Appendix A

Proposed Basin Plan Amendment

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PROPOSED BASIN PLAN AMENDMENT

Incorporating a Total Maximum Daily load and Implementation Plan to reduce mercury in the Walker Creek watershed

The following revisions indicated in single underline/strikeout are proposed for Chapter 3, Water Quality Objectives. The text shown with double underline is pending adoption by the Water Board in August 2006, as part of the Basin Plan amendment for mercury in San Francisco Bay.

Chapter 3. Water Quality Objectives

OBJECTIVES FOR SPECIFIC CHEMICAL CONSTITUENTS

Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use. Water quality objectives for selected toxic pollutants for surface waters are given in Tables 3-3, 3-3A, 3-3B, and 3-4.

The Water Board intends to work towards the derivation of site-specific objectives for the Bay-Delta estuarine system. Site-specific objectives to be considered by the Water Board shall be developed in accordance with the provisions of the federal Clean Water Act, the State Water Code, State Water Board water quality control plans, and this Plan. These site-specific objectives will take into consideration factors such as all available scientific information and monitoring data and the latest U.S. EPA guidance, and local environmental conditions and impacts caused by bioaccumulation. Pending the adoption of site-specific objectives, the objectives in Tables 3-3 and 3-4 apply throughout the region except as otherwise indicated in the Tables or when site-specific objectives for the pollutant parameter have been adopted. Site-specific objectives for copper and nickel, adopted for South San Francisco Bay south of the Dumbarton Bridge, are listed in Table 3-3A. Objectives for mercury that apply to San Francisco Bay are listed in Table 3-3B. Objectives for mercury that apply to Walker Creek and its tributaries are listed in Table 3-4A.

Table 3-4: Freshwater[a] Water Quality Objectives for Toxic Pollutants for Surface Waters (all values in ug/l)

Compound	4-day Average	1-hr Average
Arsenic[b, c, d]	150	340
Cadmium[b, d]	e	e
Chromium III[f]		
Chromium VI[b, c, d, g]	11	16
Copper[b, c, d]	9.0[h]	13[h]
Cyanide[i]		
Lead[b, c, d]	2.5[j]	65[j]
Mercury[k]	0.025	2.4

Table 3-4: Freshwater[a] Water Quality Objectives for Toxic Pollutants for Surface Waters (all values in ug/l)

Compound	4-day Average	1-hr Average
Nickel[b, c, d]	52[l]	470[l]
Selenium[m]		
Silver[b, c, d]		3.4[n]
Tributyltin[o]		
Zinc[b, c, d]	120[p]	120[p]

Notes:

a. Freshwaters are those in which the salinity is equal to or less than 1 part per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. Unless a site-specific objective has been adopted, these objectives shall apply to all freshwaters except for the South Bay south of Dumbarton Bridge, where the California Toxics Rule (CTR) applies. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the marine (Table 3-3) and freshwater objectives.

b. Source: 40 CFR Part 131.38 (California Toxics Rule or CTR), May 18, 2000.

c. These objectives for metals are expressed in terms of the dissolved fraction of the metal in the water column.

d. These objectives are expressed as a function of the water-effect ratio (WER), which is a measure of the toxicity of a pollutant in site water divided by the same measure of the toxicity of the same pollutant in laboratory dilution water. The 1-hr. and 4-day objectives = table value X WER. The table values assume a WER equal to one.

e. The objectives for cadmium and other noted metals are expressed by formulas where H = ln (hardness) as CaCO3 in mg/l: The four-day average objective for cadmium is $e^{(0.7852\ H\ -\ 3.490)}$. This is 1.1 µg/l at a hardness of 100 mg/l as CaCO3. The one-hour average objective for cadmium is $e^{(1.128\ H\ -\ 3.828)}$. This is 3.9 µg/l at a hardness of 100 mg/l as CaCO3.

f. Chromium III criteria were promulgated in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 180 ug/l (4-day average) and 550 ug/l (1-hr. average). The objectives for chromium III are based on hardness. The values in this footnote assume a hardness of 100 mg/l CaCO3. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective for chromium III is $e^{(0.8190H+1.561)}$. The 1-hour average for chromium III is $e^{(0.8190\ H+3.688)}$.

g. This objective may be met as total chromium.

h. The objectives for copper are based on hardness. The table values assume a hardness of 100 mg/l CaCO3. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective for copper is $e^{(0.8545H-1.702)}$. The 1-hour average for copper is $e^{(0.9422H-1.700)}$.

i. Cyanide criteria were promulgated in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and

Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 5.2 ug/l (4-day average) and 22 ug/l (1-hr. average).

j. The objectives for lead are based on hardness. The table values assume a hardness of 100 mg/l CaCO3. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective is $e^{(1.273H - 4.705)}$. The 1-hour average for lead is $e^{(1.273H-1.460)}$.

k. Source: U.S. EPA Quality Criteria for Water 1986 (EPA 440/5-86-001), which established a mercury criterion of 0.012 ug/l. The Basin Plan set the objective at 0.025 based on considerations of the level of detection attainable at that time. The 4-day average value for mercury does not apply to Walker Creek and Soulejule Reservoir and their tributaries; instead, the water quality objective specified in Table 3-4A applies. The 1-hour average value continues to apply to these waters.

l. The objectives for nickel are based on hardness. The table values assume a hardness of 100 mg/l CaCO3. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective is $e^{(0.8460H + 0.0584)}$. The 1-hour average objective is $e^{(0.8460H + 2.255)}$.

m. Selenium criteria were promulgated for all San Francisco Bay/Delta waters in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 5.0 ug/l (4-day average) and 20 ug/l (1-hr. average).

n. The objective for silver is based on hardness. The table value assumes a hardness of 100 mg/l CaCO3. At other hardnesses, the objective must be calculated using the following formula where H = ln (hardness): The 1-hour average objective for silver is $e^{(1.72H – 6.52)}$. U.S. EPA has not developed a 4-day criterion.

o. Tributyltin is a compound used as an antifouling ingredient in marine paints and toxic to aquatic life in low concentrations. U.S. EPA has published draft criteria for protection of aquatic life (Federal Register: December 27, 2002, Vol. 67, No. 249, Page 79090-79091). These criteria are cited for advisory purposes. The draft criteria may be revised.

p. The objectives for zinc are based on hardness. The table values assume a hardness of 100 mg/l CaCO3. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective for zinc is $e^{(0.8473 H+0.884)}$. The 1-hour average for zinc is $e^{(0.8473 H+ 0.884)}$.

Table 3-4A: Freshwater Water Quality Objectives for Mercury in Walker Creek, Soulejule Reservoir, and all tributary waters

Protection of Aquatic Organisms and Wildlife	0.05 mg mercury per kg fish	Average wet weight concentration measured in whole fish 5–15 cm in length
	0.10 mg mercury per kg fish	Average wet weight concentration measured in whole fish 15 – 35 cm in length

The following revisions are proposed for Chapter 7, Water Quality Attainment Strategies including Total Maximum Daily Loads (TMDLs).

Total Maximum Daily Load for Mercury in Walker Creek

Walker Creek and Soulejule Reservoir, which is located in the Walker Creek watershed, are impaired by mercury. This TMDL applies to Soulejule Reservoir and the freshwater portions of Walker Creek. The goal of the TMDL is to establish and maintain environmental conditions that will support beneficial uses of these waters established in the Chapter 2.

The following sections establish a concentration-based TMDL for mercury in the Walker Creek watershed, and prescribe actions and monitoring necessary to implement and maintain the TMDL. The numeric targets, allocations, and associated implementation plan will ensure that Walker Creek and Soulejule Reservoir attain applicable water quality standards and achieve the TMDL.

The TMDL allocations and implementation plan are designed to control the amount of mercury discharged to Walker Creek and Soulejule Reservoir, and prescribe and promote actions to minimize the potential for mercury to be present in the toxic and bioavailable form, methylmercury. Effectiveness of implementation actions, monitoring to track progress toward targets, and the scientific understanding pertaining to mercury will be periodically reviewed. The TMDL may be adapted as warranted.

Problem Statement

Walker Creek is impaired because mercury adversely affects beneficial uses, including wildlife habitat and all uses supporting aquatic life.

- Mercury concentrations in Walker Creek exceed the mercury freshwater aquatic life acute toxicity objective established to protect aquatic organisms (Table 3.4).
- Terrestrial species that primarily or exclusively eat fish (such as piscivorous birds, the most sensitive wildlife species in the watershed) are at risk from exposure to mercury due to its tendency to bioaccumulate in the food web. Because mercury concentrations in Walker Creek fish are high enough to threaten the health of piscivorous birds the narrative bioaccumulation objective (see Chapter 3) and numeric aquatic organism and wildlife mercury water quality objective (Table 3-4a) are not being met.

Soulejule Reservoir is impaired because some fish in the reservoir exceed mercury levels considered safe for human consumption.

- The beneficial use aimed at protecting the health of people who choose to consume Soulejule Reservoir fish (COMM) is impaired and the narrative bioaccumulation water quality objective is not being met.
- In 2004, the California Office of Environmental Health and Hazard Assessment issued an interim advisory recommending that people limit consumption of reservoir fish due to elevated mercury levels.

Sources

The following sources have the potential to discharge mercury to surface waters in the Walker Creek watershed:

- **Gambonini Mine site** – An inactive mercury mine and the largest mercury processing facility in the watershed. Mining waste was not properly contained on-site, and consequently the site discharged large quantities of mercury-laden sediments prior to cleanup (initiated in 1998).

- **Soulejule watershed and Reservoir** – Two abandoned mercury mines are located in this watershed. Soulejule reservoir discharges into Walker creek just downstream of the Gambonini Mine drainage.

- **Downstream depositional features** – Mercury-laden sediments in depositional areas (creek beds, banks, and floodplains) downstream of the mercury mines, which discharge mercury to the creek during storms.

- **Background** – Mercury is present at low concentrations throughout the watershed. Background levels account for atmospheric deposition and naturally occurring mercury found in the watershed's soils. The Walker Creek watershed background suspended sediment mercury concentration is 0.2 mg mercury per kg dry sediment.

TMDL Targets

- To protect wildlife and rare and endangered species, the mercury concentration in fish consumed by piscivoroufs birds shall not exceed 0.05 mg mercury per kg fish, measured in whole fish 5–15 cm in length, average wet weight nor shall it exceed 0.10 mg mercury per kg fish, measured in whole fish 15-35 cm in length, average wet weight.. The goal of these targets, which are consistent with the bioaccumulation objective in Chapter 3, is to ensure that controllable water quality factors do not cause detrimental mercury concentrations in Walker Creek wildlife.

- To protect aquatic organisms, water column mercury concentrations shall not exceed the water quality objective of 2.4 µg/l (one-hour average).

- To protect humans who consume Soulejule Reservoir and Walker Creek fish (assuming future conditions allow for the consumption of Walker Creek fish), water column mercury concentrations shall not exceed the California Toxics Rule (CTR) criterion of 0.050 µg/l (averaged over a 30-day period). If the CTR is updated or replaced with a fish tissue concentration value, the human health target shall be that new objective.

Allocations and Total Maximum Daily Load

The TMDL for Walker Creek is 0.5 mg mercury per kg suspended sediment and the TMDL for Soulejule Reservoir is 0.050 µg mercury per liter water sample.

Concentration-based load allocations for Walker Creek and Soulejule Reservoir mercury sources are shown in Table 7-x.

Table 7-x TMDL Mercury Load and Wasteload Allocations[1]

Source	Allocation
Gambonini Mine site	5 mg mercury per kg suspended sediment
Soulejule watershed and Reservoir	0.050 µg mercury per liter water sample
	0.5 mg mercury per kg suspended sediment
Downstream depositional features[2]	0.5 mg mercury per kg suspended sediment
Background[3]	0.2 mg mercury per kg suspended sediment

[1]Wasteload allocations apply to any sources subject to regulation by a NPDES permit.
[2]Applies to sediment released from depositional features (creek beds, banks, and floodplains) downstream of the Gambonini Mine and Soulejule Reservoir.
[3]The background allocation applies to all areas in the Walker Creek watershed outside of the influence of the Gambonini Mine site or Soulejule Reservoir

Implementation Plan

The implementation plan builds upon previous and ongoing successful efforts to reduce mercury loads in Walker Creek and its tributaries. Table 7-y contains the required implementation measures for each source.

It is important to note that the numeric targets and load allocations in the TMDL are not directly enforceable. To demonstrate attainment of applicable allocations, responsible parties must demonstrate compliance with specified implementation measures and any applicable waste discharge requirements (WDRs) or waiver conditions.

Table 7-y Trackable Implementation Measures for Walker Creek Mercury TMDL

Source	Action	Implementing Parties	Completion Date
Gambonini Mine Site	Apply for coverage under the State of California's Industrial Stormwater General Permit	Gambonini Mine Site owner(s)	2008
	Submit to the Water Board for approval a Stormwater Pollution Prevention Plan (SWPPP), implementation schedule, and monitoring plan		
Soulejule Watershed Mine Sites	Comply with Mines and Mineral Producers Discharge Control Program described in Chapter 4	Marin Municipal Water District	2008
Soulejule Reservoir	Submit to the Executive Officer of the Water Board, a monitoring and implementation plan and schedule to 1) characterize fish tissue, water, and suspended sediment mercury concentrations in Soulejule Reservoir and Arroyo Sausal Creek, and 2) develop and implement methylmercury production controls necessary to attain both in-reservoir and downstream TMDL targets	Marin Municipal Water District	2009

Table 7-y Trackable Implementation Measures for Walker Creek Mercury TMDL

Source	Action	Implementing Parties	Completion Date
Downstream Depositional Features	Applicants seeking coverage under waste discharge requirements (WDRs) or waivers of WDRs to control pathogens, nutrients, or sediments discharges in the Walker Creek watershed must incorporate management practices that minimize mercury discharges and methylmercury production	All creekside property owners downstream of Gambonini Mine and Soulejule Reservoir	2009
	All projects regulated under Clean Water Act Section 401 shall include provisions to minimize mercury discharges and methylmercury production		
	Comply with conditions of Marin County's Creek Permit Program		
	Update Marin County's *Creek Permit Guidance for Unincorporated Areas of Marin* to include specific guidance for projects in areas that may contain mercury-enriched sediments	County of Marin	2008

Cost Estimate

Because the implementation measures for grazing lands constitute an agricultural water quality control plan, the cost of that program is estimated below, consistent with California Water Code requirements (Section 13141).

We estimate that 100 percent of the downstream depositional areas can be considered grazing lands. Costs estimated for reducing mercury discharges and methylmercury production on grazing lands are $1.5 to 2.5 million over a ten-year period. These costs are associated with reducing sediment discharges and enhancing habitat conditions on Walker Creek and its tributaries. Considering potential benefits to the public in terms of habitat restoration and water quality, we expect that a significant portion of the costs will be paid for with public funds.

Evaluation and Monitoring

Water Board staff will conduct water quality monitoring to evaluate mercury concentrations in Walker Creek and its tributaries as part of the Surface Water Ambient Monitoring Program (SWAMP). All water quality monitoring (including quality assurance and quality control procedures) will be performed pursuant to the State Water Board's Quality Assurance Management Plan for this program. The main objectives of the monitoring are:

- Assess attainment of TMDL targets
- Evaluate spatial and temporal water quality trends
- Refine our understanding of mercury loading in downstream depositional areas

- Collect sufficient data to prioritize implementation efforts and assess the effectiveness of source control actions

Table 7-z presents locations in the Walker Creek watershed for baseline water quality monitoring. These sites will be monitored for suspended particulate, methyl- and total mercury concentrations during the wet and dry seasons. Wet season sampling will focus on characterizing conditions during peak flow events. Monitoring will be conducted based on availability of funds.

Walker Creek Ranch is considered an "integration" site for the watershed. Water quality data collected at Walker Creek Ranch integrates Salmon Creek background concentrations with loads from the Gambonini Mine Site, Soulejule Reservoir, and some downstream depositional features. Mercury levels in 5–15 cm fish in Walker Creek will be monitored every five years at Walker Creek Ranch to assess progress towards attaining the wildlife target. In addition, the Water Board, in cooperation with the United States Geological Survey, maintains a continuous data recorder at Walker Creek Ranch that monitors suspended sediment and particulate mercury concentrations in Walker Creek.

Five years after adoption of this TMDL, the Water Board will evaluate monitoring results and assess progress made toward attaining targets and load allocations. Beginning In 2012 and approximately every five years thereafter, the Water Board will evaluate site specific, sub-watershed-specific, and watershed-wide compliance with the trackable implementation measures specified in Table 7-y.

Table 7-z. Baseline Monitoring Sites

Salmon Creek, upstream of the Gambonini Mercury Mine Site
Walker Creek at Walker Creek Ranch
Walker Creek at Highway 1
Chileno Creek downstream of the inactive Chileno Mine
Soulejule Reservoir
Arroyo Sausal Creek downstream of Soulajoule Reservoir

Adaptive Implementation

Approximately every five years, the Water Board will review the Walker Creek Mercury TMDL and evaluate new and relevant information from monitoring, special studies, and the scientific literature. At a minimum, the following questions will be incorporated into the reviews. Additional questions will be developed in collaboration with stakeholders during each review cycle.

- Are the Creek and the tributaries progressing toward TMDL targets as expected? If progress is unclear, how should monitoring efforts be modified to detect trends? If there has not been adequate progress, how should the implementation actions or allocations be modified?

- What are the pollutant loads for the various sources? Have these loads changed over time? How do they vary seasonally? How might source control measures be modified to improve load reduction?
- What wetland and creek restoration methods should be used to minimize mercury discharges and methylmercury production while enhancing and restoring habitat values?
- Is there new, reliable, and widely accepted scientific information that suggests modifications to targets, allocations, or implementation actions? If so, how should the TMDL be modified?
- Are wildlife feeding in Soulejule Reservoir at risk? If so, how can the Reservoir be managed to reduce this risk?

Reviews will be coordinated through the Water Board's continuing planning program, with stakeholder participation. Any necessary modifications to the targets, allocations, or implementation plan will be incorporated into the Basin Plan via an amendment process. In evaluating necessary modifications, the Water Board will favor actions that reduce sediment and nutrient loads, pollutants for which the Walker Creek is also impaired.