank-5[c]	0.03	---
blank-6[a]	0.02	
blank-7[a]	0.03	
blank-8[a]	0.03	
mean	0.15	---
SD	0.20	---
estimated MDL	0.6	---
DORM-2[a]	---	rep 1: 4,635 rep 2: 4,655 rep 3: 4,427
certified range	---	4,640 ± 260
PACS-1[b]	---	rep 1: 4,709 rep 2: 4,483
certified range	---	4,540 ± 160

[a]NRCC certified fish tissue

[b]NRCC certified marine sediment

[c]for typical 3 gram sample aliquot

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Measurement Science | Science des mesures

Ottawa, Canada
K1A 0R6

(613) 993-2359
FAX (613) 993-2451

NRC·CNRC

January, 1981
Revised 1987, 1990, 1993

BCSS-1, MESS-2, PACS-1

Marine Sediment Reference Materials for Trace Elements and Other Constituents

The following tables show those constituents for which certified values have been established. Certified values are based on the results of determinations by at least two independent methods of analysis. The uncertainties represent 95% confidence limits for an individual subsample. That is, 95% of samples from any bottle would be expected to have concentrations within the specified range 95% of the time.

Trace Metals - Milligrams per Kilogram

	MESS-2	BCSS-1	PACS-1
Antimony (g,h,i,n,q,x)	1.09 ± 0.13	0.59 ± 0.06	171 ± 14
Arsenic (b,g,h,i,n,p,x)	20.7 ± 0.8	11.1 ± 1.4	211 ± 11
Beryllium (g,i,q)	2.32 ± 0.12	1.3 ± 0.3	---
Cadmium (g,i,m,q)	0.24 ± 0.01	0.25 ± 0.04	2.38 ± 0.20
Chromium (f,g,m,n,p,q,x)	106 ± 8	123 ± 14	113 ± 8
Cobalt (b,f,g,i,m,n,p,x)	13.8 ± 1.4	11.4 ± 2.1	17.5 ± 1.1
Copper (f,g,i,m,n,q,x)	39.3 ± 2.0	18.5 ± 2.7	452 ± 16
Lead (f,g,i,m,p,q,x)	21.9 ± 1.2	22.7 ± 3.4	404 ± 20
Lithium (g,q)	73.9 ± 0.7	---	---
Manganese (b,f,i,n,p,x)	365 ± 21	229 ± 15	470 ± 12
Mercury (c,q)	0.092 ± 0.009	---	4.57 ± 0.16
Molybdenum (g,i,q)	2.85 ± 0.12	(1.9)*	12.9 ± 0.9
Nickel (g,i,m,n,q,x)	49.3 ± 1.8	55.3 ± 3.6	44.1 ± 2.0
Selenium (g,h,l,m)	0.72 ± 0.09	0.43 ± 0.06	1.09 ± 0.11
Silver (g,q)	0.18 ± 0.02	---	---
Strontium (f,i,g,q)	125 ± 10	(96.)*	277 ± 11
Thallium	(0.98)*	(0.6)*	---
Tin (g,h,i,q)	2.27 ± 0.42	1.85 ± 0.20	41.1 ± 3.1
Vanadium (b,f,i,m,n)	252 ± 10	93.4 ± 4.9	127 ± 5
Zinc (f,i,m,n,q,x)	172 ± 16	119 ± 12	824 ± 22
Tributyltin	---	---	1.27 ± 0.22 (as Sn)
Dibutyltin	---	---	1.16 ± 0.18 "
Monobutyltin	---	---	0.28 ± 0.17 "

Matrix and Minor Constituents - Percent

	MESS-2	BCSS-1	PACS-1
Al_2O_3 (f,i,n,x)	16.2 ± 0.49	11.83 ± 0.41	12.23 ± 0.22
C (e,r)	2.14 ± 0.03	2.19 ± 0.09	3.69 ± 0.11
CaO (f,i,n,p,x)	---	0.760 ± 0.074	2.92 ± 0.13
Cl (n,v,x)	---	1.12 ± 0.05	2.39 ± 0.09
Fe_2O_3 (f,i,n,p,x)	6.22 ± 0.31	4.70 ± 0.14	6.96 ± 0.12
K_2O (f,n,x)	---	2.17 ± 0.04	1.50 ± 0.09
MgO (f,i,p)	---	2.44 ± 0.23	2.41 ± 0.09
Na_2O (f,i,n,p)	---	2.72 ± 0.21	4.40 ± 0.11
P_2O_5 (i,x)	0.28 ± 0.03	0.154 ± 0.016	0.233 ± 0.018
S (i,x,x)	0.18 ± 0.04	0.36 ± 0.05	1.32 ± 0.08
SiO_2 (f,x)	59.4 ± 2.3	66.1 ± 1.0	55.7 ± 0.5
TiO_2 (f,i,n,p,x)	---	0.734 ± 0.024	0.703 ± 0.011

* Information value only.

Coding

a - Atomic fluorescence spectrometry
b - Inductively coupled plasma mass spectrometry
c - Cold vapour atomic absorption spectrometry
e - Coulometry
f - Flame atomic absorption spectrometry
g - Graphite furnace atomic absorption spectrometry
h - Hydride generation atomic absorption spectrometry
i - Inductively coupled plasma atomic emission spectrometry
l - Liquid chromatography
m- Isotope dilution solid source mass spectrometry
n - Instrumental neutron activation analysis
p - Instrumental photonuclear activation analysis
q - Isotope dilution inductively coupled plasma mass spectrometry
r - Infrared spectrometry
v - Volumetric analysis
x - X-ray fluorescence spectrometry

Not all the methods listed above were applied to all three certified reference materials.

These reference materials are primarily for use in the calibration of procedures and the development of methods used for the analysis of marine sediments and materials with similar matrices.

Note: With the release of MESS-2 which is certified for mercury, BEST-1 which was certified only for mercury has been withdrawn from distribution.

Preparation of material

BCSS-1 was collected from the Baie des Chaleurs in the Gulf of St. Lawrence . MESS-2 is from the Beaufort Sea. PACS-1 was collected in the harbour of Esquimalt, B.C. They were all freeze dried, screened to pass a No. 120 (125 μm) screen, blended and bottled by Institute staff using the facilities of the Canada Centre for Mineral and Energy Technology in Ottawa. After bottling, the samples were radiation sterilized with a minimum dose of 2.5 Mrad by the Canadian Irradiation Centre to minimize any effects from biological activity.

Instructions for drying

Although initially free from moisture following the freeze drying, the materials, which contain sea salt, have picked up moisture during subsequent operations. They should be dried to a constant weight before use. Drying for several hours at 105°C has proved to be a relatively simple method to achieve a dry weight for most purposes. They should be kept well sealed and in a cool place.

Homogeneity

Randomly selected bottles were used for the analytical determinations. Results from different bottles showed no significant differences compared to results from sub-samples within bottles. Nor was there any correlation between values obtained and bottle sequence. Thus, it is assumed that all bottles of each of these materials have essentially the same composition. PACS-1 was also extensively tested for homogeneity at the Department of Chemistry, University of Alberta, Edmonton, Alberta.

Information values

The following values are considered less reliable than those quoted above because they are not based on the results of at least two independent methods or there were insufficient analyses performed. **These numbers are given for information only and care should be excised not to attribute more reliability to these numbers than they warrant.** Values are in mg/kg.

	MESS-2	BCSS-1	PACS-1
Cs (n,p)	---	(4)	---
Ge (m)	---	(1.5)	---
Mo (m)	certified	(1.9)	certified
Sr (f)	certified	(96)	certified
Tl (m,q)	(0.98)	(0.6)	---

It is anticipated that as more data become available the established values may be updated and certified numbers assigned to more elements. These updates will be sent to all users of these reference materials.

Feedback and comments from users will be welcomed.

Acknowledgements

These materials were prepared following the advice of the NRC Committee on Marine Analytical Chemistry (M. Bewers, Chairman). The guidance of the members is much appreciated.

The following staff of the Environmental Measurement Science program, Institute for Environmental Research and Technology, National Research Council of Canada, participated in the analysis of at least one of these sediment certified reference materials: S. Berman, D. Beauchemin, V.J. Boyko, V.P. Clancy, A. Desaulniers, R. Guevremont, J. Lam, H.B. MacPherson, H. Marshall, J.W. McLaren, B. Methven, M. Miedema, A. Mykytiuk, D.S. Russell, P. Semeniuk, H. Tao*, K.W.M. Siu, R. Sturgeon and S. Willie.

* Visiting scientist

The cooperation of the following during the certification of one or more of these sediments is gratefully acknowledged:

D. Boomer, Laboratory Services and Applied Research Branch, Ministry of the Environment, Toronto, Ontario.

D. Buckley and R. Fitzgerald, Atlantic Geoscience Centre, Energy, Mines and Resources Canada, Bedford Institute of Oceanography, Dartmouth, N.S.

Y.K. Chau, Canada Centre for Inland Waters, Environment Canada, Burlington, Ontario.

M. Chaudhry, W. Johnson and P. Ralph, Ministry of Energy, Mines and Petroleum Resources, Victoria, B.C.

C. Chiu, Air Pollution Technology Centre, Environment Canada, Ottawa, Ontario.

R.C. Clark, Northwest Fisheries Science Center, Seattle, Washington.

E. Crecelius, C.W. Apts, O.A. Cotter and R.W. Sanders, Battelle Northwest, Sequim, Washington.

R. Deverill, H. McDonald, F. Chen and D. Randhawa, Analytical Service Laboratories, Vancouver, B.C.

M. Epstein, National Institute of Standards and Technology, Gaithersburg, Maryland.

G. Hall, Geological Survey of Canada, Ottawa, Ontario.

R. Hancock, SLOWPOKE Reactor, University of Toronto, Toronto, Ontario.

B. Kratochvil, Department of Chemistry, University of Alberta, Edmonton, Alberta.

S. Landsberger, Department of Nuclear Engineering, University of Illinois, Urbana, Illinois.

D. Loring and R. Rantala, Chemical Oceanography Division, Fisheries and Oceans Canada, Bedford Institute of Oceanography, Dartmouth, N.S.

S. MacKnight, MacLaren Plansearch Ltd., Dartmouth, N.S.

R. Presley and T. Wade, Texas A & M University, College Station, Texas.

P.F. Seligman, S. Cola and J. Testa, US Department of the Navy, San Diego, California.

C. Smith, H. Steger, P. Westra and D. McIntosh, Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources Canada, Ottawa, Ontario.

A. Uhler, Battelle Ocean Sciences, Duxbury, Massachusetts.

J. Van Loon and A. Paudyn, Department of Geology, University of Toronto, Toronto, Ontario.

M. Yunker, Institute of Ocean Sciences, Fisheries and Oceans Canada, Sidney, B.C.

V.S. Zdanowicz, S.L. Cunneff and T.W. Finneran, Northeast Fisheries Center, Highlands, New Jersey.

Comments, information and inquiries should be addressed to:

Dr. Shier Berman
Environmental Measurement Science
Institute for Environmental Research and Technology
National Research Council
Montreal Road
Ottawa, Canada K1A 0R6

National Research Council Canada
Conseil national de recherches Canada

Institute for Environmental Research and Technology
Institut de technologie et de recherche environnementales

Measurement Science
Science des mesures

Ottawa, Canada
K1A 0R6

(613) 993-2359
FAX (613) 993-2451

NRC·CNRC

March 1994

DORM-2 DOLT-2

DOGFISH MUSCLE AND LIVER CERTIFIED REFERENCE MATERIALS FOR TRACE METALS

The following table shows those elements for which certified values have been established for the two dogfish (*Squalus acanthias*) reference materials. Certified values are based on results of determinations by at least two independent methods of analysis. The uncertainties represent 95 percent tolerance limits for an individual sub-sample of 250 mg or greater.

Trace Elements - mg/kg

	DORM-2	DOLT-2
Aluminum (d,g,i)[a]	10.9 ± 1.7	25.2 ± 2.4
Arsenic (d,g,h,x)	18.0 ± 1.1	16.6 ± 1.1
Cadmium (g,p)	0.043 ± 0.008	20.8 ± 0.5
Cobalt (d,g)	0.182 ± 0.031	0.24 ± 0.05
Chromium (g,i,p)	34.7 ± 5.5	0.37 ± 0.08
Copper (g,i,p,x)	2.34 ± 0.16	25.8 ± 1.1
Iron (g,i,p,x)	142 ± 10	1103 ± 47
Lead (g,p)	0.065 ± 0.007	0.22 ± 0.02
Manganese (d,g,i)	3.66 ± 0.34	6.88 ± 0.56
Mercury (c,p)	4.64 ± 0.26	1.99 ± 0.10
Nickel (g,i,p)	19.4 ± 3.1	0.20 ± 0.02
Selenium (g,p)	1.40 ± 0.09	6.06 ± 0.49
Silver (g,p)	0.041 ± 0.013	0.608 ± 0.032
Thallium (p)	(0.004)*	--
Tin (p)	(0.023)*	(0.13)*
Zinc (f,g,i,p)	25.6 ± 2.3	85.8 ± 2.5
Methylmercury (as Hg)	4.47 ± 0.32	0.693 ± 0.053

[a] - See next page for key to coding.
* - Not certified; information value only.

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Coding

The coding refers only to the ultimate method of analyte determination and not all methods were always applied to both certified reference materials, DORM-2 and DOLT-2, which were certified more than a year apart. No mention is made here regarding the various methods of sample preparation, decomposition and possible analyte separation prior to determination within each coded method.

c - Cold vapour atomic absorption spectrometry.
d - Inductively coupled plasma mass spectrometry.
f - Flame atomic absorption spectrometry.
g - Graphite furnace atomic absorption spectrometry.
h - Hydride generation atomic absorption spectrometry.
i - Inductively coupled plasma atomic emission spectrometry.
p - Isotope dilution inductively coupled plasma mass spectrometry.
x - Xray fluorescence spectrometry

These reference materials are primarily intended for use in the calibration of procedures and the development of methods used for the analysis of marine animals and materials with a similar matrix.

There appear to be elevated concentrations of iron, chromium and nickel in DORM-2 indicating the possible contamination of this material by stainless steel during its preparation. The mercury concentration of this certified reference material (CRM) is also relatively high but it is almost all organomercury and was probably in the dogfish muscle to start with.

The materials should be kept tightly closed in the original bottles and should be stored in a cool location, away from any intense radiation sources such as ultraviolet lamps and sunlight.

The bottles should be well mixed by rotation and shaking prior to use, and tightly closed immediately thereafter. A cleaned teflon ball is included with each sample. It should be inserted into the bottle the first time it is opened. This aids in mixing the material which may tend to cake on prolonged standing.

Homogeneity

The materials were tested for homogeneity at the National Research Council (NRC) in Ottawa. Also, randomly selected bottles were used for the analytical determinations by the NRC laboratory and the collaborating laboratories.

Results from different bottles indicated no significant differences compared to results from sub-samples within bottles. It is assumed, then, that all bottles of these materials have essentially the same composition. The homogeneity is warranted by NRC for samples of 250 mg weight and above for the elements listed on the first page. There is other evidence which supports homogeneity for some of the analytes down to the level of 25 mg samples.

Instructions for Drying

DORM-2 and DOLT-2 can be dried to constant weight by:

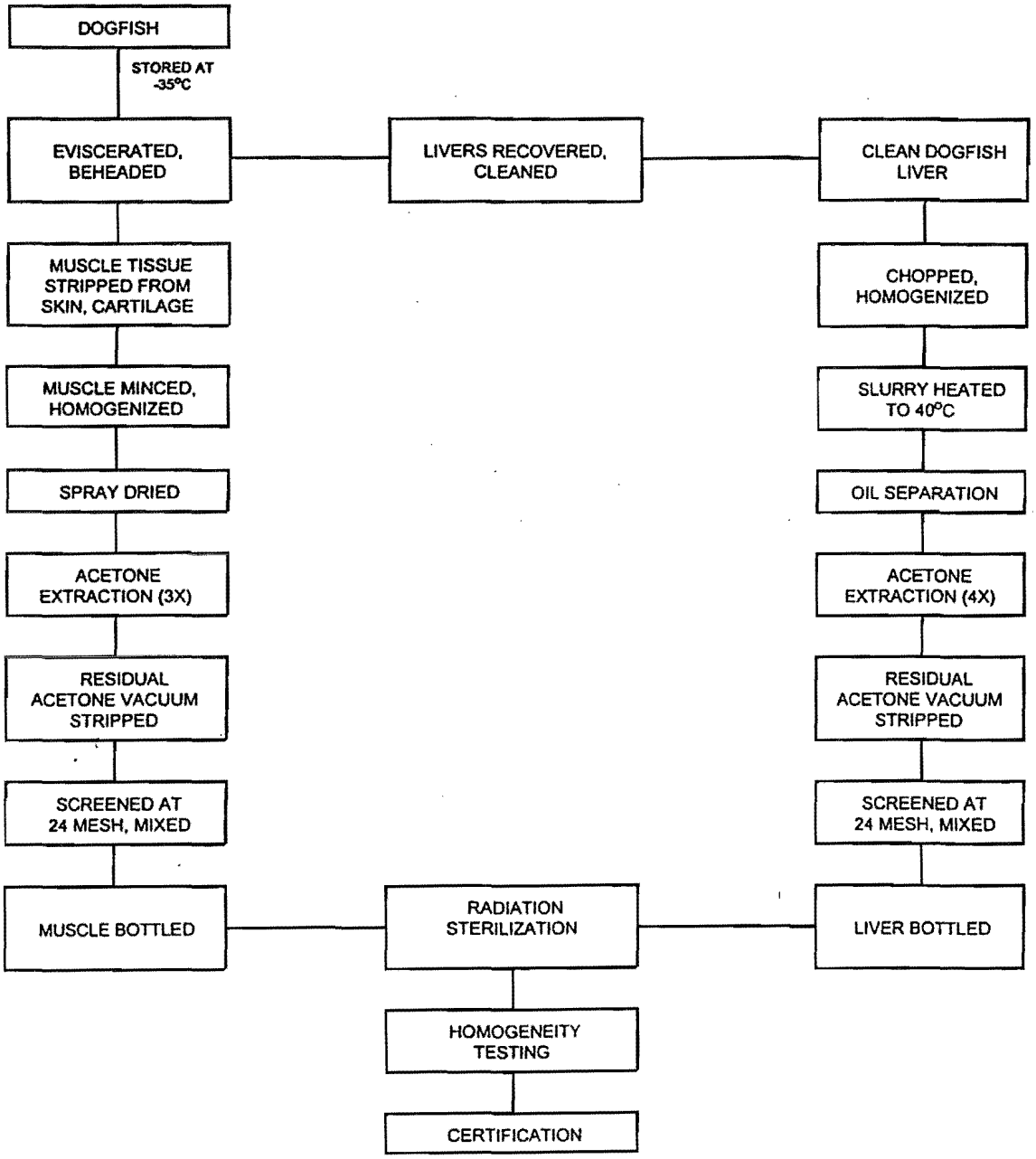
(1) drying at reduced pressure (e.g. 50 mm Hg) at room temperature in a vacuum desiccator over magnesium perchlorate for 24 hours.

(2) vacuum drying (about 0.5 mm Hg) at room temperature for 24 hours.

Both of these methods were used to obtain a conversion factor to produce the "dry weight" results listed on the first page.

Preparation of Materials

These reference materials were processed at the Canadian Institute for Fisheries Technology, Technical University of Nova Scotia, Halifax. The preparation scheme is described below in the schematic drawing. The procedure does not result in totally defatted materials. The dogfish muscle (DORM-2) and liver (DOLT-2) materials respectively contain about 5 and 24 percent fat.



Stability

The predecessor CRMs, DORM-1 and DOLT-1, have been periodically analyzed for more than eight years and have been both physically and chemically stable over that time. We expect similar behaviour from DORM-2 and DOLT-2.

Acknowledgements

This material was prepared following the advice of the NRC Committee on Marine Analytical Chemistry (M. Bewers, Chairman). The guidance of the members of the Committee is much appreciated.

These members of staff of Environmental Measurement Science, Institute for Environmental Research and Technology, National Research Council of Canada, participated in the analyses: S. Berman, V.J. Boyko, V.P. Clancy, J. Lam, P. Maxwell, J.W. McLaren, B. Methven, K.W.M. Siu and S. Willie.

The cooperation of the following in the preparation and analysis of these materials is gratefully acknowledged:

E.G. Bligh, I. Britt and C.H. Hotton, Canadian Institute of Fisheries Technology, Technical University of Nova Scotia, Halifax, Nova Scotia.

E. Crecelius, B. Lasorsa and R.W. Sanders, Marine Science Laboratories, Battelle Pacific Northwest, Sequim,Washington.

B. Presley and P. Boothe, Department of Oceanography, Texas A&M University, College Station, Texas.

It is anticipated that as more data become available the established values may be updated and reliable values assigned to more elements. Updates will be sent to all users of this reference material.

Feedback and comments from users are encouraged.

Comments and inquiries should be addressed to:

Dr. Shier Berman
Director, Environmental Measurement Science
Institute for Environmental Research and Technology
National Research Council
Ottawa, Ontario, Canada K1A 0R6

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA	Sampled: Apr 16, 1996
500 First St.	Sample Descript:	Water, 1, Solano MW3	Received: Apr 17, 1996
Woodland, CA 95695	Analysis for:	General Minerals	Reported: Apr 24, 1996
Attention: Vicki Kretsinger	Lab Number:	604-0635	

GENERAL MINERAL ANALYSIS

Analyte	Date Analyzed	Lab ELAP #	Reporting Limit	Sample Result
Bicarbonate Alkalinity, mg/L	04/18/96	1624	10	220
Calcium, mg/L	04/18/96	1624	0.10	40
Carbonate Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Chloride, mg/L	04/18/96	1624	1.0	59
Copper, mg/L	04/18/96	1624	0.010	N.D.
Hardness, mg/L	04/18/96	1624	1.0	230
Hydroxide Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Iron, mg/L	04/18/96	1624	0.020	N.D.
Magnesium, mg/L	04/18/96	1624	0.10	32
Manganese, mg/L	04/18/96	1624	0.010	N.D.
pH, pH units	04/17/96	1624	N/A	7.7
Potassium, mg/L	04/18/96	1624	1.0	1.4
Sodium, mg/L	04/18/96	1624	0.50	50
Specific Conductance, µmhos/c	04/17/96	1624	10	700
Sulfate, mg/L	04/22/96	1624	2.0	35
Surfactants, mg/L	04/18/96	1624	0.050	0.051
Total Dissolved Solids, mg/L	04/22/96	1624	5.0	360
Zinc, mg/L	04/18/96	1624	0.010	0.076

Analytes reported as N.D. were not detected at or above the reporting limit.
Please note that the sample for metals was field filtered, thus results are dissolved metals.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA	Sampled: Apr 16, 1996
500 First St.	Sample Descript:	Water, 3, Cache Creek	Received: Apr 17, 1996
Woodland, CA 95695	Analysis for:	General Minerals	Reported: Apr 24, 1996
Attention: Vicki Kretsinger	Lab Number:	604-0637	

GENERAL MINERAL ANALYSIS

Analyte	Date Analyzed	Lab ELAP #	Reporting Limit	Sample Result
Bicarbonate Alkalinity, mg/L	**04/18/96**	**1624**	**10**	**240**
Calcium, mg/L	**04/18/96**	**1624**	**0.050**	**35**
Carbonate Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Chloride, mg/L	**04/18/96**	**1624**	**1.0**	**48**
Copper, mg/L	04/18/96	1624	0.0050	N.D.
Hardness, mg/L	**04/18/96**	**1624**	**0.50**	**240**
Hydroxide Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Iron, mg/L	**04/18/96**	**1624**	**0.010**	**0.24**
Magnesium, mg/L	**04/18/96**	**1624**	**0.10**	**37**
Manganese, mg/L	**04/18/96**	**1624**	**0.0050**	**0.011**
pH, pH units	**04/17/96**	**1624**	**N/A**	**8.4**
Potassium, mg/L	**04/18/96**	**1624**	**0.50**	**2.0**
Sodium, mg/L	**04/18/96**	**1624**	**0.25**	**42**
Specific Conductance, µmhos/c	**04/17/96**	**1624**	**10**	**650**
Sulfate, mg/L	**04/22/96**	**1624**	**2.0**	**20**
Surfactants, mg/L	04/18/96	1624	0.050	N.D.
Total Dissolved Solids, mg/L	**04/22/96**	**1624**	**5.0**	**340**
Zinc, mg/L	04/18/96	1624	0.050	N.D.

Analytes reported as N.D. were not detected at or above the reporting limit.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040635.LUH <3>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA	Sampled:	Apr 16, 1996
500 First St.	Sample Descript:	Water	Received:	Apr 17, 1996
Woodland, CA 95695	Analysis for:	Nitrate as NO3	Analyzed:	Apr 18, 1996
Attention: Vicki Kretsinger	First Sample #:	604-0635	Reported:	Apr 24, 1996

LABORATORY ANALYSIS FOR: Nitrate as NO3

Sample Number	Sample Description	Reporting Limit mg/L	Sample Result mg/L
604-0635	1, Solano MW3	1.0	18
604-0636	2, Cache Cr. MW3	1.0	7.1
604-0637	3, Cache Creek	1.0	9.4

Analytes reported as N.D. were not detected at or above the reporting limit.

SEQUOIA ANALYTICAL, ELAP #1210

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040635.LUH <4>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini
500 First St.
Woodland, CA 95695
Attention: Vicki Kretsinger

Client Project ID: 96-7-030 / YCAPA
Matrix: Water
QC Sample Group: 6040635-37

Reported: Apr 24, 1996

QUALITY CONTROL DATA REPORT

ANALYTE	Calcium	Magnesium	Copper	Iron	Sodium	Surfactants
Method:	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	EPA 425.1
Analyst:	K. Barta	K. Barta	K. Barta	K. Barta	K. Barta	L. Martin
Concentration Spiked:	5.0 mg/L	5.0 mg/L	5.0 mg/L	5.0 mg/L	5.0 mg/L	0.50 mg/L
LCS Batch#:	LCS041896E	LCS041896E	LCS041896E	LCS041896E	LCS041896E	LCS041896
Date Prepared:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Date Analyzed:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Instrument I.D.#:	ICP-1	ICP-1	ICP-1	ICP-1	ICP-1	UV Spec 1
LCS % Recovery:	102	103	98	103	102	96
Control Limits:	90-110	90-110	90-110	90-110	90-110	80-120
MS/MSD Batch #:	6040636	6040636	6040636	6040636	6040636	BS041796
Date Prepared:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/17/96
Date Analyzed:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/17/96
Instrument I.D.#:	ICP-1	ICP-1	ICP-1	ICP-1	ICP-1	UV Spec 1
Matrix Spike % Recovery:	30	47	96	100	10	104
Matrix Spike Duplicate % Recovery:	28	45	96	100	10	98
Relative % Difference:	6.8	4.3	0.0	0.0	0.0	5.9

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040635.LUH <5>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini
500 First St.
Woodland, CA 95695
Attention: Vicki Kretsinger

Client Project ID: 96-7-030 / YCAPA
Matrix: Water
QC Sample Group: 6040635-37

Reported: Apr 24, 1996

QUALITY CONTROL DATA REPORT

ANALYTE	Calcium	Magnesium	Copper	Iron	Sodium
Method:	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7
Analyst:	K. Barta	K. Barta	K. Barta	K. Barta	K. Barta
Concentration Spiked:	12.5 mg/L	12.5 mg/L	0.50 mg/L	5.0 mg/L	12.5 mg/L
LCS Batch#:	LCS041896	LCS041896	LCS041896	LCS041896	LCS041896
Date Prepared:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Date Analyzed:	04/19/96	04/19/96	04/19/96	04/19/96	04/19/96
Instrument I.D.#:	ICP-1	ICP-1	ICP-1	ICP-1	ICP-1
LCS % Recovery:	94	97	91	96	90
Control Limits:	80-120	80-120	80-120	80-120	80-120
MS/MSD Batch #:	6040637	6040637	6040637	6040637	6040637
Date Prepared:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Date Analyzed:	04/19/96	04/19/96	04/19/96	04/19/96	04/19/96
Instrument I.D.#:	ICP-1	ICP-1	ICP-1	ICP-1	ICP-1
Matrix Spike % Recovery:	72	76	88	90	68
Matrix Spike Duplicate % Recovery:	94	90	91	94	82
Relative % Difference:	26	16	3.4	4.3	18

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040635.LUH <6>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini
500 First St.
Woodland, CA 95695
Attention: Vicki Kretsinger

Client Project ID: 96-7-030 / YCAPA
Matrix: Water
QC Sample Group: 6040635-37
Reported: Apr 24, 1996

QUALITY CONTROL DATA REPORT

ANALYTE	Alkalinity	Chloride	EC	Sulfate	TDS	Nitrate
Method:	EPA 310.1	EPA 325.3	EPA 120.1	EPA 375.4	EPA 160.1	EPA 300.0
Analyst:	L. Martin	S. Phillips	L. Martin	S. Phillips	SP/LM	S. Lee
Concentration Spiked:	27 mg/L	50 mg/L	1000 µmhos/cm	20 mg/L	500 mg/L	10 mg/L
LCS Batch#:	LCS041896	LCS041896	LCS041796	LCS042296	LCS042296	LCS041896
Date Prepared:	04/18/96	04/18/96	04/17/96	04/22/96	04/22/96	04/18/96
Date Analyzed:	04/18/96	04/18/96	04/17/96	04/22/96	04/22/96	04/18/96
Instrument I.D.#:	pH-1	Titration	EC-1	T-1	BAL 4	INIC-1
LCS % Recovery:	94	104	110	100	98	100
Control Limits:	80-120	80-120	80-120	80-120	80-120	90-110
MS/MSD Batch #:	6040583	6040662	6040635	6040662	6040662	9604C25-01
Date Prepared:	04/18/96	04/18/96	04/17/96	04/22/96	04/22/96	04/18/96
Date Analyzed:	04/18/96	04/18/96	04/17/96	04/22/96	04/22/96	04/18/96
Instrument I.D.#:	pH-1	Titration	EC-1	T-1	BAL 4	INIC-1
Matrix Spike % Recovery:	90	92	90	104	101	97
Matrix Spike Duplicate % Recovery:	90	94	90	102	98	97
Relative % Difference:	0.0	2.2	0.0	1.9	3.0	0.0

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040635.LUH <7>

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Lundorff & Scalmanini
500 First St.
Woodland, CA 95695
Attention: Vicki Kretsinger

Client Project ID: 96-7-030 / YCAPA
Matrix: Water
QC Sample Group: 6040635-37

Reported: Apr 24, 1996

QUALITY CONTROL DATA REPORT

ANALYTE
pH

Method: EPA 150.1
Analyst: L. Martin
Date: 04/17/96

Sample #:	6040635
Sample Concentration:	7.7
Sample Duplicate Concentration:	7.7
% RPD:	0.0
Control Limits:	0-20

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040635.LUH <8>

SEQUOIA

Send Invoice To:

CHAIN OF CUSTODY RECORD

Send Lab. Results To: LSCE (address below)

Client name: YCAPA | LSCE Project No.: 96-7-030

Project name: G.W MONITORING

Project manager: VICKI KRETSINGER | Sampler(s): GARY WILEST

Analyses required: GEN MIN. / NITRATE / Hazardous sample Special handling required

Sample number	Time sampled	Type: Composite / Grab / Matrix	Date sampled	Sample description (Location Details)	Number of containers	*Container 2	*Container 1	Remarks
(1)	~~1200~~	H_2O GRAB	4-16-96	SOLANO MW 3	3	X	X	5604-0635 METALS FIELD FILTERED .45µ
(2)	1600	H_2O GRAB	4-16-96	CACHE CR. MW3	3	X	X	-0636 METALS FIELD FILTERED .45µ
(3)	1955	H_2O GRAB	4-16-96	CACHE CREEK	3	X	X	-0637 NON FILTERED
								NORMAL TAT
								5 DAY TAT

*Sample Container Description

1. Polyethylene, no preservatives	4. Polyethylene – sterile
2. Polyethylene, preacidified	5. 40 ml Glass Vial, duplicate
3. Glass, screw cap	6.

	Signature	Company	Date	Time
Relinquished by	Gary Wilest	LSCE	4-17-96	0840
Received by	Paula Wilde	LSCE	4-17-96	0840
Relinquished by	Jeremy DeHaze	LSCE	4-17-96	11:32
Received by	Taylor Howell	SEQUOIA	4/17/96	1132
Relinquished by	Taylor Howell	SEQUOIA	4/17/96	1200
Received by	Sandra Hinson	Sequoia	4/17/96	1200

Luhdorff and Scalmanini, Consulting Engineers
500 First Street, Woodland, Ca. 95695

Sequoia Analytical

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819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA	Sampled: Apr 17, 1996
500 First St.	Sample Descript:	Water, 1, Cache Cr MW5	Received: Apr 18, 1996
Woodland, CA 95695	Analysis for:	General Minerals	Reported: Apr 25, 1996
Attention: Vicki Kretsinger	Lab Number:	604-0662	

GENERAL MINERAL ANALYSIS

Analyte	Date Analyzed	Lab ELAP #	Reporting Limit	Sample Result
Bicarbonate Alkalinity, mg/L	**04/18/96**	**1624**	**10**	**240**
Calcium, mg/L	**04/18/96**	**1624**	**0.10**	**42**
Carbonate Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Chloride, mg/L	**04/18/96**	**1624**	**1.0**	**39**
Copper, mg/L	04/18/96	1624	0.010	N.D.
Hardness, mg/L	**04/18/96**	**1624**	**1.0**	**240**
Hydroxide Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Iron, mg/L	04/18/96	1624	0.020	N.D.
Magnesium, mg/L	**04/18/96**	**1624**	**0.10**	**34**
Manganese, mg/L	04/18/96	1624	0.010	N.D.
pH, pH units	**04/18/96**	**1624**	**N/A**	**7.4**
Potassium, mg/L	**04/18/96**	**1624**	**1.0**	**1.7**
Sodium, mg/L	**04/18/96**	**1624**	**0.50**	**32**
Specific Conductance, µmhos/c	**04/18/96**	**1624**	**10**	**600**
Sulfate, mg/L	**04/22/96**	**1624**	**2.0**	**38**
Surfactants, mg/L	**04/18/96**	**1624**	**0.050**	**0.12**
Total Dissolved Solids, mg/L	**04/22/96**	**1624**	**5.0**	**330**
Zinc, mg/L	04/18/96	1624	0.010	N.D.

Analytes reported as N.D. were not detected at or above the reporting limit.
Please note that the sample for metals was field filtered, thus results are dissolved metals.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040662.LUH <1>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA	Sampled:	Apr 17, 1996
500 First St.	Sample Descript:	Water	Received:	Apr 18, 1996
Woodland, CA 95695	Analysis for:	Nitrate as NO3	Analyzed:	Apr 18, 1996
Attention: Vicki Kretsinger	First Sample #:	604-0662	Reported:	Apr 25, 1996

LABORATORY ANALYSIS FOR: Nitrate as NO3

Sample Number	Sample Description	Reporting Limit mg/L	Sample Result mg/L
604-0662	1, Cache Cr MW5	1.0	8.3

Analytes reported as N.D. were not detected at or above the reporting limit.

SEQUOIA ANALYTICAL, ELAP #1210

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040662.LUH <2>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
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819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini
500 First St.
Woodland, CA 95695
Attention: Vicki Kretsinger

Client Project ID: 96-7-030 / YCAPA
Matrix: Water
QC Sample Group: 604-0662

Reported: Apr 25, 1996

QUALITY CONTROL DATA REPORT

ANALYTE	Calcium	Magnesium	Copper	Sodium	Zinc	Surfactants	Alkalinity
Method:	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	EPA 425.1	EPA 310.1
Analyst:	K. Barta	K. Barta	K. Barta	K. Barta	K. Barta	L. Martin	L. Martin
Concentration Spiked:	5.0 mg/L	5.0 mg/L	5.0 mg/L	5.0 mg/L	5.0 mg/L	0.50 mg/L	27 mg/L
LCS Batch#:	LCS041896E	LCS041896E	LCS041896E	LCS041896E	LCS041896E	LCS041896	LCS041896
Date Prepared:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Date Analyzed:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Instrument I.D.#:	ICP-1	ICP-1	ICP-1	ICP-1	ICP-1	UV Spec 1	pH-1
LCS % Recovery:	102	103	98	102	100	96	94
Control Limits:	90-110	90-110	90-110	90-110	90-110	80-120	80-120
MS/MSD Batch #:	6040636	6040636	6040636	6040636	6040636	BS041796	6040583
Date Prepared:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Date Analyzed:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Instrument I.D.#:	ICP-1	ICP-1	ICP-1	ICP-1	ICP-1	UV Spec 1	pH-1
Matrix Spike % Recovery:	30	47	96	10	100	104	90
Matrix Spike Duplicate % Recovery:	28	45	96	10	100	98	90
Relative % Difference:	6.8	4.3	0.0	0.0	0.0	5.9	0.0

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040662.LUH <3>

Sequoia Analytical

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404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
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Luhdorff & Scalmanini
500 First St.
Woodland, CA 95695
Attention: Vicki Kretsinger

Client Project ID: 96-7-030 / YCAPA
Matrix: Water
QC Sample Group: 604-0662

Reported: Apr 25, 1996

QUALITY CONTROL DATA REPORT

ANALYTE	Chloride	EC	Sulfate	TDS	Nitrate
Method:	EPA 325.3	EPA 120.1	EPA 375.4	EPA 160.1	EPA 300.0
Analyst:	L. Martin	S. Phillips	L. Martin	S. Phillips	S. Lee
Concentration Spiked:	50 mg/L	1000 µmhos/cm	20 mg/L	500 mg/L	10 mg/L
LCS Batch#:	LCS041896	LCS041896	LCS042296	LCS042296	LCS041896
Date Prepared:	04/18/96	04/18/96	04/22/96	04/22/96	04/18/96
Date Analyzed:	04/18/96	04/18/96	04/22/96	04/22/96	04/18/96
Instrument I.D.#:	Titration	EC-1	T-1	BAL 4	INIC-1
LCS % Recovery:	104	110	100	98	100
Control Limits:	80-120	80-120	80-120	80-120	90-110
MS/MSD Batch #:	6040662	6040662	6040662	6040662	9604C25-01
Date Prepared:	04/18/96	04/18/96	04/22/96	04/22/96	04/18/96
Date Analyzed:	04/18/96	04/18/96	04/22/96	04/22/96	04/18/96
Instrument I.D.#:	Titration	EC-1	T-1	BAL 4	INIC-1
Matrix Spike % Recovery:	92	100	104	101	97
Matrix Spike Duplicate % Recovery:	94	100	102	98	97
Relative % Difference:	2.2	0.0	1.9	3.0	0.0

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040662.LUH <4>

Sequoia Analytical

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Luhdorff & Scalmanini
500 First St.
Woodland, CA 95695
Attention: Vicki Kretsinger

Client Project ID: 96-7-030 / YCAPA
Matrix: Water
QC Sample Group: 604-0662

Reported: Apr 25, 1996

QUALITY CONTROL DATA REPORT

ANALYTE
pH

Method: EPA 150.1
Analyst: L. Martin
Date: 04/18/96

Sample #:	6040662
Sample Concentration:	7.4
Sample Duplicate Concentration:	7.4
% RPD:	0.0
Control Limits:	0-20

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040662.LUH <5>

Send Invoice To: _____

CHAIN OF CUSTODY RECORD

Send Lab, Results To: LSCE (address below)

Client name	LSCE Project No.
YCAPA	96-7-030
Project name G.W. MONITORING	
Project manager VICKI KRETSINGER	**Sampler(s)** GARY WUEST

Sample number	Time sampled	Type: Composite / Grab	Matrix	Date sampled	Sample description (Location Details)	Number of containers	Analyses required: *1	*2	GEN MIN	NITRATE				Hazardous sample / Special handling required	Remarks
~~(1)~~	1245	Grab	H_2O	4-17-96	CACHE CR MW5	3	X	X							METALS FIELD FILTERED .45µ
~~(2) GW~~	GW	~~Grab~~	~~H_2O~~	~~4-17-96~~	GW										

per Vicki Kretsinger 4/18/96 LCS

5 day ~~NORMAL~~ TAT

*Sample Container Description

1. Polyethylene, no preservatives	4. Polyethylene – sterile
2. Polyethylene, preacidified	5. 40 ml Glass Vial, duplicate
3. Glass, screw cap	6.

	Signature	Company	Date	Time
Relinquished by	Gary Wuest	LSCE	4-18-96	0800
Received by				
Relinquished by				
Received by				
Relinquished by				
Received by	Sandi Hinson	Sequoia	4/18/96	0800

Luhdorff and Scalmanini, Consulting Engineers
500 First Street, Woodland, Ca. 95695

County of Yolo
June 14, 1996

4-293

OCMP EIR Response to Comments
Response to Comments

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA	Sampled:	Apr 15, 1996
500 First St.	Sample Descript:	Water, 1, Solano MW 8 Deep	Received:	Apr 16, 1996
Woodland, CA 95695	Analysis for:	General Minerals	Reported:	Apr 25, 1996
Attention: Vicki Kretsinger	Lab Number:	604-0583		

GENERAL MINERAL ANALYSIS

Analyte	Date Analyzed	Lab ELAP #	Reporting Limit	Sample Result
Bicarbonate Alkalinity, mg/L	**04/18/96**	**1624**	**10**	**400**
Calcium, mg/L	**04/18/96**	**1624**	**0.10**	**76**
Carbonate Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Chloride, mg/L	**04/18/96**	**1624**	**10**	**80**
Copper, mg/L	04/18/96	1624	0.010	N.D.
Hardness, mg/L	**04/18/96**	**1624**	**1.0**	**430**
Hydroxide Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Iron, mg/L	04/18/96	1624	0.020	N.D.
Magnesium, mg/L	**04/18/96**	**1624**	**0.10**	**59**
Manganese, mg/L	04/18/96	1624	0.010	N.D.
pH, pH units	**04/16/96**	**1624**	**N/A**	**7.4**
Potassium, mg/L	**04/18/96**	**1624**	**1.0**	**2.4**
Sodium, mg/L	**04/18/96**	**1624**	**0.50**	**72**
Specific Conductance, µmhos/c	**04/16/96**	**1624**	**10**	**1,000**
Sulfate, mg/L	**04/18/96**	**1624**	**4.0**	**54**
Surfactants, mg/L	**04/17/96**	**1624**	**0.050**	**0.055**
Total Dissolved Solids, mg/L	**04/22/96**	**1624**	**5.0**	**620**
Zinc, mg/L	04/18/96	1624	0.010	N.D.

Analytes reported as N.D. were not detected at or above the reporting limit.
Please note that sample for metals was field filtered, thus results are dissolved metals.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040583.LUH <1>

Sequoia Analytical

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Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA	Sampled:	Apr 15, 1996
500 First St.	Sample Descript:	Water, 2, Solano MW 8 Shallow	Received:	Apr 16, 1996
Woodland, CA 95695	Analysis for:	General Minerals	Reported:	Apr 25, 1996
Attention: Vicki Kretsinger	Lab Number:	604-0584		

GENERAL MINERAL ANALYSIS

Analyte	Date Analyzed	Lab ELAP #	Reporting Limit	Sample Result
Bicarbonate Alkalinity, mg/L	**04/18/96**	**1624**	**10**	**430**
Calcium, mg/L	**04/18/96**	**1624**	**0.10**	**82**
Carbonate Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Chloride, mg/L	**04/18/96**	**1624**	**1.0**	**89**
Copper, mg/L	04/18/96	1624	0.010	N.D.
Hardness, mg/L	**04/18/96**	**1624**	**1.0**	**530**
Hydroxide Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Iron, mg/L	04/18/96	1624	0.020	N.D.
Magnesium, mg/L	**04/18/96**	**1624**	**0.10**	**79**
Manganese, mg/L	04/18/96	1624	0.010	N.D.
pH, pH units	**04/16/96**	**1624**	**N/A**	**7.1**
Potassium, mg/L	**04/18/96**	**1624**	**1.0**	**1.4**
Sodium, mg/L	**04/18/96**	**1624**	**0.50**	**69**
Specific Conductance, µmhos/c	**04/16/96**	**1624**	**10**	**1,200**
Sulfate, mg/L	**04/18/96**	**1624**	**4.0**	**68**
Surfactants, mg/L	04/17/96	1624	0.050	N.D.
Total Dissolved Solids, mg/L	**04/22/96**	**1624**	**5.0**	**720**
Zinc, mg/L	04/18/96	1624	0.010	N.D.

Analytes reported as N.D. were not detected at or above the reporting limit.
Please note that sample for metals was field filtered, thus results are dissolved metals.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040583.LUH <2>

Sequoia Analytical

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Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA	Sampled: Apr 16, 1996
500 First St.	Sample Descript:	Water, 3, Solano MW 2	Received: Apr 16, 1996
Woodland, CA 95695	Analysis for:	General Minerals	Reported: Apr 25, 1996
Attention: Vicki Kretsinger	Lab Number:	604-0585	

GENERAL MINERAL ANALYSIS

Analyte	Date Analyzed	Lab ELAP #	Reporting Limit	Sample Result
Bicarbonate Alkalinity, mg/L	**04/18/96**	**1624**	**10**	**310**
Calcium, mg/L	**04/18/96**	**1624**	**0.10**	**59**
Carbonate Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Chloride, mg/L	**04/18/96**	**1624**	**1.0**	**68**
Copper, mg/L	04/18/96	1624	0.010	N.D.
Hardness, mg/L	**04/18/96**	**1624**	**1.0**	**340**
Hydroxide Alkalinity, mg/L	04/18/96	1624	1.0	N.D.
Iron, mg/L	04/18/96	1624	0.020	N.D.
Magnesium, mg/L	**04/18/96**	**1624**	**0.10**	**46**
Manganese, mg/L	04/18/96	1624	0.010	N.D.
pH, pH units	**04/16/96**	**1624**	**N/A**	**7.4**
Potassium, mg/L	**04/18/96**	**1624**	**1.0**	**1.9**
Sodium, mg/L	**04/18/96**	**1624**	**0.50**	**54**
Specific Conductance, µmhos/c	**04/16/96**	**1624**	**10**	**800**
Sulfate, mg/L	**04/18/96**	**1624**	**4.0**	**37**
Surfactants, mg/L	**04/17/96**	**1624**	**0.050**	**0.051**
Total Dissolved Solids, mg/L	**04/22/96**	**1624**	**5.0**	**480**
Zinc, mg/L	04/18/96	1624	0.010	N.D.

Analytes reported as N.D. were not detected at or above the reporting limit.
Please note that sample for metals was field filtered, thus results are dissolved metals.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040583.LUH <3>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA	Sampled: Apr 15, 1996
500 First St.	Sample Descript:	Water	Received: Apr 16, 1996
Woodland, CA 95695	Analysis for:	Nitrate as NO3	Analyzed: Apr 17, 1996
Attention: Vicki Kretsinger	First Sample #:	604-0583	Reported: Apr 25, 1996

LABORATORY ANALYSIS FOR: Nitrate as NO3

Sample Number	Sample Description	Reporting Limit mg/L	Sample Result mg/L
604-0583	1, Solano MW 8 Deep	1.0	54
604-0584	2, Solano MW 8 Shallow	1.0	85

Analytes reported as N.D. were not detected at or above the reporting limit.

SEQUOIA ANALYTICAL, ELAP #1210

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040583.LUH <4>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA	Sampled: Apr 16, 1996
500 First St.	Sample Descript:	Water	Received: Apr 16, 1996
Woodland, CA 95695	Analysis for:	Nitrate as NO3	Analyzed: Apr 17, 1996
Attention: Vicki Kretsinger	First Sample #:	604-0585	Reported: Apr 25, 1996

LABORATORY ANALYSIS FOR: Nitrate as NO3

Sample Number	Sample Description	Reporting Limit mg/L	Sample Result mg/L
604-0585	3, Solano MW 2	1.0	31

Analytes reported as N.D. were not detected at or above the reporting limit.

SEQUOIA ANALYTICAL, ELAP #1210

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040583.LUH <5>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA. 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini
500 First St.
Woodland, CA 95695
Attention: Vicki Kretsinger

Client Project ID: 96-7-030 / YCAPA
Matrix: Water
QC Sample Group: 604-0583

Reported: Apr 25, 1996

QUALITY CONTROL DATA REPORT

ANALYTE	Calcium	Magnesium	Iron	Sodium	Potassium	Surfactants	Alkalinity
Method:	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	EPA 425.1	EPA 310.1
Analyst:	K. Barta	K. Barta	K. Barta	K. Barta	K. Barta	L. Martin	L. Martin
Concentration Spiked:	5.0 mg/L	5.0 mg/L	5.0 mg/L	5.0 mg/L	5.0 mg/L	0.50 mg/L	27 mg/L
LCS Batch#:	LCS041896E	LCS041896E	LCS041896E	LCS041896E	LCS041896E	LCS041896	LCS041896
Date Prepared:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Date Analyzed:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Instrument I.D.#:	ICP-1	ICP-1	ICP-1	ICP-1	ICP-1	UV Spec 1	pH-1
LCS % Recovery:	102	103	103	102	98	96	94
Control Limits:	90-110	90-110	90-110	90-110	90-110	80-120	80-120
MS/MSD Batch #:	6040636	6040636	6040636	6040636	6040636	BS041796	6040583
Date Prepared:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Date Analyzed:	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96	04/18/96
Instrument I.D.#:	ICP-1	ICP-1	ICP-1	ICP-1	ICP-1	UV Spec 1	pH-1
Matrix Spike % Recovery:	30	47	100	10	100	104	90
Matrix Spike Duplicate % Recovery:	28	45	100	10	100	98	90
Relative % Difference:	6.8	4.3	0.0	0.0	0.0	5.9	0.0

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040583.LUH <6>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini
500 First St.
Woodland, CA 95695
Attention: Vicki Kretsinger

Client Project ID: 96-7-030 / YCAPA
Matrix: Water
QC Sample Group: 604-0583

Reported: Apr 25, 1996

QUALITY CONTROL DATA REPORT

ANALYTE	Chloride	EC	Sulfate	TDS	Nitrate
Method:	EPA 325.3	EPA 120.1	EPA 375.4	EPA 160.1	EPA 300.0
Analyst:	L. Martin	L. Martin	L. Martin	S. Phillips	S. Lee
Concentration Spiked:	50 mg/L	1000 µmhos/cm	20 mg/L	500 mg/L	10 mg/L
LCS Batch#:	LCS041896	LCS041696	LCS041896	LCS042296	LCS041796
Date Prepared:	04/18/96	04/16/96	04/18/96	04/22/96	04/17/96
Date Analyzed:	04/18/96	04/16/96	04/18/96	04/22/96	04/17/96
Instrument I.D.#:	Titration	EC-1	T-1	BAL 4	INIC-1
LCS % Recovery:	104	110	102	98	100
Control Limits:	80-120	80-120	80-120	80-120	90-110
MS/MSD Batch #:	6040662	6040569	6040585	6040662	9604A89-01
Date Prepared:	04/18/96	04/16/96	04/18/96	04/22/96	04/17/96
Date Analyzed:	04/18/96	04/16/96	04/18/96	04/22/96	04/17/96
Instrument I.D.#:	Titration	EC-1	T-1	BAL 4	INIC-1
Matrix Spike % Recovery:	92	80	100	101	98
Matrix Spike Duplicate % Recovery:	94	80	101	98	88
Relative % Difference:	2.2	0.0	1.0	3.0	11

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040583.LUH <7>

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
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819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

Luhdorff & Scalmanini	Client Project ID:	96-7-030 / YCAPA
500 First St.	Matrix:	Water
Woodland, CA 95695		
Attention: Vicki Kretsinger	QC Sample Group: 604-0583	Reported: Apr 25, 1996

QUALITY CONTROL DATA REPORT

ANALYTE
pH

Method: EPA 150.1
Analyst: L. Martin
Date: 04/16/96

Sample #:	6040570
Sample Concentration:	10.2
Sample Duplicate Concentration:	10.2
% RPD:	0.0
Control Limits:	0-20

SEQUOIA ANALYTICAL

Linda C. Schneider
Project Manager/Sacramento Laboratory

6040583.LUH <8>

Send Invoice To:

CHAIN OF CUSTODY RECORD

Send Lab. Results To: LSCE (address below)

Client name: YCAPA	LSCE Project No. 96-7-030
Project name: G. W. MONITORING	
Project manager: VICKI KRETSINGER	Sampler(s): GARY WUEST

Analyses required: GEN MIN (2), NITRATE (1); Hazardous sample / Special handling required

Sample number	Time sampled	Type Composite Grab Matrix	Date sampled	Sample description (Location Details)	Number of containers	GEN MIN (2)	NITRATE (1)		Remarks
1	1245	H2O GRAB	4-15-96	SOLANO MW 8 DEEP	3	X	X	5604-0583	NORMAL TAT METALS FIELD FILTERED .45µ
2	1515	H2O GRAB	4-15-96	SOLANO MW 8 SHALLOW	3	X	X	-0584	METALS FIELD FILTERED .45µ
3	0945	H2O GRAB	4-16-96	SOLANO MW 2	3	X	X	-0585	METALS FIELD FILTERED .45µ
									7 DAY TAT

*Sample Container Description

1. Polyethylene, no preservatives	4. Polyethylene – sterile
2. Polyethylene, preacidified	5. 40 ml Glass Vial, duplicate
3. Glass, screw cap	6.

	Signature	Company	Date	Time
Relinquished by	[signature]	LSCE	4-16-96	11:25
Received by	[signature]	LSCE	4-16-96	11:26
Relinquished by	[signature]	LSCE	4/16/96	1:36
Received by	[signature]	SEQUOIA	4/16/96	1336
Relinquished by	[signature]	SEQUOIA	4/16/96	1405
Received by	[signature]	Sequoia	4/16/96	1405

Luhdorff and Scalmanini, Consulting Engineers
500 First Street, Woodland, Ca. 95695

Chain-of-Custody (COC)

To: Frontier Geosciences Inc.
414 Pontius Avenue North
Seattle, WA 98109
(206) 622-6960

From: Mark Bowland / Bill Stitts
Foster Wheeler Environmental Corporation
2525 Natomas Park Drive Suite 250
Sacramento, CA 95833-2900

bottle #	sample location	depth	date/time	collected by	preservation	analyses needed
Cent-891	Solano Concrete OWS-D	GRAB	4/15 12:47	M. Bowland	None	Total Mercury, Filtered Methyl Mercury, Filtered
Cent-769	Solano Concrete OWS-S	GRAB	4/15 3:10	M. Bowland	None	Total Mercury Filtered
Cent-2	Solano Concrete Field Blank	GRAB	4/15 2:55	M. Bowland	None	Total Mercury, Filtered Methyl Mercury, Filtered

Relinquished by: Mark Bowland (NAME) _____ (SIGNATURE) 4/15/96 (DATE) 3:12 pm (TIME)

Recieved By: Paula Noble (NAME) _____ (SIGNATURE) 4/15/96 (DATE) 3:12 pm (TIME)

Comments: _____

QA Level Desired: (X) Normal Research ( ) EPA CLP Style (high level, 30% additional cost)

Chain-of-Custody (COC)

To: Frontier Geosciences Inc.
414 Pontius Avenue North
Seattle, WA 98109
(206) 622-6960

From: Mark Bowland
Foster Wheeler Environmental Corporation
2525 Natomas Park Drive Suite 250
Sacramento CA 95833-2900

bottle #	sample location	depth	date/time	collected by	preservation	analyses needed
Cent-838	OW-2 - Solano Concrete	GRAB	4/16 9:37a	M. Bowland	None - ice	Total Mercury - Filtered
Cent-827	OW-3 - Solano Concrete	GRAB	4/16 12:25p	M. Bowland	None - ice	Total Mercury - Filtered Methyl Mercury - Filtered
Cent-828	MW-3 Cache Creek Aggregates	GRAB	4/16 3:55p	M. Bowland	None - ice	Total Mercury - Filtered Methyl Mercury - Filtered
Cent-548	MW-1 Cache Creek Aggregate	GRAB	4/16 7:15p	M. Bowland	None-Ice	Total Mercury - Filtered
Cent-530	Cache Creek	GRAB	4/16 7:55p	M. Bowland	None - Ice	Unfiltered total Mercury Unfiltered Methyl Mercury Filtered total Mercury Filtered Methyl Mercury
Cent-757	Cache Creek Field Blank	GRAB	4/16 7:57p	M. Bowland	None - Ice	Filtered total Mercury Filtered Methyl Mercury

Relinquished by: Mark Bowland (NAME) Mark Bowland (SIGNATURE) 4/16/96 (DATE) 20:15 (TIME)

Recieved By: [signature] (NAME) Gary Wuest (SIGNATURE) 4-16-96 (DATE) 2015 (TIME)

Comments: Cent-530 (Cache Creek) - Filtered Analyses (total Hg and Methyl Hg) to be filtered at the lab.

QA Level Desired: ( ) Normal Research ( ) EPA CLP Style (high level, 30% additional cost)

Chain-of-Custody (COC)

To: Frontier Geosciences Inc.
414 Pontius Avenue North
Seattle, WA 98109
(206) 622-6960

From: Mark Bowland
Foster Wheeler Environmental
2525 Natomas Park Drive Suite 250
Sacramento CA 95833-2900

bottle #	sample location	depth	date/time	collected by	preservation	analyses needed
Cent-833	Cache Creek Aggregate MW-5	grab	4/17 12:40p	M. Bowland	None - ice	Total Mercury, Filtered Methyl Mercury, Filtered
Cent-537	Cache Creek Agg MW-4A	grab	4/17 4:12p	M. Bowland	None - ice	Total Mercury - Filtered
Cent-868	Cache Creek Agg MW4B	grab	4/17 6:40p	M. Bowland	None - ice	Total Mercury - Filtered
Cent-754	Cache Creek Agg Field Blank	grab	4/17 6:15p	M. Bowland	None - ice	Total Mercury - Filtered

Relinquished by: Mark Bowland (NAME) — Mark Bowland (SIGNATURE) — 4/17/96 (DATE) — 18:25 (TIME)

Recieved By: Gary Wenet (NAME) — Gary Wenet (SIGNATURE) — 4-17-96 (DATE) — 18:25 (TIME)

Comments: All samples are from Cache Creek Aggregate

QA Level Desired: (X) Normal Research ( ) EPA CLP Style (high level, 30% additional cost)

Send Invoice To: ~~[illegible]~~ FOSTER WHEELER

CHAIN OF CUSTODY RECORD

Send Lab. Results To: LSCE (address below)

Client name: YCAPA | LSCE Project No.: 967030

Project name: Mercury Investigation

Project manager: Rick Sitts (Lsce contact Vicki Kretsinger) | Sampler(s): Liese Schadt

Analyses required: *6 | Low Level Hg | CH3 Hg | Hazardous sample Special handling required

Sample number	Time sampled	Type Composite Grab Matrix	Date sampled	Sample description (Location Details)	Number of containers	*6	Low Level Hg	CH3 Hg	Hazardous sample Special handling required	Remarks
SC-1-2½		Grab	4/15/96	Solano Concrete Barrel 1	1	✓				
SC-1-6			4/15/96	"	1	✓	✓			
SC-1-16			4/15/96	"	1	✓				
SC-1-45			4/15/96	"	1	✓	✓			
SC-1-50			4/15/96	"	1	✓				
SC-2-2½			4/15/96	Solano Concrete Barrel 2	1	✓				
SC-2-6			4/15/96			✓	✓	(CH3)		
SC-2-16			4/15/96	"	1	✓				
SC-2-35			4/15/96	"	1	✓				
SC-2-45		↓	4/15/96	"	1	✓	✓			

*Sample Container Description

1. Polyethylene, no preservatives
2. Polyethylene, preacidified
3. Glass, screw cap
4. Polyethylene – sterile
5. 40 ml Glass Vial, duplicate
6. Brass Tubes

	Signature	Company	Date	Time
Relinquished by	Vicki Kretsinger	Luhdorff & Scalmanini, Cons. Engrs.	4/16/96	4[65]pm
Received by				
Relinquished by				
Received by				
Relinquished by				
Received by				

Luhdorff and Scalmanini, Consulting Engineers
500 First Street, Woodland, Ca. 95695

Contact Person: Vicki Kretsinger / Rick Sitts

Foster Wheeler

CHAIN OF CUSTODY RECORD

Send Lab. Results To: LSCE (address below)

Client name: YCAPA | LSCE Project No.: 967030

Project name: Mercury Investigation

Project manager: Rik Sills (LSCE contact - Vicki Kretzinger) | Sampler(s): Liese Schadt

Analyses required: *6 | Low level Hg | CH3 Hg | Hazardous sample Special handling required

Sample number	Time sampled	Type Composite Grab Matrix	Date sampled	Sample description (Location Details)	Number of containers	*6	Low level Hg		CH3 Hg				Remarks
CC-1-3		Grab	4/16/96	Cache Creek Ag. Boring 1	1	✓	✓						
CC-1-6				"	1	✓	###	No	CH3 Hg				
CC-1-25				"	1	✓							
CC-1-40				"	1	✓	✓						
CC-1-50				"	1	✓							
CC-2-3				Cache Creek Ag Boring 2	1	✓	✓	(###)					
CC-2-6					1	✓							
CC-2-16				"	1	✓							
CC-2-40				"	1	✓	✓						
CC-2-50		↓	↓	"	1	✓							

*Sample Container Description

1. Polyethylene, no preservatives
2. Polyethylene, preacidified
3. Glass, screw cap
4. Polyethylene - sterile
5. 40 ml Glass Vial, duplicate
6. Brass Tubes

	Signature	Company	Date	Time
Relinquished by	Vicki Kretzinger	Luhdorff & Scalmanini, Cons. Engrs.	4/16/96	4:05 pm.
Received by				
Relinquished by				
Received by				
Relinquished by				
Received by				

Luhdorff and Scalmanini, Consulting Engineers
500 First Street, Woodland, Ca. 95695
Phone: (916) 661-0109

Contact Person: Vicki Kretzinger

APPENDIX B

MERCURY CONCENTRATIONS IN SEDIMENTS FROM THE GRAVEL MINING AREA

APPENDIX B

MERCURY CONCENTRATIONS IN SEDIMENTS OF THE GRAVEL MINING AREA.

Data on mercury collected in sediments in the gravel mining area is described below. This data was collected by Luhdorff and Scalmanini Consulting Engineers, Woodland California, and their drilling contractor.

Sample Location Criteria. The concentrations of total mercury and methyl mercury in soils were determined at existing and planned wet-pit areas adjacent to lower Cache Creek. On April 15 and April 16, 1996, soil samples were collected from two borings installed at each of the Solano Concrete and Cache Creek Aggregates project sites. The boring locations and sample selections were based on the following criteria:

- *Location of the boring relative to the Creek.* Borings at each site were selected both near to and away from Cache Creek, and the two sites are located near to (Cache Creek Aggregates) and away from (Solano Concrete) the head of the lower Cache Creek basin.

- *Location of the boring relative to an existing or planned wet-pit mining area.* Borings were located near an existing wet pit (Solano Concrete) and planned wet pits (Cache Creek Aggregates).

- *Sample depth relative to the water table.* Several samples were collected both above and below the water table in each boring.

- *Sample gradation.* Samples were collected in both fine- and coarse-grained soils.

The borings were designated SC-1 and SC-2 at Solano Concrete and CC-1 and CC-2 at Cache Creek Aggregates, and are located on their respective site maps (Figures 5-1 and 5-2).

Sample Collection. A hollow-stem auger rig was used to install the borings to a depth of 50 feet. Soil samples were collected as the drilling proceeded using a California sampler (lined with 2-inch brass and stainless steel sleeves), driven ahead of the auger bit into undisturbed soil at 2-1/2 to 10-foot intervals. Soil samples were numbered by boring location and depth (e.g. a sample from Solano Concrete's boring #1 from a depth of 16 feet was denoted as "SC-1-16"). The sampler and sleeves were cleaned with Alconox and then rinsed with deionized water prior to collecting all soil samples. All sample sleeves were capped, taped, sealed in Ziploc bags, and stored on ice for transport to Frontier Geosciences in Seattle, Washington, with appropriate chain-of-custody procedures.

An attempt was made during sample collection to provide a "full" soil sample in each sleeve; however, the coarse nature of the gravel deposits, which often contained cobbles larger than 2 inches, resulted in some partially-filled sleeves. Also, due to the sleeve size and sample collection method, the samples comprise soils with gravel sizes limited to a 2-inch size or less. Thus, samples from the coarsest deposits of gravel and cobbles beneath the sites are not truly representative of these deposits. The position of the water table was estimated from the degree of sample saturation noted during drilling and from the position of water rising up into the augers after drilling ceased.

Soil samples collected on April 15, 1996, were frozen overnight at Luhdorff and Scalmanini Consulting Engineers office in Woodland, California. Following sampling activities on April 16, 1996, soil samples for total mercury and methyl mercury analyses were shipped overnight to Frontier Geosciences. The samples were packed with ice packs and dry ice.

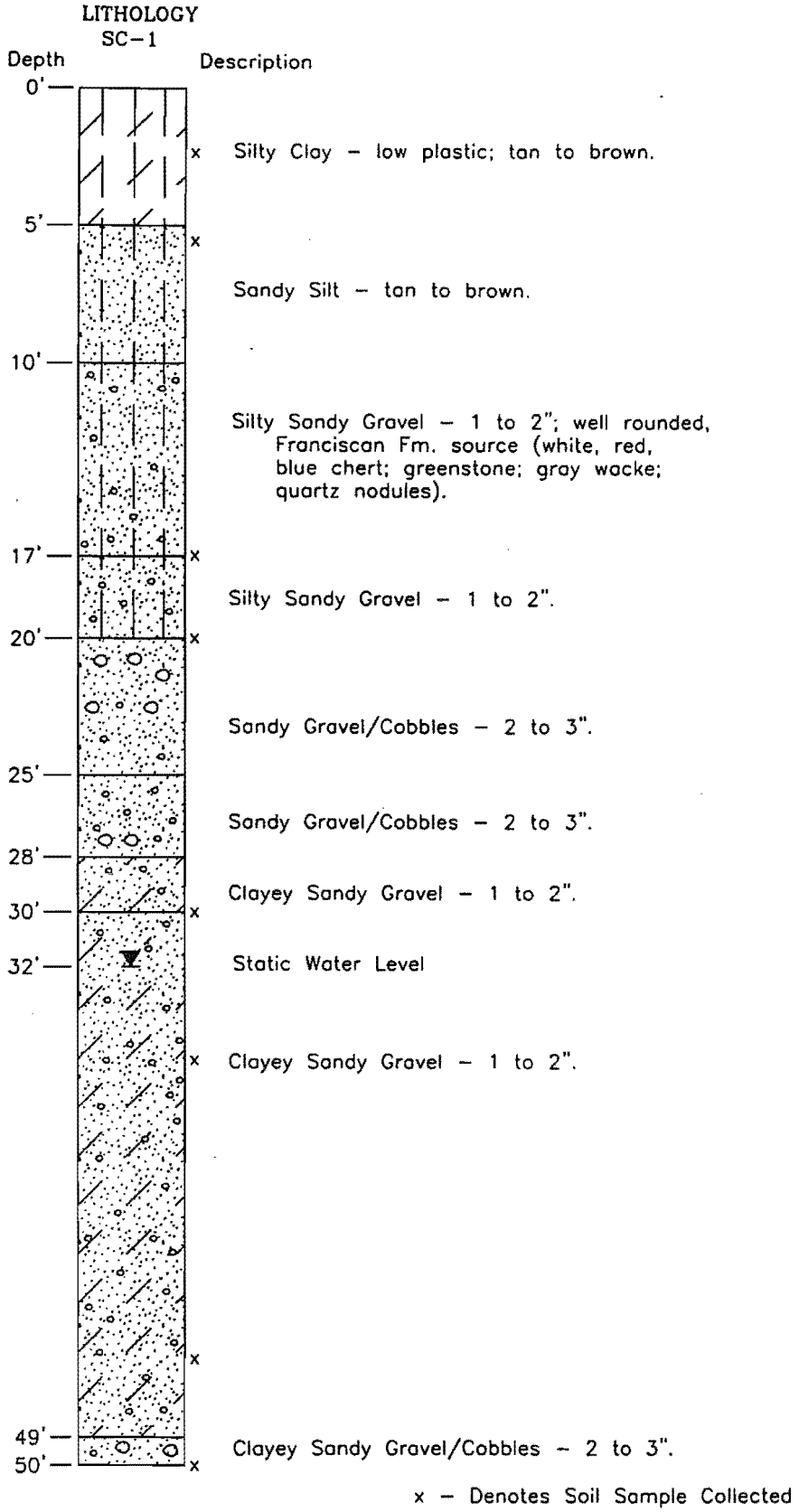
Soil Sample Analyses. Soil samples were collected for total mercury analyses at the four boring locations. Two samples from boring SC-1 at Solano Concrete were analyzed for methyl mercury. These samples included SC-1-2.5 (near surface soil collected at a depth of 2.5 feet) and SC-1-45 (saturated soil collected below the water table at a depth of 45 feet). Soil samples were handled at the laboratory using ultra-clean protocols. Soil for analysis was extracted from the center of the cores so as to analyze material not in contact with the wall of the sleeve. As mentioned above, in several cases (particularly samples collected below the water table), incomplete sample retrieval (i.e. loose soil, partially filling the sleeve) made it difficult to obtain soil that had not been in contact with the sleeve.

When trying to extract the center of a sample, away from the core, gravel material was removed and discarded. It is assumed that Frontier Geosciences, Inc., removed material only from the gravely samples. Thus, concentration of mercury in gravely samples are considered overestimates.

Sample Results. The materials encountered during drilling at each site were similar and comprised a thin upper layer of clayey silty overburden, underlain by a fairly continuous deposit of coarse sand and well-rounded gravels and cobbles. A description of the soil materials, as well as sample and water table locations, is provided in lithologic logs for each site (Figures B-1 through B-4). The results of the total mercury and methyl mercury analyses are summarized in Table B-1. The laboratory analytical data sheets are included in Appendix A materials.

An analysis of two sieved samples containing gravely sand or gravel/sand/mud, indicated that smaller material contains most of the mercury. Sieved material 2 mm in diameter or smaller contained 81 or 91 percent of the total mercury in both size groups. On a dry weight basis, mercury in the cores from the Solano Concrete site were at 0.1 and 0.9 mg/kg (parts per million [ppm]) in the top 3 feet of sandy soil, and 0.3 and 0.2 mg/kg in muddy sand at 35 and 45 feet, respectively. Otherwise, mercury was less than 0.05

mg/kg. None of the samples from the Cache Creek Aggregates sites exceeded 0.07 mg/kg in total mercury. The two methyl mercury samples from sandy soil or gravely sand at the Solano Concrete site were measured at <0.000001 and 0.00009 mg/kg.

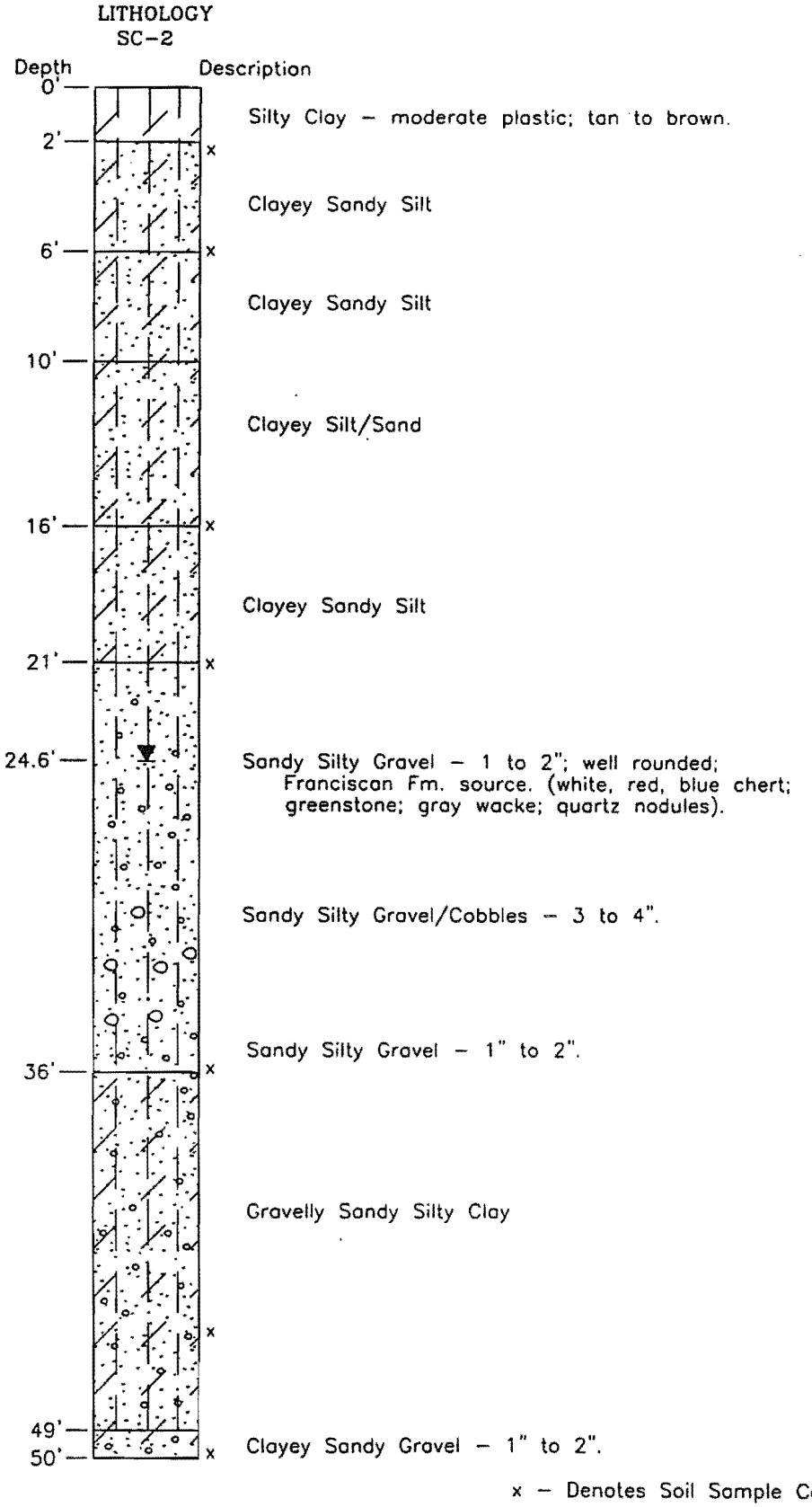


96-7-030/YCAPASC1.DWG

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure B-1. Boring SC-1, Solano concrete lithologic profile.

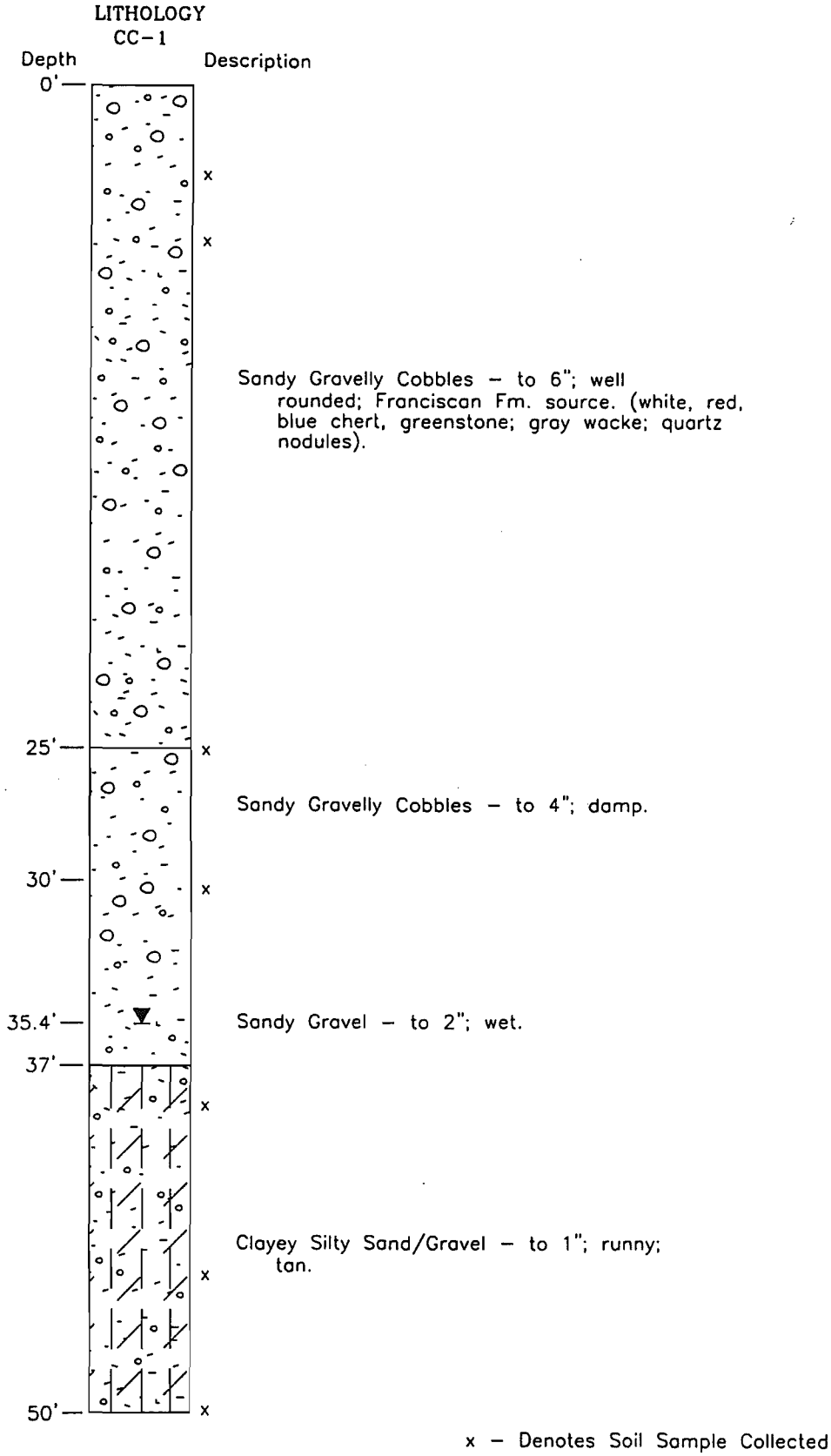
B-4



96-7-030/YCAPASC2.DWG

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure B-2. Boring SC-2, Solano concrete lithologic profile.



96-7-030/YCAPACC1.DWG

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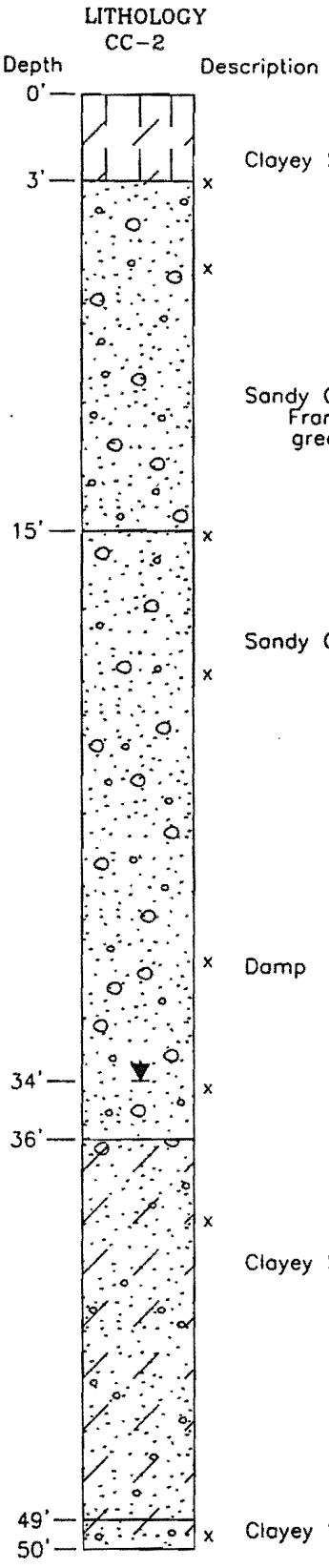
Figure B-3. Boring CC-1, Cache Creek aggregates lithologic profile.



96-7-030/YCAPACC2.DWG

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Figure B-4. Boring CC-2, Cache Creek aggregates lithologic profile.

TABLE B-1

MERCURY SPECIATION IN CORE BORINGS AT SOLANO CONCRETE AND CACHE CREEK AGGREGATES SITES, YOLO COUNTY, CALIFORNIA, APRIL 15-16, 1996.

Sample	Sample Date	Soil Description	Dry Fraction	[Hg], ng/g (ppb)	
				Wet Basis	Dry Basis
SC-1-2.5	4-15-96	Silty Clay	0.8590	766.3	892.1
SC-1-2.5 methyl	4-15-96	Silty Clay	0.8590	0.081	0.094
SC-1-16	4-15-96	Silty Sandy Gravel	0.9710	39.8	41.0
SC-1-45	4-15-96	Clayey Sandy Gravel	0.8655	33.4	38.6
SC-1-45 methyl	4-15-96	Clayey Sandy Gravel	0.8655	<0.001	<0.001
SC-1-50	4-15-96	Clayey Sandy Gravel/Cobbles	0.8214	40.7	49.5
SC-2-2.5	4-15-96	Clayey Sandy Silt	0.8179	86.2	105.4
SC-2-16	4-15-96	Clayey Silt/Sand	0.9676	32.1	33.2
SC-2-35	4-15-96	Sandy Silty Gravel	0.7855	245.5	323.5
SC-2-45	4-15-96	Gravely Sandy Silty Clay	0.7947	153.3	192.9
CC-1-3	4-16-96	Sandy Gravely Cobbles	0.9731	15.8	16.2
CC-1-25	4-16-96	Sandy Gravely Cobbles	0.9345	68.4	73.2
CC-1-25	4-16-96	Sandy Gravely Cobbles (>2mm)	0.9576	6.1	6.4
CC-1-40	4-16-96	Clayey Silty Sand/Gravel	0.8735	38.2	43.7
CC-1-40	4-16-96	Clayey Silty Sand/Gravel (>2mm)	0.8975	6.9	7.7
CC-1-50	4-16-96	Clayey Silty Sand/Gravel	0.8881	36.9	41.5
CC-2-3	4-16-96	Clayey Silt	0.9118	43.5 67.7	61.0
CC-2-16	4-16-96	Sandy Gravely Cobbles	0.9622	21.2	22.0
CC-2-16	4-16-96	Sandy Gravely Cobbles (>2mm)	0.9242	3.9	4.2
CC-2-40	4-16-96	Clayey Sandy Gravel	0.8660	40.4	46.7
CC-2-50	4-16-96	Clayey Sand/Gravel	0.8472	35.3	41.7

LETTER 14: FOSTER WHEELER ENVIRONMENTAL CORPORATION

Response to Comment 14-1:

The commentor presents two general points regarding the appropriateness in the DEIR of a mercury level of 0.5 mg/kg in fish tissue as an action level presented in Mitigation Measure 4.4-3. Staff agrees with the commentor that the level is conservative relative to the FDA fish advisory criterion which applies to interstate commerce and human consumption. Staff would like to point out that the mining proposed under the OCMP results in the creation of habitat not currently found in the Cache Creek region (with the exception of the Solano Concrete unreclaimed lakes). The potential for methylation of mercury could be enhanced if conditions favorable for anaerobic bacteria growth is created in the bottoms of the pits. Within this environment, many species could be affected by the potential conversion of mercury to methylmercury in the lakes. The EIR does not, as suggested by the commentor, initiate a "new regulatory process that is inconsistent with existing federal or state processes". The mitigation measures in the DEIR are recommended to reduce the potential for adverse environmental impacts. A conservative approach was warranted for the evaluation of the mercury levels in the existing mining pit lakes.

In the second portion of the comment, the commentor acknowledges that the California EPA Office of Environmental Health Hazard Assessment (OEHHA) has used the 0.5 mg/kg as a "red flag" for potential human health problems related to consumption of fish population affected by mercury. The commentor also points out that health advisories have been set in areas of the state where fish contain similar levels of mercury. The purpose of applying this standard to the required testing of existing mining pit lakes was to provide a "red flag" to be considered in the approval process.

The comments regarding the function of fish advisories and typical application of the advisories provides prospective for the potential of high mercury levels in fish in lakes that would be created under the proposed OCMP. However, the purpose of the performance standards presented in Mitigation Measure 4.4-3a is also to avoid creation or maintenance of environments which present an unacceptable risk of exposure of other species to methylmercury in the environment.

At the time of preparation of the DEIR information regarding mercury levels in fish in the mining pits and Cache Creek within lower Cache Creek basin were not available. The results of the Slotton and Rueter study of the Solano Concrete mining pit lakes provide important information supporting the analyses of potential impacts of environmental mercury presented in the DEIR. In addition, the report on the study presents significant information regarding ambient levels of mercury in Cache Creek within the OCMP planning area. The results of the study indicate that fish within the Solano Concrete mining pit lakes contain mercury at levels of concern for the protection of human health for individuals consuming fish from the lakes. The levels of mercury in fish collected from the lakes ranged from 0.16 to 0.30 mg/kg for smaller non-predatory species (i.e. green sunfish) to

0.30 to 0.92 mg/kg for larger predatory fish (i.e. smallmouth bass and brown bullhead) and catfish. Although none of the fish contained mercury levels above the FDA threshold of 1.0 mg/kg, five of the 17 larger fish specimens contained mercury levels above the NAS threshold level of 0.5 mg/kg.

The Slotton and Rueter study also presented previously unpublished data on mercury levels in fish collected from the lower Cache Creek in October 1995. The comparison of mercury levels in fish collected within the creek were compared to the mercury levels in fish collected from the Solano Concrete mining pit lakes. The mercury levels in smaller, non-predatory fish and small to medium-sized predatory fish (smallmouth bass and crappie) and large catfish were similar in both sampling populations. The results for brown bullhead specimens indicated that the levels of mercury in fish collected from the Solano Concrete lakes were slightly elevated relative to similar specimens collected from the creek.

The results of the sampling and mercury testing of fish in the Solano Concrete lakes and the lower Cache Creek channel provoke re-examination of the requirements presented in Mitigation Measure 4.4-3a. Although the data set is not complete enough to establish the ambient levels of fish in the lower Cache Creek environment, the data suggest that mercury accumulation in fish from both the creek and the mining pit lake environment are similar. The similarity of the measured mercury levels raises an important question. If the levels of mercury in the mining pit lakes are similar to the levels within fish in the creek, does the proposed creation of permanent lakes in portions of the proposed present an unacceptable increased risk to human or environmental health? Under these conditions, the risk of exposure is an existing condition. Therefore, staff and the preparers of the EIR do not consider exposure of humans or other predators to mercury within the mining pit lakes to be an unacceptable risk.

Creation of aquatic habitat, resulting from reclamation of a mining area to permanent lake, provides an increase in the amount of habitat available within a region which, through the combined effects of conversion of riparian and wetland environments to agricultural and urban uses, has experienced the loss of comparable environments. Although the proposed lakes present a relatively deep-water environment compared to the floodplain and active channel environment of an unaltered Cache Creek streamway, the presence of shoreline and open-water habitat provide ecologic opportunities for indigenous and migratory species. Development of riparian and wetland habitat within the lower Cache Creek basin is supported by the goals and objectives of the OCMP. However, under existing conditions and conditions resulting from implementation of the mining and reclamation activities proposed under the OCMP, species taking advantage of the available ecologic opportunities would be exposed to the presence of mercury (and more specifically methylmercury) in the environment. This exposure and associated health risks increase for longer-lived species, particularly for predatory species which are close to the top of the food-chain. This group includes human hunters and, more specifically for the environment of concern, fishermen. If these "predators" are opportunistic, then they would take advantage of both the lake and creek environments. Similar levels of mercury in fish collected from the two environments indicate an equivalent health hazard associated with

consumption of prey from the mining pit lakes or creek channel environment. The levels of mercury in the fish are also comparable to levels found in other areas of northern California which are affected by significant sources of mercury in the environment, including Clear Lake, Lake Berryessa, Lake Herman, and the American River (Slotton et al., 1996).

Staff and the preparers of EIR consider the similarity of mercury levels in fish collected from the Solano Concrete mining pit lakes to levels in fish from Cache Creek and the aquatic environments within the region to be a significant consideration which was not incorporated into the mitigation measures presented in the DEIR. It is clear that the presence of relatively high levels of mercury within the environment results in accumulation of mercury in biota of the region at levels that approach or exceed the NAS standard of 0.5 mg/kg. On-going research within the region on the availability of mercury in the environment and exposure of humans and other species to health impacts related to mercury will provide refinement of the definition of "ambient" or regional conditions.

In acknowledgement of the relatively high levels of mercury that have been measured in the Cache Creek watershed, it is reasonable and appropriate to use ambient (background) mercury levels as the standard against which the results of long-term monitoring of mercury levels of fish in mining pit lakes should be compared. Considering that available data indicate that mercury levels in predatory fish within the Cache Creek watershed currently approach or exceed the threshold of 0.5 mg/kg recommended in the DEIR, staff concludes that an alternative threshold for fish flesh which reflects ambient conditions should be included in the mitigation measure. When sufficient data is made available through additional sampling of fish in the lower Cache Creek basin, a statistically verified ambient level of mercury in fish within the lower Cache Creek basin would provide a more meaningful standard for comparison. This rationale for revision of the standard was developed with the support of the preparers of the EIR and Dr. Darell Slotton of the University of California at Davis. Text Change # 34 has been made to the EIR to present a more appropriate strategy for mercury monitoring and associated corrective action. Although this change was not made in direct response to the points raised by the comment, the change is relevant to a discussion of the development appropriate standards for the determination of the significance of mercury occurring in the environment.

Response to Comment 14-2:

Staff agrees with the commentor's recognition that the recent water quality testing performed at the lakes in mined areas on the Solano Concrete Company property (Appendix C) does not indicate that mercury in water in the lakes (0.00000225 to 0.00000345 mg/L) exceed USEPA national ambient water quality standards for protection of freshwater aquatic life (0.000012 mg/L). In addition, the water quality results do not exceed the California Maximum Contaminant Level for mercury in drinking water. The commentor's point that the levels of mercury are also well below the USEPA recommended ambient water quality standards to protect human health from mercury consumed in fish (0.000146 mg/L) is noted for the record.

Response to Comment 14-3:

The commentor suggests that comparisons of the results of testing of mercury levels in fish collected at the Solano Concrete Company lakes within formerly mined areas (Appendix C) are comparable to the ranges of mercury concentrations found in fish nationwide and throughout California. The preparers of the EIR contend that the comparison of the results to national and statewide ranges is not particularly informative. The data presented in the comment for ranges does not describe the "central tendency" for the data set. There is no indication in the comment as to whether the national or statewide results are statistically representative of background levels or whether the results are skewed by sampling of fish collected in areas with known mercury problems. A more appropriate measure of similarity of results is provided by a comparison of mean values for a more localized area to compare the results to a more meaningful discussion of "background". The comment presents a comparison of the Solano Concrete lake fish results to the results obtained for Davis Creek reservoir. The preparers of the EIR acknowledge that the results of testing indicate that mercury levels collected in fish from the Solano Concrete Company pits are similar to mercury levels in fish collected in lower Cache Creek basin and lower than those in Davis Creek Reservoir, as described in Appendix C and in the comment.

The preparers of the EIR do not see the relevance of the comparison of mercury levels in fish within the lower Cache Creek basin to fish collected in Swedish lakes. The processes for methylmercury production in Swedish lakes are affected by significantly different environmental conditions. In particular, "acid rain" problems common in Sweden would promote the conversion of available mercury to methylmercury. Therefore, smaller amounts of environmental mercury could create similar or greater methylmercury production in that county.

The commentor's discussion of mercury levels in commercial fish is noted. Although the levels of mercury in fish collected from the Solano Concrete lakes, Cache Creek, Clear Lake, and Davis Creek Reservoir fall within the range of mercury levels cited in the comment, the creation of environments which can potentially promote methylation of mercury and accumulation of methylmercury is a significant impact.

Response to Comment 14-4:

The commentor provides relevant results of groundwater and surface water sampling and analysis within the OCMP area that were not available during the preparation of the DEIR. Specifically, the analysis of water collected from nine monitoring wells (including four wells at the Solano Concrete and five wells at Cache Creek Aggregates) and one sample from Cache Creek were sampled using "ultra-clean" sampling techniques. The samples were analyzed at Frontier Geosciences Laboratories for analysis of total mercury at detection level of 0.000000012 mg/L. The level of total mercury in the filtered groundwater samples ranged from 0.00000085 to 0.00000381 mg/L. Methylmercury levels in the groundwater samples ranged from nondetectable (<0.0000000012 mg/L) to 0.0000000030 mg/L. The results of the testing support the commentor's conclusion that the levels of mercury in the

groundwater samples is well below the California Maximum Contaminant Levels for mercury in groundwater. These new data provide further support for the conclusion in the DEIR (page 4.4-45), based on previously available data, that levels of mercury in groundwater in the OCMP area are significantly below drinking water standards.

Response to Comment 14-5:

The information presented in the comment regarding a health risk assessment approach to determination of potential environmental impacts is noted for the record. The preparers of the DEIR agree that the USEPA screening levels and reference dose (RfD) for mercury are not currently consistent, reflecting the difficulties in setting a health standard for mercury. The current screening level is not substantially different from the threshold of 0.5 mg/kg presented in the DEIR for fish flesh mercury concentrations. The preparers of the DEIR consider the approach of choosing a more conservative threshold appropriate for evaluation of potential adverse conditions in the existing mining pit lakes. Mercury concentrations in fish above this threshold would indicate elevated levels relative to a conservative human health threshold. The commentor's point that application of the RfD would result in identification of consumption of "virtually all fish" as an unacceptable health risk is noted for the record. If the consumption of fish affected by mercury is a potential health hazard, exposure of species using aquatic and riparian habitat to the expected conditions of methylmercury production in mining area lakes is considered to be a significant impact, as described in the DEIR.

The commentor develops the argument that an incremental increase in mercury exposure would occur only if the levels of mercury in fish from the mining area lakes, which are eaten, were higher than levels in fish which are currently consumed. Alternatively, the commentor suggests that an incremental increase would occur if fishing in the lakes would result in increased consumption of affected fish. The DEIR preparers concur that it would be a significant human health impact if fish from the lake that contained high levels of mercury were consumed. Whether the mercury levels in the fish from the lake would necessarily have to be higher than the mercury levels in fish currently consumed by the fish-eating population does not appear supportable. The argument developed by the commentor assumes "the absence of fish advisories applied to the proposed lakes". Staff does not consider this assumption to be necessary. It is possible that, given the relatively high levels of mercury in the Cache Creek watershed, issuance of future fish advisories is possible. In recognition of the potential for mercury levels in fish within the Cache Creek basin (including in mining pit lakes) to present human health hazards, Mitigation Measure 4.34-3a has been amended by Text Change # 34 to address the potential for issuance of fish advisories.

LETTER # 15

David Morrison, Resource Management Coordinator.
YoloCounty Community Development Agency
292 West Beamer Street
Woodland, CA 95695

Re: Comments on Yolo County Off-Channel Mining Plan DEIR

A more specific public comments are forthcoming by others (Dr Robert Speirs Ph.D. etal) about which I give my full support. There are some additional comments I submit as follows:

1. Letter of May 7, 1993 (ref:333:JAL:266.0) attached by SWRCB - Div. of Water Rights recognizes "The potential exists for impacts to the aquifers underlying Cache Creek due to aggregate mining" . . . . staff will review and comment on this document. . . The writer refreshed the Div. of Water Rights in mid-March 1996 of the forthcoming DEIR, appraised them of all new players, public concerns, mercury contamination problems etc. In following up this week as of this date I'm advised they didn't comment. Are not the people of Woodland and those using this aquifer entitled to a better protection etc. No written comment is noted from the County Health / Environmental Officer. He should have a professional opinion and are not the taxpayers paying his salary for his professional expertise? **15-1**

2. Attached excerpt from an Alameda County Clean Water Program "Did you know that dumping one quart of motor oil down a storm drain contaminates 250,000 gallons of water" - This is not smoke and mirrors.
What would it do to an aquifer supplying Woodland's potable water and is without benefit of an expensive treatment plant.
Note also the attached editorial on" Much Contaminated Ground Water Can't Be Cleaned Up" by John Bredehoeft. **15-2**

3. The construction and operation of wet pits invading the aquifer should be construed as inherently dangerous to the public health and safety and such mining operators should not receive any diminution of responsibility or accountability as a result of their creation of this hazard. **15-3**

4. The Technical Advisory panel created for In-Stream mining should also have jurisdiction over Off-Channel mining. Experience has proven via the Homestake TRP that the County interests are better served by such review capability. **15-4**

5. Todd Engineers by their Jan. 5, 1996 fax to contract planner Tschudin states "Accordingly the Technical Studies recommend that SUCH USE OF WET PITS BE DISCOURAGED' photocopy attached. **15-5**

6. Monitoring wells once established should be maintained to contribute to the database for the life of the operator's permits plus probably 20 years. 15-6

Should you not agree to the above inconsistencies, recommendations please explain your position and justification therefor.

Respectively yours

E. Avery Tindell - P,O, Box 8, Rumsey, CA 95679
May 9, 1996

STATE OF CALIFORNIA
PETE WILSON, Governor

STATE WATER RESOURCES CONTROL BOARD
THE PAUL R. BONDERSON BUILDING
901 P STREET
SACRAMENTO, CA 95814
(916) 657-1359

FAX: (916) 657-1485

Mailing Address
DIVISION OF WATER RIGHTS
P.O. BOX 2000, Sacramento, CA 95812-2000

MAY 7 1993

In Reply Refer
to:333:JAL:266.0

Ms. Sally Oliver
16634 County Road 98
Woodland, CA 95695

Dear Ms. Oliver:

GRAVEL MINING IN THE CACHE CREEK AREA OF YOLO COUNTY

Thank you for your participation in the Public Forum of the State Water Resources Control Board's (State Water Board) workshop on April 12, 1993, and for your letter of the same date. In your presentation you requested that the State Water Board commence a study on strip mining for gravel on Cache Creek to determine impacts to aquifer recharge from the stream and impacts to aquifer storage capacity. In response to your request, the State Water Board agreed to discuss this issue with other involved agencies and to furnish you with a written response.

The California Division of Mines and Geology (DMG) and the Yolo County Planning Department were contacted and the following information was obtained. Pursuant to the Surface Mining and Reclamation Act, the DMG completed a mineral land classification study of aggregate resources in the Sacramento-Fairfield production-consumption region which includes the Cache Creek drainage. The DMG study, however, did not address the issues of impacts to water quality and quantity resulting from mining operations. The study concluded that Cache Creek deposits, totaling 27 square miles in area, contain high-grade aggregate. According to DMG geologist, Don Dupras, in spite of the presence of high grade aggregate resources, the State Mining and Geology Board did not designate the Cache Creek area as having regionally significant mineral deposits for land use planning purposes.

Mr. David Flores of the Yolo County Planning Department explained that the county is preparing an environmental impact report (EIR) on aggregate mining in the Cache Creek area. Previously, a resource management plan was prepared for the county by consultant Dames & Moore. Because of opposition from the community, this plan was not adopted. Mr. Flores stated that Yolo County has authorized hiring a Resource Manager to prepare a request for proposal on a new resource management plan. Mr. Flores explained that the county has completed a project description, and the subsequent EIR will address the issues of impacts to storage capacity in the underlying aquifers and impacts to the quality of groundwater due to aggregate extraction.

According to Mr. Flores, the source of water for the ongoing mining is groundwater pumped from nearby wells. The EIR will address the issue of groundwater pumping impacts on Cache Creek. Division of Water Rights (Division) staff asked Mr. Flores to examine the issue of groundwater classification for appropriative water right purposes in the EIR. Mr. Flores agreed to this request.

The potential exists for impacts to the aquifers underlying Cache Creek due to aggregate mining; however, Division staff did not discover any reports or studies that document the existence of such problems. Yolo County intends to examine these issues in its EIR. State Water Board staff will review and comment on this document when it is circulated through the State Clearinghouse.

I hope the information in this letter is helpful to you. If you have questions regarding this letter, please call me at the number above.

Sincerely,

Edward C. Anton, Chief
Division of Water Rights

Did you know that dumping one quart of motor oil down a storm drain contaminates 250,000 gallons of water?

Most people don't realize that emptying oil and other pollutants into a gutter or storm drain contributes to urban runoff pollution in the San Francisco Bay. That is one of the reasons the Alameda County Urban Runoff Clean Water Program was formed by Alameda County and 14 cities in the East Bay.

The program participants recognize the need for providing information to the public and encouraging active involvement to improve water quality in the Bay. In addition, the Program is initiating a pollution control program which includes inspection of storm drain discharges and an implementation program to control pollutant runoff through public agencies and regulatory means.

A combined and widespread effort by public agencies, businesses and community residents in Alameda County will effectively control Bay-damaging pollutants at their source.

Alameda County
Urban Runoff
Clean Water Program

editorial

MUCH CONTAMINATED GROUND WATER CAN'T BE CLEANED UP

by John Bredehoeft

I recently attended a national meeting convened to consider the current status of environmental remediation, including ground-water cleanup. One of the keynote speakers was John Cherry, who many of us feel is the leading consultant on problems of ground-water contamination. John pointed out how our paradigm for cleaning up ground water has changed as we have gained field experience during the past ten years.

The View a Decade Ago

Ten years ago the prevailing view was that most sources of contamination were in the shallow subsurface. It was thought that most aquifers were contaminated by undesirable chemicals in solution in the ground water. Most ground-water hydrologists believed that we could clean up aquifers by pumping to remove the contaminated ground water from the aquifer, once the source of shallow contamination was eliminated through excavation. It was recognized that some contamination would be sorbed on the aquifer skeleton. However, few ground-water professionals thought that the sorbed contamination posed an insurmountable problem; one might have to pump more ground water to remove the sorbed contaminants.

It was on the basis of this paradigm that many cleanups were designed. It left one with the warm feeling that indeed we could clean up ground water, even though it might be expensive.

Our Current Paradigm

At this conference, John Cherry explained that the field experience of the past decade indicates that in many, if not most instances, the contaminating source is either a free, or residual, phase of the contaminant that has penetrated deep within the aquifer. This is especially true for the chlorinated organic liquids that are immiscible, and approximately 50 percent denser than water. A number of recent papers document the occurrence of a free, or residual, contaminant phase within the saturated aquifer.

The chlorinated organic solvents are common ground-water contaminants. They have been used widely for cleaning many industrial products, and by dry cleaning establishments everywhere. John Cherry suggested that these are by far the most prevalent source of industrial ground-water contamination.

The chlorinated organics liquids, which are immiscible and heavy, tend to migrate both downward and laterally until they reach a stable configuration such that they no longer move. They exist either as a residual fraction left behind within the pore space as the contaminant moves or as a pool of free contaminant. The compounds are somewhat soluble in water. As ground water flows past the contaminant—either the residual fraction or the pool—some of the contaminant dissolves into

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The views expressed in this editorial are those of the author, and do not reflect the views of the Ground Water Publishing Company, the Association of Ground Water Scientists and Engineers, and/or the National Ground Water Association.

the ground water, contaminating it. Since we are usually concerned about contamination at the parts per billion level, a little dissolved chlorinated organic can contaminate an enormous quantity of ground water.

The light, immiscible phase contaminants pose similar problems except that they tend to rise in the ground-water system. The light organic liquids are common contaminants associated with petroleum products—gasoline, jet fuel, heating oil, etc.

A free, or residual, immiscible phase contaminant within the aquifer system poses a very different remediation problem from that of a contaminant in solution. John indicated that they are impossible to clean up. We simply do not know how to remove a residual phase of an immiscible contaminant from an aquifer, short of freezing it in place and mining it out.

Petroleum reservoirs provide a perfect example of the problem. Additional oil recovery can mean great additional profit. Large investments have been made in enhanced recovery technologies in the oil industry. Even with secondary and tertiary recovery, a substantial portion of the oil—somewhere between 10 and 50 percent—is left in the reservoir. Enhanced oil recovery technologies include the use of solvents such as liquefied carbon dioxide, steam flooding, and the use of surfactants. Some of these methods are being experimented with for ground-water remediation.

John Cherry made it clear that we do not presently have the technology to clean up an aquifer to the standards needed to produce drinking water if a free, or residual, phase of immiscible contaminant has reached the aquifer. The best we can do is contain the contamination. This is a disconcerting fact.

A Public Backlash?

The hazardous waste remediation effort in the United States has now reached an annual expenditure of approximately $10 billion. The public, I believe, think that we are cleaning up the environment, including ground water. They are unaware of the technical difficulties posed by the problem.

In my opinion, the ground-water community has been slow to inform the public of the changes in our understanding of the problem. A decade ago, many of us thought it was feasible to clean up most ground water. We now know that we did not understand the problem.

I am concerned that as the public find out what they are actually buying for their $10 billion a year, they will become completely disenchanted with both the cleanup and the professional community engaged in this effort. There will be a public backlash. We will have spent tens of billions without much to show for it. All of us stand to lose greatly from such a backlash; we stand to be the *bad guys* in a ground-water cleanup scandal. It is incumbent upon us, as professionals, to alert the public to the nature of the problem as our scientific understanding grows. It is in our long-term, best interest to have a well-informed public.

TODD ENGINEERS

GROUNDWATER • WATER RESOURCES • HYDROGEOLOGY • ENVIRONMENTAL ENGINEERING

January 5, 1996

Post-It® Fax Note 7671	Date 1/5/95	# of pages ▶ 1
To Heidi Tschudin	From Iris Priestaf	
Co./Dept.	Co.	
Phone #	Phone #	
Fax # 916 4440227	Fax #	

MEMORANDUM

To: Heidi Tschudin

From: Iris Priestaf

Re: Responses to Comments on the Technical Studies for the CCRMP

Rick Hanson informed me that questions remaine regarding the salt balance of groundwater in the vicinity of Cache Creek, factors affecting the salt balance, and potential impacts of mining reclamation to wet pits. These impacts could occur through evaporation losses or possible use of pits for agricultural tailwater retention. This memorandum reiterates the findings of the Technical Studies that address this topic.

First, the historical perspective indicates a possible trend toward increasing salinity in groundwater and an adverse salt balance. As indicated in the report, this is likely the result of increased cycling of groundwater for irrigation uses; in other words, the major factor changing the salt balance is groundwater irrigation.

Potential impacts of mining on the salt balance are limited to creation of wet pits. The effect of exposure of the water table on evaporation and salt loading is shown in the Technical Studies to be an unavoidable, but minor impact that can be mitigated by lessening evaporation through pit design. Discussions with County staff revealed no serious intentions or plans for disposal or retention of poor quality irrigation tailwater in wet pits. Retention of poor quality water in wet pits was stated in the Technical Studies as potentially entailing significant adverse impacts on groundwater quality. Accordingly, the Technical Studies recommend that such use of wet pits be discouraged.

NOTE

Please call if you have questions or comments.

2200 Powell Street, Suite 225 • Emeryville, CA 94608 • 510/595-2120 • Fax 510/595-2112

LETTER 15: E. AVERY TINDELL

Response to Comment 15-1:

Thank you for your letter. The commentor is correct in noting that the Regional Water Quality Control Board did not comment on the OCMP. The County Director of Environmental Health's comments were received on May 13, 1996 and are responded to in this document (see Comment Letters #19 and #20 from the County of Yolo, Department of Public Health).

Response to Comment 15-2:

The preparers of the DEIR are aware that a relatively small amount of a chemical contaminant can degrade the quality of a large amount of water, although it should be noted that 250,000 gallons is less than 1 acre foot of water. With regard to the project, no storm drains are proposed to drain into the wet pits. In addition, numerous mitigation measures have been included in the DEIR which would minimize potential impacts to water quality. The editorial by John Bredehoeft (published in one of the National Groundwater Association's journals, *Ground Water*) was primarily focussing on the difficulties remediating sites where dense nonaqueous phase liquids (primarily chlorinated solvents) have been spilled. As discussed above, the DEIR provides mitigation measures to minimize the risk of such a spill (refer to Mitigation Measure 4.12-1a).

Response to Comment 15-3:

The DEIR examines the potential for impacts to water quality from the proposed depth of mining. Numerous mitigation measures have been included to address the potential impact. The aggregate producers, under the supervision of the County, would be largely responsible for ensuring that the mitigation measures are implemented. The MMP contained in Appendix B of this document identifies the entity with responsibility for implementation of each mitigation measure.

Response to Comment 15-4:

The commentor's opinion that the Technical Advisory panel created for in-stream mining should also have jurisdiction over off-channel mining is noted for the record. The staff have not made this recommendation because of the different types of programs being proposed. Future erosion control, channel sculpting, and habitat restoration projects proposed under the Cache Creek Resources Management Plan and accompanying Cache Creek Improvements Program will alter the creek's dynamics, creating a more stable channel. As geomorphological conditions change, however, both the CCRMP and the CCIP may need to be adjusted in order to respond to new reach-specific characteristics. Due to the complexity of issues involved in river management, interdisciplinary expertise will be periodically needed in order to assess these changes and recommend appropriate measures for addressing the changing conditions.

In contrast, off-channel surface mining will have to comply with the standards, mitigation measures, and monitoring programs adopted as a part of the OCMP, and the requirements imposed by the State through SMARA. Where appropriate, these regulations and mitigations have specific stated thresholds which, if exceeded, could result in adverse environmental impacts and would require remedial actions by the mining operators. If an operator is found by the Community Development Agency to be in violation, and fails to carry out orders requiring them to comply, the case would be referred to the Planning Commission, which may begin the process of modifying or revoking the mining permit. In addition, copies of all monitoring reports filed by the operators will also be provided to the Planning Commission, along with any analysis provided by staff or independent consultants. If unforeseen problems develop, the Commission can recommend to the Board of Supervisors that changes be made in the Off-Channel Mining Plan, so that activities creating the problems would be prohibited.

Expanding the scope of the Technical Advisory Committee to include off-channel mining would duplicate the proposed regulatory framework of SMARA, the OCMP, and implementing County ordinances, as well as the oversight responsibilities of the Planning Commission. No modification of the project or the EIR, as related to this point, is recommended.

Response to Comment 15-5:

As noted in the memorandum referenced by the commentor, the Technical Studies discouraged use of wet pits for retention of poor quality water (e.g. agricultural tailwater, industrial effluent). The OCMP and DEIR severely restrict inputs to the wet pits. Sites must be graded so that tailwater drains away from the pits (Performance Standard 3.5-3 under Mitigation Measure 4.4-2a on page 4.4-37 of the DEIR). The use of off-channel wet pits for the storage and treatment of sewage effluent, or for landfill purposes, is prohibited (Performance Standard 3.5-11 page 4.4-49 of the DEIR). For additional discussion of the salt loading issue, please refer to Response 13-152.

Response to Comment 15-6:

Please refer to Response to Comment 13-105 and 16-3.

LETTER # 16

City of Woodland

CITY MANAGER 300 FIRST STREET WOODLAND, CALIFORNIA 95695 (916) 661-5800
FAX (916) 661-5844

May 9, 1996

RECEIVED
MAY 10 1996
By

Mr. David Morrison
Resource Management Coordinator
Yolo County Community Development Agency
292 West Beamer Street
Woodland, CA 95695

SUBJECT: OFF-CHANNEL MINING PLAN FOR LOWER CACHE CREEK

Dear Mr. Morrison:

We have reviewed the March 26, 1996 Draft EIR for the Off-Channel Mining Plan for Lower Cache Creek (OCMP) and the April 8, 1996 Draft Program EIR for the Cache Creek Resources Management Plan (CCRMP) and Project Level EIR for Cache Creek Improvement Program for Lower Cache Creek.

As we stated in our comments November 9, 1995, December 20, 1995 and January 10, 1996 regarding the Technical Studies and the Off-Channel Mining Plan (OCMP), the City of Woodland is primarily concerned about the possibility of contamination of our groundwater drinking supplies by way of a nearby open wet pit either during mining or after reclamation. **16-1**

As seen in Figure 1 of the Cache Creek Resources Management Plan (CCRMP), the eastern limits of both the Mineral Resource Zone (MRZ) and the Recommended In-Channel Boundary come to within half a mile of the Woodland City limits. This area is in Subreach 3, an area hydrologically upgradient from Woodland wells and an area that, given time, would contribute water to our wells. Consequently we find that the CCRMP, OCMP, the draft County Gravel Mining Ordinances and Draft EIR documents do not adequately address the City's concerns for potential water quality degradation from gravel mining in this area.

The Draft EIR for the OCMP page (4.4-13 Table 4.4-2) indicates the distance from Woodland wells to the nearest "Proposed Mining Sites" is 10,500 feet. Our concern is not with current proposed mining sites but with an OCMP, CCRMP and related Ordinances that would allow future mining sites within the full MRZ, an area whose southeastern boundary comes closer than one half mile of the current Woodland city limits. In prior meetings with the county, its consultants and representatives from a major gravel mining company regarding the close proximity of the MRZ to the City, we understood that an acceptable solution to our concerns would be to limit gravel mining to an area smaller than the entire MRZ, thus creating a larger buffer zone near Woodland municipal wells. Although there may be no current plans to mine **16-2**

gravel in the area close to Woodland, we would like to see this restriction stated in the plan, EIR and ordinances. 16-2

A second item of concern to us is the long term monitoring of groundwater quality related to the effects of gravel mining. There still seems to be a lack of a plan to investigate or clean up contaminants if they are discovered in a monitoring well downgradient of a wet pit. The Technical Study says the water quality in the pits needs to be maintained "in perpetuity". However, the OCMP DEIR, page 4.4-39, states that after active reclamation, monitoring wells need not be tested for petroleum hydrocarbons and pesticides, two of our major constituents on concern. It further states that "If, at the completion of the mining and reclamation period, water quality has not been impacted, all monitoring wells shall be destroyed . . ." This does not seem to assure the maintenance of the water quality "in perpetuity". Also the lack of a pollution remediation plan leaves the method of funding of clean up work and responsibility uncertain. 16-3

An additional comment we have in the OCMP DEIR is that page 4.4-56, Action 3.4-2 states "Coordinate with the Yolo County Flood Control and Water Conservation District (YCFCWCD) in developing an integrated recharge plan for Cache Creek, in order to increase the available groundwater supply for municipal and agricultural uses." While we are encouraged by the potential for conjunctive use, if the City of Woodland municipal use is potentially affected by recharge projects, the projects should be coordinated with the City as well as the YCFCWCD. 16-4

Thank you for your consideration, we look forward to working with you and the County to ensure development of a OCMP, CCRMP, and gravel mining ordinances that best suit the needs of those involved, including the City of Woodland.

Sincerely,

Kris Kristensen
City Manager

cc: Woodland City Council members
Tom Stallard
Gary Wegener
Mike Horgan
Harrison Phipps

LETTER 16: CITY OF WOODLAND

Response to Comment 16-1:

It is unclear how the City can conclude that the OCMP DEIR and other documents do not adequately address the potential for water quality degradation, based on a Figure in the CCRMP. The CCRMP is not analyzed in this DEIR and the referenced Figure simply portrays various boundaries. No response is possible. The DEIR fully discusses the issue of water quality under Impacts 4.4-2 and 4.4-3 in Section 4.4.

Response to Comment 16-2:

The commentor is referred to Impact 4.2-10 of the DEIR for discussion of allowable mining areas. Mitigation Measure 4.2-10a associated with this impact does exactly what the City is requesting. It narrows the possible area for mining from 23,174 acres to 2,932 acres over 50 or more years. It also restricts new mining to areas west of CR 96. In other words, an applicant wishing to mine on acreage other than that identified, would have to secure a General Plan Amendment, Cache Creek Area Plan Amendment, rezone, mining permit and reclamation plan approval, and would be subject to a full EIR analysis including a re-examination of cumulative effects based on changes in the reasonably foreseeable future.

Response to Comment 16-3:

The DEIR establishes rigorous monitoring of surface water quality in the wet pits and groundwater quality upgradient and downgradient of the pits. This program would begin prior to commencement of mining and continue until ten years after reclamation. The preparers of the DEIR believe that by the time monitoring may be discontinued, an excellent database would have been generated and the potential for degradation adequately determined. For the entire OCMP, 30 years of water quality would be collected. Individual mining projects would have monitoring periods ranging from 10 to 30 years. Specific actions are required under Mitigation Measure 4.4-2a if water quality degradation is identified, including notification of regulatory agencies, additional characterization, and corrective action. The Technical Studies state that "maintenance of the water quality in the lake is essential." Appropriate site design and maintenance measures descried in the studies include: perimeter berms, site runoff and erosion controls, restrictions on site activities, and setbacks. These have been implemented in Mitigation Measure 4.4-2a and 4.4-3a. With regard to the destruction of monitoring wells, this is another measure designed to protect water quality. Abandoned wells often act as a conduit for contamination of groundwater. The mitigation measure does allow the County or another regulatory agency to take over maintenance of selected wells for future water resources evaluation after the close of the required monitoring period, should they so choose.

Response to Comment 16-4:

Action 3.4-2 is recommended for deletion in Mitigation Measure 4.4-5a because a recharge program has not been proposed for consideration or comparison. Please see page 4.4-55 of the DEIR.

Thank you for your letter.

LETTER # 17

American Farm Bureau Federation/California Farm Bureau Federation

YOLO COUNTY FARM BUREAU

P.O. Box 1556, Woodland, California 95776
(916) 662-6316

May 10, 1996

Yolo County Community Development Department
292 West Beamer Street
Woodland, CA 95695

Re: Comments on Draft EIR for Off-channel Mining

The Yolo County Farm Bureau's interest that drives comments for this draft EIR off-channel mining stems from our commitment to protect, promote and enhance the agricultural industry in Yolo County. The Farm Bureau finds that the issue of gravel mining surfaces the major concerns of water quality, groundwater quantity and loss of productive agricultural land.

17-1

The following are specific concerns that have arisen in our studies of the draft EIR. We wish to bring these to your attention.

In the summary table of impacts and mitigations on page 2-23, "potential impacts associated with groundwater recharge" is listed as a significant environmental impact. In order to mitigate this impact the EIR proposes the elimination of objective 3.3-3 which states "insure that off-channel mines are operated such that the surface and groundwater supplies are not adversely affected by erosion, lowering of the water table, and/or contamination." We oppose the elimination of this objective.

While we recognize that there is an opportunity for our local water district to utilize available underground storage and manage the groundwater basin to meet growing needs, we are fearful that if the county chooses to allow wet pit mining, it may subject itself to unnecessary risk of contamination. We would like the assurance that responsibility is taken for long-term maintenance and monitoring of wet pits.

17-2

We concur with the EIR's conclusion that Alternative 4 poses the least amount of risk to our groundwater resource. Additionally, all of the land that was farmed before mining will be available for reclamation to agricultural use. We see this as positive; however, the current draft of the off-channel mining ordinance does not contain a section on land reclamation standards. The American Farm Bureau Federation Policy on mineral development #138 states that mined lands should be subject to rules and regulations which

17-3

require the reclamation of all mined lands, including disrupted underground and surface water.

17-3

We do recognize that Alternative 4 may not provide the quantity of gravel necessary to make the gravel industry a viable one over the proposed 30-year contract period. A shorter contract may be more appropriate. This may also allow more latitude for study and monitoring changing conditions within mining areas.

We question Objective 7.3-2 which says "consider reclamation that includes recreation elements as meeting all or a portion of the net gains requirements." While we realize that there is a value to recreation elements, the Farm Bureau would like to see a net gain analysis included in the EIR.

17-4

Thank you for your consideration on this important issue.

Sincerely,

Blake Harlan
Vice President

cc: Yolo County Board of Supervisors

LETTER 17: YOLO COUNTY FARM BUREAU

Response to Comment 17-1:

Thank you for your letter. The commentor has identified an error in the text. Objective 3.3-2 of the OCMP is incorrectly listed as Objective 3.3-3 in the DEIR, and recommended for deletion. This was not intentional. It is Objective 3.3-2 that is actually recommended for deletion. Please refer to Text Change # 36.

Response to Comment 17-2:

Long term maintenance and monitoring of the wet pit is provided for in revised Performance Standard 3.5-4 and will be ensured through implementation of the Mitigation Monitoring Plan as required under CEQA.

Response to Comment 17-3:

Staff concurs with American Farm Bureau Federation Policy that all mined lands should be reclaimed. Agricultural reclamation standards are included in the draft Surface Mining Reclamation Ordinance, not the Off-Channel Mining Ordinance. Conditions requiring field releveling of settled areas, the ripping of reclaimed soils, the handling of dry topsoil to avoid compaction, and the preservation of stockpiled topsoil are all included. The DEIR provided mitigation measures that required prime land converted to non-agricultural uses to be offset at a 1:1 ratio, phasing plans that minimize disturbed agricultural lands, and adequate storm drainage for reclaimed fields. These are in addition to existing Williamson Act and SMARA requirements, which shall also be enforced. A shorter permit period may be approved, regardless of whether Alternative 4 is selected by the County Board of Supervisors as the preferred alternative. The mitigation measures and draft ordinances require a number of monitoring programs and annual reports that will allow for the ongoing analysis of environmental conditions within the mining areas. It is also proposed that both the mining permit/reclamation plan and the OCMP undergo review a minimum of every 10 years, to respond to changing circumstances. Alternative 5b examines a shorter mining period (15 years). The commentor's thoughts regarding this alternative will be considered by the decision makers.

Response to Comment 17-4:

The "net gains" proposed by each mining applicant are described in the project-level EIRs, and will be compared and contrasted in the full staff report on the OCMP.

LETTER # 18

THE LEAGUE OF WOMEN VOTERS OF WOODLAND

P. O. Box 2463, Woodland, CA 95776

1121 West Street
Woodland, CA 95695
May 7, 1996

To: Heidi Tschudin, County Contract Planner, and David Morrison, planner for Yolo County Community Development Agency
From: Woodland League of Women Voters
Subject: Written comments for the final comment period for the DEIR for the Off-Channel Mining Plan

The League's specific comments and questions on the DEIR Off-Channel Mining Plan appear in another document as composite questions of several groups. They are written because of the League's grave concern over what will happen to this County's natural resources. Some of our concerns are: 18-1

the threat of contamination to the water, 18-2
the loss of so many acres of productive agricultural land, 18-3
the danger to the public safety of citizens traveling the roads with thousands of trucks hauling gravel daily, 18-4
the tremendous increases in air emissions in an Air Quality District that is already a non-attainment area, 18-5
the health effects of the emissions on citizens living in the mining areas, 18-6
the loss of wildlife habitat of all types, and, 18-7
the changing forever of the landscape along Cache Creek from Capay to Yolo with either pits reclaimed to agriculture many feet below ground surface, or pits filled with water with fenced and locked gates around them. 18-8

Yolo County has many laudable and fine sounding Conservation Policies in their General Plan. Conservation Policy 6 states: Yolo County shall plan, encourage, and regulate to ensure that natural resources are maintained for their long-term ecological values as well as for their more direct and immediate benefits.

Conservation Policy 10 states: Yolo County shall plan, encourage, and regulate public and private agencies to prevent the wasteful exploitation, destruction, or neglect of the State's resources.

18-9

The League of Women Voters has similar positions that address the conservation of natural resources.

How can the County be said to be upholding those policies when they are going to allow 5.5 million tons of aggregate to be removed off-channel in deep wet pits every year for the next 30 years and then guarantee that the aggregate companies can apply to do the same for 20 more years?

The gravel has been identified by the State Division of Mines and Geology in Special

Report 156 as being in the MRZ-2 zone around Cache Creek, but just because it has been identified does not mean it needs to be mined at such a great rate. In fact, Report 156 states that although SMARA provides for the aggregate resource to be classified, and acted upon by affected local governments, "the sectorization and sector maps do not of themselves carry with them specific obligations imposed on local governments by SMARA". **It can be conserved and made to last for many, many years!** 18-9

PCC grade aggregate is the highest grade of aggregate. PCC stands for Portland cement concrete. The gravel in and along Cache Creek has the PCC designation and can be used for foundations, dams, airport runways, bridge abutments buildings and general construction. It is a high quality, non-renewable resource and should be used for the above uses. Instead, much of it is going into asphalt and road beds where a lesser grade of aggregate would suffice.

The League would suggest that the County is not only putting our agricultural lands and water, and the safety of its citizens in jeopardy, but is allowing a small group of aggregate companies to squander a non-renewable resource, gravel, for very little gain to anyone but the aggregate companies. 18-10

Marie E. Bryan

Patricia Murray, co-presidents

Lois V. Linford, Natural Resources Chair

LETTER 18: THE LEAGUE OF WOMEN VOTERS OF WOODLAND

Response to Comment 18-1:

Thank you for your letter. The staff assumes the comment is in reference to Letter 13 of this volume. Please refer directly to Letter 13, and corresponding responses for a detailed discussion.

The list of concerns summarized in the commentors' letter are addressed in the OCMP DEIR, and Response to Comments 18-3 through 18-8 below address each concern individually.

Thank you for your correspondence.

Response to Comment 18-2:

The threat of contamination to the water is evaluated and fully mitigated under Impacts 4.4-2: Potential Degradation of Water Quality During Aggregate Mining and Reclamation, and 4.4-3: Potential Degradation of Water Quality after Reclamation of Mined Lands.

Response to Comment 18-3:

The loss of productive agricultural land is discussed and partially mitigated under Impact 4.5-2: Potential Impact of Permanent Loss of Agricultural Land Caused by Conversion of Agricultural Land to Other Post-Reclamation Uses.

Response to Comment 18-4:

The danger to public safety along mining haul routes is discussed and fully mitigated under Impacts 4.8-1 through 4.8-16 within the Traffic and Circulation section.

Response to Comment 18-5:

The increases in air emissions in a non-attainment area are discussed and partially mitigated in Impacts 4.7-1 through 4.7-4 within the Air Quality section.

Response to Comment 18-6:

Health effects of those emissions on local residents are evaluated and fully mitigated under Impact 4.7-4: Potential Impacts on Sensitive Receptors.

Response to Comment 18-7:

The loss of wildlife habitat is addressed and fully mitigated in Impacts 4.6-1 through 4.6-5 within the Biological Resources section.

Response to Comment 18-8:

Permanent changes to the landscape are evaluated and partially mitigated in Impact 4.10-2: Effects on Views or Vistas Following Reclamation, and Impact 4.10-3: Potential for Visual Compatibility with Surrounding Land Uses.

Response to Comment 18-9:

The consistency of the OCMP with Yolo County General Plan Policies is addressed and fully mitigated in Impact 4.2-1 within the Land Use and Planning section. No decision to allow mining will occur until findings are made under Section 15091 of the CEQA Guidelines, and after the County Board of Supervisors considers this EIR and decides whether and how to approve or carry out the project. Staff concurs with the commentor's observation that aggregate resources can be conserved and made to last for years. The OCMP looks at mining of 2,887 acres out of a land area of 23,174 acres where mining theoretically could occur over the next 50 years. The 216 million tons of aggregate resulting from this would represent approximately 27 percent of the nearly 807 million tons (918 million tons including those deposits located below the theoretical thalweg) estimated to occur in the total acreage.

Regarding PCC grade aggregate being utilized for "lesser" uses, the mining operators have indicated that much of the aggregate contained in the deposit is not of PCC grade because it is either too large, too small, too "dirty", or not in proper proportions to be used in PCC projects. It should also be noted that Standard Specifications adopted by Caltrans in July 1995 (and many other jurisdictions in the state) are more restrictive than the specifications that aggregate for other applications must meet, and prohibit or limit the use of lesser grade materials for its various uses.

Response to Comment 18-10:

The DEIR and other technical studies in the record do not support the commentor's suggestion that responsible, conditioned, mitigated aggregate mining puts agriculture, water, or citizens in jeopardy. In their final deliberations, the Yolo County Board of Supervisors must balance the advantages and disadvantages of the project and then make a decision.

LETTER # 19

DEPARTMENT OF PUBLIC HEALTH

Environmental Health Services

COUNTY OF YOLO

ROBERT O. BATES, Jr., M.D. - DIRECTOR OF PUBLIC HEALTH
THOMAS Y. TO — DIRECTOR OF ENVIRONMENTAL HEALTH

☐ 10 COTTONWOOD ST. • WOODLAND, CA 95695
(916) 666-8646
☐ 600 "A" ST. • DAVIS, CA 95616
(916) 757-5540 • (916) 372-3700

MEMORANDUM

TO: David Morrison, Resource Management Coordinator
Community Development Agency

FROM: Tom To, Director
Environmental Health

DATE: May 10, 1996

SUBJECT: Comments on the Draft EIR for Off-Channel Mining Plan for Lower Cache Creek

Off-channel gravel mining can impact groundwater quality in many ways as detailed in the referenced DEIR chapter 2.7, 4.4 and 4.12. Upon the review of the DEIR, I found that the proposed approach and measures to mitigate potential impacts on groundwater quality resulting from the proposed off-channel mining to be acceptable with the following exceptions: **19-1**

1. On page 2-18 under Mitigation Measures. The DEIR currently stated that the sampling and testing of TPH and BTEX may be discontinued immediately after all the heavy equipment work has been completed in the vicinity of the pit. I suggest that at least one more testing on TPH and BTEX from the pit should be done after all the heavy equipment has been removed from the site. This will allow the detection of any spillage from heavy equipments at the last moments of activities prior to their departure. **19-2**

2. The mercury level in Cache Creek has been found to exceed the maximum contaminant level when measured in the Winter of 1995 by the State Regional Water Quality Control Board. Being adjacent to Cache Creek and sharing the same water aquifer, the proposed deep wet pits for off-channel gravel mining may be affected with mercury and its sediment may encourage methylation of this heavy metal. Since mercury can accumulate in fish tissues and the wet pits may be transformed into lakes stocked with game fishes after reclamation, I suggest that the on-going testing of methyl mercury be included in the monitoring program. In addition to the analysis of pit water for mercury as an inorganic element, soil sediment and fish (as soon as they are available) from the wet pits should also be tested for methyl mercury and total mercury at a frequency **19-3**

similar to that of the inorganic chemicals. A baseline of mercury and methyl mercury should be obtained in the early stage of the project. 19-3

3. The DEIR does not appear to have clearly stated the number of samples to be collected at each time at each of the proposed monitoring points. Adequate number of samples must be provided at each monitoring point especially at the wet pit which is the focal point of monitoring for baseline and detection. 19-4

4. On page 4.4-33 under PS 3.5-5. Permanent toilets shall be properly engineered and design approved by the Yolo County Environmental Health not by Yolo County Building Official. 19-5

Please do not hesitate to contact me (X8646) if you have any questions regarding this matter.

LETTER 19: COUNTY OF YOLO, DEPARTMENT OF PUBLIC HEALTH

Response to Comment 19-1:

The commentor's acceptance of the proposed approach and measures to mitigate potential impacts on groundwater quality resulting from the proposed off-channel mining with the exceptions noted in the comments responded to below is noted for the record.

Response to Comment 19-2:

Please refer to Text Change # 32.

Response to Comment 19-3:

Staff agrees with the commentor's point that testing of mercury and methylmercury should be conducted as part of the monitoring for the proposed project. Performance Standard 3.5-4 of Mitigation Measures 4.4-2 requires testing of inorganics (which includes total mercury) in groundwater and surface water in the mining pits. This monitoring is required in the mining and reclamation phases (Mitigation Measure 4.4-2a) and post-reclamation (Mitigation Measure 4.4-3a) periods at the same frequency as other required analyses. The monitoring of methylmercury in fish is required (Mitigation Measure 4.4-3a) for the post-reclamation phase as the most reliable indication of the accumulation of this compound in the environment. The requirement for monitoring of the existing mining pit lake was included in Mitigation Measure 4.4-3a in the DEIR, which provides a "baseline" for mercury and methylmercury in mining pit lakes. In addition, testing of inorganics (including mercury) in groundwater prior to the beginning of wet pit mining is also required. Please refer to Response to Comment 14-1.

Response to Comment 19-4:

Mitigation Measure 4.4-2a (under "Monitoring" bottom of the second paragraph) requires that water samples collected from the wet pits be representative. This would require multiple sampling locations. The sampling strategy specific to each site is left to the qualified professionals implementing the monitoring program.

Response to Comment 19-5:

Please refer to Text Change # 31.

LETTER # 20

DEPARTMENT OF PUBLIC HEALTH

Environmental Health Services

COUNTY OF YOLO

ROBERT O. BATES, Jr., M.D. - DIRECTOR OF PUBLIC HEALTH
THOMAS Y. TO — DIRECTOR OF ENVIRONMENTAL HEALTH

☐ 10 COTTONWOOD ST. • WOODLAND, CA 95695
(916) 666-8646

☐ 600 "A" ST. • DAVIS, CA 95616
(916) 757-5540 • (916) 372-3700

MEMORANDUM

TO: David Morrison, Resource Management Coordinator
Community Development Agency

FROM: Tom To, Director
Environmental Health

DATE: May 10, 1996

SUBJECT: Comments on "Ground-Water Quality Protection Near Planned Wet-Pit Mining operations"

I have reviewed the above referenced document and found that the approach and method proposed to protect the groundwater near and at the planned wet-pit mining areas to be acceptable. I agree that the focal point of baseline and detection monitoring should be at the wet pit. Under this proposed monitoring plan, regulatory agencies are given the flexibility to require additional sampling and testings when contaminants are discovered by this process. **20-1**

Since the question of whether deep wet pit mining can encourage the methylation of mercury has not been answered, I suggest that methyl mercury and total mercury to be included as items of on-going monitoring. Soil sediment and fish when available from the wet pits should be sampled and tested regularly at a frequency similar to other stated items such as inorganic chemicals. A Baseline for methyl mercury and total mercury should be formed at the early stage of the operation. **20-2**

I do not notice a clear description of the number of samples that will be taken at each time at each monitoring point. The number of samples at the monitoring wells can be minimum. However, due to the large surface area and volume of water in the wet pit, adequate number of samples should be collected each time from the wet pit to form the representative composite sample.

Please do not hesitate to call me (X8646) if you have any questions.

LETTER 20: COUNTY OF YOLO, DEPARTMENT OF PUBLIC HEALTH

Response to Comment 20-1:

The commentor's acceptance of the proposed approach and method to protect groundwater near and at the planned wet-pit mining areas is noted for the record.

Response to Comment 20-2:

The commentor is referred to the Response to Comment 19-3 to address the issues related to mercury testing and to the Response to Comment 19-4 for the number of sampling points.

State of California

GOVERNOR'S OFFICE OF PLANNING AND RESEARCH

1400 TENTH STREET
SACRAMENTO 95814

PETE WILSON
GOVERNOR

LEE GRISSOM
DIRECTOR

May 10, 1996

DAVID MORRISON
YOLO COUNTY COMMUNITY DEVELOPMENT AGENCY
292 WEST BEAMER STREET
WOODLAND, CA 95695

Subject: CACHE CREEK OFF CHANNEL MINING PLAN SCH #: 95113034

Dear DAVID MORRISON:

The State Clearinghouse has submitted the above named draft Environmental Impact Report (EIR) to selected state agencies for review. The review period is now closed and the comments from the responding agency(ies) is(are) enclosed. On the enclosed Notice of Completion form you will note that the Clearinghouse has checked the agencies that have commented. Please review the Notice of Completion to ensure that your comment package is complete. If the comment package is not in order, please notify the State Clearinghouse immediately. Remember to refer to the project's eight-digit State Clearinghouse number so that we may respond promptly.

Please note that Section 21104 of the California Public Resources Code required that:

> "a responsible agency or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency."

21-1

Commenting agencies are also required by this section to support their comments with specific documentation.

These comments are forwarded for your use in preparing your final EIR. Should you need more information or clarification, we recommend that you contact the commenting agency(ies).

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Antero A. Rivasplata

ANTERO A. RIVASPLATA
Chief, State Clearinghouse

Enclosures
cc: Resources Agency

Notice of Completion *Supplementary Document M*

Mail to: State Clearinghouse, 1400 Tenth Street, Sacramento, CA 95814 916/445-0613

See NOTE below
SCH # 95113034

Project Title: CACHE CREEK OFF CHANNEL MINING PLAN

Lead Agency: YOLO COUNTY COMMUNITY DEV AGENCY — Contact Person: DAVID MORRISON
Street Address: 292 WEST BEAMER ST — Phone: 916-666-8020
City: WOODLAND — Zip: 95695 — County: YOLO

Project Location

County: YOLO — City/Nearest Community: CAPAY, ESPARTO, MADISON, YOLO
Cross Streets: _____ — Zip Code: _____ — Total Acres: 23,117 AC
Assessor's Parcel No. _____ — Section: _____ — Twp. _____ — Range: _____ — Base: _____
Within 2 Miles: State Hwy #: 16, SCS, 5 — Waterways: CACHE CREEK
Airports: WOODLAND — Railways: _____ — Schools: _____

Document Type

CEQA: ☐ NOP ☐ Early Cons ☐ Neg Dec ☒ Draft EIR ☐ Supplement/Subsequent ☐ EIR (Prior SCH No.)_____ ☐ Other _____
NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI
Other: ☐ Joint Document ☐ Final Document ☐ Other_____

Local Action Type

☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan
☐ Specific Plan ☐ Master Plan ☐ Planned Unit Development ☐ Site Plan
☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, Parcel Map, Tract Map, etc.)
☐ Annexation ☐ Redevelopment ☐ Coastal Permit ☒ Other MINING PLAN

Development Type

☐ Residential: Units _____ Acres _____
☐ Office: Sq.ft. _____ Acres _____ Employees _____
☐ Commercial: Sq.ft. _____ Acres _____ Employees _____
☐ Industrial: Sq.ft. _____ Acres _____ Employees _____
☐ Educational _____
☐ Recreational _____

☐ Water Facilities: Type _____ MGD _____
☐ Transportation: Type _____
☒ Mining: Mineral AGGREGATE
☐ Power: Type _____ Watts _____
☐ Waste Treatment: Type _____
☐ Hazardous Waste: Type _____
☐ Other: _____

Project Issues Discussed in Document

☒ Aesthetic/Visual
☒ Agricultural Land
☒ Air Quality
☒ Archeological/Historical
☐ Coastal Zone
☒ Drainage/Absorption
☐ Economic/Jobs
☐ Fiscal
☒ Flood Plain/Flooding
☐ Forest Land/Fire Hazard
☒ Geologic/Seismic
☐ Minerals
☒ Noise
☐ Population/Housing Balance
☒ Public Services/Facilities
☒ Recreation/Parks
☐ Schools/Universities
☐ Septic Systems
☐ Sewer Capacity
☒ Soil Erosion/Compaction/Grading
☐ Solid Waste
☒ Toxic/Hazardous
☒ Traffic/Circulation
☒ Vegetation
MAR 27 1996
☒ Water Quality
☒ Water Supply/Groundwater
☒ Wetland/Riparian
☒ Wildlife
☐ Growth Inducing
☒ Landuse
☒ Cumulative Effects
☐ Other _____

Present Land Use/Zoning/General Plan Use Agriculture & aggregate extraction
A-P and A-1
Agriculture & aggregate extraction

Project Description Policy document & ordinances to regulate off-channel mining along Cache Creek between the Capay Dam and the town of Yolo

State Clearinghouse Contact: Ms. Dana Lidster (916) 445-0613

State Review Began: 3.27.96
Dept. Review to Agency 5.3
Agency Rev to SCH 5.8
SCH COMPLIANCE 5.10

Please note SCH Number on all Comments

Please forward late comments directly to the Lead Agency

AQMD/APCD 40 (Resources: 3,30

Project Sent to the following State Agencies

- X Resources
- ___ Boating
- ___ Coastal Comm
- ___ Coastal Consv
- ___ Colorado Rvr Bd
- X Conservation
- X Fish & Game # 2
- ___ Delta Protection Commission
- ___ Forestry
- X Parks & Rec/OHP
- ___ Reclamation
- ___ BCDC
- X DWR
- ___ OES

Bus Transp Hous

- ___ Aeronautics
- ___ CHP
- X Caltrans # 3
- ___ Trans Planning
- ___ Housing & Devel

Health & Welfare

- ___ Drinking H20
- ___ Medical Waste

State/Consumer Svcs

- ___ General Services

Cal/EPA

- X ARB
- ___ CA Waste Mgmt Bd
- ___ SWRCB: Grants
- ___ SWRCB: Delta
- ___ SWRCB: Wtr Quality
- ___ SWRCB: Wtr Rights
- X Reg. WQCB # 5
- X DTSC/CTC SAR

Yth/Adlt Corrections

- ___ Corrections

Independent Comm

- ___ Energy Comm
- ___ NAHC
- ___ PUC
- ___ Santa Mn Mtns
- X State Lands Comm
- ___ Tahoe Rgl Plan
- ___ Other: _____

LETTER 21: GOVERNOR'S OFFICE OF PLANNING AND RESEARCH

Response to Comment 21-1:

No response is necessary. Referenced comments letters from other state agencies are addressed individually. Thank you for your correspondence.

Historical Resources Information System

ALAMEDA
COLUSA
CONTRA COSTA
DEL NORTE
HUMBOLDT
LAKE
MARIN
MENDOCINO
MONTEREY
NAPA
SAN BENITO
SAN FRANCISCO
SAN MATEO
SANTA CLARA
SANTA CRUZ
SOLANO
SONOMA
YOLO

Northwest Information Center
Sonoma State University
1801 East Cotati Avenue
Rohnert Park, California 94928-3609
(707) 664-2494 • Fax (707) 664-3947
E-mail: nwic.center@sonoma.edu

May 24, 1996

File No.: 96-YO-31E

RECEIVED
MAY 30 1996
By

David Morrison
Resource Management Coordinator
292 West Beamer Street
Woodland, CA 95695

re: Notice of Availability and Public Hearing Draft Environmental Impact Report for the Yolo County Off-Channel Mining Plan.

Dear Mr. Morrison:

Records at this office were reviewed to determine if this project could adversely affect historical resources. The review for possible historic structures, however, was limited to references currently in our office. The Office of Historic Preservation has determined that any building or structure 45 years or older may be of historic value. Therefore, if the project area contains such properties they should be evaluated by a historian prior to commencement of project activities. **Please note that use of the term historical resources includes both archaeological sites and historic structures.**

____ The proposed project area contains or is adjacent to the archaeological site(s) ( ). A study is recommended prior to commencement of project activities.

X___ The proposed project area has the possibility of containing unrecorded archaeological site(s). A study is recommended prior to commencement of project activities.

____ The proposed project area contains a listed historic structure ( ). See recommendations in the comments section below.

____ Study # ~~identified~~ one or more historical resources. The recommendations from the report are attached.

____ Study # identified no historical resources. Further study for historical resources is not recommended.

____ There is a low possibility of historical resources. Further study for historical resources is not recommended.

_X___ Comments: It is recommended that the policy on pg. 4.11-6 "Potential Impacts to Cultural Resources" include the statement that all resource records are checked for the presence of and the potential for prehistoric and historic sites.

22-1

If archaeological resources are encountered during the project, work in the immediate vicinity of the finds should be halted until a qualified archaeologist has evaluated the situation. If you have any questions please give us a call (707) 664-2494. 22-1

Sincerely,

Liz Black

Liz Black for
Leigh Jordan
Coordinator

LETTER 22: NORTHWEST INFORMATION CENTER

Response to Comment 22-1:

Thank you for your correspondence. The additional performance standard identified in Mitigation Measure 4.11-1a on page 4.11-9 would ensure that site-specific cultural resource studies would be conducted as part of project level EIRs prior to commencement of mining activities. In response to the comment, the performance standard has been further modified as noted in Text Change # 70 to ensure that all resource records are checked for the presence of and the potential for prehistoric and historic sites. As noted by the commentor and in Performance Standard 2.5-3 of the OCMP, if archeological sites are encountered during the project, work would be stopped until a qualified archeologist assesses the situation.

APPENDIX A REVISED SUMMARY TABLE

Table 2-1: REVISED SUMMARY OF IMPACTS AND MITIGATION MEASURES					
Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
	LS	**S**		**LS**	**SU**
Land Use and Planning					
Impact 4.2-1: Consistency with Yolo County General Plan	OCMP, A-4, A-5a, A-5b and A-6	A-1a, A-1b, A-2, A-3	*Mitigation Measure 4.2-1a (OCMP, A-4, A-5a, A-5b, A-6)* *None required. However, the amendment to draft OCMP Objective 5.3-1 proposed in Mitigation Measure 4.2-5a would reinforce Implementation Strategy #2 of the Capay Valley Area Plan (as discussed above under "Draft OCMP and Implementing Ordinances") by encouraging the reclamation of land within the Capay Valley Area to agricultural uses (i.e., areas of creek maintenance). This action would enhance the compatibility of the OCMP, A-4, A-5a, A-5b, and A-6 with the Capay Valley Area Plan.* *Mitigation Measure 4.2-1b (A-1a, A-1b, A-2, A-3)* *In lieu of adopting an OCMP and its implementing ordinances, the County shall develop an alternate approach for responding to the requirements of General Plan Conservation Policies 34 and 35. An alternate approach would be to amend the General Plan to include Conservation Policies 42, 43, 44, and 45 as discussed in Section 4.2.*	OCMP, A-4, A-5a, A-5b, and A-6	A-1a, A-1b, A-2, A-3
Impact 4.2-2: Consistency with the Yolo County Zoning Ordinance and County Code	A-1a, A-1b, A-2, and A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.2-2a (OCMP, A-4, A-5a, A-5b, A-6)* *The following sections of the Yolo County Zoning Ordinance shall be amended to implement the OCMP and its implementing ordinances: Sections 8-2.404(g), 8-2.404(j), 8-2.604(n), 8-2.2311, 8-2.2312(a), and 8-2.2312(b). New sections shall be added to the Yolo County Zoning Ordinance at Section 8-2.404 (to address land use contracts in the A-P Zone), and at 8-2.23.8 (to address the Special Sand and Gravel Combining Zone [SGR]).*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.2-3: Consistency with the State Mining and Reclamation Act (SMARA) and the State Mining and Geology Board Reclamation Regulations	OCMP, A-4, A-5a, A-5b, and A-6	A-1a, A-1b, A-2, and A-3	*Mitigation Measure 4.2-3b (A-1a, A-1b, A-2 and A-3)* *In lieu of adopting an OCMP and its implementing ordinances, the County shall amend the mining regulations and ordinances to ensure consistency with SMARA and the State Reclamation Regulations.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.2-4: Consistency with the Regional Water Quality Control Board's Basin Plan		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*None Required* *Implementation of Mitigation Measures 4.4-2a and 4.4-3b would adequately mitigate this impact.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
	LS	**S**		**LS**	**SU**
Impact 4.2-5: Consistency with the RCD Agriculture Policies	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*Mitigation Measure 4.2-5a (OCMP, A-4, A-5a, A-5b, A-6)* *None required. As an improvement measure, however, it is recommended that the following language be added to Objective 5.3-1 of the OCMP:* *Reclamation of agricultural lands to other uses, however, is discouraged, wherever agricultural reclamation is feasible.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.2-6: Compatibility with Existing and Planned Land Uses	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.2-7: Change in Land Use Intensity	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required at the program level.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.2-8: Land Use Incompatibility Due to Changes in the Creek Boundary	OCMP, A-1a, A-1b, A-2, and A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.2-9: Land Disturbance During Mining	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.2-10: Potential for Additional Mining Above That Which Is Currently Known	A-1a, A-1b, A-2, and A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.2-10a (OCMP, A-4, A-5a, A-5b, A-6)* *The final OCMP boundaries shall be defined as including only those 2,932 acres (including a 45-acre borrow area) presently under consideration for rezoning.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Table 2-1: REVISED SUMMARY OF IMPACTS AND MITIGATION MEASURES					
Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
	LS	**S**		**LS**	**SU**
Impact 4.2-11: Potential Impacts from the Future Sale or Transfer of Property Included within a Current Mining/Reclamation Application	A-1a, A-1b, A-2, and A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.2-11a (OCMP, A-4, A-5a, A-5b, A-6)* *The OCMP and its implementing ordinances shall be expanded and clarified to address the issue of transferability of mining permits. The clarification would indicate that if a property is sold or transferred, the tonnage attributed to that property transfers as well. If that tonnage is still processed at the original plant site pursuant to the original permit approval, no additional environmental assessment or permits would be required. If that transferred tonnage is processed elsewhere, additional analysis and approvals would be required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.2-12: Compatibility with Watts-Woodland Airport Comprehensive Land Use Plan	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required at the program level.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Geology and Soils					
Impact 4.3-1: Potential for Damage from Seismic Shaking		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.3-1a (OCMP, A-4, A-5a, A-5b, A-6)* *The following performance standards shall be added to the Aggregate Resources Element of the OCMP and its implementing ordinances and existing ordinances:* *Performance Standard 2.5-25: Improvements, including the construction of buildings, roadways or other public facilities proposed for construction in reclaimed mining pits shall require a geotechnical investigation of the stability of fills conducted by a qualified and licensed geotechnical engineer. A report on the results and recommendation of the investigation shall be submitted to the Yolo County Community Development Agency prior to the issuance of building permits. The recommendations of the geotechnical investigation shall be fully implemented by the applicant.* *Performance Standard 2.5-26: Backfilled mining areas and slopes shall be inspected by the Yolo County Community Development Agency following strong seismic shaking events. Observable damage shall be reported to the ~~Yolo County Community Development Agency~~ landowner. ~~If, upon inspection for the reported damage,~~ the YCCDA determines that the damage requires repair to meet the intended use of the reclaimed land, the landowner shall perform the required repairs.* *Performance Standard 2.5-27: The cost of implementing recommendations for repair of reclaimed land caused during earthquakes or other natural events shall be met through application of contingency costs provided for by the project's financial assurances as required by SMARA.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
	LS	**S**		**LS**	**SU**
			Performance Standard 5.5-3 of the OCMP shall be modified as follows: *Performance Standard 5.5-3: The operator shall retain a licensed Land Surveyor to resurvey any areas reclaimed to agricultural usage after the first two (2) crop seasons have been completed. Any areas where settling has occurred shall be re-leveled to the field grade specified in the approved reclamation.* *Mitigation Measure 4.3-1b (A-1a, A-1b, A-2, A-3)* *Existing mining ordinances shall require a geotechnical investigation of the stability of fills conducted by a qualified and licensed geotechnical engineer for improvements proposed for construction in reclaimed mining pits, including the construction of buildings, roadways, or other public facilities. A report on the results and recommendation of the investigation shall be submitted to the Yolo County Community Development Agency (or other similar authority in areas outside Yolo County) prior to the issuance of building permits.*		
Impact 4.3-2: Potential Impacts Related to Slope Stability, Erosion, and Sedimentation	A-1a and A-1b	OCMP, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.3-2a (OCMP, A-4, A-5a, A-5b, A-6)* *The following performance standards of the OCMP shall be modified as follows:* *Performance Standard 2.5-4: During mining operations, a series of benches may be excavated in a slope provided that the excavations are made in compliance with the requirements of the state Mine Safety Orders (California Code of Regulations, Title 8, Subchapter 17). The vertical height and slope of the benches constructed for permanent reclaimed slopes shall not exceed maximum standards for the specific soil types presented in California Code of Regulations, Title 8, Article 6. In general, vertical cutslopes between benches shall not exceed four (4) feet in height in topsoil and overburden sediments. Benching shall be allowed in cohesive soil (clay, sandy or silty clay, clayey silt) only. Slopes above the elevation of groundwater (determined at the time of excavation by the level of exposed water in the excavation) that exceed the maximum vertical height shall be excavated and maintained at slopes not greater than 2:1. Slopes located five (5) feet or less below the average summer low groundwater level shall not be steeper than 2:1. Slopes located more than five (5) feet below the average summer low groundwater level shall not be steeper than 1:1 (horizontal to vertical).* *Vertical cutslopes in excess of four feet in height may be approved for development of special habitat (e.g. bank swallows) if a site specific slope stability analysis, performed by a licensed engineer, indicates that the slope does not exceed critical height for the on-site soil conditions. Projects proposing such slopes will be required to submit a long-term maintenance plan to ensure that the function of the slopes as habitat is met.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
	LS	**S**		**LS**	**SU**
			Performance Standard 2.5-16: Except where benches are used, all banks above groundwater level shall be sloped no steeper than 2:1 (horizontal:vertical). Proposed steeper slopes shall be evaluated by a slope stability study, prepared by a qualified engineer. Slopes below the groundwater level shall be no steeper than 1:1 (horizontal:vertical). Slopes located five feet or less below the summer low groundwater level shall not be steeper than 2:1. *Performance Standard 2.5-17: Performance Standard 2.5-17: Upon completion of operations, grading and vegetation shall minimize erosion and convey ~~surface~~ storm water runoff from reclaimed mining areas to natural outlets or interior basins. The condition of the land shall allow sufficient drainage to prevent water pockets or undue erosion. Natural and storm water drainage shall be designed so as to prevent flooding on surrounding properties and County rights-of-way.* *Storm water runoff from mining areas shall be conveyed to lowered areas (detention basins) to provide detention of runoff generated during a 20-year, one-hour storm event. All drainage conveyance channels or pipes (including spillways for detention areas) shall be designed to ensure positive drainage and minimize erosion. The drainage conveyance system and storm water detention areas shall be designed and maintained in accordance with Best Management Practices for the reduction of pollutants associated with runoff from mined areas. The design and maintenance procedures shall be documented in the Storm Water Pollution Prevention Plan required for mining operations. The drainage system shall be inspected annually by a Registered Civil Engineer, Registered Geologist, or Certified Erosion and Sediment Control Specialist to ensure that the drainage system is functioning effectively and that adverse erosion and sedimentation are not occurring. The annual inspection shall be documented in the Annual Mining and Reclamation Report.* *Performance Standard 2.5-18: All final reclaimed slopes shall have a minimum safety factor equal to or greater than the critical gradient as determined by an engineering analysis of the slope stability. Final slopes less than five (5) feet below the average summer low groundwater level shall be designed in accordance with the reclaimed use and shall not be steeper than 2:1. Reclaimed wet pit slopes located five (5) feet or more below the average summer low groundwater level shall not be steeper than 1:1 (horizontal:vertical), in order to minimize the effects of sedimentation and biological clogging on groundwater flow, to prevent stagnation and to protect the public health.*		

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	LS	S		LS	SU
			The maximum slope angle for all final reclaimed slopes shall be determined by slope stability analysis performed by a licensed and qualified civil or geotechnical engineer and submitted with any mining and reclamation application for review by the Yolo County Community Development Agency (YCCDA). The slope stability analysis shall conform with industry standard methodologies rotational slope failures under static and pseudostatic (seismic) conditions. The minimum factor of safety for all design reclamation slopes located adjacent to levees or below existing structures shall not be less than 1.5 for static and 1.1 for pseudostatic (seismic) conditions. Other reclamation slopes shall meet a minimum factor of safety that is consistent with the post-reclamation use proposed for the mining area. *Performance Standard 2.5-21: The grading of final slopes, the replacement soil, and associated erosion control measures shall take place prior to November 1 in areas where mining has been completed. To minimize erosion, the finish grading of mining pit slopes above the average seasonal high groundwater level, with the exception of the location of designated haul roads, shall be performed as soon as practical after the completion of mining of overburden and unsaturated aggregate resources. A drought-tolerant, weed-free mix of native and non-native grass species shall be established on slopes prior to November 1 or alternate erosion control (mulch or netting) shall be placed on exposed soil on the slopes prior to this date. Phasing of mining to minimize the length of exposed mining slopes during the rainy season is encouraged.* *Mitigation Measure 4.3-2b (A-2, A-3)* *Local mining and reclamation regulations for mining operations outside the OCMP planning area shall adopt standards similar to Performance Standards 2.5-4, 2.5-17, 2.5-18, and 2.5-21 to control erosion during mining activities.* *Mitigation Measure 4.3-2d (OCMP, A5a, A5b, A6)* *An application for construction shall be filed with the California Division of Safety for Dams and approved prior to start of construction for any new dam that falls under the State jurisdiction for safety.*		

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	LS	**S**		**LS**	**SU**
Impact 4.3-3: Potential for Erosion from Surface Water Discharge, Including "Pit Capture"	A-1a, A-1b, A-2 and A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.3-3a (OCMP, A-4, A-5a, A-5b, A-6)* *The following text shall be added to Action 4.4-2 of the OCMP:* *Action 4.4-2: Designate the streamway influence boundary described in the Technical Studies as part of the Off-Channel Mining Plan. The boundary describes the general area of the creek subject to meandering, as defined by the historical activities of the channel. The streamway influence boundary also defines the area where in-stream and off-channel issues overlap and are addressed in each both plans. Whereas the streamway influence boundary shall be recognized as representative of historical conditions, the current hydraulic conditions of creek shall be considered in decision-making regarding channel and floodplain management.* *Action 4.4-3 of the OCMP shall be replaced by the following action:* *Action 4.4-3: Evaluation of proposed significant modifications to the flood plain, including off-channel mining areas, shall be made with reference to the channel improvement strategy and guidelines presented in the Cache Creek Resource Management Plan. This would ensure a consistent frame of reference and allow consideration of such modifications in the context of an integrated creek management program.* *Action 4.4-6 shall be amended as follows:* *Action 4.4-6: Allow for the design of spillways or other engineered features that provide controlled flooding of off-channel mining pits during flood events which exceed the 100-year flood event.* *Performance Standard 4.5-1 shall be amended as follows:* *Performance Standard 4.5-1: All off-channel surface mining operations shall be provided with a minimum one-hundred (100) year flood protection (including a minimum of three feet of freeboard above the 100-year flood elevation). Off-channel excavations shall be designed to minimize the possibility of levee breaching and/or pit capture.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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	LS	S		LS	SU
			Performance Standard 4.5-2 shall be deleted from the OCMP. *Performance Standard 4.5-3 shall be amended as follows:* *Performance Standard 4.5-3: Proposed off-channel excavations within the streamway influence boundary shall be set back a minimum of seven-hundred (700) feet from the existing channel bank, unless it is demonstrated that a smaller distance would not adversely affect channel stability. Under no circumstances shall the setback be less than two-hundred (200) feet. The evaluation of the potential for adverse effects of bank erosion or failure of the land separating pits located less than 700 feet from the active channel shall include, at minimum, the following analyses:* • *The 200-foot setback area shall not include portions of the former historic active floodplain or formerly mined lands separated from the active channel by levees or unmined areas less than 200 feet wide (measured perpendicular to the active channel).* • *Identification of the former historic positions of the Cache Creek channels as delineated in the CCRMP Technical Studies, and determination if proposed project is located within the limits of the historic channel.* • *Description of current channel hydraulic conditions (based on existing or site-specific hydraulic models) for the Cache Creek channel adjacent to the site and extending not less than 1,000 feet upstream and downstream of the site.* • *Determination of erosion potential of stream bank adjacent to the site made on the basis of stream flow velocity and estimated shear stress on bank materials during 100-year flood flows and historic patterns of erosion.* • *Analytical slope stability analysis in conformance with Performance Standards 2.5-16 and 2.5-18. This slope stability analysis of the slopes separating the mining area from the creek channel shall include evaluation of stability conditions during 100-year flood flows in the channel.* • *Future proposed bank stabilization designs, if recommended, shall not conflict with channel design recommendations of the Cache Creek Resource Management Plan unless approved by the Technical Advisory Committee.*		

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Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
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			The following performance standard shall be added to the Floodway and Channel Stability Elements of the OCMP and implementing ordinances: *Financial assurances for off-channel mining operations which include mining within 700 feet of the active channel of Cache Creek shall include adequate funding for maintenance during the mining and reclamation period of any bank stabilization features approved for the mining permit. Maintenance of the bank stabilization features following the completion of reclamation shall be the responsibility of the property owners under the Cache Creek Resource Management Plan.* *The condition of flood protection structures and the integrity of the land within the approved setback zone separating the mining areas and the stream channel shall be inspected annually by a licensed engineer and reported to the Yolo County Community Development Agency. The annual report shall include recommendations for remedial action for identified erosion problems. Following reclamation, the YCCDA shall inspect the land separating the mining areas and creek channel every five years. Observable damage shall be reported to the property owner. If the YCCDA determines that damage requires repair to meet the intended performance of the separator, the property owner shall perform the required repairs.*		
Impact 4.3-4: Decreased Availability of Aggregate Resources	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Hydrology and Water Quality					
Impact 4.4-1: Potential Impacts to Groundwater Levels, Rate of Flow, and Direction of Flow	A-1a, A-1b, A-2, A-3, and A-4	OCMP, A-5a, A-5b, and A-6	*Mitigation Measure 4.4-1a (OCMP, A-5a, A-5b, A-6)* *Performance Standard 3.5-1 included in the OCMP shall be as follows:* *Performance Standard 3.5-1: The area of backfilled off-channel excavations extending below the groundwater table shall be minimized to reduce changes to groundwater levels and flow. Backfilled pits shall be oriented with regard to the direction of groundwater flow to prevent localized obstructions. If a backfilled off-channel excavation is proposed to penetrate either fifty (50) feet or one-half (½) into the saturated thickness of the shallow aquifer, then at least six months prior to the commencement of excavation below average high groundwater level the applicant shall demonstrate in a manner consistent with the Technical Studies, that the pit design would not adversely affect active off-site wells within one-thousand (1,000) feet of the proposed pit boundary. If the application includes a series of backfilled pits, then the applicant shall also demonstrate that the cumulative effects of the multiple backfilled pits would not adversely affect groundwater flow, if there are any active off-site wells within one-thousand (1,000) feet of the pit boundaries.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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			The applicant shall demonstrate, using MODFLOW [16] (or a similar model of equal capability and proven reliability, as approved by the Yolo County Community Development Director) that the proposed pit design will not adversely impact active off-site well within 1,000 feet of the proposed pit boundary or results in well failure. Average, historic low groundwater levels, which represent the condition of maximum threat to water levels in the subject well, shall be used for this simulation. If an adverse impact were identified by the MODFLOW (or other selected model) simulation, the mining and reclamation plan will be modified or the applicant shall submit a written agreement that the well owner has agreed to relocate or redesign the well, or accept the potential impact (at no expense to the County) *In addition, the following performance standards measures shall be added to the Water Resources Element of the OCMP:* *3.5-16 Site-specific aquifer testing shall be conducted, if needed, to determine aquifer properties for the required modeling.* *3.5-17 A well survey shall be conducted and all wells within 1,000 feet of the limits of mining plotted on a scaled map. Each property owner owning a parcel(s) within 1,000 feet of the proposed limits of wet pit mining shall be contacted and queried about wells that may be located near the wet pit mining area.*		
Impact 4.4-2: Potential Degradation of Water Quality During Aggregate Mining and Reclamation	A-1a, A-1b, A-2, A-3, and A-4	OCMP, A-5a, A-5b, and A-6	*Mitigation Measure 4.4-2a (OCMP, A-5a, A-5b, A-6)* *Mitigation of potential water quality impacts would be addressed as described in the flowchart presented as Figure 4.4-9. The OCMP and implementing ordinances shall be modified as described below.* *Pollution Prevention* *Performance Standard 3.5-6 of the OCMP and the associated ordinance shall both be modified as follows:*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

[16] MODFLOW is a three-dimensional finite difference model used to simulate groundwater flow. A three-dimensional model would be necessary since aquifer permeability would vary with depth after reclamation.

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			If any off-channel excavation proposes to extend below the level of seasonal high groundwater, then six months prior to the commencement of excavation below average high groundwater level the applicant shall identify and locate all off-site municipal wells within 1,000 feet and all domestic wells within 500 feet of the proposed wet pit mining boundary If active wells are identified, well characteristics (pumping rate, depth, and locations of screens) shall be determined. If wells are not located within 1,000 feet, the pre-mining impact evaluation would be considered complete. *If wet pit mining is proposed within 1,000 feet of a municipal water supply well or within 500 feet of a domestic water supply well, a capture zone analysis shall be conducted using the U.S. Environmental Protection Agency model WHPA (or a similar model of equal capability and proven reliability, as approved by the Yolo County Community Development Director). The simulation shall assume 30 days of continuous pumping of the water supply well (at its maximum probable yield) under analysis. A mining setback shall be established so that the capture zone and the pit do not coincide. Alternatively, the applicant shall submit a written agreement that the well owner has agreed to relocate or redesign the well (at no expense to the County). The analysis shall be prepared and signed by a Registered Professional Engineer or Certified Hydrogeologist and submitted to the County for review and shall be submitted to, and approved by, the County at least six months prior to commencement of excavation below the seasonal high groundwater level.* *Any new drinking water wells proposed for installation within 1,000 feet of a proposed wet pit mining area shall be subject to review by the Yolo County Environmental Health Department. The County shall determine, based on site-specific hydrogeology and available water quality data, whether to approve the proposed well installation.* *The County may retain appropriate staff or a contract consultant to provide third party critical review of all hydrogeologic reports related to mining applications.*		

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			Performance Standard 3.5-3 of the OCMP and the associated ordinance shall be replaced with the following Performance Standard: *Surface water shall be prevented from entering mined areas, through perimeter berms or ditches and grading. Appropriate erosion control measures shall be incorporated into all surface drainage systems. Drainage and detention facilities within the proposed mining areas and vicinity shall be designed to prevent discharges to the wet pits and surface water conveyances (i.e. creeks and sloughs) from the 20 year/1-hour storm or less. For events greater than the 20 year/1 hour storm, runoff from around the perimeter of the mining areas should be directed to surface water conveyances. Runoff from within the lowered mining area shall be directed away from wet pits to detention/infiltration areas. Drainage plans shall not rely solely on ditches and berms to direct runoff away from the wet pit. Without proper maintenance, berms and ditches may deteriorate with time and become ineffective. Drainage plans shall emphasize grading of disturbed areas that results in broad gentle slopes that drain away from the pits. Grading plans shall be reviewed by the County to evaluate compliance with drainage plan objectives prior to project approval.* *In addition, a restriction shall be recorded on the deed that requires berms and ditches to be permanently maintained in a condition consistent with the final approval. The deed restriction shall require an inspection easement which allows County staff or other authorized personnel access for inspection of the berms and ditches. If the County determines that evidence of damage to these facilities exists, the County shall require that the owner have an inspection report for the property prepared by a registered geologist or professional engineer. The inspection report including recommendations for corrective action, if needed, shall be submitted to the Yolo County Community Development Agency. The property owner shall be required to implement recommended corrective action, if any.* *Performance Standard 2.5-8 of the OCMP and the associated ordinance shall be modified as follows:* *Unnecessary personnel shall be excluded from off-channel excavations. Open wet pits shall be fenced with a 42-inch minimum, four strand barbed wire fence or the equivalent, prior to the commencement of excavation, during excavation, and during reclamation. Fencing may enclose the property of which mining is a part, the mining site, or both. In addition, signs shall be installed at the project site boundaries and access road, indicating that the excavation area is restricted. Additional security (e.g., gates with protected locks and wing fences to prevent drive-arounds) shall be provided at all vehicular access routes. The fencing and gates shall be maintained throughout the mining and reclamation period and after completion of reclamation. A requirement shall be recorded on the deed of the property which requires the landowner to maintain fences and gates.* *The potential for water quality degradation resulting from operation of motorized watercraft is adequately mitigated by Performance Standards 3.5-10 and 2.5-8.*		

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			Performance Standard 3.5-5 of the OCMP and the associated ordinance shall be modified as follows: *At least one toilet shall be provided for each off-channel mining operation. Chemical toilets shall be properly maintained and serviced regularly. Permanent toilets shall be properly engineered and the design approved by both the Yolo County Building Official and the Environmental Health Department prior to installation. All on-site water storage facilities shall be labeled "potable" or "non-potable."* *The potential for eutrophication of the wet pit lakes would be adequately mitigated by Performance Standards 2.5-18 and 3.5-11 (discussed in Impact 4.4-3).* *Performance Standard 2.4-11 of the OCMP and associated ordinance shall be deleted.* *Monitoring* *Performance Standard 3.5-4 of the OCMP and the associated ordinance shall be modified as follows:* *All surface mining operations that propose off-channel excavations extending below the groundwater table shall develop and maintain a groundwater monitoring program consisting of two components; water level measurements and water quality testing. A groundwater level monitoring program shall be initiated at least six months prior to removal of overburden. At a minimum, the groundwater level monitoring program shall consist of three monitoring wells, with at least one well upgradient of the wet pit and one well downgradient of the wet pit. Monitoring programs for proposed mining areas exceeding 100 acres (total proposed mining area over the life of the project) shall include one additional well for each 100 acres to be mined. Therefore, proposed mining areas of 1 to 99 acres would require 3 wells, 100 to 199 acres would require four wells, 200 to 299 acres would require 5 wells, and so on. These wells shall be distributed through the vicinity of the proposed mining area and used for groundwater level measurements. Groundwater levels shall be collected from the monitoring wells on a quarterly basis for six months prior to mining and for the duration of the mining period. All wellheads shall be surveyed with horizontal and vertical control to allow calculation of groundwater elevations and development of groundwater contour maps. Groundwater levels shall be measured with an accuracy of plus or minus 0.01 foot, at minimum.*		

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			Water quality in the vicinity of each active wet pit mining location would be evaluated by analyzing samples from selected monitoring wells (one upgradient and one downgradient) and wet pit surface water sampling locations. Since mining would be conducted in phases over a relatively long period of time, pit boundaries would change with time. Selection, and installation if necessary, of downgradient monitoring wells, which would be critical to adequately characterize the groundwater quality in the vicinity of the wet pits, would be proposed by the applicant for review and approval by the County. The selected monitoring wells shall be installed and sampled at least six months prior to removal of overburden. The downgradient wells shall be located as near to active wet pit mining areas as is practical. The upgradient wells shall be located an adequate distance from the proposed mining area to ensure that effect of the wet pit on water quality in the well would be negligible. The water samples from the wet pit shall be collected in a manner so as to ensure that they are representative of water quality within the wet pit. The minimum sampling schedule and required analyses are described below. *Groundwater level and pit water surface level measurements:* *Quarterly in all wells for the duration of mining and reclamation* *For proposed wet pit mining, sample collection and analysis of physical, chemical, and biological constituents shall be conducted according the following specifications:* • *Prior to removal of overburden- One upgradient and one downgradient well shall be sampled at least six months prior to removal of overburden and again at the start of excavation. The samples shall, at minimum, be analyzed for general minerals, inorganics, nitrates, total petroleum hydrocarbons (TPH) as diesel and motor oil, benzene, toluene, ethylbenzene, and xylenes (BTEX), pesticides (EPA 8140 and 8150), and coliform (with E. coli confirmation).* • *During wet pit mining and active reclamation- The wet pit shall be sampled semi-annually for the duration of mining and active reclamation. The samples shall, at minimum, be analyzed for general minerals, inorganics, nitrates, TPH as diesel and motor oil, BTEX, pesticides (EPA 8140 and 8150), and coliform (with E. coli confirmation).* *One upgradient and one downgradient well shall be analyzed, at minimum, for general minerals, inorganics, nitrates, TPH as diesel and motor oil, BTEX, pesticides (EPA 8140 and 8150), and coliform (with E. coli confirmation). The wells shall be sampled according to the following schedule:* *0-2 years: Semi-annually* *2 years to completion of reclamation: Annually*		

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			• *After active reclamation- After all heavy equipment work has been completed in the vicinity of the pit, the TPH and BTEX analyses may be discontinued. The wet pit and one upgradient and one downgradient well shall be sampled and analyzed for pH, temperature, nutrients (phosphorus and nitrogen), total dissolved solids, total coliform (with E. coli confirmation), and biological oxygen demand. This monitoring shall be conducted every two years for a ten year period after completion of reclamation.* *A report to the Yolo County Community Development Agency and Department of Environmental Health shall be submitted within 30 days of the required groundwater testing.* *If, at the completion of the mining and reclamation period, water quality has not been impacted, all monitoring wells shall be destroyed in accordance with California Department of Water Resources Well Standards (DWR, 1991). If the County or other agency wishes to maintain the wells for future water resources evaluation, selected wells could be preserved for this use.* *The County may retain appropriate staff or a contract consultant to provide third party critical review of all hydrogeologic reports related to monitoring.* *Data Evaluation/Corrective Action* *The following performance standard shall be added to the Water Resources Element of the OCMP and implementing ordinance.* *Monitoring during the mining and reclamation period shall be a condition of the permit. A performance bond shall be acquired to ensure that monitoring continues ~~through the mining period and~~ for ten years after the completion of reclamation.* *Action 3.4-4 of the OCMP shall be modified as follows:* *The Yolo County Community Development Agency shall designate staff and resources , ~~and~~ State, and Federal agencies that may wish to receive copies of data generated from the off-channel mining operations, including the towns of Capay, Esparto, Yolo, and Madison, the city of Woodland, and the Yolo County Flood Control and Water Conservation District, the Water Resources Agency, the Central Valley Regional Water Quality Control Board, and the California Department of Water Resources. The data base shall be expanded to include other relevant sources of information, so that it can be used as reference material for regional water planning efforts.*		

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			Additional tests and analysis shall be required only if a new condition is recognized that may threaten water quality or results of previous tests fall outside allowable ranges. If at any time during the monitoring period, testing results indicate that sampling parameters exceed Maximum Contaminant Levels (MCLs), as reported in the California Code of Regulations, or established background levels, a qualified professional shall evaluate potential sources of the contaminants. The evaluation shall determine the source and process of migration (surface or subsurface) of the contaminants. A report shall be submitted to the regulatory agencies (Yolo County Community Development Agency the Yolo County Department of Health Services, the Central Valley Regional Water Quality Control Board and U.S. EPA) which identifies the source of the detected contaminants and specifies remedial actions to be implemented by the applicant for corrective action. If it is determined that the source of water quality degradation is off- site, and County and RWQCB are in agreement with this conclusion, the applicant shall not be responsible for corrective action. *If corrective action is ineffective or infeasible, the responsible party must provide reparation to affected well owners, either by treatment of water at the wellhead or by procurement of alternate water supply.* *Analysis of environmental impact for projects in the vicinity of the wet pits shall include consideration of potential water quality impacts on the open water bodies.*		
Impact 4.4-3: Potential Degradation of Water Quality after Reclamation of Mined Lands	A-1a, A-1b, A-2, A-3, and A-4	OCMP, A-5a, A-5b, and A-6	*Mitigation Measure 4.4-3a (OCMP, A-5a, A-5b, A-6)* *In addition to the policies included in the OCMP, the following mitigation measures shall be implemented:* *The potential for eutrophication and biological degradation of wet pit lakes would be adequately mitigated by Performance Standards 2.5-18 and 3.5-11, and Mitigation Measure 4.4-2a.* *The potential for illegal discharges to occur would be adequately mitigated by Mitigation Measure 4.4-2a.* ~~*The potential for water quality degradation resulting from the legal operation of motorized watercraft is adequately mitigated by Performance Standard 3.5-10.*~~ *Performance Standard 3.5-10 of the OCMP shall be modified as follows:* ~~*The use of motorized watercraft on any pond, lake, or other water body created as part of the approved reclamation plan is prohibited.*~~ *Only motorized dredges shall be allowed on the wet pit lakes. All other fuel-powered (gasoline or diesel) watercraft shall not be used on the wet pit lakes. Electric-powered boats would be permissible.* *The potential impacts associated with illegal operation of watercraft in the lakes is adequately mitigated by the requirement for fencing and locked gates, discussed above (Performance Standard 2.5-8).*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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			The potential impacts associated with groundwater quality degradation would be partially mitigated by implementation of the monitoring program described in Mitigation Measure 4.2-2a. In addition, the following Performance Standard shall be added to the OCMP and implementing ordinance: *Overburden and processing fines shall be used whenever possible to support reclamation activities around reclaimed wet pits. These materials may be used in reclamation activities without testing for agricultural chemicals. If topsoil (A-horizon soil), formerly in agricultural production, is proposed for use within the drainage area of a wet pit, the soils must be sampled prior to placement and analyzed for pesticides and herbicides (EPA 8140 and 8150). Samples shall be collected and analyzed in accordance with EPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, Third Edition (as updated). Topsoil that contains pesticides or herbicides above the Maximum Contaminant Levels for primary drinking water (California Code or Regulations) shall not be placed in areas that drain to the wet pits.* *The following performance standards shall be added to the Water Resources Element of the OCMP:* *Prior to approval of reclamation of aggregate mining areas to permanent lakes, the County shall commission a sampling and analysis program, to be implemented in one existing wet pit mining area within the OCMP planning area, to evaluate the potential for increased methylmercury production associated with wet pit mining and reclamation of mining areas to permanent lakes. The program shall include sampling of water and sediments from the bottom of the existing pit and analysis of the samples for organic content, pH, dissolved oxygen content, dissolved carbon content, and total mercury. In addition, samples of predatory fish (preferably, largemouth bass) shall be collected and analyzed for mercury content. If the initial sampling indicates either of the following conditions, the County shall perform verification sampling:* • *Average concentrations of total mercury in excess of 0.000012 mg/l in the water;* • *Average mercury levels in fish samples in excess of 0.5 mg/kg.* *If verification sampling indicates exceedance of these mercury criteria, the County shall approve reclamation of mining areas to permanent lakes Only if the average level of mercury in fish collected from the existing mining pits is shown to be equal to or less than ambient (background) mercury levels determined from a representative sample of similar species of fish (of similar size) collected in the Cache Creek channel within the planning area. The determination of the ambient mercury level shall be performed by the County within six months after approval of the OCMP and paid for by the mining permit applicants on a fair-share basis. After ten years, the County shall evaluate available data to determine any significant change in ambient concentrations of mercury in fish within the Cache Creek channel.*		

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			In the event of approval of reclamation of mined areas to permanent lakes, each mining area to be reclaimed to a permanent lake as part of each approved long-range mining plan shall be evaluated annually by the landowner for five years after creation of the lake for conditions that could result in significant methylmercury production. The annual evaluations shall be conducted by a qualified aquatic biologist or limnologist and shall include the following analyses: • *Lake condition profiling during the period June through September, including measurements of pH, eH (or redox potential), temperature, dissolved oxygen, and total dissolved carbon.* • *Collection of a representative sample of fish specimens (including minimum of five predator fish if available) and analysis of the specimens for mercury and content. Sampling and analysis shall be conducted using methodologies which are consistent with the California State Water Resources Control Board Toxic Substances Monitoring Program procedures, or more stringent procedures.* • *The results of the evaluation shall be summarized in a report and submitted to the County. The report shall include a comparison of the site specific data to available data on the background concentrations of mercury in fish within the Cache Creek watershed. The County shall be responsible for submitting the data on mercury levels in fish to the California Department of Fish and Game and the Office of Environmental Health Hazard Assessment for a determination of whether a fish advisory should be issued.* • *If a fish advisory is issued, the owner/operator shall be required to post warnings on fences surrounding the mining pit lakes which prohibit fishing in the lakes an describe the fish advisory.* *If the average fish specimen mercury content exceeds the statistically verified ambient mercury concentrations for comparable fish species (of similar size) collected within the CCRMP planning area for two consecutive years, wet pit mining on property controlled by the mining operator/owner shall be suspended and the owner/operator shall either:* • *Present a revised reclamation plan to the Yolo County Community Development Agency which provides for filling the reclaimed lake to a level five feet above the average seasonal high groundwater level with a suitable backfill material, or*		

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Environmental Impact	Level of Significance Before Mitigation		Mitigation Measures	Level of Significance After Mitigation	
	LS	S		LS	SU
			• *Present a mitigation plan to the Yolo County Community Development Agency which provides a feasible and reliable method for reducing methylmercury production or exposure to elevated mercury levels. Potential mitigation could include permanent aeration of bottom levels of the lake, alteration of water chemistry (increasing pH or dissolved organic carbon levels), control of anaerobic bacteria populations, or removal and replacement of affected fish populations. The mitigation plan would require approval by the Regional Water Quality Control Board, Department of Fish and Game, and the Yolo County Department of Environmental Health.* • *The reclamation plan shall be modified to provide that mitigation approved for methylmercury reduction shall be applied to all mining areas proposed for reclamation to permanent lakes within the reclamation plan.*		
Impact 4.4-4: Loss of Water from Aquifer Storage Due to Evaporation	A-1a, A-1b, A-2, A-3, and A-4	OCMP, A-5a, A-5b, and A-6	*Mitigation Measure 4.4-4a (OCMP, A-5a, A-5b, A-6)* *Performance Standard 3.5-12 of the OCMP shall be modified as follows:* *All permanent wet pits shall be reclaimed to include valuable wildlife habitat to offset evaporation losses from wet pits.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.4-5: Potential Impacts Associated with Groundwater Recharge	A-1a, A-1b, A-2, and A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.4-5a (OCMP, A-4, A-5a, A-5b, A-6)* *The County shall eliminate the following actions and performance standards from the OCMP: Objective 3.3-2, Actions 3.4-2, 3.4-6 through 3.4-8, Performance Standards 3.5-7, 3.5-9, 3.5-14, and 3.5-15.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.4-6: Potential Impacts Resulting from Storm-Related Flooding	A-1a, A-1b, A-2, and A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.4-6a (OCMP, A-4, A-5a, A-5b, A-6)* *The following performance standard shall be added to the Floodway and Channel Stability Element of the OCMP:* *Performance Standard 4.5-8: Flood protection upgrades shall be completed in the vicinity of the mining and processing areas, if necessary, to ensure protection from the 100-year flood event. Flood protection shall be provided from flooding associated with overtopping of the alluvial separators or levees along Cache Creek and all tributaries and drainage channels (including, but not limited to, Willow Slough and Lamb Valley Slough).*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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			The flood protection upgrades shall be designed and constructed to provide the necessary 100-year protection without exacerbating downstream flooding problems. Downstream flooding could be increased if floodplain storage areas were removed from the drainage system by constructing levees in areas where they did not exist before (or raising levees that are overtopped in floods up to the 100-year event). Alternative flood management design systems (potentially using detention basins, infiltration galleries, and/or floodplain storage in noncritical areas) shall be required as a condition of project approval. *The following performance standard shall be added to the Floodway and Channel Stability Element of the OCMP:* *Performance Standard 4.5-9: The County Floodplain Administrator shall file for a Letter of Map Revision with FEMA, to update the FIRMs affected by channel maintenance activities and levee improvements with the planning area every ten years.*		
Impact 4.4-7: Potential Impacts from Flooding Related to Dam Failure	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.4-8: Potential Impacts Associated with Inundation of Dry Pits or Lowered Reclaimed Surfaces by High Groundwater Conditions	A-1a, A-1b, A-2, A-3, and A-4	OCMP, A-5a, A-5b, and A-6	*Mitigation Measure 4.4-8a (OCMP, A-5a, A-5b, A-6)* *The following performance standard shall be added to the Water Resources Element of the OCMP and associated ordinance:* *The final distance between reclaimed lowered surfaces and average high groundwater shall not be less than five feet. The average high groundwater level shall be established for each proposed mining area. The degree of groundwater level fluctuation varies with location throughout the basin and within relatively small areas (proposed mining sites). The determination of average high groundwater level shall be conducted by a professional engineer or certified hydrogeologist and shall be based on wet season water level elevation data collected at the proposed site or adjacent areas with similar hydrogeological conditions. Water level records prior to 1977 shall not be used since they would reflect conditions prior to installation of the Indian Valley Dam. The dam caused a significant change in hydrology of the basin and data collected before its installation shall not be used in estimation current average high groundwater levels. The wells shall be adequately distributed throughout the proposed mining site to reflect spatial variation in groundwater levels and fluctuations.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Agriculture					
Impact 4.5-1: Consistency with the California Land Conservation Act of 1965 (Williamson Act) Regulations	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.5-2: Potential Impact of Permanent Loss of Agricultural Land Caused by Conversion of Agricultural Land to Other Post-Reclamation Uses		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.5-2a (OCMP, A-4, A-5a, A-5b, A-6)* *The following performance standards shall be included in OCMP:* *Performance Standard 4.5-8: All proposed mining and reclamation plans shall provide information in permit applications to allow identification of portions of the proposed mined lands that meet the definition of "prime farmlands" as defined under the Williamson Act.* *Performance Standard 4.5-9: All mining permit applications that include "prime farmlands" as defined by the provisions of the Williamson Act shall identify the location and acreage of "prime farmlands" which, as a result of reclamation, would be permanently converted to non-agricultural uses. For each acre of "prime farmland" that would be converted to non-agricultural use, the reclamation plan shall present provisions to offset (at a 1:1 ratio) the conversion of these lands. The potential offsets can include, but not be limited to one or more of the following options:* • *Identification of improvements by a qualified soil scientist to the agricultural capability of non-prime lands within or outside the project site that convert non-prime to prime agricultural conditions. These improvements can include permanent improvement of soil capability though soil amendments, reduction of soil limitations (such as excessive levels of toxins), or improvements in drainage for areas limited by flooding or low permeability soils.*		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6

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	LS	**S**		**LS**	**SU**
			• *Placement of Agricultural Preserve easements on lands meeting Williamson Act definition of "prime farmland."* • *Demonstration of the ability to provide irrigation to non-prime lands limited only by lack of irrigation water supply. The identified water supply cannot be made at the expense of "prime farmlands" currently using the same water supply.* *Mitigation Measure 4.5-2b (A-2, A-3)* *None required. However, agencies regulating aggregate mining projects in agricultural areas outside Yolo County shall consider adopting regulations similar to Performance Standard 4.5-9 to reduce the impacts of permanent conversion of agricultural land to non-agricultural uses.* *Mitigation Measure 4.5-2c (A-1a, A-1b)* *None available.*		
Impact 4.5-3: Potential Impacts of the Temporary Loss of Agricultural Productivity Due to Disturbance by Mining		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.5-3a (OCMP, A-4, A-5a, A-5b, A-6)* *The following performance standard shall be added to the Agricultural Resources Element of the OCMP:* *Performance Standard 5.5-3: All proposed mining and reclamation plans shall present a phasing plan for mining and reclamation activities. The phasing plan shall be structured to minimize the area of disturbed agricultural lands during each mining phase, and encourage the early completion of reclamation of agricultural land.* *Mitigation Measure 4.5-3b (A-1a, A-1b)* *None available.* *Mitigation Measure 4.5-3c (A-2, A-3)* *Agencies regulating aggregate mining projects in agricultural areas outside Yolo County shall adopt performance standards, similar to Performance Standard 5.5-3 of the OCMP, to minimize the area and duration of disturbance of agricultural lands.*		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6

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	LS	S		LS	SU
Impact 4.5-4: Permanent Loss of Agricultural Soils Due to Wind or Water Erosion	A-1a and A-1b	OCMP, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.5-4a (OCMP, A-2, A-3, A-4, A-5a, A-5b, A-6)* *OCMP Action 5.5-2 shall be amended as follows :* *Action 5.5-2: Topsoil, subsoil, and subgrade materials in stockpiles shall not exceed (40) feet in height, with slopes no steeper than 2:1 (horizontal:vertical). Stockpiles, other than aggregate stockpiles, shall be seeded with a vegetative cover to prevent erosion and leaching. The use of topsoil for purposes other than reclamation shall not be allowed without the prior approval of the Yolo County Community Development Director.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.5-5: Potential Impacts on Agricultural Capability Caused by Soil Management During Removal, Stockpiling, and Reuse		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.5-6: Potential Impacts on Agricultural Production Related to Lowered Reclaimed Surfaces	A-1a and A-1b	OCMP, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.5-6a (OCMP, A-2, A-3, A-4, A-5a, A-5b, A-6)* *The Agricultural Resources Element of the OCMP and ordinances shall be augmented with the following standard:* *Performance Standard 5.5-5: Reclaimed agricultural surfaces shall be graded to provide adequate field gradients to allow surface/furrow irrigation of crops and allow for adequate storm water drainage.* *Mitigation Measure 4.5-6b (A-4, A-5a, A-5b, A-6)* *The addition of Performance Standard 3.5-16 (Mitigation Measure 4.4-2a) would reduce the potential damage to crops by high groundwater conditions.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.5-7: Potential Cumulative Loss of Productive Agricultural Land Within Yolo County		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.5-7a (OCMP, A-1a, A-1b, A-4, A-5a, A-5b, A-6)* *Implementation of Mitigation Measure 4.5-2a would reduce the cumulative impact of permanent conversion of agricultural land to non-agricultural uses but not to a less-than-significant level.* *Mitigation Measure 4.5-7b (A-2, A-3)* *No enforceable mitigation available.*		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6

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Biological Resources					
Impact 4.6-1: Impact on Existing Vegetative Cover	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.6-2: Impact on Sensitive Natural Community Types		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.6-2a (OCMP, A-4, A-5a, A-5b, A-6)* *Section 10-4.502(b)(1) of the Off-Channel Surface Mining Ordinance shall be revised as follows:* *...The analysis shall propose appropriate measures to reduce any potential adverse impacts to species of concern, sensitive natural communities, or significant habitat.* *The following revisions shall be made to Performance Standard 6.5-2 of the OCMP:* *6.5-2. Avoid disturbance of riparian vegetation, including identified off-channel vegetation. Replacement habitat shall be established where complete avoidance is not possible according to a habitat restoration plan prepared by a qualified biologist, consistent with the goals of this plan.* *The following shall be included as an additional performance standard in Chapter 6 of the OCMP:* *6.4-12. Avoid disturbance of oak woodland vegetation and mature oaks Replacement habitat and plantings shall be established where complete avoidance is not possible according to a habitat restoration plan prepared by a qualified biologist, consistent with the goals of this plan.* *Mitigation Measure 4.6-2b (A-1a, A-1b, A-2, A-3)* *None Required.*	OCMP, A-4, A-5a, A-5b, and A-6	A-1a, A-1b, A-2, and A-3

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Impact 4.6-3: Disturbance to Wildlife Habitat and Disruption of Movement Corridors		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.6-3a (OCMP, A-4, A-5a, A-5b, A-6)* *The following shall be incorporated as an additional action policy in the Biological Resources Element of the OCMP:* *6.4-13. Where fence row or field margin habitat previously existed, reestablish ~~fence row~~ similar habitat as part of reclamation to agricultural use to replace and improve the wildlife habitat value of agricultural lands, allowing for reestablishment of scattered native trees, shrubs, and ground covers along the margins of reclaimed fields. Reestablished habitat can be in locations other than where occurred originally. Restoration plans shall specify ultimate fence row or field margin locations, identify planting densities for trees and shrubs, and include provisions for monitoring and maintenance to ensure establishment.* *The following shall be incorporated as an additional action policy in the OCMP:* *6.4-14 and 7.4-9. Avoid disturbance to important wildlife habitat features such as nest trees, colonial breeding locations, elderberry host plants for VELB, and essential cover associated with riparian forest and oak woodland habitat. This shall include sensitive siting of haul roads, trails, and recreational facilities away from these features.* *Mitigation Measure 4.6-3a (A-1a, A-1b, A-2, A-3)* *None Required.*	OCMP, A-4, A-5a, A-5b, and A-6	A-1a, A-1b, A-2, and A-3
Impact 4.6-4: Impact on Special-Status Species		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.6-4a (OCMP, A-4, A-5a, A-5b, A-6)* *The following shall be included as additional action policies in the Biological Resources Element of the OCMP:* *6.4-15. Essential habitat for special-status species shall be protected and enhanced, or replaced as part of mitigation plans prepared by a qualified biologist.* *6.4-16. Restoration components of reclamation plans shall include provisions to enhance habitat for special-status species, where feasible.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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			Performance Standard 6.5-3 of the OCMP shall be replaced with the following: *6.5-3. Slopes on stockpiled soils shall be graded to 2:1 for long-term storage to prevent use by bank swallows. At no time during the active breeding season (1 May through 31 July) shall slopes on stockpiles exceed 1:1, even on a temporary basis. Stockpiles shall be graded to a minimum 1:1 slope at the end of each work day where stockpiles have been disturbed during the active breeding season.* *Performance Standard 6.5-7 of the OCMP shall be revised as follows:* *6.5-7. Proposed habitat restoration or mitigation plans shall be sent to the California Department of Fish and Game, U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers for review and comment to ensure that the projects do not conflict with other existing habitat enhancement efforts.* *Performance Standard 6.5-8 of the OCMP shall be revised as follows:* *6.5-8 All surface mining operations and reclamation plans shall complement the preservation and enhancement measures in the Yolo County Habitat Conservation Plan. Mining operators with lands designated as having a moderate to high potential for use as mitigation areas in the HCP shall be encouraged to participate in the Developer HCP Participation Options, including use of lands as mitigation sites.*		
Impact 4.6-5: Modifications to Jurisdictional Wetlands or Other Waters		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.6-5a (OCMP, A-4, A-5a, A-5b, A-6)* *The following shall be included as an additional action policy in the Biological Resources Element of the OCMP:* *6.4-14. Existing jurisdictional wetlands shall be retained to the extent possible. Replacement wetlands shall be provided where complete avoidance is not possible according to a habitat restoration plan prepared by a qualified wetland specialist and approved by jurisdictional agencies, ensuring no net loss of wetland acreage or habitat value.* *Performance Standard 6.5-7 of the OCMP shall be revised as recommended in Mitigation Measure 4.6-4a.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Impact 4.6-6: Compatibility and Consistency of Restoration Provisions		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.6-6a (OCMP, A-4, A-5a, A-5b, A-6)* *Action Policy 6.4-2 of the OCMP shall be revised as follows:* *6.4-2. Coordinate with the California Department of Fish and Game, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers to ensure that proposed habitat restoration projects are consistent with or complement the Off-Channel Mining Plan.* *Performance Standard 6.4-10 of the OCMP shall be revised as follows:* *6.4-10. Restore riparian habitat throughout the planning area, wherever appropriate. However, revegetative efforts shall be primarily focussed on implementing recommendations described in the Technical Studies and the subsequent Restoration Recommendations incorporated into the CCRMP.* *Performance Standard 6.5-9 of the OCMP shall be revised as follows:* *6.5-9. If any wet pit is proposed to be reclaimed for recreational uses and/or riparian habitat, the design shall account for fluctuations in the groundwater table.* *Performance Standard 6.5-7 of the OCMP shall be revised as recommended in Mitigation Measure 4.6-4a.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Air Quality					
Impact 4.7-1: Potential Emissions of PM_{10}	A-1a, A-2, A-3, A-4, and A-5a	OCMP, A-1b, A-5b, and A-6	*Mitigation Measure 4.7-1a (OCMP, A-1b, A-5b, A-6)* *The following performance standard shall be added to the OCMP:* *Wherever practical and economically feasible, portable or movable conveyor systems shall be used to transport raw materials and overburden.*	A-1a, A-2, A-3, A-4, and A-5a	OCMP, A-1b, A-5b, and A-6

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Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
	LS	**S**		**LS**	**SU**
Impact 4.7-2: Potential Emissions of Ozone Precursors (ROG and NO_x)	A-1a, A-2, A-4, and A-5a	OCMP, A-1b, A-3, A-5b, and A-6	*Mitigation Measure 4.7-2a (OCMP, A-1b, A-3, A-5b, A-6)* *The following performance standards shall be added to the OCMP:* *Wherever practical and economically feasible, portable or movable conveyor systems shall be used to transport raw materials and overburden.* *OCMP Performance Standard 2.5-7 and proposed Off-Channel Surface Mining Ordinance Section 10.4.11 shall be amended as follows:* *All internal combustion engine driven equipment and vehicles shall be kept tuned according to the manufacturer's specifications and properly maintained to minimize the leakage of oils and fuels. No vehicles or equipment shall be left idling longer than 10 minutes.*	A-1a, A-2, A-4, and A-5a	OCMP, A-1b, A-3, A-5b, and A-6
Impact 4.7-3: Cumulative Effects on Attainment of State and Federal Standards	A-1a, A-4, and A-5a	OCMP, A-1b, A-2, A-3, A-5b, and A-6	*Mitigation Measure 4.7-3b (OCMP, A-1b, A-2, A-3, A-5b, A-6)* *No enforceable mitigation measures are available.*	A-1a, A-4, and A-5a	OCMP, A-1b, A-2, A-3, A-5b, and A-6
Impact 4.7-4: Potential Impacts on Sensitive Receptors	OCMP, A-1a, A-2, A-3, A-4., A-5a, A-5b, and A-6	A-1b	*Mitigation Measure 4.7-4a (A-1b)* *None available.*	OCMP, A-1a, A-2, A-3, A-4., A-5a, A-5b, and A-6	A-1b
Traffic and Circulation					
Impact 4.8-1: Potential Increase in Trips Associated with Recycling	OCMP, A-1a, A-1b, A-2, A-3, A-4., A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4., A-5a, A-5b, and A-6	

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	LS	S		LS	SU
Impact 4.8-2 Potential for Increase in Vehicle Trips	A-la, A-1b, A-2, A-4, and A-5a	OCMP A-3, 5b, and 6	*Mitigation Measure 4.8-2a (OCMP, A-3, A-5b, and A-6)* *Performance Standard 2.5-5 of the OCMP and Section 10-4.407 of the Off-Channel Surface Mining Ordinance shall be amended as follows:* *As a condition of approval, the operator shall agree to assume joint pavement maintenance responsibility with the County (or shared with another producer using the same roadway) for all County roads along a designated haul route from the access point of the surface mining operation to the nearest State Highway. The operator shall agree to submit an evaluation of the structural integrity of the identified roadways on or before December 1 of each year in which mining operations are permitted. The report shall be prepared by a registered professional engineer and/or Country staff with expertise in the area of roadway pavement and shall be subject to the approval of the Public Works Department. Based on the results of this annual evaluation, the Public Works Department shall identify the improvements required to maintain safe and efficient traffic operations on the road for the upcoming year. The County agrees to implement maintenance improvements similar to other County roads (i.e., fill cracks and chip seal). The operator agrees to implement the improvements beyond the typical County improvements in a timeframe set forth by the Public Works Department. The operator does not assume the liability for the roadway, except for cases where the operator has not fulfilled its maintenance obligations.* *If a subsequent mining operation utilizes a road previously required to be improved pursuant to this subsection, then the subsequent operator shall be responsible for compliance with the agreements and requirements of the previous operator.*	A-la, A-1b, A-2, A-4, and A-5a	OCMP, A-3, 5b and 6
Impact 4.8-3: Potential Change in LOS at the State Route 16 / Road 98 / Main Street Intersection	A-la, A-1b, A-2, A-4, and A-5a	OCMP, A-3, A-5b, and A-6	*Mitigation Measure 4.8-3a: (OCMP, A-3, A-5b, A-6)* *The following performance standard shall be added to the OCMP and its implementing ordinance:* *Each operator shall pay its fair share toward improvements required to maintain LOS C operations on County roads or LOS D operations on State Highways within the OCMP planning area. Fair share mitigation shall also be required to improve existing operational deficiencies of the transportation system. Specific locations shall be identified through the project-specific environmental review process for each operator's long-term mining permit application. Each operator shall participate in a funding program operated by Yolo County which is designed to ensure that all improvements are made in a timely manner and that a reimbursement mechanism is in place to ensure repayment of any costs contributed in excess of fair share amounts. The program shall be initiated upon the approval of the long-term mining permits and shall be updated biennially by Yolo County to ensure any new or modified impacts or funding sources are being addressed.*	OCMP, A-1a, A-1b, A-2, A-3, A-4., A-5a, A-5b, and A-6	

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	LS	S		LS	SU
			Each operator shall have the option to complete the work at their expense without triggering the competitive bid process, as long as they comply with the applicable legal requirements of the County. If the operator declines the option, the County shall utilize the competitive bid process.		
Impact 4.8-4: Potential Change in LOS at the State Route 16 / Road 89 Intersection	A-1a, A-1b, A-2, A-4, and A-5a	OCMP, A-3, A-5b, and A-6	*Mitigation Measure 4.8-4a (OCMP, A-3, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 3, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.8-5: Potential Impacts to the Non-Standard Segment of Road 19, West of Interstate 505	A-1a, A-1b, A-2, A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.8-5a (OCMP, A-4, A-5a, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.8-6: Potential Impacts to the Non-Standard Segment of State Route 16 Between I-505 and the Entrance to the Solano Concrete Plant	A-1a, A-1b, A-2, A-4, and A-5a	OCMP, A-3, A-5b, and A-6	*Mitigation Measure 4.8-6a (OCMP, A-3, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 3, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.8-7: Potential Impacts to the Non-Standard Segment of Road 14, West of Interstate 505	A-1a, A-1b, A-2, A-3	OCMP, A-4, A-5a, A- 5b, and A-6	*Mitigation Measure 4.8-7a (OCMP, A-4, A-5a, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.8-8: Potential Impacts to the Non-Standard Pavement Segment of Road 14, West of Interstate 505	A-1a, A-1b, A-2, A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.8-8a (OCMP, A-4, A-5a, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.8-9: Potential Impacts to Two Non-Standard Bridges on Road 89, North of State Route 16	A-1a, A-1b, A-2, A-4, and A-5a	OCMP, A-3, A-5b, and A-6	*Mitigation Measure 4.8-9a (OCMP, A-3, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 3, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
	LS	**S**		**LS**	**SU**
Impact 4.8-10: Potential Impacts to a Non-Standard Bridge on Road 19, West of Interstate 505	A-1a, A-1b, A-2, A-3	OCMP, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.8-10a (OCMP, A-4, A-5a, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.8-11: Potential Impacts to a Non-Standard Bridge on Road 85, North of Road 16A	A-1a, A-1b, A-2, A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.8-11a (OCMP, A-4, A-5a, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.8-12: Potential Impacts to a Non-Standard Bridge on Road 14, West of Interstate 505	A-1a, A-1b, A-2, A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.8-12a (OCMP, A-4, A-5a, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.8-13: Potential Impacts to the Non-Standard Curve Radii at the Road 85 / Road 14 Intersection	A-1a, A-1b, A-2, A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.8-13a (OCMP, A-4, A-5a, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 5a, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.8-14: Potential Impacts to the Non-Standard Curve Radii at the State Route 16 / Road 89 Intersection	A-1a, A-1b, A-2, A-4, and A-5a	OCMP, A-3, A-5b, and A-6	*Mitigation Measure 4.8-14a (OCMP, A-3, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 3, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.8-15: Potential Impacts to the Non-Standard Curve Radii at the Road 20 / Road 96 Intersection	A-1a, A-1b, A-2, A-4, and A-5a	OCMP, A-3, A-5b, and A-6	*Mitigation Measure 4.8-15a (OCMP, A-3, A5b, A-6)* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 3, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
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Impact 4.8-16: Potential for Accelerated Pavement Deterioration	A-1b an d A-2	OCMP, A-1a, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.8-16a (OCMP, A-1a, A-3, A-4, A-5a, A-5b, A-6)* *Implementation of Mitigation Measure 4.8-2a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 1a, 3, 4, 5a, 5b and 6.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Noise					
Impact 4.9-1: Exposure to Unacceptable Noise Levels from Mining, Processing, Hauling, Reclamation, and Post-Reclamation Activities On Site	A-1a, A-1b, A-2, and A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.9-1a (OCMP, A-4, A-5a, A-5b, A-6)* *The performance standards in the Off-Channel Surface Mining Ordinance (Section 10-4.418) shall be modified so that the residential noise limit is a CNEL of 60 dB rather than the currently specified L_{eq} of 60 dB. This change shall also be made in the Off-Channel Mining Plan.* *Mitigation Measure 4.9-1b (OCMP, A-4, A-5a, A-5b, A-6)* *From 6:00 a.m. to 6:00 p.m., noise levels shall not exceed an average noise level equivalent (L_{eq}) of eighty (80) decibels (dBA) measured at the property boundaries of the site. However, noise levels may not exceed an average noise level equivalent (L_{eq}) of sixty (60) decibels for any nearby off-site residences or other noise-sensitive land uses.* *From 6:00 p.m. to 6:00 a.m., noise levels shall not exceed an average noise level equivalent (L_{eq}) of sixty-five (65) decibels (dBA) measured at the property boundaries of the site.* *Noise levels shall not exceed a community noise equivalent level (CNEL) of sixty (60) decibels (dBA) for any nearby off-site residence or other noise-sensitive land uses.* *Mitigation Measure 4.9-1c (OCMP, A-4, A-5a, A-5b, A-6)* *The following performance standard shall be added to the OCMP:* *Mining activities shall not exceed the noise limit of CNEL 60 dB at existing residences. An existing residence shall be considered the property line of any residentially zoned area or, in the case of agricultural land, any occupied residential structures. Achieving the noise standards could involve setbacks as proposed in the Off-Channel Surface Mining Ordinance (Section 10.4.425), the use of quieter equipment adjacent to residences, or the construction of landscaped berms between mining activities and residences.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Impact 4.9-2: Exposure to Unacceptable Increases in Noise Generated by Off-Site Truck Traffic	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.9-3: Contribution to Increase in Cumulative Noise	A-2	OCMP, A-1a, A-1b, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.9-3a (OCMP, A-4, A-5a, A-5b, A-6)* *The following performance standard shall be added to the OCMP and its implementing ordinances:* *Operators shall provide acoustical analysis for future truck and traffic noise associated with the individual operations along County roadways identified as experiencing significant impacts due to increased traffic noise. The study shall identify noise levels at adjacent noise-sensitive receptors and ways to control the noise to the "normally acceptable" goal of a CNEL of 60 dB and reduce the increase over existing conditions to 5 dB or less. Typical measures that can be employed include construction of noise barriers (wood or masonry), earthen berms, or re-routing of truck traffic.* *Mitigation Measure 4.9-3c (A-1a, A-1b, A-3)* *Existing mining ordinances shall be modified to require an acoustical analysis for future truck and traffic noise associated with individual operations along County roadways identified as experiencing significant impacts due to increased traffic noise. The study shall identify noise levels at adjacent noise-sensitive receptors and ways to control the noise to the "normally acceptable" goal of a CNEL of 60 dB and reduce the increase over existing conditions to 5 dB or less. Typical measures that can be employed include construction of noise barriers (wood or masonry), earthen berms, or re-routing of truck traffic.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.9-4: Generation of Vibration or Nuisance Noise	A-1a, A-1b, and A-2	OCMP, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.9-4a (OCMP, A-3, A-4, A-5a, A-5b, A-6)* *The following performance standard shall be added to the OCMP:* *If mining occurs within 1500 feet of residences, equipment used during nighttime activities shall be equipped with non-sonic warning devices consistent with OSHA regulations, which may include fencing of the area to avoid pedestrian traffic, adequate lighting of the area, and placing an observer in clear view of the equipment operator to direct backing operations. Prior to commencement of operations without sonic warning devices, operators shall file a variance request with the Cal OSHA Standards Board showing that the proposed operation would provide equivalent safety to adopted safety procedures, including sonic devices.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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	LS	**S**		**LS**	**SU**
Aesthetics					
Impact 4.10-1: Effects on Existing Views or Vistas During Mining	A-2 and A-3	OCMP, A-1a, A-1b, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.10-1a (OCMP, A-4, A-5a, A-5b, A-6)* *In conjunction with the environmental review of individual projects permitted under the OCMP, means of minimizing the visibility of mining operations, facilities and landform alterations from public viewpoints shall be assessed based on site-specific visual characteristics and viewing conditions. The use of berms, vegetative screens, seeding, special plant materials and contouring the sides and top surfaces of modified landforms, or other measures, shall be incorporated into the individual mine and reclamation plans as appropriate.* *Mitigation Measure 4.10-1b (OCMP, A-4, A-5a, A-5b. A-6)* *Where mining occurs within 1,000 feet of a public right-of-way, the operators shall phase mining such that no more than 50 acres of the area that lies within 1,000 feet of the right-of-way would be actively disturbed at any time except where operations are adequately screened from public view. Where adequate screening exists in the form of mature vegetation and/or constructed berms that effectively block public view, the area of active disturbance within 1,000 feet of the right-of-way shall not exceed the area that is screened by more than 50 acres at any time. Actively disturbed areas are defined as those on which mining operations of any kind, or the implementation of reclamation such as grading, seeding or installation of plant material are taking place.* *Mitigation Measure 4.10-1c (A-1a, A-1b)* *None available.*		OCMP, A-1a, A-1b, A-4, A-5a, A-5b, and A-6
Impact 4.10-2: Effects on Views or Vistas Following Reclamation	OCMP, A-4, A-5a, A-5b, and A-6	A-1a, A-1b, A-2, and A-3	*Mitigation Measure 4.10-2a (OCMP, A-4, A-5a, A-5b, A-6)* *None required. However, the following condition would further reduce impacts:* *In conjunction with the environmental review of individual projects permitted under the OCMP, further means of improving the appearance of the landscape after reclamation shall be assessed based on site-specific visual characteristics, site lines and view corridors. The use and placement of berms, vegetative screens, special plant materials, grading slopes and contouring the sides and top surfaces of modified landforms to mimic surrounding landforms, or other measures, shall be incorporated into the mine reclamation plans as appropriate.* *Mitigation Measure 4.10-2b (A-1a, A-1b, A-2 and A-3)* *No mitigation available.*	OCMP, A-4, A-5a, A-5b, and A-6	A-1a, A-1b, A-2, and A-3

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	LS	**S**		**LS**	**SU**
Impact 4.10-3: Potential for Visual Incompatibility with Surrounding Land Uses	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.10-4: Introduction of Light and Glare	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.10-5: Consistency with Yolo County General Plan Policies	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Issue 4.10-6: Contribution to Cumulative Visual Impacts	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Cultural Resources					
Impact 4.11-1: Potential Impacts to Cultural Resources		OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.11-1a (OCMP, A-4, A-5a, A-5b, A-6)* *The following performance standard shall be added to the OCMP:* *All resource records shall be checked for the presence of and the potential for prehistoric and historic sites. Damaging effects on cultural resources shall be avoided whenever possible. If avoidance is not feasible, the importance of the site shall be evaluated by a qualified professional prior to commencement of mining operations. If a cultural resource is determined not to be important, both the resource and the effect on it shall be reported to the County, and the resource need not be considered further. If avoidance of an important cultural resource is not feasible, a mitigation plan shall be prepared and implemented. The mitigation plan shall explain the importance of the resource, describe the proposed approach to mitigate destruction or damage to the site, and demonstrate how the proposed mitigation would serve the public interest.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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OCMP = Draft Off-Channel Mining Plan and Implementing Ordinances
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A-5a = Decreased Mining (Restricted Allocation)
A-5b = Decreased Mining (Shorter Mining Period)
A-6 = Agricultural Reclamation (with Mining Operations as Proposed)

Table 2-1: REVISED SUMMARY OF IMPACTS AND MITIGATION MEASURES					
Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
	LS	**S**		**LS**	**SU**
			In addition, Performance Standard 2.5-3 of the OCMP shall be modified as follows: *If human skeletal remains are encountered during excavation, all work within seventy-five (75) feet shall immediately stop, and the County Coroner shall be notified within twenty-four (24) hours. If remains are of Native American origin, the appropriate Native American community identified by the Native American Heritage Commission shall be contacted, and an agreement for treating or disposing of, with appropriate dignity, the remains and associated grave goods shall be developed. If any cultural resources such as chipped or ground stone, historical debris, building foundations, or paleontological materials are encountered during excavation, then all work within seventy-five (75) feet shall immediately stop and the Director shall be notified at once. Any cultural resources found on the site shall be recorded by a qualified archaeologist and the information shall be submitted to the County.* *Mitigation Measure 4.11-1b (A-1a, A-1b, A-2, A-3)* *None required. Impacts to cultural resources within areas where mining currently is permitted or in off-site areas are subject to existing State and Federal regulations and restrictions related to the disturbance of cultural resources.*		
Hazards					
Impact 4.12-1: Potential Human Health And/Or Environmental Impacts from the Accidental Release of Petroleum Products and Other Chemicals Used During Mining and Reclamation And/Or at Processing Plants	A-1a, A-1b, A-2, and A-3	OCMP, A-4, A-5a, A-5b, and A-6	*Mitigation Measure 4.12-1a (OCMP, A-4, A-5a, A-5b, A-6)* *Goal 2.2-4 of the OCMP shall be revised as follows:* *Eliminate or minimize hazards to the public health and safety that are associated with surface mining operations and reclamation.* *Objective 2.3-3 of the OCMP shall be revised as follows:* *Provide standards and procedures for regulating surface mining operations and reclamation so that hazards are eliminated or minimized and potential adverse environmental effects are reduced or prevented.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Table 2-1: REVISED SUMMARY OF IMPACTS AND MITIGATION MEASURES					
Environmental Impact	Level of Significance Before Mitigation		Mitigation Measures	Level of Significance After Mitigation	
	LS	S		LS	SU
			Action 2.4-2 of the OCMP shall be revised as follows: *~~Improve the County's monitoring of mining by requiring that all operations within the planning area submit detailed annual reports, as well as copies of permits approved by other agencies or jurisdictions.~~ Hazardous materials business plans must be submitted biannually as required by the Health and Safety Code, unless the types of hazardous materials used change, in which case revised business plans must be submitted within 30 days of the change. ~~This will enable the County to better assess the impacts of off-channel mining and the success of reclamation efforts.~~* *The following performance standard shall be added to the Aggregate Resources Element of the OCMP:* *PS 4.5-9: Fueling and maintenance activities of heavy equipment (except draglines and floating suction dredges) are prohibited within 100 feet of open bodies of water during mining and reclamation. All Storm Water Pollution Prevention Plans shall include provisions for releases of fuels during fueling activities for draglines and floating suction dredges.* *Objective 3.3-3 and Action 3.4-3 of the OCMP shall be revised as follows:* *Objective 3.3-3: Ensure that off-channel surface mines are operated such that surface and groundwater supplies are not adversely affected by erosion, lowering of the water table, and/or contamination during mining and reclamation.* *Action 3.4-3: Include a groundwater monitoring program as a condition of approval for any surface mining and reclamation operation that proposes off-channel excavations that extend below the groundwater level. The monitoring program shall require regular groundwater level data, as well as a water quality monitoring program based on a set of developed standards.*		
Impact 4.12-2: Historic Pesticide Use May Affect the Health and Safety of Workers Engaged in Mining or Reclamation Activities	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	

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Table 2-1: REVISED SUMMARY OF IMPACTS AND MITIGATION MEASURES					
Environmental Impact	**Level of Significance Before Mitigation**		**Mitigation Measures**	**Level of Significance After Mitigation**	
	LS	**S**		**LS**	**SU**
Impact 4.12-3: Steep Pit Slopes May Present a Drowning Hazard to the Public	A-1a, A-1b, A-2, A-3, and A-4	OCMP, A-5a, A-5b, and A-6	*Mitigation Measure 4.12-3a (OCMP, A-5a, A-5b, A-6)* *Goals 2.2-4 and 2.3-3 of the OCMP shall be revised to include references to reclamation. Refer to Mitigation Measure 4.12-1a.* *Performance Standards 2.5-4, 2.5-16, and 2.5-18 shall be revised as required by Mitigation Measure 4.3-2a to require that slopes shall not be steeper than 2:1 five feet below the average summer low groundwater level.* *Performance Standard 2.5-8 shall be revised to include signage and fencing requirements during and after reclamation. These changes have been included in Mitigation Measure 4.4-2a in the Hydrology section.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.12-4: Open Bodies of Water May Become Breeding Areas for Mosquitoes. An Increase in the Mosquito Population Could Adversely Affect the Public Health	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, A-3, A-4, A-5a, A-5b, and A-6	
Public Services and Utilities					
Impact 4.13-1: Potential for Long-Term Impacts to Open Space and Recreational Opportunities in the Lower Cache Creek Area	OCMP, A-1a, A-1b, A-2, and A-3, A-4, A-5a, A-5b, and A-6		*None required.*	OCMP, A-1a, A-1b, A-2, and A-3, A-4, A-5a, A-5b, and A-6	
Impact 4.13-2: Potential Increase in Demand for Public Services	OCMP, A-1a, A-1b, A-2, and A-3, A-4, A-5a, A-5b, and A-6		*Mitigation Measure 4.13-2a (OCMP, A-4, A-5a, A-5b, A-6)* *None required; however, the following is recommended:* *The County shall identify the costs of implementing the policies contained in the OCMP, and determine a fair-share cost program for reimbursement by gravel operators and any other affected parties.* *Mitigation Measure 4.13-2b (A-1a, A-1b, A-2, A-3)* *None required.*	OCMP, A-1a, A-1b, A-2, and A-3, A-4, A-5a, A-5b, and A-6	

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APPENDIX B MITIGATION MONITORING PLAN

MITIGATION MONITORING PLAN

ENVIRONMENTAL IMPACT REPORT for
OFF-CHANNEL MINING PLAN
for LOWER CACHE CREEK

SCH #95113034

Yolo County

June 14, 1996

INTRODUCTION

The California Environmental Quality Act requires public agencies to report on and monitor measures adopted as part of the environmental review process (PRC Section 21081.6). This Mitigation Monitoring Plan (MMP) is designed to ensure that the measures identified in the ~~Off-Channel Mining Plan EIR~~ are fully implemented. The MMP describes the actions that must take place as a part of each measure, the timing of these actions, who is responsible for implementation, and the agency responsible for enforcing each action.

For most of the measures noted in this MMP, the County has ultimate responsibility for implementation of mitigation measures. Therefore, it is recommended that the Resources Management Coordinator of the Community Development Agency be assigned chief monitor and be responsible for assigning monitoring actions to responsible agencies. The Resources Management Coordinator would track the overall progress of each action.

If another agency or entity is responsible for implementation, it is recommended that the Resources Management Coordinator contact these agencies or entities and request detailed information to be appended to this Plan, in order to ensure coordination in monitoring and reporting.

As required by Section 21081.6 of the PRC, the Yolo County Community Development Agency is the "custodian of documents and other material" which constitute the "record of proceedings" upon which a decision to adopt the OCMP was based. Inquiries should be directed to:

David Morrison, Resources Management Coordinator,
Yolo County Community Development Agency
(916) 666-8041

The location of this information is:

Yolo County Community Development Agency
292 West Beamer Street
Woodland, California 95695

In order to assist implementation of Off-Channel Mining Plan EIR mitigation measures, the Plan has been formatted as a table with the following information:

- Impact - listed verbatim in order of the EIR;
- OCMP Mitigation Measures - listed verbatim in order of the EIR;
- Reporting/Monitoring Requirement - applicable milestones;
- Responsibility for Compliance - applicable entity;
- Method of Compliance - how actions will be implemented;
- Enforcement - how implementation of action will be assured; and
- Checkoff - verification of implementation.

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Land Use and Planning						
Impact 4.2-1: Consistency with Yolo County General Plan	*Mitigation Measure 4.2-1a* *None required. However, the amendment to draft OCMP Objective 5.3-1 proposed in Mitigation Measure 4.2-5a would reinforce Implementation Strategy #2 of the Capay Valley Area Plan by encouraging the reclamation of land within the Capay Valley Area to agricultural uses (i.e., areas of creek maintenance). This action would enhance the compatibility of the OCMP with the Capay Valley Area Plan.*	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	
Impact 4.2-2: Consistency with the Yolo County Zoning Ordinance and County Code	*Mitigation Measure 4.2-2a* *The following sections of the Yolo County Zoning Ordinance shall be amended to implement the OCMP and its implementing ordinances: Sections 8-2.404(g), 8-2.404(j), 8-2.604(n), 8-2.2311, 8-2.2312(a), and 8-2.2312(b). New sections shall be added to the Yolo County Zoning Ordinance at Section 8-2.404 (to address land use contracts in the A-P Zone), and at 8-2.23.8 (to address the Special Sand and Gravel Combining Zone [SGR]).*	Prior to Mining	Planning	Add Amendment to Zoning Ordinance	Incorporate into Zoning Ordinance	
Impact 4.2-3: Consistency with the State Mining and Reclamation Act (SMARA) and the State Mining and Geology Board Reclamation Regulations	*None Required.*					
Impact 4.2-4: Consistency with the Regional Water Quality Control Board's Basin Plan	*None Required.*					
Impact 4.2-5: Consistency with the RCD Agriculture Policies	*Mitigation Measure 4.2-5a* *None required. As an improvement measure, however, it is recommended that the following language be added to Objective 5.3-1 of the OCMP:* *Reclamation of agricultural lands to other uses, however, is discouraged, wherever agricultural reclamation is feasible.*	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	
Impact 4.2-6: Compatibility with Existing and Planned Land Uses	*None required.*					

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Impact 4.2-7: Change in Land Use Intensity	*None required at the program level.*					
Impact 4.2-8: Land Use Incompatibility Due to Changes in the Creek Boundary	*None required.*					
Impact 4.2-9: Land Disturbance During Mining	*None required.*					
Impact 4.2-10: Potential for Additional Mining Above That Which Is Currently Known	*Mitigation Measure 4.2-10a* *The final OCMP boundaries shall be defined as including only those 2,932 acres (including a 45-acre borrow area) presently under consideration for rezoning.*	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	
Impact 4.2-11: Potential Impacts from the Future Sale or Transfer of Property Included within a Current Mining/Reclamation Application	*Mitigation Measure 4.2-11a* *The OCMP and its implementing ordinances shall be expanded and clarified to address the issue of transferability of mining permits. The clarification would indicate that if a property is sold or transferred, the tonnage attributed to that property transfers as well. If that tonnage is still processed at the original plant site pursuant to the original permit approval, no additional environmental assessment or permits would be required. If that transferred tonnage is processed elsewhere, additional analysis and approvals would be required.*	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	
Impact 4.2-12: Compatibility with Watts-Woodland Airport Comprehensive Land Use Plan	*None required at the program level.*					

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Geology and Soils						
Impact 4.3-1: Potential for Damage from Seismic Shaking	*Mitigation Measure 4.3-1a* *The following performance standards shall be added to the Aggregate Resources Element of the OCMP and its implementing ordinances.*					
	Performance Standard 2.5-25: Improvements, including the construction of buildings, roadways or other public facilities proposed for construction in reclaimed mining pits shall require a geotechnical investigation of the stability of fills conducted by a qualified and licensed geotechnical engineer. A report on the results and recommendation of the investigation shall be submitted to the Yolo County Community Development Agency prior to the issuance of building permits. The recommendation of the geotechnical investigation shall be fully implemented by the applicant.	Post-Reclamation	Applicant	Submittal of Geotechnical Report	Require as Permit Condition	
	Performance Standard 2.5-26: Backfilled mining areas and slopes shall be inspected by the Yolo County Community Development Agency following strong seismic shaking events. Observable damage shall be reported to the landowner. If the YCCDA determines that the damage requires repair to meet the intended use of the reclaimed land, the landowner shall perform the required repairs.	Ongoing - Following Strong Seismic Shaking Event	Planning	Inspection	Incorporate into OCMP	
	Performance Standard 2.5-27: The cost of implementing recommendations for repair of reclaimed land caused during earthquakes or other natural events shall be met through application of contingency costs provided for by the project's financial assurances as required by SMARA.	Ongoing - Mining and Reclamation	Applicant	Application of Contingency Costs	Financial Assurances	
	The following performance standard of the OCMP shall be modified as follows:					
	Performance Standard 5.5-3: The operator shall retain a licensed Land Surveyor to resurvey any areas reclaimed to agricultural usage after the first two (2) crop seasons have been completed. Any areas where settling has occurred shall be re-leveled to the field grade specified in the approved reclamation.	Following Completion of 2 Crop Seasons	Planning	Resurvey and Re-leveling	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Impact 4.3-2: Potential Impacts Related to Slope Stability, Erosion, and Sedimentation	*Mitigation Measure 4.3-2a* *The following performance standards of the OCMP shall be modified as follows:*					
	Performance Standard 2.5-4: During mining operations, a series of benches may be excavated in a slope provided that the excavations are made in compliance with the requirements of the state Mine Safety Orders (California Code of Regulations, Title 8, Subchapter 17). The vertical height and slope of benches constructed for permanent reclaimed slopes shall not exceed maximum standards for the specific soil types presented in California Code of Regulations, Title 8, Article 6. In general, vertical cutslopes between benches shall not exceed four (4) feet in height in topsoil and overburden sediments. Benching shall be allowed in cohesive soil (clay, sandy or silty clay, clayey silt) only. Slopes above the elevation of groundwater (determined at the time of excavation by the level of exposed water in the excavation) that exceed the maximum vertical height shall be excavated and maintained at slopes not greater than 2:1. Slopes located five (5) feet or less below the average summer low groundwater level shall not be steeper than 2:1. Slopes located more than five (5) feet below the average summer low groundwater level shall not be steeper than 1:1 (horizontal to vertical). *Vertical cutslopes in excess of four feet in height may be approved for development of special habitat (e.g. bank swallows) if a site specific slope stability analysis, performed by a licensed engineer, indicates that the slope does not exceed critical height for the on-site soil conditions. Projects proposing such slopes will be required to submit a long-term maintenance plan to ensure that the function of the slopes as habitat is met.*	During Mining	Planning	Submittal of Slope Stability Study	Require as Permit Condition	
	Performance Standard 2.5-16: Except where benches are used, all banks above groundwater level shall be sloped no steeper than 2:1 (horizontal:vertical). Proposed steeper slopes shall be evaluated by a slope stability study, prepared by a qualified engineer. Slopes below the groundwater level shall be no steeper than 1:1 (horizontal:vertical). Slopes located five feet or less below the summer low groundwater level shall not be steeper than 2:1.	Post-Reclamation	Planning	Submittal of Slope Stability Study	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	Performance Standard 2.5-17: Upon the completion of operations, grading and revegetation shall minimize erosion and convey storm water runoff from reclaimed mining areas to natural outlets or interior basins. The condition of the land shall allow sufficient drainage to prevent water pockets or undue erosion. Natural and storm water drainage shall be designed so as to prevent flooding on surrounding properties and County rights-of-way. *Storm water runoff from mining areas shall be conveyed to lowered areas (detention basins) to provide detention of runoff generated during a 20-year, one-hour storm event. All drainage conveyance channels or pipes (including spillways for detention areas) shall be designed to ensure positive drainage and minimize erosion. The drainage conveyance system and storm water detention areas shall be designed and maintained in accordance with Best Management Practices for the reduction of pollutants associated with runoff from mined areas. The design and maintenance procedures shall be documented in the Storm Water Pollution Prevention Plan required for mining operations. The drainage system shall be inspected annually by a Registered Civil Engineer, Registered Geologist, or Certified Erosion and Sediment Control Specialist to ensure that the drainage system is functioning effectively and that adverse erosion and sedimentation are not occurring. The annual inspection shall be documented in the Annual Mining and Reclamation Report.*	Prior to Reclamation and then Ongoing (Annually)	Planning	Submittal of Storm Water Pollution Prevention Plan/Annual Inspection	Incorporate into Annual Mining and Reclamation Report	
	Performance Standard 2.5-18: All final reclaimed slopes shall have a minimum safety factor equal to or greater than the critical gradient as determined by an engineering analysis of the slope stability. Final slopes less than five (5) feet below the average summer low groundwater level shall be designed in accordance with the reclaimed use and shall not be steeper than 2:1. Reclaimed wet pit slopes located five (5) feet or more below the average summer low groundwater level shall not be steeper than 1:1 (horizontal:vertical), in order to minimize the effects of sedimentation and biological clogging on groundwater flow, to prevent stagnation and to protect the public health.	Prior to Reclamation	Planning	Submittal of Slope Stability Study	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	The maximum slope angle for all final reclaimed slopes shall be determined by slope stability analysis performed by a licensed and qualified civil or geotechnical engineer and submitted with any mining and reclamation application for review by the Yolo County Community Development Agency (YCCDA). The slope stability analysis shall conform with industry standard methodologies rotational slope failures under static and pseudostatic (seismic) conditions. The minimum factor of safety for all design reclamation slopes located adjacent to levees or below existing structures shall not be less than 1.5 for static and 1.1 for pseudostatic (seismic) conditions. Other reclamation slopes shall meet a minimum factor of safety that is consistent with the post-reclamation use proposed for the mining area.					
	Performance Standard 2.5-21: The grading of final slopes, the replacement soil, and associated erosion control measures shall take place prior to November 1 in areas where mining has been completed. To minimize erosion, the finish grading of mining pit slopes above the average seasonal high groundwater level, with the exception of the location of designated haul roads, shall be performed as soon as practical after the completion of mining of overburden and unsaturated aggregate resources. A drought-tolerant, weed-free mix of native and non-native grass species shall be established on slopes prior to November 1 or alternate erosion control (mulch or netting) shall be placed on exposed soil on the slopes prior to this date. Phasing of mining to minimize the length of exposed mining slopes during the rainy season is encouraged.	During Mining	Planning	Submittal of Mining and Permit Application	Require as Permit Condition	
	Mitigation Measure 4.3-2d *An application for construction shall be filed with the California Division of Safety for Dams and approved prior to start of construction for any new dam that falls under the State jurisdiction for safety.*	Prior to Mining	Planning and California Division of Safety of Dames	Submittal of Application for Construction	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Impact 4.3-3: Potential for Erosion from Surface Water Discharge, Including "Pit Capture"	*Mitigation Measure 4.3-3a* *The following text shall be added to Action 4.4-2:* *Action 4.4-2: Designate the streamway influence boundary described in the Technical Studies as part of the Off-Channel Mining Plan. The boundary describes the general area of the creek subject to meandering, as defined by the historical activities of the channel. The streamway influence boundary also defines the area where in-stream and off-channel issues overlap and are addressed in each both plans. Whereas the streamway influence boundary shall be recognized as representative of historical conditions, the current hydraulic conditions of creek shall be considered in decision-making regarding channel and floodplain management.* *Action 4.4-3 of the OCMP shall be replaced by the following action:* *Action 4.4-3: Evaluation of proposed significant modifications to the flood plain, including off-channel mining areas, shall be made with reference to the channel improvement strategy and guidelines presented in the Cache Creek Resource Management Plan. This would ensure a consistent frame of reference and allow consideration of such modifications in the context of an integrated creek management program.* *Action 4.4-6 shall be amended as follows:* *Action 4.4-6: Allow for the design of spillways or other engineered features that provide controlled flooding of off-channel mining pits during flood events which exceed the 100-year flood event.* *Performance Standard 4.5-1 shall be amended as follows:* *Performance Standard 4.5-1: All off-channel surface mining operations shall be provided with a minimum one-hundred (100) year flood protection (including a minimum of three feet of freeboard above the 100-year flood elevation). Off-channel excavations shall be designed to minimize the possibility of levee breaching and/or pit capture.*	Prior to Mining Prior to Mining Prior to Mining Prior to Mining	Planning Planning Planning Planning	Adoption of OCMP Adoption of OCMP Submittal of Mining and Reclamation Application Submittal of Mining and Reclamation Application	Incorporate into OCMP Incorporate into OCMP Require as Permit Condition Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	Performance Standard 4.5-2 shall be deleted from the OCMP.	Prior to Mining	Planning	Adoption of OCMP	Delete from OCMP	
	Performance Standard 4.5-3 shall be amended as follows:					
	Performance Standard 4.5-3: Proposed off-channel excavations within the streamway influence boundary shall be set back a minimum of seven-hundred (700) feet from the existing channel bank, unless it is demonstrated that a smaller distance would not adversely affect channel stability. Under no circumstances shall the setback be less than two-hundred (200) feet. The evaluation of the potential for adverse effects of bank erosion or failure of the land separating pits located less than 700 feet from the active channel shall include, at minimum, the following analyses: • *The 200-foot setback area shall not include portions of the former historic active floodplain or formerly mined lands separated from the active channel by levees or unmined areas less than 200 feet wide (measured perpendicular to the active channel).* • *Identification of the former historic positions of the Cache Creek channels as delineated in the CCRMP Technical Studies, and determination if proposed project is located within the limits of the historic channel.* • *Description of current channel hydraulic conditions (based on existing or site-specific hydraulic models) for the Cache Creek channel adjacent to the site and extending not less than 1,000 feet upstream and downstream of the site.* • *Determination of erosion potential of stream bank adjacent to the site made on the basis of stream flow velocity and estimated shear stress on bank materials during 100-year flood flows and historic patterns of erosion.* • *Analytical slope stability analysis in conformance with Performance Standards 2.5-16 and 2.5-18. This slope stability analysis of the slopes separating the mining area from the creek channel shall include evaluation of stability conditions during 100-year flood flows in the channel.* • *Future proposed bank stabilization designs, if recommended, shall not conflict with channel design recommendations of the Cache Creek Resource Management Plan unless approved by the Technical Advisory Committee.*	Prior to Mining	Planning	Submittal of Slope Stability Study	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	The following performance standard shall be added to the OCMP and implementing ordinances: *Performance Standard 4.5-8: Financial assurances for off-channel mining operations which include mining within 700 feet of the active channel of Cache Creek shall include adequate funding for maintenance during the mining and reclamation period of any bank stabilization features approved for the mining permit. Maintenance of the bank stabilization features following the completion of reclamation shall be the responsibility of the property owners under the Cache Creek Resource Management Plan.* *The condition of flood protection structures and the integrity of the land within the approved setback zone separating the mining areas and the stream channel shall be inspected annually by a licensed engineer and reported to the Yolo County Community Development Agency.* *The annual report shall include recommendations for remedial action for identified erosion problems. Following reclamation, the YCCDA shall inspect the land separating the mining areas and creek channel every five years. Observable damage shall be reported to the property owner. If the YCCDA determines that damage requires repair to meet the intended performance of the separator, the property owner shall perform the required repairs.*	During Mining and Reclamation Annually During Mining and Every Five Years Following Reclamation	Property Owners Property Owners and Planning	Application of Contingency Costs Inspection and Report	Financial Assurances Incorporate into OCMP and Require as Permit Condition	
Impact 4.3-4: Decreased Availability of Aggregate Resources	*None required.*					

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Hydrology and Water Quality						
Impact 4.4-1: Potential Impacts to Groundwater Levels, Rate of Flow, and Direction of Flow	*Mitigation Measure 4.4-1a* *Performance Standard 3.5-1 included in the OCMP shall be as follows:* *Performance Standard 3.5-1: The area of backfilled off-channel excavations extending below the groundwater table shall be minimized to reduce changes to groundwater levels and flow. Backfilled pits shall be oriented with regard to the direction of groundwater flow to prevent localized obstructions. If a backfilled off-channel excavation is proposed to penetrate either fifty (50) feet or one-half (½) into the saturated thickness of the shallow aquifer, then at least six months prior to the commencement of excavation below average high groundwater level the applicant shall demonstrate in a manner consistent with the Technical Studies, that the pit design would not adversely affect active off-site wells within one-thousand (1,000) feet of the proposed pit boundary. If the application includes a series of backfilled pits, then the applicant shall also demonstrate that the cumulative effects of the multiple backfilled pits would not adversely affect groundwater flow, if there are any active off-site wells within one-thousand (1,000) feet of the pit boundaries.* *The applicant shall demonstrate, using MODFLOW,[1] (or a similar model of equal capability and proven reliability, as approved by the Yolo County Community Development Director) that the proposed pit design will not adversely impact active off-site well within 1,000 feet of the proposed pit boundary or results in well failure. Average, historic low groundwater levels, which represent the condition of maximum threat to water levels in the subject well, shall be used for this simulation. If an adverse impact were identified by the MODFLOW (or other selected model) simulation, the mining and reclamation plan will be modified or the applicant shall submit a written agreement that the well owner has agreed to relocate or redesign the well, or accept the potential impact (at no expense to the County)*	Prior to Mining	Planning	Submittal of Groundwater Flow Simulation	Modification of Mining and Reclamation Plan or Submittal of Written Agreement	

[1]MODFLOW is a three-dimensional finite difference model used to simulate groundwater flow. A three-dimensional model would be necessary since aquifer permeability would vary with depth after reclamation.

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	In addition, the following performance standards shall be added to the OCMP: *Performance Standard 3.5-16: Site-specific aquifer testing shall be conducted, if needed, to determine aquifer properties for the required modeling.* *Performance Standard 3.5-17: A well survey shall be conducted and all wells within 1,000 feet of the limits of mining plotted on a scaled map. Each property owner owning a parcel(s) within 1,000 feet of the proposed limits of wet pit mining shall be contacted and queried about wells that may be located near the wet pit mining area.*	Prior to Mining Prior to Mining	Environmental Health	Aquifer Testing and Well Survey Well Survey and Statement from Property Owners	Approval of Well Installation Incorporate into Mining and Reclamation Plan	
Impact 4.4-2: Potential Degradation of Water Quality During Aggregate Mining and Reclamation	*Mitigation Measure 4.4-2a* *Mitigation of potential water quality impacts would be addressed as described in the flowchart presented as Figure 4.4-9. The OCMP and implementing ordinances shall be modified as described below.* *Pollution Prevention* *Performance Standard 3.5-6 of the OCMP and the associated ordinance shall both be modified as follows:* *If any off-channel excavation proposes to extend below the level of seasonal high groundwater , then six months prior to the commencement of excavation below average high groundwater level the applicant shall identify and locate all off-site municipal wells within 1,000 feet and all domestic wells within 500 feet of the proposed wet pit mining boundary If active wells are identified, well characteristics (pumping rate, depth, and locations of screens) shall be determined. If wells are not located within 1,000 feet, the pre-mining impact evaluation would be considered complete.*	As required in Performance Standard	Environmental Health	Submittal of Capture Zone Analysis and Hydrogeologic Report	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	If wet pit mining is proposed within 1,000 feet of a municipal water supply well or within 500 feet of a domestic water supply well, a capture zone analysis shall be conducted using the U.S. Environmental Protection Agency model WHPA (or a similar model of equal capability and proven reliability, as approved by the Yolo County Community Development Director). The simulation shall assume 30 days of continuous pumping of the water supply well (at its maximum probable yield) under analysis. A mining setback shall be established so that the capture zone and the pit do not coincide. Alternatively, the applicant shall submit a written agreement that the well owner has agreed to relocate or redesign the well (at no expense to the County). The analysis shall be prepared and signed by a Registered Professional Engineer or Certified Hydrogeologist and submitted to the County for review and shall be submitted to, and approved by, the County at least six months prior to commencement of excavation below the seasonal high groundwater level. *Any new drinking water wells proposed for installation within 1,000 feet of a proposed wet pit mining area shall be subject to review by the Yolo County Environmental Health Department. The County shall determine, based on site-specific hydrogeology and available water quality data, whether to approve the proposed well installation.* *The County may retain appropriate staff or a contract consultant to provide third party critical review of all hydrogeologic reports related to mining applications.* *Performance Standard 3.5-3 of the OCMP and the associated ordinance shall be replaced with the following Performance Standard:* *Surface water shall be prevented from entering mined areas, through perimeter berms or ditches and grading. Appropriate erosion control measures shall be incorporated into all surface drainage systems. Drainage and detention facilities within the proposed mining areas and vicinity shall be designed to prevent discharges to the wet pits and surface water conveyances (i.e. creeks and sloughs) from the 20 year/1-hour storm or less. For events greater than the 20 year/1 hour storm, runoff from around the perimeter of the mining areas should be directed to surface water conveyances. Runoff from within the lowered mining area shall be directed away from wet pits to detention/infiltration areas. Drainage plans shall not rely solely on ditches and berms to direct runoff away from the wet pit. Without proper maintenance, berms and ditches may deteriorate with time and become ineffective. Drainage plans shall emphasize grading of disturbed areas that results in broad gentle slopes that drain away from the pits. Grading plans shall be reviewed by the County to evaluate compliance with drainage plan objectives prior to project approval.*	Prior to Mining	Planning	Submittal of Grading and Drainage Plans	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	In addition, a restriction shall be recorded on the deed that requires berms and ditches to be permanently maintained in a condition consistent with the final approval. The deed restriction shall require an inspection easement which allows County staff or other authorized personnel access for inspection of the berms and ditches. If the County determines that evidence of damage to these facilities exists, the County shall require that the owner have an inspection report for the property prepared by a registered geologist or professional engineer. The inspection report including recommendations for corrective action, if needed, shall be submitted to the Yolo County Community Development Agency. The property owner shall be required to implement recommended corrective action, if any.	Prior to Mining	Planning	Submittal of Inspection Report	Deed Restriction	
	Performance Standard 2.5-8 of the OCMP and the associated ordinance shall be modified as follows:					
	Unnecessary personnel shall be excluded from off-channel excavations. Open pits shall be fenced with a 42-inch minimum, four strand barbed wire fence or the equivalent, prior to the commencement of excavation, during excavation, and during reclamation. Fencing may enclose the property of which mining is a part, the mining site, or both. In addition, signs shall be installed at the project site boundaries and access road, indicating that the excavation area is restricted. Additional security (e.g., gates with protected locks and wing fences to prevent drive-arounds) shall be provided at all vehicular access routes. The fencing and gates shall be maintained throughout the mining and reclamation period and after completion of reclamation. A requirement shall be recorded on the deed of the property which requires the landowner to maintain fences and gates.	Ongoing	Applicant	Submittal of Mining and Reclamation Application	Require as Permit Condition	
	Performance Standard 3.5-5 of the OCMP and the associated ordinance shall be modified as follows:					
	At least one toilet shall be provided for each off-channel mining operation. Chemical toilets shall be properly maintained and serviced regularly. Permanent toilets shall be properly engineered and the design approved by both the Yolo County Building Official and the Environmental Health Department prior to installation. All on-site water storage facilities shall be labeled "potable" or "non-potable."	Prior to Mining	Building and Environmental Health	County Approval	Require as Permit Condition	
	The potential for water quality degradation resulting from operation of motorized watercraft is adequately mitigated by Performance Standards 3.5-10 and 2.5-8.	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	The potential for eutrophication of the wet pit lakes would be adequately mitigated by Performance Standards 2.5-18 and 3.5-11 (discussed in Impact 4.4-3).	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	
	Performance Standard 2.4-11 of the OCMP and associated ordinance shall be deleted. *Monitoring* *Performance Standard 3.5-4 of the OCMP and the associated ordinance shall be modified as follows:*	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	
	All surface mining operations that propose off-channel excavations extending below the groundwater table shall develop and maintain a groundwater monitoring program consisting of two components; water level measurements and water quality testing. A groundwater level monitoring program shall be initiated at least six months prior to removal of overburden. At a minimum, the groundwater level monitoring program shall consist of three monitoring wells, with at least one well upgradient of the wet pit and one well downgradient of the wet pit. Monitoring programs for proposed mining areas exceeding 100 acres (total proposed mining area over the life of the project) shall include one additional well for each 100 acres to be mined. Therefore, proposed mining areas of 1 to 99 acres would require 3 wells, 100 to 199 acres would require four wells, 200 to 299 acres would require 5 wells, and so on. These wells shall be distributed through the vicinity of the proposed mining area and used for groundwater level measurements. Groundwater levels shall be collected from the monitoring wells on a quarterly basis for six months prior to mining and for the duration of the mining period. All wellheads shall be surveyed with horizontal and vertical control to allow calculation of groundwater elevations and development of groundwater contour maps. Groundwater levels shall be measured with an accuracy of plus or minus 0.01 foot, at minimum.	Quarterly Beginning Six Months Prior to Mining Through Duration of Mining	Applicant	Submittal of Groundwater Monitoring Program Results	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	Water quality in the vicinity of each active wet pit mining location would be evaluated by analyzing samples from selected monitoring wells (one upgradient and one downgradient) and wet pit surface water sampling locations. Since mining would be conducted in phases over a relatively long period of time, pit boundaries would change with time. Selection, and installation if necessary, of downgradient monitoring wells, which would be critical to adequately characterize the groundwater quality in the vicinity of the wet pits, would be proposed by the applicant for review and approval by the County. The selected monitoring wells shall be installed and sampled at least six months prior to removal of overburden. The downgradient wells shall be located as near to active wet pit mining areas as is practical. The upgradient wells shall be located an adequate distance from the proposed mining area to ensure that effect of the wet pit on water quality in the well would be negligible. The water samples from the wet pit shall be collected in a manner so as to ensure that they are representative of water quality within the wet pit. The minimum sampling schedule and required analyses are described below. *Groundwater level and pit water surface level measurements:* *Quarterly in all wells for the duration of mining and reclamation.* *For proposed wet pit mining, sample collection and analysis of physical, chemical, and biological constituents shall be conducted according the following specifications:* • *Prior to removal of overburden- One upgradient and one downgradient well shall be sampled at least six months prior to removal of overburden and again at the start of excavation. The samples shall, at minimum, be analyzed for general minerals, inorganics, nitrates, total petroleum hydrocarbons (TPH) as diesel and motor oil, benzene, toluene, ethylbenzene, and xylenes (BTEX), pesticides (EPA 8140 and 8150), and coliform (with E. coli confirmation).*	As required within Performance Standard	Planning and Environmental Health	Submittal of Groundwater Monitoring Program Results	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	• *During wet pit mining and active reclamation- The wet pit shall be sampled semi-annually for the duration of mining and active reclamation. The samples shall, at minimum, be analyzed for general minerals, inorganics, nitrates, TPH as diesel and motor oil, BTEX, pesticides (EPA 8140 and 8150), and coliform (with E. coli confirmation).* *One upgradient and one downgradient well shall be analyzed, at minimum, for general minerals, inorganics, nitrates, TPH as diesel and motor oil, BTEX, pesticides (EPA 8140 and 8150), and coliform (with E. coli confirmation). The wells shall be sampled according to the following schedule:* *0-2 years: Semi-annually* *2 years to completion of reclamation: Annually* • *After active reclamation- One year after all heavy equipment work has been completed in the vicinity of the pit, the TPH and BTEX analyses may be discontinued. The wet pit and one upgradient and one downgradient well shall be sampled and analyzed for pH, temperature, nutrients (phosphorus and nitrogen), total dissolved solids, total coliform (with E. coli confirmation), and biological oxygen demand. This monitoring shall be conducted every two years for a ten year period after completion of reclamation.* *A report to the Yolo County Community Development Agency and Department of Environmental Health shall be submitted within 30 days of the required groundwater testing.* *If, at the completion of the mining and reclamation period, water quality has not been impacted, all monitoring wells shall be destroyed in accordance with California Department of Water Resources Well Standards (DWR, 1991). If the County or other agency wishes to maintain the wells for future water resources evaluation, selected wells could be preserved for this use.*					

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	The County may retain appropriate staff or a contract consultant to provide third party critical review of all hydrogeologic reports related to monitoring. *Data Evaluation/Corrective Action* *The following performance standard shall be added to the Water Resources Element of the OCMP and implementing ordinance.* *PS. 3.5-16: Monitoring during the mining and reclamation period shall be a condition of the permit. A performance bond shall be acquired to ensure that monitoring continues for ten years after the completion of reclamation.*	Prior to Mining	Planning	Proof of Performance Bond	Financial Assurances	
	Action 3.4-4 of the OCMP shall be modified as follows: *The Yolo County Community Development Agency shall designate staff and resources to coordinate with City, County, regional, State, and Federal agencies that may wish to receive copies of data generated from the off-channel mining operations, including the towns of Capay, Esparto, Yolo, and Madison, the city of Woodland, and the Yolo County Flood Control and Water Conservation District, the Water Resources Agency, the Central Valley Regional Water Quality Control Board, and the California Department of Water Resources. The data base shall be expanded to include other relevant sources of information, so that it can be used as reference material for regional water planning efforts.*	Ongoing on an As-Needed Basis	Planning	Submittal of Groundwater Database	Incorporate into OCMP	
	Additional tests and analysis shall be required only if a new condition is recognized that may threaten water quality or results of previous tests fall outside allowable ranges. If at any time during the monitoring period, testing results indicate that sampling parameters exceed Maximum Contaminant Levels (MCLs), as reported in the California Code of Regulations, or established background levels, a qualified professional shall evaluate potential sources of the contaminants. The evaluation shall determine the source and process of migration (surface or subsurface) of the contaminants. A report shall be submitted to the regulatory agencies (Yolo County Community Development Agency, the Yolo County Department of Health Services, the Central Valley Regional Water Quality Control Board, and the U.S. EPA) which identifies the source of the detected contaminants and specifies remedial actions to be implemented by the applicant for corrective action. If it is determined that the source of water quality degradation is off- site, and County and RWQCB are in agreement with this conclusion, the applicant shall not be responsible for corrective action.	During Mining	Planning and CVRWQ CB	Submittal of Testing Results	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	If corrective action is ineffective or infeasible, the responsible party must provide reparation to affected well owners, either by treatment of water at the wellhead or by procurement of alternate water supply. *Analysis of environmental impact for projects in the vicinity of the wet pits shall include consideration of potential water quality impacts on the open water bodies.*					
Impact 4.4-3: Potential Degradation of Water Quality after Reclamation of Mined Lands	*Mitigation Measure 4.4-3a* *In addition to the policies included in the OCMP, the following mitigation measures shall be implemented:*					
	The potential for eutrophication and biological degradation of wet pit lakes would be adequately mitigated by Performance Standards 2.5-18 and 3.5-11, and Mitigation Measure 4.4-2a.	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	
	The potential for illegal discharges to occur would be adequately mitigated by Mitigation Measure 4.4-2a.	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	
	Performance Standard 3.5-10 of the OCMP shall be modified as follows: *Only motorized dredges shall be allowed on the wet pit lakes. All other fuel-powered (gasoline or diesel) watercraft shall not be used on the wet pit lakes. Electric-powered boats would be permissible.* *The potential impacts associated with illegal operation of watercraft in the lakes is adequately mitigated by the requirement for fencing and locked gates, discussed above (Performance Standard 2.5-8).* *The potential impacts associated with groundwater quality degradation would be partially mitigated by implementation of the monitoring program described in Mitigation Measure 4.2-2. In addition, the following Performance Standard shall be added to the OCMP and implementing ordinance:*	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	Overburden and processing fines shall be used whenever possible to support reclamation activities around reclaimed wet pits. These materials may be used in reclamation activities without testing for agricultural chemicals. If topsoil (A-horizon soil), formerly in agricultural production, is proposed for use within the drainage area of a wet pit, the soils must be sampled prior to placement and analyzed for pesticides and herbicides (EPA 8140 and 8150). Samples shall be collected and analyzed in accordance with EPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, Third Edition (as updated). Topsoil that contains pesticides or herbicides above the Maximum Contaminant Levels for primary drinking water (California Code or Regulations) shall not be placed in areas that drain to the wet pits. *The following performance standards shall be added to the Water Resources Element of the OCMP:*	During Reclamation	Planning and Environmental Health	Submittal of Soil Samples	Require as Permit Condition	
	Prior to approval of reclamation of aggregate mining areas to permanent lakes, the County shall commission a sampling and analysis program, to be implemented in one existing wet pit mining area within the OCMP planning area, to evaluate the potential for increased methylmercury production associated with wet pit mining and reclamation of mining areas to permanent lakes. The program shall include sampling of water and sediments from the bottom of the existing pit and analysis of the samples for organic content, pH, dissolved oxygen content, dissolved carbon content, and total mercury. In addition, samples of predatory fish (preferably, largemouth bass) shall be collected and analyzed for mercury content. If the initial sampling indicates either of the following conditions, the County shall perform verification sampling: • *Average concentrations of total mercury in excess of 0.000012 mg/l in the water;* • *Average mercury levels in fish samples in excess of 0.5 mg/kg.* *If verification sampling indicates exceedance of these mercury criteria, the County shall approve reclamation of mining areas to permanent lakes Only if the average level of mercury in fish collected from the existing mining pits is shown to be equal to or less than ambient (background) mercury levels determined from a representative sample of similar species of fish (of similar size) collected in the Cache Creek channel within the planning area. The determination of the ambient mercury level shall be performed by the County within six months after approval of the OCMP and paid for by the mining permit applicants on a fair-share basis. After ten years, the County shall evaluate available data to determine any significant change in ambient concentrations of mercury in fish within the Cache Creek channel.*	As Required within Performance Standard	Planning, Environmental Health, RWQCB, CDFG	Submittal of Sampling and Analysis Program and Mitigation Plan as Necessary	Incorporate into OCMP	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	In the event of approval of reclamation of mined areas to permanent lakes, each mining area to be reclaimed to a permanent lake as part of each approved long-range mining plan shall be evaluated annually by the landowner for five years after creation of the lake for conditions that could result in significant methylmercury production. The annual evaluations shall be conducted by a qualified aquatic biologist or limnologist and shall include the following analyses: • *Lake condition profiling during the period June through September, including measurements of pH, eH (or redox potential), temperature, dissolved oxygen, and total dissolved carbon.* • *Collection of a representative sample of fish specimens (including minimum of five predator fish if available) and analysis of the specimens for mercury and content. Sampling and analysis shall be conducted using methodologies which are consistent with the California State Water Resources Control Board Toxic Substances Monitoring Program procedures, or more stringent procedures.* • The results of the evaluation shall be summarized in a report and submitted to the County. The report shall include a comparison of the site specific data to available data on the background concentrations of mercury in fish within the Cache Creek watershed. The County shall be responsible for submitting the data on mercury levels in fish to the California Department of Fish and Game and the Office of Environmental Health Hazard Assessment for a determination of whether a fish advisory should be issued. • If a fish advisory is issued, the owner/operator shall be required to post warnings on fences surrounding the mining pit lakes which prohibit fishing in the lakes an describe the fish advisory. If the average fish specimen mercury content exceeds the statistically verified ambient mercury concentrations for comparable fish species (of similar size) collected within the CCRMP planning area for two consecutive years, wet pit mining on property controlled by the mining operator/owner shall be suspended and the owner/operator shall either: • Present a revised reclamation plan to the Yolo County Community Development Agency which provides for filling the reclaimed lake to a level five feet above the average seasonal high groundwater level with a suitable backfill material, or					

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	• Present a mitigation plan to the Yolo County Community Development Agency which provides a feasible and reliable method for reducing methylmercury production or exposure to elevated mercury levels. Potential mitigation could include permanent aeration of bottom levels of the lake, alteration of water chemistry (increasing pH or dissolved organic carbon levels), control of anaerobic bacteria populations, or removal and replacement of affected fish populations. The mitigation plan would require approval by the Regional Water Quality Control Board, Department of Fish and Game, and the Yolo County Department of Environmental Health. • *The reclamation plan shall be modified to provide mitigation approved for methylmercury reduction shall be applied to all other mining areas proposed for reclamation to permanent lakes within the reclamation plan.*					
Impact 4.4-4: Loss of Water from Aquifer Storage Due to Evaporation	*Mitigation Measure 4.4-4a* *Performance Standard 3.5-12 of the OCMP shall be modified as follows:* *All permanent wet pits shall be reclaimed to include valuable wildlife habitat to offset evaporation losses from wet pits.*	Prior to Mining	Planning	Submittal of Mining and Reclamation Application	Require as Permit Condition	
Impact 4.4-5: Potential Impacts Associated with Groundwater Recharge	*Mitigation Measure 4.4-5a* *The County shall eliminate the following Actions and Performance Standards from the OCMP: Objective 3.3-2, Actions 3.4-2, 3.4-6 through 3.4-8, Performance Standards 3.5-7, 3.5-9, 3.5-14, and 3.5-15.*	Prior to Mining	Planning	Adoption of OCMP	Delete from OCMP	
Impact 4.4-6: Potential Impacts Resulting from Storm-Related Flooding	*Mitigation Measure 4.4-6a* *The following performance standard shall be added to the OCMP:* *Performance Standard 4.5-8: Flood protection upgrades shall be completed in the vicinity of the mining and processing areas, if necessary, to ensure protection from the 100-year flood event. Flood protection shall be provided from flooding associated with overtopping of the alluvial separators or levees along Cache Creek and all tributaries and drainage channels (including, but not limited to, Willow Slough and Lamb Valley Slough).*	Prior to Mining	Planning	Submittal of Mining and Reclamation Application	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	The flood protection upgrades shall be designed and constructed to provide the necessary 100-year protection without exacerbating downstream flooding problems. Downstream flooding could be increased if floodplain storage areas were removed from the drainage system by constructing levees in areas where they did not exist before (or raising levees that are overtopped in floods up to the 100-year event). Alternative flood management design systems (potentially using detention basins, infiltration galleries, and/or floodplain storage in noncritical areas) shall be required as a condition of project approval. *The following performance standard shall be added to the OCMP:* *Performance Standard 4.5-9: The County Floodplain Administrator shall file for a Letter of Map Revision with FEMA, to update the FIRMs affected by channel maintenance activities and levee improvements with the planning area every ten years.*	Every 10 Years	Planning and FEMA	Submittal of Letter of Map Revision	Incorporate into OCMP	
Impact 4.4-7: Potential Impacts from Flooding Related to Dam Failure	*None required.*					
Impact 4.4-8: Potential Impacts Associated with Inundation of Dry Pits or Lowered Reclaimed Surfaces by High Groundwater Conditions	*Mitigation Measure 4.4-8a* *The following performance standard shall be added to the OCMP and associated ordinance:* *Performance Standard 3.5-16: The final distance between reclaimed lowered surfaces and average high groundwater shall not be less than five feet. The average high groundwater level shall be established for each proposed mining area. The degree of groundwater level fluctuation varies with location throughout the basin and within relatively small areas (proposed mining sites). The determination of average high groundwater level shall be conducted by a professional engineer or certified hydrogeologist and shall be based on wet season water level elevation data collected at the proposed site or adjacent areas with similar hydrogeological conditions. Water level records prior to 1977 shall not be used since they would reflect conditions prior to installation of the Indian Valley Dam. The dam caused a significant change in hydrology of the basin and data collected before its installation shall not be used in estimation current average high groundwater levels. The wells shall be adequately distributed throughout the proposed mining site to reflect spatial variation in groundwater levels and fluctuations.*	Prior to Mining and Post Reclamation	Planning	Submittal of Mining and Reclamation Application	Require as Permit Condition	
Agriculture						

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Impact 4.5-1: Consistency with the California Land Conservation Act of 1965 (Williamson Act) Regulations	*None required.*					
Impact 4.5-2: Potential Impact of Permanent Loss of Agricultural Land Caused by Conversion of Agricultural Land to Other Post-Reclamation Uses	*Mitigation Measure 4.5-2a* *The following performance standards shall be included in OCMP:* *Performance Standard 4.5-8: All proposed mining and reclamation plans shall provide information in permit applications to allow identification of portions of the proposed mined lands that meet the definition of "prime farmlands" as defined under the Williamson Act.* *Performance Standard 4.5-9: All mining permit applications that include "prime farmlands" as defined by the provisions of the Williamson Act shall identify the location and acreage of "prime farmlands" which, as a result of reclamation, would be permanently converted to non-agricultural uses. For each acre of "prime farmland" that would be converted to non-agricultural use, the reclamation plan shall present provisions to offset (at a 1:1 ratio) the conversion of these lands. The potential offsets can include, but not be limited to one or more of the following options:* • *Identification of improvements by a qualified soil scientist to the agricultural capability of non-prime lands within or outside the project site that convert non-prime to prime agricultural conditions. These improvements can include permanent improvement of soil capability though soil amendments, reduction of soil limitations (such as excessive levels of toxins), or improvements in drainage for areas limited by flooding or low permeability soils.* • *Placement of Agricultural Preserve easements on lands meeting Williamson Act definition of "prime farmland".* • *Demonstration of the ability to provide irrigation to non-prime lands limited only by lack of irrigation water supply. The identified water supply cannot be made at the expense of "prime farmlands" currently using the same water supply.*	Prior to Mining Prior to Mining	Planning Planning	Submittal of Mining and Reclamation Application Submittal of Mining and Reclamation Application	Require as Permit Condition Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Impact 4.5-3: Potential Impacts of the Temporary Loss of Agricultural Productivity Due to Disturbance by Mining	*Mitigation Measure 4.5-3a* *The following performance standard shall be added to OCMP:* *Performance Standard 5.5-3: All proposed mining and reclamation plans shall present a phasing plan for mining and reclamation activities. The phasing plan shall be structured to minimize the area of disturbed agricultural lands during each mining phase, and encourage the early completion of reclamation of agricultural land.*	Prior to Mining	Planning	Submittal of Phasing Plan	Require as Permit Condition	
Impact 4.5-4: Permanent Loss of Agricultural Soils Due to Wind or Water Erosion	*Mitigation Measure 4.5-4a* *OCMP Action 5.5-2 shall be amended as follows :* *Action 5.5-2: Topsoil, subsoil, and subgrade materials in stockpiles shall not exceed (40) feet in height, with slopes no steeper than 2:1 (horizontal:vertical). Stockpiles, other than aggregate stockpiles, shall be seeded with a vegetative cover to prevent erosion and leaching. The use of topsoil for purposes other than reclamation shall not be allowed without the prior approval of the Yolo County Community Development Director.*	Ongoing	Planning	Submittal of Mining and Reclamation Application	Require as Permit Condition	
Impact 4.5-5: Potential Impacts on Agricultural Capability Caused by Soil Management During Removal, Stockpiling, and Reuse	*None required.*					
Impact 4.5-6: Potential Impacts on Agricultural Production Related to Lowered Reclaimed Surfaces	*Mitigation Measure 4.5-6a* *The OCMP and implementing ordinances shall be augmented with the following standard:* *Performance Standard 5.5-5: Reclaimed agricultural surfaces shall be graded to provide adequate field gradients to allow surface/furrow irrigation of crops and allow for adequate storm water drainage.*	Post-Reclamation	Planning	Submittal of Mining and Reclamation Application	Require as Permit Condition	
Impact 4.5-7: Potential Cumulative Loss of Productive Agricultural Land Within Yolo County	*Mitigation Measure 4.5-7a* *Implementation of Mitigation Measure 4.5-2a would reduce the cumulative impact of permanent conversion of agricultural land to non-agricultural uses but not to a less-than-significant level.*	See Mitigation Measure 4.5-2a				

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Biological Resources						
Impact 4.6-1: Impact on Existing Vegetative Cover	*None required.*					
Impact 4.6-2: Impact on Sensitive Natural Community Types	*Mitigation Measure 4.6-2a* *Section 10-4.502(b)(1) of the Off-Channel Surface Mining Ordinance shall be revised as follows:* *...The analysis shall propose appropriate measures to reduce any potential adverse impacts to species of concern, sensitive natural communities, or significant habitat.*	Prior to Mining	Planning	Submittal of Mining and Reclamation Application	Require as Permit Condition	
	The following revisions shall be made to Performance Standard 6.5-2 of the OCMP: *6.5-2. Avoid disturbance of riparian vegetation, including identified off-channel vegetation. Replacement habitat shall be established where complete avoidance is not possible according to a habitat restoration plan prepared by a qualified biologist, consistent with the goals of this plan.*	Ongoing	Planning	Submittal of Habitat Restoration Plan	Require as Permit Condition	
	The following shall be included as an additional performance standard in Chapter 6 of the OCMP: *6.4-12. Avoid disturbance of oak woodland vegetation and mature oaks Replacement habitat and plantings shall be established where complete avoidance is not possible according to a habitat restoration plan prepared by a qualified biologist, consistent with the goals of this plan.*	Ongoing	Planning	Submittal of Habitat Restoration Plan	Require as Permit Condition	
Impact 4.6-3: Disturbance to Wildlife Habitat and Disruption of Movement Corridors	*Mitigation Measure 4.6-3a* *The following shall be incorporated as an additional action policy in Chapter 6 of the OCMP:* *6.4-13. Where fence row or field margin habitat previously existed, reestablish similar habitat as part of reclamation to agricultural use to replace and improve the wildlife habitat value of agricultural lands, allowing for reestablishment of scattered native trees, shrubs, and ground covers along the margins of reclaimed fields. Reestablished habitat can be in locations other than where occurred originally. Restoration plans shall specify ultimate fence row or field margin locations, identify planting densities for trees and shrubs, and include provisions for monitoring and maintenance to ensure establishment.*	During Reclamation	Planning	Submittal of Habitat Restoration Plan	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	The following shall be incorporated as an additional action policy in Chapters 6 and 7 of the OCMP: *6.4-14 and 7.4-9. Avoid disturbance to important wildlife habitat features such as nest trees, colonial breeding locations, elderberry host plants for VELB, and essential cover associated with riparian forest and oak woodland habitat. This shall include sensitive siting of haul roads, trails, and recreational facilities away from these features.*	Ongoing	Planning	Submittal of Mining and Reclamation Application	Require as Permit Condition	
Impact 4.6-4: Impact on Special-Status Species	*Mitigation Measure 4.6-4a* *The following shall be included as additional action policies in Chapter 6 of the OCMP:* *6.4-15. Essential habitat for special-status species shall be protected and enhanced, or replaced as part of mitigation plans prepared by a qualified biologist.*	Ongoing	Planning	Submittal of Habitat Restoration or Mitigation Plan	Require as Permit Condition	
	6.4-16. Restoration components of reclamation plans shall include provisions to enhance habitat for special-status species, where feasible. *Performance Standard 6.5-3 of the OCMP shall be replaced with the following:*	Prior to Mining	Planning	Submittal of Habitat Restoration or Mitigation Plan	Require as Permit Condition	
	6.5-3. Slopes on stockpiled soils shall be graded to 2:1 for long-term storage to prevent use by bank swallows. At no time during the active breeding season (1 May through 31 July) shall slopes on stockpiles exceed 1:1, even on a temporary basis. Stockpiles shall be graded to a minimum 1:1 slope at the end of each work day where stockpiles have been disturbed during the active breeding season. *Performance Standard 6.5-7 of the OCMP shall be revised as follows:*	Ongoing	Planning	Submittal of Mining and Reclamation Plan	Require as Permit Condition	
	6.5-7. Proposed habitat restoration or mitigation plans shall be sent to the California Department of Fish and Game, U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers for review and comment to ensure that the projects do not conflict with other existing habitat enhancement efforts.	Prior to Mining	Planning	Submittal of Habitat Restoration Plan	Incorporate into OCMP	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	Performance Standard 6.5-8 of the OCMP shall be revised as follows: *6.5-8 All surface mining operations and reclamation plans shall complement the preservation and enhancement measures in the Yolo County Habitat Conservation Plan. Mining operators with lands designated as having a moderate to high potential for use as mitigation areas in the HCP shall be encouraged to participate in the Developer HCP Participation Options, including use of lands as mitigation sites.*	Prior to Mining	Planning	Submittal of Habitat Restoration or Mitigation Plan	Require as Permit Condition	
Impact 4.6-5: Modifications to Jurisdictional Wetlands or Other Waters	*Mitigation Measure 4.6-5a* *The following shall be included as an additional action policy in Chapter 6 of the OCMP:* *6.4-14. Existing jurisdictional wetlands shall be retained to the extent possible. Replacement wetlands shall be provided where complete avoidance is not possible according to a habitat restoration plan prepared by a qualified wetland specialist and approved by jurisdictional agencies, ensuring no net loss of wetland acreage or habitat value.* *Performance Standard 6.5-7 of the OCMP shall be revised as recommended in Mitigation Measure 4.6-4a.*	Prior to Mining	Planning, CDFG, USFWS, Corps	Submittal of Habitat Restoration Plan	Require as Permit Condition	
Impact 4.6-6: Compatibility and Consistency of Restoration Provisions	*Mitigation Measure 4.6-6a* *Action Policy 6.4-2 of the OCMP shall be revised as follows:* *6.4-2. Coordinate with the California Department of Fish and Game, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers to ensure that proposed habitat restoration projects are consistent with or complement the Off-Channel Mining Plan.* *Performance Standard 6.4-10 of the OCMP shall be revised as follows:* *6.4-10. Restore riparian habitat throughout the planning area, wherever appropriate. However, revegetative efforts shall be primarily focussed on implementing recommendations described in the Technical Studies and the subsequent Restoration Recommendations incorporated into the CCRMP.*	Prior to Mining During Reclamation	Planning Planning	Submittal of Habitat Restoration Plan Adoption of OCMP	Incorporate into OCMP Incorporate into OCMP	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	Performance Standard 6.5-9 of the OCMP shall be revised as follows: *6.5-9. If any wet pit is proposed to be reclaimed for recreational uses and/or riparian habitat, the design shall account for fluctuations in the groundwater table.* *Performance Standard 6.5-7 of the OCMP shall be revised as recommended in Mitigation Measure 4.6-4a.*	Prior to Mining See Mitigation Measure 4.6-4a	Planning	Submittal of Habitat Restoration Plan	Require as Permit Condition	
Air Quality						
Impact 4.7-1: Potential Emissions of PM_{10}	*Mitigation Measure 4.7-1a* *The following performance standard shall be added to the OCMP:* *Wherever practical and economically feasible, portable or movable conveyor systems shall be used to transport raw materials and overburden.*	Prior to Mining	Planning	Submittal of Mining and Reclamation Plan	Require as Permit Condition	
Impact 4.7-2: Potential Emissions of Ozone Precursors (ROG and NO_X)	*Mitigation Measure 4.7-2a* *The following performance standard shall be added to the OCMP:* *Wherever practical and economically feasible, portable or movable conveyor systems shall be used to transport raw materials and overburden.* *OCMP Performance Standard 2.5-7 and proposed Off-Channel Surface Mining Ordinance Section 10.4.11 shall be amended as follows:* *All internal combustion engine driven equipment and vehicles shall be kept tuned according to the manufacturer's specifications and properly maintained to minimize the leakage of oils and fuels. No vehicles or equipment shall be left idling longer than 10 minutes.*	See Mitigation Measure 4.7-1a Ongoing	Applicant	Compliance with Manufacturer's Specifications and Proper Maintenance	Require as Permit Condition	
Impact 4.7-3: Cumulative Effects on Attainment of State and Federal Standards	*Mitigation Measure 4.7-3b* *No enforceable mitigation measures are available.*	None available				
Impact 4.7-4: Potential Impacts on Sensitive Receptors	*None required.*					

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Traffic and Circulation						
Impact 4.8-1: Potential Increase in Trips Associated with Recycling	*None required.*					
Impact 4.8-2 Potential for Increase in Vehicle Trips	*Mitigation Measure 4.8-2a* *Performance Standard 2.5-5 of the OCMP and Section 10-4.407 of the Off-Channel Surface Mining Ordinance shall be amended as follows:* *As a condition of approval, the operator shall agree to assume joint pavement maintenance responsibility with the County (or shared with another producer using the same roadway) for all County roads along a designated haul route from the access point of the surface mining operation to the nearest State Highway. The operator shall agree to submit an evaluation of the structural integrity of the identified roadways on or before December 1 of each year in which mining operations are permitted. The report shall be prepared by a registered professional engineer and/or Country staff with expertise in the area of roadway pavement and shall be subject to the approval of the Public Works Department. Based on the results of this annual evaluation, the Public Works Department shall identify the improvements required to maintain safe and efficient traffic operations on the road for the upcoming year. The County agrees to implement maintenance improvements similar to other County roads (i.e., fill cracks and chip seal). The operator agrees to implement the improvements beyond the typical County improvements in a timeframe set forth by the Public Works Department. The operator does not assume the liability for the roadway, except for cases where the operator has not fulfilled its maintenance obligations.* *If a subsequent mining operation utilizes a road previously required to be improved pursuant to this subsection, then the subsequent operator shall be responsible for compliance with the agreements and requirements of the previous operator.*	Annually during Mining	Public Works	Submittal of Roadway Evaluation	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Impact 4.8-3: Potential Change in LOS at the State Route 16 / Road 98 / Main Street Intersection	*Mitigation Measure 4.8-3a:* *The following performance standard shall be added to the OCMP and its implementing ordinance:* *Each operator shall pay its fair share toward improvements required to maintain LOS C operations on County roads or LOS D operations on State Highways within the OCMP planning area. Fair share mitigation shall also be required to improve existing operational deficiencies of the transportation system. Specific locations shall be identified through the project-specific environmental review process for each operator's long-term mining permit application. Each operator shall participate in a funding program operated by Yolo County which is designed to ensure that all improvements are made in a timely manner and that a reimbursement mechanism is in place to ensure repayment of any costs contributed in excess of fair share amounts. The program shall be initiated upon the approval of the long-term mining permits and shall be updated biennially by Yolo County to ensure any new or modified impacts or funding sources are being addressed.* *Each operator shall have the option to complete the work at their expense without triggering the competitive bid process, as long as they comply with the applicable legal requirements of the County. If the operator declines the option, the County shall utilize the competitive bid process.*	Biannually upon Approval of Mining	Public Works	Participation in Funding Program	Require as Permit Condition	
Impact 4.8-4: Potential Change in LOS at the State Route 16 / Road 89 Intersection	*Mitigation Measure 4.8-4a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 3, 5b and 6.*	See Mitigation Measure 4.8-3a				
Impact 4.8-5: Potential Impacts to the Non-Standard Segment of Road 19, West of Interstate 505	*Mitigation Measure 4.8-5a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	See Mitigation Measure 4.8-3a				
Impact 4.8-6: Potential Impacts to the Non-Standard Segment of State Route 16 Between I-505 and the Entrance to the Solano Concrete Plant	*Mitigation Measure 4.8-6a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 3, 5b and 6.*	See Mitigation Measure 4.8-3a				

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Impact 4.8-7: Potential Impacts to the Non-Standard Segment of Road 14, West of Interstate 505	*Mitigation Measure 4.8-7a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	See Mitigation Measure 4.8-3a				
Impact 4.8-8: Potential Impacts to the Non-Standard Pavement Segment of Road 14, West of Interstate 505	*Mitigation Measure 4.8-8a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	See Mitigation Measure 4.8-3a				
Impact 4.8-9: Potential Impacts to Two Non-Standard Bridges on Road 89, North of State Route 16	*Mitigation Measure 4.8-9a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 3, 5b and 6.*	See Mitigation Measure 4.8-3a				
Impact 4.8-10: Potential Impacts to a Non-Standard Bridge on Road 19, West of Interstate 505	*Mitigation Measure 4.8-10a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	See Mitigation Measure 4.8-3a				
Impact 4.8-11: Potential Impacts to a Non-Standard Bridge on Road 85, North of Road 16A	*Mitigation Measure 4.8-11a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	See Mitigation Measure 4.8-3a				
Impact 4.8-12: Potential Impacts to a Non-Standard Bridge on Road 14, West of Interstate 505	*Mitigation Measure 4.8-12a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 4, 5a, 5b and 6.*	See Mitigation Measure 4.8-3a				
Impact 4.8-13: Potential Impacts to the Non-Standard Curve Radii at the Road 85 / Road 14 Intersection	*Mitigation Measure 4.8-13a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 5a, 5b and 6.*	See Mitigation Measure 4.8-3a				
Impact 4.8-14: Potential Impacts to the Non-Standard Curve Radii at the State Route 16 / Road 89 Intersection	*Mitigation Measure 4.8-14a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 3, 5b and 6.*	See Mitigation Measure 4.8-3a				

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Impact 4.8-15: Potential Impacts to the Non-Standard Curve Radii at the Road 20 / Road 96 Intersection	*Mitigation Measure 4.8-15a* *Implementation of Mitigation Measure 4.8-3a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 3, 5b and 6.*	See Mitigation Measure 4.8-3a				
Impact 4.8-16: Potential for Accelerated Pavement Deterioration	*Mitigation Measure 4.8-16a* *Implementation of Mitigation Measure 4.8-2a would reduce this impact to a less-than-significant level for the OCMP and Alternatives 1a, 3, 4, 5a, 5b and 6.*	See Mitigation Measure 4.8-2a				
Noise						
Impact 4.9-1: Exposure to Unacceptable Noise Levels from Mining, Processing, Hauling, Reclamation, and Post-Reclamation Activities On Site	*Mitigation Measure 4.9-1a* *The performance standards in the Off-Channel Surface Mining Ordinance (Section 10-4.418) shall be modified so that the residential noise limit is a CNEL of 60 dB rather than the currently specified L_{eq} of 60 dB. This change shall also be made in the Off-Channel Mining Plan.* *Mitigation Measure 4.9-1b* *From 6:00 a.m. to 6:00 p.m., noise levels shall not exceed an average noise level equivalent (L_{eq}) of eighty (80) decibels (dBA) measured at the property boundaries of the site. However, noise levels may not exceed an average noise level equivalent (L_{eq}) of sixty (60) decibels for any nearby off-site residences or other noise-sensitive land uses.* *From 6:00 p.m. to 6:00 a.m., noise levels shall not exceed an average noise level equivalent (L_{eq}) of sixty-five (65) decibels (dBA) measured at the property boundaries of the site.* *Noise levels shall not exceed a community noise equivalent level (CNEL) of sixty (60) decibels (dBA) for any nearby off-site residence or other noise-sensitive land uses.*	Prior to Mining Prior to Mining	Planning Planning	Adoption of OCMP and Ordinances Submittal of Acoustical Analysis	Incorporate into OCMP Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
	Mitigation Measure 4.9-1c *The following Performance Standard shall be added to the OCMP:* *Mining activities shall not exceed the noise limit of CNEL 60 dB at existing residences. An existing residence shall be considered the property line of any residentially zoned area or, in the case of agricultural land, any occupied residential structures. Achieving the noise standards could involve setbacks as proposed in the Off-Channel Surface Mining Ordinance (Section 10.4.425), the use of quieter equipment adjacent to residences, or the construction of landscaped berms between mining activities and residences.*	During Mining	Planning	Submittal of Acoustical Analysis	Require as Permit Condition	
Impact 4.9-2: Exposure to Unacceptable Increases in Noise Generated by Off-Site Truck Traffic	*None required.*					
Impact 4.9-3: Contribution to Increase in Cumulative Noise	*Mitigation Measure 4.9-3a* *The following performance standard shall be added to the OCMP and its implementing ordinances:* *Operators shall provide acoustical analysis for future truck and traffic noise associated with the individual operations along County roadways identified as experiencing significant impacts due to increased traffic noise. The study shall identify noise levels at adjacent noise-sensitive receptors and ways to control the noise to the "normally acceptable" goal of a CNEL of 60 dB and reduce the increase over existing conditions to 5 dB or less. Typical measures that can be employed include construction of noise barriers (wood or masonry), earthen berms, or re-routing of truck traffic.*	Prior to Mining	Planning	Submittal of Acoustical Analysis	Require as Permit Condition	
Impact 4.9-4: Generation of Vibration or Nuisance Noise	*Mitigation Measure 4.9-4a* *The following performance standard shall be added to the OCMP:* *If mining occurs within 1500 feet of residences, equipment used during nighttime activities shall be equipped with non-sonic warning devices consistent with OSHA regulations, which may include fencing of the area to avoid pedestrian traffic, adequate lighting of the area, and placing an observer in clear view of the equipment operator to direct backing operations. Prior to commencement of operations without sonic warning devices, operators shall file a variance request with the Cal OSHA Standards Board showing that the proposed operation would provide equivalent safety to adopted safety procedures, including sonic devices.*	During Mining	Planning and CalOSHA Standards Board	Adoption of Safety Procedures or Submittal of Variance Request	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Aesthetics						
Impact 4.10-1: Effects on Existing Views or Vistas During Mining	*Mitigation Measure 4.10-1a* *In conjunction with the environmental review of individual projects permitted under the OCMP, means of minimizing the visibility of mining operations, facilities and landform alterations from public viewpoints shall be assessed based on site-specific visual characteristics and viewing conditions. The use of berms, vegetative screens, seeding, special plant materials and contouring the sides and top surfaces of modified landforms, or other measures, shall be incorporated into the individual mine and reclamation plans as appropriate.* *Mitigation Measure 4.10-1b* *Where mining occurs within 1,000 feet of a public right-of-way, the operators shall phase mining such that no more than 50 acres of the area that lies within 1,000 feet of the right-of-way would be actively disturbed at any time except where operations are adequately screened from public view. Where adequate screening exists in the form of mature vegetation and/or constructed berms that effectively block public view, the area of active disturbance within 1,000 feet of the right-of-way shall not exceed the area that is screened by more than 50 acres at any time. Actively disturbed areas are defined as those on which mining operations of any kind, or the implementation of reclamation such as grading, seeding or installation of plant material are taking place.*	During Mining During Mining	Planning Planning	Submittal of Mining and Reclamation Application Submittal of Phasing Plan	Require as Permit Condition Require as Permit Condition	
Impact 4.10-2: Effects on Views or Vistas Following Reclamation	*Mitigation Measure 4.10-2a* *None required. However, the following condition would further reduce impacts:* *In conjunction with the environmental review of individual projects permitted under the OCMP, further means of improving the appearance of the landscape after reclamation shall be assessed based on site-specific visual characteristics, site lines and view corridors. The use and placement of berms, vegetative screens, special plant materials, grading slopes and contouring the sides and top surfaces of modified landforms to mimic surrounding landforms, or other measures, shall be incorporated into the mine reclamation plans as appropriate.*	Prior to Mining	Planning	Submittal of Mining and Reclamation Application	Require as Permit Condition	
Impact 4.10-3: Potential for Visual Incompatibility with Surrounding Land Uses	*None required.*					

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Impact 4.10-4: Introduction of Light and Glare	*None required.*					
Impact 4.10-5: Consistency with Yolo County General Plan Policies	*None required.*					
Issue 4.10-6: Contribution to Cumulative Visual Impacts	*None required.*					
Cultural Resources						
Impact 4.11-1: Potential Impacts to Cultural Resources	*Mitigation Measure 4.11-1a* *The following performance standard shall be added to the OCMP:*					
	All resource records shall be checked for the presence of and the potential for prehistoric and historic sites. Damaging effects on cultural resources shall be avoided whenever possible. If avoidance is not feasible, the importance of the site shall be evaluated by a qualified professional prior to commencement of mining operations. If a cultural resource is determined not to be important, both the resource and the effect on it shall be reported to the County, and the resource need not be considered further. If avoidance of an important cultural resource is not feasible, a mitigation plan shall be prepared and implemented. The mitigation plan shall explain the importance of the resource, describe the proposed approach to mitigate destruction or damage to the site, and demonstrate how the proposed mitigation would serve the public interest.	Prior to Mining	Planning	Submittal of Mitigation Plan	Require as Permit Condition	
	In addition, Performance Standard 2.5-3 of the OCMP shall be modified as follows: *If human skeletal remains are encountered during excavation, all work within seventy-five (75) feet shall immediately stop, and the County Coroner shall be notified within twenty-four (24) hours. If remains are of Native American origin, the appropriate Native American community identified by the Native American Heritage Commission shall be contacted, and an agreement for treating or disposing of, with appropriate dignity, the remains and associated grave goods shall be developed. If any cultural resources such as chipped or ground stone, historical debris, building foundations, or paleontological materials are encountered during excavation, then all work within seventy-five (75) feet shall immediately stop and the Director shall be notified at once. Any cultural resources found on the site shall be recorded by a qualified archaeologist and the information shall be submitted to the County.*	During Mining	Applicant and County Coroner	Adoption of OCMP	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Hazards						
Impact 4.12-1: Potential Human Health And/Or Environmental Impacts from the Accidental Release of Petroleum Products and Other Chemicals Used During Mining and Reclamation And/Or at Processing Plants	*Mitigation Measure 4.12-1a* *Goal 2.2-4 shall be revised as follows:* *Eliminate or minimize hazards to the public health and safety that are associated with surface mining operations and reclamation.*	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	
	Objective 2.3-3 shall be revised as follows: *Provide standards and procedures for regulating surface mining operations and reclamation so that hazards are eliminated or minimized and potential adverse environmental effects are reduced or prevented.*	Prior to Mining	Planning	Adoption of OCMP	Incorporate into OCMP	
	Action 2.4-2 shall be revised as follows: *Hazardous materials business plans must be submitted biannually as required by the Health and Safety Code, unless the types of hazardous materials used change, in which case revised business plans must be submitted within 30 days of the change.*	Biannually During Mining	Planning	Submittal of Materials Business Plan	Require as Permit Condition	
	The following performance standard shall be added to the Aggregate Resources Element of the OCMP: *PS 4.5-9: Fueling and maintenance activities of heavy equipment (except draglines and floating suction dredges) are prohibited within 100 feet of open bodies of water during mining and reclamation. All Storm Water Pollution Prevention Plans shall include provisions for releases of fuels during fueling activities for draglines and floating suction dredges.*	During Mining and Reclamation	Planning	Submittal of SWPPP	Require as Permit Condition	
	Objective 3.3-3 and Action 3.4-3 shall be revised as follows: *Objective 3.3-3: Ensure that off-channel surface mines are operated such that surface and groundwater supplies are not adversely affected by erosion, lowering of the water table, and/or contamination during mining and reclamation.*	During Mining and Reclamation	Planning	Submittal of Groundwater Monitoring Program	Require as Permit Condition	
	Action 3.4-3: Include a groundwater monitoring program as a condition of approval for any surface mining and reclamation operation that proposes off-channel excavations that extend below the groundwater level. The monitoring program shall require regular groundwater level data, as well as a water quality monitoring program based on a set of developed standards.	During Mining and Reclamation	Planning	Submittal of Groundwater Monitoring Program	Require as Permit Condition	

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Impact 4.12-2: Historic Pesticide Use May Affect the Health and Safety of Workers Engaged in Mining or Reclamation Activities	*None required.*					
Impact 4.12-3: Steep Pit Slopes May Present a Drowning Hazard to the Public	*Mitigation Measure 4.12-3a* *Goals 2.2-4 and 2.3-3 shall be revised to include references to reclamation. Refer to Mitigation Measure 4.12-1a.* *Performance Standards 2.5-4, 2.5-16, and 2.5-18 shall be revised as required by Mitigation Measure 4.3-2a to require that slopes shall not be steeper than 2:1 five feet below the average summer low groundwater level.* *Performance Standard 2.5-8 shall be revised to include signage and fencing requirements during and after reclamation. These changes have been included in Mitigation Measure 4.4-2a in the Hydrology section.*	 See Mitigation Measure 4.12-1a See Mitigation Measure 4.3-2a See Mitigation Measure 4.4-2a				
Impact 4.12-4: Open Bodies of Water May Become Breeding Areas for Mosquitoes. An Increase in the Mosquito Population Could Adversely Affect the Public Health	*None required.*					

OCMP MITIGATION MONITORING PLAN						
Environmental Impact	**Mitigation Measures**	**Reporting/ Monitoring Requirement**	**Responsibility for Compliance**	**Method for Compliance**	**Enforcement**	**Checkoff Date/Initials**
Public Services and Utilities						
Impact 4.13-1: Potential for Long-Term Impacts to Open Space and Recreational Opportunities in the Lower Cache Creek Area	*None required.*					
Impact 4.13-2: Potential Increase in Demand for Public Services	*Mitigation Measure 4.13-2a* *None required; however, the following is recommended:* *The County shall identify the costs of implementing the policies contained in the OCMP, and determine a fair-share cost program for reimbursement by gravel operators and any other affected parties.*	Prior to Mining	Planning	Preparation of Fair-Share Cost Program	Incorporate into OCMP	

APPENDIX C
OFF-CHANNEL GRAVEL PIT LAKES -- MERCURY CONSIDERATIONS

OFF-CHANNEL GRAVEL PIT LAKES -- MERCURY CONSIDERATIONS

LOWER CACHE CREEK, YOLO COUNTY, CALIFORNIA

Preliminary Study, April 1996

prepared for

Yolo County, California

Study and Report by

Darell G. Slotton, Ph.D.
Shaun M. Ayers
John E. Reuter, Ph.D.

1624 Pacific Drive
Davis, California 95616
(916) 756-1001 dgslotton@ucdavis.edu

May 2, 1996

EXECUTIVE SUMMARY

Conditions of environmental mercury were investigated at existing off-channel gravel pit lakes near Cache Creek in Yolo County. Bottom sediments, water, aquatic invertebrates, and fishes were sampled for mercury levels at the existing lakes and in adjacent Cache Creek, to provide some indication of likely mercury conditions in proposed additional off-channel gravel pit lakes. Water concentrations of mercury at the time of this April 1996 sampling (2-4 ng/L) were lower and less variable than corresponding levels from adjacent Cache Creek, and were well below the water quality criterion for mercury (12 ng/L). Bottom sediments were somewhat elevated at 0.2-1.0 ppm, though this is typical for the region and is far lower than levels seen in highly contaminated sites. Fish collected from the existing gravel pit lakes were of some concern, in that they approached and in some cases even surpassed the 0.5 ppm consumption guideline for fish mercury. However, these fish muscle mercury concentrations were very similar to concentrations found in corresponding samples from adjacent Cache Creek. Similar levels are also routinely found from many locations throughout the mercury contaminated regions of northern California.

It is not clear at this point whether the existing pit lakes at Solano Gravel become anoxic in the bottom waters during the summer. We recommend that this be investigated. Even if the current lakes do not experience seasonal anoxia at this time, the potential exists for new lakes and older lakes to become seasonally anoxic. This could result if they are either considerably deeper or more organic rich than the lakes tested. If seasonal bottom anoxia occurred, the possibility would exist for methyl mercury production and subsequent transfer of mercury into fish to be enhanced. Additionally, there may be an initial (2-3 year) surge in mercury bioavailability and uptake in newly formed lakes, associated with the flooding of formerly terrestrial soils and associated organic material. The likelihood, though, of mercury bioavailability--in off-channel gravel pit lakes of any configuration along lower Cache Creek--increasing to levels as high as those seen in Davis Creek Reservoir is not supported by the findings of this study of the existing lakes. Sediment bulk mercury levels are considerably lower than in highly contaminated sites and the water quality in the proposed systems may not be readily conducive to anoxia. However, because the potential clearly exists for fish mercury to accumulate to health guideline levels and above, we strongly recommend that the issue of environmental mercury be monitored closely in conjunction with future operations.

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1. INTRODUCTION

In April 1996, our mercury biogeochemistry research group was approached by Yolo County and asked to provide input regarding the mercury related aspects of the currently proposed off-channel gravel mining operations near Cache Creek in Yolo County. The proposed expanded gravel operations will involve the formation of a number of fairly deep lakes adjacent to Cache Creek throughout the region between Woodland and Capay. Concerns have been raised as to the potential for the resulting mining pit lakes to provide an environment in which mercury could conceivably become a problem, from a human health and environmental perspective. As Yolo County is known to naturally contain high levels of mercury in some areas, including the Cache Creek watershed, this concern was not unfounded. It is clear from our extensive work in the region that, under certain specific conditions, the naturally elevated levels of mercury in portions of the County may be readily transformed into the mercury species that has been demonstrated throughout the scientific literature to move into aquatic foodchains and result in unacceptably high mercury levels in edible fish. This mercury fraction is methyl mercury, an organic species.

Methyl mercury is produced as a biproduct of a select group of microorganisms, including sulfur reducing bacteria. Under conditions where an excess of inorganic mercury is present, together with a stable population of the key microorganisms, and the conditions to support them, methyl mercury can be produced at levels sufficient to raise the mercury levels in edible fish tissue above concentrations which have been deemed safe for consumption by health agencies.

The approach taken in this short-term, preliminary study was to investigate the mercury conditions present in the most analagous off-channel, gravel pit lakes already in existence in Yolo County, i.e.--the two pit lakes present at Solano Gravel, north of Highway 16 and just east of Highway 505. These lakes were developed approximately 8 years ago and are moderately deep (~40 ft, Fig. 1), similar to many of the proposed gravel lakes. According to Solano Gravel employees, the lakes were stocked with fish early in their development. Our survey found a variety of sizes and ages, consistent with a well established population. Fish collected in 1996 obtained all or the great majority of their accumulated mercury from the lake environments and can thus be effectively utilized as biological monitors of existing mercury availability.

Our plan for this preliminary study included the examination of mercury levels in fish of the existing gravel pit lakes, together with aquatic invertebrates, bottom sediments, and water. These can be compared to corresponding levels in the adjacent Cache Creek, as well as levels in other water bodies in the County and in northern California in general. The initial plan was to focus on the North Lake, which was believed to be deeper. When fish collections proved difficult at this time in the North Lake, we extended the work into the adjacent South Lake, where fish were more populous and could be sampled effectively in a range of species and sizes.

The sampling sites utilized for this project at the Solano Gravel property are shown in Figure 1. We estimated depth contours of the existing lakes with the use of sonar. Comparative fish samples from Cache Creek were collected in October 1995 from lower Cache Creek between Road 102 and Highway 5.

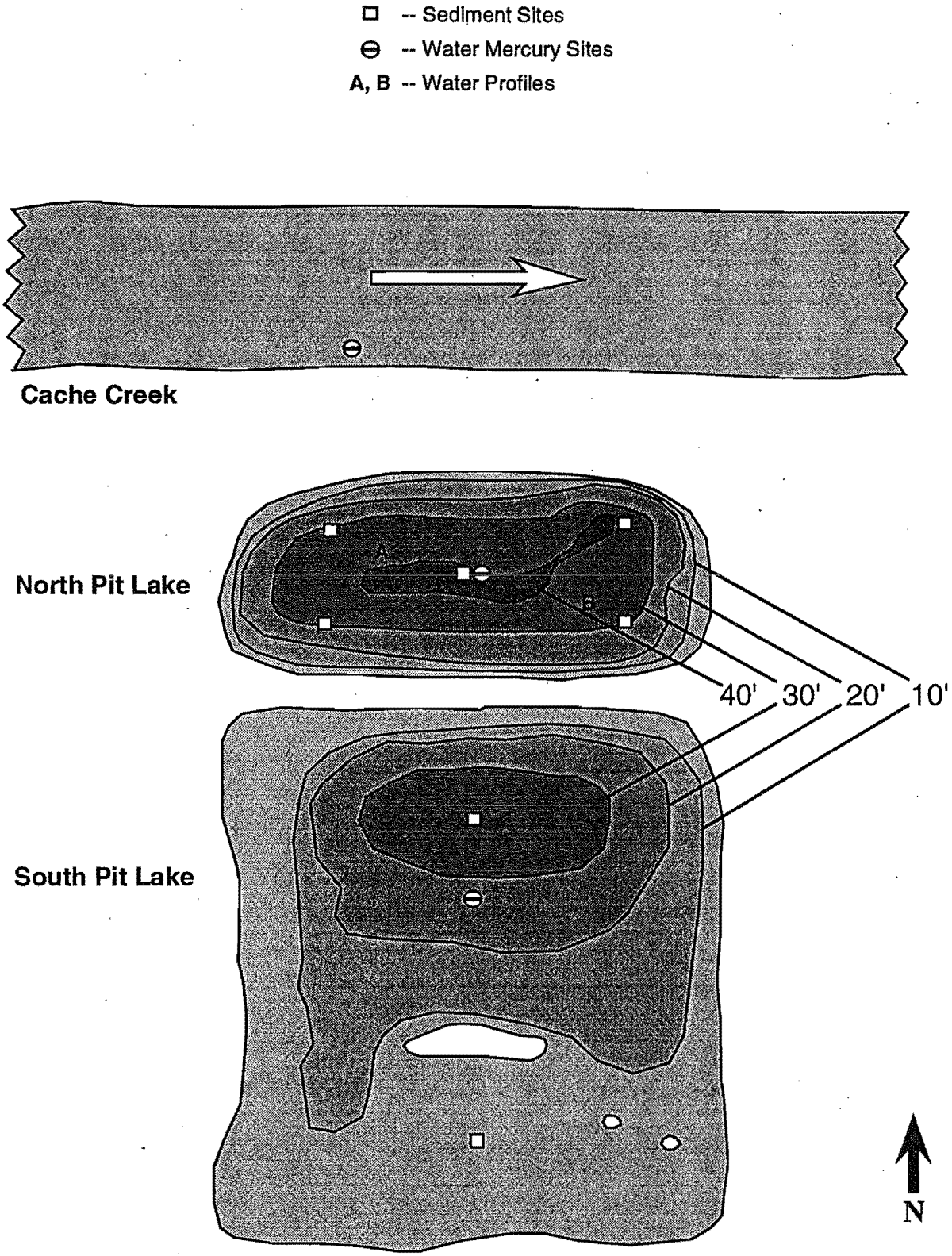
Table 1 summarizes the mercury analytical samples collected for this preliminary project. Aqueous mercury samples were taken on 4 different dates from the pit lakes, together with 4 corresponding samples from the adjacent creek. Each sample was fractionated into filtered (< 0.2 μm) and raw portions, each of which were analyzed for total mercury. In addition, methyl mercury was analyzed in all of the raw water samples and 6 of the 8 filtered samples. Total mercury was analyzed in 39 individual biotic and sediment samples, including 24 individual fish analyzed for muscle mercury from the Solano Gravel pit lakes. Additional analytical samples for the project included suspended solids samples from all 8 water collections, and moisture and organic percentage analyses in the 7 bottom sediment samples.

Table 1. Summary of all Samples Analyzed for Mercury in This Project

	Pit Lakes	Cache Creek
Aqueous Total Mercury (Raw Water):	4	4
Aqueous Total Mercury (Filtered Water):	4	4
Aqueous Methyl Mercury (Raw Water):	4	4
Aqueous Methyl Mercury (Filtered Water):	3	3
TOTAL AQUEOUS SAMPLES:	15	15
Invertebrate Composites:	8	2
Individual Fish Muscle Samples:	(24)	(16) ¥
Green Sunfish:	*7*	
Channel Catfish:	*10*	*4* ¥
Brown Bullhead:	*2*	*4* ¥
Smallmouth Bass:	*5*	
Carp:		*2* ¥
Sacramento Sucker:		*1* ¥
Bluegill Sunfish:		*2* ¥
White Crappie:		*3* ¥
Sediment:	7	1 ¥
TOTAL SOLID SAMPLES:	39	19

¥ - Samples collected earlier (10/95) by D. G. Slotton and S.M. Ayers

Figure 1. Schematic Map of Solano Gravel Pit Lakes and Adjacent Cache Creek



2. METHODS

2.1 Collection Techniques

2.1.1 Sediment

Surficial sediment was collected from the bottoms of the Solano Gravel pit lakes with an Ekman dredge. Resulting samples were spooned into pre-cleaned glass jars with teflon-lined caps. Sediment samples were maintained refrigerated but unfrozen (so as to not alter mineral structure) until they were analyzed for mercury within 18 days of collection.

2.1.2 Water

Water collections for mercury analysis were made in conjunction with Frontier Geosciences Laboratory of Seattle Washington, which is the most highly esteemed aqueous mercury laboratory in the world. Ultra-clean 1 L teflon collection bottles were shipped to us, individually packaged in double zip-lock bags. Two person clean collecting protocol was used, in which the actual sample bottle was touched only by one researcher, who handled nothing else and wore sterile gloves. Creek samples were taken in flowing water by standing in-stream and, facing upstream, submerging the bottle in the middle of the flow. Lake samples were taken by idling the boat slowly into the wind at midlake, with the sample taken from the front of the boat. In all collections, the bottle cap was removed underwater, allowing the bottle to fill without coming into contact with potential surface film material, and then resealed before bringing to the surface. The bottle was then placed into the waiting isolation bags, held by the co-worker. Bagged ice packs kept the bottles cool and samples were shipped by overnight mail to Frontier Geosciences. Water samples were filtered and preserved appropriately in a trace metal clean room within 24 hours of collection, and later analyzed within standard holding times.

In conjunction with each set of aqueous mercury samples, we collected identical water into 1 liter bottles for analysis of suspended solids. These bottles were held in a separate ice chest, on ice, and were returned to our laboratory in Davis for processing within 48 hours of collection.

2.1.3 Invertebrates

Aquatic invertebrates were taken from each of the sites, as available, with various nets and screens. Forceps were used to pick macro-invertebrates into prepared collection jars. This process was repeated at each site until a sufficient sample size of each taxon of interest was accumulated to permit analysis for mercury.

Samples were maintained in their collection jars on ice, and then cleaned within 24 hours of collection. Cleaning was accomplished by suspending sample organisms in distilled water and, as necessary, shaking individuals in the water with teflon-coated forceps to remove any significant clinging surficial material. Gastropod samples (aquatic snails) taken from the two lakes were additionally purged of potentially high-sediment gut contents by maintaining them live for 4 days and changing the water repeatedly until clear. Cleaned organisms of all types were stored in pre-cleaned jars with teflon-lined caps, which were frozen and then dried at 50-60 °C. The dried sample was homogenized to a fine powder with teflon-coated instruments and a glass laboratory mortar and pestle. All of these techniques have been well established and tested in extensive prior mercury research work throughout California (Slotton et al. 1995a).

2.1.4 Fish

Fish were collected from the Solano Gravel pit lakes using a boat with a variety of experimental gillnets. Gill nets were also used in the Cache Creek collections, together with seines. Individual fish to be analyzed were weighed and measured on site. Stomach contents were assessed within an hour of collection. Muscle tissue samples for mercury analysis were excised in the laboratory within 24 hours, using clean technique, with stainless steel scalpels. Muscle samples were taken from the dorso-lateral ("shoulder") region, as done by the California Department of Fish and Game. Samples were placed directly into laboratory digestion tubes, which were capped with teflon liners. We have utilized these techniques with great success in similar work over the past 11 years (Reuter et al. 1989, Slotton 1991, Slotton et al. 1995a, Slotton et al. 1995b)

2.3 Analytical Methodology

2.3.1 Water

Total mercury in water was analyzed by dual amalgamation/cold vapor atomic fluorescence spectrometry, as developed by Bloom and Crecelius (1983). Methyl mercury was analyzed utilizing aqueous phase ethylation, followed by cryogenic gas chromatography with cold vapor atomic fluorescence detection, as developed by Bloom (1989). The detection levels for these extremely sensitive analyses are approximately 0.2 (total Hg) and 0.01 (methyl Hg) ng L^{-1} (parts per trillion), generally below most environmental aqueous mercury levels present throughout Northern California. It is notable that Nicolas Bloom, the developer of these techniques, is the director of the laboratory utilized for this work.

2.3.2 Suspended Solids

Suspended solids concentration at each site was determined by filtering a given volume of well mixed sample water through a pre-weighed glass fiber filter. The solids were retained on the filter, which was then dried at 105 °C for 24 hours. After cooling the filter in a dessicator, it was re-weighed to the nearest 0.0001 g. The weight of solids was obtained by subtracting the initial, clean weight of the filter from the weight with solids. This amount was divided by the volume of water filtered to derive the solids concentration on a milligram per liter basis.

2.3.3 Fish, Invertebrate, and Sediment Total Mercury

Solid samples for mercury were analyzed using homogeneous portions. Sediment was subsampled from homogenized, wet (liquefied) samples. Identical subsamples were used to determine moisture content for dry weight conversions. Fish tissue was also analyzed on wet (fresh) samples, as is the standard procedure used by governmental agencies. Mercury analyses of invertebrate samples were conducted with dried and powdered samples for uniformity, as described in Slotton et al. (1995a).

Solid samples of all types were processed by first digesting in concentrated sulfuric and nitric acids and potassium permanganate, under pressure, at 80-100 °C for three hours. They were subsequently analyzed for total mercury using a well-established modified cold vapor atomic absorption (CVAA) micro-technique, described in Slotton et al. (1995b). The level of detection for this technique is approximately 0.01 mg kg^{-1} (ppm), sufficient to provide above-detection results for nearly all aquatic sediment and biota samples in this region.

2.3.4 Sediment Water and Organic Content

Moisture content of sediment samples was determined by weight difference between fresh, homogenized sample (10-25 g) and the sample after drying at 105 °C to constant weight (generally 24 hours), subtracting out the weight of the weighing container. Weights were accurate to ± 0.001 g. To obtain the Loss On Ignition (LOI) estimate of organic content, the dried sample was subsequently placed in a 475 °C muffle furnace for 2 hours, to burn off any organic matter. After cooling, the mineral moisture of hydration was returned by re-wetting the sample. The sample was again dried at 105 °C to constant weight, cooled in a dessicator, and weighed again to ± 0.001 g. The loss in weight between the initial dry sample and the sample after the muffle furnace treatment is attributed to organic matter.

2.4 Quality Assurance/Quality Control (QA/QC)

2.4.1 Water

The water samples for mercury were analyzed at Frontier Geosciences Laboratory in a single analytical run for total mercury and another for methyl mercury. Each run was accompanied by QA/QC samples. QA/QC was excellent, as summarized below in Table 2.

Table 2. Frontier Geosciences Laboratory Aqueous Mercury QA/QC (from 2 analytical runs)

QC Data	Total Mercury *(ng/L)*	Methyl Mercury *(ng/L)*
Method Blanks	0.19 ± 0.06	0.013 ± 0.004
(n)	(3)	(3)
Estimated Detection Limit	0.18	0.012
NRCC Dogfish	4,733	4,465
Certified Concentration	4,640 ± 260	4,470 ± 370
Recovery (%)	102%	100%
Before Filter Blank (4/10/96)	0.45	
After Filter Blank (4/10/96)	0.28	
Before Filter Blank (4/16/96)	1.61	
After Filter Blank (4/16/96)	1.19	

2.4.2 Fish, Invertebrates, and Sediment

Extensive QA/QC accompanied our total mercury analyses of aquatic biota and sediment samples. For each sample batch of approximately 24 samples, a large number of QA/QC samples were included through all phases of the digestion and analysis procedures (16 total). These included 1 blank and 7 aqueous mercury standards, standard reference materials with known mercury concentrations, duplicates of analytical samples, and spiked analytical samples. These additional samples were used, as always, to ensure the reliability of the data generated. The QA/QC results for this portion of the work are summarized in Table 3.

The extensive set of aqueous standards was used to construct an accurate curve of mercury concentration vs atomic absorbence for each analytical run. The standard curve R^2 values for the mercury runs utilized in this project fell between 0.999 and 1.000, well above the control range of ≥ 0.975. The standard reference material samples included two fish standards and a

Table 3. D.G. Slotton Laboratory Total Mercury QA/QC Summary (from 3 analytical runs)

	Std Curve R^2	Spike Recoveries	Duplicate RPD	NBS Tuna	IAEA Tuna	NBS Sediment
Certified Level (ppm)				0.95	4.70	1.47
Ideal Recovery	1.000	(100%)	(0%)	(100%)	(100%)	(100%)
Control Range (%)	≥0.975	75-125%	≤25%	75-125%	75-125%	75-125%
Control Range (ppm)				0.71-1.19	3.60-6.00	1.10-1.84
Recoveries (%)	0.999-1.000	94-111%	0.1-10.7%	95-110%	90-96%	101-107%
(ppm)				0.90-1.04	4.32-4.61	1.49-1.57
(n)	n=3	n=6	n=18	n=7	n=2	n=2
Mean Recoveries (%)	0.999	101%	4%	100%	93%	104%
Mean Recoveries (ppm)				0.95	4.47	1.53

sediment standard. All recoveries were within the 75% - 125% control levels, at 90-110%. Sample duplication was excellent, with relative % difference (RPD) having a mean value of 4% among 18 total paired samples. Spike recoveries were also consistently good, with recoveries of 94% - 111%, as compared to the 75% - 125% control levels.

3. RESULTS

3.1 General Limnological Survey

With sonar sweeps along transects, we were able to construct a rough bottom contour map of the Solano Gravel pit lakes (Fig. 1). The North Lake was found to have a fairly regular pit configuration, with relatively steep perimeter slopes and the majority of the bottom area deeper than 20 ft, reaching a maximum depth of approximately 43 ft. There was little area available for shallow accumulations of aquatic plants, which were confined largely to a narrow strip along the southern perimeter. The South Lake, 2-3 times larger in surface area, was considerably shallower on average, though it also contained a basin at its northern end that was similar to that in the North Lake. Here, depths reached approximately 35 ft. The majority of the South Lake, however, was shallower than 20 ft, with extensive areas at the southern end well under 10 ft. Here, plant growth was extensive, with beds of aquatic plants, macro-algae, and willows. This environment proved to be excellent fish habitat, with considerably greater collection success here as compared to deeper areas.

Adjacent Cache Creek, during the period of this April 1996 preliminary work, was quite variable, ranging from moderately high, turbid flow conditions soon after storms (4/4/96) to intermediate flow and turbidity levels (4/9/96), to relative baseline conditions (4/11/96, 4/15/96).

We collected information on a number of limnological parameters in the North Lake to provide some basic information as to the trophic status of the system and its potential to provide an environment suitable for mercury methylating microorganisms. At two sites in this basin (Fig. 1), we collected water column samples from surface, mid depth (5 m, 16 ft), and deep water 1 m above the bottom (11-12 m, ~38 ft). These samples were analyzed for pH, total suspended solids (TSS), and Chlorophyll A (a measure of algal density). Data are presented in Table 4. Additionally at these two sites, temperature and dissolved oxygen were profiled surface to bottom through the water column, at 1 m increments (Table 5, Fig. 2).

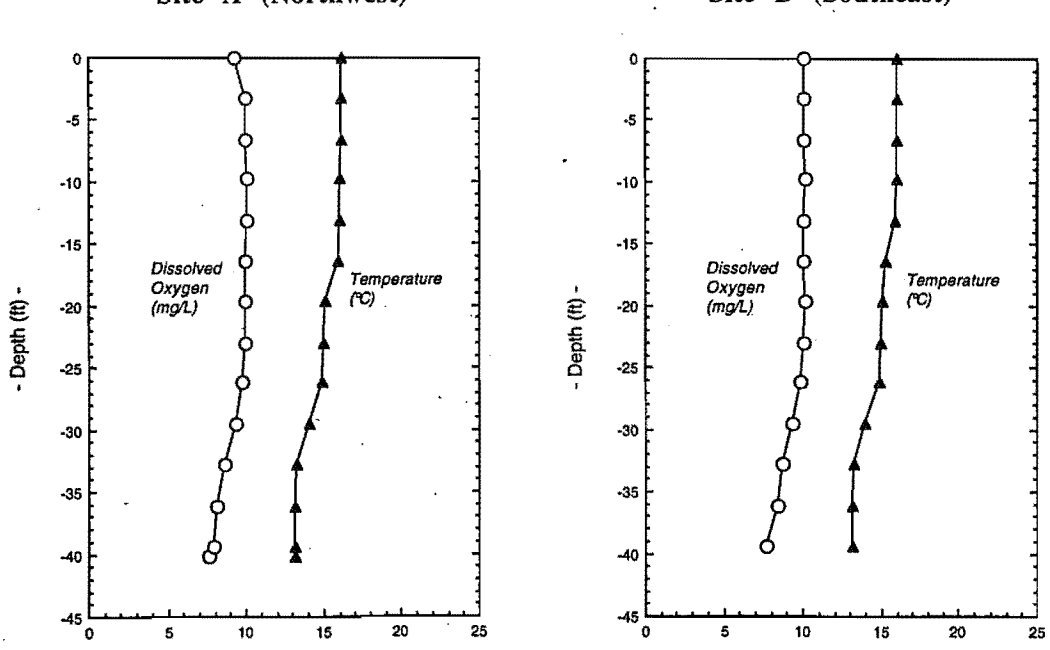
Table 4. Water Column pH, TSS, and Chlorophyll A; North Pit Lake, 4/4/96

Depth	pH		TSS (mg/L)		Chlorophyll A (µg/L)	
	Site A	Site B	Site A	Site B	Site A	Site B
Surface (0.3 m, 1 ft)	8.56	8.54	4.4	10.2	2.2	1.5
Mid (5 m, 16 ft)	8.57	8.54	4.1	4.4	2.0	1.9
Deep (11-12 m, ~38 ft)	8.40	8.39	6.2	7.8	1.8	1.8

Table 5. Water Column Profiles of Temperature and Dissolved Oxygen; North Pit Lake, 4/4/96

Depth (m)	Depth (ft)	Temperature (°C) Site A	Temperature (°C) Site B	Dissolved Oxygen (mg/L = ppm) Site A	Dissolved Oxygen (mg/L = ppm) Site B
0.0	0.0	16.1	16.2	10.1	9.3
1.0	3.3	16.1	16.2	10.1	10.0
2.0	6.6	16.0	16.2	10.1	10.0
3.0	9.8	16.0	16.1	10.2	10.1
4.0	13.1	15.9	16.0	10.1	10.1
5.0	16.4	15.3	15.9	10.1	10.0
6.0	19.7	15.1	15.1	10.2	10.0
7.0	23.0	15.0	15.0	10.1	10.0
8.0	26.2	14.9	14.9	9.9	9.8
9.0	29.5	14.0	14.1	9.4	9.4
10.0	32.8	13.3	13.3	8.7	8.6
11.0	36.1	13.2	13.2	8.4	8.1
12.0	39.4	13.2	13.2	7.7	7.9
12.3	40.2		13.2		7.6

Figure 2. Water Column Profiles of Temperature and Dissolved Oxygen; North Pit Lake, 4/4/96



As expected, the water column was still relatively unstratified (fairly well mixed) on this April date, with only a slight difference in both temperature and dissolved oxygen between the surface and the bottom. Profiles were also essentially identical at the two sides of the lake. Temperature ranged from 13.2 °C (55.8 °F) in the deep water, gradually warming to 16.2 °C (61.1 °F) at the surface. Oxygen levels remained high throughout the water column at this time, at approximately 10 ppm in the top 25 ft, declining only to approximately 8 ppm at the bottom. With the onset of hot summer weather, the upper waters can be expected to become sufficiently warmer than the underlying cool bottom waters, so as to form a density stratification. In this circumstance, the upper waters remain mixed and in contact with the atmosphere, while the cooler, denser bottom waters become isolated from the upper water layer and the influence of the air. Under these normal conditions of warm season water column stratification, oxygen can become depleted in the bottom water. This occurs when there is sufficient organic matter and bacterial metabolism to use up the available oxygen.

At this time, the water of the North Lake appeared to be relatively sterile, as compared to more eutrophic ponds and lakes in the region. Chlorophyll A was similar in the various samples, at 1.5-2.2 µg/L (ppb), which is quite low. The corresponding Secchi disk measure of water column visibility was 2.2 m (7.2 ft) which is fairly clear for these types of systems. The sediment data (below) also indicates that organic matter in the lake is relatively low, integrated across the seasonal accumulations sampled at the bottom.

Water column pH was very similar throughout and well above neutrality at 8.39-8.57. This is typical for the region. Suspended solids were in the range of 4-5 mg/L (ppm) in most surface and midwater samples, with a somewhat higher level at the bottom (6-8 mg/L), as is typical. The Site B surface sample was higher at this time (10.2 mg/L), consistent with the surface cloud of suspended sediment noted at this site on this windy collection date.

3.2 Bottom Sediments

Bottom sediments were taken from 5 locations distributed across the deep portion of the North Lake and from a deep and shallow site in the South Lake (Fig. 1). Most of the deep sediments were composed of fine-grained silts and clays, as is typical. While a variety of grain sizes enter lakes, the smaller particles are particularly susceptible to resuspension from wave action. They are repeatedly resuspended into the water column until they randomly deposit in deeper water, beyond the reach of continued wave action. Thus, deepwater sediments will ultimately be of finer grain size (clays and silts) than the sands and gravels remaining in the shallower areas.

Analytical data from the sediment samples are presented in Table 6. Moisture percentage was similar among the samples, at 52% - 68%. Organic percentage was relatively low in the North Lake sediments (1.1% - 2.4%), a function of the relatively low presence of aquatic plants and

water column algae. South Lake sediments were somewhat higher, at 3.2% - 4.5% organic fraction. The South Lake was characterized by containing shallower regions with extensive plant growth.

Table 6. Sediment Analytical Data; Solano Gravel Lakes, April 1996

Sediment I.D.	Depth (m)	Depth (ft)	Description	ppm Hg (dry wt)	Percent Moisture	Percent Organic
NORTH LAKE						
Northwest	11.6	38.1	Silts and fine sands	0.38	58.6%	2.4%
Northeast	11.9	39.0	Fine silts, clays	0.77	54.2%	1.9%
Southeast	10.0	32.8	Fine silts, clays	0.65	67.5%	1.1%
Southwest	10.5	34.4	Fine silts, clays	0.60	52.0%	1.4%
Center	13.0	42.7	Finest clays	1.00	60.3%	2.3%
SOUTH LAKE						
North Side (deep)	11.0	36.1	Fine silts, clays	0.15	56.9%	3.2%
South Side (shallow)	2.7	8.9	Silts and fine sands	0.22	53.2%	4.5%

Mercury concentrations were lower in the South Lake sediments (0.15 - 0.22 ppm) than in the samples from the North Lake (0.38 - 1.00 ppm). The highest concentration (1.00 ppm) came from the deepest sample taken from the center of the North Lake, where the finest grain sizes were present. The lowest mercury sample from the North lake (0.38 ppm) was found in conjunction with larger grain size material, including sands. Among the North Lake samples with similar grain size, mercury was similar at 0.60 - 0.77 ppm. These data are consistent with other regional research, in which metals, including mercury, have been found to be more concentrated in a given weight of fine grained particles than in coarser material (Slotton and Reuter 1995). This is a function of the larger surface area for adsorption afforded by the smaller particles.

These sediment mercury concentrations are elevated as compared to global averages, but are considerably lower than levels seen in many mercury contaminated regions of California, where levels in the 10s and 100s of ppm have been reported. In our October 1995 collections of fish from lower Cache Creek, we took a single sample of creek sediment for mercury. This sample was quite coarse, dominated by fine sands and silts, with a mercury concentration of 0.51 ppm. Depending on the flow regime and consistency of the bottom sediment, sediment mercury from the creek can be expected to be highly variable.

3.3 Aqueous Mercury Concentrations

Aqueous mercury concentrations, in units of nanograms per liter (ng L^{-1}, = parts per trillion), are presented in Table 7. Concentrations from the North Lake were quite consistent across the 11 day period of sampling. This period encompassed a variety of climatic conditions including post-rain, high winds, and warm/calm. Total mercury ranged from 2.89 to 3.45 ng/L in raw water samples, with a mean of 3.22 ng/L. Total mercury in the filtered fraction was also quite consistent at 1.12-1.47 ng/L, with a mean of 1.27 ng/L and a mean filtered fraction representing 40% of raw concentrations. These concentrations appear to be relatively characteristic of the lake, and can be compared to the water quality criterion for mercury of 12 ng/L. These raw water total mercury concentrations are approximately 27% of the criterion level.

Table 7. Mercury Concentrations in Water; Solano Gravel Lakes and Cache Creek, April 1996

	Date	Total Hg (ng/L)		Methyl Hg (ng/L)	
		(raw)	*(≤0.2 µm)*	*(raw)*	*(≤0.2 µm)*
NORTH LAKE					
	4/4/96	3.45	1.12	0.032	(not done)
	4/9/96	2.89	1.47	0.031	0.007
	4/15/96	3.31	1.23	0.022	0.011
SOUTH LAKE					
	4/11/96	2.25	0.88	0.044	0.010
CACHE CREEK AT SOLANO GRAVEL					
	4/4/96	52.50	1.14	0.329	(not done)
	4/9/96	7.46	1.53	0.116	0.039
	4/11/96	3.60	1.16	0.114	0.038
	4/15/96	3.81	1.30	0.114	0.043

A sample was taken from the South Lake when it became clear that we would need to utilize the other basin in our fish collections. While a single point is not enough to form statistical conclusions, it is notable that this sample was somewhat lower in total mercury than those taken from the North Lake, with 2.25 ng/L in raw water and 0.88 ng/L (39%) in the filtered fraction.

The corresponding samples taken across this time period from adjacent Cache Creek ranged from concentrations very similar to the pit lake samples to considerably higher levels, clearly associated with high flow suspended sediment loads. A high concentration of 52.50 ng/L was found in the turbid, high flow raw water sample from April 4. In related work by the Central

Valley Regional Water Quality Control Board, raw water concentrations of total mercury in lower Cache Creek have ranged as high as 1,500 ng/L during peak storm flow conditions (Chris Foe, Central Valley Regional Water Quality Control Board, personal communication).

By April 9 in the present study, flows had receded considerably and a much reduced intermediate concentration of 7.46 ng/L total mercury was found in raw water from the creek. Flows and, apparently, mercury levels had stabilized relative to storm flows on the April 11 and 15 collection dates, with similar raw water total mercury concentrations of 3.60 and 3.81 ng/L. These levels were approximately 15% higher than the corresponding levels from the North Lake and 65% higher than the single concentration measured in the South Lake.

When the suspended particulate contribution to the creek total mercury concentrations was factored out by filtering the samples, levels were quite similar across the range of flow conditions (1.14-1.53 ng/L). This was nearly identical to filtered concentrations from the North Lake samples.

Methyl mercury was measured at 0.329 ng/L in Cache Creek raw water during the high flow date (4/4/96), and then at approximately 1/3 of that concentration in further collections, with nearly identical levels of 0.114, 0.114, and 0.116 ng/L. Methyl mercury in the creek water filtered fraction was also very consistent at 0.038-0.043 ng/L (~35% of the raw water methyl mercury).

In contrast, methyl mercury in the pit lake samples was significantly lower in both raw and filtered samples. Levels of 0.022-0.032 ng/L were found in raw water from the North Lake. These methyl mercury concentrations were approximately 25% of the levels found in corresponding lower flow Cache Creek samples. Raw water methyl mercury from the South Lake sample was somewhat higher at 0.044 ng/L (~38% of creek levels). Filtered samples of methyl mercury from both pit lakes were very similar, at 0.007-0.011 ng/L. These levels were also approximately 25% of the corresponding levels seen at this time in the adjacent creek.

3.4 Aquatic Invertebrates

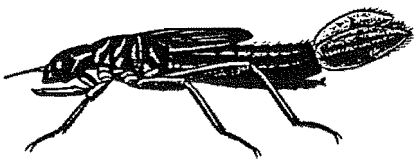
Aquatic invertebrates that were analyzed for this project are illustrated in Figure 3. We were able to collect extensive samples of Coenagrionid damselfly nymphs from each of the pit lakes, together with aquatic snails, which were an important food item for the fish. Additional invertebrate samples included predaceous giant water bugs (Belostomatidae) from the North Lake, predaceous creeping water bugs (Naucoridae) from Cache Creek, and dragonfly nymphs (Aeschnidae, Libellulidae) from the North Lake and Cache Creek. The mercury data for the invertebrate samples are presented in Table 8.

Native invertebrate species have proven to be excellent monitors of mercury bioavailability in California water bodies (Slotton et al. 1995a). Because they incorporate mercury into their bodies

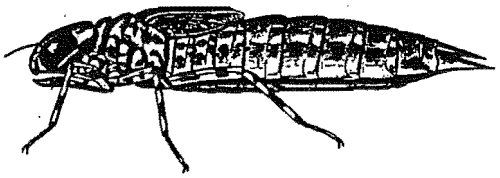
Figure 3. Aquatic Invertebrates Sampled in This Project

(illustrations taken from McCafferty 1981)

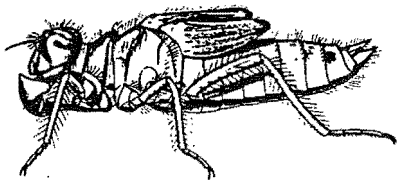
Aquatic Snails (Gastropoda)



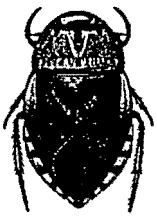
Damselflies (Zygoptera)
Coenagrionidae



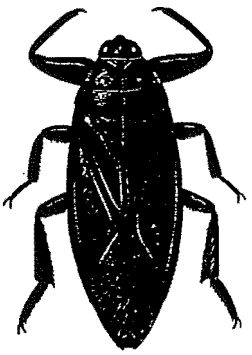
Dragonflies (Anisoptera)
Aeschnidae



Dragonflies (Anisoptera)
Libellulidae



Creeping Water Bugs (Hemiptera)
Naucoridae



Giant Water Bugs (Hemiptera)
Belostomatidae

throughout their lives, they can provide a time-integrated measure of mercury availability, 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. They thus function as relatively static biological probes of the fraction of mercury in the water that is bioavailable.

Table 8. Invertebrate Mercury Concentrations§; Solano Gravel Lakes and Cache Creek, April 1996
(Dry weight mg/kg mercury, =ppm; Multiple individual composites)

Invertebrates	North Pit Lake	South Pit Lake	Cache Creek at Solano Gravel
Snails	0.16 (n=23)	0.11 (n=29)	
Damselfly Nymphs A	0.22 (n=48)	0.17 (n=47)	
Damselfly Nymphs B	0.21 (n=36)	0.17 (n=37)	
Dragonfly Nymphs	0.27 (n=3)		0.32 (n=4)
Naucoridae (Creeping water bugs)			0.29 (n=14)
Belostomatidae (Giant water bugs)	0.51 (n=5)		

§ - No regulatory criteria exist at this time for these organisms

It was not possible to collect identical types of samples from each of the sites, though there was some overlap. Aquatic snails and damselfly nymphs were taken from each of the pit lakes. Dry weight mercury levels were somewhat higher from the North Lake (0.16 ppm in snails vs 0.11 ppm in the South Lake, and 0.21 ppm in damselfly nymphs vs 0.17 ppm in the South Lake). The field duplicate composites of both sets of damselfly nymphs were essentially identical, suggesting that the difference seen between basins in this parameter reflected actual environmental differences rather than general variability.

Mercury in dragonfly nymphs and Naucorid bugs (predaceous "creeping" water bugs) from the Creek samples was similar (0.32 and 0.29 ppm), reflecting their very similar diet of small to medium invertebrates. 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). Mercury levels among invertebrate species with similar foods are typically similar (Slotton et al 1995a). Concentrations generally increase, moving up through the food chain. That was the case in the samples taken in this project, which are arranged in order of ascending trophic food level in Table 8.

Dragonfly nymphs from the North Lake were similar in mercury, though somewhat lower, as compared to dragonflies from the creek (0.27 ppm vs 0.32). The Belostomatid ("giant") water bugs from the North Lake were considerably higher in mercury than any of the other invertebrate samples, at 0.51 ppm. This reflects the considerably higher mercury levels in their preferred food item, juvenile fish. The utility of this preliminary invertebrate mercury data could be increased with expanded collections.

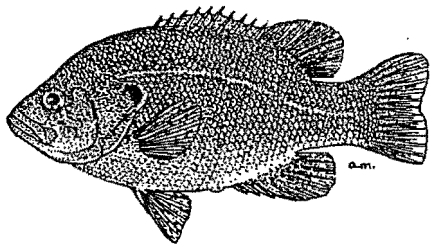
3.5 Fish

Fish sampling for mercury was a very important component of this preliminary study. Throughout their lifetimes, fish accumulate mercury almost exclusively of the methyl fraction in their tissues, primarily in the edible fillet muscle, and thus provide time-integrated information on mercury bioavailability, which can be compared to fish data from other systems. Regulatory considerations are often driven by fish mercury levels, largely because fish muscle mercury represents the major exposure pathway of significance, both for people and fish-eating wildlife.

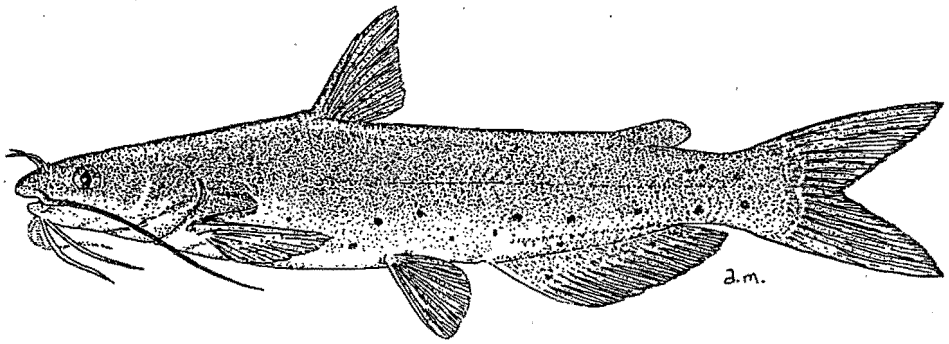
The fish species sampled in this project are illustrated in Figures 4 and 5. The gravel pit lakes contained green sunfish, channel catfish, brown bullhead, and smallmouth bass. The Cache Creek samples also included channel catfish and brown bullhead, together with carp, Sacramento sucker, bluegill sunfish, and white crappie. In order to obtain sufficiently diverse samples from the gravel pit lakes, we had to utilize the South Lake as well as the North Lake. At this time of year (April), only smaller individuals were collectable from the North Lake. However, when muscle mercury concentrations are plotted against fish size, the trends are generally consistent between lakes (Fig. 6). The fish muscle mercury data collected in this project are shown in Tables 9 and 10 and are plotted graphically in Figures 6 and 7.

Mercury concentrations generally varied with size/age of individual and with trophic feeding level of the species, as is typical. Small green sunfish, which eat small invertebrates, contained the lowest muscle mercury levels (0.16-0.30 ppm in 5-6 " fish), while the highest levels were found in the larger predatory species. Channel catfish contained muscle mercury of 0.27-0.67 ppm in 11-23" fish, smallmouth bass of 10-15" had 0.30-0.90 ppm, and 11-12" brown bullhead were relatively quite high at 0.72-0.92 ppm. These levels can be compared to the 0.5 ppm Health Guidelines of the California Department of Health Services, the U.S. Academy of Sciences, and most nations (TSMP 1990). The U.S. federal guideline (FDA) for mercury in edible fish is 1.0 ppm. None of these pit lake fish were above the 1.0 ppm guideline, though several were above the 0.5 ppm level, including the largest channel catfish (23 inches, 6 lbs, 0.67 ppm), the larger smallmouth bass (13-15 inches, 1.5-2 lbs, 0.79-0.90 ppm), and the brown bullheads (~12 inches,

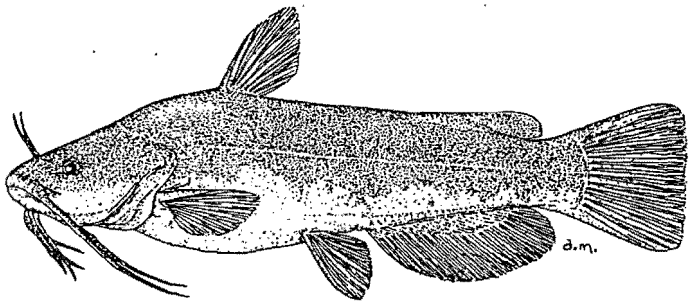
Figure 4. Fish Species Sampled From Solano Gravel Pit Lakes
(illustrations taken from Moyle 1976)



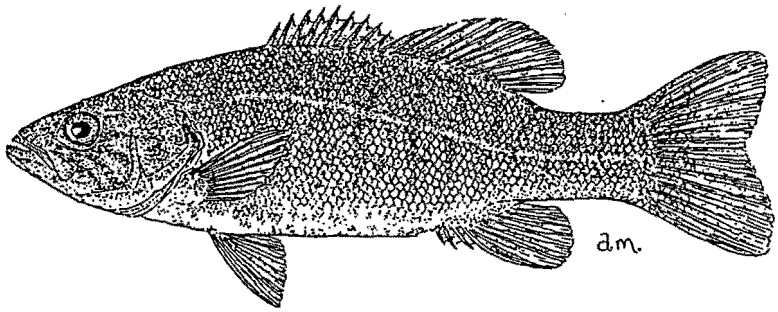
Green Sunfish
Lepomis cyanellus



Channel Catfish
Ictalurus punctatus

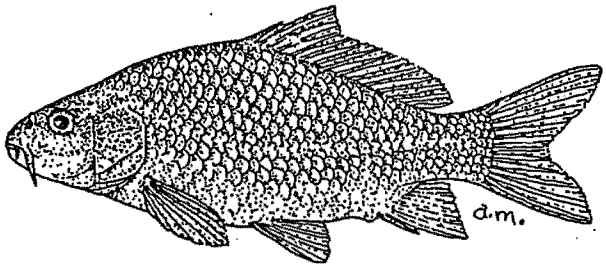


Brown Bullhead
Ictalurus nebulosus

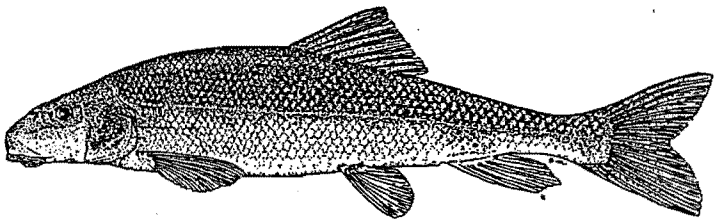


Smallmouth Black Bass
Micropterus dolomieui

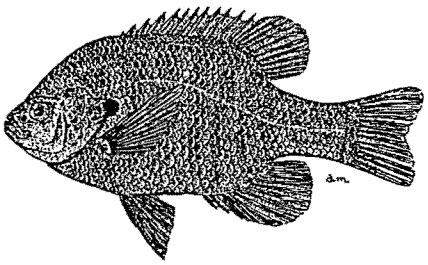
Figure 5. Additional Fish Species Sampled From Cache Creek
(illustrations taken from Moyle 1976)



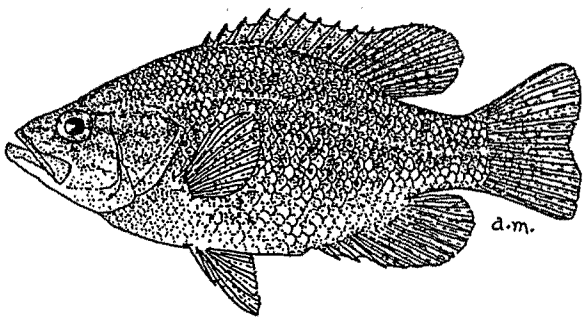
Carp
Cyprinus carpio



Sacramento Sucker
Catostomus occidentalis



Bluegill Sunfish
Lepomis macrochirus



White Crappie
Pomoxis annularis

Table 9. Fish Muscle Mercury Concentrations *(wet wt ppm)*; Solano Gravel Lakes, April 1996

Identification	Length (mm)	Length (inches)	Weight (grams)	Weight (pounds)	ppm Hg (wet wt)
NORTH LAKE (4/96)					
Green Sunfish	135	5.3	45	0.1	0.21
Green Sunfish	132	5.2	48	0.1	0.21
Green Sunfish	153	6.0	67	0.1	0.30
Green Sunfish	152	6.0	70	0.2	0.16
Green Sunfish	154	6.1	74	0.2	0.21
Channel Catfish	192	7.6	82	0.2	0.24
Channel Catfish	210	8.3	95	0.2	0.13
Channel Catfish	238	9.4	163	0.4	0.23
Smallmouth Bass	223	8.8	135	0.3	0.19
SOUTH LAKE (4/96)					
Green Sunfish	135	5.3	65	0.1	0.25
Green Sunfish	160	6.3	73	0.2	0.29
Channel Catfish	279	11.0	250	0.6	0.35
Channel Catfish	375	14.8	600	1.3	0.44
Channel Catfish	400	15.7	770	1.7	0.27
Channel Catfish	400	15.7	860	1.9	0.30
Channel Catfish	432	17.0	950	2.1	0.39
Channel Catfish	467	18.4	1,375	3.0	0.47
Channel Catfish	584	23.0	2,630	5.8	0.67
Brown Bullhead	298	11.7	435	1.0	0.72
Brown Bullhead	305	12.0	463	1.0	0.92
Smallmouth Bass	267	10.5	300	0.7	0.45
Smallmouth Bass	273	10.7	305	0.7	0.30
Smallmouth Bass	337	13.3	640	1.4	0.79
Smallmouth Bass	371	14.6	850	1.9	0.90

Table 10. Fish Muscle Mercury Concentrations *(wet wt ppm)*; Lower Cache Creek, October 1995

Identification	Length		Weight		ppm Hg
	(mm)	*(inches)*	*(grams)*	*(pounds)*	*(wet wt)*
CACHE CREEK (10/95)					
Carp	202	8.0	180	0.4	0.28
Carp	210	8.3	200	0.4	0.27
Sacramento Sucker	393	15.5	660	1.5	0.29
Bluegill Sunfish	157	6.2	105	0.2	0.29
Bluegill Sunfish	169	6.7	118	0.3	0.28
White Crappie	207	8.1	130	0.3	0.48
White Crappie	238	9.4	205	0.5	0.51
White Crappie	272	10.7	275	0.6	0.65
Brown Bullhead	260	10.2	260	0.6	0.22
Brown Bullhead	293	11.5	410	0.9	0.28
Brown Bullhead	310	12.2	438	1.0	0.31
Brown Bullhead	316	12.4	535	1.2	0.27
Channel Catfish	332	13.1	578	1.3	0.57
Channel Catfish	351	13.8	680	1.5	0.28
Channel Catfish	353	13.9	730	1.6	0.46
Channel Catfish	470	18.5	1,380	3.0	0.33

Figure 6. Fish Muscle Mercury From Solano Gravel Pit Lakes, April 1996

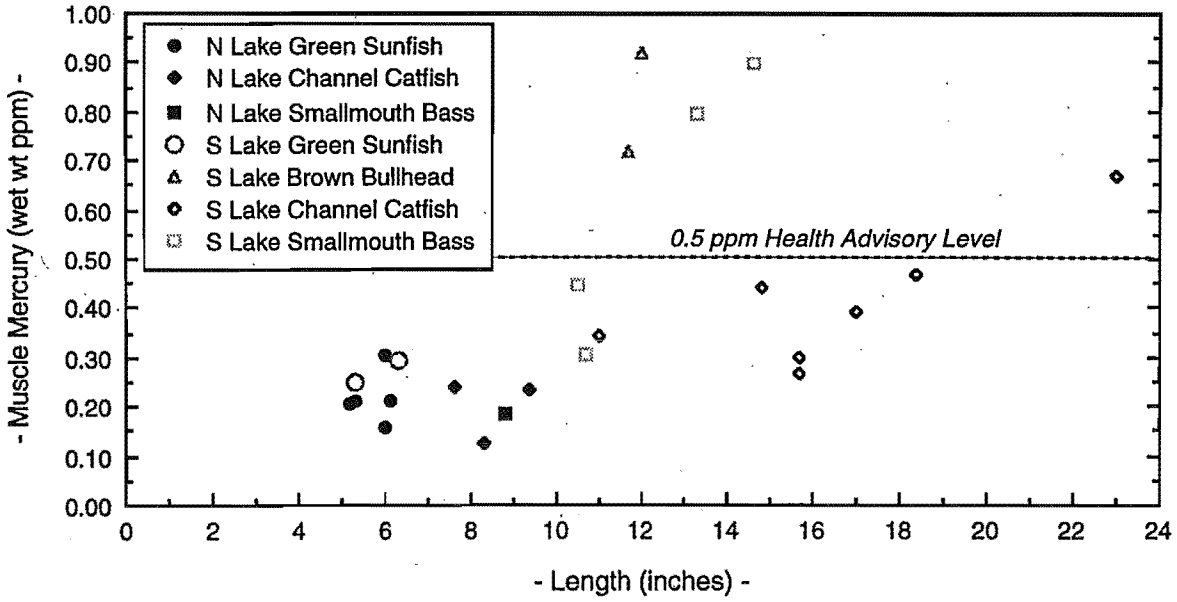
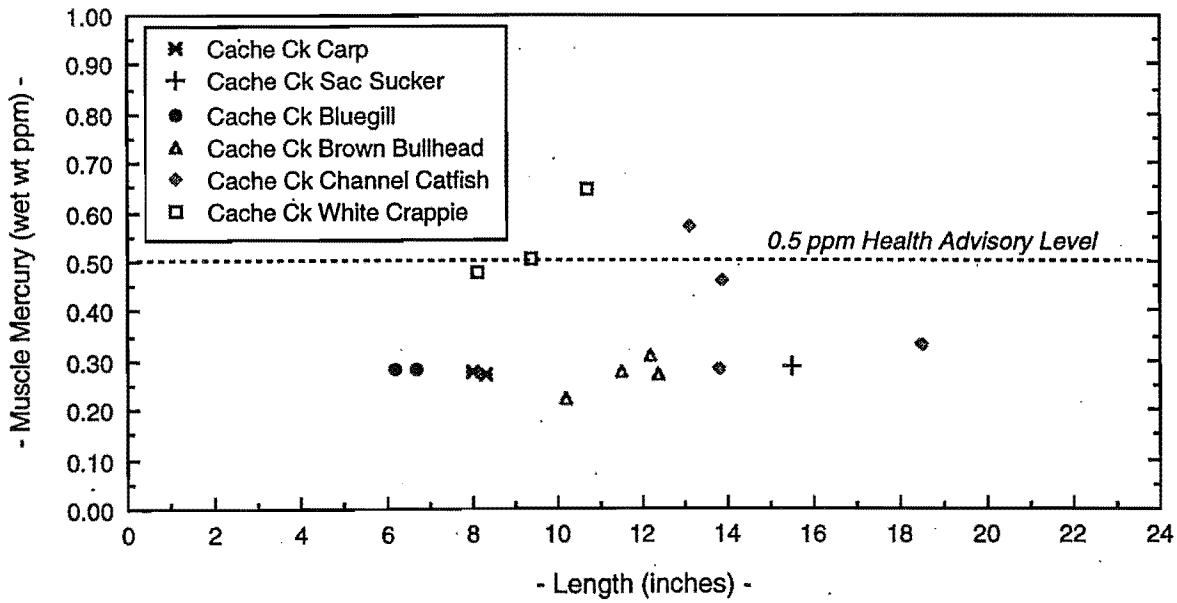


Figure 7. Fish Muscle Mercury From Lower Cache Creek, April 1996



1 lb, 0.72-0.92 ppm). In Figure 6, the data for the pit lake fish are displayed in conjunction with the 0.5 ppm guideline.

We collected comparable fish from lower Cache Creek in October of 1995. These data appear in Table 10 and Figure 7. Similar symbols are utilized in the plot for same or similar species, as compared to the pit lake samples. It was not possible to obtain bass or very large catfish in the creek sampling, but there was considerable overlap. The species which feed lower in the food web (carp, Sacramento sucker, and bluegill sunfish) were quite similar to each other in mercury content (0.27-0.29 ppm), and also very similar to the levels seen in the pit lakes green sunfish (0.16-0.30 ppm). Channel catfish in the range of 11-19" had 0.28-0.57 ppm muscle mercury from Cache Creek (mean = 0.41 ppm) and 0.27-0.47 ppm in the gravel pit lakes (mean = 0.37 ppm). These levels for comparable fish between pit lakes and Cache Creek are very similar and not differentiable statistically.

Additional Cache Creek fish samples included white crappie and brown bullhead. The crappie from Cache Creek were also consistent with the pit lake data. These fish are piscivorous (fish eaters) and thus correspond closest to the smallmouth bass. Crappie of 8-11" and 0.3-0.6 lbs from the creek had elevated mercury levels of 0.48-0.65 ppm. While sizes are not directly comparable, the diets of crappie in this size range would be similar to those of small to medium smallmouth bass, which demonstrated similar mercury concentrations in the pit lakes.

Only the brown bullhead showed a difference between pit lakes and Cache Creek. The four creek bullhead, of a similar size to those taken in the pit lakes, were considerably lower in mercury (0.22-0.31 ppm), similar to the carp, sucker, and bluegill samples from the creek. The relatively high mercury levels seen in the two 12" bullhead taken from the South Lake (0.72-0.92 ppm) are anomalous, as compared to all of the other fish data. We have no clear explanation at this time. The digestive tracts of these two fish were full of aquatic snails, a relatively low mercury food source. At this time, we do not place too much significance on the two anomalous samples.

4. DISCUSSION AND CONCLUSIONS

At the time of this survey, water column mercury in the existing off-channel gravel pit lakes at Solano Gravel (2.2-3.5 ng/L) was well below the 12 ng/L water quality criterion and was lower than concentrations seen in the adjacent section of Cache Creek (3.6-52 ng/L). Levels in the filtered fraction (≤ 0.2 µm) were similar across dates and sites (0.9-1.5 ng/L for lake and creek samples), indicating that the variation seen in raw water total mercury was mainly a function of mercury in suspended sediment. The total mercury levels in raw and filtered water from the pit lakes were consistent across a variety of climatic conditions and are probably relatively characteristic for these lakes.

Methyl mercury was found at orders of magnitude lower levels (0.02-0.04 ng/L) and was also considerably lower in the pit lake samples than in the corresponding creek samples (~0.11 ng/L). However, this fraction of the aqueous mercury could change significantly under different conditions. Thermal stratification of the water column had not developed at the time of this work and oxygen was present at moderate to high levels throughout. As methyl mercury is produced from inorganic mercury mainly as a metabolic bi-product of certain microorganisms, its relative concentrations are dependent on (1) presence of inorganic mercury, (2) presence of mercury methylating organisms, and (3) presence of conditions favorable for the methylating organisms.

In our mercury research work in the region, we have found that the rate of methyl mercury production--and the corresponding transfer of mercury into fish--is enhanced by anaerobic (no oxygen) conditions. At Davis Creek Reservoir in northwestern Yolo County, the water column stratifies thermally each warm season and the entire hypolimnion (lower water layer) goes anaerobic by mid to late summer. The bottom water becomes anaerobic because the system is sufficiently rich in organic matter for normal bacterial metabolism to use up the existing store of dissolved oxygen, which cannot be replaced until later in the year when the thermal stratification breaks down and the water column mixes top to bottom. Large concentrations of methyl mercury accumulate in the anaerobic water and are delivered into surface waters, available for biological uptake, at fall turnover each year (Slotton et al 1995b). This system also has a much larger source of inorganic mercury than the lower Cache Creek region, as it is located in the heart of the historic mercury mining district of the California Coast Range.

Fish accumulations are probably the most dependable indicators of methyl mercury production and availability, as averaged across time. Despite the variation we found on these dates in water column mercury between the gravel pit lakes and the adjacent creek, fish accumulations were very similar, suggesting that, on average, the fish in both environments have similar overall exposures to bioavailable mercury.

At Davis Creek Reservoir, levels of mercury in fish are far higher than those found in this project (Table 11, Figs. 8 and 9). During the initial flush of bacterial activity associated with the formation of the reservoir and the flooding of formerly terrestrial soils, extremely high levels (to over 4.0 ppm) were seen in 1987 largemouth bass and bluegill. In recent years, levels have stabilized, though they are still quite high, as indicated by the 1995 data, with most "keeper" sized bass and bluegill well above the 0.5 ppm guideline at 1.0-2.0 ppm. Clearly, that system provides a much greater exposure to methyl mercury than do the existing gravel pit lakes and lower Cache Creek. The levels seen in the gravel pit lakes are of some concern, in that they approach and in some cases even surpass the 0.5 ppm consumption guideline for fish. However, these fish muscle mercury concentrations were very similar to concentrations found in adjacent Cache Creek. Similar levels are also routinely found from many locations throughout the mercury contaminated regions of northern California, including Clear Lake, Lake Berryessa, the American River, Lake Herman, Lake Nacimiento, Folsom Lake, and Bullards Bar Reservoir (TSMP 1990, 1991, 1992, 1993).

It is not clear at this point whether the pit lakes at Solano Gravel become anoxic in the bottom waters during the summer. We recommend that this be investigated. Even if the current lakes do not experience seasonal anoxia at this time, the potential exists for new lakes and older lakes to become seasonally anoxic. This could result if they are either considerably deeper or more organic rich than the lakes tested. If seasonal bottom anoxia occurred, the possibility would exist for methyl mercury production and subsequent transfer of mercury into fish to be enhanced. Additionally, there may be an initial (2-3 year) surge in mercury bioavailability and uptake in any newly formed lake, associated with the flooding of formerly terrestrial soils and their accumulated store of organic matter (Reuter et al 1989, Slotton 1991). The likelihood, though, of mercury bioavailability--in off-channel gravel pit lakes of any configuration along lower Cache Creek--increasing to levels as high as those seen in Davis Creek Reservoir is not supported by the findings of this study of the existing lakes. Sediment bulk mercury levels are considerably lower than in highly contaminated sites and the water quality in the proposed systems may not be readily conducive to anoxia. However, because the potential clearly exists for fish mercury to accumulate to health guideline levels and above, we strongly recommend that the issue of environmental mercury be monitored closely in conjunction with future operations. Specific recommendations follow in Section 5.

Table 11. Selected Fish Muscle Mercury Concentrations *(wet wt ppm)*; Davis Creek Reservoir

Identification	Length (mm)	Length (inches)	Weight (grams)	Weight (pounds)	ppm Hg (wet wt)
DAVIS CREEK RESERVOIR (9/87, = new impoundment Hg surge)					
Largemouth Bass	169	6.7	63	0.1	2.79
Largemouth Bass	188	7.4	83	0.2	3.14
Largemouth Bass	206	8.1	121	0.3	3.15
Largemouth Bass	215	8.5	136	0.3	3.85
Largemouth Bass	233	9.2	160	0.4	3.50
Largemouth Bass	239	9.4	195	0.4	3.31
Largemouth Bass	253	10.0	230	0.5	4.50
Bluegill Sunfish	152	6.0	91	0.2	2.22
Bluegill Sunfish	163	6.4	117	0.3	2.23
Bluegill Sunfish	166	6.5	124	0.3	2.81
Bluegill Sunfish	168	6.6	130	0.3	2.51
Bluegill Sunfish	203	8.0	227	0.5	2.60
Bluegill Sunfish	205	8.1	270	0.6	2.67
DAVIS CREEK RESERVOIR (11/95, = equilibrium levels)					
Largemouth Bass	165	6.5	52	0.1	0.79
Largemouth Bass	232	9.1	185	0.4	1.07
Largemouth Bass	266	10.5	285	0.6	1.43
Largemouth Bass	300	11.8	375	0.8	1.21
Largemouth Bass	352	13.9	625	1.4	1.45
Largemouth Bass	375	14.8	870	1.9	1.61
Largemouth Bass	437	17.2	1,275	2.8	1.87
Bluegill Sunfish	142	5.6	65	0.1	0.67
Bluegill Sunfish	149	5.9	72	0.2	0.74
Bluegill Sunfish	193	7.6	203	0.4	0.98
Bluegill Sunfish	211	8.3	272	0.6	1.01
Bluegill Sunfish	221	8.7	302	0.7	1.18
Bluegill Sunfish	250	9.8	440	1.0	1.51

Figure 8. Comparative Fish Muscle Mercury From Davis Creek Reservoir (1987, 1995)

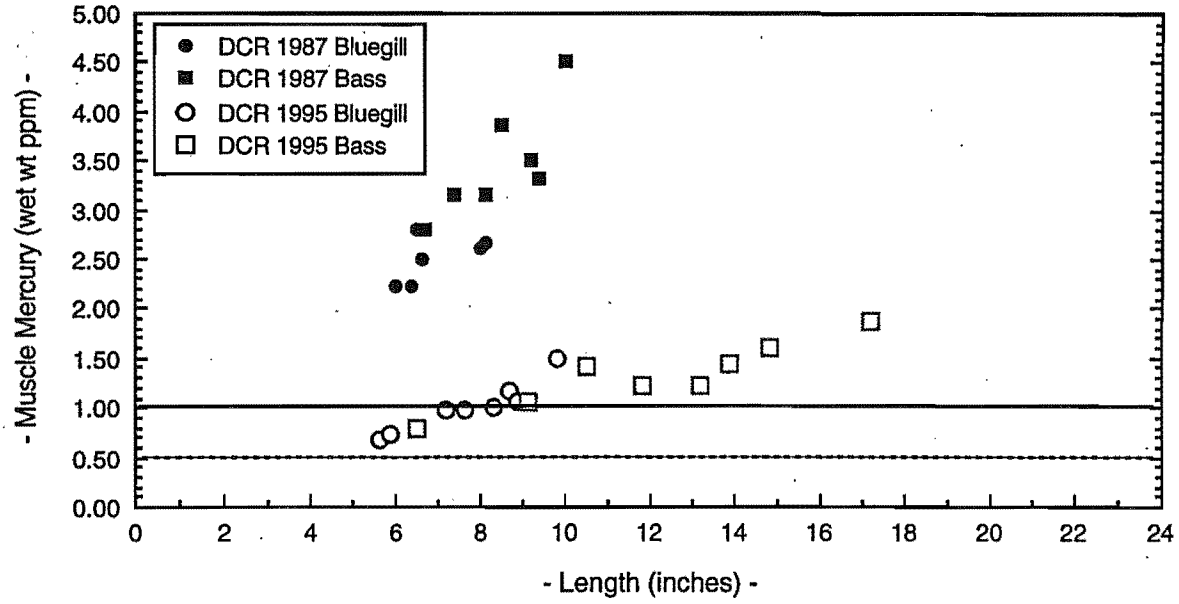
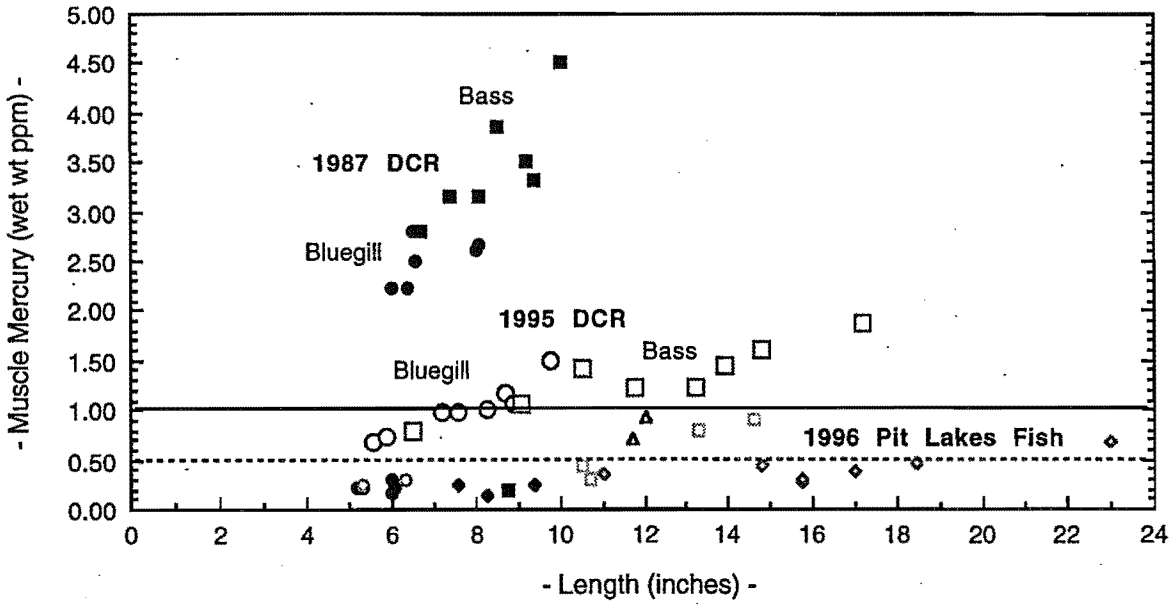


Figure 9. Davis Creek Reservoir Fish vs Fish From Solano Gravel Pit Lakes



5. PROJECT RECOMMENDATIONS

1. Determine the degree of bottom water anoxia (and resultant potential increases in mercury methylation and biological uptake) in the representative, existing gravel pit lakes during the late summer and/or fall of this year. The existing lakes include both a pit design (North Lake; more prone to anoxia by configuration), and one with extensive shallows and heavy plant growth (South Lake; where the amount of organic material and biological activity may contribute to anoxia). The warm season behavior of these two representative systems will provide very useful information for the planning and management of the proposed pit lakes, with regard to environmental mercury. Collections for this purpose should focus on water column mercury concentrations and biota samples of short-lived organisms such as aquatic invertebrates and young-of-year fish. At a minimum, water collections should be made from surface vs isolated bottom water during peak stratification. Appropriate, ultra-clean collecting technique should be used. Aqueous fractionation should be as in the current study; i.e.- total and methyl mercury in both the raw water and filtered fractions. Recommended biota collections include composite samples of water column plankton, each of the 3-4 major macroinvertebrate species, and young-of-year fish from each of the lakes. Mercury levels in adult fish and sediment are not likely to vary significantly on a seasonal basis.

2. Supplement the existing adult fish mercury data base from the existing Solano Gravel pit lakes and Cache Creek. It was not possible in this preliminary investigation, under the constraints of time, creek flow conditions, and lake fish activity patterns, to collect a complete set of inter-comparable fish samples from the Solano Gravel pit lakes and Cache Creek. As mercury levels in larger, edible fish constitute the most significant potential hazard associated with mercury in both the current and proposed gravel lakes, a comprehensive, comparative data base would be extremely useful. Additionally, these samples integrate mercury bioavailability over time and represent perhaps the most meaningful unit of mercury comparison between lakes (both existing and proposed) and between the gravel lakes and other systems, particularly Cache Creek. Recommended additional 1996 fish collections include larger catfish and a range of smallmouth bass from Cache Creek, additional bullhead and smallmouth bass from the South Lake, and samples of larger bass and channel catfish from the North Lake.

3. Additional collections from Cache Creek in future years. Comparative collections of water, invertebrates, and fish should be made every two to three years from lower Cache Creek,

to provide a realistic benchmark for comparison to the proposed gravel lakes. Multi-year collections will provide a measure of inter-annual variability and a range of levels naturally occuring in the watershed. It will be imperative that this data base be complete and representative, as this comparison will form the basis for gravel lake management decisions.

4. Institute an effective monitoring program for environmental mercury in new gravel-mining lakes as they are developed. Because additional, proposed lakes will necessarily have varying depths, configurations, bottom material, and water quality, we recommend that mercury conditions be assessed in each new system. As the potential for increased mercury methylation is considerable in the first few years, initial monitoring should be done at a greater frequency; i.e. semi-annually or annually, while later monitoring could be reduced both in frequency and parameters, based on the data. Assessments should include measurements analagous to those made in this project: aqueous mercury species, bottom sediment mercury and organic matter, aquatic invertebrates, annual/juvenile fish, and adult edible fish, together with a general assessment of lake trophic status. The adult fish and sediment samples will provide information on multi-year integrated mercury conditions and fish consumption hazard, while the water, invertebrate and annual/juvenile fish will provide data suitable for inter-annual comparisons to assess potential changes and trends. Ideally, this work will be performed and interpreted by researchers experienced in the mercury dynamics of the region as well as general limnology. The program should be dynamic and flexible, with changes in monitoring frequency and range based on the understanding of the individual systems generated by the initial monitoring. Once individual lakes become relatively stabilized in their mercury dynamics, ongoing monitoring could also be reduced significantly--for example, to annual work at several selected lakes, representative of the main configurations, with occassional (i.e.- every 5 years) checks of all of the lakes for selected parameters. In the event that a gravel pit lake develops fish mercury levels significantly greater than those already existing in lower Cache Creek and this is determined to be unacceptable, several options will be available. These include (a) physically removing (poisoning with rotenone) the high mercury predatory fish and replacing with species low on the food chain which do not accumulate as much mercury, (b) seasonally de-stratifying lakes which go anoxic if that is found to be an effective mitigation in proposed future U.C. Davis research, and/or (c) discontinue practices which lead to the unacceptable conditions. By instituting a monitoring program which includes the elements described here, the County will be in a position to understand the mercury dynamics of the new lakes and provide informed decisions as to their ongoing management.

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